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IC-AMCE - 2023

Organized by: **Department of Mechanical & Civil Engineering**

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PREFACE

It is a great honour and pleasure for us to write a message for the "INTERNATIONAL CONFERENCES ON ADVANCES IN MECHANICAL AND CIVIL ENGINEERING 2023 (IC-AMCE -2023)" scheduled during Feb.24 & Feb.25, 2023. This International Conference aims to provide international forum and a vibrant platform for academicians, researchers and industry practitioners from Civil, Mechanical and allied Engineering to share their original research work, practical challenges, recent innovations, trends and to explore methods of application of research to the technological development leading to human welfare. The conference program includes Design, Manufacturing, and Thermal Engineering. Our conference sessions are designed to help & solve existing challenges, accelerate career, and get practical insights on Innovations. The papers contributed in this volume are of Keynote speakers and authors of selected power point presentations. Who were given the opportunity to submit a manuscript for publication. These manuscripts were reviewed by the conference editors and members of the Editorial Committee. Only those papers judged suitable for publication following the author's consideration of reviewer suggestions appear in this volume. The IC-AMCE 2023 acknowledges and appreciates the contribution of the editors and the reviewers. They have made a significant contribution to improving the quality of this publication. I am sure, these contributions will enrich our knowledge and motivate many of us to take up these challenging application areas and contribute effectively for the Sustainable Global Development. TCET has successfully held parallel four International events IC-ICN-2023, IC-HSTE 2023, IC-CCDS 2023 and IC AMCE 2023. MULTICON- W 2015, 16, 17, 18, 19, 20, 21 and 2022 in association with international journals of repute and multinationals in the Mechanical & Civil Engineering industry with an objective to reach new horizons. We feel that the present endeavour could not have been possible without the moral support, strong belief and time to time motivation from management of Thakur Educational Group. We are grateful to all the participants at the meeting and for their contributions. We thank to all the members of the organizing and editorial committee for supporting the event and extending their cooperation to make it a grand successful event. My apologies to our readers and contributors for that and request them to kindly send / e-mail their criticism and suggestions, which will be vital for the improvement.

Convener (IC-AMCE 2023)
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Another path to clean energy- Solar Wind Turbines

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***Abstract*—To combat Increase in demand on energy sectors alongside environmental concerns, the Government of India has announced goals to hit zero carbon emissions by 2070 and to increase the renewable energy sector to cover 50% of the electrical needs of the nation by 2030. This research paper covers the challenges in designing, manufacturing and distribution of means to harvest and utilize the renewable solar and wind energy by mass production of a Solar Wind Turbine. The core focus of the project is to make the model cheap, easy to maintain and accessible for middle to low class individuals, who are usually unable to harness renewable energy harvesting due to various factors. The model will be able to produce a greater range of energy compared to currently commercially available wind turbines, which can output anywhere from 250 to 400W per hour. Solar panel with solar tracking technology would be attached to vertical axis wind turbine.**

Keywords— renewable, solar, wind, turbine, energy, VAWT, Solar Tracking

BACKGROUND AND INTRODUCTION

I. The Background

In today's world, we are slowly seeing the decrease in usage of fossil fuels. This isn't only due to there being a better option in terms of energy efficiency, but due to other factors unrelated to their energy yield. Fossil fuels are an unsustainable means to gain energy as they are non-renewable resources that take millions of years to make, and therefore, have a finite amount we can utilize. According to a study [1] performed in 2015, humans will run out of usable oil in 51 years and coal in 114 years.

The excavation of fossil fuels as well as the burning of fossil fuels also causes great environmental damage which as time passes, causes more and more damage to the health of beings in said ecosystem. Data shows [2] that the CO2 emissions have increased by 47% from 2000-2021. Alongside the damage caused, the increased demand of fossil fuels lead to increase in prices. From 2020 to 2022, coal prices surged from 52$/T in May, 2020 to 427$/T in May,2022.[3]

Figure 1: Price of Coal in USD/T over time [3]

II. The Shift

The world has started swapping fossil fuels for other more cleaner alternatives. Among the primary of those kinds include the antithesis of non-renewable resources. Things in nature such as wind, sunlight, flow of water, etc. which are not finite and can therefore be harvested to run our complex machinery. India has increased reliance on renewable energy sources for energy generation by 50% [4]. Of the two, Solar and Wind constitute the vast majority of energy. Of the total 163 GW of power, Wind contributes 41.2 GW and Solar contributes 59.34 GW[5]. Solar and Wind have seen vast usages in locations to gain immense amount of power. Today we will propose utilizing wind turbines with solar energy absorption components on roadways to conserve more energy.

As covered earlier, fossil fuels are a major source of energy in our current world which is slowly running out. Alongside this, the general populace is more against methods of energy generation that leads to environmental damage. To remove both these hurdles, it is necessary to adopt some amount of renewable energy usage.

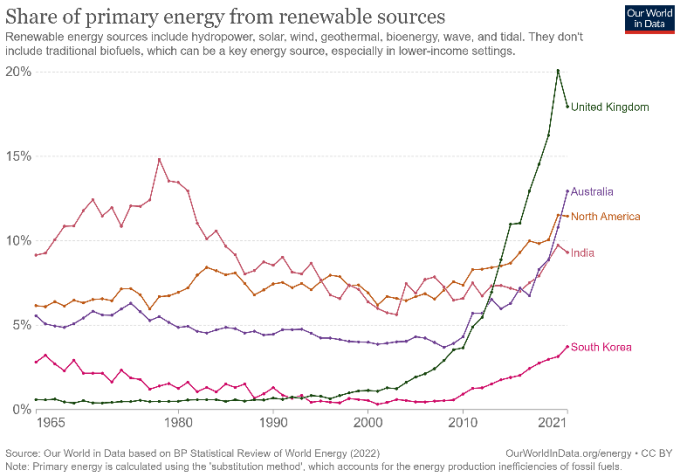

Figure 2: Energy Dependence of Various Countries on Renewable Sources [4]

LITERATURE SURVEY

Research work done on our objective can be broken down into two separate parts. Work tied to Solar Panels and solar tracking systems and work tied on wind turbines and configurations. The former can be further divided based on their trackers into ones based on drives used as well as the axis, whereas the latter can be divided based on their axis of rotation.

I. Solar Panels and Tracking Systems

Solar is the leading source of energy in India and across the world for generation of energy, only overshadowed by wind based on region.

A. Basic Working of Solar Panels

Solar panels are constructed using photovoltaic cells. The word "Photovoltaic" comes from the Greek word "Photo", which means light and "volt", which means electricity. These cells capture sunlight and convert it into electricity. Besides generating electricity, these cells can be used to generate hydrogen, which can be used as an alternative fuel source.

B. Solar Tracking

However for photovoltaic cells and consecutively solar panels to generate the maximum energy, they must be held perpendicular to incoming sunlight. To solve this issue, solar tracking is involved. Solar trackers are devices that are implemented into solar devices to help in capturing maximum amount of energy possible by reorienting solar panels towards the sun. They are divided based on type of drive and based on axis of rotation.

Time (Hrs)	Without Tracking			With Tracking		
	Voltage (V)	Current (A)	Power (W)	Voltage (V)	Current (A)	Power (W)
9 am	5.5	0.11	0.605	12.2	0.23	2.8
10 am	9	0.19	1.71	13.5	0.25	3.4
11 am	10.5	0.2	2.1	14	0.28	3.92
12 am	12.5	0.28	3.5	14	0.3	4.2
1 pm	14	0.32	4.49	15	0.3	4.5
2 pm	13.5	0.3	4.05	14	0.3	4.2
Total -	65	1.4	16.455	82.7	1.66	23.02

Figure 3: Solar Energy gained Without and With Tracking.[6]

i. Solar Trackers based on Drive Types

These can be separated into two types, passive and active trackers.

a) Passive Trackers: These type of trackers are usually two tanks containing fluid placed on the sides of solar panels. The mechanism works on principles of basic thermos hydraulic principles. When the orientation of the sun changes to be away from the panel, the fluid in the tank heats up and leads to a difference in pressure to be formed, which tilts the panel to move towards the sun. This form of tracking is less expensive however also yields less results due to sluggishness of system to changes.

b) Active trackers: This system is comprised of motor and gear assemble that is controlled by a controller which responds to the position of the sun. Due to the moving parts of the system, it requires more maintenance however its quick responsiveness allows it to generate more energy compared to passive systems

ii. Solar Trackers based on Axis

These can also be separated into two types, Single and Dual Axis trackers.

a) Single Axis: These trackers are only able to rotate along a single axis. There are Three main configurations of this kind. Horizontal Single Axis Trackers or HSAT, whose axis of rotation is along horizontal axis; Polar aligned Single Axis Trackers or PSAT, whose axis alignment is along the polar direction and Vertical Single Axis Trackers or VSAT, whose axis of rotation is along the vertical axis.

b) Dual Axis: As the name suggests, this system has two degrees of rotation which allows the panel to move both horizontally as well as to manipulate its tilt. This system can manipulate its direction and angle to more accurately receive more solar energy.

II. Wind Turbine

Wind is the second most utilized renewable energy in India. To harvest this energy, wind turbines are utilized. These turbines utilize the wind to turn the turbine blades, which works similar to an airplane wing.

A. Working of Wind Turbine

When wind flows across the blade of turbine, there is a difference in pressure on both side of the blades. This difference leads to the creation of lift and drag. The lift ends up being stronger than drag, which leads to the rotation of the blades of the turbine. The spinning rotor is connected to a generator which leads to generation of electricity.

B. Types of Wind Turbine

Wind Turbines are of 2 Types based on axis of rotation. These are horizontal axis and vertical axis wind turbines.

i. Horizontal Axis Wind Turbine

Horizontal Axis Wind Turbines or HAWTs are the most common wind turbine design currently in use. HAWTs use airfoils fitted to a rotor, which are positioned either upwind or downwind. These airfoils are made to be aerodynamic and are affected by aerodynamic lift to turn. HAWTs can be either two or three bladed depending on the situation or need.

ii. Vertical Axis Wind Turbine

Vertical Axis Wind Turbines (VAWTs) are a type of wind turbine which are most frequently used for residential purposes to provide renewable energy source to the home. They include the rotor shaft and two or three blades where the rotor shaft moves vertically.

METHODOLOGY

The aim of our work is to generate a composite of renewable energy generation systems in an effort to improve efficiency. Alongside improving efficiency, we also aim to minimize costs to make it economically viable for manufacture and purchase.

I. Solar Tracking

A. Components

Components
Arduino Uno (ATmega328P)
Servo Motor
Light Dependent Resistors
10K Resistors & Potentiometers

i. Light dependent resistors (LDR) – Also known as Photoresistor are a passive electronic component, which has a resistance that varies depending of the light intensity. An LDR is made of a semiconductor which has high resistance that absorbs photons from sunlight and based on the quantity and frequency of the photons, the semiconductor material gives bound electrons energy to move into conduction band. This results in free electrons conducting electricity which results in lowering the resistance of the LDR.

ii. Servo motor – This component is a rotary or linear actuator which allows for precise control of factors such as angular or linear position as well as the velocity and acceleration. It consists of a motor which matches design specifications coupled to a sensor which provides position feedback. For the functioning of servo motor, a dedicated controller/module is required.

iii. Microcontroller – A microcontroller is a small integrated circuit (IC) designed to control specific operations in an embedded system. Standard microcontroller consists of processor, memory and input/output (I/O) peripherals on a chip. They are also referred as microcontroller unit or embedded controllers. In simple terms they are mini personal computers designed to control small features of large components.

B. Microcontroller Technical Specifications

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage	7-12V
Input Voltage Limit	6-20V
Digital I/O Pins	14 (6 Provide PWM Output)
SRAM	2KB
EEPROM	1KB
Clock speed	16MHz

C. Circuit Diagram

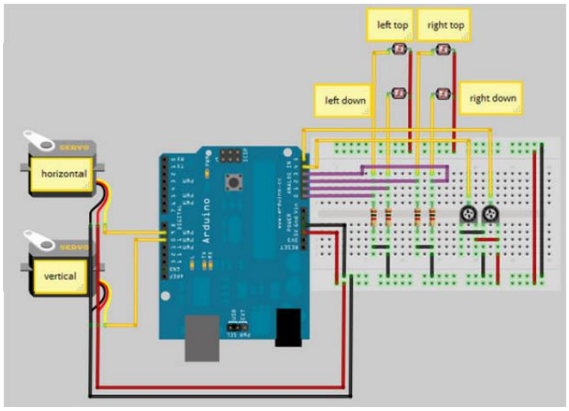

Figure 4: Arduino Uno (ATmega328P) Circuit Diagram [7]

II. Wind Turbine

Components and Material

Components	Material
Stator Coil	Copper
Hub	Steel
Blade	Aluminum
Magnetic Disk and Spindle	Mild Steel
Stator Casting	Epoxy
Magnet	Neodymium

i. Stator – This is an electrical component of the turbine which contains the coils which will be induced with voltage with the help of magnets that would be passed over them. Copper is used to construct these due to it being a material that can easily conduct electricity.

ii. Rotor Hub – The rotor hub is the component that holds the blades of turbine and connects them to the main shaft, rotation of which drives the generator. By holding the blades in the proper place, it assures maximum aerodynamic efficiency and in turn, energy generation.

iii. Blades – Airfoils that rotate in response to oncoming wind, leading to the generation of energy.

IMPLEMENTATION

These designs will see 2 areas of major implementation, one for public and/or governmental use and the other in residential areas. For public/governmental use these turbines will be placed along roadways that have high volume of fast-moving traffic. The idea behind this is that air displaced due to fast moving traffic would cause rotation of wind turbine as a side effect. This would lead to recouping some of the energy utilized by vehicles. The electricity generated from this implementation would either be stored in batteries or converted from DC power to AC power before being sent to the electricity grid to lessen the load on the grid.

Meanwhile, a smaller scale setup can be implemented for domestic/ residential use. These settlements already are accustomed to using smaller scale wind turbines to generate electricity to lower electricity bills or in case of an energy outage or disconnection from the energy grid. The output of smaller scale wind turbines reaches up to 88 kW. With our setup we aim to increase this amount due to matching the setup with a potentially more efficient wind turbine setup alongside a solar panel.

CONCLUSION AND FUTURE SCOPE

Our future scope with this project is to comb through data acquired by past research work done in fields of wind and solar renewable energy generation alongside our own calculations and findings to create a cheaper model that can be purchased by the common man. Our aim with said model is to make it economical to produce and sell, while also utilizing materials that are abundant and resilient.

ACKNOWLEDGEMENT

We, students from Mechanical Branch of Thakur College of Engineering and Technology, would like to thank our college for giving us this opportunity to delve into such a fascinating topic. A topic which tackles a very real issue that is being tackled in real world. It is possible that due to their guidance, the work we have done and will continue to do so, may have long lasting benefits. For both our future careers as well as that of the respective field.

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A Review On Industrial Gas LeakageInspection Robot

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Abstract*—In this paper we discussed about how to detect and locate gas pipeline leaks, several different wireless sensors for detecting the different types of gases (e.g., Infrared gas sensors, ultrasonic gas sensors etc.) Have been proposed. This paper addresses the issue of gas leaks from high-pressure gas pipelines. This approach will be helpful for gas pipeline industry and other firms. Here, we are travelling with a various gas sensor. An IR remote is used to instruct the robot to move in plant site. A SMS service Arduino module is used to send the SMS to inspector. A GPS sensor is used to identify the real position of the robot on plant site. A motor drive unit is used to get the motion of the wheels. Leakage, or damage to the pipeline, is detected by gas sensors and then output signals then processed by the microcontroller if signal gets detected the SMS Arduino or Wi-Fi module sends the signal will be send to mobile app. An app will be used to show which gas is leaking from the pipeline. Using an IOT module attached to the controller, the web server will be updated with all this data.

Keywords*—Safety, IR Remote, Arduino, GPS Sensor, WIFI Module.

I. INTRODUCTION (*HEADING 1*)

A gas detection system is used to allow inspector to work autonomously in changing environments. In this project, we briefly describe a mobile robot system that are used for detection and location of leaked gases: a universal mounting system that allows the inspector to connect various sensors and cameras as needed, a communication system between the robot and the user, and a self-positioning system. In today's market, an autonomous surveillance robots are tremendous used in many industries and in everyday life. Advances in robotics enable many applications of mobile robots, especially in places and situations where human activity is dangerous, such as radioactive or explosive environments. 3-2008 hazardous environment), difficult (e.g. dusty environment) or even impossible. The detection and containment of harmful gases emitted to avoid damage to people, nature and property, or simply to avoid financial losses, is of particular importance in industry and the public sector. The development of new leak detection technologies helps reduce facility operating costs while providing better coverage of what is being inspected. It also frees inspectors from repetitive tasks to focus on value-added monitoring and optimization. The proposed system consists of a gas detection equipment and an autonomous mobile surveillance robot with local intelligence at different distances. The sensing system enables autonomous operation in a variety of environments. This project presents the following mobile robot systems for the inspection of technical objects: Universal installation system for the installation of various sensors and video cameras if necessary; communication system between the robot and the user; and its own tracking system during missions. Advances in robotics have made many applications possible for mobile robots. Especially in places and situations where human activity is dangerous (e.g., explosive or radioactive hazardous areas, 3-2008), difficult (such as dusty environments); or even impossible (as in space). To prevent this, there is great interest in industry and society in tracking and monitoring hazardous gases.

Gas leaks can be incredibly dangerous, potentially leading to explosions or fires. As a result, it is critical to detect and repair gas leaks as quickly as possible. However, traditional methods of gas leak inspection, such as manually checking pipes and equipment, can be time-consuming, labor-intensive, and even dangerous for human workers. This is where gas leak inspection robots come in. These robots are designed to safely and efficiently detect gas leaks, helping to protect both workers and the public.

Gas leak inspection robots come in a variety of forms, but most are designed to be small, mobile, and able to navigate through tight spaces. They may be equipped with a variety of sensors, such as infrared cameras and gas detectors, to detect leaks. Some robots are even able to identify the specific type of gas that is leaking. Many gas leak inspection robots are also equipped with cameras and lights, allowing operators to see inside pipes and other equipment.

One of the key advantages of gas leak inspection robots is that they can operate in environments that may be too dangerous for humans. For example, they can be used to inspect pipelines in remote or hard-to-reach areas, such as offshore oil rigs or underground mines. They can also be used in hazardous environments, such as chemical plants or refineries, where toxic gases may be present.

Gas leak inspection robots can also save time and money by reducing the need for human workers to perform inspections. They can be programmed to perform inspections

on a regular schedule, without the need for human intervention. This can help companies to quickly identify andrepair gas leaks, reducing the risk of accidents and minimizing downtime.

Another advantage of gas leak inspection robots is that they can provide more accurate and detailed information than human workers. For example, a robot equipped with an infrared camera can detect temperature variations that may indicate a gas leak, even if the leak is not visible to the naked eye. This can help to identify leaks that may have been missed by human inspections.

Gas leak inspection robots can also be used to perform maintenance and repair tasks. For example, some robots are equipped with tools that can be used to tighten loose connections or replace faulty valves. This can help to reduce the need for human workers to perform these tasks, reducing the risk of accidents and minimizing downtime.

Overall, gas leak inspection robots are an important tool for detecting and repairing gas leaks. They can operate in dangerous environments, save time and money, provide accurate and detailed information, and perform maintenance and repair tasks. As technology continues to improve, we can expect to see even more advanced gas leak inspection robots in the future.

It's worth mentioning that, while the usage of these robots could bring a lot of benefits, they also require a significant upfront investment, and the maintenance cost is high. Therefore, a cost-benefit analysis should be performed before implementing these robots in any company.

We will be working on the project to achieve following objectives:-

1. To avoid the accident occurs due to explosion of flammable gases.
2. Minimize the potential occurrence due to accident from the industrial gases.
3. Ensure the safe working environment of the firm as well as employee working in the enterprise.
4. To advance the inspection used in manufacturing and petroleum industry.
5. Establish suitable fire suppression systems to swiftly contain and put out any reasonably foreseeable fire that might break out during routine operations.
6. Make that there are enough safety mechanisms and redundancy to detect, isolate, and prevent uncontrolled releases of flammable and poisonous liquids and gases.
7. To avoid damage of property of the public and the financial loss of the industry.
8. To ensure the efficiency of the inspection of the industry.
9. To remove the headache of the inspector to carry out the inspection of the industry.
10. To allow the clean and hygienic process of inspection carrying out in the industry.

Problem Statement :-

Inspection of underground pipe is a chaotic job in industries, factories etc. Proactive monitoring and frequent inspections are critical to maintain pipeline health, as gas, oil, water pipelines have become an indispensable part of life. The main aim of the project is to design a robot that can crawl in to a metal pipeline check the gas.

Methodology: -

Sensing and Detection: The robot is equipped with sensors such as gas sensors, infrared cameras, and ultrasonic sensors to detect the presence of gas leaks. The gas sensors can detect the specific gas that is leaking, while the infrared cameras and ultrasonic sensors can detect the location and size of the leak.

Movement and Navigation: The robot is designed to move through industrial environments and navigate through tight spaces using wheels, tracks, or a combination of both. The robot can also be equipped with a robotic arm for accessing hard-to-reach areas.

Data Collection and Analysis: The robot collects data from the sensors and transmits it to a remote-control system for analysis. The data is analyzed to determine the type, location, and size of the gas leak.

Communication and Alerts: The robot can communicate with a remote-control system and send alerts in case of a gas leak. The alerts can be sent to a control room or to a mobile device to alert the operator of the leak.

Safety Measures: The robot is designed with safety features such as explosion-proofing and fire-resistance to protect the robot and operators from potential hazards.

Maintenance and Calibration: The robot is designed to be easy to maintain and calibrate. Regular maintenance and calibration can ensure the sensors and other components of the robot are working correctly.

Human-Robot Interaction: The robot can be operated remotely, allowing for a safe distance between the operator and the gas leak. The robot can also be programmed to follow specific instructions, such as performing a specific task or following a specific route.

Literature Review: -

A literature survey on industrial gas leakage inspection robots in India is relatively limited, as the use of these robots in the country is still in its early stages. However, there are a few studies and research papers that have been published on the topic in recent years.

Industrial gas leakage inspection robots have been an active area of research in recent years due to the potential safety and cost benefits they can provide. These robots are designed to detect and locate gas leaks in industrial settings, such as petrochemical plants, power stations, and oil and gas pipelines.

One of the main advantages of using robots for gas leakage inspection is their ability to operate in hazardous environments without putting human workers at risk. They can also be programmed to detect leaks at a much faster rate than manual inspections, reducing the overall time and cost of inspections.

Several different types of industrial gas leakage inspection robots have been developed and tested. These include ground-based robots, aerial drones, and underwater robots. Ground-based robots are typically equipped with sensors and cameras to detect and locate leaks, while aerial drones use infrared cameras and gas sensors to detect leaks from above. Underwater robots, also known as remotely operated vehicles (ROVs), use sonar and other sensors to detect leaks in underwater pipelines.

One of the main challenges facing industrial gas leakage inspection robots is their ability to accurately detect and locate leaks. Many current robots rely on sensors that can be affected by environmental factors, such as wind and temperature changes, which can lead to false alarms or missed leaks.

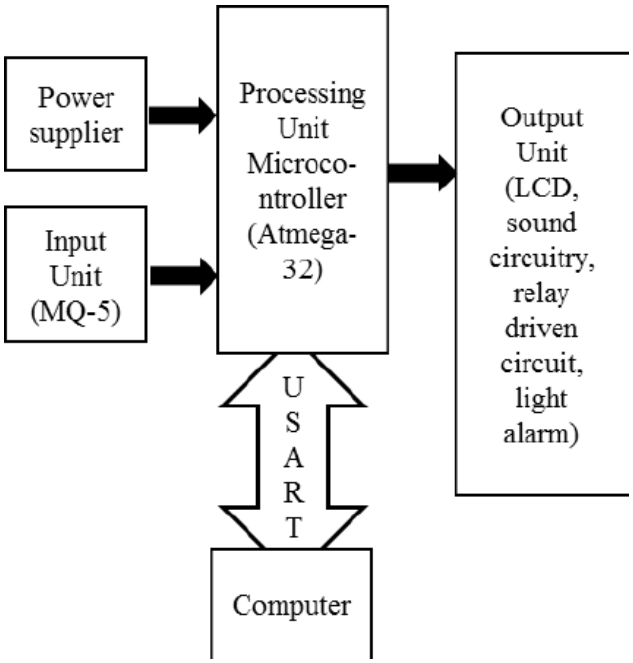
One study, published in the International Journal of Advanced Research in Engineering and Technology in 2018, presents the design and development of a robot for inspecting gas pipelines. The robot was equipped with sensors for detecting methane and carbon monoxide, and it was able to navigate through a pipeline using a combination of ultrasonic and infrared sensors. The study found that the robot was able to detect leaks with a high degree of accuracy, and it was concluded that the robot had the potential to be a useful tool for inspecting gas pipelines in industrial settings.

Another study, published in the International Journal of Applied Engineering Research in 2019, focuses on the use of drones for inspecting gas pipelines. The study proposed the use of a drone equipped with a methane sensor and a thermal camera, and it was able to detect and locate leaks in a pipeline with a high degree of accuracy. The study also discussed the potential benefits of using drones for gas pipeline inspection, such as cost savings and improved safety.

There are also some papers that are discussing the applications of the robots for gas leakage inspection in the context of Indian industries and the challenges that comes with that like the cost and the environmental conditions.

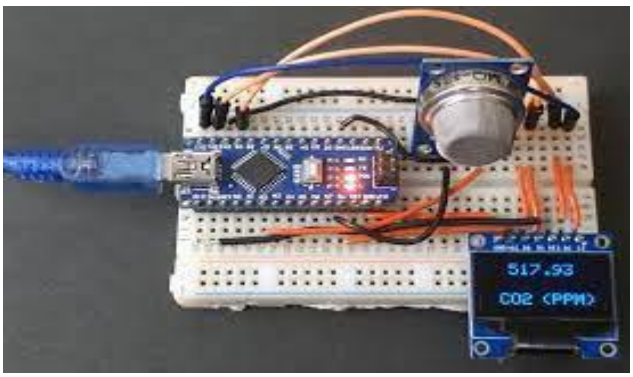
It's important to note that, the research in this area is ongoing and new studies and papers will be published regularly in the future, as more and more organizations in India are starting to explore the potential of industrial gas leakage inspection robots for improving safety and reducing costs in industrial settings.

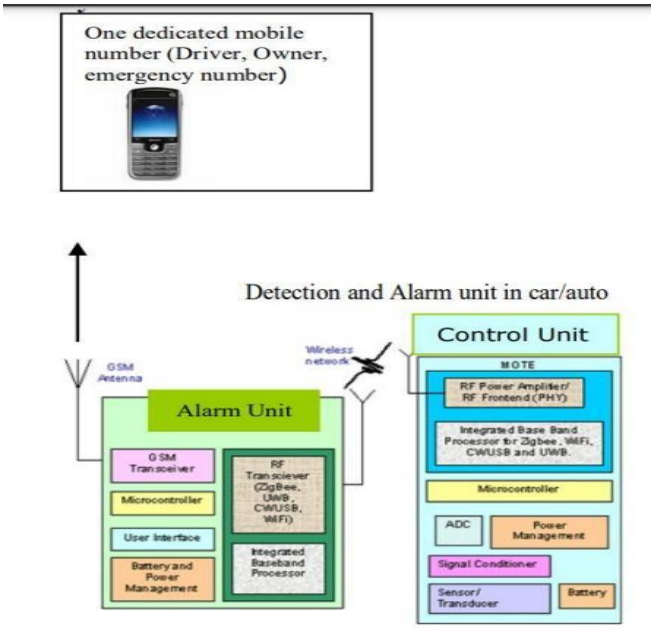
Process chart of the robot: -



Result: -

The results of industrial gas leakage inspection robots vary depending on the specific design and implementation of the robot, as well as the conditions in which it is used. However, in general, the literature suggests that these robots have the potential to be a cost-effective and efficient method for detecting and locating gas leaks in industrial pipelines.





One study found that a robot equipped with sensors for detecting methane and carbon monoxide was able to detect leaks with a high degree of accuracy and concluded that the robot had the potential to be a useful tool for inspecting gas pipelines in industrial settings. Another study that proposed the use of a drone equipped with a methane sensor and a thermal camera, found that the drone was able to detect and locate leaks in a pipeline with a high degree of accuracy. The study also discussed the potential benefits of using drones forgas pipeline inspection, such as cost savings and improved safety.

However, there are still several challenges to be addressed in the development and implementation of industrial gas leakage inspection robots, including improving the accuracy and reliability of the sensors and navigation systems, and developing robust and easy-to-use control interfaces for operators. It's also important to note that the use of gas leakage inspection robots will depend on the specific needs and requirements of the industry and organization. For some cases, it may be more cost-effective and efficient to use traditional methods, while in other cases,the use of robots may be the best option.

CONCLUSION OR PROJECT OUTCOMES: -

In this project we have made a Robot which is used to detect & locate the escaping the from the pipeline. We have used the several sensors to detect the leaking gases from the pipeline which is carrying the gases from the one point to another point. The Raspberry Pi 3 point and Arduino UNO was used for both robotics & process management. When the hazardous gas gets detected by the (e.g. Methane, CO,CO2, H_2 etc.) Gets detected by the inspexo Robot, the alert will be shown on the mobile or on the buzzer as well as display. The approach is very straight forward but highly dependable. The inspexo robot has Remarkable leakage detection it can be used for both Petrochemical as well as manufacturing industry & gaseous industry. The inspexo robot can be used to save lives in perilous situation. The GSM module process the output signal and sends out a warning. Gases such as CO_2, oxygen and propane Methane are detected by the sensors Equipped on the robot. The Arduino OND Microcontroller is used for processing Signals & driver mechanism of the robot. The project is built for the purposeto reduce inspection cost, safe working environment, Remove reduce the efforts required for inspection. The inspexo robot is constructed, conceived and successfully executed as a prototype. The robot was tested on the field and as well as in industry with different gases.

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3. Mechanical carrier of an autonomous mobile robot for inspecting technical objects Marcin Januszka Silesian
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Design and development of a Quadruped robot

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***Abstract*—** The design, development, and motion planning of mobile robots are actively researched fields within robotics. These robots have a wide range of applications, from space exploration and military use to industrial applications. Among the different types of mobile robots, quadrupedal robots are particularly noteworthy due to their ability to navigate various terrains, much like humans and animals. This research project aims to design a quadruped robot capable of stable and efficient movement on both even and uneven terrain. This robot will be modelled after the natural mobility, autonomy, and speed of four-legged animals. The ultimate goal is to create a reliable solution that allows for the exploration of inaccessible landmass that are difficult or dangerous for humans to navigate. The objective is to mimic the sophisticated locomotion patterns of four-legged creatures, providing a means of traversing challenging surfaces that are inaccessible to wheeled robots.

Keywords—quadruped motion, quadruped robot, kinematics, dynamics. Gait development

I. INTRODUCTION

The current research endeavors to create a quadruped robot by utilizing commercially available components, as opposed to the custom-made and complex parts utilized by renowned research institutions such as Boston Dynamics, ANYMal, and ETH Zurich. The objective is to develop a robot that possesses similar capabilities to those of the aforementioned laboratories. The study implements finite element analysis to verify the strength of the selected parts.[1] The focus of the research is to provide a thorough examination of the various components that constitute a quadruped robot. The body parts of the robot are constructed using Polylactic Acid (PLA) produced through 3D printing technology. The design also includes provisions for incorporating electronic components.

II. BODY

A. General Structure

The quadruped robot is comprised of four legs, each attached to the main body via a hip joint. To achieve a total of twelve degrees of freedom, each leg is equipped with three servo motors. The robot also features a torso, which houses the Arduino microcontroller and the Inertial Measurement Unit (IMU) sensor. The front and rear sections of the robot provide space for the installation of ultrasonic sensors, which assist in detecting nearby objects. The design philosophy emphasizes the creation of a robust and uncomplicated structure, utilizing as few components as possible.

Fig 1. *Body of robot*

B. 12 DOF Design

Quadruped robots can have different topologies, including 8-DOF, 12-DOF, and 16-DOF configurations. The 8-DOF structure consists of four hip joints and four knee joints, all aligned parallel to each other. This design allows for fast forward and backward movement, but lacks transverse swing freedom of the hip joint and steering capability. On the other hand, the 16-DOF quadruped robot has more joints for agile locomotion, but is challenging to control. Therefore, the 12-DOF design, which has three rotational joints per leg, is considered the most suitable for this study as it provides a balance between agility and control complexity.

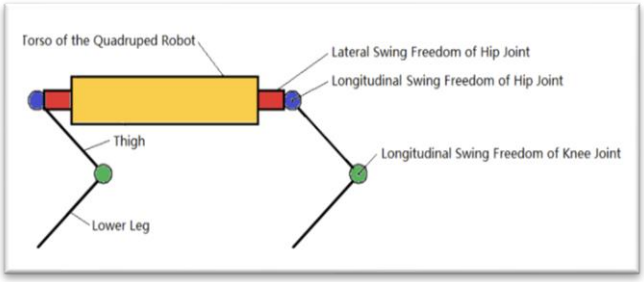

Fig 2. *12 DOF robot front view*

C. Hip Joint

The hip joint is a crucial component in the design and is responsible for generating two degrees of freedom, one for rolling and another for pitch motion. It also serves as the connection point between the torso and legs. A servo motor is placed within the joint cavity and secured using a six-petal flower servo horn. The fabrication process involves integrating the shaft end and hip joint, which streamlines installation and minimizes assembly inaccuracies. Furthermore, the servo for the pitch motion of the hip joint is mounted within the hip joint bracket to conserve

space.

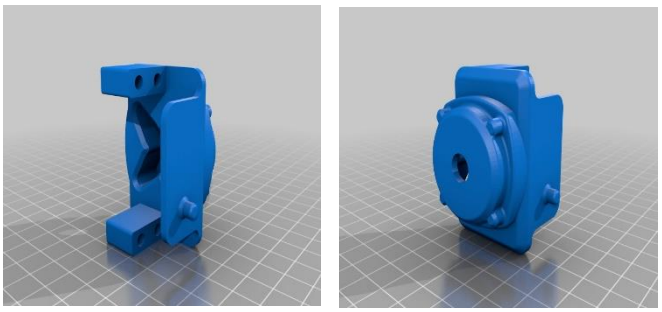

Fig 3. *CAD model of Hip Joint*

D. Torso

The torso of the robot serves as the main housing for electronic components, with carved out holes for securely attaching an IMU sensor using nuts and bolts. Additionally, the plate has a designated groove to accommodate the USB port on the Arduino board for efficient code testing. The design also takes into consideration the placement of the robot's center of mass and battery, and includes fixtures on both the front and rear for attaching the shoulders and legs, respectively.

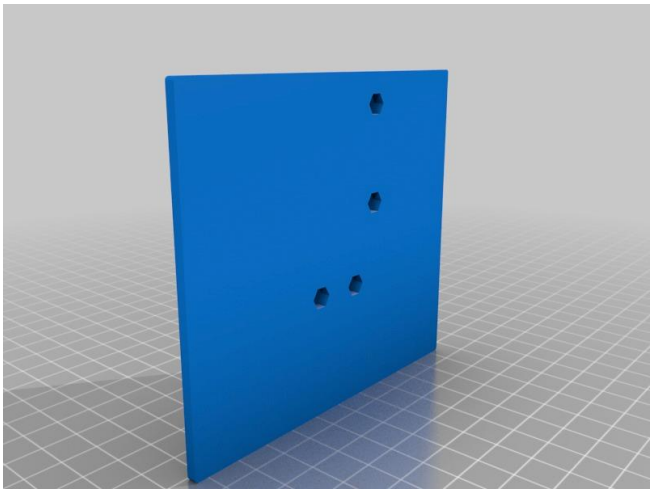

Fig 4. *CAD model of torso*

E. Leg

The design of the legs of the quadruped robot is of utmost importance as they are in constant contact with the ground and serve as a source of power. The forward motion of the hip joint is facilitated by the use of bearings to manage axial forces. To minimize theoretical errors, the thigh and lower leg are designed to be as lightweight as possible. Servo motors are utilized at both the hip and knee joints, with space provided to accommodate the motors. The portion of the leg below the knee joint is particularly significant as it bears the majority of the ground forces and is susceptible to bending or breaking under the weight of the machine. To mitigate these issues, a wheel-like, grooved leg component is added to the end of each leg, providing the ability to traverse various types of terrain with a strong grip.[3]

III. KINEMATICS ANALYSIS

The quadruped robot is a robotic system that comprises a stiff body and four legs with three degrees of freedom each, and all legs share the same structure. The legs are made up of links that are linked to one another via rotary joints. A diagram of the physical representation of the quadruped robot can be seen in Figure 5.

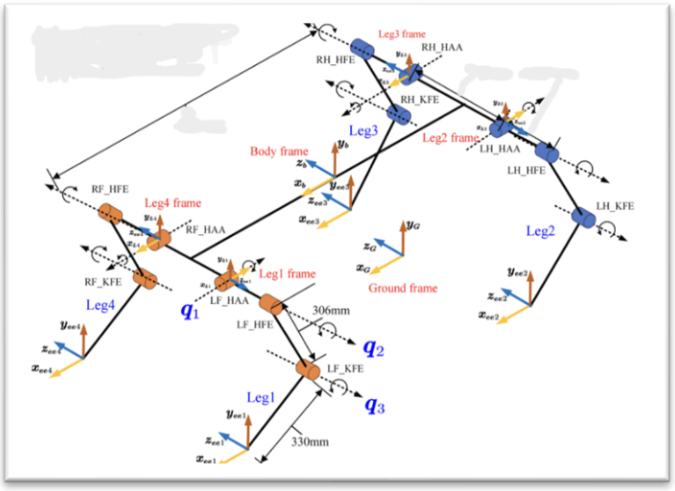

Fig 5. *Physical model of quadruped robot*

The parameters and the different notation used in kinematics analysis is given in the table below.

Physical Dimensions	The Length of Robot	L=1 [m]
	The Width of Robot	W=0.4 [m]
	The Length of Side Swing Joint	L1=0.1 [m]
	The Length of Hip Joint	L2=0.4 [m]
	The Length of Knee Joint	L3=0.4 [m]
Coordinate Systems	The Coordinate System of centre of Body	$[x_m, y_m, z_m]$
	The Main Coordinate System of Each Leg	$[x_0, y_0, z_0]$
	The Coordinate System of Side Swing Joint	$[x_1, y_1, z_1]$
	The Coordinate System of Hip Joint	$[x_2, y_2, z_2]$
	The Coordinate System of Knee Joint	$[x_3, y_3, z_3]$
	The Coordinate System of Endpoint of Leg	$[x_4, y_4, z_4]$
Variables	The Yaw Angle of Robot	ϕ
	The Pitch Angle of Robot	ψ
	The Roll Angle of Robot	ω
	The Angle of Side Swing Joint	θ_1
	The Angle of Hip Joint	θ_2
	The Angle of Knee Joint	θ_3

Table 1. *The parameters of robot*

The relationship between the rotational movements (φ, ψ, ω) around the center of the robot's body and the coordinate system of each leg's endpoint (x_4, y_4, z_4) is studied because the robot's body configuration can vary based on the leg coordinates. To find the position and orientation of the robot's center of body in the workspace, a transformation matrix is obtained using rotation matrices (Eq. 1, Eq. 2, Eq. 3, Eq. 4) in Eq. 5.

$$R_x = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos\omega & -\sin\omega & 0 \\ 0 & \sin\omega & \cos\omega & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad \dots \text{Eq 1}$$

$$R_y = \begin{bmatrix} \cos\phi & 0 & \sin\phi & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & \cos\phi & 0 \\ -\sin\phi & 0 & 0 & 1 \end{bmatrix} \quad \dots \text{Eq 2}$$

$$R_z = \begin{bmatrix} \cos\psi & -\sin\psi & 0 & 0 \\ \sin\psi & \cos\psi & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad \dots \text{Eq 3}$$

$$R_{xyz} = R_x\, R_y\, R_z \quad \dots \text{Eq 4}$$

$$T_m = R_{xyz}\ X \begin{bmatrix} 1 & 0 & 0 & Xm \\ 0 & 1 & 0 & Ym \\ 0 & 0 & 1 & Zm \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad \dots \text{Eq 5}$$

The relationship between the center of the robot's body coordinate system (X_m, Y_m, Z_m) and the main coordinate system of each leg (x_0, y_0, z_0) is described by the transformation matrices in Eq.6, Eq.7, Eq.8, Eq.9. Based on the position and orientation of the robot's body, the positions and orientations of each leg can be determined.

$$T_{rightback} = T_m * \begin{bmatrix} \cos(\pi/2) & 0 & \text{si1n}(\pi/2) & -L/2 \\ 0 & 1 & 0 & 0 \\ -\sin(\pi/2) & 0 & \cos(\pi/2) & W/2 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad \dots \text{Eq}$$

$$6$$

$$T_{rightfront} = T_m * \begin{bmatrix} \cos(\pi/2) & 0 & \sin(\pi/2) & L/2 \\ 0 & 1 & 0 & 0 \\ -\sin(\pi/2) & 0 & \cos(\pi/2) & W/2 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad \dots \text{Eq 7}$$

$$T_{leftfront} = T_m * \begin{bmatrix} \cos(-\pi/2) & 0 & \sin(-\pi/2) & L/2 \\ 0 & 1 & 0 & 0 \\ -\sin(-\pi/2) & 0 & \cos(-\pi/2) & -W/2 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad \dots \text{Eq 8}$$

$$T_{leftback} = T_m * \begin{bmatrix} \cos(-\pi/2) & 0 & \sin(-\pi/2) & -L/2 \\ 0 & 1 & 0 & 0 \\ -\sin(-\pi/2) & 0 & \cos(-\pi/2) & -W/2 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad \dots \text{Eq 9}$$

Forward kinematics of robots involves understanding the relationship between the movement of the joints and the position, velocity, and acceleration of the links. Inverse kinematics, on the other hand, involves determining the joint angles required to achieve a specific position and orientation of the end effector or endpoint of the robot. This is important for controlling the movement of the robot and achieving desired motions.

In the case of a quadruped robot, all the legs have a similar structure but may be in different orientations. Therefore, it is sufficient to study the forward and inverse kinematics of a single leg to understand the overall movement of the robot. The process of forward and inverse kinematic analysis involves mathematical calculations and models of the robot structure to accurately predict the motion and determine the required joint angles.

IV. DENAVIT-HARTENBERG METHOD

The illustration of the right front leg of a robot displays the coordinate systems and the angular positions of its joints. The Denavit-Hartenberg parameters are used to describe the forward kinematics of the leg. These parameters, presented in a table, provide a mathematical model for the relationship between the movements of the joints and the position of the end effector.

The Denavit-Hartenberg parameters are widely used in the field of robotics for the analysis of forward and inverse kinematics of robots. They allow for a systematic and precise calculation of the position and orientation of the end effector based on the joint angles. Understanding and using these parameters is crucial for controlling the motion of a robot and achieving accurate and precise movements.

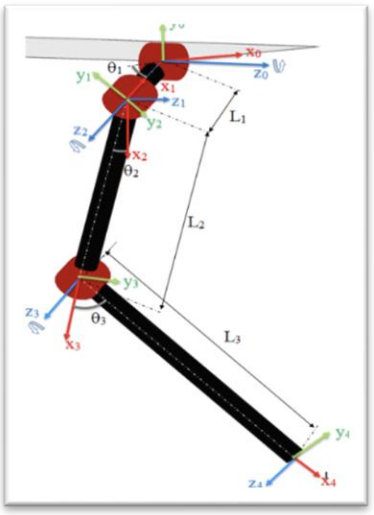

Fig 6. *The Coordinate Systems of Leg Joints*

Link	α_{i-1}	a_{i-1}	d_i	θ_i
0-1	0	L1	0	$\theta 1$
1-2	$-\pi/2$	0	0	$-\pi/2$
2-3	0	L2	0	$\theta 2$
3-4	0	L3	0	$\theta 3$

Table 2. *DH parameters for links of robot*

Each transformation matrix (T_0^1, T_1^2, T_2^3, T_3^4) are given in the equation below and the forward kinematics equation T_0^4 follows further.

$$T_0^1 = \begin{bmatrix} \cos\theta_1 & -\sin\theta_1 & 0 & -L_1\cos\theta_1 \\ \sin\theta_1 & \cos\theta_1 & 0 & -L_1\sin\theta_1 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad \dots \text{Eq 10}$$

$$T_1^2 = \begin{bmatrix} 0 & 0 & -1 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad \dots \text{Eq 11}$$

$$T_2^3 = \begin{bmatrix} \cos\theta_2 & -\sin\theta_2 & 0 & L_2\cos\theta_2 \\ \sin\theta_2 & \cos\theta_2 & 0 & L_2\sin\theta_2 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad \dots \text{Eq 12}$$

$$T_3^4 = \begin{bmatrix} \cos\theta_3 & -\sin\theta_3 & 0 & L_3\cos\theta_3 \\ \sin\theta_3 & \cos\theta_3 & 0 & L_3\sin\theta_3 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad \ldots \text{Eq 13}$$

$$T_0^4 = T_0^1\, T_1^2\, T_2^3\, T_3^4 = \begin{bmatrix} m_{11} & m_{12} & m_{13} & m_{14} \\ m_{21} & m_{22} & m_{23} & m_{24} \\ m_{31} & m_{32} & m_{33} & m_{34} \\ m_{41} & m_{42} & m_{43} & m_{44} \end{bmatrix} \quad \ldots \text{Eq 14}$$

The values of m_{11} to m_{44} are given in the table below. These are called as the elements of a forward kinematics matrix.

$m_{11} = \cos\theta_2\ \cos\theta_3\ \sin\theta_1 - \sin\theta_1 \sin\theta_2 \sin\theta_3$
$m_{12} = -\cos\theta_2\ \sin\theta_1\ \sin\theta_3 - \cos\theta_3\ \sin\theta_1\ \sin\theta_2$
$m_{13} = -\cos\theta_1$
$m_{14} = L_2\cos\theta_2\ \sin\theta_1 - L_1\ \cos\theta_1 + L_2\ \cos\theta_2\ \cos\theta_3\ \sin\theta_1 - L_3\ \sin\theta_1 \sin\theta_2 \sin\theta_3$
$m_{21} = \cos\theta_1 \sin\theta_2 \sin\theta_3 - \cos\theta_1 \cos\theta_2 \cos\theta_3$
$m_{22} = \cos\theta_1 \cos\theta_2 \sin\theta_3 + \cos\theta_1 \cos\theta_3 \sin\theta_2$
$m_{23} = -\sin\theta_1$
$m_{24} = L_3\cos\theta_1 \sin\theta_2 \sin\theta_3 - L_2\cos\theta_1 \cos\theta_2 - L_3\cos\theta_1 \cos\theta_2 \cos\theta_3 - L_1\sin\theta_1$
$m_{31} = \cos\theta_2 \sin\theta_3 - \cos\theta_3 \sin\theta_2$
$m_{32} = \cos\theta_2 \cos\theta_3 - \sin\theta_2 \sin\theta_3$
$m_{33} = 0$
$m_{34} = L_2\sin\theta_2 + L_3\cos\theta_2 \sin\theta_3 + L_3\cos\theta_3 \sin\theta_2$
$m_{41} = 0$
$m_{42} = 0$
$m_{43} = 0$
$m_{44} = 1$

Table 3. *Elements of forward kinematics Matrix*

To obtain an inverse kinematic solution for a quadruped robot, the necessary transformation and forward kinematic matrices are first acquired, and then analytical methods are utilized. This involves formulating equations that describe the angular positions of the joints (θ1, θ2, and θ3) as depicted in Equations 15, 16, and 17. It is essential to keep in mind that the inverse kinematic solutions comprise nonlinear equations, and not all calculated mathematical expressions may have a physical solution. Furthermore, there may be multiple solutions to position a leg's endpoint to reach the desired location.[4]

$$\theta_1 = -a\tan 2(-y_4, x_4) - a\tan 2\left(\sqrt{x_4^2 + y_4^2 - L_1^2}, -L_1\right) \ldots \text{Eq 15}$$

$$\theta_2 = a\tan 2\,(z_4, \sqrt{x_4^2 + y_4^2 - L_1^2}) - a\tan 2\,(L_3\sin\theta_3, L_2 + L_3\cos\theta_3) \quad \ldots \text{Eq 16}$$

Below are presented both the solutions which the inverse kinematics provides.

$$\theta_3 = a\tan 2\left(-\sqrt{1 - D^2}, D\right) \text{ (For leg 1 and 3)}$$

$$\theta_3 = a\tan 2\,(\sqrt{1 - D^2}, D) \text{ (For leg 2 and 4)} \quad \ldots\ldots \text{Eq 17}$$

$$D = (x_4^2 + y_4^2 - L_1^2 + z_4^2 - L_2^2 - L_3^2)/(2\,L_2 L_3)$$

V. LOAD ANALYSIS

The load analysis was conducted using the FEA simulation tool in SOLIDWORKS and the results showed the strain and displacement diagrams for the lower leg when subjected to a vertical contact force. The dynamic load coefficient, η, can be adjusted to take into consideration factors such as environmental conditions, ground-foot interaction, and movements of other legs. The results indicated that the generated strains were within acceptable limits, being less than 3.0 x 10^-4. Additionally, the maximum displacement under maximum torque was found to be only 0.34 mm, meeting the design requirements. These findings indicate that the design of the lower leg is sound and capable of handling the applied forces.

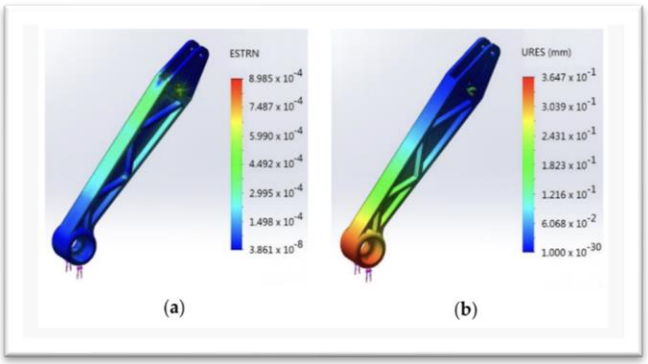

Fig 7. *Load analysis of lower leg*

VI. ELECTRONIC COMPONENTS

The design of the Quadruped Robot incorporates a range of electronic components, including servo motors, sensors such as an ultrasonic sensor and an IMU sensor, motor drivers, a microprocessor such as an Arduino MEGA, a buck converter, a LiPO battery, and connecting wires. Careful consideration has been given to the placement of each component in the design, ensuring that all parts are utilized effectively. Furthermore, the design accommodates potential future developments and aims to ensure versatility in its applications.

A. Motors

The motors are considered as the critical component of the robot, as they enable all useful functions of the robot. The selection of the appropriate motors is crucial in ensuring the success of the robot. In order to drive the leg joints effectively, the motors must meet two essential requirements, namely the ability to provide angular feedback for accurate positioning of the leg and the capability to generate enough torque to support the weight of the robot.

Servo Motors were deemed as the best choice to meet these criteria due to their affordability and capabilities. The team decided to use MG 996R motors, with a total of 12 being integrated mainly into the legs of the robot. These servo motors provide both angular feedback and ample torque, making them suitable for driving the leg joints and ensuring proper function of the robot.

B. Sensors

The robot is designed with a range of sensors that enable it to gather information about its surroundings and map it out. One of these sensors is an ultrasonic sensor, which uses proximity to detect objects in its environment. Another important sensor that

the robot has is the Inertial Measurement Unit (IMU) sensor. The IMU sensor provides information about the orientation of the robot by measuring the six degrees of freedom through three axes of gyroscopic and three axes of accelerometric data.[2] The use of IMU sensor, along with controllers such as PID, allows the robot to maintain balance on uneven surfaces or slopes. By combining the data from these sensors and utilizing advanced control systems, the robot is able to operate efficiently and navigate challenging environments with ease.

VII. OVERALL DESIGN

The figure below presents the complete design of the quadruped robot, which has a total of 12 degrees of freedom and a full-elbow leg configuration. The design uses four identical legs, making it easier to control the robot. The hip joint is connected directly to the servo motor, streamlining the internal structure, while the knee joint incorporates a servo motor within its design. This design approach simplifies the control and movement of the quadruped robot.[7]

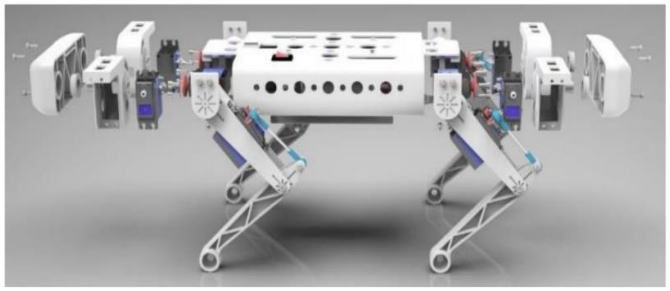

Fig 8. *3D exploded view of the quadruped robot assembly*.

VIII. GAIT ANALYSIS

Gait analysis is a critical process utilized to examine the movements of quadruped robots during their locomotion. The technique involves the utilization of several sensors, including accelerometers, gyroscopes, and motion capture systems, to monitor and record the robot's movements. The data collected during this process is analysed to study the robot's coordination and gait during various forms of locomotion, such as walking and running.[5]
Through gait analysis, an in-depth understanding of the robot's performance, identify any anomalies or inconsistencies in its movements, and improve its locomotion strategies. Additionally, gait analysis can help determine the most efficient way for the robot to move and adapt to different terrains. This, in turn, can enable the development of better control algorithms for the robot, thus improving its stability during locomotion.

A. Walking Gait

Walking gait in a quadruped robot involves the coordinated movement of all four legs to achieve forward motion. During the walking gait, the robot's legs alternate between two support phases and two swing phases. In the support phases, the robot's legs are in contact with the ground, providing stability and support to the robot. In the swing phases, the robot's legs are lifted off the ground and moved forward to take the next step.

The walking gait can be further subdivided into specific phases, which include the stance phase and the swing phase. During the stance phase, the robot's leg is in contact with the ground, providing support and propulsion for the robot's forward movement. The swing phase, on the other hand, is when the robot's leg is lifted off the ground and swung forward to prepare for the next step.

B. Pace Gait

Pace gait is a type of locomotion used by quadruped robots that involves the coordinated movement of diagonal pairs of legs. During trotting gait, the front left leg and the rear right leg move together, and the front right leg and the rear left leg move together in a cyclic pattern.[6] This gait is faster than walking and is commonly used by quadruped robots for faster locomotion.

During pace, the robot's body bounces up and down with each stride, and the legs experience both vertical and horizontal forces. The robot's legs are extended out in front of the body and then pulled back under the body to push off the ground and take the next step. This motion creates a rhythmic pattern that propels the robot forward.

C. Trotting Gait

Trotting gait is a faster and more dynamic gait used by quadruped robots for locomotion. During Trotting gait, the robot's legs move in a cyclic pattern, with all four legs lifted off the ground during the swing phase of the gait. The robot's body is also lifted off the ground during the running gait, creating a more dynamic and rapid movement.
The Trotting gait involves the legs moving in a coordinated pattern, with the front and hind legs moving together. The robot's legs are extended out in front of the body and then pulled back under the body to push off the ground and take the next step, creating a galloping-like motion.
Trotting gait requires more complex control strategies than other gaits, as the robot must maintain balance and stability at higher speeds. This is achieved through a combination of open-loop and closed-loop control, with the robot's sensors providing feedback to the control system to adjust the robot's gait and maintain stability during the high-speed locomotion.

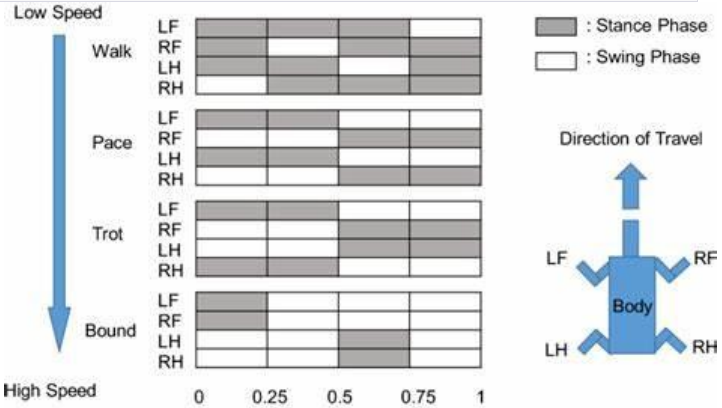

Fig9. *Different gaits w.r.t to speed*

IX. CONCLUSION

This study investigates various aspects of a quadruped robot based on the design of the Boston Dynamics robot. The study utilizes the Denavit Hartenberg method for forward kinematics and analytical solutions for inverse kinematics to perform forward and inverse kinematic analysis of the robot. The

resulting kinematic equations are subsequently utilized for further analysis of the robot's movement.
In addition, the study examines the electronic components of the robot and provides suggestions for future development.
The lower portion of the robot's leg, which bears the majority of the body weight, was subjected to Finite Element Analysis (FEA) to test for strength and durability. The analysis resulted in determining the load capacity of the leg, which was found to be without any signs of failure or cracks, indicating the overall stability and robustness of the robot.
Finally, the study explores the different gaits used by the robot and the associated gait analysis, which is critical for the robot's locomotion. This involves identifying and analysing various parameters, including joint angles, leg displacement, and ground reaction forces, to determine the most efficient and stable gait for the robot. The results of this study provide important insights into the design and development of quadruped robots and their movement capabilities, paving the way for their use in various applications.

IX. FUTURE SCOPE

Our current research focuses on enhancing the capabilities of our quadruped robot. We are exploring the addition of wheels at the knee joint to increase its speed and efficiency when moving on smooth surfaces. Additionally, we are working to add more sensors to make the robot more versatile and applicable to a wider range of industries. To achieve full autonomy, we aim to integrate advanced technologies like Kalman filters, path planning algorithms, and probability. Our goal is to create a quadruped robot that can operate independently and handle complex tasks with ease.[8]

ACKNOWLEDGMENT

We would like to take a moment to thank TCET, and for our patient guidance, enthusiastic supporter, and useful critic of this research work, our advisor, Dr. Hemant Kasturiwale and Mr. Sachin Oak.

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Review on increasing the efficiency of pulsating heat pipes

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***Abstract*: Heat pipes are one of the most important elements used for cooling of electronic components. By definition, it transfers heat between two devices through phase transition. There are two types of heat pipes: Open loop heat pipe and Closed loop heat pipe. They are widely used in cooling systems of laptops and computers, spacecrafts, solar energy, etc. Efficiency in heat pipes is one of the most important factors for effective heat transfer in cooling systems[15]. Our paper discusses the efficiency of an open loop copper heat pipe using different mixtures in different diameters**

Keywords: Pulsating heat pipes, heat, dimensions, working fluid, temperature, evaporator, adiabatic, condenser

Introduction

What is a heat pipe?

Heat pipes have been used in several applications since many decades[16]. Applications of heat pipes are:

- Aeronautical Engineering
- Space Equipments
- Electronics cooling
- Solar Energy

Heat pipes and vapour chambers have emerged as the most significant technology and cost-effective thermal solution owing to their excellent heat transfer capabilities, high efficiency and structure simplicity.[2] A selection of the working fluid is based on the operating temperature of the application.[2]

Heat Pipes can also be used in several environmental applications in future as it is the most developing field recently.

Parts of a heat pipe

Any heat pipe consists:

1. Condenser
2. Evaporator
3. Adiabatic
4. Wick
5. Working Fluid

No power source other than heat is required in a heat pipe as long as the temperature difference in the heat pipe is large enough to carry out the operation .[5]

The adiabatic section is important for improving the anti-dry out ability of the heat pipe which is one of the key factors in determining the efficiency of heat pipe[17].

The condenser section is the section where the working fluid is cooled and the evaporator section is the section where it gets vaporised.

The function of the wick of the heat pipe is to vary the capillary force about the cross section of the heat pipe to return the liquid[18] from the evaporator and condenser.

The working fluid is responsible for the heat transfer capabilities of the heat pipe. Thus the heat transfer capability depends largely on the working fluid of the heat pipe.

Introduction to Pulsating Heat Pipe

By definition, a pulsating heat pipe, a type of wickless heat pipe, is a medium of heat transfer between hot and cold sources. Oscillating, loop type or pulsating heat pipes (PHPs) are a relatively new type of heat transfer devices, which may be classified in a special category of heat pipes. They have been introduced in the mid-1990s.[1]

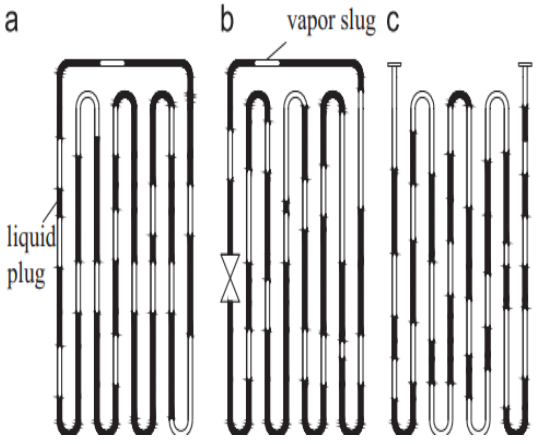

Figure 1 (a) closed PHP; (b) closed PHP with check valve; and (c) open PHP by Xiaohong Han, Xuehui Wang, Haoce Zheng, Xiangguo Xu n , Guangming Chen

There are three types of pulsating heat pipes:

1. Open Loop Pulsating Heat Pipe
2. Closed Loop Pulsating Heat Pipe
3. Closed Loop Pulsating Heat Pipe with check valve

The features of the open loop and closed loop pulsating heat pipe are as follows:

1. Closed loop heat pipe is an endless heat pipe and the open loop heat pipe's tube ends are not connected to each other.
2. Though closed loop and open loop heat pipes consist of both evaporator and condenser sections, adiabatic sections may or might not be present.
3. The ends of the open loop heat pipes are sealed post the working fluid is filled in it.

Filling Ratio for a Heat Pipe

The optimal filling ratio for the heat pipe is considered to be 40% as at 100% filling ratio, the device acts as a buoyancy driven thermosyphon[7]

Required Number of turns

An optimum number of turns are required in a heat pipe so that the dry-out ability and heat flux of the heat pipe are not affected.

Design of the pulsating heat pipe

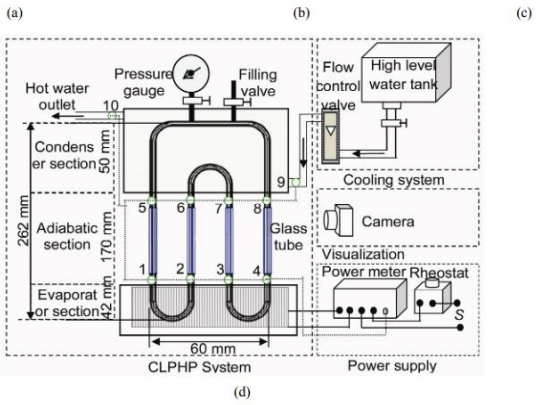

Figure 2: (a) Experimental set-up photograph; (b) copper/ glass tube arrangement; (c) heater arrangement; (d) schematic of experimental set-up by Pramod R. Pachghare, and Ashish M. Mahalle

We are going to consider the given dimensions for our heat pipe.

The working fluids for which the heat pipes are going to be tested are water-methanol and water-ethanol solutions for 2 mm and 3 mm ID

The material used for the heat pipe is copper.

The wall thickness is 0.5 mm in the given heat pipe.

Results and Discussions

	For 2 mm ID	
Heat Input In Watts	Evaporator Temperature(K)	Condenser Temperature(K)
10	351	320
30	368	333
50	375	344
70	386	351

Table 1: Effect of water-methanol solution on a heat pipe with 2mm ID by J.Venkata suresha,P.Bhramarab

	For 3 mm ID	
	Evaporator Temperature(K)	Condenser Temperature(K)
	317	303
	327	306
	333	307
	339	308

Table 2: Effect of water-methanol solution on a heat pipe with 3mm ID by J.Venkata suresha,P.Bhramarab

	For 2 mm ID	
Heat Input In Watts	Evaporator Temperature(K)	Condenser Temperature(K)
10	317	303
30	378	333
50	397	347
70	410	354

Table 3: Effect of water-ethanol solution on a heat pipe with 2mm ID by J.Venkata suresha,P.Bhramarab

	For 3 mm ID	
	Evaporator Temperature(K)	Condenser Temperature(K)
	316	303
	325	306
	330	307
	339	308

Table 4: Effect of water-ethanol solution on a heat pipe with 3mm ID by J.Venkata suresha,P.Bhramarab

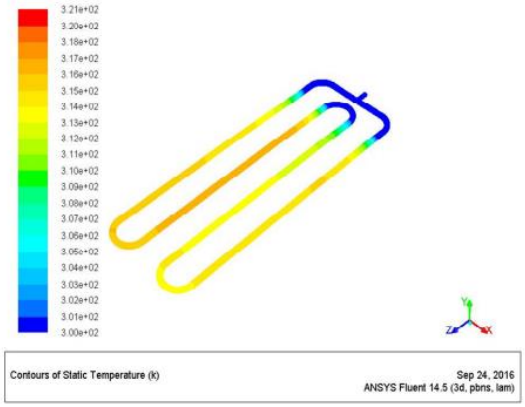

Figure 3: Temperature Contours of PHP Water-Ethanol as Working fluid 10W Heat Input (v/s) Fill Ratio For 2mm inner dia by J.Venkata suresha,P.Bhramarab

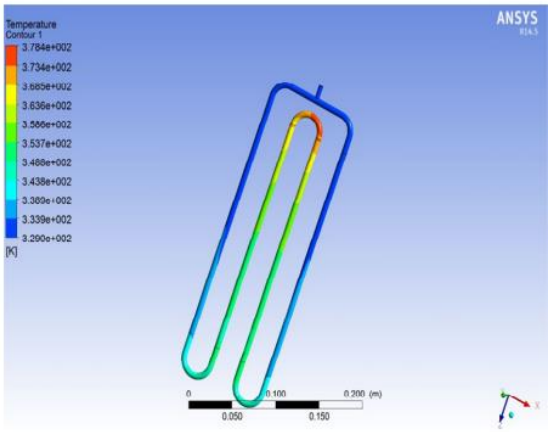

Figure 4: Temperature Contours of PHP Water-Methanol as Working fluid 10W Heat Input (v/s) Fill Ratio For 3mm inner dia by J.Venkata suresha,P.Bhramarab

Future Scope

We have included the test results of heat pipe with water-ethanol and water-methanol solutions.

Water-ethanol, water-methanol, water-acetone solutions fall under the category of conventional working fluids.

The above heat pipe can be tested with non-conventional fluids like FS39E and Al2O3.

Acknowledgement

We would like to thank our institute: Thakur College of Engineering and Technology for providing the platform for the research of the project. We would also like to thank our mentor, Mr. Pawan Tiwari for the guidance and mentorship of the project.

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Predictive Maintenanace of AC motor

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ABSTRACT

Condition monitoring together with predictive maintenance of electric motors and other equipment used by the industry avoids severe economic losses resulting from unexpected motor failures and greatly improves the system reliability. This project describes a Machine Learning architecture for Predictive Maintenance. The system will be tested on a real industry example, by developing the data collection and data system analysis, applying the Machine Learning approach. Data has been collected by various sensors, machine microcontroller and communication protocols and made available to Data Analysis Tool on the ThingSpeak Cloud architecture.

I. INTRODUCTION

Recently, with the emergence of Industry 4.0 (I4.0), smart systems, machine learning (ML) within artificial intelligence (AI), predictive maintenance approaches have been extensively applied in industries for handling the health status of industrial equipment. Due to digital transformation towards I4.0, information techniques, computerized control, and communication networks, it is possible to collect massive amounts of operational and processes conditions data generated form several pieces of equipment and harvest data for making an automated fault detection and diagnosis with the aim to minimize downtime and increase utilization rate of the components and increase their remaining useful lives. Predictive maintenance is inevitable for sustainable smart manufacturing in I4.0. Machine learning (ML) techniques have emerged as a promising tool in Predictive maintenance applications for smart manufacturing in I4.0, thus it has increased attraction of authors during recent years. This project aims to provide a comprehensive review of the recent advancements of ML techniques widely applied to Predictive maintenance for smart manufacturing in I4.0 by classifying the research according to the ML algorithms, ML category, machinery, and equipment used, device used in data acquisition, classification of data, size and type etc.

II. Background

Breakdown maintenance was practiced in the early days of production technology and was reactive in nature. Equipment was allowed to run until a functional failure occurred. Secondary damage was often observed along with a primary failure. This led to time-based maintenance, also called preventive maintenance.

Due to the high maintenance costs when using preventive maintenance, an approach to rather schedule the maintenance or overhaul of equipment based on the condition of the equipment was needed. This led to the evolution of predictive maintenance and its underlying techniques. Predictive maintenance requires continuous monitoring of equipment to detect and diagnose defects. Only when a defect is detected, the maintenance work is planned and executed.Today, predictive maintenance has reached a sophisticated level in industry. Till the early 1980s, justification spreadsheets were used in order to obtain approvals for condition-based maintenance programs. Luckily, this is no longer the case.The advantages of predictive maintenance are accepted in industry today, because the tangible benefits in terms of early warnings about mechanical and structural problems in machinery are clear. The method is now seen as an essential detection and diagnosis too that has a certain impact in reducing maintenance costs, operational vs. repair downtime and inventory hold-up.

III. OBJECTIVES & SCOPE

To design and develop a system for predictive maintenance of motor which has the following features:
Collects data using various sensors.
Logs data to cloud server.
Data logged can be exported to csv file.
Machine learning approach for predictive maintenance based on the csv file obtained.

IV . LITERATURE SURVEY

The recent explosion of smart manufacturing applications, the Internet of things (IoT), and big data has considerably increased the amount of data collected and analyzed in different areas such as health care, transportation, power energy, food and beverage, multimedia, environment, finance, and logistics. Several types of predictions, production forecasting, fault detection and, predictive maintenance result from analyzing various datasets [1], [2]. One of the most common data types collected in this new

growing era of Industry 4.0 is time-series data. Time-series data are known as observations sequentially recorded over time [3], [4]. Time-series data are intensively analyzed, as a preventive tool, in the manufacturing industry where unforeseen failures of machinery can conduct to very long production downtime and losses. Studying and analyzing data to detect faults and threats in devices before they occur and taking appropriate measures to reduce the risk of failures is called ‘‘predictive maintenance’’ [5]. As per [6], predictive maintenance is an ensemble of activities that detect any abnormal physical condition changes in equipment (signs of failure) to carry out the required maintenance tasks to boost the service life of equipment without increasing the risk of failure. For the past years, predictive maintenance has been subject to much research to bring improvement. One of the current innovative trends for this concept is the use of machine learning (ML) techniques in combination with advanced technological concepts to offer better predictive maintenance results. Machine learning (ML) is a field of Artificial Intelligence (AI) to extricate useful insights from various data (time-series data) [7] through some of the following paradigms: supervised learning, semi-supervised learning, unsupervised learning, and reinforcement learning [8]. It is also commonly known as a study that offers machines different means and ways to make correct decisions on their own and execute tasks without explicit assistance from human beings. Deep Learning is a branch of ML that has the capability of extracting data representation. Some popular deep learning methods are Artificial Neural Network (ANN), Convolution Neural Networks (CNN), Deep Belief Network, Recurrent Neural Networks, and Stacked Auto-Encoders. In this research, we focus on CNN, which is a deep learning technique that tries to imitate the operations of a human brain, especially its ability to recognize and classify objects based on their appearances. This feature has made CNN the conventional method used for image classification and identification [10]. In 2015, [11] initiated an inventive approach that improved classification and imputation by encoding univariate time-series (UTS) data to images and using them as inputs to CNN models. The concept of computer vision introduced the transformation of time-series into images. By learning spatially invariant features from raw time series (inputs to the model), the CNN method can reduce the risks of losing temporal information and those that the features learned are no longer time-invariant, which are with the traditional multilayer-perceptron approach [12]. The outcome of this study generated better results than traditional machine learning techniques for classification. Since then, fewer more studies were conducted in the same vision utilizing the basis of timeseries imaging encoding and deep learning approaches to ameliorate classification modelling in various sectors. Reference [13] developed a similar framework that uses Relative Position Matrix with CNN. The method was named RPMCNN and was used to perform the classification by transforming 2D images from time-series data received as inputs. Their results displayed improved performances. In the manufacturing sector, an approach was int roduced by [14] using multivariate timeseries (MTS) data as input to a classification of Tool wear for a CNN model. Because of the large volume of MTS data and in order to ease data processing, this approach divided MTS inputs into three channels before being converted to images and fed into the CNN model. Reference [3] conducted another research in that direction by converting MTS data to coloured images and feeding them as inputs of a CNN model for sensor classification. Their research encodes MTS data into multiple images combined into a single bigger image used as an input to a CNN model.

V . PROPOSED WORK

Sensors will be used to monitor and collect data.

The data collected will be passed to NodeMCU Microcontroller.

NodeMCU microcontroller is chosen because it supports inbuilt Wi-Fi. Hence data can be directly stored to cloud storage over the internet.

Cloud Storage that will be used for storing data is ThingSpeak Cloud. It supports data storage along with visualizations. Once sufficient amount of data is collected it can be exported into Excel .csv format.

The data exported from ThingSpeak Cloud is the dataset which will be used as a dataset for Machine Learning.

Pre-processing steps such as exploration, cleaning and transformation of dataset will be done using Python.

Machine learning prediction models such as Random Forest, Decision Tree, Naïve Bayes etc. can be used for predictive maintenance of motor and to predict failures in motor.

Visualisation of the data can be done using Python Modules such as matplotlib, seaborn, ggplot etc.

VI. WORKING

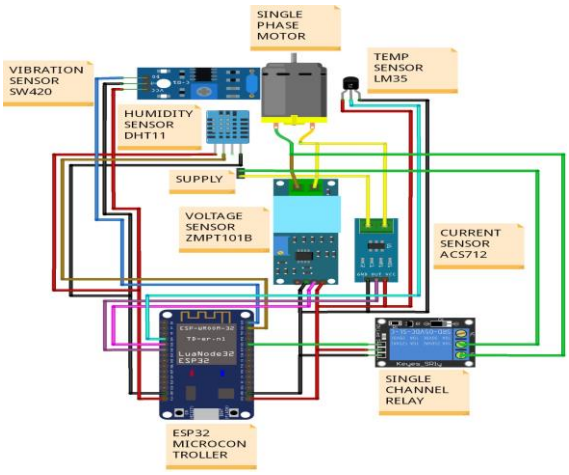
The system comprises of sensors such as Temperature, Humidity, Vibration, Current, Voltage. These sensors are connected to the ESP32 Microcontroller. The reason for using ESP32 Microcontroller is, it has inbuilt Wi-Fi which makes it suitable for IoT applications. The sensors are connected in order to monitor the Motor which is the device that has to predict failures. The Temperature, Current and Voltage Sensors work on analog pins of microcontroller with supply voltage 3.3V while the Humidity and Vibration sensors work on Digital Pins with supply voltage 5V. All the sensors collect data and provide it to the microcontroller. The microcontroller then processes this data and if any of the sensor value exceeds threshold it sends an alert and switches off the supply to the motor by de-energizing the relay. All this data is then sent to ThingSpeak Cloud Storage. This data can then be exported and used for Machine Learning i.e. Predictive Maintenance of Motor. Once the data is exported it needs to be cleaned for inconsistent data removal and dropping data which is not required. Then the data is explored in order to identify the relationship between data. Necessary adjustments are done in the data

transformation step so that the machine can correlate the data. Once these stages are completed, we train the machine by giving 70% of the data. Testing is done on the next 30% data and a model is built based on this. Now live data can be provided for predicting failure of the system.

VII . ALGORITHM

Step 1: Start
Step 2: Is device connected to internet. If yes go to step 3 or else repeat step 2.
Step 3: Collect sensor data
Step 4: Log sensor data to cloud.
Step 5: Export sensor data from cloud
Step 6: Use ML for predictive maintenance on exported data.
Step 7: Stop

VIII . CIRCUIT DIAGRAM



IX . MATHEMATICAL MODELING

Current Sensor
cavg = 150 sample values of current / 150
Sensitivity = 0.66
current = (2.5-(cavg*(5.0/1024.0)))/0.066;

Voltage Sensor
vout = (vtgsensed * 5.0) / 4095.0
voltage = vout / (7500.0/(30000.0+7500.0))

Temperature Sensor
milliVolt = lm35voltagesensed * (3300.0 / 4096.0);
tempC = milliVolt / 10;

Logic
if (temp > 50 or hum > 75 or vib == 1 or vol > 230 or cur > 3) --> Alert
else --> No Alert

X . ADVANTAGES

Increase in machine productivity
Improved repair time & product quality
Increase machine life
Resources for repair can be properly planned
Save maintenance costs.

XI . APPLICATIONS

Assess engine degradation, shaft and rotor alignment, insulation, gears, scan for short-circuits.

XII . RESULTS AND DISCUSSION

The result of the project was that we were able to learn the basics of machine learning and python. We were able to form a bridge between the hardware part and the software analysis. We have started working on the implementation process. We understood that with the help of python language we could use the machine learning algorithms on the jupyter notebook which we would later feed it to the microcontroller.

XIII . CONCLUSION

Predictive maintenance requires continuous monitoring of equipment to detect and diagnose defects. Only when a defect is detected, the maintenance work is planned and executed. Today, predictive maintenance has reached a sophisticated level in industry. Till the early 1980s, justification spreadsheets were used in order to obtain approvals for condition-based maintenance programs. Luckily, this is no longer the case. The advantages of predictive maintenance are accepted in industry today, because the tangible benefits in terms of early warnings about mechanical and structural problems in machinery are clear. The method is now seen as an essential detection and diagnosis too that has a certain impact in reducing maintenance costs, operational vs. repair downtime and inventory hold-up.

XIV . FUTURE SCOPE

Customized Cloud server can be developed instead of using ThingSpeak Cloud Server.
Data logging rates can be adjusted for more accurate results.

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***Abstract*—This paper focuses on power generation on highway by using Vertical Axis Wind Turbine & Solar System. Energy is a very essential part of life which has unlimited usage but the resources of it is limited. So, there is a need to establish a relationship between resources and the population. In this context, renewable energy has a huge role. And, from the numerous available renewable sources, our paper will focus on wind power. Wind is available on each corner of the world, but harnessing it as a energy source came to mind in 19th century. In the highway, the vehicles provide considerable amount of wind that can be extracted for small purposes. VAWT is a special type of windmill which is capable to perform such task. The air will rotate the turbine in one direction and the solar system will also generate electrical energy and the output of both this system will be stored in the battery that will be utilized for street lighting, toll gates and so on.**

Keywords—Vertical Axis Wind Turbine, Renewable Energy, Wind Power, Solar Panels, Battery, Highways.

I. INTRODUCTION

Wind is generated through uneven heating of earth surface by the sun. And, this wind can be utilized as the renewable source of power. To harness the wind, the turbine is used, whether horizontal which is very common and vertical which is our attempt of project. The prime aim behind our project is to design a Vertical Axis Wind Turbine which can effectively catch the wind from the vehicle speed running on the highway. From the main two types of VAWT, we will be working on Savonius VAWT.

The savonius turbine was introduced by Finnish Engineer S.J. Savonius in 1922. This type of windmill are commonly used for wind speed instrument such as the anemometer. The solar panels installed will help to generate electricity in sun mode and in the absence of sun, wind will do his work of generating power. The electrical output produced will be stored in the battery which can be utilized according to the small or minimal needs or at the time of power grid failure. This project will also fight for Mother Earth by reducing the burning of fossil fuels and restricting the emission of gases.

II. LITERATURE SURVEY

THE FOLLOWING LITERATURE PERTAINED BY US WHICH WHERE RELATED TO OUR EXPERIMENTAL METHODS.

"A REVIEW ON THE DEVELOPMENT OF VERTICAL AXIS WIND TURBINES" BY MAJID AMIDPOUR ET AL. (RENEWABLE AND SUSTAINABLE ENERGY REVIEWS, 2019): THIS REVIEW PAPER PROVIDES AN OVERVIEW OF THE DEVELOPMENT OF VERTICAL AXIS WIND TURBINES, INCLUDING THEIR HISTORY, CLASSIFICATION, DESIGN, AND APPLICATIONS. **"A COMPREHENSIVE REVIEW OF VERTICAL AXIS WIND TURBINES" BY KARIM M. M. ET AL. (RENEWABLE AND SUSTAINABLE ENERGY REVIEWS, 2018):** THIS REVIEW PAPER PROVIDES A DETAILED OVERVIEW OF THE VARIOUS TYPES OF VAWTS, THEIR AERODYNAMICS, STRUCTURAL DESIGN, AND PERFORMANCE CHARACTERISTICS. **"VERTICAL AXIS WIND TURBINES: HISTORY, TECHNOLOGY AND APPLICATIONS" BY S. PARASCHIVOIU (RENEWABLE ENERGY, 2009):** THIS PAPER PROVIDES A HISTORICAL OVERVIEW OF VAWTS AND THEIR VARIOUS DESIGNS, INCLUDING THE DARRIEUS, AND SAVONIUS DESIGNS.

III. DESIGN

This phase is one of the most important and essential phases of our project. The design required and intended for our project is to enhance and improve the efficiency of our turbine. It should have low cut-in wind speed, lightweight

and should be easily movable without adding extra cost and without reduction of it's efficiency. The low cut-in speed will make it suitable for urban applications. The design of VAWT can be varied according to their applications and usage, but they all consists of rotor, shaft and blades.

Our model have a simple design with two or three blades are attached to a hub. The blades are curved in a semi-circular shape around a central shaft. Fig. 1 shows the image of our proposed turbine.

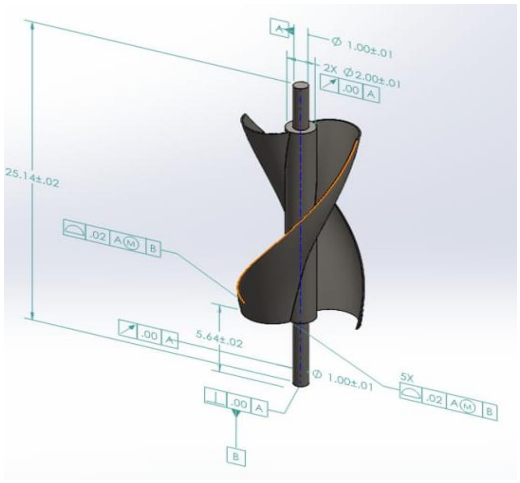

Fig 1: Savonius VAWT's Model

The structure of our proposed model is kept simple for the economic feasibility of our project. The model consists of a rotor blades, shaft, bearings, and the generator. Fig 2 shows a sample model or design of our VAWT.

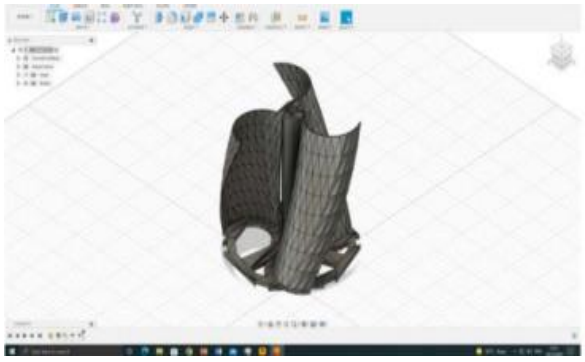

Fig 2: Savonius VAWT on Fusion 360 software

IV. MATERIAL SELECTION

As mentioned earlier, the prime components of the Savonius VAWT are rotor blades, shaft, generator, solar panels, battery.

A) Rotor Blades –

Blades are the most important part of turbine which can reduce or increase the efficiency of the turbine depending upon their design. VAWT are of two types – Drag Machines which are self-starting but have low efficiency and another one is Lift Machines which have great efficiency but are not self-starting. And, in case of Highway Windmills, self-starting is most important feature. For our project, we are using PVC pipe as main material and the blade strip will be of mild steel.

B) Shaft –

Shaft should be less in thickness and light in weight. It should be properly fitted to the blade. Shaft will be made up of Mild Steel in our project.

C) Bearing –

Bearing is one of the most essential mechanical components. It will used in our project for smooth functioning of our shaft. Same dimension bearing is used at both the ends of shaft for smooth function.

D) Battery –

Battery is very crucial part of our project for storing the electrical output. For our project, we are using, a sealed lead-acid (SLA) gel battery which is also called as valve regulated acid lead battery. It's a maintenance free battery.

V. METHODOLOGY

Design Parameters for Wind Turbine is considered for our project and the related calculation is pertained in this paper.

Length of blades/turbine, L = 900mm (Effective)
Diameter of turbine, D = 700mm
No. of turbine blades = 6
No. of casing/guide blades = 6

Swept Area i.e., the air enclosed in the movement of turbine is calculated as –

S = 2 RL (1) = 2x0.35x0.9 = 0.63m2
Where, S is the swept area [m2], R is the rotor radius [m], and L is the blade length [m].

Power that can be extracted from the wind can be calculated from the following formula –

Pw= ½ ρ S Vo 3
The theoretical calculation for 6 m/s wind is as follows;
Pw = ½ ρ S Vo 3 = 1/2x1.225x0.63x63
Pw = 83.249 watt. Hence from above Power available (Pw) at 6m/s we get the output of 83.249watt.
Considering the efficiency of 16.67%, the power captured as 13.894watt.
For 10m/s, Pw = ½ ρ S Vo 3 = 1/2x 1.225X0.63x 103 Pw = 385.875 watt Again considering efficiency of 15-20%, the power captured is 64 watt approximately.

Number of blades has a direct effect in the smoothness of the turbine –

Considering tip-speed ratio to be 2, then linear velocity at the tip is 5m/s.
Tmax= Pmax /(V/R) = 385.875/ (5/.35)
Tmax = 27.01125 Nm
Maximum force acting on blades,

Fmax = Tmax /R = 27.01125/.35
Fmax = 77.175 N For good lift force and minimize the drag force, angle of attack should be in between 300 -450 .
In our case, this is taken care by guide blades on casing. The turbine blades are made up of PVC pipes which were cut in semi-circular shape to serve the purpose.
Angle of attack = 300
Lift = 77.175cos (300) = 66.835 N
Drag = 77.175sin (300) = 38.587 N
Collapse resistance of blades = 735.75 kPa… (From Std. catalogue of PVC pipe)
Blade strength = Fmax /Area of single blade (10) = 77.175/ (πdb 2L/4) = 77.175/(πx.1532x.9/4) = 4664.0305 Pa < collapse resistance of blade.

Hence, design of blades is safe.

VI. ACKNOWLEDGEMENT

We sincerely thank to our Principal Mr. B.K. Mishra, Mentor Dean Mrs. Kamal Shah, HOD Mr. Siddesh Siddappa and Guide Mr. Krishna Gaikwad for his guidance and support for carrying out our project work.

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Drone for seed sowing

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***Abstract*—As the project is related to the agriculture field and converting any manual process into mechanized one has many challenges to solve the defined problem. There are seed dropping drones available in the market for curing deforestation and no such product is available for seed sowing in farming by using drones. The aim is to have a drone which sows seeds with having a heavy payload of 15 - 20 kg. The challenge is to fly the drone at a given height with a determined speed by carrying variable payload. The target is to have a product which can be useful for the majority of crops but the seed rate differs for all therefore there arises a need to make the functions automatic so as to make the product more user friendly. The plan of work flow is to build a scaled down prototype with 2 kg payload and on the basis of the results develop design for 20 kg payload. For this project the seeding mechanism used in different products is needed to be studied. This paper gives the detailed information of different types of seeding mechanism.**

Keywords—Drone, seed wowing, mechanism

I. INTRODUCTION

In farming there are many problems but by research the problem which can be solved by engineering is lack of mechanization. Mechanization plays an important role in speeding up any process. It gives power and speed to the process but sadly the agricultural activities in India are not using much machinery in the field. The green revolution is the growth of production of crops but there is a need for evergreen revolution to produce more crops for the increasing population.

The problem statement of the project revolves around the low yield produced by the manual processes and which leads to less profit and low production of food for the population. Agricultural sector in India is yet to follow and develop the technological advancements for enhancing the crop yield. Our objective is to fill this gap using drone technology. To identify proper seed treatment achieve the required seed rate for sowing.

II. LITERATURE REVIEW

A. *Seed and seed treatment*

Let's focus on seeds to get the problem narrowed Seeds for quality seeds production Seeds can be sold by anyone either a farmer or a company etc. The company can produce quality seeds and can get them certified through the certification process. Before the use of seed the seeds need grading Grading is also been done for the year produced by the farming

Problems related to quality seeds and their production is Quality seed in the market for farming are costly If the farmer self-produces the seeds and uses them it can be profitable for the farmer and also he will get the quality seeds and can also sell those seeds in market if in access.

Types of seeds: Nucleus, Breeder, Foundation, Certified

Talking about the farmer, the farmer can only produce certified seeds.

The steps to be followed

- Area selection
- Selection of land
- Selection of season
- Selection of crop and varieties
- Seeds and sowing
- Isolation & factors influencing isolation
- Distance
- Pre sowing seed treatment
- Seed rate
- Time of planting
- Rouging space
- Irrigation rouging
- Fertilizer and supplementary pollination
- Weeding
- Plant protection measures
- Harvest
- Processing
- Seed storage

The points which are important for project are

- Seeds and sowing
- Pre sowing seed treatment
- Seed rate

Seed & sowing: good seed is required for seed production

Seed treatment: nutrient treatment soaking and mechanical and chemical processes Seed rate: position of crop plant line showing scattered sowing etc population of crop and density of crop in a particular area

Seed production is different from farming

- Not much of the standards are taken care of in farming
- Seed quality is not considered as the first priority because the seeds used are certified seeds, only the yield is taken into consideration
- No isolation is required

The question arises that is seed production possible with the farming process?

The answer is partially yes and partially no. The quality seed production cannot be done simultaneously with the farming but it can be done separately on the same farm with isolation. Here different factors stated above in this document are needed to be considered.

Seed quality testing equipment are available in market at higher price but not the scope of our project

The project aims to solve problem of low yield and time consumption

Seed treatment is important for good yield and is also the focus of project problem statement

There is generally two times where the seed treatment is done

- Seed treatment for seed production
- Seed treatment for farming

Seed treatment for farming is also known as pre sowing treatment of a particular crop. In general for farming there are three types of pre- sowing seed treatment

1) Dry treatment
2) Wet treatment
3) Slurry treatment

B. Drone for Basics

Types of drone: Industry based drones,

commercial Systems in drone: hardware, software and mechanical

Hardware: This is a multilayer Power Circuit Board that helps in accommodating the SOC (system on a chip) and different components of the subsystems interconnected via copper traces (part of the PCB) or using physical wires. SOC, Subsystem(input, output, communication device) The drones have certain specifications and some components Motors, sensors, gyroscopes, transmitter, receiver, main controller, propellers, etc

Software: main categories are: Firmware components; Operating System and drivers; Sensing, navigating, and controlling and more Application-specific components

Mechanical: Includes all the mechanical parts. The propellers, the motors, the exterior and interior, etc

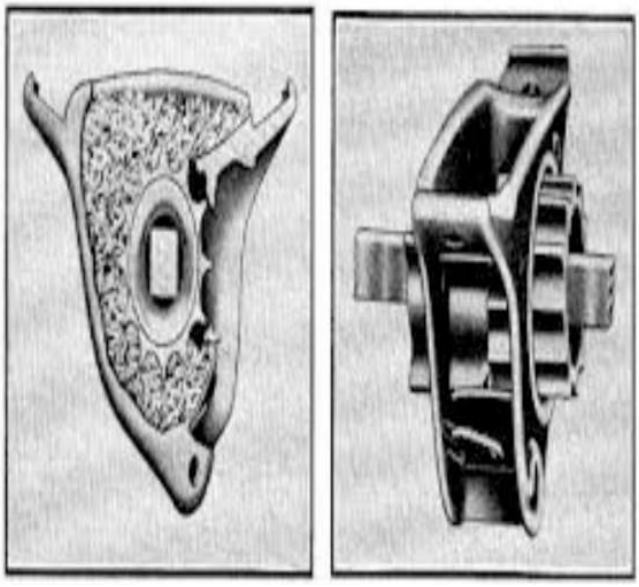
POV: Heavier drones are mostly powered using alternate fuels other than batteries, such as solar power or gasoline. Drones operating with such fuels are not only heavy but use different technologies and are designed for different purposes.

Controllers and accessories: There are two types of controllers, ground based controller and integrated system controller. Alternatively, the drones can also be controlled with a smartphone, thanks to the latest technological advancements, but the only condition is that the drones should be capable of connecting to the 3G/LTE mobile network.

C. Seeding Mecahnisms

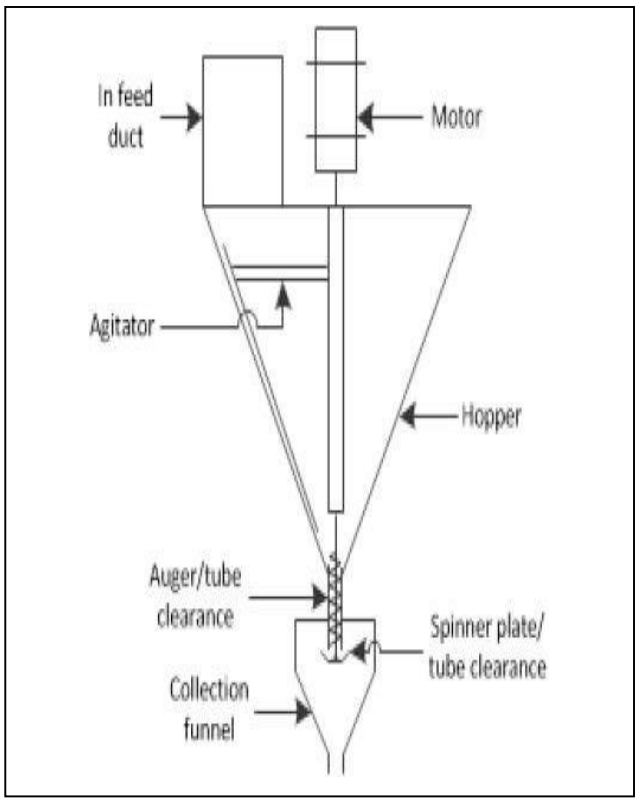
Fluted feed type

The fluted wheels are also known as fluted rollers which are driven mostly by a square shaft. There are horizontal grooves provided along its outer periphery of the wheel and the wheel can be shifted sideways depending upon the seed rate. These rollers are mounted at the bottom of the seed box. They get the seeds in the longitudinal groves which is passed on to the seed tube throughthe seed hole.



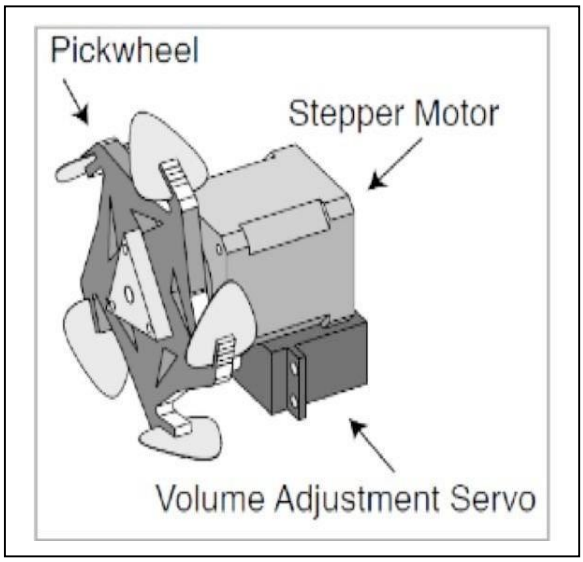
Auger Feed Mechanism

This type of mechanism is a distributing mechanism, consists of an auger which due to which substances flow evenly in the field or land, through an aperture at the base or on the side of the hopper. Many of the fertiliser drills of our country uses an auger feed type of mechanism.



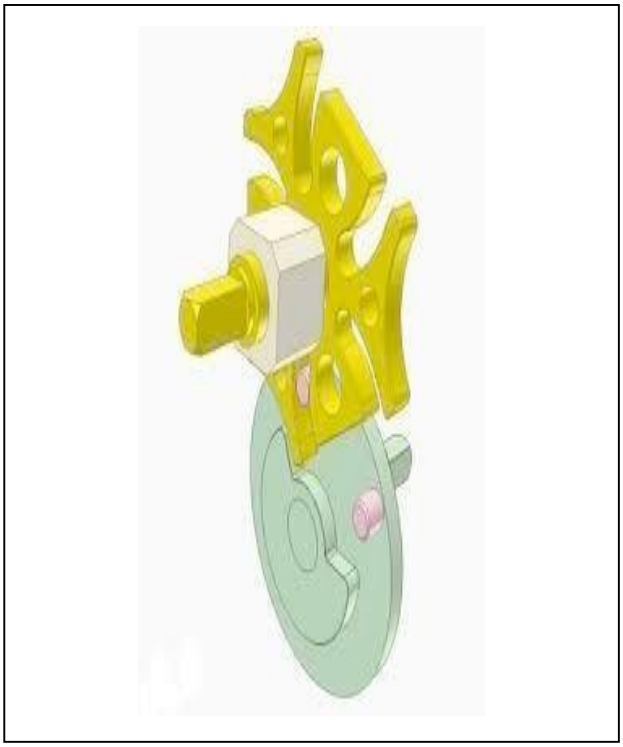
Picker Wheel Mechanism

In this type of mechanism, a vertical plate is provided with radically projected arms, which works by dropping large seeds like potato in furrows with the help of suitable jaws.



Star Wheel Mechanism:

This is a type of feed mechanism which consists of a toothed wheel, that rotates in a horizontal plane and conveys or delivers the fertilizer through a feed gate which is locatedjust below the star wheel.



D. Market survey for agricultural drone

Various start-ups and companies are using drone technology for deforestation and agriculture purposes. It is challenging for humans to go in high terrains and in the deep forest to plant the trees. But this can be done accurately and more efficiently with the help of drone. Here are some of the companies that uses drone for agriculture and deforestation purpose:

1) Drone seed
2) American Robotics
3) Skycision
4) Top flight Technologies
5) Honeycomb

III. METHODOLOGY

Crop name	Seed properties		
	Sowing process	Seed rate (kg/acre)	Refills required
Rice	Sprinkle, transplant	20	1
Maize, jowar	Sprinkle and sow	35-40	2
Ground nut	Drop and sow	80-100	5
Soyabean	Drop, sprinkle	25-35	1
Wheat	Sprinkle	35-40	2
Millets	Dropping	2-3	0
Vegetables	Dropping	8-10	0

The work plan for the project is:

- To achieve a specific height with the given weight
- Design the electronic circuit for the system Hardware block design
- PCB design
- Finalizing all the electronic components
- To design the block model of the system (The completearchitecture)
- Design of flight system
- Design of the drone structure (Frame)Design for seeding system
- Design of the power system (battery)
- Design of mechanical systems (all structures)
- Design for heat dissipation of system Architecture of software system Programming of the product
- Design for manufacturing
- Design for assembly Prototyping
- Testing

Requirements aimed
Use of drone for seeding in farming
The drone should have the capability to change the seed rate and distance for sowing
The drone should have certain amount of capacity to store seed in it
The drone should work faster than the humans working and should have an economic effect on the overall process.
The function will be preloaded with all the parameters for the given crop the user just needs to enter the crop name and the drone will perform as per the parameters preloaded (seed rate, speed, seed treatment, seed depth)
There should be a provision to use the seeding operation by custom settings (parameters)

Height obtained by the drone depend upon the following factors:

1. The height of flight is directly proportional to the thrust produced by the motors used to fly the drone. The thrust obtained by the propeller is dependent upon the speed(rpm) of the motor.
2. The rpm of the motor is directly proportional to the power supplied. The more KV we supplied the thrustwill generated
3. Size of the propeller, different types of propeller used for different applications.
4. For every motor there is a limitation of height and the weight lifted by drone.

IV. COSTING

The above items and estimated expenditure may vary if any additional requirement is there for the project

Sr. No	Head	Items	Estimated Expenditure (Approx.)
1	Consumables	Wires, Sensors	3,000
2	Equipments		
		Aurdino	400
		Wireless Camera	7,000
		Motor stepper and driver	10,000
		Other hardware	5,000
		Electronic Speed Controller(4)& Propeller(4)	1600+200 =1800
		3 Axis: Accelerometer & Gyroscopic module	500
		Flight Controller	3000
3	Books & peripheral	-	
4	Contingency	-	
		Grand Total	**30,700**

V. CONCLUSION

The team has completed the defining of the problem statement and has also found the desired outcomes from the project. The results which are required to achieve to call it a successful project. We have also defined the targets to achieve and the tasks which are needed to be performed in order to complete the project. The team is working on the design part of the drone from now and will be definitely building the prototype for the project.

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ABSTRACT

In this developing tech-savvy world, technology is advancing every day. Technology is the best way to complete a particular task efficiently and it is not time consuming. Introducing advanced technology in agriculture can prove beneficial for the farmers as the harvest of the crops will take less effort and more profit. Humidity Control in Grid Technology is the new invention we are introducing to reduce labor work and focus on a good quality harvest of the crops.
As per our current research, we're designing the system of the project. We have chosen to work on Kharif crops which give a good quality harvest during the monsoon season. Thus, it is mandatory to maintain the humidity throughout the year to give the best quality harvest all year along.
The humidity sensor will sense low or high humidity and pump sufficient water to the crops. This will only require supervision until the project is undergoing analysis and iterations. Once the project is in picture, it will require less maintenance.

KEY WORDS

Humidity, agriculture, crops, harvest, irrigation, grid sampling, sensors.

INTRODUCTION

The most crucial element when it comes to agricultural income is crop growth and good quality at the appropriate time of harvest. Grid sampling is a popular technology right now that focuses on giving crops the nutrients they need based on their specific needs. In addition to nutrients, HUMIDITY is an important component in determining how well crops grow and produce. The crops must have their humidity maintained. Regardless of the humidity, the irrigation system pumps water to the harvest. This may result in the harvest dying or growing poorly. One strategy to deal with these effects is humidity control in grid technology.

The surrounding humidity saturates leaves with water vapor as plants transpire. A plant cannot make water evaporate (part of the transpiration process) or extract nutrients from the soil when relative humidity levels are too high or there is insufficient air circulation. The result of this is that a plant finally rots when it happens frequently. A plant's transpiration rates rise in warm environments with low relative humidity levels, which minimizes the requirement for fertilizer application by a gardener.

Plant growth is frequently hampered by low humidity because crops take significantly longer to reach a size that is

suitable for sale. Lower leaves frequently fall off, growth is difficult, and increase production cost.

PROPOSED WORK

Humidity, or atmospheric moisture, is a crucial element of the environment for plant growth and development. Physiologists for a long time ignored the significance of humidity for plants in favor of focusing on the more dramatic effects of radiation, temperature, soil moisture, and mineral nutrition on plant growth. However, extensive study over the previous ten years has shown and clarified the crucial role that humidity plays in plant growth. This most recent research was motivated by the need to better understand how humidity impacts how sensitive plants are to contaminants and how efficiently plants use water.
To complete soil sampling in the past, a composite paddock sample that represented a farm's land management area was used. However, there has recently been a shift toward more comprehensive sample techniques such as direct/zonal soil sampling, grid soil sampling, and all-paddock survey.

The grid-based approach's utility was demonstrated by analyzing 10 fully mapped grassland plots, which revealed spatial dependence at a much lower sampling effort than mapping each plant. Ripley's K-function, a commonly used test for point patterns, performed well on the grids, while the gridded quadrat approach performed well for quantifying space patterns.

In the winter, common grid sizes for applying nutrients such as phosphorus (P), potassium (K), magnesium (Mg), and micronutrients include 2.5-5 acre-sized blocks and typically range from 2.5 to 10 acres. You can connect the georeferenced grid created by various agriculture software providers to the same (or similar) processing software at your local analytical lab.

Traditional losses such as deep percolation, runoff, and soil erosion are reduced by efficiently supplying irrigation water to the root zone of plants using drip irrigation. It also allows for the use of irrigation water, fertilizers, insecticides, and other water-soluble substances, resulting in higher yields and higher-quality produce. Drip irrigation systems can solve many problems in dry land agriculture while also increasing the productivity of irrigated farmland. With these considerations in mind, the current study was designed to investigate the scope of benefits obtained from drip irrigation in horticultural crops as well as the challenges farmers encountered when implementing the technique.

The purpose of this research is to see how humidity and nutrients affect the plant growth. Similarly how grid sampling results in better yield of crops.

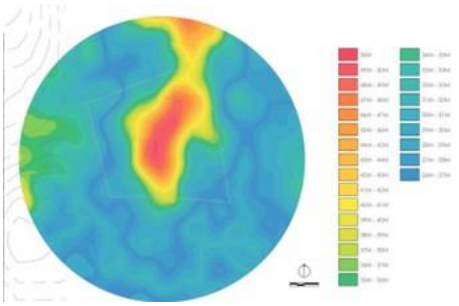
IMPLEMENTATION

SOIL UNDER CONSIDERATION

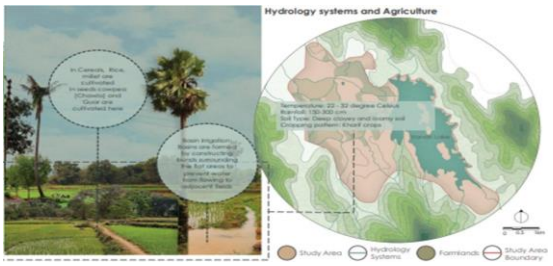
This area contains various types of soils but mainly contains Clayey and Loamy soil which have the following properties :

Loamy Soil combines sand, silt, and clay so that the advantageous qualities of each are present. For instance, it can hold onto nutrients and moisture, making it more ideal for cultivation. Due to the equilibrium of all three types of soil materials—sandy, clay, and silt—as well as the presence of humus, this soil is also known as agricultural soil. Due to its inorganic origins, it also has increased calcium and pH levels in addition to these.

Compared to the other two forms of soil, clay has the tiniest particles. There is little to no airspace between the soil's particles, which are closely packed together. Because of its excellent capacity to hold water, this soil is impermeable to moisture and air. When wet, it feels quite sticky to the touch; when dry, it feels silky. The most dense and heavy form of soil is clay, which does not drain effectively or give room for plant roots to spread out.



Elevation of the Land under Survey /Analysis

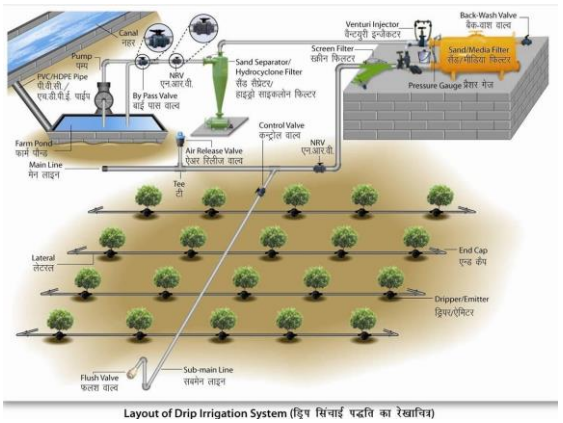


Farmlands near the proposed area

I. DRIP IRRIGATION

Coming to drip irrigation , application consistency for drip irrigation is extremely high, typically exceeding 90%.Sprinklers and gravity watering are difficult to use in areas with irregularly shaped plantings, while drip irrigation is quite flexible.Drip irrigation is capable of germinating seeds and setting transplants which eliminates the need for "sprinklering up" and eliminates the resulting waste in the early stages of crop growth . Early maturity results in higher and faster returns on investment. Fertilizer use efficiency increases by 30%

Thus due to these reasons we have decided to combine drip irrigation with our project



Layout of Drip Irrigation System (ड्रिप सिंचाई पद्धति का रेखाचित्र)

II. PARAMETERS CONSIDERED

1. **Fertilizers**
2. **Sprinklers**
3. **Sensors**

Hygrometer

Data of the crops which are to be cultivated in that particular region

Soil Moisture (VWC):
Also known as soil volumetric water content, soil moisture allows you to see at a glance whether or not your plants need to be watered. This can prevent overwatering, especially in cases of high humidity or rainfall where additional watering is not needed.

Soil Temperature:
By monitoring underneath ground level, farmers are able to figure out if the soil is at the right temperature for planting, watering, or weeding. Crops thrive when they are planted at the right temperature, and watering plants before it gets too hot outside ensures that water won't be wasted from evaporation.

Air Temperature:
Like soil temperature, knowing the current air temperature can offer ideal planting and watering times.

Leaf Wetness:
Detecting the moisture on the leaves through a sensor that acts as a "digital leaf" with a flat surface to collect rainfall, leaf wetness helps determine if watering is needed and can be beneficial in tracking the crops by knowing how moisture affects growth.

Solar Radiation:
Sun and weather in a specific geographical region can make a huge impact on crop growth and output. Solar radiation sensors measure the active radiation and ultraviolet rays of the sun, which can help farmers best decide what crops to plant each season.

Atmospheric Pressure:
Looking up weather in a search engine or app for your city often gives a large approximation that may not be accurate for your exact land. By measuring atmospheric pressure in your exact area, you can better predict weather patterns and climate changes. This will cut down on watering and helps farmers know the best time to seed or fertilize their fields.

Wind Direction:
Wind direction is another useful metric for tracking watering and weather changes. This helps you be better prepared for weather and to take protective measures if needed.

Air Humidity:
Depending on the local climate and time of year, humidity can play a part in crop growth and watering. By tracking humidity of your land over a period of time, you can better schedule planting and harvesting.

Components for drip irrigation

1) Water Pump

A pump of a suitable capacity Water pump is used to supply water through the drip irrigation system components at a specific level of pressure.
The electric motors or diesel engines are the common prime mover of the pump.

Recently the solar pump is being used to popularize it for drip irrigation purposes.

2) Control Head
The control head consists of valves to control the discharge and pressure In the entire system. It may also have filters to clear the water. Common types of filter include screen filters and graded sand filters which remove fine material suspended in the water.

3) Main Line:
The mainline transfers the total amount of water for the irrigation system. It connects the different sub-mains to a water source. The main pipes are commonly made of flexible materials such as PVC (polyvinyl chloride) or plastics.

4) Submain:
The sub-main feeds to the laterals on one or both sides. It is made of either medium-density polyethylene (PE) or PVC. There should be a balance between the diameter of the main and sub-mains.

5) Laterals:
Laterals are made up of low-density polyethylene (LDP) or linear low-density polyethylene (LLDPE) material and are available in different sizes, 12 mm, 16mm, and 20 mm. Based on the availability of water, crop, and spacing, 12 millimeter 16-millimeter laterals are installed.

6) Drippers:
Drippers are also called emitters. The dripper is discharging water from the lateral pipe to the soil. Drippers are generally manufactured from polypropylene materials.

RESULT & DISCUSSION

We have collected the data of the crops and site so far. We will be designing and analyzing our system as soon as we visit an industry and have a word with the industrial experts.

The analysis will show the humidity of the crop soil and indicate the need to provide water and nutrients to the soil.

CONCLUSION

In a nutshell, our project will be beneficial for farmers, government and agro based industries and will provide profitable crop harvest with good quality crops.
To conclude we will be implementing 3 important domains of agriculture - Grid sampling, humidity and drip irrigation simultaneously.

Sixth Sense Technology and its Applications

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ABSTRACT

There are five basic senses in living beings - hearing, seeing, smelling, tasting and feeling. These senses are evolved in living thing through million of years and we have did multiple work to insert these senses into machine and I will say that we have successfully achieved that. Right Now we are moving into the new era of 6th sense technology where machine will be able understand human gestures. Basically it sounds like miracle or alive machine, which is beyond science. Sixth Sense Technology is a neck worm wearable gestural interface that amplifies the physical world around us with the digital information. It is the new technology that plays with the human gestures to make the world more interactive and make work simpler. Its basic use is to cause computers to adapt to human needs. It's a developing technology, once fully developed it has the potential to give human being any source of information about the world around him. The aim of sixth sense is to let the computer assist or help human in making correct decisions by molding/showing information into various forms. Sixth Sense technology bridges the gap between tangible and non-tangible world. 6th sense is like breathing a new life in the world of virtual reality. Using the 6th sense technology,we can make changes or development easy in developing cities or countries.

Keywords

Camera, projector, mirror, microphone, color markers, gestures.

1. INTRODUCTION

In the rising world of technology, we follow different technologies for specific tasks in our daily life. Moreover, technology has been running in our daily lives in all sectors, no matter what industry you are dealing with, it has an impact in an unquestionable manner. Today each and every member, regardless of age is aware of the technical devices. All over we can say is "Technology is our useful servant". However, technology is emerging rapidly and there are no chances for being slowing in nearer future. Since for last many years, technology has taken the world in terms of the products we purchase, communicate, the way we live, learn and has brought lots of changes with this constant advancement of technology. The technology which we use is constantly evolving due to which innovations in technology in today's time is very common.one of the most example of innovation we see is computer size it is decreased on year by year.sixth sense technology is also a such type of innovation..Sixth Sense is a gesture based wearable device developed at MIT Media Lab by Mr. Steve Mann in 1994 and 1998, and further it developed by Pranav Mistry in 2009. It comprises a head worm or neck worm that contains both a data projector and camera.Headword versions are built at Media mat Lab in 1997 that combined cameras and illumination systems for interactive photographic art, and also included gesture recognition
(e.g finger tracking using colored tapes on the fingers).[1]

1.1 Why Sixth Sense Technology?

Sixth sense technology is a elevated platform which connects the physical world with the digital information using natural hand gestures to interact with that information in a simplest way. This technology has a wide application in the field of artificial intelligence.

Sixth sense technology has a power of connecting the real world with the digital world, and making many work more digital which will save our lot of time. It recognizes the objects around you, displaying information automatically and letting you access it in any way you want, and you can carry it to anywhere. The sixth sense technology sample model shows various applications like visual clock that displays the ability, usefulness, viability and flexibility of the system. [2]

1.2 6TH SENSE TECHNOLOGY PROTOTYPE

Sixth sense is a mini projector coupled with a camera and a smartphone, designed for obeying hand gestures. Sixth sense is a

Extra sensory perception that aims at a more developed future with both physical and digital world connected without the help of hardware devices.

However, instead of requiring you to be in front of a big screen like computer, laptop or mobile phone, Sixth Sense can do its magic everywhere. [3]

The basic components of 6th sense device are;-

- Camera.
- Projector.
- Colored markers.
- Mirror
- Smart phone.

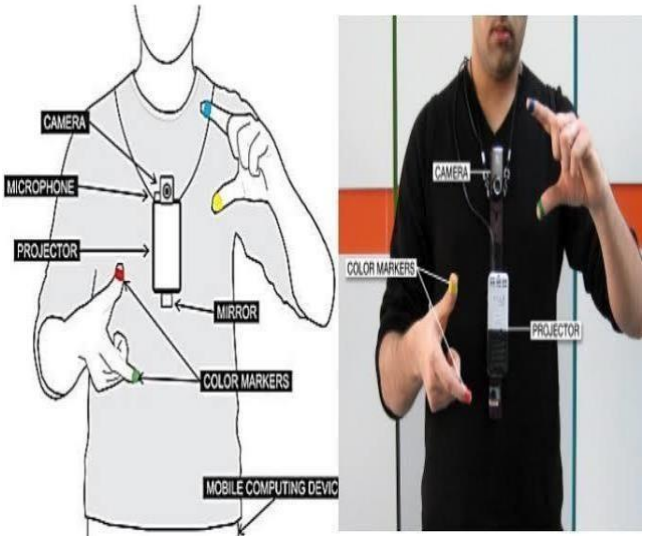

Figure2: Components of Sixth Sense Technology

1.2.1 Camera

The function of the camera is like that of a human eye, the only difference being it will provide digital information. Camera recognizes and tracks user's hand gestures and physical objects around us to be used as interfaces.

1.2.2 Projector

The projector is basically an output device which projects visual information enabling Surfaces, walls and physical objects to be used as interface. The projector itself contains a battery inside, with a life span of 3 hours.

1.2.3 Colored Markers

Colored markers are placed at the tip of the user's fingers using simple computer vision techniques. It helps the webcam to track the movement of the fingers. Marking the user's fingers with red, yellow, Green and blue tape helps webcam recognize gestures. The movements are arrangements of these fudicials are interpreted into gestures that act as interaction instructions for the projected application interface.

1.2.4 Mirror

Mirror is placed just below the projector. The projector can project the information in any direction with the help of a mirror which can be tilted in any direction as per the user's requirement.

1.2.5 Mobile Device

Mobile device may be a laptop, PDA, smart phone etc. these are connected to other hardware devices and send information to the projector for projection. The important thing is that the device is a mobile device. It means it is so light that we can take it with us where we want to. It is as small a cell phone and is so simple to use. [8]

2. WORKING of SIXTH SENSE TECHNOLOGY

In Sixth Sense Intuition gadget inspect what an individual view and works on the surfaces and actual item where individual is interfacing with... To form a Brand new interaction experience, a number of gadgets like projector, mobile phone and a webcam have been combined which is done by the researchers. The various object around us, Presenting information and provide access in any way what user wants in a simple way is identified by sixth sense technology. The technology is mainly based on hand gesture recognition, image capturing, processing and manipulation etc.

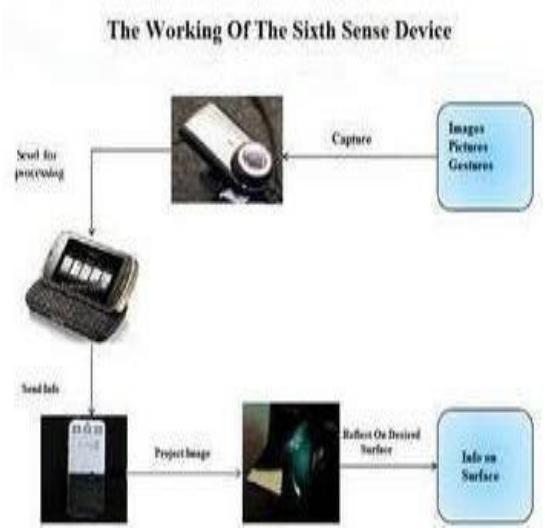

Figure 3: Working of Sixth Sense Technology [8]

The camera is used to capture and recognize hand gestures of the user, individuals, images and physical objects using computer vision based technologies, while the projector is used to project visual information on walls or on any physical object around us to be used as an interface. Other hardware includes mirror and colored caps to be used for fingers. The Sixth Sense Technology has a camera doing live video stream to tracks the location of object if the tip of the fingers is used to identify the gestures. The process is done using some techniques of computer vision. Basically it is device which is a mini projector and which can be projected on any surface. It carries the information stored in it and also collects information from the web. It is the one which obeys hand gestures of ours and give us what we want to see and know. it is the combined technology of computer along with the cell phone. It works when a person hang it on his neck and start projecting through the micro projector attached to it. Our fingers work like a keyboard as well as the mouse.

3. APPLICATIONS

3.1 Motion Capture

The new camera was praised by majority people at the time of demonstration. The pictures can be edited, managed into galleries and shared on any interface. The data is stored inside an inbuilt storage device. At the time of using a surface, the entire data is taken into that surface and after editing, it is stored in the device.

Figure 4: Motion capture

3.2 Capturing Photos using Fingers

The burden of carrying a camera and keeping it safe and sound free on a trip can now be avoided by simply using the Sixth sense technology. We can do this with sixth sense. If you make the square using your index fingers and thumb then your picture is clicked by the camera.

Figure 5: Capturing image using fingers

3.3 Check the Brand of the Product

A product of the best brand can be chosen.

Figure 6: Check the brand of the product.

3.4 Reviewing Flight Status

Because of sixth sense we can review flight status. we can use any background as a screen for projection, on which the status of flight can be checked by placing the ticket in front of this technology.

Figure 7: Reviewing Flight Status

3.5 Time without watch

Time can be viewed merely by drawing a circle on the wrist instead of physically wearing a wristwatch.

Figure 8: Time without watch

3.6 3D Drawing

Provides a pencil that allows users to draw in 3D, a good way to learn for the beginners in the field of 3D modeling.

Figure 9: 3d drawing

3.7 Call using palm as dialer

It gives the provision of using the hand as a screen onto which the dialer is projected, using which an individual can make a call.

Figure 10: Call using palm as dialer

3.8 Video newspaper

It determines the news headline and the displays the appropriate video.

Figure 11: Video newspaper

3.9 Zoom in Zoom out

It helps to view images and related things in the way one wants to see. [6]

Figure 12: Zoom in Zoom out

Application	Description
Make a Call	This Technology enables the user to make a call without using dialer
Get Flight updates	The device can tell whether is user is in delay or on time by looking at the tickets.
The Map	It allow the user to navigate a map that displayed on a nearby surface by using our hand gestures, which is similar to the gestures supported by the multi touch based system allows the user to zoom in and zoom out.
3D Drawing Application	It lets the user draw on any surface by tracking the tips movements of the user index finger.
The Clock	The user just needs to make a gesture of a circle on the wrist and the clock with current time will be projected on the user's hand.
Motion Capture	Using fingers the user can capture photos without carrying an extra gadget
Video Newspaper	This device also identify the articles in the newspaper, retrieve the recent stories from the internet and then then show them on pages for individuals.
Book Information	For book lovers it proved to be a blessing as you just open any book and find the ratings of the book, also move on any page and get additional information.

Figure13: Applications of Sixth Sense Technology [7]

4. ADVANTAGES OF SIXTH SENSE TECHNOLOGY

a) The digital information and its objects are combined into the physical world by using the Sixth sense interface, thereby making the entire world as our own computer.

b) Sixth Sense makes machines like computers to adapt to human needs and not the other way round.

c) Hand gestures are used to communicate with digital information, multi-touch and multi-user interaction is also supported.

d) Data from machine is directly accessed into real time. It is open source and it is cost effective and map idea can be minded anywhere.

e) Our relevant information is provided by the gesture controlled wearable computing device that manipulates any surface into a display.

f) It is portable

g) Comparatively easy to carry as can be worn in our neck

h) Even a naïve man with little or no knowledge of mouse and computer can use this device.

i) The cost that arose for the making of the sixth sense technology proto type is very low. A normal sixth sense device sums up to $300. [5]

5. DISADVANTAGES OF SIXTH SENSE TECHNOLOGY

a) Excessive use of a technology can cause addiction and can hamper social life as well. It can diminish humanness.

b) Exposure of rays on surfaces like human arms can lead to health problems.

c) This technology will affect the hardware market and will result in less revenue being generated and lower the cash inflow.

d) It can affect the vision of the user because of its peculiar and better use at night time and in dark areas as compared to mornings and bright places.[5]

6. CONCLUSION

The Sixth sense technology is continuously evolving to combine information into real world. The coming life is based on AI in that sixth sense has much use. It can grant an simple power over equipment and machinery in industry. It can assist in en-rooting multiple application areas for different engineers and builders upon their innovation, imagination, what's their requirement and how they need. Due to its worldwide application it is also Known as open source software. It is a replacement of Fifth sense Technology. The Sixth sense technology will bring a severe alteration in the area of science and technology.

7. FUTURE SCOPE

Further development in this technology will lead to involvement of new markets. Hardware used in the current technology can be perfected as it plays an important role in this technology by interacting with the user. Security of the current technology can further be improved and more accuracy should be aimed for. Enhancements should be made so that visually impaired people can use this technology. The current technology is a little bulky to carry around, so few improvements can make it user friendly.

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Automated Waste Segregator

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Abstract—Waste Management and segregation is a much-needed process in metro cities and urban areas due to spreading of diseases. It is estimated that India produces 42.0 million tons of municipal solid waste annually at present. Waste lying littered in the surrounding, dumped on open lands, becomes a major problem for various types of disease-causing bacteria and viruses hence, segregation, transport, handling and disposal of waste must be managed properly to minimize the risks of the public and environment. When mixed dry and wet waste breaks down in lowland, it creates nasty greenhouse gases. Segregation makes it attainable to utilize and recycle the waste effectively. This waste segregator system can easily segregate waste. When waste is thrown in the pipe, IR sensor will sense the waste. Waste is divided into three categories namely Wet, Dry and Metallic. Another sensor will sense the garbage category. As per the algorithm used, if the waste is metallic then the mechanism will bring the metal collecting bin below the pipe and with the help of servo motor the waste will fall into the metal bin. Similarly, the process will repeat if wet waste is sensed. If the sensor doesn't activate both the sensor category then the waste will be considered to be a dry waste segregation system for household use, so that it can be sent directly for processing. It is designed to sort the refuse into metallic waste, wet waste and dry waste. The AWS employs parallel resonant impedance sensing mechanism to identify metallic items, and capacitive sensors to distinguish between wet and dry waste. Experimental results show that the segregation of waste into metallic, wet and dry waste has been successfully implemented using the AWS.

(Keywords- waste management, segregation, metro cities, metallic waste, IR sensor, pipe, AWS.)

I. INTRODUCTION

In India about 60 million tonnes of waste is being generated every year. Ten million tonnes of garbage is generated in metropolitan cities. The landfills of most of these cities are overflowing with no space for fresh garbage waste. The philosophy of "waste management hierarchy" has been adopted by most nations as the step for developing municipal solid waste (MSW) management strategies.

According to a sanitation survey called ministry of urban development under the swachh bharat mission, it was found that about 50% people in India face the problem of improper waste collection and management. According to centre of science and environment, innovative disposal and recycling methods must be introduced instead "Swachh Survekshan-2016" conducted.

Thus, we have proposed a cost effective Automatic waste segregator categorizes the waste as plastic, metallic or organic. The monitoring system helps to monitor the waste collection process. The common method of waste disposal is by unplanned and uncontrolled dumping at landfill areas . This method is hazardous to human health, plant and animal life. When the waste is segregated into basic streams such as plastic, metallic and organic, the waste has a higher potential of recovery, and then, recycled and reused "Automatic waste segregator and monitoring system" for proper management of waste.

The organic waste Is converted either into compost or methane-gas or both Compost can replace demand for chemical fertilizers, and biogas can be used as a source of energy. The metal waste could be reused or recycled. Even if there are large scale industrial waste segregators present, it is always feasible to separate the waste at the source itself. The hazard for waste workers is reduced Also, the separated waste could be directly sent to the recycling and processing plant instead of sending it to the segregation plant then to the recycling plant.

II. EASE OF USE

Sorting of waste at the primary stage will make the waste management more effective and fruitful.

It can make the dustbins cleared as and when they are filled, thus giving way to a cleaner environment.

It also helps to reduce the requirement of manpower to manage the waste collection process.

It helps to convey direct message transformation between smart segregation system and municipal department the traffic flow on the road reduces.

III. LITERATURE REVIEW

Nimisha S Gupta, Deepthi V, Mayakunnath, Rejeth Pal S, Badsha T S, Nikhil Binoy C, proposes a spot automatic waste segregation unit that effectively gives a solution to this problem. In order to segregate the metallic waste a parallel resonance impedance system is used, and for the separation of wet and dry waste capacitive sensors are used. The benefits

of this work are, the waste has a higher potential for recovery and the occupational hazards of waste separating workers is also reduced. Ms. Suchitra Vmr. Shariq Mohammed Shaik Ms. Stuti Jha Ms. Suchitra V, It deals with the minimization of blue-collar method utilization for exclusion of waste into an automated panache. An automation of this style not only saves the manual segregators of the numerous health issues, but also proves to be economical to the nation. Besides, this system utilizes low cost components for the successful segregation of most types of waste. When installed in apartments or small colonies, it proves to be beneficial in sorting the waste at the site of disposal itself. Amrutha Chandramohan et. Al.states there is no such system for segregation of wastes into categories such as dry, wet and metallic wastes at the household level. An Automated Waste Segregator (AWS) can be used at the household level so that the waste can be sent directly for processing. The AWS employs inductive sensors to identify metallic items, and capacitive sensors to distinguish between wet and dry waste depending upon the threshold values set. However, it cannot segregate ceramic into dry waste because it has the higher relative dielectric constant as compared to other dry wastes that are segregated. By increasing accuracy and overall efficiency, we can eliminate noise. Nishigandha Kothari et. Al. used Ultrasonic Sensors are used to monitor the garbage collection. When the garbage reaches the sensor level an interrupt is sent to the microcontroller. J.S. Bajaj et. Al. says many upgradations can be done to the existing project. Some of which are listed below: Advanced processing techniques can be incorporated once the waste has been segregated, methods for individual material feeding for local use so that the segregation can be performed continuously once the waste is dumped, image sensing can be used to segregate materials through Image processing technology. Rashmi M. Kittali et. Al. says that even PLC can be used for AWS. It has an advantage of reduced manpower, improved accuracy and speed of management of waste. It also avoids the risk of working in hazardous places. This work can be implemented by making use of a robotic arm in the future to pick and place certain materials which can be re-used. The bins can be unloaded by placing limit sensors at the top of each bin.

IV METHODOLOGY

Fabrication is an important industry that involves cutting, manipulating and assembling materials to produce desired structures. And while different fabrication companies use different techniques, most rely on three basic processes: cutting, bending and assembling.

1) Cutting

The first process of fabrication is cutting. During this process, the metal fabrication company cuts one or more pieces of raw metal for use in the creation of a new metal structure or product. Whether it's steel, aluminum, iron or any other common type of metal, though, cutting metal requires special tools. Some metal fabrication companies use torches to cut metal, whereas others numerical control (CNC) machines involving lasers or water jets. When finished, the company will have clean, appropriate-sized sheets or sections of metal with which to work

2) Bending

After cutting raw metal, metal fabrication companies must bend it. Again, there are different ways to bend metal after cutting it. Some metal fabrication companies hammer the metal sheets or sections into the desired shape. Hammering can be done by hand, or it can be done using a machine (power hammering). Recently, though, many metal fabrication companies have begun using press brakes to bend their metal. This heavy industrial machine automatically presses metal sheets and sections into a specific shape when engaged. It essentially clamps the metal between a punch die, forcing the metal into the desired shape.

3) Assembling

The third and final process of metal fabrication is assembling. As the name suggests, this process involves assembling the metal sheet or sections into the desired finished product. Assembling is typically performed via welding, though other steps may be included in the process as well. In addition to welding, for example, metal fabrication companies may crimp seams, apply screws or other fasteners, and apply glue. After assembling the metal, the company will finalize the product before shipping and selling it to its customers.

Metal fabrication is a driving force behind the country's ever-growing manufacturing sector. Although there are countless machines and techniques used by metal fabrication companies, must rely on a three-step process that consists of cutting, bending and assembling. These three processes allow metal fabrication companies to transform raw metal materials into new products.

V DESIGN CONSIDERATIONS

Several structural design considerations should be taken into account for economical and efficient manufacturing. Many of these apply to other joining methods, and all apply to both subassemblies and the complete structure.

1. The device should be suitable for local manufacturing capabilities.

2. The attachment should employ low-cost materials and manufacturing methods.

3. It should be accessible and affordable by low-income groups, and should fulfill their basic need for mechanical power

4. It should be simple to manufacture, operate, maintain and repair.

5. It should be as multi-purpose as possible, providing power for various agricultural implements and for small machines used in rural industry.

6. It should employ locally available materials and skills. Standard steel pieces such as steel plates, iron rods, angle iron, and flat stock that are locally available should be used. Standard tools used in machine shops such as hacksaw, files, punches, taps & dies; medium duty welder; drill press; small lathe and milling machine should be adequate to fabricate the parts needed for the dual-purpose bicycle.

7. It should make use of standard parts wherever possible.

8. The device should adapt easily No permanent structural modification should be made

9. Excessive weight should be avoided, as durability is a prime consideration.

VI MECHANICAL PROPERTIES OF MATERIALS

- Strength
- Stiffness/Rigidity
- Elasticity
- Plasticity
- Ductility
- Brittleness
- Malleability
- Toughness
- Machinability
- Resilience
- Creep
- Fatigue
- Hardness

VII AESTHETIC

Another important criterion in any product design is to consider the looking of the product itself, which is known as aesthetics of the product. This product's aesthetic contributes substantially to satisfy the customer needs. In the proposed chair design, several aesthetics issues such as social appeal, colour, dimension, cushion material, etc., were also considered into account. Various aesthetic issues with respect to students' needs of the proposed chair are highlighted in Table X with brief explanation.

VIII COMPONENTS

- Servo Motor (MG996R)
- Base Plate
- Container
- Round Plate
- Rod Spacer
- Supporting Frame
- Mounts
- Joints & Screws
- Coupler

IX WORKING

- Drop the waste into the pipe.
- IR sensor will sense the waste and it will rest on the bottom plate.
- Now the sensor on the plate will sense the waste as in 3 categories – Metallic or wet.
- Now the algorithm is so made that if the waste is metallic then the mechanism will bring the metal collecting bin below the pipe and the servo will let the waste fall into the bin.
- Similarly, the process will be repeated for wet test.
- If both the sensor doesn't activate then the waste will be detected as dry waste.

X RESULTS

Automatic Waste Segregation System" sorts wastes into three different categories, namely metal, plastic and the wet (organic) waste. Wet waste refers to organic waste such as vegetable peels, left-over food etc. Separating our waste is essential as the amount of waste being generated today causes immense problem. Here, we have tested the household wastes whichh are generated in every home today and we have come up with the following result. When exposed to our automatic waste segregator and monitoring system. The proposed system would be able to monitor the solid waste collection process and management of the overall collection process. It would provide in time solid waste collection. The technologies which are used in the proposed system are good enough to ensure the practical and perfect for solid waste collection process monitoring and management for green environment.

XI CONCLUSIONS

This paper enhances the cleanliness of the smart cities by the practical application of Automatic waste management and segregation system using automation with urbanization and increasing population, disposal of waste is a major concern. This proposed system is an effective waste segregation system that has no human intervention or interference to separate dry and wet waste. It provides timely collection and disposal. The proposed system can be deployed on a domestic scale in a household or a large scale in public places.

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Electric Tiles

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Abstract: **Man has needed and used energy at an increasing rate for the substance and well - being since time immemorial. Due to this a lot of energy resources have been exhausted and wasted. Proposal for the utilization of waste energy of foot power with human locomotion is very much relevant and important for highly populated countries like India where the railway stations, temples, etc., are overcrowded all round the clock. In this project the simple mechanism of rack and pinion and piezoelectric assembly mechanism is used for generating power by utilization of force which is obtained during the walking on steps is converted in to electrical energy with the help of mechanical systems.**

I. INTODUCTION

The most frequent activity in a person's life is walking. Due to the transfer of weight onto the road surface through foot falls on the ground with each step, when a person walks, he sends energy to the road surface in the form of impact, vibration, sound, etc. This energy can be captured and transformed into a form that is useful, like electrical form. We are creating a foot step power generating equipment in order to develop a method to collect footstep energy.

If this device is buried in a sidewalk, it can transform the energy of a footfall into an electrical charge. The device's top plate will slightly droop when a pedestrian steps on it because of the weight of the pedestrian, according to the working theory. Piezoelectric material used in the device is compressed as a result of the plate's downward movement, creating electrical energy.

II. LITERATURE SURVEY

To know the problems in the current situation in the world we first analysed the global data regarding energy consumption. When we came to the conclusion that we need to harvest energy by some method, we thought of tiles that can produce electricity.

We read several papers regarding this on websites like Science Direct, JSTOR, EBSCO etc. Complementarity, we also consulted secondary sources such as Google Scholar, ResearchGate and Academia. We found papers from 2012 to 2022, by choosing those whose content have information on methods of generation and energy harvesting.

There were mainly two main methods to produce electricity using pressure and they were piezoelectric and Rack and Pinion Gear systems. We have planned to maximize the power output by combining both the systems into a single system. Limiting the usage of a single system individually does have losses in terms of limitations in the PEC’s, or the frictional losses in the gears etc. We have planned to keep these tiles at places where we have the maximum number of people walking onto this.

III. PROBLEM STATEMENT

Proposal for the utilization of waste energy of foot power with human locomotion is very much relevant and important for highly populated countries like India and China where the roads, railway stations, bus stands, temples, etc. are all over crowded and millions of people move around the clock. Using piezoelectric to harvest vibration energy from humans walking, machinery vibrating, or cars moving on a

roadway is an area of great interest, because this vibration energy is otherwise untapped. Since movement is everywhere, the ability to capture this energy cheaply would be a significant advancement toward greater efficiency and cleaner energy production.

IV. MODE OF OPERATION & DESIGN

Fig. 1 shows the system model of the power generation.
The projections on the tile surface come in contact with the piezo material and hence apply force on it. For maximizing the output we have also added rack and pinion arrangement below it, so that the excess force which is wasted is converted into electricity and stored in the generator.

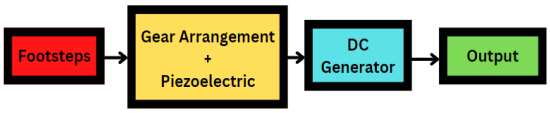

Fig 1

Study of Piezoelectric Materials:- Piezoelectric ceramics belong to the group of ferroelectric materials. Ferroelectric materials are crystals which are polar without an electric field being applied. The main component we are using is the piezoelectric material. The proper choice of the piezo material is of prime importance. Next, to check the connection that gives considerable voltage and current necessary, for that six piezo transducers are connected in series. The process for selection is better output voltage for various pressures applied. In order to understand the output corresponding to the various forces applied, the VI characteristics of each material namely, Piezo transducer are plotted. Voltmeters are connected across both of them for measuring voltages and an ammeter is connected to measure the current. As various forces are applied on the Piezo material, different voltage readings corresponding to the force are displayed. For each such voltage reading across the force sensor, various voltage and current readings of the Piezo test material are noted.
The energy generated depends upon the weight of the person, type of movement, and maximum deflection. This kinetic energy is converted into electricity. This generated electricity is stored in the form of batteries.to which the rectifier is connected to get pure dc supply.

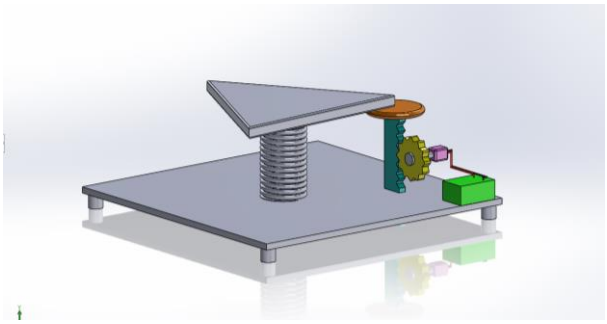

Fig 2

V. CALCULATIONS

Charging Time:
The entire energy that is produced when the load is applied on the footsteps is stored in a storage device called BATTERY. So, it is taken as important criteria to determine the charging time taken by the battery.
Charging Time = Battery Rating/Charging current

Battery Backup Time:
Backup Time = Battery Rating/Load Applied

Spring Stiffness:
Hooke's law is a principle of physics that states that the force F needed to extend or compress a spring by some distance X is proportional to that distance.
That is: F = kX, where k is a constant factor characteristic of the spring: its stiffness, and X is small compared to the total possible deformation of the spring.
The spring constant K is measured in newtons per metre (N/m), or kilograms per second squared (kg/s^2)
Now, to the matter:-
Find force exerted by the weights which you have. i.e., for example if you have a 20 Kg block of weight, then

F = (mass) x g
F= (20 kg) x (9.8 m/s^2) = 196 N
Now use F=kX where X is the displacement produced in the spring when the weight is suspended.
The displacement in this case of our project work is 0.1524 m.
=> k=F/X

=> k = 196/0.1524
=> k= 1286.08 N/m.
So, for a minimum weight of a person of 20 kgs the stiffness of the spring is given as 1286.08 N/m.

Theoretical Output:
To determine the output power of the device it is essential to determine the force applied on the model. Let the force applied be calculated as,

Force = Weight of the body = m.g.
Work done = Force x Displacement
Power = Work done/sec
Let the weight applied by the body is 20 kgs, then the maximum displacement of the spring can be noted as 0.05 m
Force = 20 x 9.81 = 196.2N
i.e., work done = 9.81N
Power = 0.981 / 60 i.e., power = 0.1635
Power generated per hour = 0.1635 x 3600 = 588.6 watts

No of steps	Duration of light	Total Energy	Energy/Step
250	6	600	2.4
500	12	1200	2.4
750	18	1800	2.4
1000	24	2400	2.5

VI. RESULT

Piezoelectric flooring is ideal for places that receive heavy foot traffic. It can be placed at tourist attractions, dance floors or town halls, schools, stadiums, In fact, the hard Energy Floors has a product called the Sustainable Dance Floor especially designed for clubs. Piezoelectric tiles can also be placed in other busy places such as subway stations, airports, universities, and malls. The technology of using piezoelectric tiles to generate electricity using pressure is new, companies in this sector are still looking for venture capitalists and investors. It would be interesting to see if any automotive companies develop an interest in this technology to harvest electricity from the movement of cars and other vehicles.

VII. CONCLUSION

A piezo tile capable of generating 12V has been devised. Comparison between various piezoelectric materials shows that PZT is superior in characteristics. Also, by comparison, it was established that series parallel combination connection is more suitable. The weight which is applied to the piezoelectric tile and corresponding voltage generated is studied and they are found to have a linear relation. It is especially suited for implementation in crowded areas. This can be used in street lighting without the use of long power lines. It can also be used as charging ports, and lighting of pavement side buildings.

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Vertical Axis Wind Turbine

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***Abstract*—The current project involves the creation of a vertical axis wind turbine (VAWT) that has been designed and fabricated to meet specific requirements. The VAWT blades have an aerodynamic shape that allows for less weight and greater rigidity. The turbine is mounted on the street divider, where the speed of air from passing vehicles is sufficient to turn the blades. The VAWT is unique in that it is constructed to allow vehicles on both sides of the street to move the blades. The blades are connected to an inner shaft that generates power, which is then stored in a battery and can be used for various applications. A small-scale model was created and tested in the lab, and it was found that at a speed of 25 m/s, the VAWT could generate up to 4kW of power. It can also function with low wind speeds ranging from 4 m/s to 35 m/s.**

Keywords—VAWT, design, simulation.

I. Introduction

Wind power is a renewable energy source that can serve as an alternative to traditional fossil fuels. It is clean, abundant, and has the potential to help address the issue of global warming. Vertical Axis Wind Turbines (VAWTs) have several advantages, such as the ability to place heavy parts on the ground for easy servicing and the capacity to detect wind from all directions. Asynchronous connection directly to the grid is one of the most straightforward methods for wind power generation. In addition, wind power can complement conventional combustion processes to provide additional power.

Vertical axis wind turbines (VAWTs) have higher efficiency and are a feasible option for power generation in areas without access to electrical mains. They differ from the conventional horizontal axis wind turbines as they rotate around a vertical axis using rotors. VAWTs have various advantages such as the ability to rotate regardless of wind direction, easier maintenance, lower noise, and reduced gravity-induced errors. The development of VAWTs has been studied for 30 years, and recently more focus has been on optimizing their profitability and power generation.

II. Design

A. Product Performance

The Savonius vertical axis wind turbine (VAWT) has been developed with a focus on educational and household use. To ensure its effectiveness, the VAWT's ability to withstand various environmental conditions and winds was analyzed. Additionally, the VAWT's response to specific wind conditions was considered to ensure proper movement and performance.

The Savonius wind turbine operates by utilizing the difference in forces exerted on each blade. The concave half of the lower blade facing the wind direction catches the wind and generates a force that causes the blade to rotate around its central vertical shaft. On the other hand, the convex half of the upper blade facing the wind direction hits the wind and deflects it sideways around the blade.

The curvature of the Savonius wind turbine blades results in the blades experiencing less drag force (Fconvex) when moving against the wind than when moving with the wind (Fconcave). As a result, the half cylinder with the concave side facing the wind experiences more drag force than the other cylinder, which causes the rotor to rotate. The differential drag force is what enables the Savonius turbine to spin. However, due to the significant amount of power used to push the convex half of the blade, Savonius turbines typically extract less of the wind's power than similarly sized lift type turbines, resulting in lower efficiency. The three-blade Savonius wind turbine is constructed from three half cylinders arranged at 120 degrees relative to each other, as shown in the figure.

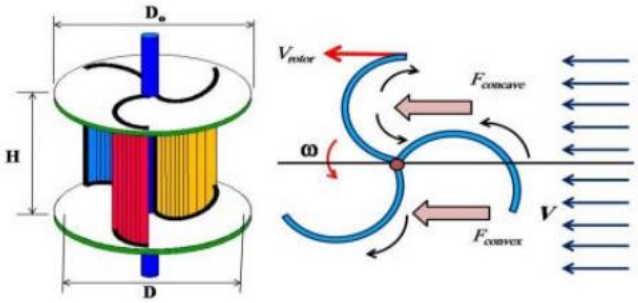

Figure 1: Schematic drawing showing the drag forces exert on three blade Savonius

B. Structure

The decision to use a Savonius type wind turbine in the VAWT was based on its suitability for a drag-type turbine design and the positive readings obtained through simulations. Additionally, the blade design of the Savonius turbine can be easily modified or changed to meet future development goals.

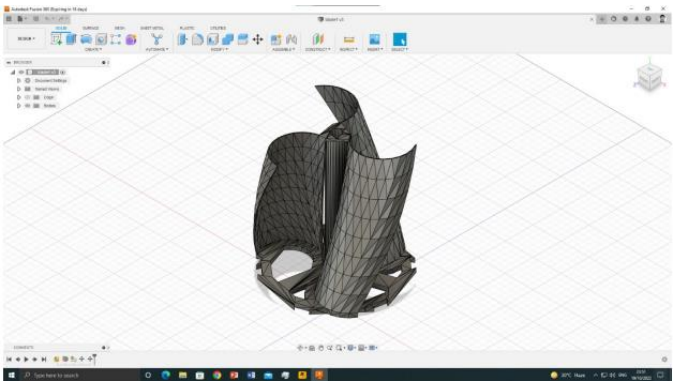

Figure 2: Savonius Blade Design on Fusion 360

Savonius turbines are known for their simplicity, as they consist of two or three blades in a drag-type design. The blades are typically shaped like half-cylinders and are arranged vertically. In cross-section, a two-blade Savonius wind turbine would resemble the shape of the letter "S."

III. Componenet Selection

A. Blades

Aluminum sheet plate is a common material used for rotor blades in wind turbines due to its lightweight nature, corrosion resistance, rigidity, recyclability, ease of construction, and low cost. Thicknesses available for aluminum sheet plates range from 3mm, and sizes range from 2000 x 1000mm. For this project, the rotor blade was manufactured with a length of up to 1000mm and a width of 300mm. The blade was designed using the Twisted Savonius method, which is a modified version of the Savonius design and is one of the subtypes of the vertical axis design.

Increasing the infill density can help to strengthen the structure and prevent breakage under stress. However, it can also increase the weight of the blade and may affect its aerodynamic performance. Therefore, the infill density needs to be carefully selected based on the specific requirements of the blade. Additionally, 3D printing may not be the most cost-effective option for mass production of blades, but it can be useful for prototyping and testing.

B. Shaft

The material used for the shaft is also an important consideration. Mild steel is a common choice for shafts due to its strength, durability, and cost-effectiveness. The diameter of the shaft should be selected based on the torque requirements and the strength of the material. The length of the shaft should be selected based on the distance between the blade rotor and the generator or gearbox. It is important to ensure that the shaft is properly fitted to the blade rotor to prevent any wobbling or instability during operation. Additionally, the weight of the shaft should be minimized as much as possible to reduce the load on the bearings and increase the efficiency of the turbine.

C. Bearing

Ball bearings are commonly used in wind turbines to support the rotor shaft and reduce friction between the rotating parts. Grease is used to lubricate the bearings and reduce wear and tear. It is important to maintain the bearings properly to ensure smooth operation of the turbine and prevent premature failure of the components.

D. Spur gears

The spur gears are being used as a speed increaser to improve the output power of the wind turbine. The two gears used have different sizes, with the larger gear having more teeth than the smaller gear. As the wind turbine rotates, the smaller gear turns the larger gear, resulting in an increase in speed of rotation. This increase in speed allows for more power to be generated by the wind turbine.

E. Generator

The generator is a crucial component in our Savonius wind turbine design as it converts the rotor's rotational energy to electrical energy. The generator type we select will depend on factors such as the required power output, electrical output voltage and frequency, and cost and availability. Common generator types for wind turbines include induction, synchronous, and permanent magnet. We'll need to consider how the generator is connected to the rotor shaft and electrical load, as well as efficiency, reliability, and maintenance requirements.

IV. Methodology

To optimize the design of a vertical axis wind turbine (VAWT), several parameters must be considered, including wind speed, blade area, blade pitch angle, number of blades, generator efficiency, gear ratio, and power output. These parameters affect the amount of power that can be generated and how efficiently it can be converted to electrical energy. By carefully adjusting these parameters, the VAWT can be designed to achieve maximum power output and efficiency.

The average natural wind speed in India to be 5.3m/s. Density of air 1.225kg/m^3.

For minimum speed = 14.4 km/hr
= 4 m/s
For Maximum wind speed = 21.6 Km/hr
= 6 m/s
For Average wind speed = 19.8 Km/hr
= 5.5 m/s
Power in the wind
The power of the wind is described by:
P kin= $0.5*m*v^2$
Where:
P kin = kinetics power [W];
m = mass flow = $\rho*A*v$ [kg/s]
ρ = density [kg/m^3]
A = area [m^2]
v = speed [m/s]

Although the frequency distribution of wind speed varies across different locations, it generally aligns well with the distribution.

For VAWT (Vertical Axis wind turbine) the area is calculated by

A= d*h
Where d= diameter of the rotor (m)
h= height of the blades (m)
So area A= 0.6*1
A= 0.6 m^2
Power in the wind:
P kin= 0.5*m*v^2
m = ρ*A*v
= 1.225*0.6*5.5
m = 4.0425 kg/sec
P kin= 0.5*m*v^2
= 0.5*4.0425*5.5^2
= 61.143 W
= 0.06 KW

This is the power of the shaft, the power obtained from the generator may reduce 30% because of power losses.

V. Conclusion

The experiment will be conducted within the college premises using a blower with varying wind speeds, while measuring the wind speed using an anemometer. The motor will be connected to a digital multimeter to record the corresponding voltage and current at each wind speed, which will then be used to calculate the power generated. The theoretical power output at wind speeds of 4m/s, 5.5m/s, and 6m/s are 0.02KW, 0.06KW, and 0.08KW, respectively. However, the actual output will be lower due to losses in both the mechanical and electrical systems.

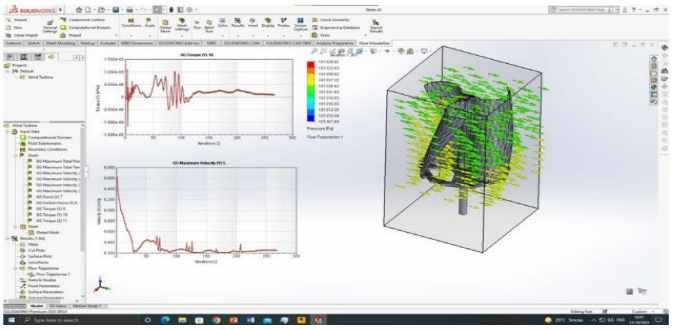

Figure 3: Solidworks Flow Simulation Results

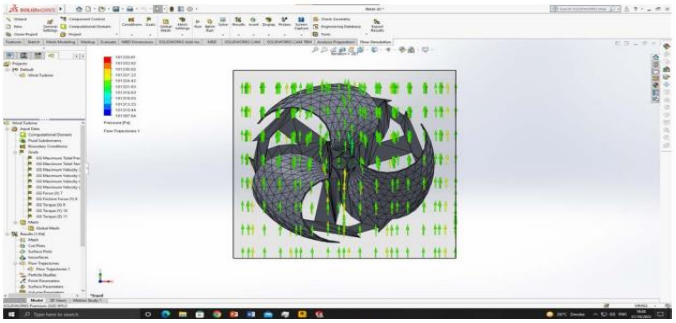

Figure 4: Solidworks Flow Simulation Top View

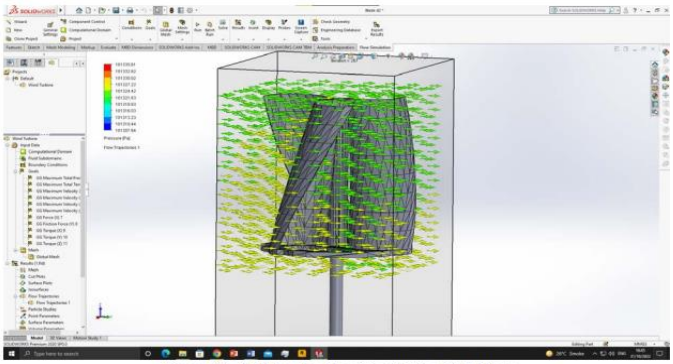

Figure 5.3: Solidworks Flow Simulation Side View

Figure 5: Solidworks Flow Simulation Side View

The VAWT is constructed to be able to harness wind from any direction, and its power output at a wind speed of 6m/s is calculated to be 0.08kW. To improve the efficiency of the VAWT, the size and shape of the blade can be modified. The theoretical and experimental results differ due to the assumption in theoretical calculations that the wind is hitting all three turbine blades, while in practice, it only hits one blade at a time.

The "Vertical Axis Wind Turbine" project is suitable for both household and industrial applications and can be easily implemented. Based on the project, it can be inferred that wind turbines have a wide range of applications in generating power.

Acknowledgment.

We express our gratitude towards Thakur College of Engineering for their support and financial assistance in carrying out this project, as well as the faculty members who have been very helpful and supportive throughout the project.

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Fake Currency Detection System

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Abstract*— Currency is a very important aspect in our day to day lives. Almost all countries in the world are facing the problem of fake currencies including India. Counterfeit notes can be easily printed with high accuracy which makes it difficult to differentiate the original note. Over the year various studies and researches have been carried out on technologies to detect fake currency and as a result different methods were introduced but there exist problems in these methods which makes them less accurate. Hence an advance method to identify fake notes is the necessity of time which can overcome the flaws of the existing detection methods. This paper introduces a new technology to detect fake notes based on unique features and image correlations. The main aim is to design a simple but efficient algorithm to detect counterfeit currency. This method requires no human intervention and is automatic which can be easily used. For classifications, convolution neural network is used as a tool for pattern recognition. The use of Neural Network improves the accuracy of the system.

Keywords*— counterfeit notes, fake currency, classification technique extraction of features, image processing, detection methods, currency crimes, rupees, currency crime, bank crimes, economical crimes.

I. Organization of paper

This paper is divided into sections including organization of paper.

II. Introduction

Currency is used in every country on large basis by banks, offices etc. Also, small shops, vendors as well as common people currencies in their day to day lives. With growing technology counterfeit notes are printed with great accuracy and perfection that it becomes difficult for an individual to detect the authenticity of the note merely by basic observations. Hence there is a need of a system which can detect fake currency easily with accurate results and which can not only function in large organizations but also for common man. Previously existing hardware systems have various flaw and cannot be used as a handy day to day note detector, as it can only be of use in banks and offices. Also these cash-sorting machines are costly. The new approach for solving these issues is by using image processing techniques. According to the denominations, paper notes have different features. Each feature can be extracted and then used for recognition. The features of the paper currency can be detected using image processing. After the image is processed, the quality of the pictorial representation of the image is enhanced. Convolution Neural Network (CNN) used for feature detection. Also CNN improves recognition with high accuracy.

III. PREVIOUS TECHNIQUES.

Paper currency is the most secure way of transaction. Though it can not be made by anyone with the same accuracy but it can easily made with considering paper quality and certain parameters.

Techniques to detect counterfeit notes kept on evolving with checking some official parameters to machine learning and neural network.

A. Generally used methods to detect counterfeit currency

1. Watermark

In a fake currency, the watermark usually looks thick. Pay detail attention to the watermark. The fake currency gang apply oil, grease or wax to give the picture a translucent feel.

2. Figures & Alignment

In real currency, the figures will be aligned perfectly. But in the fake currency, chances are there to get the figures out of alignments. The gap between digits, smaller or bigger number, and the unaligned digits should be observed carefully.

3. Ink Smudge

Real notes will not have ink smudges and broken rinted lines. The notes with broken printed lines and ink smudges should be regarded with suspicion.

4. Security Threads

Security threads that are just drawn or printed on the currency, instead of the original one that is incorporated through the currency.

5. Typography

In fake note s, the typography for "Reserve Bank of India" will be thicker whereas in real Indian currency will have smoother lettering

.

6. Micro lettering

In real currency, the micro-lettering feature appears between the vertical band and Mahatma Gandhi portrait which contains 'RBI'.
A magnifying glass would be required to see this feature well.

B. Digital image processing method

The design flow of fake currency detection system includes eight stages: Image acquisition, pre-processing, gray scale conversion, edge detection, image segmentation, feature extraction, comparison and output [11]. This system is works on two images, one is test currency image on which authentication is to performed and other is the original currency image.

IV. WHAT IS CNN

A system that has interconnected artificial neurons that exchange the messages between one another is called Neural network. An accurately trained network will respond correctly when presented with an image or pattern to recognize, due to the connection having numeric ways are turned during the training process. Multiple layers of feature detecting neurons are placed in the network. Each layer consists of a number of neurons which respond to various combination of inputs from the previous layer.

Ref. the figure no.1 shown, the layers are built up in such a way that the first layer identifies a set of primitive patterns in the input, the patterns of pattern are detected by the second layer, and then the following layer detects pattern of the existing pattern and so on. A typical CNN uses 5 to 25 distinct layers of pattern recognition.

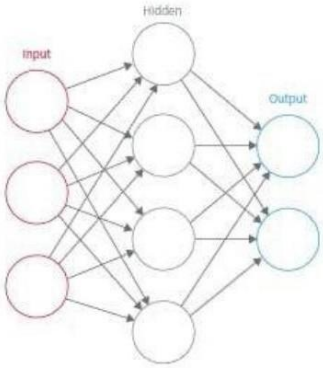

Figure 1:an artificial neural network

Biological Neural Network stimulates the neural network. Neuron is the basic computational of the brain and it is connected with the synapses. Figure 2 compares the biological neuron with the basic mathematical model.

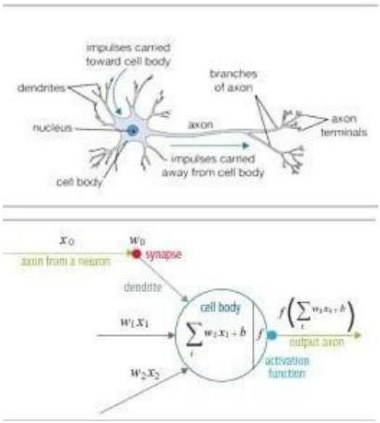

Figure 2: Illustration of a biological neuron (up) and its mathematical model (down)

- Let us consider a real animal neural system, a neuron receives the input signals from its dendrites and produces output signals along its axon. The axon branches are connected via synapses to dendrites of other neurons. When the combined input signals reaches the saturation among its input dendrites, it triggers the neurons and the successor neurons is communicated by its activation.
- Now considering the neural network computational model, the signal travelling along the axons multiplies with dendrites of other neurons based on the synaptic strength. We can learn and control the influence of one neuron or another. The signals are then carried by the dendrites to the cell body, where they are all

summed up. If the final sum observed is above a specified threshold the neuron bursts, giving a spike along its axon. In computational model we assume that the particular timings of the firing does not matter but the frequency of the firing communicated the information.

We are using CNN in this project because in recent past there has been tremendous growth in the field of convolutional neural networks, while other pattern detection networks have been around for the past 50 years.

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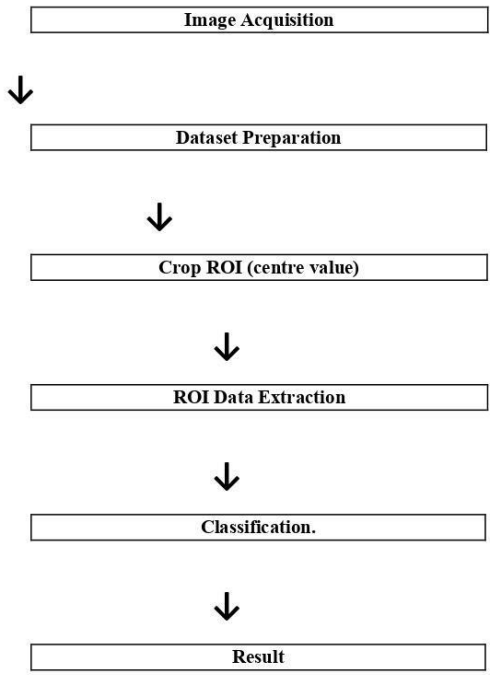
I. Proposed Method

BLOCK DIAGRAM



- **Image Acquisition**

We have scanned images for each denomination of 100,200,500- and 2000-rupee notes.

- **Pre-processing**

Following pre-processing steps are required to be applied,

1. Rotate and crop

As we are interested only in the currency part, the images are scanned in A4 size boundary. So first we rotate images to 90 degrees and then crop the image by setting the dimensions

2. Covert to standard dimension

As all the currencies are different in dimensions so to apply uniform logic to all the currencies, we initially convert all currencies to standard dimensions of 250*150.

- **Region of interest**

We are focusing watermark, numeric value and other important features of the note

- **Data Extraction**

In order to achieve the ultimate extracted images initially convert the cropped ROI images to grayscale images.

- **Classification**

In order to classify neural networks, pattern recognition app is used that is available in MATLAB. The neural network pattern recognition app will help us to train a network of specific data, and determine its performance using CNN.

- **Result**

A. Authors and Affiliation

The template is designed for, but not limited to, six authors. A minimum of one author is required for all conference articles. Author names should be listed starting from left to right and then moving down to the next line. This is the author sequence that will be used in future citations and by indexing services. Names should not be listed in columns nor group by affiliation. Please keep your affiliations as succinct as possible (for example, do not differentiate among departments of the same organization).

1) For papers with more than six authors: Add author names horizontally, moving to a third row if needed for more than 8 authors.

2) For papers with less than six authors: To change the default, adjust the template as follows.

a) Selection: Highlight all author and affiliation lines.

b) Change number of columns: Select the Columns icon from the MS Word Standard toolbar and then select the correct number of columns from the selection palette.

c) Deletion: Delete the author and affiliation lines for

the extra authors.

B. Identify the Headings

Headings, or heads, are organizational devices that guide the reader through your paper. There are two types: component heads and text heads.

Component heads identify the different components of your paper and are not topically subordinate to each other.

Examples include Acknowledgments and References and, for these, the correct style to use is "Heading 5". Use "figure caption" for your Figure captions, and "table head" for your table title. Run-in heads, such as "Abstract", will require you to apply a style (in this case, italic) in addition to the style provided by the drop down menu to differentiate the head from the text.

Text heads organize the topics on a relational, hierarchical basis. For example, the paper title is the primary text head because all subsequent material relates and elaborates on this one topic. If there are two or more sub-topics, the next level head (uppercase Roman numerals) should be used and, conversely, if there are not at least two sub-topics, then no subheads should be introduced. Styles named "Heading 1", "Heading 2", "Heading 3", and "Heading 4" are prescribed.

C. Figures and Tables

a) Positioning Figures and Tables: Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation "Fig. 1", even at the beginning of a sentence.

TABLE I.

Table Head	**Table Column Head**		
	Table column subhead	***Subhead***	***Subhead***
copy	More table copy[a]		

[a] Sample of a Table footnote. (*Table footnote*)

Fig. 1. Example of a figure caption. (*figure caption*)

Figure Labels: Use 8-point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity "Magnetization", or "Magnetization, M", not just "M". If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write "Magnetization (A/m)" or "Magnetization {A[m(1)]}", not just "A/m". Do not label axes with a ratio of quantities and units. For example, write "Temperature (K)", not "Temperature/K".

ACKNOWLEDGMENT *(Heading 5)*

The preferred spelling of the word "acknowledgment" in America is without an "e" after the "g". Avoid the stilted expression "one of us (R. B. G.) thanks ...". Instead, try "R. B. G. thanks...". Put sponsor acknowledgments in the unnumbered footnote on the first page.

REFERENCES

The template will number citations consecutively within brackets [1]. The sentence punctuation follows the bracket [2]. Refer simply to the reference number, as in [3]—do not use "Ref. [3]" or "reference [3]" except at the beginning of a sentence: "Reference [3] was the first ..."

Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it was cited. Do not put footnotes in the abstract or reference list. Use letters for table footnotes.

Unless there are six authors or more give all authors' names; do not use "et al.". Papers that have not been published, even if they have been submitted for publication, should be cited as "unpublished" [4]. Papers that have been accepted for publication should be cited as "in press" [5]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

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Autonomous Chess Playing Robot

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***Abstract*— Chess is an ancient strategy board game that is played on an 8x8 board. Although digital games have become attractive today, chess still retains its popularity in the onscreen version of the game. There has also been considerable development in the chess game engines to play against a human counterpart. The objective of this work is to integrate these chess engines with an actual board game experience and create an autonomous chess player. The system is designed around the use of an open source chess engine and a computer numeric control (CNC) controlled magnetic moving mechanism for moving around the chess pieces. The moves from the human counterpart are taken through an overhead computer vision system. The robot makes the game much more interactive and builds a link between the human and computer system.**

Keywords*— *Chess engine, ROS, Arduino, Computer vision, CNC control.

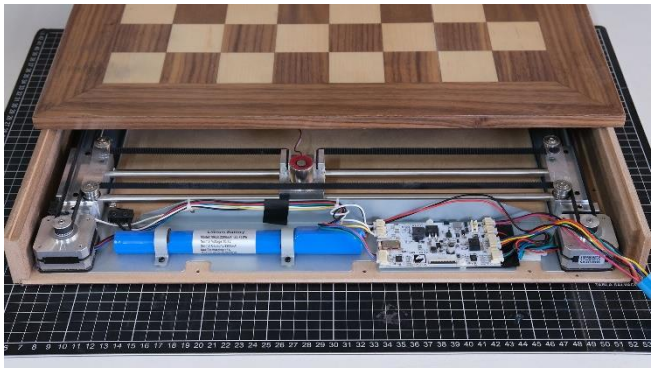
I. INTRODUCTION

We live today in an increasingly digitized world and technology has developed tremendously due to which computer chess games and online chess hubs have become very popular. Unfortunately, they do not give the feeling of playing a real game of chess with chess board and pieces.

A lot of mobile and desktop applications are available that allow users to play chess with a computer through an user Interface(UI) but they do not consider the interactive domain of the game.

Motivation behind the development of an autonomous chess robot comes from the goals that can be achieved with it. The robot as an industrial product can help in conducting professional chess matches remotely from two different places. Chess being one of the most popular strategy games requires tremendous practice and training. Chess training centers around the globe can use these robots for giving remote training sessions to children from experts around the world.

Automation of the game of chess has been previously attempted through different robotic models. The most common approaches used for handling the autonomous movements of chess pieces is using a mobile manipulator[1]. The design and development of such a manipulator which can carry out accurate and precise onboard movements is difficult and expensive. Use of passive electronic sensors such as reed switches and hall sensors have been used previously by Sušac and Filip [2] to keep track of the piece engines and make its mechanical unit work in sync. The basic system architecture of the proposed system can be seen in Fig. 1.



As an additional feature, a voice command gaming positions on the physical chess board but they are fragile magnetic switches which are susceptible to permanent damage in case of any mechanical jerk on the robot positions on the physical chess board but they are fragile magnetic switches which are susceptible to permanent damage in case of any mechanical jerk on the robot.

The objective of this work was to create a simple and durable automated chess playing robot that will be able to interact with a human chess player and play full-length matches. It utilizes an electromagnetic head to latch on to magnetic bottom ends of the chess pieces and drag the pieces.

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II. LITERATURE REVIEW

Existing efforts in developing chess-playing robots generally greatly simplify the challenges of creating a holistic perceive-compute-actuate system by applying significant constraints. The most common is the use of a Digital Game Technology (DGT) board, which uses sensors physically embedded in the board and the pieces to report the current square location of each piece to a computer, thus removing any need for external perception. Examples of this include Chesska from Russia and the KUKA Monstr from Germany, which competed in a "World Championship for Robot Chess". However, DGT boards are not only expensive but far less common than standard non-digital chess sets, immediately restricting the generality of the chess robot.

In cases where computer vision is used for perception, common simplifications include using non-standard colours (such as pink and green) to help the camera differentiate between the board squares and pieces, and mounting the camera directly above the board to reduce perspective distortion. Chess uses Harris corner detection and heatmaps to detect the board and piece movements at acute camera angles from a laptop webcam, but requires manual move triggering and is susceptible to errors with an inability to recover. Neufeld and Hall propose a probabilistic matching algorithm based on image masks to detect and classify the pieces and their current positions, although with lower accuracy than our method. Tam, Lay, and Levy use a combination of Hough line transforms and domain knowledge to segment squares from populated chessboards in a similar approach to ours, although no piece detection is implemented. Bennett and Lasenby present a feature detector that identifies chess board vertices in a robust way, although again this method only finds chess boards and does not identify occupancy or pieces. Czyzewski describes a three-step system that finds, then analyses, and then refines the chess board segmentation from different angles using neural networks, but only a draft of the algorithm has been released and more tests need to be conducted to verify the reliability and robustness of this approach.

One of the common simplifications used by hobbyists for the mechatronics subsystem is to use an XY linear slide system, mounted on top of the board so that a gripper can easily and consistently move to a square and pick up or put down a piece. However, this requires a fixed board position, and can sometimes occlude the board from a human player, while also making the board much less portable.

A. Slider Mechanism

The mechanical unit of the robot primarily contains a three-layer design for implementing an XY slider that can maneuver an electromagnet to each and every position of the chess board. Two railings are used in the Y direction and one in the X direction. Linear gear along each axis and motors with circular gears, mate to drive the sliders along both the axis. The chess pieces have small neodymium magnets attached to their base for coupling with the electromagnet. Fluorescent yellow papers are attached on top of the pieces for detection using image processing.

Position accuracy is achieved by implementing IR feedbacks from both the axis of motion. Slider displacement is quantized by using black and white strips of width 3mm. The IR circuit counts the strips and moves according to the demanded count. A Low Pass Filters (LPF) has been used to filter out the noise in the feedback due to mechanical vibrations. This feedback signal is further processed with a time-based filter in the microcontroller to get accurate position feedbacks. This setup is can be seen in Fig 2.

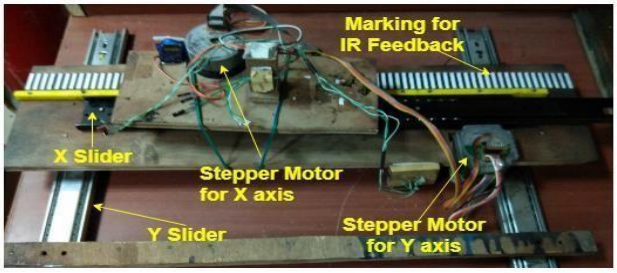


Fig. 2: Slider Mechanism

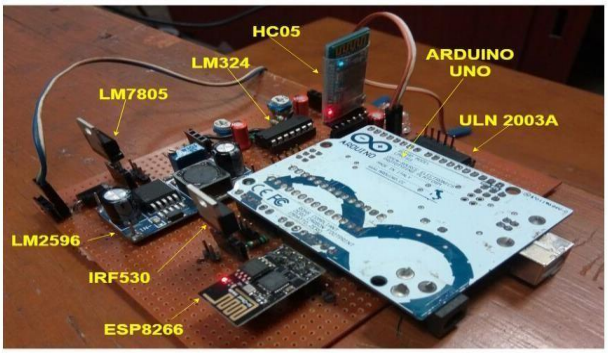


Fig. 3: Control Circuit

B. Vision system

The user's physical moves are fed to the system using a Logitech C270 720p [13] overhead camera which takes real- time images of the board at a rate of 40 Frames per Second (FPS). Three copies of each frame are made for three different tasks consisting up color segmentation for chess piece detection, edge detection for square center tracking and hand detection for process control. The acquired square centers are mapped on the binary frame generated after piece detection to produce an 8X8 binary integer matrix representing the occupancy of each square in the image of the chess board. The generated matrix is considered for further processing only if there is no hand detected in the hand detection output, thus preventing any ambiguous input to the system.

Irregular lighting conditions in an indoor environment makes edge detection difficult thus creating problems in accurate square center detection. To solve this issue the tracked square coordinates are latched to a buffer and gets updated each time when all 32 white squares are tracked. This is feasible because the board remains static with respect to the camera during the entire game-play.The setup of the overhead camera fitted on a stilt can be seen in Fig. 4.

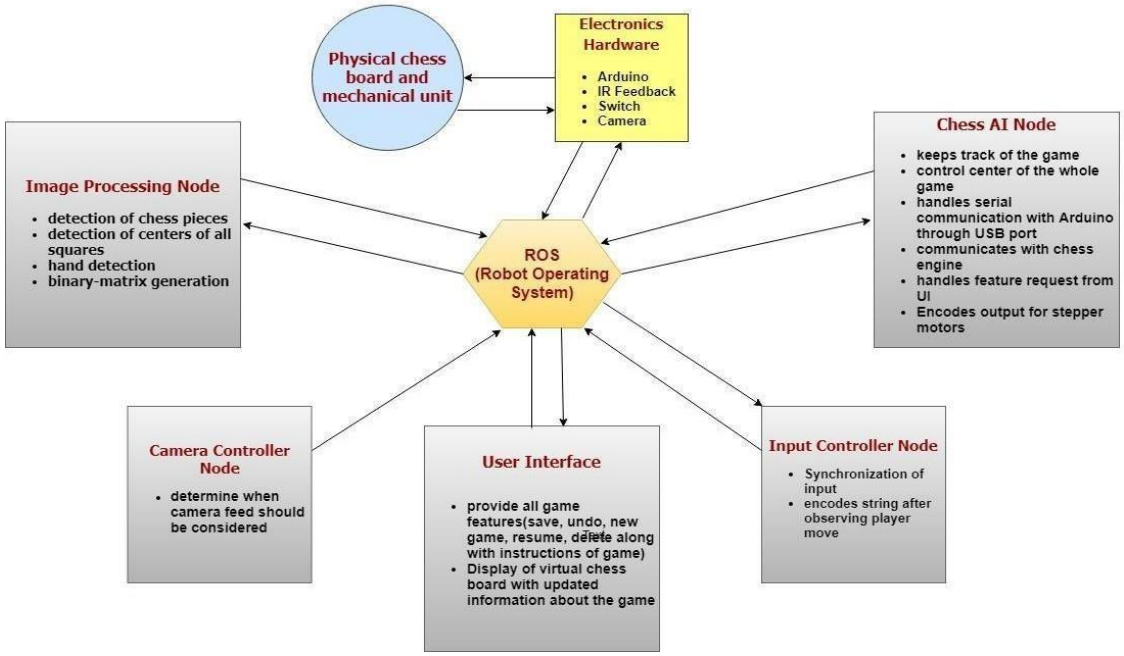


Fig. 5: ROS node map showing data flow between different modules

These 32 white squares can then map to the rest 32 black squares and thus track the entire chess board in every frame. The vision algorithms are developed with the OpenCV [14] libraries in C++.

C. Control system and chess engine

The software for the robot is powered with a chess engine which processes the user input and gives the corresponding best move as the output. Currently, the open- source Stockfish engine has been used by default which is also the World's best chess engine. The 8X8 matrix is processed to determine the onboard position changes to generate the user input in the form of a string according to the Universal Chess Interface (UCI)[15] format which is recognized by all the chess engines globally. Once the engine gives its output as another UCI string, it is encoded into a move sequence string which is sent to the microcontroller through serial communication. The microcontroller then reads this string to carry out on board changes with the XY slider.

The user is assisted with an interactive UI during the entire game-play to keep him/her updated with the game which provides all the virtual game features including save, restart, load, undo and delete options. This makes the game more user-friendly and interesting as it includes both real and virtual features of the chess game. The control system is developed with the Robot Operating System (ROS) framework in C++ and Python assisted with UI (User Interface) developed with Qt in C++. The interactions with the chess engines and game state tracking are handled by python chess module. Serial communication with the microcontroller is achieved with pyserial python module[16]. The interaction between individual nodes in ROS can be visualized with the node map in Fig. 5.

III. METHODOLOGY

Chess board pattern detection methods are based on corner detection algorithms. These have two basic drawbacks.

- The number of false positive outputs increase with increasing noise in the captured image.
- Outliers detected are difficult to segregate from the correct set of points.

The algorithm used in this work for center detection of the chess squares requires further filtering of the output to get the approximated position of the chess pieces. The algorithm assumes static configuration between camera and the chess board in real-time, it is a simple yet effective approach to solve the problem of chess board square center detection. This algorithm uses a latched vector approach for consistent center detection based on HSV image segmentation and canny edge detection. The robustness was tested by using prints of the chess board for giving tough detection challenge to the algorithm. The algorithm works in 6 steps.

A. Cropping the Image

The image obtained is cropped to get the Region of Interest (ROI) that is the chess board. This removes unnecessary noise from the surroundings during detection of the centers.

B. Cloning the frame

The obtained cropped frame is cloned thrice to make a total of four frames. Each frame is used for a different purpose in the subsequent steps.

C. *Chess piece position detection*

A cloned RGB frame is converted into a corresponding HSV frame. This frame is threshed with respect to the color of the yellow markers attached on the top of the pieces, to obtain a binary image highlighting the position of the pieces in the frame. The result can be seen in Fig 6.

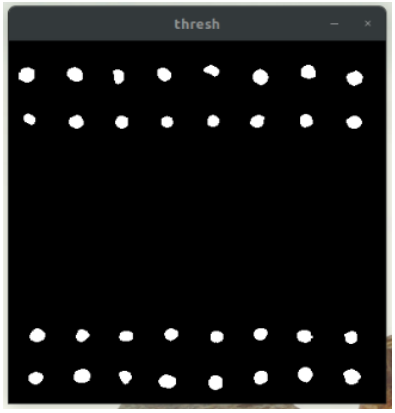


Fig 6: Threshed image for chess piece position detection

D. *Detection of the square Centres*

A cloned RGB frame is converted into a grayscale image. This frame is then blurred by Gaussian Blur convolution with a kernel size of 7X7. The blurred frame is then processed with the canny edge detection algorithm [17] to get the contours present in the image. This can be seen in Fig. 7. The obtained contours are filtered with respect to their shape and area to get the contours corresponding to the white squares on the chess board image. Each of the obtained contours is processed with respect to their moments to get the center of area, which in the real world would correspond to the center of the white square on the board. The center coordinate vector (32X2) obtained is not in an accessible format as the contours are randomly detected during the contour detection process. Hence this vector is sorted in ascending order according to the sorting criteria given below.

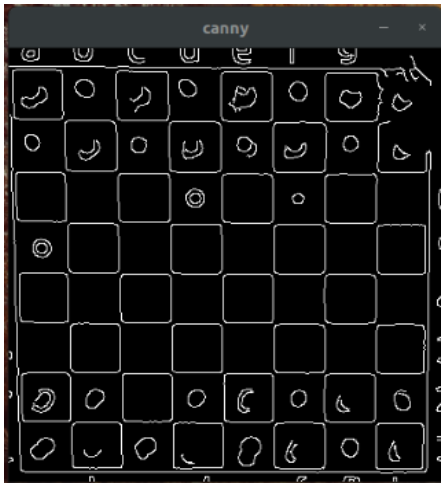


Fig.7: Canny Edge Detected output

A vector of 32 points having each point represented as (Xi, Yi). First, we sort the vector with respect to the Y coordinates. Then we divide the 32 element vector into 8 equal parts. Each part is sorted with respect to X coordinates. The algorithm is illustrated in Fig. 8. This converts the vector into a systematic format for accessing the position of a particular square on the image of the chess board.

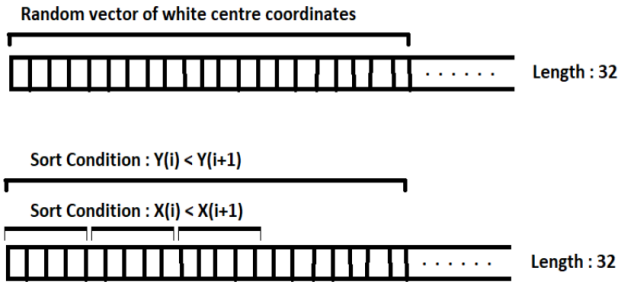


Fig. 8: Sorting Algorithm pictorial representation

The black square centers are mapped with respect to their corresponding white square. This mapping is done with a pixel offset which depends on the vertical distance of the camera from the chess board. Fig. 9 represents the above mapping technique. As the vertical distance of the camera increases the offset value decreases and parallax error reduces. With this step, we have obtained the coordinates of all the 64 square centers present on the board image. The vector of 64 coordinates is latched in the memory for reference until a new set of coordinates is detected by the process. This step is essential because edge detection algorithms are sensitive to lighting conditions of the environment. As the position of the camera remains fixed with respect to the board throughout the game, the latched coordinates can be assumed to be reliable for referencing the center of the squares.

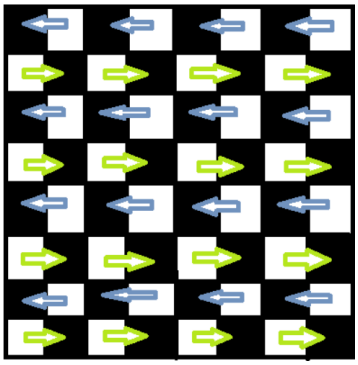
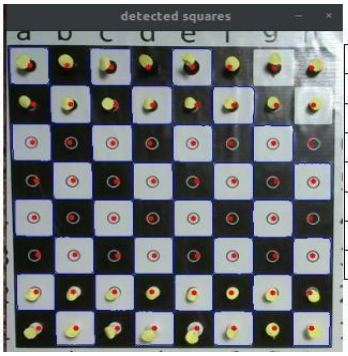


Fig 9: Mapping of the black squares from the detected white squares

E. *Generating the binary position array*

The obtained coordinate vector is accessed to get the coordinates of each square. The HSV threshed frame obtained in Step-C has the same dimensions as that of the frame processed in Step-D. Hence a white pixel cluster in the HSV threshed frame at a coordinate obtained from the vector will represent the presence of a piece on the real board corresponding a specific square. This method when applied to all the 64 coordinates in an iterative manner gives the board configuration in the form of a 2D binary array of 1s

and 0s. 1 correspond to a position being occupied by a chess piece and 0 corresponds to an unoccupied position. Fig. 10 shows the binary matrix corresponding to a board configuration at the start of the game.



1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1

Fig 10: Tracked coordinates of all 64 squares and Binary matrix representation of the initial chess board configuration

F. Hand Detection

The hand detection is a simple procedure for preventing any input errors to the system during the user's move. The user is asked to wear a fluorescent color glove while playing the game. These gloves are easy to detect in the image using the same HSV thresholding methods as described in step-C. The binary image obtained after thresholding is checked pixel by pixel to determine the presence of the gloves in the frame in real-time. The computation of the binary matrix for piece position detection is done only in the absence of the gloves thus preventing any possible input errors.

IV. RESULTS

The Wizard Chess was able to play complete games with several human opponents and an extensive analysis was made on the overall performance. Our prototype showed relatively less problems in detecting user moves and generating machine moves accordingly. However, we note that most of the problems encountered by our system were caused by off-center placement of a piece by the mechatronic system. Using a PD controller in the motor feedback system this error was reduced significantly.

In our analysis, we evaluated our system in three parts. Firstly, we checked the problems encountered in user move detection. We took 40 trials and analyzed the data. Secondly, we analyzed success rate in picking a piece and placing it in the right destination. We took 20 trials without the PD controller and 40 trials with the PD controller. Lastly, we analyzed the prototype playing an entire game of chess for ten times. It was able to finish the game uninterruptedly 6 times. Most of the errors encountered during the full games were caused by the serial connection between PC and Arduino.

TABLE I. SATISTICAL DATA OF THE PERFORMANCE OF WCR

Name of the test	No. of trials	Success rate
Human move detection	40	87.5 % (35 times)
Piece pick up with P controller	20	45% (9 times)
Piece pick up with PD controller	40	77.5% (31 times)
Piece drop with P controller	20	35% (7 times)
Piece drop with PD controller	40	82.5% (33 times)
Complete chess game	10	60%

These results suggest that our system presents a reliable and robust chess playing robot. Although the data set is small the overall result suggests a high potential for further improvement.

V. DISCUSSION

In this section, we will discuss the terms of the chess robot's performance against humans, quantitative analysis of the CV algorithm, and some qualitative comments about the overall timing and errors.

- *Playing Chess Against Humans*

Stockfish is a very strong chess engine, so the average person is not able to beat it since we use a minimum search depth of 6 (most humans only plan two or three moves ahead). As we have not tested Baxter against any Grandmasters, in over 50 complete games, no human has beaten Baxter at chess yet.

- *Analysis of Computer Vision Algorithm(s)*

We took a sample of 500 frames from Baxter's camera, with variations in the chess board orientation, chess board position, piece positions, external lighting intensity, and external lighting orientation. Of those, only about 270 frames were suitable for further analysis, because in many of the frames the camera was saturated, making it impossible to distinguish between edges or between white squares and white pieces, even to a human looking at the image. Most of this saturation would be temporary, so when running our algorithm in the real-world, it would simply reject these images and wait for a more suitable frame. In this test set, only 76 samples were taken in what could be considered "normal" lighting conditions; all other samples involved the use of a lamp to create extreme lighting conditions in order to challenge the CV algorithm

- *Timing and Errors*

We see that Baxter plays chess with different timing requirements to human players. When humans play at a high level, the perception time for detecting and analysing a move is very short, the computation time of deciding the next move is comparatively long, and the actuation time of moving a piece is very short. For Baxter, this is exactly the opposite; running on a 1.9 GHz i5 processor, the CV subsystem can only process a few frames per second (faster if the algorithm does not find a chess board or squares), and the chess engine subsystem returns a move in a few seconds or less (depending on the difficulty level/search depth). However, actuating the piece can take a significant amount of time, about 45–90 s, depending on if Baxter needs to move one piece or two (such as during piece capture or castling). This can give the impression that Baxter is a very slow player, particularly at the beginning of the game when a human player usually executes well-known opening sequences from memory without much computation.

However, as the game progresses and becomes more complex, human players slow down as they consider the different options and consequences of their moves, so Baxter can outpace them since its move time remains roughly the same throughout the game.

In future, we intend to use a single board computer such as Raspberry Pi inside the mechatronic system to make our proposed robot more user-friendly and robust. This will eliminate the use of a personal computer to run the chess program and make it an independent gaming console. We also intend to include voice recognition system to provide user moves so that disabled persons can also be benefited from our system.

VI. CONCLUSION

This robot is aimed towards giving the user a realistic experience of playing chess with a computer. The challenge was to create a fully functional and working interface between the physical world and the engine. The robot was tested in different indoor environments with variations in lighting conditions and the results of the position tracking were robust and consistent. The robot could play full length matches with more than 50 moves independently.

A. The Advancements in technology haven't entered the game as of now. The physical chess playing experience is not matched in the digital world

B. Thus the project will help to bridge this gap and provide a hassle free experience for a human to play against a AI based system

C. It's time to move back from a virtual world to the real world. And not just moving back but taking the best out of both the worlds. In this project me make use of AI to help our mind be better at critical thinking. It is supposed to serve as a tool to the mind.

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VIII. ACKNOWLEDGEMENT

The authors would like to acknowledge Mrs. Seema Nagrani for mentorship. The authors are thankful to the Thakur college of engineering and technology (Mechanical department) for giving us such an great opportunity. Also, thanks to the RBL professors for guiding us in all point of time.

Automated Solar Panel Cleaning

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***Abstract*—The use of solar power is growing as a result of rising electricity costs and concerns about the environmental impact of fossil fuels. Photovoltaic (PV) panel arrays are the main way to harness solar energy. Keeping the panels clean is crucial, as a single dirty panel can reduce its energy output by up to 50%. Our project's goal is to create an automated solar panel cleaning system to mitigate the impact of dirt and debris on industrial PV cells. The target is to increase a dirty panel's maximum energy output by 10%. However, autonomous cleaning robots tend to be cost-prohibitive for smaller installations due to both the expense of installation and the need for custom-made mounts**

Keywords—component, formatting, style, styling, insert (*key words****)***

I. INTRODUCTION (*HEADING 1*)

The growing interest in renewable energy has led to the expansion of the solar photovoltaic (PV) industry globally in the past decade. In 2014, a total of 3.03 million gigawatt hours (GWh) of electricity was generated in the European Union, accounting for 3% of the total electricity demand. As solar energy is a readily available technology, it has become a popular investment for both companies and households. This demand has driven the search for ways to increase the output of solar systems, leading to research into making the technology more efficient and cost-effective.

The PV industry is expanding worldwide due to its technological and financial advantages, with conversion efficiency ranging from 10 to 13%. The reduction in efficiency is due to losses in the inverter, wiring, and dust pollution. Dust is made up of substances such as beach sand, bacteria, mill dust, pollen, wood smoke, and explosive vapors, as well as suspended solid atmospheric particles that remain in the air for long periods. Studies have shown that airborne dust deposits on outdoor PV modules can reduce the transmittance of the cell glazing and significantly decrease the transformation efficiency of PV modules.

However, cleaning solar panels is not always straightforward. First, accessibility is a challenge as PV panels are often placed in hazardous and difficult-to-reach locations. Cleaning them manually can be difficult and time-consuming. Second, cleaning a panel once may not have a significant impact on the monthly energy yield, as dust can accumulate again quickly, making the difference negligible. If you need to hire someone to clean the panels, it may not be cost-effective. Nevertheless, leaving panels uncleaned can lead to permanent damage to the glass, reducing the longevity of the installation.

II. PREVIOUS WORKS AND IMPORTANCE

A. Background

Cleaning solar panels by hand is a traditional approach, but new solutions like robotic cleaners, waterless vibration, and special coatings can be expensive and inefficient, especially for smaller installations and unique setups like agrivoltaics. To effectively clean panels, special brushes and basic cleaning tools like those used on car windshields can be used.

B. Importance of Project

The full generating capacity of solar PV panels is often not reached due to the buildup of dirt and debris, especially in dry, dusty climates where long periods without rain are common. Rain run-off also leaves stains and deposits that decrease efficiency. Existing cleaning methods are either expensive, risky (such as manual cleaning on residential roofs), or ineffective for dry solar PV installations (such as water-based cleaning in desert areas). PV Cleanser is an affordable, self-sufficient, and dry mechanical device that maximizes solar panel performance while minimizing owner impact.

III. LITERATURE SURVEY AND PROPOSED WORK

Sims et al. and Bock et al. designed a self-cleaning PV module based on electrodynamics Their designs demonstrate that as voltage values increased, dust removal rates also did so. However, because it doesn't include any liquid, this sort of cleaning procedure has several drawbacks, such as the inability to remove sticky or muddy particles, and the high initial and ongoing costs. Mani et. al discussed the impact of dust settlement on the operation of the PV module during two phases. The main focus is on how ecological factors affect the performance of PV modules without identifying practical ways to lessen their impact. Mekhilef et al. studied the effects of dust settlement, wind speed, and humidity on the PV module. They claimed that because each factor affects the others, they ought to be measured at the same time. Syed et

al. revised the impact of the ecological condition and dirt settlement on the output of the PV module.They came to the conclusion that the weather conditions at the installation site determine the most efficient method of dust removal. Since the frequency of dust storms largely determines the required rate of PV module cleaning, there is no set recommendation. The studies done by Costa et al, Darwish et al., Sayyah et al., and Sarver et al. , offer data associated with soiling impact at the overall performance of the PV gadget in specific regions and countries. The purpose of this research is to use Arduino to build a solar panel cleaning robot. The project's objectives are to design and construct a microcontroller-based dust cleaning system using the Arduino UNO as the primary system, to optimise PV panel operation performance in a dusty environment, and to increase solar panel efficiency by maintaining their cleanliness.

A. Objectives and Scope

The robot uses the Arduino UNO as its main control system, which controls the movement of the robot and its cleaning mechanism. The robot is equipped with a cleaning mechanism such as brushes or wipers to remove dirt and debris from the surface of the solar panels. The robot moves along the tracks mounted on the photovoltaic panel structure, cleaning the panels as it goes. The goal of the project is to increase the efficiency of the photovoltaic panels by maintaining their cleanliness, optimizing their performance in dusty environments, and reducing power losses.

B. Units

- Use either SI (MKS) or CGS as primary units. (SI units are encouraged.) English units may be used as secondary units (in parentheses). An exception would be the use of English units as identifiers in trade, such as “3.5-inch disk drive”.
- Avoid combining SI and CGS units, such as current in amperes and magnetic field in oersteds. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity that you use in an equation.
- Do not mix complete spellings and abbreviations of units: “Wb/m2” or “webers per square meter”, not “webers/m2”. Spell out units when they appear in text: “. . . a few henries”, not “. . . a few H”.
- Use a zero before decimal points: “0.25”, not “.25”. Use “cm3”, not “cc”. (*bullet list*)

C. Equations

The equations are an exception to the prescribed specifications of this template. You will need to determine whether or not your equation should be typed using either the Times New Roman or the Symbol font (please no other font). To create multileveled equations, it may be necessary to treat the equation as a graphic and insert it into the text after your paper is styled.

Number equations consecutively. Equation numbers, within parentheses, are to position flush right, as in (1), using a right tab stop. To make your equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use a long dash rather than a hyphen for a minus sign. Punctuate equations with commas or periods when they are part of a sentence, as in:

$$a + b = \gamma \tag{1}$$

Note that the equation is centered using a center tab stop. Be sure that the symbols in your equation have been defined before or immediately following the equation. Use “(1)”, not “Eq. (1)” or “equation (1)”, except at the beginning of a sentence: “Equation (1) is . . .”

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- The word “data” is plural, not singular.
- The subscript for the permeability of vacuum μ_0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter “o”.
- In American English, commas, semicolons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase, punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)
- A graph within a graph is an “inset”, not an “insert”. The word alternatively is preferred to the word “alternately” (unless you really mean something that alternates).
- Do not use the word “essentially” to mean “approximately” or “effectively”.
- In your paper title, if the words “that uses” can accurately replace the word “using”, capitalize the “u”; if not, keep using lower-cased.
- Be aware of the different meanings of the homophones “affect” and “effect”, “complement” and “compliment”, “discreet” and “discrete”, “principal” and “principle”.
- Do not confuse “imply” and “infer”.
- The prefix “non” is not a word; it should be joined to the word it modifies, usually without a hyphen.
- There is no period after the “et” in the Latin abbreviation “et al.”.
- The abbreviation “i.e.” means “that is”, and the abbreviation “e.g.” means “for example”.

An excellent style manual for science writers is [7].

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The template is designed for, but not limited to, six authors. A minimum of one author is required for all conference articles. Author names should be listed starting from left to right and then moving down to the next line. This is the author sequence that will be used in future citations and by indexing services. Names should not be listed in columns nor group by affiliation. Please keep your affiliations as succinct as possible (for example, do not differentiate among departments of the same organization).

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c) Deletion: Delete the author and affiliation lines for the extra authors.

B. Conclusion

In conclusion, the automatic brush type solar panel cleaning system is a promising solution for cleaning solar panels, as it reduces water consumption and improves panel efficiency. However, further improvements can be made to the system, such as increased eco-friendliness, improved assembly, smaller size, and enhanced features such as proximity sensors and a thermal camera module. It is important to determine public willingness to pay for the long-term savings promised by the project through public opinion research.

C. Result and Discussion

The PV Cleanser robot effectively cleans solar panels, reducing the cost of cleaning by 80% compared to manual cleaning. It is efficient and quick, taking less time to clean a panel. The cleaning process removes sticky materials and dust, improving the solar panel's efficiency by 25% by allowing more sunlight to penetrate the surface. The robot consumes 90% less water and is suitable for almost all panel sizes worldwide. The cleaning process reduces the labor force needed and increases power production. The reduction in water consumption and cost per area make this an attractive solution for cleaning solar panels.

We suggest that you use a text box to insert a graphic (which is ideally a 300 dpi TIFF or EPS file, with all fonts embedded) because, in an MSW document, this method is somewhat more stable than directly inserting a picture.

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ACKNOWLEDGMENT *(Heading 5)*

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Unless there are six authors or more give all authors' names; do not use "et al.". Papers that have not been published, even if they have been submitted for publication, should be cited as "unpublished" [4]. Papers that have been accepted for publication should be cited as "in press" [5]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

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[1] G. Eason, B. Noble, and I. N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529–551, April 1955. *(references)*

[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.

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[4] K. Elissa, "Title of paper if known," unpublished.

[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740–741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

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SOLAR ENERGY BASED WATER PURIFICATION SYSTEM

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Abstract*—We propose a Solar energy-based water purification system with the utmost use of technology, for the welfare of the people living in the rural area and barely using any technical equipment. Solar energy-based products are always encouraged as energy is non-conventional and renewable. The sound use of energy will lead to the sure betterment of human life. We have tried our best to modify the traditional water purification system by using the latest versions of technology.

Keywords—*Technical, solar energy, modify human lives, water purification.*

INTRODUCTION:

The water problem is the most faced natural calamity in the world and purification Is the very subset of that problem. Only 3% of the total water on the earth is drinkable and hence it's a big challenge ahead in future to purify the other 97% of water to make it suitable for use. Hence scientists are finding new techniques for the purification of water. Traditional water purification systems do exist but they are not economical and are remote. One such system is the solar water purification system. Solar purification is flexible and can be modified in many ways to make it more effective. It is a green project as there is no emission of any pollutants nor there is the use of any conventional resources for the same. It is carried out by the SOID process followed by chemical and mechanical filtration. The project is tried to make as much as versatile and economical and mobile.

PROBLEM DEFINITION:

The need for water purification systems in rural and urban areas is increasing. Providing access to clean drinking water to everyone. Energy consumption of an electrical system drastically increases operation costs. So, a Solar Energy based system to save operation cost. To ensure smooth functioning and good quality output through an IOT system with a feedback mechanism.

OBJECTIVES:

- To make clean drinking water available.
- Make use of Green Energy to reduce the carbon footprint.
- Use advanced technologies to make an efficient system.
- Use naturally available resources to reduce costs.
- Make operation of the system free of cost.
- Use IOT systems to track real time data and get an alert if the quality of water diminishes.

THEORY:

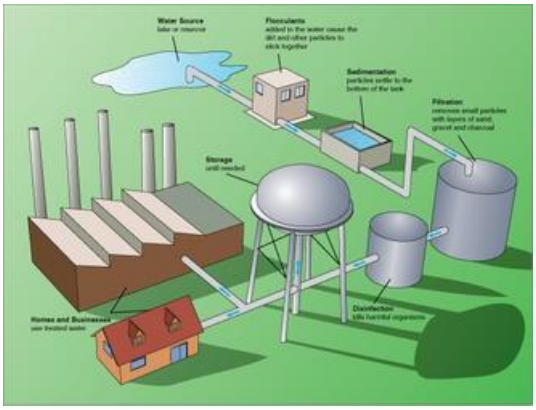
Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids, and gases from water. The goal is to produce water fit for specific purposes. Most water is purified and disinfected for human consumption (drinking water), but water purification may also be carried out for a variety of other purposes, including medical, pharmacological, chemical, and industrial applications. The methods used include physical processes such as filtration, sedimentation, and distillation; biological processes such as slow sand filters or biologically active carbon; chemical processes such as flocculation and chlorination; and the use of electromagnetic radiation such as ultraviolet light. Water purification may reduce the concentration of particulate matter including suspended particles, parasites, bacteria, algae, viruses, and fungi as well as reduce the concentration of a range of dissolved and particulate matter. The standards for drinking water quality are typically set by governments or by international standards. These standards usually include minimum and maximum concentrations of contaminants, depending on the intended use of the water.

Visual inspection cannot determine if water is of appropriate quality. Simple procedures such as boiling or the use of a household activated carbon filter are not sufficient for treating all possible contaminants that may be present in water from an unknown source. Even natural spring water – considered safe for all practical purposes in the 19th century – must now be tested before determining what kind of treatment, if any, is needed. Chemical and microbiological analysis, while expensive, is the only way to obtain the information necessary for deciding on the appropriate method of purification.

According to a 2007 World Health Organization (WHO) report, 1.1 billion people lack access to an improved drinking water supply; 88% of the 4 billion annual cases of diarrheal disease are attributed to unsafe water and inadequate sanitation and hygiene, while 1.8 million people die from the diarrheal disease each year. The WHO estimates that 94% of these diarrheal disease cases are preventable through modifications to the environment, including access to safe water. Simple techniques for treating water at home, such as chlorination, filters, and solar disinfection and for storing it in safe containers could save a huge number of lives each year. Reducing deaths from waterborne diseases is a major public health goal in developing countries.

WATER TREATMENT:

The goals of the treatment are to remove unwanted constituents in the water and to make it safe to drink or fit for a specific purpose in industry or medical applications. Widely varied techniques are available to remove contaminants like fine solids, micro-organisms and some dissolved inorganic and organic materials, or environmental persistent pharmaceutical pollutants. The choice of method will depend on the quality of the water being treated, the cost of the treatment process and the quality standards expected of the processed water.



Ph ADJUSTMENT:

Pure water has a pH close to 7 (neither alkaline nor acidic). Seawater can have pH values that range from 7.5 to 8.4 (moderately alkaline). Freshwater can have widely ranging pH values depending on the geology of the drainage basin or aquifer and the influence of contaminant inputs (acid rain). Lime addition increases the calcium ion concentration, thus raising the water hardness. For highly acidic waters, forced draft detoxifies can be an effective way to raise the pH, by stripping dissolved carbon dioxide from the water. Making the water alkaline helps coagulation and flocculation processes work effectively and also helps to minimize the risk of lead being dissolved from lead pipes and from lead solder in pipe fittings. Sufficient alkalinity also reduces the corrosiveness of water to iron pipes. Acid (carbonic acid, hydrochloric acid or sulfuric acid) may be added to alkaline waters in some circumstances to lower the pH.

COAGULATION AND FLOCCULATION:

One of the first steps in most conventional water purification processes is the addition of chemicals to assist in the removal of particles suspended in water. Particles can be inorganic such as clay and silt or organic such as algae, bacteria, viruses, protozoa and natural organic matter. Inorganic and organic particles contribute to the turbidity and color of the water. The addition of inorganic coagulants such as aluminium sulfate (or alum) or iron (III) salts such as iron(III) chloride cause several simultaneous chemical and physical interactions on and among the particles. Within seconds, negative charges on the particles are neutralized by inorganic coagulants. Also, within seconds, metal hydroxide precipitates of the iron and aluminium ions begin to form. These precipitates combine into larger particles under natural processes such as Brownian motion and through induced mixing which is sometimes referred to as flocculation. Amorphous metal hydroxides are known as "floc".

SEDIMENTATION:

Waters exiting the flocculation basin may enter the sedimentation basin, also called a clarifier or settling basin. It is a large tank with low water velocities, allowing floc to settle to the bottom. The sedimentation basin is best located close to the flocculation basin so the transit between the two processes does not permit settlement or floc break up. Sedimentation basins may be rectangular, where water flows from end to end or circular where flow is from the centre outward. Sedimentation basin outflow is typically over a weir so only a thin top layer of water—that furthest from the sludge—exits. In 1904, Allen Hazen showed that the efficiency of a sedimentation process was a function of the particle settling velocity, the flow through the tank and the surface area of the tank. Sedimentation tanks are typically designed within a range of overflow rates of 0.5 to 1.0 gallons per minute per square foot (or 1.25 to 2.5 litres per square meter per hour). In general, sedimentation basin efficiency is not a function of detention time or depth of the basin. Although, basin depth must be sufficient so that water currents do not disturb the sludge and settled particle interactions are promoted. As particle concentrations in the settled water increase near the sludge surface on the bottom of the tank, settling velocities can increase due to collisions and agglomeration of particles. Typical detention times for sedimentation vary from 1.5 to 4 hours and basin depths vary from 10 to 15 feet (3 to 4.5 meters).

Carbon filters:

Carbon filters work with the aid of using adsorption, wherein pollutants present in the fluids to be dealt with are trapped by the porous structure of the carbon substrate. Granulated Activated Carbon (GAC) is the most commonly used substrate. This substrate is manufactured from many carbon granules, which are already very porous. As a result, the substrate has a huge surface area for activation inside which contaminants may be trapped. Activated carbon is commonly utilized in air and water filters thanks to its extensively large surface area. One gram of activated carbon can provide up to 3000 m2 of activation surface.

Specifications:

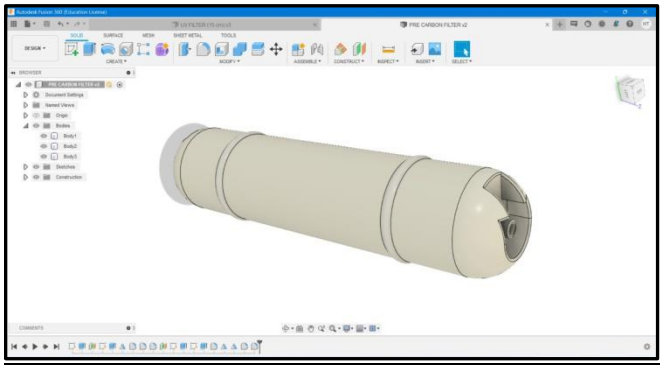
Dimensions: 270x60 mm

Weight: 400 Grams

GAC weight: 186 Grams

Filtration: 0.5-50 microns

Impurities: dust, dirt, rust, chlorine, nitrites, organic compounds, improves color and odour.
Maximum water force: 1GPM
Maximum Pressure: 125 Psi
Service life: 3000-5000 Gallons



SLOW SAND FILTER:

Slow sand filters may be used where there is sufficient land and space, as the water flows very slowly through the filters. These filters rely on biological treatment processes for their action rather than physical filtration. They are carefully constructed using graded layers of sand, with the coarsest sand, along with some gravel, at the bottom and finest sand at the top. Drains at the base convey treated water away for disinfection. Filtration depends on the development of a thin biological layer, called the zoogleal layer or Schmutzdecke, on the surface of the filter. An effective slow sand filter may remain in service for many weeks or even months, if the pretreatment is well designed, and produces water with a very low available nutrient level which physical methods of treatment rarely achieve. Very low nutrient levels allow water to be safely sent through distribution systems with very low disinfectant levels, thereby reducing consumer irritation over offensive levels of chlorine and chlorine by-products.

DISINFECTION:

Disinfection is accomplished both by filtering out harmful micro-organisms and by adding disinfectant chemicals. Water is disinfected to kill any pathogens which pass through the filters and to provide a residual dose of disinfectant to kill or inactivate potentially harmful micro-organisms in the storage and distribution systems. Possible pathogens include viruses, bacteria,
including Salmonella, Cholera, Campylobacter and Shigella, and protozoa, including Giardia lamblia and other cryptosporidia. After the introduction of any chemical disinfecting agent, the water is usually held in temporary storage – often called a contact tank or clear well – to allow the disinfecting action to complete.

WATER CHLORINATION:

The most common disinfection method involves some form of chlorine or its compounds such as chloramines or chlorine dioxide. Chlorine is a strong oxidant that rapidly kills many harmful micro-organisms. Because chlorine is a toxic gas, there is a danger of a release associated with its use. This problem is avoided by the use of sodium hypochlorite, which is a relatively inexpensive solution used in household bleach that releases free chlorine when dissolved in water. Chlorine solutions can be generated on-site by electrolyzing common salt solutions. A solid form, calcium hypochlorite, releases chlorine on contact with water. Handling the solid, however, requires more routine human contact through opening bags and pouring than the use of gas cylinders or bleach, which are more easily automated. The generation of liquid sodium hypochlorite is inexpensive and also safer than the use of gas or solid chlorine. Chlorine levels up to 4 milligrams per litre (4 parts per million) are considered safe in drinking water. The use of chloramines is becoming more common as a disinfectant. Although chloramines are not as strong an oxidant, it provides a longer-lasting residual than free chlorine because of its lower redox potential compared to free chlorine. It also does not readily form THMs or haloacetic acids (disinfection byproducts).

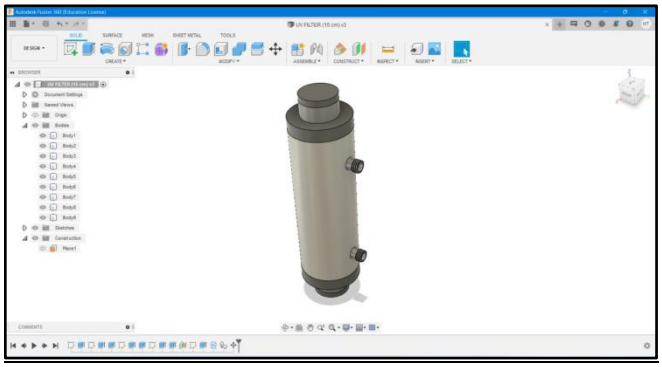
OZONE DISINFECTION:

Ozone is an unstable molecule that readily gives up one atom of oxygen providing a powerful oxidizing agent which is toxic to most waterborne organisms. It is a very strong, broad spectrum disinfectant that is widely used in Europe and in a few municipalities in the United States and Canada. Ozone disinfection, or ozonation, is an effective method to inactivate harmful protozoa that form cysts. It also works well against almost all other pathogens. Ozone is made by passing oxygen through ultraviolet light or a "cold" electrical discharge. To use ozone as a disinfectant, it must be created on-site and added to the water by bubble contact. Some of the advantages of ozone include the production of fewer dangerous by-products and the absence of taste and odour problems (in comparison to chlorination). No residual ozone is left in the water. In the absence of a residual disinfectant in the water, chlorine or chloramines may be added throughout a distribution system to remove any potential pathogens in the distribution piping.

ULTRAVIOLET DISINFECTION:

Ultraviolet light (UV) is very effective at inactivating cysts, in low turbidity water. UV light's disinfection effectiveness

decreases as turbidity increases, a result of the absorption, scattering, and shadowing caused by the suspended solids. The main disadvantage to the use of UV radiation is that, like ozone treatment, it leaves no residual disinfectant in the water; therefore, it is sometimes necessary to add a residual disinfectant after the primary disinfection process.



WORKING:

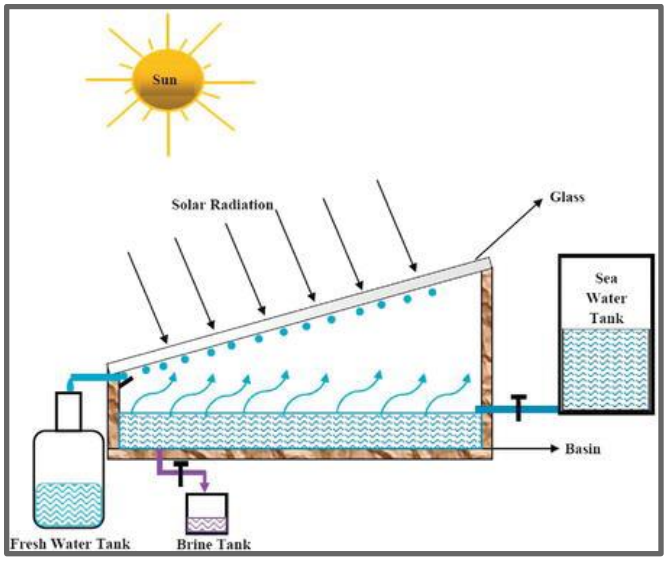
Solar power is the conversion of energy from sunlight into electricity, either directly using photovoltaic (PV), indirectly using concentrated solar power, or a combination. Concentrated solar power systems use lenses or mirrors and solar tracking systems to focus a large area of sunlight into a small beam. Photovoltaic cells convert light into an electric current using the photovoltaic effect. Photovoltaics were initially solely used as a source of electricity for small and medium-sized applications, from the calculator powered by a single solar cell to remote homes powered by an off-grid rooftop PV system. Commercial concentrated solar power plants were first developed in the 1980s. As the cost of solar electricity has fallen, the number of grid-connected solar PV systems has grown into the millions and utility-scale photovoltaic power stations with hundreds of megawatts are being built. Solar PV is rapidly becoming an inexpensive, low-carbon technology to harness renewable energy from the Sun. The current largest photovoltaic power station in the world is the Pavagada Solar Park, India with a generation capacity of 2050 MW.

The basic idea behind the working is a waterfall-like structure of the machine itself. With the help of solar energy, water will be sucked through a pile with the help of a motor. The aim is to have a range of at least 2-3 Km. this way application of the system increases.

Starting from the top the system will comprise of a mechanical filtration system for the screen of suspended wastes and dust particles. It trickles down to the secondary sedimentation stage, where sedimentation and coagulation will take place and sediments will be separated. The next and last stage is chemical filtration where chlorides and ultraviolet filtration will take place.

DESIGN OF SWP:

A solar water purifier consists of a solar panel, battery, heating coil, filtering column, pump and several water vessels (storage tanks). It may come up with some accessories like inverter, controller, water tap, wheels for mobility etc., depending upon the cost of the project.

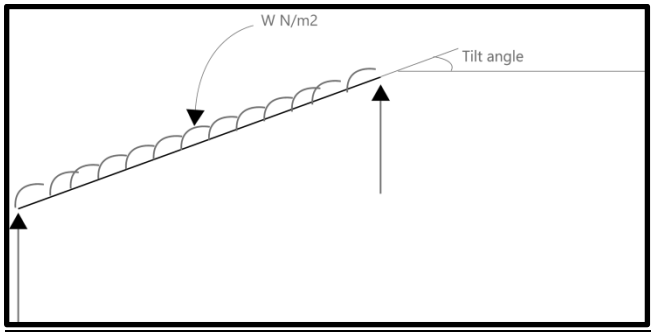


The design is made for aiming for an optimal costing of the project with less maintenance cost in future. The initial cost may vary to the factors like availability of space, water requirement, input water take quantity etc.

SOLAR PANEL:

The tilt of the panels is important because your panels will produce a maximum of energy when the sun is directly perpendicular to them. During the spring the best angle is 45°, and during the summer when the sun is high in the sky, it's best to have a low tilt at 20°. The aim is to produce more heat in the winter and less heat in the summer. Example: In Marseille, for conventional thermal energy, 4m² of panels are necessary for a typical home's hot water needs (200 L at 45 ° C) and the best inclination of the panels is between 50° and 55°. This inclination does not correspond to maximum sunshine, but because there is a surplus of production in the summer, it is better to optimize the angle for the winter.

The more the area of the solar panel, the more is the rate of heat transfer acquired (Q ∝Area). The supports of the solar panel are made to hold the solar panel and in the case of pipe built along with the solar panel, they are also designed to hold the flowing water. The water is taken as Uniform Distributed Load (UDL).



PUMPING SYSTEM:

The system requires a way to pump water from the primary holding tank into the solar water purification stage. Purchasing a pump is a possible choice, but that increases the overall price of the system and needs the power to operate which could increase the number of required solar panels. With this consideration, building a hand pump was more appealing for cost-benefit reasons and still completes the same job as a mechanical pump.

FILTERING SYSTEM:

The first layer consists of gravel to filter out impurities that are visible, the second layer consists of sand which filters out smaller impurities and the third which is the last layer consists of activated charcoal which has a huge internal surface area, packed with nooks and crannies that attract and trap chemical impurities through a process called absorption.

ADVANTAGES:

It is well documented that solar energy can be an effective means of cleaning contaminated water. This is because ultraviolet (UV) light destroys the formation of DNA linkages in microorganisms, thereby preventing them from reproducing and thus rendering them harmless. The World Health Organization lists solar disinfection in clear bottles by the combined action of UV radiation, as well as thermal disinfection (pasteurization) in opaque vessels with sunlight from solar cookers or reflectors and combination systems employing chemical coagulation-flocculation as some of the most promising and accessible technologies for household water treatment. Solar energy treats water contaminated with bacteria, viruses, protozoa and worms safe to drink.

Water contaminated with non-biological agents such as toxic chemicals or heavy metals require additional steps to make the water safe to drink. It is a simple water treatment method using solar radiation (UV-A light and temperature) to destroy pathogenic bacteria and viruses present in the water. Its efficiency to kill Protozoa is dependent on the water temperature reached during solar exposure and on the climatic and weather conditions.

- Improves the microbiological quality of drinking water
- Does not change the taste of water,
- Is applicable at the household level,
- Is simple in application,
- Relies on local resources and renewable energy,
- Is replicable with low investment costs Relevant

Public water supply systems in developing countries often fail to provide water safe for consumption. SODIS provides individual users with a simple method that can be applied at the household level under their control and responsibility. Consequently, the use of SODIS reduces deforestation, a major environmental problem in most developing countries, and SODIS decreases air pollution created by burning conventional energy sources. SODIS reduces the need for traditional energy sources such as firewood and kerosene/gas. SODIS is easy to understand. Everybody can afford SODIS, as the only resources required are sunlight, which is cost-free and plastic bottles.

PROTOTYPING:

The prototyping phase was a bit difficult for us as we had lockdown imposed due to COVID-19.

We choose a Hybrid Plant solar system for the project which uses both solar energy as well as battery backup produced by the solar energy itself.

Consideration of the working conditions:

1) SWP is operated where solar energy is available for at least 8-10 hours per day.
2) Water is taken from a large reservoir(tank).

Pump:

For initial consideration, we didn't require a high-end pump for the project. So, we choose the Stookin DC 12V 60W High-Pressure Water Pump. The flow rate of 5 L/min. was adequate and overall, the pump didn't take much of the space.

Pump Calculations:

PSI (Pounds per square inch) generally – 30-60 PSI

Average flow rate of domestic water supply required for proper performance of the filters is 6-12 gpm (Gallons per minute)

Pump parameters:

Voltage: 12V

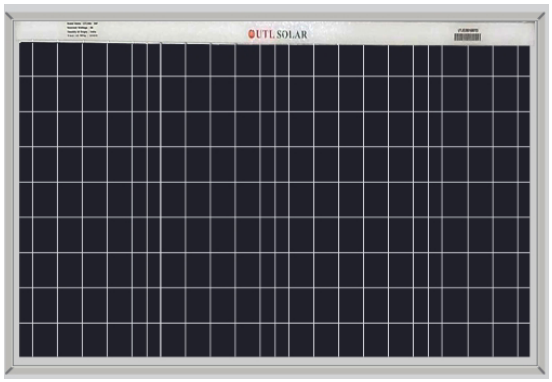
Current: 3-5 Amps

Calculating Power of the motor.

$$W = A \times V$$

W= Power in Watts
A=amps rating
V= Voltage rating
W= 5×12 = 60 Watts
Pump capacity = 0.8 MPa = **116 psi**
(We chose a higher-pressure rating as the pre filter will reduce water pressure making it suitable for the carbon and sediment filters)
Pump efficiency = **70%**
Therefore, watts of pump = 60+(60×0.3) = **78 Watts**
Now, the energy consumption in 1 hour = **78 watt-hour**
If the pump is running for 5 hours, we get = 5×78 = 392 watt-hour = **0.39 kilowatt-hour**

Solar Panel:
As per the requirement of the pump i.e. (60W, 12V), we selected the UTL Solar PV Panel 60 Watt/12 Volt (Polycrystalline). We also choose a battery backup for the project which could be charged up when the SWP is not in use. This will also help to run the project in the absence of sunlight.



Measuring solar panel output:

What are Standard Test Conditions?

A good place to start is by understanding the parameters that earn a solar panel its wattage rating. How many watts your solar panel is able to produce might be anywhere between 250 watts and 370 watts. Does this mean that your system will generate that exact amount all of the time? Not really. That's where those variables come in. But a solar panel efficiency number is a gauge of how many watts your solar panel is capable of producing in ideal conditions.

These ideal conditions are simulated in a laboratory where solar panels are tested, known as Standard Test Conditions (STC). Standard Test Conditions for solar panel wattage would mean your solar panel is operating at 77 degrees Fahrenheit while there are 1000 watts of sunlight per square meter hitting the panel. So, under these ideal conditions, a 250-watt solar panel will produce 250 watts of electricity. This standard is a good way to ensure that all solar panels meet specific criteria when they're manufactured. As for how well they perform in the wild, let's get into some of those variables.

Solar Panel Output Calculation:

Here's a simple formula for calculating your solar panel's power output. Solar panel watts x average hours of sunlight x 70% = daily watt-hours

Let's say you have 80-watt solar panels and live in a place where you get 7 hours of sunlight per day. What's that 70 percent for? That's to account for all those variables we've been going over.

150 watts x 7 hours x 0.70 = 735 daily watt-hours

To translate this into the more familiar kilowatt hours you're used to seeing on your electricity bill, simply divide by 1000.

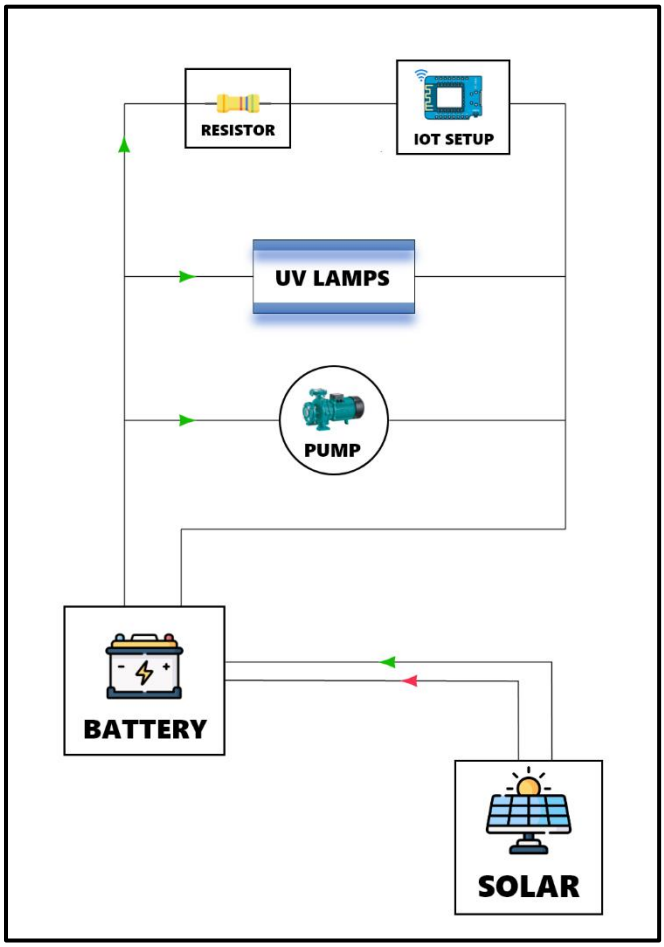
735 / 1000 = 0.735 kWh

That **is 0.735 kilowatt-hours** per solar panel.

BATTERY:

A car battery rated **60 AH and 12V** will give an output power as:

Output Power = **60×12 = 720 watt-hour = 0.72 kilowatt-hour**



PWM (Pulse with Modulation) Charged controller:

The technology for solar photovoltaic battery charge controllers has advanced dramatically over the past five years. The most exciting new technology, PWM charging, has become very popular. Some frequently

asked questions about PWM battery charging are addressed here.

What is PWM?

Pulse Width Modulation (PWM) is the most effective means to achieve constant voltage battery charging by switching the solar system controller's power devices. When in PWM regulation, the current from the solar array tapers according to the battery's condition and recharging needs.

Why is there so much excitement about PWM?

Charging a battery with a solar system is a unique and difficult challenge. In the old days, simple on-off regulators were used to limit battery out-gassing when a solar panel produced excess energy. However, as solar systems matured it became clear how much these simple devices interfered with the charging process.

The history for on-off regulators has been early battery failures, increasing load disconnects, and growing user dissatisfaction. PWM has recently surfaced as the first significant advance in solar battery charging.

PWM solar chargers use technology similar to other modern high quality battery chargers. When a battery voltage reaches the regulation set-point, the PWM algorithm slowly reduces the charging current to avoid heating and gassing of the battery, yet the charging continues to return the maximum amount of energy to the battery in the shortest time. The result is a higher charging efficiency, rapid recharging, and a healthy battery at full capacity.
In addition, this new method of solar battery charging promises some very interesting and unique benefits from the PWM pulsing. These include:

1. Ability to recover lost battery capacity and disulfate a battery.
2. Dramatically increase the charge acceptance of the battery.
3. Maintain high average battery capacities (90% to 95%) compared to on-off regulated state-of-charge levels that are typically 55% to 60%.
4. Equalize drifting battery cells.
5. Reduce battery heating and gassing.
6. Automatically adjust for battery aging.
7. Self-regulate for voltage drops and temperature effects in solar systems.

Advantages:

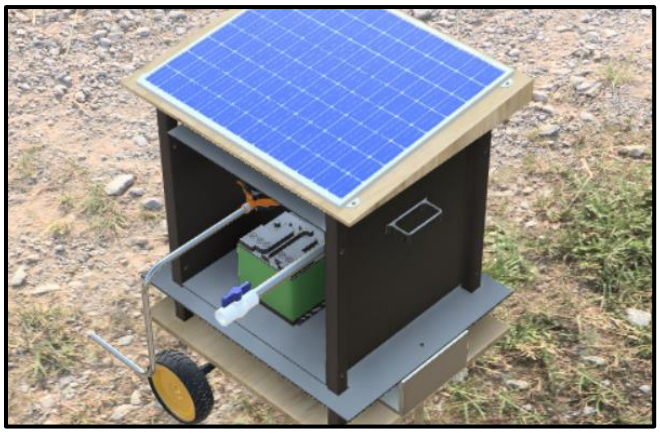
The benefits noted above are technology driven. The more important question is how the PWM technology benefits the solar system user.

- Longer battery life:
  - Reducing the costs of the solar system
  - Reducing battery disposal problems
  - Increasing the reliability of the solar system
  - Reducing load disconnects
  - Opportunity to reduce battery size to lower the system cost
- Greater use of the solar array energy:
  - Get 20% to 30% more energy from your solar panels for charging
  - Stop wasting the solar energy when the battery is only 50% charged
  - Opportunity to reduce the size of the solar array to save costs
- Greater user satisfaction: get more power when you need it for less money.

Filtration Unit:

Chemical Filtration was required to make the water drinkable. Ceramic Water Filtration with activated carbon provided the necessary Filtration followed by UV light for sterilization and ionizing resin.
Water is taken from a large reservoir (tank in case of domestic house purpose). The pump is driven by the energy produced from the solar panel. A Lithium battery stores the extra energy developed by the solar panel when it is not in use, thereby creating a backup source.
The water is further passed to the filtration unit. At the end of the filtration unit, we obtain clean drinkable water. The flow rate obtain varies from 4-5 L/min.
We have planned to adopt a different approach too for the same project after the termination of lockdown and when we could perform the project physically.
For improvement, we are planning to provide a solar panel with more transferable energy (say 100W) and use part of the energy to produce boiled water and eliminate some filtration components.

Design:



Filters:

Sediment Filter:

Depth Filter Cartridges

Depth filters are commonly seen as wound string, spun, or "melt-blown" cartridges that trap particles of larger size on the surface and smaller particles under the surface down to the center core.

They work best when a variety of particle sizes are being filtered. Depth filters remove more sediment and hold more sediment in general, without losing pressure, than a surface filter cartridge. The material used for the same is Polypropylene. Thus it is also called PP spun filter.

Carbon Filters:

WHAT IS ACTIVATED CARBON?

Activated carbon (also called activated charcoal, activated coal or active carbon) is a very useful adsorbent. Due to their high surface area, pore structure (micro, meso and macro), and high degree of surface reactivity, activated carbon can be used to purify, dechlorinate, deodorize and decolorize both liquid and vapor applications. Moreover, activated carbons are economical adsorbents for many industries such as water purification, food grade products, cosmetology, automotive applications, industrial gas purification, petroleum and precious metal recovery mainly for gold. The base materials for activated carbons are coconut shell, coal or wood.

APPLICATION OF ACTIVATED CARBON

Different types of activated carbon are suited for various specialized applications.

- Granulated activated carbon
- Pelletized activated carbon
- Powdered activated carbon
- Impregnated activated carbon
- Catalytic activated carbon

Each grade and size of activated carbon is application specific. Selecting the correct activated carbon product and mesh size depends on the application and contaminants you plan to remove.

Typical applications are:

- Removal of volatile organic compounds such as Benzene, TCE, and PCE.
- Hydrogen Sulfide (HS) and removal of waste gases
- Impregnated activated carbon used as a bacteria inhibitor in drinking water filters
- Removal of taste and odor causing compounds such as MIB and geosmin
- Recovery of gold
- Removal of chlorine and chloramine

Designing a proper activated carbon filtration system with enough contact time, pressure drop, and vessel size is important. Also, activated carbon's physical and chemical characteristics play an important role in removing contaminants effectively. Therefore, material testing is essential and ASTM test methods such as butane activity, surface area, density, and water content (moisture) can be carried out to find the best suitable material for your application.

Different types of activated carbon are suited for various specialized applications

- Granulated activated carbon dechlorinates water, adsorbs organic material and produces a chemical-reducing environment
- Granulated activated carbon impregnated with silver salts inhibits the growth of bacteria
- Catalytic activated carbon removes chloramines from drinking water
- Pelletized (or extruded) activated carbon effectively dechlorinates and removes chemicals
- Powdered activated carbon is used to eliminate trace synthetic chemicals and taste and odor causing chemicals, and for chemical spills or algal blooms

TYPES OF ACTIVATED CARBON

1. **COCONUT SHELL ACTIVATED CARBON**

Coconut shell activated carbon has a very high hardness and is more abrasion resistant than any other type. It is a totally natural, environmentally friendly product, that has a very small carbon foot print, since it is derived from coconut shells. As most of its pore structure consists of micropores (more than 80%), coconut shell carbon can efficiently absorb impurities with micropore molecular structure, such as those present in drinking water. In addition, because of its high abrasion resistance and exceptional chemical and physical characteristics, only coconut shell activated carbon can support applications such as recovery of gold and other precious metals.

APPLICATIONS:

- Portable water purification
- Wastewater purification
- Gold absorption from gold solution (precious metal recovery)
- Organic impurity removal in food and beverage applications
- Medical use
- Catalyst support

2. COAL BASED ACTIVATED CARBON

Coal based activated carbon is available in four different types of base material - bituminous, sub bituminous, anthracite, & lignite, consisting of micro, meso and macro pore structures. This unique pore distribution makes coal based activated carbon ideal to remove small to large molecular structures. Typical applications include but not limited to odor control in liquid & vapor phase applications, improve taste in liquids, liquid decolorization and purification of wastewater & potable water. Coal base carbon is also available in granular, extruded (Pelletized), and powder forms.

APPLICATIONS:

- Portable water purification
- Wastewater treatment
- Industrial air purification
- Purification of food and beverage
- Medical and pharmaceutical uses
- Automotive uses
- Chemical purification

3. WOOD BASED ACTIVATED CARBON

Wood based activated carbon is produced from selected types of wood and sawdust. This type of carbon is produced by either steam or phosphoric acid activation. Most pores in wood based carbon are in the meso and macro pore region which is ideal for decolorization of liquids and water. Wood base carbon is primarily used in surface water and wastewater filters to remove organic impurities and to effectively remove larger molecular structures like MIB (2-Methylisoborneol) and Geosmin. Wood base phosphoric acid activation can yield carbon with a very high surface area, ranging from 1500-2500 m2/g. The product is available in granular, pelletized, or powder forms.

APPLICATIONS:

- Potable water purification
- Surface and wastewater treatment
- Food and beverage decolorization
- Pharmaceutical industry
- Purification and decolorization of edible oil

4. CATALYTIC/SURFACE-MODIFIED CARBON

Catalytic carbon is a class of activated carbon used to remove chloramines and hydrogen sulfide from drinking water.
It has all the adsorptive characteristics of conventional activated carbons, as well as the ability to promote chemical reactions.

WHAT ARE CHLORAMINES?

Chloramines are added to water as an alternative to chlorine. They inhibit the formation of carcinogenic trihalomethanes (THMs) caused by the interaction of chlorine with organic plant materials.

CATALYTIC CARBON IS NOT IMPREGNATED WITH CAUSTIC CHEMICALS

Because catalytic carbons have no impregnates, you won't have to worry about reduced organic odor capacity or the higher bed fire potential of the impregnated carbons.
Catalytic carbon is created by altering the surface structure of activated carbon. It is modified by gas processing at high temperatures to change the electronic structure and create the highest level of catalytic activity on carbon for reducing chloramine and H2S in water. This added catalytic functionality is much greater than that found in traditional activated carbons. Catalytic carbon is an economical solution to treat H2S levels as high as 20 to 30 ppm.

Catalytic carbon converts adsorbed H2S into sulfuric acid and sulfurous acid which are water soluble, so carbon systems can be regenerated with water washing to restore H2S capacity for less frequent physical change-outs.

THE BENEFITS OF USING CATALYTIC CARBON:

- More effective than conventional carbons; catalytic activity promotes a variety of chemical reactions
- Faster chemical reaction means less carbon and smaller equipment
- Non-Impregnated carbon eliminates worries about exothermic reaction, ignition temperature and toxic disposal
- On-site regeneration lowers operating costs and extends service life
- Can be recycled and reused through thermal reactivation

5. IMPREGNATED ACTIVATED CARBON

Carbon Activated makes a variety of coconut shell-based, impregnated activated carbon, in standard and custom sizes, for applications where non-treated carbon may not be effective.

Surface impregnation chemically modifies activated carbon through a fine distribution of chemicals and metal particles on the internal surfaces of its pores. This greatly enhances the carbon's adsorptive capacity through a synergism between the chemicals and the carbon and provides a cost-effective way to remove impurities from gas streams which would otherwise not be possible.

WATER TREATMENT

Because of its antimicrobial/antiseptic properties, silver-impregnated carbon is an effective adsorbent for purification in earth-bound domestic and other water systems.

GAS PURIFICATION

Impregnated activated carbon is used to treat flue gases in coal-fired generation plants and other air pollution control applications. Carbon can be specifically impregnated for removal of acid gases, ammonia and amines, aldehydes, radio-active iodine, mercury and inorganic gases such as arsine and phosphine. Carbon impregnated with metal-oxide targets inorganic gases including HCN, H2S, phosphine and arsine.

TYPES OF SEDIMENT FILTER CARTRIDGE IN PIPING SYSTEMS:

Based on their filtration mechanism, sediment filters can be described as either surface, depth, or adsorptive sediment filters.

1) Surface Sediment Filters

These filters are usually made of some thin, permeable material, such as cloth, and trap sediment on the surface as the fluid passes through. They are recommended when dealing with evenly sized sediment. Because the filtration occurs on the surface, these filters are easier to clean. That is, getting rid of the trapped sediment so that it can continue to filter with ease. In certain cases, it can also be unclogged by shaking or some other means to dislodge the trapped sediment. The bag filter is a surface filter.

2) Depth Sediment Filters

Depth sediment filters work by forcing the liquid to pass through several layers of the filter material in order to eliminate debris. As the fluid passes through these layers of filter material, the filter traps increasingly smaller particles. By design, depth filters are meant to be disposable, for while the top layer of filter material may seem easy to clean, and may seem so after a rinse. It is not possible to remove the finer particles trapped further within the filter.

3) Adsorptive Sediment Filters

Adsorption is the process by which a compound or particle is attached to another by chemical attraction. And, that is exactly how these filters work. Adsorbents, the compounds used to bind unwanted impurities from the fluid, have inordinately large surface areas peppered with binding sites that adhere to the impurities. A pound of activated carbon, the best-known adsorbent, has an estimated surface area of 40 hectares. Once these binding surfaces are used up, the filter must be replaced. Adsorptive filters are best for removing volatile organic compounds and can be engineered to filter out other compounds and chemicals. They are usually used in multi-stage systems, installed after depth filters which trap compounds that would, otherwise, and needlessly, use up precious binding sites on them.

Examples include granular activated carbon filter and carbon block filters. Zeolite and activated alumina are also used as adsorptive filters.

UV Tube Filter:

UV stand for Ultra Violet and a UV water purifier means a water filter which uses UV or Ultra-Violet light to kill germs, bacteria, protozoa, cysts, etc. in water. The term UV also appears commonly as RO UV UF in water purifiers and the meaning of RO UV UF in water purifier is that it uses RO and UF membranes together with a UV light sterilizer. Here is a what a UV water purifier looks like inside.

1) Is UV water safe to drink?

UV purified water is free of deadly diseases causing bacteria, viruses, and protozoa such as E. What's more, UV purification does not make the water taste or smell bad.

Limitations of UV Purification. While UV purified water is not harmful to us, it does have a few limitations.

2) Does UV kill bacteria in water?

UV light kills bacteria, viruses, and some cysts. It does not kill Giardia lamblia cysts or Cryptosporidium parvum oocysts, which must be removed by filtration or distillation. It is important to note that, although UV is an effective disinfectant, disinfection only occurs inside the unit.

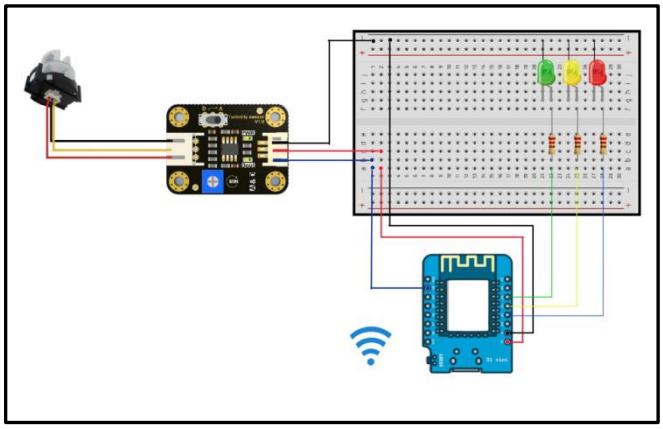
UV water purifier bulb or lamp

The most important part of a UV water purifier is the UV bulb or lamp. It is this UV bulb which produces the ultra-violet light source. To protect the bulb from direct contact with the water there is a quartz glass sleeve around the UV tube-light which protects it against water entry and consequent electric shorting. The quartz sleeve should be of the correct quality of glass to allow the glass to be transparent to short wave UVC light of 254 nanometers, the most effective UV light wavelength to kill germs in the water. Service life is about 9000 hours.

UV Tube Calculations

IoT Integration:

By integrating Arduino Wemos with a turbidity sensor, it is possible to constantly track water quality. We are using this system to ensure the purity of water and to obtain an immediate response if the standards are not met.



Circuit Diagram

Construction and Working:

The connections are made as shown in the circuit diagram.

The SEN0189 sensor is used to detect the NTU of the output water of the filter, thereby determining the quality of the output water. It uses light to detect suspended particles in water by measuring the light transmittance and scattering rate, which changes with the amount of total suspended solids (TSS) in water. As the TTS increases, the liquid turbidity level increases. Turbidity sensors are used to measure water quality in rivers and streams, wastewater and effluent measurements, control instrumentation for settling ponds, sediment transport research and laboratory measurements. This analogue sensor generates a voltage value when placed in testing. The relationship between NTU and is given as follows :

NTU=(-1120.4*x^2)+(5742.3*x)-4353.8….For Volt > 2.5

NTU=3000…….For Volt <= 2.5

The LEDs in the circuit are used for indication of the state of water.

The Arduino is made to connect to Wi-Fi before any code execution. After a successful connection, the sensor begins to send the values to the Arduino. Due to fluctuations in voltage values, we take at least 8 values of voltages and use the mean of the same. Using this mean value, the corresponding mean NTU is calculated.

Now this NTU is compared with the standards given by World Health Organization (WHO). If the NTU is between 1 to 5, the water is safe to consume. But if the NTU is out of these limits, then the board will begin to send an alert to the customer or manufacturer. A server connection will initiate which would link the PHP file on the server.

Now in this PHP file which sits in the webserver would contain the details that link the receiver's mail, subject, body text etc. Using the mail function of PHP, the mail is sent to the required address. As for this project application we used Google Host Free Web servers.

APPLICATION:

1) It can be used for purifying water for household purposes.
2)Used by industries to produce mineral water.
3) Can be used in schools and other administrative offices.
4) Solar energy is sustainable green energy thus it goes hand in hand with nature.

FUTURE GROWTH OF SOLAR IN INDIA:

The solar industry's structure will rapidly evolve as solar reaches grid parity with conventional power between 2016 and 2018. Solar will be seen more as a viable energy source, not just as an alternative to other renewable sources but also to a significant proportion of conventional grid power. The testing and refinement of off-grid and rooftop solar models in the seed phase will help lead to the explosive growth of this segment in the growth phase. Global prices for photovoltaic (PV) modules are dropping, reducing the overall cost of generating solar power. In India, this led to a steep decline in the winning bids for JNNSM projects. With average prices of 15 to 17 cents per kilowatt-hour (kWh), solar costs in India are already among the worlds lowest. Given overcapacity in the module industry, prices will likely continue falling over the next four years before levelling off. By 2016, the cost of solar power could be as much as 15 percent lower than that of the most expensive grid-connected conventional energy suppliers. The capacity of those suppliers alone, nearly 8 GW in conventional terms, corresponds to solar equivalent generation capacity potential of 25 to 30 GW. Due to implementation challenges, however, it's unlikely that all of

this potential will be realized by 2016. Grid parity will be an inflexion point, leading to two major shifts in the solar market. First, thanks to favorable project economics, grid-connected capacity will rise at a much faster rate than before, and second, regulations and policy measures will be refined to promote off-grid generation. According to one estimate, the combination of electricity demand growth, fossil fuel cost and availability challenges, and supportive environmental regulations could increase solar power capacity to more than 50 GW by 2022. The market will see a significant change after 2016. Lower solar costs combined with rising prices of grid power will convince off-takers (including distribution companies, private firms using open access, and firms putting up their own captive capacity) that solar power is economically viable. This shift will signal the start of the growth phase, during which grid-connected solar capacity will rise rapidly to about 35 GW by 2020 as developers build capacity to meet both RPO requirements and demand from off-takers seeking cost-efficient alternatives to conventional power.

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Improving Efficiency Of Regenerative Braking System

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***Abstract*— Regenerative braking systems for electric and hybrid vehicles enable the range of the vehicle to be extended, but experience has indicated that the benefits are not always as great as might be expected because of inefficiencies in the power conversion processes. Extra mass and cost can often combine to limit the financial viability of a regenerative braking system. Regenerative braking systems are typically mechanical, electrical, or hydraulic in nature; however, this is not strictly necessary, providing there is a way to store and later re-use energy. ESU, CVT, controller, regenerative brake controller are the main parameters to be considered for performance and for increasing efficiency of Regenerative Braking. A new regenerative braking system, the RBS was developed with the design, construction and testing of a proof-of-concept prototype. It involves a fast-spinning flywheel/alternator unit with a uniquely designed progressive braking system and an epicyclic gear train. This new RBS can be readily adapted for braking of electric and hybrid gas-electric vehicles during coasting and braking. The RBS will be proof-tested for its feasibility and practicality for the intended applications.**

Keywords—epicyclic gear train, regenerative braking system

I. INTRODUCTION

In response to the changing global landscape, efficient energy generation, its utilization and storage has become a primary concern for mankind. Making the energy recovery systems efficient by developing new and better systems, methods and techniques are the factors to be aimed for. Taking the mentioned factors into the account we have designed a regenerative braking system which is capable of acquiring and transmitting a huge chunk of energy, by contributing thrice the braking torque that of the conventional regenerative braking system with the help of a planetary gear set with a velocity ratio of 1:3 embedded inside the hub of a motorcycle's rear wheel. In this system the shaft is connected to the wheel though an overrunning clutch and that same shaft shares a solid connection with the sun gear. So, when the power is transmitted from the battery to the wheel through the vehicle's transmission it looks like a straight path as the sun gear and ring gear shares the same connection while rotating anticlockwise but as we apply brakes the supply of power to the motor is stopped which causes the wheel to get free off the shaft with the help of its connection through overrunning clutch. Meanwhile, the motion of the carrier i.e., revolution of the planets is constrained by a miniature disc brake which helps the transmission of energy back from the wheel rim i.e., ring gear to the sun gears via planets. As the gear ratio given is 1:3, the sun gear is made to rotate in clock-wise direction with thrice the speed of wheel and at the same time the wheel will be experiencing a resisting torque which will be thrice that of the resisting torque offered by the 250w motor, eventually contributing towards the overall braking torque required to stop the vehicle in a specified distance while supplying the energy from the wheel to the battery via the same D.C. motor, which would else go wasted.

II. LITERATURE SURVEY

- *Tijani H Peng (2008).*

This work presented the major advantages of planetary gear system one of which is splitting the power among the shafts by constraining the motions of various gears, as per the path for the power to be transmitted.

- *AJ Walenty (2011)*

In this work they discussed about the regenerative and friction brake blend control method for use in a vehicle with at least one hydraulic brake actuator for achieving friction braking and an electric motor capable of converting kinetic energy to electrical energy by providing some resistance.

- Mohit Singh et al. (2016).

This paper discusses about the use of composite material to provide adequate strength with weight reduction. They compared different composite material and their properties and suitable material was selected by analyzing on materials

- S. Mahendran et al. (2014)

In this work they have design spur gear model using design software and studied impact analysis for cast steel and composite material they have also studied torque loading for cast steel and composite material.

- Robert F. Handschuh et al. (2012).

In this work it is given about the comparison of the hybrid gear with all steel gear. As result of which it was found that the hybrid gears were more convenient in all aspect i.e. weight reduction without affecting strength

III. OBJECTIVES

- The recovery of kinetic energy in the form of electricity during the application of brakes to stop a vehicle's motion, which would else go wasted.
- The project is based on the usage of an in-wheel planetary gear train which uses torque reduction from ring to sun gear which is helpful for increasing generator shaft speed. Hence generating more electrical energy while braking.
- Applications like Solid works and Creo are used for designing and the analysis of the model.
- The designed model is compared with the existing Regenerative braking system.

IV.SIGNIFICANCE

As the project "Improving efficiency of regenerative braking system" is mainly focused on increasing the efficiency of a conventional regenerative braking. The usage of the in-wheel epicyclic gear train led us to recover the energy almost 2.5 times to that of the conventional regenerative braking which was calculated as 3 times theoretically. The conventional regenerative braking has an efficiency of about 1.5%. In this model we have been able achieve an efficiency of about 3.5%. Another fact about this project which makes it a topic of research is that the planetary gear set which is used in the wheel is acting as a braking torque multiplier, which is providing RPM three times at the motor shaft than that of wheel during the application of brakes in the vehicle while maintaining the same stopping distance of the motorcycle with the help of torque blending.

V. DESIGN SPECIFICATION

- Planetary Gear set

Parameters	Ring	Planet	Sun
Pitch Circle Diameter(mm)	120	40	40
Teeth	96	32	32
Clearance(mm)	0.3125	0.3125	0.3125
Addendum(mm)	1.25	1.25	1.25
Dedendum(mm)	1.5625	1.5625	1.5625
Thickness(mm)	15	15	15

Gear Ratios:
Epicyclic gear ratio = 1:3
Final drive gear ratio = 1:4
Overall gear ratio = 1:12

Bearings
- Shaft bearing (6003-2Z/C3)

Outer diameter- 35mm
Internal diameter-17mm
Thickness-10mm
- Planetary gear bearing (608ZZ)

Outer diameter-21mm
Internal diameter-17mm
Thickness-7mm

VI. CALCULATIONS

Considerations:
Vehicle model: Honda CB Shine
Average rider's weight: 62kg
Vehicle's weight: 123kg
Assembly's weight: 3kg
Overall weight considered of the vehicle: 188kg.
Wheel diameter: 457mm ≡ 0.457m
Wheel radius: 0.228m
Initial velocity of the vehicle: 50 km/h or 13.88m/s
Required time stated to stop the vehicle: 1.6 seconds [8]
Required deceleration can be calculated by equation:

$$v = u + a * t$$
$$13.88 = 0 + a * 1.6.$$

By the above equation we get $a = -8.675\ m/s^2$

The total braking force required will be = m * a
= 188 * 8.675
= 1631N
Hence, total torque required will be:
f * r = 1631* 0.228
= 371Nm.
Total Kinetic Energy in possession of the vehicle while moving at a velocity of 50km/h or 13.88m/s
$= 1/2 * m * v^2$
$= 1/2 * (188) * (1388)^2$
= 18.11Kj.
Losses considered:
- Rolling resistance ~ ex.: energy getting lost in heating the road ~ 4.2%.
- Mechanical friction ~ ex.: losses in bearing ~ 5.6%.
- Aerodynamic resistance ~ ex.: energy lost in heating the surroundings ~ 2.6%.

Available kinetic energy that can be recovered after the above-mentioned losses:
= Total kinetic energy – (rolling loss + mechanical loss + aerodynamic loss)
= 18.11 – (0.76 + 1.01 + 0.47)KJ
= (18.11 – 2.24)KJ
= 15.87KJ.

VII. RESULTS

CASE I.

When conventional regenerative braking system is installed, the braking torque contribution will be

$$= rated\ torque * gear\ ratio$$
$$= 1Nm * 4$$
$$= 4Nm.$$

Its overall contribution will be $=(4/371) * 100$

$$= 1.078\%.$$

Case II: When in-wheel epicyclic regenerative braking system is installed, the braking torque contribution will be

$$= rated\ torque * gear\ ratio$$
$$= 1Nm * 4 * 3$$
$$= 12Nm.$$

Its overall contribution will be $= (12/371)*100$

$$= 3.25\%$$

VIII. COMPARISON

Here, as we know that energy is directly proportional to torque while keeping the angular displacement constant:

$$E = T * \theta.$$

CASE 1:

Energy recovered by conventional regenerative braking system

= (1.07/100) * K.E of Vehicle

= (1.07/100) * 15.87 KJ

= 0.1698KJ $\approx 170J$.

CASE 2:

Energy recovered by in-wheel epicyclic regenerative braking system

= (3.5/100) * K.E of vehicle

= (3.5/100) * 15.87 KJ

= 0.55545 KJ $\approx 555.45J$

Percentage increase in recovery of energy by using the proposed concept.

= [(555.45-170)/170]*100

= 226%

*Theoretically, we are able to achieve a 226% of increase in the recovery of energy with respect to conventional regenerative braking.

IX. CONCLUSION AND FUTURE SCOPE

The energy recovered from the vehicle's kinetic energy is expected to be more than twice with respect to energy recovered through conventional regenerative braking system while making the vehicle come to rest from a speed of 50kmph. Even with low oil prices, the future of electric vehicles seems to be bright. Decreasing battery prices, availability of longer-range models and more charging stations are the reasons for the exponential growth of the electric vehicle sales and alongside auto industry is investing in billions of dollars to reduce the strong pollution levels globally, the oil industry has good reasons to be nervous. Also, as per the predictions of experts, the EV sales is expected to grow 60% worldwide last year, Bloomberg new energy finance, which predicts in an article that the EVs will account for 35% of new car sales globally by 2040. Hence the efficiency of regenerative braking system will be matter of concern. Furthermore, this system is relatively reliable as compared to the conventional system.

The future work can be carried out by:

It can be used for high end electric bikes to increase their range.

Further the weight of the assembly can be reduced.

The analysis and simulation of the system at higher speeds can be performed.

It can be made more efficient by just increasing the gear ratio of the planetary

gear set.

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Development of Smart Irrigation System

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***Abstract*— In Rural area there is no proper supply of electricity so, we are unable to know the proper timing of electricity which directly affect the irrigation of crops. There is also a problem of destruction of crop by animals. We use sensors to detect the soil properties like pH, Moisture, Humidity ,Temperature and store the data on cloud with the help of IOT . we also Integrate our Cloud system with other weathering website to get the weather report and suggest the farmer which type of crop we should cultivate and should we water our crop or not. With the help of moisture sensor we detect the water Quantityand water supply will be automatically start as per the requirement. Based on pH value on we supply the fertilizer mixed with water and this whole system is work on IOT basedautomation.**

Keywords*— PH sensor, Moisture sensor, humidity , Temperature

I. INTRODUCTION

The utilization of water for water system has been a cultivating practice since more seasoned days. Farmers were utilized to inundate their properties physically or use flood water system by redirection of ground water from wells, surface water removed from streams, lakes or repositories or from non-regular sources like treated wastewater, seepage water or other related sources. Such act of manual water system isn't effective with constraints among others, non-uniform dispersion of water for the harvests or plants, filtering off soil supplements and manures, disintegration because of flooding, loss of water from plant surfaces through dissipation, water wastage which can result to watershortage in dry season regions and creation of unfortunate yields and frail efficiency Rivalry for water assets, the decay and shortage of water assets, high water system siphoning costs and the general effect on our current circumstance and environment drives us to make a legitimate and successful water system the board. On the planet, water advancement for farming is really important, however ineffectively planned and arranged water system water the executives methodology and practices sabotages endeavors to further develop jobs and uncovered individualsand climate to gambles As of late, a few exploration works have been finished to foster feasible water system control frameworks incorporating with capacity of remotely overseeing ranch fields.

Water system water siphons will be initiated from a distance from a phone keypad when there is a need of watering of the ranches. A few works have likewise shown microcontroller based water system control frameworks where controlling is executed in view of the estimation of the dirt water pressure, soil water pull, soil water potential which all are boundaries straightforwardly connected with the dirt dampness content The higher the outright soil water strain (estimated in units ofPascal or bars), the higher how much energy that the plant expects to separate water from the dirt.

Every one of the proposed frameworks depend on soil dampness content of the dirt, which thus flags the microcontroller that controls the water-siphons relying upon the sensor input. The dirt dampness sensor types can be tensiometric frameworks, which measure water potential, resistive sensors which measure the dirt water resistivity, time space reflectometry in view of dielectric steady of soil water and capacitance based sensors The WATERMARK granular grid sensor is an illustration of soil dampness sensor in light of estimating the electrical obstruction or conductivity of soil-water.

It comprises of a granular grid upheld in a metal or plastic screen and a wafer of gypsum implanted in the granular network.

The terminals are implanted in the granular fill material and the deliberate electric conductivity between the installed cathodes gives an incentive for the water strain inside the sensor Considering the electrical conductivity of water, the granular framework sensor answers changes in the items in soil dampness. As the dirt dries, water is taken out from the sensor and the opposition estimation increments and on the other hand, when the dirt is rewetted, the obstruction brings down and in this manner giving different obstruction estimations as per the items in soil dampness. In this work, weexpected such kind of soil dampness sensor as sensor input information of the by and large electronic framework. As opposed to the past related works, which are microcontroller based water system frameworks, the generally electronic plan in this work depends on effectively accessible discrete uninvolved and dynamic electrical and electronic parts.

II. SYSTEM ARCHITECTURE

Hardware

ARDUINO

Due to its open-supply nature, arduino has come to be an international phenomenon. It evolved as a prototyping platform for hobbyist, artist, designers and extra importantly to the scholars who are new to the sector of electronics initiatives. Arduino comes with a microcontroller and a software program IDE to upload the code into the hardware board. Seeing the recognition of Arduino amongst hobbyist many sensors which might be well matched with Arduino were launched. The microcontrollers that got here before Arduino don't have a software program IDE for importing code into the hardware. One had to use a separate hardware device to add the code into the hardware. because of this flexibility function, it is easy to interface sensors with Arduino.

MOISTURE SENSOR

Soil moisture sensors measure the volumetric water content material in soil. for the reason that direct gravimetric measurement of unfastened soil moisture requires casting off, drying, and weighing of a pattern, soil moisture sensors measure the volumetric water content material indirectly via using some other assets of the soil, including electric resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content.

PH SENSOR

PH is the numeric representation of gram-equivalent per liter of hydrogen ion concentration in any solution. It varies between 0 to14. It is the logarithmic measurement of moles of hydrogen ions per litre of solution. The solutions having a pH value between 0 to 7 are acidic solutions with a large concentration of hydrogen ions whereas solutions having pH values between 8 to 14 are basic solutions with small hydrogen concentration. The solutions having a pH value of 7 are neutral solutions. Measuring the pH gives the measure of alkalinity or acidity of a solution.

WIFI MODULE

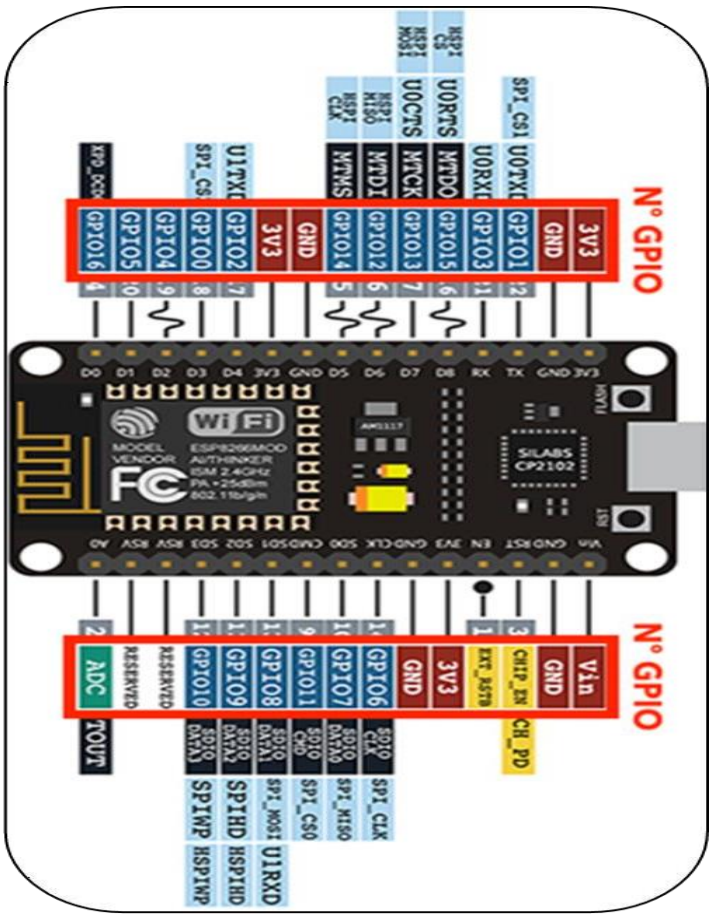
It is a SOC (System On-chip) integrated with a tack, which can provide microcontroller access to any type of Wi-Fi network. This article deals with the pin configuration, specifications, circuit diagram, applications, and alternatives of the ESP8266 Wi-Fi module. An ESP8266 Wi-Fi module is a SOC microchip mainly used for the development of endpoint applications. It is referred to as a standalone wireless transceiver, available at a very.

Pin out Diagram of Node MCU (7)

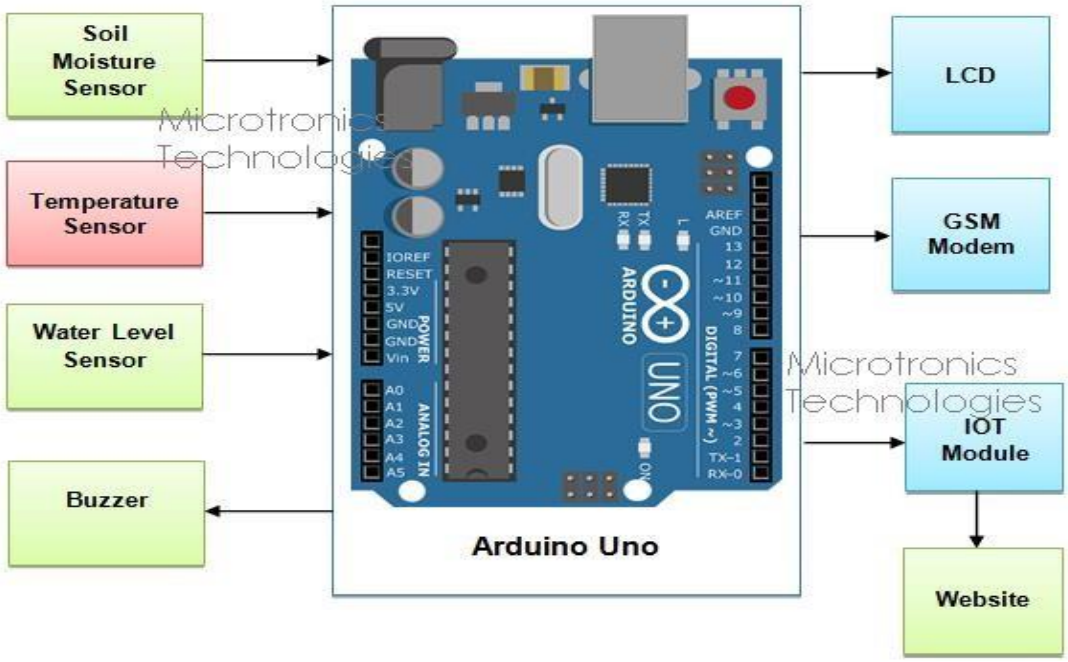
It is used to enable the internet connection to various applications of embedded systems. It can work as either a slave or a standalone application. If the ESP8266 Wi-Fi runs as a slave to a microcontroller host, then it can be used as a Wi-Fi adaptor to any type of microcontroller using UART or SPI. If the module is used as a standalone application, then it provides the functions of the microcontroller and Wi-Fi network. The ESP8266 WiFi module is highly integrated with RF balloon, power modules, RF transmitter and receiver, analog transmitter and receiver, filters, digital baseband, power modules, external circuitry, and other necessary components.

Mini Water Pump

Micro DC 3-6V Micro Submersible Pump Mini water pump For Fountain Garden Mini water circulation System DIY project. This is a low cost, small size Submersible Pump Motor which can be operated from a 3 ~ 6V power supply. It can take up to 120 liters per hour with very low current consumption of 220mA. Just connect tube pipe to the motor outlet, submerge it in water and power it. Make sure that the water level is always higher than the motor. Dry run may damage the motor due to heating and it will also produce noise.



Pin out Diagram of Node MCU (7)



Background:

In traditional farming method generally the farmer wholesome control all the features related to farming and irrigation due to which destruction of water resources is more because farmers manually turn on or off the water pump which result in either lack in water or abundance of water. If the crop does not get water efficient as per the crop requirement than it will lead to destroy the crop so when IOT is used for irrigation thanit will use the limited resources in efficient way.

Importance of the Project:

In rural areas there is frequent cut off of electricity which lead to wastage of time and wastage of energy . so when farmer manually supply the water either it result in lack of water or excess of water which lead to deficiency of nutrients in soil and the soil gets infertile
. With the help of these project , Farm will get automatic water by means of iot and sensors and these project will help the farmer to save their time and in proper irrigation.

Objectives and of the project:

The conventional irrigation system is manually operated and it is based on real-time weather and soil conditions observed manually. Water schedule driven by Heuristics based on the experience of the farmer, which is highly dependent on manual labor. The main problem faced by farmers is water scarcity due to less rainfall. The farmers sometimes have to water the field in odd hours due to variation in supply. There are also chances of overwatering and under watering in few circumstances due to human error.

Summary:

The Aim of the Entire project is to help the farmers grow their production as well as the profits with the use of Smart technologies available in the market. The system that we have proposed will not only help the farmers to Irrigate their but also they can use fertilizers along with water. which help then to maintain sufficient level of water and fertilizers in a farm. For that purpose we will use sensors like pH sensor , humidity, moisture, temperature. With the help of IoT farmers can also get data in their mobile phone only.

RESULT AND DISCUSSIONS

The fundamental thought process of the venture is to guarantee no wastage of harvest happens while giving each cultivating firm a potential chance to acquire and foster their abilities through the easiest innovation. The usage of straightforward parts will make it extremely basic for the ranchers to comprehend the kind of development waiting be established in the dirt. This not just guarantees no material is squandered yet in addition a tremendous piece of the rancher's pay gets saved as there is no longer a need to keep overview check groups drifting around for the dirt items. The venture will work with the simple comprehension of innovative viewpoints with the reconciliation of regular cultivating to order and make an air great for all. This chiefly focuses on the low income gathering of ranchers with no or extremely less information. As our undertaking plans to be spending plan amicable, it would be effectively available for all.

Consequently allowing an opportunity for each rancher to jump forward and coordinate innovation throughout everyday life. The central issues of the learning? The featured discussions and information will be pre-stacked into a point of interaction. This point of interaction will be effectively available to ranchers on their cell phones. A look onto the information with every one of the parametric qualities and it will be not difficult to develop with next to no preliminary and blunder. The undertaking expects to move the utilization of a straightforward microcontroller and use the easiest of parts to establish a climate which is sans bother.

CONCLUSION

A system to monitor moisture levels in the soil was designed and the project provided an opportunity to studythe existing systems, along with their features and drawbacks. The proposed system can be used to switch on/off the water sprinkler according to soil moisture levels thereby automating the process of irrigation which is one of the most time consuming activities in farming. Agriculture is one of the most water-consuming activities. The system uses information from soil moisture sensors to irrigate soil which helps to prevent over irrigation or under irrigation of soil thereby avoiding crop damage. The farm owner can monitor the process online through a website. Through this project it can be concluded that there can be considerable development in farming with the use of IOT and automation. Thus, the system is a potential solution to the problems faced in the existing manual and cumbersome process of irrigation by enabling efficient utilization of water resources

Future scope

The scope of the project is in future we can add more sensors and study variety of data about soil .we can add the features likeanimal warn alarm ,AI based crop recommendation system, weather conditioned monitoring system and rain based irrigationsystem

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Integrating Augmented Reality of CAD Modelling in Industry 4.0

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Abstract— ***The lack of proper training of new graduates as well as the workers is an important challenge that is not considered, mainly in heavy industries. The heavy industries are still working like the old times without any advancements. The manufacturing processes might be upgraded but the training and certification of professionals is never given importance. This is mainly because lack of resources like proper software and workforce. The data collection and data sorting are another issue faced by these industries. Many a times there is not even a single computer required for the whole manufacturing. We have focused on forging industry for our project and this industry has the least amount of modernization. We saw that not even a single computer was needed and used in the process.***

1.1 Introduction

The challenge is based totally on schooling enterprise partnership, in which we seeking to
join the scholars with the generation used with inside the industries. We are going to apply the brand-new generation of AR so that it will assist us construct an interface for the
scholars. While making of this challenge we can additionally make a product records base for the enterprise that allows you to display their clients their merchandise and what all they could offer. We are seeking to apprehend the real practices of industries and will be capable of rectify what all may be completed for far off production and automatic production.

The selection of parameters was another task in our project we had selected forging industry where there are many kinds of parameters that come into action. We have identified the parameters with predominant impact on the production and pace of production. We have researched on parameters like working temperature, no of cycles, total area of product, the capacity of forging machine, loading actions, electricity consumed, the material used, the change of material properties. As discussed, we were able to identify the parameters and we also found the challenges in the process. Our biggest challenge was lack of cad models of the forging machine. So we have to build the entire machine on our own in the solid works. We have identified the information that can help students when they refer to our project.

We were able to find the right industry partner for our project. We have short listed an
forging company. We have done the survey of their plant. We have seen the processes and working of machines. We have seen the resources used in the manufacturing.

The use of AR isn't always a brand-new phenomenon as this generation is demonstrated has a top notch ability in schooling. Recent technology including augmented truth (AR) provide the proper gear for growing incorporated getting to know environments that assist the manipulation of bodily items and visualization of contents, enriching the getting to know enjoy. Essentially, AR is a pc generation that makes use of cameras to seize and show actual international environments, items, or images, and juxtaposes virtual information (e.g., audio or graphics) onto truth in actual time. In evaluation to the artificial surroundings rendered onto a digital truth (VR) device, an AR device augments the bodily surroundings (as visible via the digital digital lens) with an artificial representation. Thus, the environments co-present collectively may be considered as some hybrid surroundings–one finishing the other, and vice versa.

As pc generation turns into extra advanced, such as cell generation and wearable generation, AR can now be skilled via way of means of nearly every person who owns a first rate cell phone, that is generally ready with a digital digital, accordingly engendering a brand new time period of generation so known as the cell AR. Integrated in cell getting to know systems, AR will offer revolutionary approaches to switch information in schooling.

The software of AR with inside the schooling subject is recommended because of its
numerous blessings. Among the blessings encompass its capacity to assist college students ‘cognitive process, specifically with inside the visible spatial process (Khalil et al., 2005; Schefter et al., 2009), its capacity to elevate college students ‘motivation level, its high quality affects in getting to know enjoy specifically for vulnerable college students (Freitas& Campos, 2008).

Augmented Reality (AR) has been extensively used in lots of academic contexts to allow college students to examine in an extra engaging, fascinating, and powerful environments. The adoption of AR in getting to know, is pushed via way of means of having easy, low priced get admission to effective contemporary-day devices (e.g., cell phones) that may be used as a green shipping medium for getting to know. An augmented truth device combines actual and digital items in actual environments, run interactively in actual time and check in items in environments concurrently (Azuma et al, 2001). The continuum of AR is depicted in Picture 1. It is a brand-new generation that generates three-dimensional (3-d) digital items and offers an interactive interface with which human beings can paintings and engage concurrently each within side the actual international and 3-d digital items. Thus, it makes AR an exciting generation for growing academic packages that permit manipulation and visualization (Ocelli et al. 2005). Additionally, in Di Serio et al., (2012) study, AR generation additionally has proven a high-quality effect at the motivation of middle-faculty college students. It's proved that AR environments should improve scholar motivation and interest, which in flip should assist them to broaden a higher know- how in getting to know contents.

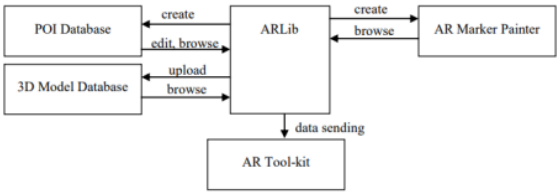

Figure 1: Basic Planning Structure

In this image one can understand what the different elements of AR project are. POI stands for point of interest. There are different points on the scale that are to be formed in order to make the AR platform. This POI can be made using different types of methods like 3D scanning and GPS sensors based on which one can create an entire layout. AR library java applet which helps the programmers to add and modify the AR features.

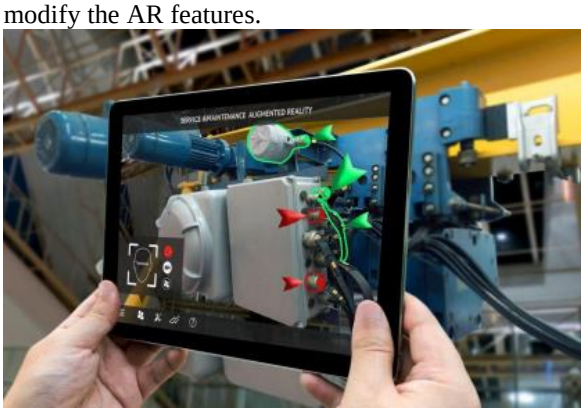

Figure 2: Vision of the project

1.2 Background

We are engineering students and when we were learning about various machineries there we're not enough resources to explain concepts especially the modern technologies. The technology that are used in industries cannot be simply explained in words. There is need of a pictorial representation for the process understanding and sometimes even more like animations and AR too. So, we came up with idea of developing the platform where one can see the manufacturing in almost real experiences. This was our main motto for developing this project.

Augmented reality content can be viewed in several ways. Initially, people may have encountered web applications which let them view quick response (QR) codes through their webcam. Using QR codes (markers), digital information, including 3D animations, can be attached, in a sense, to images on paper, cards, or other surfaces. When a marker is held in front of a webcam, those using AR applications through a computer or console can view digital content superimposed over their real environment (the paper in their hands), as shown by the display screen (which simply shows the room as the webcam sees it, augmented by the AR content). Usually, when the user moves or rotates the marker image, the digital content moves and rotates as well. Another viewing option is to use a head mounted display (HMD). While wearing a HMD (which covers the eyes), users can see digital content on the HMD screen and their real environment through the screen (or displayed on the screen by an attached camera). Today, many mobile AR applications are location based. To utilize these AR applications on a mobile device or a smartphone, the phone must be equipped with several necessary tools: (a) GPS technology; (b) an accelerometer, and (c) a digital compass (magnetometer). mobile AR applications, users may view the world through smartphone cameras in order to see digital content mixed with the real environment.

Our industry partner is Mahesh Industries which has forging machines and specializes in iron plumbing solutions. The premises have different types of machines with varying loads so that different dimension forging can be made. Forging is mainly done by die so there has to be different types of dies of different layouts and sizes. There is an furnace as well as an electrical induction machine for heating of metal. Our industry partner has facilities and experience to make product of different materials as well right from copper up to normal MS products.

1.3 Importance of project

We had selected a forging company because this topic is related to Industrial engineering and is most neglected among the students because of vast theories and lack of pictorial representation. When we look at this subject there are not many methods for explanation except for 2-D diagrams from the textbook. Adding AR in this topic could do wonders for the students.

After selecting the subject for the project, the next part was deciding what should be the contents of this AR platform which should be added. Because there is a lot of information and adding every single one cannot be possible. We are categorizing what are the possible ways we can group different information so that none of major things are left behind. This also includes things like working temperature

and tools used, power of the machines and much more. And this all information is not available on the internet, so we had to find the user manual and brochure from the company. For this we contacted our industries as well as the manufacturing company of this machines.
Our industry partner is also going to get few advantages from this project. Our AR layout is not only to help the students but also the clients of industry. We are planning to give this all data and platform to them too for their website. The clients would understand the machineries used and how the process work. What products can be made and what customize products can be order. The client will not have to visit the actual location so basically international business can also be grown by taking them into confidence.

Figure 3: Workshop

TOOLS REQUIRED

SOLIDWORKS: SolidWorks is a solid modelling computer-aided design and computer-aided engineering application published by Assault Systems.

Figure 7: Solid works

· BLENDER: Blender is a free and open-source 3D computer graphics software tool set used for creating animated films, visual effects, art, 3D-printed models, motion graphics, interactive 3D applications, virtual reality, and, formerly, video games.

Figure 8: Blender

· UNITY 3D: Unity is a cross-platform game engine developed by Unity Technologies, first announced and released in June 2005 at Apple Worldwide Developers Conference as a Mac OS X game engine. The engine has since been gradually extended to support a variety of desktop, mobile, console and virtual reality platforms.

Figure 9: Unity

· VUFORIA: Vitoria Engine is a software development kit (SDK) for creating Augmented Reality apps. With the SDK, you add advanced computer vision functionality to your application, allowing it to recognize images, objects, and spaces with intuitive options to configure your app to interact with the real world.

Figure 10: euphoria

1.4 Perspective for stakeholders and customers

As discussed earlier this project has primarily two stake holders. One is Thakur college of engineering and technology and other is Mahesh Industries. Our primary focus is on educational use of this product, but we are also trying to bend in worker guidelines and safety protocol training so that our industry partner is also benefited from our product. We are going to build a website for students who are interested in knowing the insides of the forging industry. This is going to help them develop deep knowledge of industrial working.

Advantages of augmented reality in education

 Access to learning materials. The lack of new and advance resources is a hindrance in
new education system. So, adding this is value addition.
 Access to virtual equipment. To travel every day for learning at location is not possible
and installing this heavy machine is not possible so availability of virtual equipment can
be boon for the students
 Higher student engagement. For younger generation virtual reality is a fascinating
concept so they are more inclined to learn from this technology rather than normal chalk
and board.
 Faster learning. A new way of presenting information helps reduces the overall learning
time. Subsequently, there is more time for practice and in-depth examination of niche
topics.

 Safer practice. In such cases as anatomy lessons, students no longer need to dissect real
animals; this can be accurately simulated through software. Students get the same level of
practice without harming anything or working with dangerous tools.

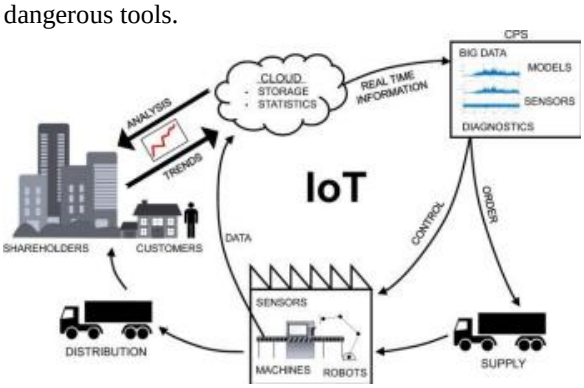

Figure 4: Mind Map

1.5 Objective and scope of project

Using mobile device as a learning tool is a new way for learners to learn anywhere and anytime, they like. A number of studies have found that mobile devices play a major role in education nowadays and sees the impact and advantages of these devices in regards to the potential for pedagogical perspectives Moreover, an application that contains multimedia elements such as animation, graphic and video encourages parents to attract the attention of their children with it. The use of devices like smartphones and tablets can facilitate the children to learn. There are many studies that
proved that there are improvements in terms of children performance before and after they used the multimedia mobile application as a learning tool.
Mobile AR application with the ability of mobile devices which has the features and properties such as portability, social interactivity, connectivity, context sensitivity and individuality have made a learning experience more meaningful. Based on the previous studies most of the users felt motivated, enjoyed and the research shows a positive educational effect on participants that leads to students to achieve higher levels of engagement in learning performance.

1.6 Summary

We are expecting to compile the raw data and the ideology till this semester while the actual implementation is going to start in the winter break because to gain exact information is we need frequent visits in the industries and that is not possible during college hours. We have started the work on the initial phases where we have images of all the machineries their working temperatures and soon. We have also made a first stage machine and a die. All the information is not available on the internet.

REFERENCES

The template will number citations consecutively within brackets [1]. The sentence punctuation follows the bracket [2]. Refer simply to the reference number, as in [3]—do not use “Ref. [3]” or “reference [3]” except at the beginning of a sentence: “Reference [3] was the first ...”

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Automatic Frictionless Braking System

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Abstract :- Collision prevention and warning systems are progressively being installed in automotive vehicles to foresee the possibility of colliding with an external object, such as another car or a person. Such systems often start an action to prevent the accident and/or alert the driver of the vehicle when they identify a probable collision. The vehicle and an IR transmitter and receiver circuit make up this braking system. The obstruction is located using the IR sensor. The IR sensor detects any obstacles in the path and delivers a control signal to the microcontroller, which in turn transmits. This concept uses an electromagnet to enable a frictionless braking system. Included in this construction module is a circular disc connected to a solenoid and a dc motor. A sensor and solenoid are included in the embedded system module together with a microprocessor. Electronic and magnetic power are used to apply the brakes during electromagnetic braking. Here, we apply the electromagnetic principle to produce frictionless braking. As there is no friction, brake wear is reduced, which tends to lengthen the lifespan and reliability of brakes.

Keywords—Electromagnet, contactless braking, sensor, Arduino uno microcontroller, Battery.

I. INTRODUCTION

Background and Justification Electromagnetic brakes, also known as electro-mechanical brakes or EM brakes, mechanically apply electromagnetic force to slow or halt motion. resistance (friction) (friction). The term "electromagnetic brakes" has replaced the earlier word "electro-mechanical brakes," which referred to how the brakes were activated. The range of uses and brake designs has greatly risen since becoming common in the 20th century, particularly in trains and trams, although the fundamental principle of operation has not changed. Brakes that use both magnetic and electric power are known as electromagnetic brakes. They operate according to the electromagnetic theory. These brakes are quite good. due to their many benefits, they should be used instead of traditional brakes. The use of this frictionless brake in automobiles is done so as to lessen brake wear. The rotating wheel or rotor is intended to be stopped by the eddy current. As a result, the rotating wheel or rotor comes to rest in the neutral position. All nations' economy depend on the creation and use of energy, which is required for a variety of tasks like lighting, phone charging, riding a bike, and many other things. Typically, non-renewable energy sources like gasoline, kerosene, and nuclear power produce pollution, which is the major motivation for the idea of creating energy.

Objective

Our project's primary goal is to design and create a model of an electromagnetic braking system.

These are our auxiliary goals in addition to the primary one.:-

- Recognize the planning and implementation of projects.
- • To comprehend fabrication procedures used in a mechanical workshop
- To understand the usage of various mechanical machine tools and also measuring tools
- To use technology in a way that makes daily living easier for people.

Our design overcomes the previous system which was in very high cost

- Simple in construction
- Less space required
- Low energy consumption
- No need of skilled persons

II. LITARATURE REVIEW

1)Author- MOHD SHAHRIZAN B. SAHR

Title-ULTRASONIC CAR BRAKING SYSTEM

An ultrasonic car braking system includes an ultrasonic wave emitter provided in a front portion of a Title-automatic braking car producing and emitting ultrasonic waves frontward in a predetermined distance in front of the car.

2)Author- Eung Soo Kim

Title-Fabrication of Auto Braking System for Pre-Crash Safety Using Sensor

This module can detect the distance between the front vehicle and the driver's vehicle to keep a constant distance using a sensor and operate the brake system forcibly if the driver does not decrease.

3) Author- Sahil Jitesh Thakur

Title-ANTILOCK BRAKING SYSTEM

ABS generally offer advanced vehicle control and minimize the stopping distance on a slippery and dry surface, conversely on a loose surface like gravel or snow-covered pavement, ABS can significantly increase braking distance, although still improving the vehicle control speed of the car.

III. METHODOLOGY

Preparation Of Design:

This step focuses primarily on the design portion, which considers several design choices in accordance with the installation requirements as planned in the preceding steps.

The process of fabricating a model involves a systematic design and seven processes of problem-solving.

The steps are as follows:

Analyzing Research Papers:

Gather all the pertinent information regarding the issues, current research projects, and their results. Then, compare them to other research projects in order to analyse them and determine how best to separate the drawbacks of more traditional braking methods.

Selection Of the Electromagnetic Brakes to Overcome the Problems:

The electromagnetic braking system was chosen in order to reduce the issues that typically arise with conventional braking systems and to address issues with efficiency, maintaining parameters, and safety. Thus, the electromagnetic braking system has been chosen for the following process in order to solve these issues.

Analysis Of the Electromagnetic Braking System:

To research and evaluate the system, concentrating on its working theory, the fabrication materials and design necessary to construct the model, and even conducting research into how the brake system would operate in accordance with the design intended.

Fabrication:

This stage of the process involves putting the selected design and methodology into practise. The model is then built in accordance with the instructions provided, and the functionality of each mechanism is tested.

Testing:

The model is put to the test to see whether it achieves all of the goals, then it is put to the test again to see if any improvements or alterations need to be made. The model is then created for implementation after the test has been completed in full.

IV. DESIGN WORK

CAD is utilised throughout the engineering process, from basic product design and layout through strength analysis of assemblies to the defining of production techniques for components. It is mostly used for thorough engineering of 3D models of physical components.

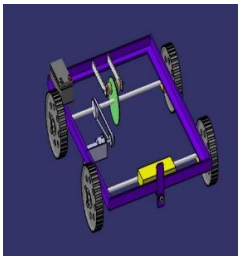

Figure 1

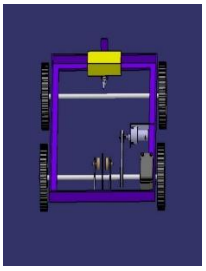

Figure 2

V. WORKING

When the motor receives power, it will rotate the main shaft via the drive system, rotating the MS plate that is welded to the shaft in front of the electromagnet. The brake control switch is turned on when braking is necessary. Hence, the electromagnet receives a voltage application.

An energising coil generates a magnetic field by applying voltage or current. The armature is drawn to the metal disc's surface by the coil, which creates magnetic lines of flux between the metal discs.

The metal disc is free to rotate when the current or voltage is released from the brake (electromagnet).

In our project, an IR sensor has also been utilised to detect objects that are about to pass in front of the vehicle. When an object passes in front of the vehicle, the electromagnet system receives signals to apply the brakes. Moreover, a manual magnetic brake button and a release button have been added to the remote control, which will assist you avoid the IR sensor when parking.

VI. DESIGN CALCULATIONS

Assume Data

Following calculation is done for robot who's speed per km hr

$k = d \times r \times 0.001885$

Where,

k = Kilometre Per Hour(km/hr)

d = Wheel Diameter(cm)

r = Revolution Per Minute (RPM)

k= 27.6 x 150 x 0.001885

k=7.8039 Kilometre Per Hour

Braking force

The total braking force required can easily be calculated by using Newton's Second

law of Motion:

$V = \Pi*d*N/60$

$= (\Pi \times 0.276 \times 150)/60 = 2.1666 m/s$

$A= (v-u)/t$

$= (2.1666-0)/2.5 = 0.86664 m/sec2$

$F= m*A=12 \times 0.867=10.40N$

Braking force

$T = (Fx 0.5d)/R$

$= (10.40 \times 0.5 \times 0.276)/1.725 = 0.832Nm$

Clamp force

$C = T/ (\mu \times Re)$

=0.832/ (0.25 x 0.06) =55.46 N

Brake power

Assuming the stop is from the test speed down to zero then the kinetic energy is given by: -

KE=0.5 x m x v2

=0.5x12x2.16662 =28.149336 Joules

Rotational Energy:

The energy required to slow rotating objects is known as rotational energy. Taking 3% of the kinetic energy is a realistic assumption, albeit it depends on the vehicle and the gear picked.

The power is then given by:

P= E/t =29.0/2.5 =11.61watt

This is the average power. The peak power at the time of braking is double of this.

Brake heating

Fade Stop Temperature Rise

Δt = (P x t)/ (ρ x c x Volume)

= (11.61x2.5)/ (7850*465*3.601*10-5)

= 1.01900C

Magnetic flux density(B):

T=1/2*□*δ*π*R2*m2*B*z2*[1- ( )]

= (0.5x59.6x106 x0.003x5π2 x 0.0152 x 0.0072 x B2) x (1-(0.035/0.996))

B =18.01Wb/m2.

B = (μs x μo x n x I)/L

18.01 = (2000 x 4Π x 10-7 x n x 8)/0.048

N= 43turns/m

Magnetic field strength (H):

H = N x I/L

= (43 x 8)/ 0.048 =7166.66 A/m

VII. COMPONENETS

1.Electromagnet

Figure 3

Electromagnets are excellent for both industrial uses and research projects. This solenoid electromagnet has an iron core and a coil to attract magnetic materials. It can raise objects weighing up to 5 kg thanks to its holding force of 10 kg (98 N)! Moreover, it has a threaded screw hole at the back that can be used to mount the electromagnet to a flat surface.

Specifications:

Holding Force: 10kg

Lifting Force: 5kg

Operating Voltage (VDC): 12

Max. Operating Current(A): 0.33

Material: Mild steel

Power Consumption (Watt): 4

Operating Temperature Range: -20 to 120

Cable Length (cm): 30

Bolt Size: M4

Dimensions in mm (LxWxH): 30x22 (Dia. x Length)

2.Metal Disc

The metal disc is one of the important components been used here. It is made up of MS plate of 2 mm thickness. The diameter of the disc is 90 mm.

Figure 4

3.Switch and Wires

ON/OFF switch used to control the power supply to the electromagnet. It is connected with the electromagnet. A typical common electric switch is used here. When the rotation of the pulley is to be stop, the braking is applied by turned the switch on. When the free rotation of the pulley is required, the switch is turned off. To provide the

Figure 5

4.Motor

High Torque Dc Geared 12v 200rpm - Grade A

Features:

- 200rpm 12v Dc Motors with Metal Gearbox And Metal Gears
- 18000 Rpm Base Motor
- 6mm Día Shaft with M3 Thread Hole
- Gearbox Diameter 37 Mm.
- Motor Diameter 28.5 Mm
- Length 63 Mm Without Shaft
- Shaft Length 30mm
- 180gm Weight
- 13.5kgcm Holding Torque
- No-Load Current = 800 Ma, Load Current = Up to 7.5 A(Max)
- Recommended To Be Used With Dual Dc Motor Driver 20 Or Dual Dc Motor Driver 20

Figure 6

5.Battery

Figure 7

NVENTO 12V 1.3Ah 1300mah Rechargeable sealed lead acid battery

- Maintenance free lead acid battery with Strong ABS Body. Recharge after every use.
- Voltage: 12V - 1.3AH (1300mah); Intitial Current: Less than 0.39A
- Cycle Use: 14.4V - 15V; Standby Use: 13.5V 13.8V
- Battery Size: 97 x 45 x 53 mm (L x W x H)

6. IR Proximity Sensor Module

Infrared Photoelectric Sensor E18-D80NK Obstacle Avoidance

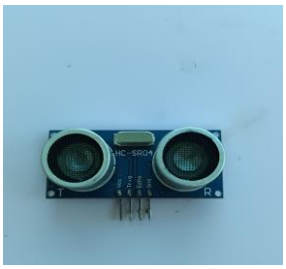

Figure 8

Description

A photoelectric sensor that combines transmission and reception is this one. You can change the detecting distance as needed. Long detection range, minimal interference from visible light, simple installation, and practical application are all features of the sensor.

Parameter

Induction distance: 0-50cm adjustable;

Working voltage: 6-36V can be;

Brown - positive, blue - negative , black - data

U:5VDC

I:100mA

Sn:3-50CM

Working environment: temperature -40 to +70 degrees Celsius;

Note:

1. When the switch is connected to the power supply, check whether the wiring is correct and check whether the voltage parameter is rated.

2. The switching load cannot be short-circuited, and the power supply in the load should not exceed the maximum output current

7.Arduino uno micro controller

Fig. 9

8. frame

Fig. 10

VIII. RESULT

Automatic frictionless braking system can operate safely and effectively in a wide range of driving conditions, such as different weather conditions, road surfaces, and traffic patterns. The system would need to be able to detect and respond to potential hazards in a timely and accurate manner to avoid accidents. Overall, while the idea of a frictionless braking system is promising, it is still in the research and development stage and it may be some time before it becomes a reality in the automotive industry.

IX. FUTURE SCOPE

The advantages of electromagnetic brakes over frictional slowing mechanisms are numerous. This brake is more effective due to the interaction between swirl presence and attracting powers. This brake can be used in a vehicle as an additional stopping device. Two-wheelers can use this brake system. Modern automotive braking technology includes the usage of electromagnetic braking systems. All forms of light motor vehicles, including cars and large motor vehicles, will use electromagnetic braking systems.

Avoid the mishap.

X. ACKNOWLEDGEMENT

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***Abstract*—Ocean waves have tremendous potential of energy generation as these waters contribute two third of our Earth. Decline in fossil fuels have escalated the need of renewable energy generation. Moreover, the existing sources such as coal, petrol, oil etc. contribute to crisis such as global warming. Converting this oscillating wave motions is indeed challenging spanning over many areas of physics, e.g., hydrodynamics, mechanics, solid mechanics, fatigue, electro- magnetism, electrochemistry, electronics, power electronics, marine biology etc. This technology is costly including sensors, cables, turbines and other infrastructure could potentially harm marine biology. And because the plants rely on coastal locations, they may not be able to support whole populations. So, these are some of the major challenges we tend to overcome by our design.**

I. ACKNOWLEDGEMENT

We sincerely thank to our guide Mr. Pankaj Rawool
for his/her guidance and support for carrying out our project work.
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The power of ocean waves, i.e., the energy flow or energy flux, is usually presented as the average power per meter of crest length of a wave, and the unit is thus usually [W/m]. What this given value really means is the aver- age energyper second that is passing under one meter of wave crest,from the surface to the seabed. Wave energy is the storage of wind energy in the form of waves in the ocean. The height andwidth of waves can vary depending on the time of year and other factors. Wave energy is a promising renewable resource that can be used to generate electricity. Sea waves are ever-changing, their heights and widths in flux due to the passing of time and the change in seasons. The power available in a sea wave is expressed as the following formula: -

$P = 0.55*3* H_s* T_z$ kW per meter length of wave crest.

Where,

H_s = average of one-third of the highest waves in meter T_z = zero crossing period in seconds.

Currently in India, the facilities are generating energy in the order of 1200MW and 7000MW respectively for the Gulf of Kutch and Khambhat and 100MW for Sundarbans and 150KW for Kerala.

Till now there is no estimation of the amount of energy which our mechanism can generate since the design is still un-der development and there has been no actual tests performed for the design.

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III. CONTENTS

A. Chapter 1 Overview

B. Introduction

The challenge for societies and environments to find clean sources of energy is only one of many they face, but the journey to a future with less pollution from energy sources is a long and difficult one. Oceans contain a vast amount of energy in the form of waves and currents and this has been known for quite some time. Estimates show that the power levels on coastlines around the world could be as high as one terawatt.

C. Background

Wave power advancement has confronted numerous troubles, thus the large number of solutions. Some of the main challenges of wave power technology are the durability of parts exposed to the ocean's forces, the high investment costs of large structures, the need for excessive reinforcement to handle mechanical overloads, long-term mooring difficulties, transmission of energy to shore, and the conversion of wave motion into high-speed, rotating generator motion. Many innovations in wave power research and development have been focused on hydrodynamics and mechanics.

D. Importance of the Project

The main aim of the project was to use simple mechanical mechanisms to generate electricity from wave motion. There have been many systems designed to harness wave energy. Some of the technologies are said to have reached commercial or close to commercial stage, some are performing small scale prototype testing of their technology, and still some technologies have not left the drawing board.

E. Objectives and Scope of the project:

The primary objectives of this project are:

. To utilize the ocean waves that are often unused and to capture its oscillating motion.

. To harness the ocean energies for power generation and to overcome the barrier of energy deficiency.

. To accelerate and enhance support for the resource assessment and deployment of ocean energy in the country

. To have a renewable, emission-free, and reliable source of energy.

NO. TABLE I

IV. SCOPE:

India has the potential to extract a lot of energy from the ocean because it is surrounded by water on three sides. The to-tal theoretical potential of wave energy is estimated to be about40,000 MW. Not to mention, the cost of electricity would be reduced because this is a shoreline project. Additionally, the cost of setting up this plan is cheaper than many other options. Due to its optimal design, it can be adapted to any location with only minor changes.

A. Summary:

Need for renewable sources of energy is rising leading to several developments and research. Ocean waves have potential to generate energy throughout day and night unlike solar energy. Harnessing this massive energy if done in properway will achieve success but is indeed challenging. One such effort is done by our team where we propose to develop a mechanism that converts ocean wave energy into electricityby capturing the on-coming wave forces.

Chapter 2 Literature Survey

Currently, there exist lot of different ocean wave energy generation systems such as floating buoys, point absorbers, bi-direction turbines and over-stopping devices. However, os- cillating buoys have proved to be a popular choice among these considering the technological and economic aspects.

Linear induction generators, turbines with oscillating air column and flapping devices attached to shores or ships are common components used in tracing wave motion. Some other mechanisms also include piezoelectric devices that generate electricity by wave force or impact. Despite developments, these technologies prominently capture only one-dimensional movement.

Some of the major units in India are located in the Gulf of Kutch, Gulf of Khambhat, Sundarbans in West Bengal and in Thiruvananthapuram, Kerala. This units are generating energyin the order of 1200MW and 7000MW respectively for the Gulf of Kutch and Khambhat and 100MW for Sundarbansand 150KW for Kerala. But all these facilities capture only thetidal energy and not the wave energy. Some of the major units in India are located in the Gulf of Kutch, Gulf of Khambhat, Sundarbans in West Bengal and in Thiruvananthapuram, Kerala. This units are generating energyin the order of 1200MW and 7000MW respectively for the Gulf of Kutch and Khambhat and 100MW for Sundarbansand 150KW for Kerala. But all these facilities capture only thetidal energy and not the wave energy. Thus, we are proposing the design and mechanism and developing it to capture both heave and pitching motion of ocean waves.

Work (Phase wise)

PHASE 1:

In this phase, brainstorming for selecting appropriate mech- anism is done. Getting general idea of current developments inthe field and challenges faced by them are studied. Future as- pects and potential changes in existing models were identified by team.

PHASE 2:

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This is the most crucial phase in which detailed researchon selected mechanism is done. Study of various components used in assembly from fields of mechanical, electric and electronic will be done. This is required for process of storing the electrical output to its fullest. The mechanical system will be designed in commensurate way to electronics andelectrical systems used. Iterations of model will be made on cad software. Finally, feasible design will be selected for further analysis.

PHASE3:

Simulations on final cad model will be done to ensure rigidity, motion and safety of model. Results will be acquired. Finally, we plan to make a small-scale model/prototype of our final mechanism. Testing the prototype in appropriate environmental conditions. Gathering the results and do small modifications if required. The results will be then presentedin appropriate documents

Chapter 3 Analysis and Planning

Initially, through literature review, we discussed various mechanisms which can be implemented. We plan to designthe CAD model using certain specifications of the componentsand build a prototype using 3D printing technology and testthe outputs of the design. According our workplan we will be simulating our model and parameters such as maximum load; factor of safety of components and frame will be estimated.A rigid structure is our objective. If it is not achieved, we will perform

modifications.

On the other hand, small prototype will be tested in lab or appropriate environment. The functioning and limitations of mechanism will be observed. As electrical component suchas generators will generate values above certain threshold or in a particular range depending upon wave nature, we have to select other components accordingly as well. Thus, with collected results, suitable power storage units and other electronic components can be updated.

Chapter 4 Design and Implementation

Initially, we had designed two mechanisms to trace both longitudinal and transverse motion of waves. First being slidercrank. Here, the floater is attached by sliding rack on both the sides as shown which allows the movement of the rods. In thisdesign, we faced issue in rotating the crank as the movements were restricted. The mechanism is able to completely capture wave only in single direction. As a result, elliptical motion of buoy is not traced. Thus, losing almost half of wave energy.

Consequently, we went for next iteration –Rack and Pinion mechanism. In this iteration, while capturing the oscillatory wave motion, the gear rotates in both anticlockwise and clockwise motion over the two racks. Even though it now captures both heave and pitching motion, there are challenges yet to tackle

Fig. 1. Slider-crank Mechanism

The electric output generated in this case will be fluctuatingand of different amplitude due to irregular wave frequency. Toconvert this AC voltage into constant DC is significant to storeit in batteries is not an easy task. In case of current design, even with application of rectifiers and stabilizers, major losses are inferred to occur. This also requires thorough knowledge ofelectronics and electrical field to design an efficient and robust mechanism. As a result, the current design is comparatively not feasible and requires modification.

We plan to develop a mechanism which is suitable to convert wave energy and at the same time store it efficiently in respective storage units without major losses.

Chapter 5 Results and Discussions

After many iterations, the CAD model of the mechanism was successfully developed which was capturing both the pitching and the heaving motion of the waves. The electrical systems and circuits required for the successful application were also identified based on their application and require- ments.

Chapter 6 Conclusion

We have accomplished the first two phases of our workplan by gathering information of development and limitation of OCWEC field and design a Cad of same.

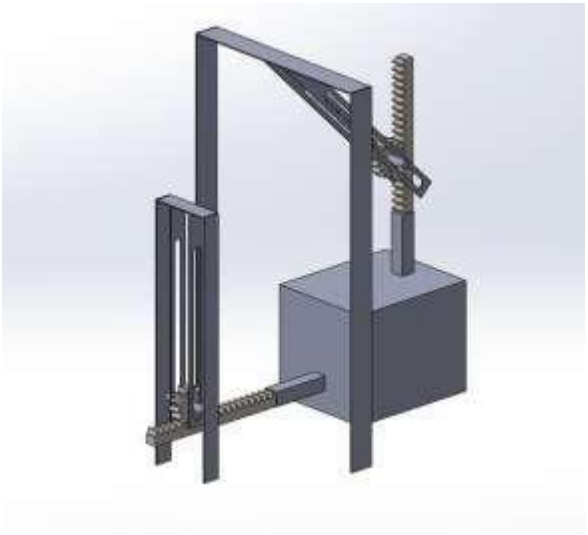
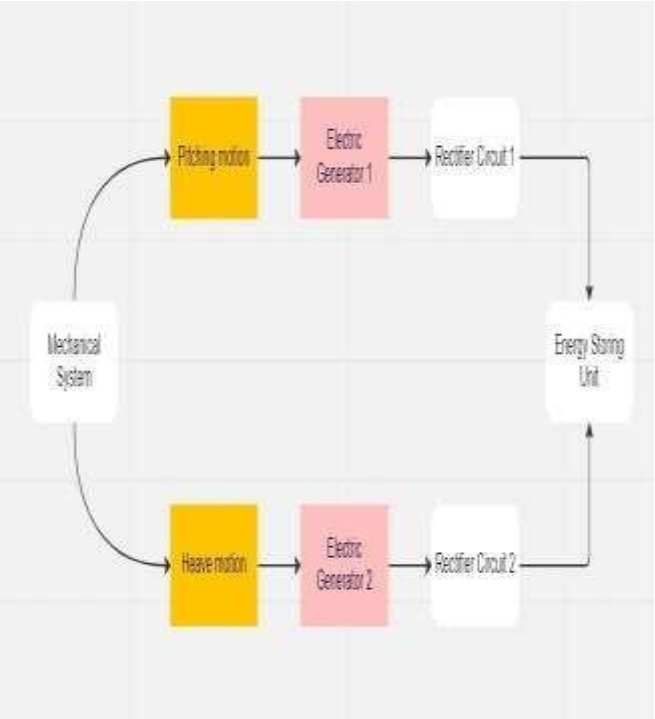


Fig. 2. Rack and Pinion Mechanism

Fig. 3. Flow of the designed system



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The Flying Bionic Eye

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***Abstract*—Humans' initial desire for flight stems from the imitation of flying creatures in nature. The advances in the flight principles of several natural creatures are then introduced, from the perspective of bionic aerodynamics. In this paper, an ornithopter prototype that mimics the flapping motion of bird flight is developed, and the lift and thrust generation characteristics of different wing designs are evaluated. This project is focused on the spar arrangement and material used for the wings that could achieve improved performance for surveillance purposes. The study of flapping flight from an experimental standpoint brought insight into the lift-generating mechanisms produced during flapping. These vehicles are meant to address a large number of civilian and military applications including intelligence, surveillance, and reconnaissance.**

Keywords— Aerodynamics, Bio-Inspiration, Ornithopter, Surveillance.

I. Introduction

A Fluttering Wing Automated Ethereal Vehicle is otherwise called an Ornithopter, the name is gotten from two Greek words, 'Ornithos' important bird, and 'pteron' significant wing. An Ornithopter is a gadget that flies by fluttering its wings. However these gadgets may contrast in structure, they are based on a similar scale as the animals they copy. The wings create the expected lift furthermore, the push expected for flight by means of a fluttering component which changes over the turning movement of the engines through the gears into swaying movement of the wings. These vehicles present different regular citizen and military applications in the field of observation and surveillance. Scaling, fluttering flight, and streamlined ways of behaving are concentrated as bio-motivation and conceived in the MAV Bird of prey plan. With an interdisciplinary methodology, the coordinated result of primary and material designing, streamlined features, control framework, and gadgets are used to plan and foster the examined airborne vehicle. It is demonstrated as an assortment of three unbending bodies (a focal body, two wings, and a tail). The wings and tail have recommended movements comparative with the focal body, i.e., they are kinematically driven. The mathematical mix of all the overseeing conditions, which are differential-mathematical, is performed all the while and intuitively in the time-space.

II. Nomenclature

KL aspect ratio coefficient

SW area of wing

ρ density of air

σ Strouhal number

v velocity of the wing through the air

β positive angle of attack

f flapping frequency

μ Kinematic viscosity

L dimensional length

FL lift force

CL coefficient of lift

α angle of attack

A aspect ratio of the wing

III. Literature Review

A few efforts have been made to construct fluttering robots or ornithopters (Bento 2017 and Box 2017). The first sensibly fruitful of these tests happened nearly a thousand years after the fact in 1060, when a priest figured out how to coast around 200 yards before his typically horrendous (however non-lethal) experience with the ground (Sanderson et al. 2016). A remarkable step in the right direction in ornithopter configuration came from Leonardo Da Vinci, spite the fact that it was never appropriately explored until the nineteenth 100 years (Sanderson et al. 2016). Leonardo da Vinci started to concentrate on the trip of birds) (Srigrarom 2015). He got a handle on that humans are excessively weighty, and not sufficiently able, to fly utilizing wings essentially connected to the arms. In this way, he portrayed a gadget in which the pilot rests on a board and works two huge, membranous wings utilizing hand switches, foot pedals, and an arrangement of pulleys (Sail et al. 2016). The principal ornithopters equipped for the flight were built in France Jobert in 1871 and utilized an elastic band to drive a little model bird (De Warble 2009).

Cron et al additionally made elastic-fueled ornithopters during the 1870s Tatin's ornithopter were maybe the first to utilize dynamic twists of the wings, and evidently, it filled in as the reason for a business toy presented by Pichancourt C. 1889. Gustave Trouve was quick to utilize inner burning and his 1890 model flew a distance of 70 meters in an exhibition for the French Foundation of Sciences (Bhargava 2015). The wings were fluttered by gunpower charges initiating a whiskey tube. While some were effective, numerous neither take off nor fly just for a brief term because of their higher intricacy.

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IV. System Design

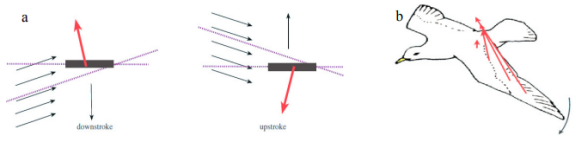
For planning falcon MAV, the motivation was taken from birds that make a lift by fluttering its wing and Maneuvering through its tail. For this, a full investigation of birds was finished for plan and streamlined features. Weight decrease was finished for a streamlined trip with solidarity to satisfy the necessary observation. Two existing ornithopter ideas were examined. The principal idea was a straightforward monoplane with one bunch of wings.

The second was a biplane idea where two arrangements of wings were set over one another. These wings moved in the counter stage on a typical rotational pivot. The two ideas were contemplated regarding the flight speed, power utilization, and strength of the ornithopter body during flight. Since Bird of prey was intended for gliding furthermore, gliding additionally, the monoplane idea was chosen for low weight and aspect. Be that as it may, because of the great shaking adequacy of the monoplane in the fuselage, it is less appropriate for the camera stage.

V. Methodology

A. Flapping Flight

The structural movement and the resulting unsteady fluid dynamics of flapping flight present a more complicated situation in design. The flapping mechanism produces both lift and thrust. During flapping, in down stroke, the relative velocity between the air and the wing is inclined upwards from below, while on the upstroke, the velocity of the air is angled from above. The thrust is produced as a forward component of inclined force of wing lift during upstroke and downstroke.



By considering the non-flexible characteristics of wing motion to be designed, the mean lift force calculation

[Linton (2007)] is based on eq. (1) as

$$Thrust = \frac{1}{3} K_L S_W \rho \sigma^2 v^2$$

In order to keep the vehicle in flight, lift force is required to be created by flapping. It is done by using a positive angle of attack, β. The mean lift force calculation is based on eq. (2) as

$$Lift = \frac{1}{2} K_L S_W \beta \rho v^2$$

Strouhal number plays an important role in flapping flight which should be in the range of 0.2 -- 0.4, and for birds in cruising flight it is almost always nearly equal to 0.2 [Linton (2007)]. For our design, the value of 0.2 was selected for calculations with the Strouhal angle [Taylor et al. (2003)] of 22°. The work done in pushing the bird through the air is simply the thrust multiplied by speed given in eq. (3) as

$$Power = \frac{1}{6} K_L S_W \sigma^2 v^3$$

By putting the values for a speed of 15 m/s and calculating an expected weight of 25 grams with KL as 5, the thrust is coming out to be 0.48N, the lift is 31 grams and power is 2.80W for the design. The effects of different parameters, such as wing area and wingspan, on the flight characteristics, based on dimensional analysis is done for scaling of aerial vehicles. First, the balance between lift and weight during steady-state flight is considered for calculation. The flapping frequency scaling is done based on eq. (4) obtained by comparing Reynolds number and Strouhal number calculations [George et al. (2012)].

$$f_{scale} = \left(\frac{\mu_{scale}}{\mu_{bird}}\right)\left(\frac{L_{bird}}{L_{scale}}\right)^2 f_{bird}$$

For a bird like falcon, the values in the above equations were put and the scaling was done to fit with size of a Micro air vehicle of 300mm maximum dimension to be designed.

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A Collaborative Study of Generative Design andAdditive Manufacturing in Automobile Industry

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***Abstract*—A new emerging technology with great potential in the industry known as Metal additive manufacturing. Moreover, with the help of new and advanced technologies like generative design, we can maximize this potential for additive manufacturing solutions by computing complex optimized parts. recent studies on automotive design aim to cut vehicle and components weights, optimizing vehicle performances, and contribute to the challenge of reducing fuel consumption and operational costs. In this perspective, innovative materials and technologies are developed but also advances in design methods and tools. Generative Design is a different tactic to automatically augment the component design. The design process must be considered to accomplish the finest solution, about design parameters, requirements, and limits Additive manufacturing technologies can now be used in constructing metallic parts. This revolution in manufacturing technology makes way for the fabrication of new shapes and geometrical features.**

Keywords- generative Design, Additive Manufacturing, Automotive Industry, Metal Additive Manufacturing

I. INTRODUCTION

Additive manufacturing (AM) methods have been usually used for rapid prototyping purposes for a great period of time in the last 30 years. They comprise of building an object "from scratch" or a semi-finished part acting as substrate. Thanks to many technological enhancements, these developments can now be used for swift manufacturing purposes [1]. Additive Manufacturing (AM) is an embryonic production technology in engineering every so often seen as the subsequent industrial revolution. Undeniably, AM is budding bigger every year and calculations on the related market see this trend growing even more, as a result of increased usage of this technology and expansion in the fields of application [2]. In contrast to orthodox manufacturing technologies, AM offers greater freedom of design and possibilities for mass customization [3]. Furthermore, this technology is capable of constructing prototypes or even finished parts in a short period without tooling or casts [4]. It

can also yield intricate parts for both professional and personal uses. Additionally,evolving Computer-Aided Design (CAD) technologies like generative design can maximize the already huge potential of AM. The generative design tools help create optimized parts or assembly by employing computer power and optimization technologies [5]. Similar to the AM field, the generative design ecosystem keeps budding every year. There is the rising use of generative design resolutions in chief industries like the automotive and aerospace domains, as well as an increasing number of generative design tools.[2]

II. GENERATIVE DESIGN

Generative Design (GD) is "a category of technologies that suggests design options, or optimizes an existing design, to meet criteria defended by the user" [5]. Indeed, designers lay down their part constraints and objectives in GD software. Then the software's objectives are to propose an improved part design. The recommended options can be adjusted for weight, stiffness, frequency, etc. [6] In that way, GD has a substantial impact on the design process. Part of the design procedure is now

automated by GD software, saving time for designers but also altering their orthodox working method. Their new role is now to make a comprehensive study of the part, so they can set up every applicable input (simulation parameters, criteria, and objectives) for the GD software. At the end of the GD process, it is also the designers' role to evaluate the diverse design possibilities and choose amid them the best suited for their application,[7] Generative Design is a design method for apprehending the designer's intent, engendering new solutions. Categorized by data-driven collaborative cloud-based technology, it depends on a highly automated activity. A set of parameters and rules (commands to the designer) is taken into consideration as the DNA of the design process; rules and parameters are considered as the genes. They are conjoined by evolutionary algorithms or even "brute force" calculations. The introduction of such trials into the design procedure allows the development of innovative design resolutions by adjusting the rules that outline a final design, difficult or impossible to attain via other methods. Grammar-based techniques exploit the principle of database strengthening the identification of rules, creating complex forms and patterns from simple stipulations. Generative design principles established particular attention in architecture; some good definitions coming from that field are reported here [8]

Lars Hesselgren stated that Generative design isn't about designing the structure – It's about designing the system that builds a structure.

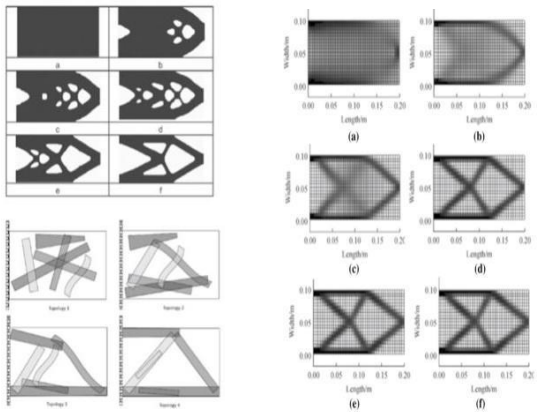
Paola Fontana states that it is the initial conditions of an object rather than modeling the final form in the Generative Design Process

Kristina Shea appends that Generative Design Systems are made to create New Design Processes that generate spatially new yet effective and buildable designs through the exploitation of current computing and manufacturing capabilities.

A. Topology Optimization

There are different tools accessible for GD, for instance, lattice infill or meta-structure blending. But the most widespread tool, booming automated optimization, is topology optimization.[5] Topology Optimization (TO) is the technology optimizing the material layout within a specified design space.[9] Topology Optimization goals are to augment a part property (weight, stiffness, frequency …) while valuing a definite set of limitations. To do so, the Topology Optimization process uses various mathematical algorithms and methods. Each Topology Optimization method has several versions aiming at faster optimization or addressing characteristic optimization's issues one of the most popular Topology Optimization methods is the Solid Isotropic Material with Penalization (SIMP) method. This distinct method idea is to give an element a continuous virtual density between 0 and 1 and steer the result to 0 or 1 after each iteration with a penalization factor. Another noteworthy distinct method is the Evolutionary Structural Optimization (ESO) method which is based on biomimicry. This discrete method uses finite component breakdown to determine and remove the inefficient components and make the structure evolve into its optima counterpart. Indeed, after each iteration, the components with the lowest stress density are removed until all the residual components have an equal stress density [10]. One direct improvement of this method, even closer to mimicking nature growth, is to also add components near the highest stress density components as well as eliminating the lowest stress density one.[11] The discrete element methods face some disputes of their own, the two most common are the mesh dependency issues, i.e., optimization results vary depending on the mesh, and the checkerboard issue, i.e., stiffness is virtually high due to a checkboard pattern of the elements. Addressing these issues, a recent Topology Optimization method emerged: The Movable Morphable Component (MMC) method. In opposition to the two previous methods, MMC is not distinct. The core idea is to find

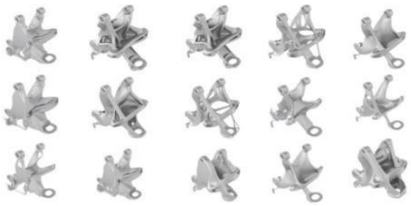
the optimal structure topology by optimizing the thickness, shape, orientation, and layout of a set of morphable components, i.e., building blocks [12]



Topology Optimization: on the left SIMP method iterations [9], on the upper right ESO method iterations [10], on the bottom right MMC method iterations [12]

B. Synthesis of Generative Design

The study of GD is essential to comprehend the GD tools optimizing operations. It is also acceptable to review the various tools possibilities, similarities, and differences.



Multiple Design Options of the same General Motors Seat Bracket proposed by Autodesk Generative Design tool [15]

III. GENERATIVE DESIGN WITHIN THE DESIGN FOR ADDITIVE MANUFACTURING APPROACH

Nowadays it is commonly accepted that in automotive and industrial applications, we can attain the key advantages from the introduction of advanced design procedures if we associate them with Additive Manufacturing (AM) processes and techniques. Therefore, we must contemplate also the coupling of evolutionary algorithms with innovative manufacturing processes, like Additive Manufacturing, and new materials. This combination introduces more degrees of freedom in the final design concept: for example, the mixing of materials with different properties allows having different properties distributed in different zones of the same part, leading to multi-functional concepts. The opportunities offered by AM are not constrained to multi-functional concepts. Deliberate that, over the last years, AM's implementation has increased across industries, with the aerospace industry contributing about 10.2% of AM's global revenues in 2012. AM provides the flexibility to create complex part geometries that are problematic to build using traditional manufacturing, such as internal cavities or lattice structures that help reduce parts' weight without compromising their mechanical performance.[13] Additionally, AM's impact on economies of scale and scope makes it a natural fit for automotive, which is mainly geared toward customized production. The new system, once manufactured thanks to AM, should fulfill the practical requirements in an innovative and more efficient way, also targeting a humbler design and a substantial cost reduction. Novel structural materials and advanced AM techniques make these technologies ready to be presented within the generative design process also for safety-critical contexts, such as the aeronautical. Even if the advantages from the introduction of the couple Generative Design and Additive Manufacturing have been widely considered.

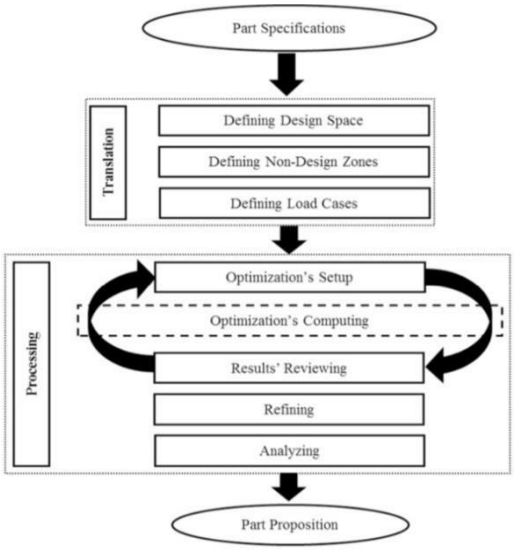
IV. GENERATIVE DESIGN APPROACH IN PRODUCT DEVELOPMENT AND AUTOMOTIVE INDUSTRY

Typical automotive design practices consider the design process spread into three main phases: the conceptual design, the preliminary design, and the detailed design. Conceptual Design is an early phase of the design process. Preliminary Design means that part of the Development Phase where all of the geometric design elements, Detailed design is the phase where the design is refined and plans, specifications, and estimates are created The design solution is proposed throughout the typical diverging – converging process, in relation to design necessities and limits. Multidisciplinary optimization processes are currently being developed to support the designer in assessing the optimal solution, in relation to all design features and constraints.

Generative Design is a novel form-finding process that considers structural performances, material properties, and ergonomic demand, throughout an automatic iterative holistic approach for component topology optimization.[14]

V. GENERIC GENERATIVE DESIGN WORKFLOW

Before starting the GD process, an initial study relating to the part Specification is required. This study is decisive since all the final GD options projected in the end rely on it. Meaning, the designer needs to have a seamless understanding of all part interactions with its environment before starting the GD process entire volume available in which GD software can operate, every space outside the design space cannot be used. Thus, according to its former study of the part, the designer's role is to determine the utmost space the part could ft in, so the results at the end of the process are the most augmented ones. To complete the design space, the designer also needs to specify the conserved geometries and voids within the design space, i.e., the functional volumes. Then, the designer applies the set of loads and boundary conditions, i.e., the load cases, on this design space.



Generic Generative Design Workflow [16]

A. Translation Phase

The first phase in the GD process, based on the outcomes of the past functional analysis, is translation. In this phase, the part specifications are "translated" into inputs for the GD software. The designer must define the basis of his optimization: the design space. The design space is the entire volume available in which GD software can function, every space outside the design space cannot be utilized. Thus, according to its preceding study of the part, the designer's role is to govern the maximal space the part could fit in, so the results at the end of the process are the most optimized ones. To complete the design space, the designer also needs to mention the preserved geometries and voids within the design space, i.e., the functional volumes. Then, the designer applies the set of loads and boundary conditions, i.e., the load cases, on this design space

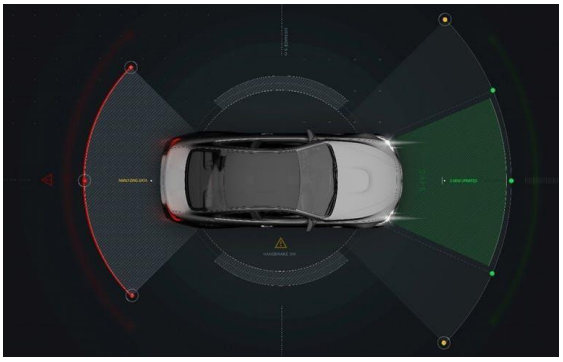
B. Processing Phase

To begin with the second phase, the designer needs to arrange his/ her optimization, i.e., to point out the optimization objectives and restraints. Some usual parameters are the material, the percentage of the design space volume for the solution, the minimal element size, etc. The designer can now run the optimization process. The second step of the GD process is the computing, this step usually does not include the designer except for software proposing live feedback and live alteration on the optimization runs. With all the previous step information, the software finds solutions attaining the specified objectives and constraints. In the third step of the GD process, the designer must evaluate the options proposed by the GD software to find the one best suited to its requirements. The designer's proficiency is once again decisive as the choice is based on the part context in terms of cost, manufacturing, production, quality, etc. If the designer is not satisfied by the GD proposed options or if he wants to enhance the optimization results, he can loop back to the first step to adapt the optimization parameters and produce new options. In the fourth step, the designer can refine even more the solution subsequently by blending complex meta-structure in the optimized part. For example, some software proposes to blend complex meta-structures like lattices, gyroids, bone-infill-like structures, etc. Once this augmentation is done, the designer should finally run an analysis of his/her solution

to determine its performance and certify the validity of the part specifications. If the specifications are not met, the designer should loop back to the first set-up step and modify the initial parameters.

VI. CASE STUDY on How Generative Design Enhances Autonomous-Vehicle Development [19]

The technological ramp to completely independent vehicles present striking challenges for the company's imperative independent-vehicle (AV) programs. Advanced detector technology, high-speed and high-bandwidth data networks, and slice-edge artificial intelligence are all decisive to the functional and marketable success of AVs. In addition, utmost approximations prognosticate that AVs will bear billions of country miles worth of testing to certify their safety. Manufacturers will need to integrate the assignments learned through dissembled and real-world testing into their AV designs to remain competitive.



Sensors Field of Perception in Autonomous Vehicles [17]

1. Autonomous- vehicle platforms must connect an array of advanced detectors and computers through high-speed data networks to perceive, assess, and act on environmental stimulants.

The Society of Automotive Engineers (SAE) states six situations of complication for independent vehicles, from zero to five. An auto with position-two autonomy may feature active voyage control, a lane-departure warning system, lane keep help, and parking backing. In total, this auto requires about 17 detectors to enable its motorist-backing systems.

The calculations performed by such an auto's automated systems are fairly primitive. The lane- keep- help system, for case, is only assigned with covering the vehicle's position relative to the lines of the road. Should the motorist begin to transgress, the system will notify the motorist or take corrective action, but the ultimate responsibility for control of the vehicle lies with the motorist.

A position-five AV will have complete control over the driving task, taking no mortal input. As a result, a position-five auto is projected to have further than 30 fresh detectors of an important wider variety to cover the immense number of tasks an independent vehicle will need to attain.On top of the ultrasonic, compass camera, and long-and short-range radar detectors of a position-two auto, position five will bear long-range and stereo cameras, LiDAR, and dead-reckoning detectors. The increase in detectors will increase the quantum of wiring demanded in the harness and the necessary computational coffers to handle the gigabits of data being produced by the detectors.

2. A completely independent vehicle will bear numerous types of detectors to directly perceive dynamic driving surroundings. While designing a position-five platform, masterminds will need to perform armature and concession analyses to examine architectural proffers, similar to a centralized vs. sphere vs. distributed armature. These analyses will need to regard for hundreds of factors and millions of signals while enhancing function locales, network quiescence, error rates, and more.

Despite these challenges, the independent drive is a raising request. At least 144 companies have blazoned AV programs. Some of these are major automotive manufacturers seeking to stay ahead of the coming assiduity interruption, but utmost are startups or companies from other diligence seeking to enter a traditionally impenetrable request.

These companies warrant assiduity-specific experience and the engineering coffers to spontaneously force their way through the complications of independent vehicle design. Indeed the major automotive OEMs will face problems that their heritage design overflows

are ill-equipped to handle. To contend, these companies will need a new design methodology that permits youthful masterminds to design accurate and optimized systems, which can only be done by landing the experience and knowledge of expert masterminds. They will need generative design. Generative Design and Engineering

Generative design takes system delineations and conditions as input and generates architectural flings for the sense, software, tackle, and networks of the electrical and electronic systems using rules-grounded robotization. These rules capture the knowledge and experience of the expert masterminds to guide youngish masterminds throughout the design. Landing this IP helps companies to advance both vehicle infrastructures and new generations of masterminds as they learn and apply being company knowledge.

3. Generative design uses rules-grounded robotization to induce proffers for the sense, software, tackle, and networks of the electrical and electronic (E/ E) system.

The adding electrical and electronic content of ultramodern vehicles is formerly conclusive current design styles to their limits, yet the complexity of automotive systems will only continue to grow in the future. Autonomous buses will contain the most complicated electrical and electronic systems yet seen in the automotive assiduity.

For case, further, than 30 detectors, country miles of wiring, and hundreds of ECUs will be needed to gather, move, and process the data necessary for independent driving. The data networks will need to be extremely fast to support real-time perceptivity, decision-timber, and action to help collisions and detriment to mortal passengers or climbers. Masterminds developing these vehicles will also need to balance performance conditions against power consumption, physical space constraints, weight, and thermal considerations.

Generative design authorizes automotive masterminds to attack the challenges of electrical and electronic systems design for independent vehicles. It employs rules-grounded robotization for rapid-fire design admixture, enables masterminds to design in the environment of a full vehicle platform, and tightly integrates colorful design disciplines to ensure data abidance.

Originally, employing robotization throughout the process will help design brigades manage design complexity without adding time-to-request. Robotization helps masterminds concentrate on the most dangerous aspects of the design and verification of the functionality of the E/ E system's functionality and reduces crimes from homemade data entry. This empowers masterminds to concentrate further of their time on applying their creativity and inventiveness to creating the coming generation of automotive technology improvements. Robotization also applies company IP to the generated proffers through design rules, adding the delicacy and quality of the designs.

Next, designing in the full platform environment helps masterminds to understand the way signals, cables, and other factors are enforced across the entire vehicle platform, thereby reducing crimes at interfaces or due to the complexity of the harness. This design inflow also enables brigades to exercise undisciplined data across vehicle platforms to ameliorate quality and reduce development costs.

Eventually, a tightly unified terrain enables the electrical masterminds to partake data with masterminds and tools in other disciplines, similar to mechanical or PCB design. The relations between the electrical, mechanical, and software factors of a vehicle are adding. Flawless synchronization of data between these disciplines improves the integration of them into a single system.

Generative design also creates a nonstop thread of data from the primary system description and conditions to full-scale product and service. The same data forages each stage of the generative design inflow so that nothing is lost between design stages or design disciplines. This nonstop thread of data keeps all engineering platoon members up to date and

working with the most current data while also icing that designs are meeting colorful conditions for functionality, safety, weight, and so forth.

4. Generative design ensures data continuity from initial system definitions through production and after-sales for full traceability and acquiescence with requirements.

Data continuity ensures that projects have a single data source, providing a clear picture of the innumerable inter-domain and inter-system interactions. Designs can be automatically checked against design rules to ensure their functionality, accuracy, and quality. As changes are made to the design, they can be examined with detailed impact analysis that will inform the engineer of issues the change may cause in other domains. For instance, moving or removing an ECU could be evaluated for its impact on network timing, signal integrity, or physical clearance and collision issues. As a result, changes are made knowing their full impact on the system.

Generative design will be a key enabler for new and established automotive companies in their quest of developing fully autonomous vehicles. The ability to generate electrical system architectures automatically enables early exploration and optimization of designs while entrenching company IP into the design flow. In addition, a singular source of data promotes consistency between domains, design reuse, and enhances the analysis of change impact. Finally, tight integrations between the electrical domains and with mechanical and product lifecycle management tools streamline the entire design flow from the outset through production.

The massive intricacy intrinsic in AV design will continue to push the tools and methodologies used by automotive engineers. This is especially true in the electrical and electronic systems domains as they come to dominate the operation of a vehicle's safety-critical systems and conveniences. The winners in this disruptive technology will be those companies that can most effectively integrate the advanced technologies required for an autonomous drive into a package that's reliable, safe, and attractive to consumers, and then get those technologies to market quickly and with a high level of quality.

VII. CONCLUSION

Generative Design is an innovative procedure to support the designer in widely exploring the design space. It is not only a topology optimization, nor an evolutionary algorithm, but it syndicates several optimization modules to topology definition within a CAD environment, according to design requirements, limits, and the bounding space. The output is not only the most appropriate solution, while it is a family of different results that the designer could properly select and modify. The solution space is generally established considering freeform shapes: it would not be possible to reach a better solution using a traditional design method. Additionally, the selected shape is designed to be manufactured by an Additive Manufacturing process. Even if some case studies and some tools have been developed, the potentials brought by Generative Design principles are not yet discovered enough. Some examples have been well-thought-out in small component design. Additive manufacturing is formerly being used at the sports auto manufacturer in prototype construction, manufacturing spare corridor for classic sports buses as well as in other areas. For the first time, the pistons for the high-performance machine of the 911 flagship model were designed using topology optimization, the GT2 RS, are now being produced with a 3D printer with the help of generative design. General Motors also used generative design before this time in an evidence-of-conception design to develop a featherlight seat-type prototype for its electric buses of the future. The technology is also proving its value for the future of space exploration.

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Air Powered Vehicle

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***Abstract*— The environmental problems of passenger cars are serious and require a wide range of evolutionary and innovative solutions. Gasoline, the most common fuel used in such vehicles, contributes to vehicle pollution as it produces carbon dioxide, nitrogen oxides and unburned hydrocarbons. A potential alternative to petrol cars is air-powered vehicles. Abundant, contaminant-free air can be cheaply compressed to high pressures. Compressed air powered vehicles (CAVs) offer an environmentally friendly and efficient method of generating and transmitting electricity. Air-powered propulsion systems for transportation applications are receiving increasing research attention as one of the technologies with the potential to achieve zero emissions targets.**

Keywords*— *Renewable Energy, Air compression, stroke piston, zero pollution

I. Introduction

This project focuses on design and calculation of an Air Powered Vehicle. In its first phase, it will be more centred towards two wheelers, the power generation aspect of things and the actuation mechanism of the vehicle. We have achieved this by using pneumatic cylinders and solenoid valves along with the use of Arduino for Input output processing. Alternatively, a compressed air power unit can be integrated with a conventional internal combustion engine (ICE) to form a hybrid system. A hybrid powertrain system can be used as a transitional vehicle propulsion system between a fossil fuel-fueled internal combustion engine and a zero-emission propulsion system. B. Electric or compressed air driven units are considered.

Hybrid powertrains are currently one of the most viable solutions for improving fuel economy and reducing emissions at a relatively low total investment cost compared to lithium-ion battery electric powertrains. A hybrid powertrain consists of two power units, including an internal combustion engine and an auxiliary power unit powered by a clean energy source such as a battery or compressed air unit. Hybrid powertrains allow conventional internal combustion engines powered by fossil fuels to operate under optimized conditions to reduce fuel consumption and pollutant emissions.

II. Background

In today's world most of the vehicles we see on road are either powered by petrol/gas or are electric. The former option as a fuel is most definitely Non-renewable and is also responsible for climate change in major aspect. The latter is also shaping the world to move towards renewable sources butit is not completely renewable. Thus, air as a fuel is chosen as it is renewable, has zero carbon emission and is cost effective.

III. Objectives and Scope of the project

Although some advancements have been made by MDI and TATA Motors in this domain; these are made in the four-wheeler segment. The project in this phase aims to develop a two-wheeler air powered vehicle using pneumatic cylinders as main power generating source of the vehicle. If this is scaled and made it a level where it can carry a group of 30-40 people, then contracts with government can be made to develop them into public transport.

IV. Literature Survey &Proposed Work

The exhaust emission standards are getting more and more stringent and there now exists a discussion about the introduction of a mandatory emissions standard for CO2, a greenhouse gas that contributes to the climate change which is an issue of growing international concern. This demand for lower exhaust emission levels together with increasing fuel prices leads to the demand of combustion engines with better fuel economy, which forces engine developers to find and investigate more efficient alternative engine management. Gasoline is already the fuel of the past. Automobile manufacturers know all of this and have spent lots of time and money to find and develop the fuel of the future. An air powered engine is a type of motor which does mechanical work by expanding compressed air. Pneumatic motors generally convert the compressed air energy to mechanical work through either linear or rotary motion. Linear motion can come from either a diaphragm or piston actuator, while rotary motion is supplied by either a vane type air motor, piston air motor, air turbine or gear type motor. Compressing a gas into a small space is a way to store energy. When the gas expands again, that energy is released to do work [1].

Two centuries before that Dennis Papin apparently came up with the idea of using compressed air (Royal Society London, 1687). The Mekarski air engine was used for street transit (In 1872), consisting of a single stage engine. A numerous locomotives were manufactured and a number of regular lines

were opened up (the first in Nantes in 1879) [1]. Robert Hardie introduced a new method of heating that at the same time served to increase the range of the engine which in turn helped to increase the distance that could be traveled at a stretch (In 1892). The engine as a compressor during deceleration, air and heat were added to the tanks, increasing the range between fill-ups. The first urban transport locomotive was not introduced until 1898, by Hoadley and Knight, and was based on the principle that the longer the air is kept in the engine the more heat it absorbs and the greater its range. Charles B. Hodges will always be remembered as the true father of the compressed air concept applied to cars, being the first person, not only to invent a car driven by a compressed air engine but also to have considerable commercial success with it. Guy Negre has developed an engine that could become one of the biggest technological advances of this century, after twelve years of research and development. He designed a low consumption and low pollution engine. First air cars will almost certainly use the Compressed Air Engine (CAE) developed by the French company, Motor Development International

(MDI). Air cars using this engine will have tanks that will probably hold about 3,200 cubic feet (90.6 kiloliters) of compressed air. The vehicle's accelerator operates a valve on its tank that allows air to be released into a pipe and then into the engine, where the pressure of the air's expansion will push against the pistons and turn the crankshaft. This will produce enough power for speeds of about 35 miles (56 kilometers) per hour. When the air car surpasses that speed, a motor will kick in to operate the in-car air compressor so it can compress more air on the fly and provide extra power to the engine [5].

Piston-type CAEs have been commonly used in high-power machines that require a high-starting torque. Compressed air is supplied intermittently instead of continuously so that the air consumption is much less than that of the rotary compressed engine [13]. Piston-type CAEs are powered by compressed air, which is stored in a tank. Instead of mixing fuel with air and burning it in the engine to drive the pistons with hot expanding gases, compressed-air engine use the expansion of compressed air to drive the pistons. Thus, in CAEs, the pressure outside of the intake valve (at the intake port) is always higher than that inside the cylinder. The intake valve must be modified to open and close at high pressures, and the cam profile must be modified to change the engine from a 4-stoke to a 2-stroke operation. Therefore, the conventional combustion engine does not applied to the CAE [7].

V. WORKING

A. Introduction to Components

1. Two-wheeler frame:

   The two-wheeler frame will serve as the main skeleton for the other electric and pneumatic components. The main aim is to design the frame as light and strong as possible within certain cost limits. The frame needs to have good strength to weight ratio.

2. Compressed Air tank:

   The air tank will consist of compressed air which is fuelled from a compressor. It will be connected to valves and hoses for movement of the fluid.

3. Pneumatic single piston cylinder:

   This is the main power generating source of the vehicle. Expanded air is passed into the cylinder and then it is compressed by piston which results in power generation for the vehicle.

4. Crank lever mechanism:

   This mechanism serves as the power transmission system for the vehicle. Power is generated at the cylinder and is transmitted via crank lever mechanism to the drive wheels.

5. Electronic controlled valves:

   Solenoid valves will be used which will control the flow of the air from the air tank outlet.

   - 2/2 valve for single cylinder use
   - 3/2 valve for double cylinder or a 3-way electric ball valve

6. Flexible Rubber Hose:

   Flexible rubber hoses are used for transmission of air.

7. Arduino Circuit:

   To provide a relay and electrical system to the vehicles, arduino will be used. It will also be used the control the valve timings.

8. LiPo batteries:

   Small power supply using normal LiPo batteries which can be recharged (for current use).

9. Infrared Beam Sensor:

   To measure the angle by counting the number of teeth on the driver sprocket to help the relay system to control the pressure supplied to the piston cylinder.

10. Push button Switch:

    To reset or zero down the angle measured by the IR beam sensor.

11. Driver and driven sprocket and chain:

    This will consist of the drive mechanism to the wheels.

B. Line Diagram

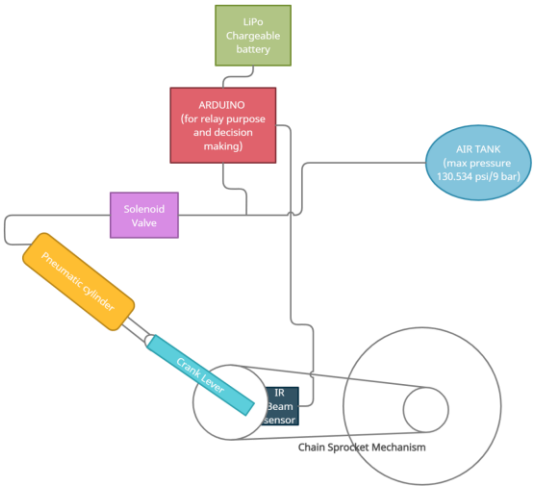

Fig 1

C. Workflow and Process

1 The compressed air tank is firstly filled with compressed air at a pressure of 9 bar.

2 This tank is then connected to the electrically controlled valves. This flow of air from the tank to the valves is controlled by the arduino which is programmed to relay the compressed air according to necessity.

3 The compressed air when it reaches the valves is made to flow through the flexible rubber hose connected to the pneumatic cylinder. This is the flow of air until now.

4 Now once the piston starts to move due to pressure of the air the end of the cylinder is connected to a crank mechanism which helps in moving the drive sprocket. Behind this drive sprocket there is an IR beam sensor which helps in measuring the angle of the rotation done by a fixed point/ tooth on the sprocket.

5 The data of angle received from the IR beam sensor is then conveyed to the arduino which then replies to the system by beams of adjusting the pressure of the air by means of valves.

6 Such working majorly guides in the initial stroke performed by the stroke thereby providing the initial torque to the wheel.

7 The driver sprocket then conveys the rotational energy to the driven sprocket and the wheel is set into motion.

VI. Results& Discussion

From above calculation we can say that with 40 km/ hr velocity we should capable of get energy 25.44 KW which is enough for low distance tour.

For identical electricity we want to get 486.1 N. m torque.

To obtain equal torque.

The project is still in the calculation phase. There is needfor repetitive analysis and simulation of Actuator circuit is needed for proper verification of the results achieved.

VII. Conclusion

For the entire disruption, it can be said that using an air vehicle results in less air pollution. The advantages of using this zero-emission technology for emissions are clear. Additionally, cost savings and local job creation are project goals. The lack of gasoline and its exorbitant cost are also addressed with air cars. There will be a shortage of gasoline (petrol, diesel), and in the future, the only option will be an engine that operates on compressed air. This is because the price of gasoline and diesel is rising, and the price of oil is prone to fluctuation for motorists.

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Carrier Bot

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Abstract*— A bot that can help us in many areas such as carrying objects, work with more precision in less time in every kind of work. A robot that can help us in the hospital or bring medical supplies in any emergency will be more useful for doctors in emergencies. This type of robot has so many advantages and will be useful in the future. This type of robot can be close to people is very possible. This useful project is focused on trying to follow the right person or obstacle. In this robot, infrared sensors are used to move the robot in direction and ultrasonic sensor for forward and backward direction. We used an Arduino Uno microcontroller as the brain of this project. This robot is powered by four DC motors and controlled by a motor driver. The main purpose of designing this useful project is to make our life better and more luxurious. In this project, a robot car senses a person using an IR sensor automatically and follows the person and obstacles. This type of robot will be more useful and will be the trend of the future.

Keywords—: Arduino, DC gear motor, Infrared sensor, Microcontroller, Ultrasonic sensor, Robot.

I. INTRODUCTION

The aim of the projects is to design a robot that can be controlled using an Android mobile phone. The robot is controlled wirelessly via Here in the project, an Android smartphone is used as a remote control to control the robot. Android is a software package for mobile devices that includes an operating system, middleware, and key applications. Android boasts a healthy range of connectivity options, including Wi-Fi and wireless data over cellular connections (such as GPRS, EDGE (Enhanced Data rate for GSM Evolution) and 3G). Android provides access to a wide range of useful libraries and tools that can be used to build rich applications. In addition, Android includes a full set of tools that were built from the ground up with the platform, giving developers high productivity and deep insight into their applications. A specification for short-range radio frequency (RF) connectivity technology that promises to change the face of computing and wireless communications. It is designed as a low-cost wireless networking system for all classes of portable devices such as laptops, PDAs (personal digital assistants) and mobile phones. It will also enable wireless connections for desktop computers, so the connection between monitors, printers, keyboards and CPUs will be cable-free. The control device of the entire system is a microcontroller. RFID module, DC motors are connected with microcontroller. Data received by the module from the Android smartphone is fed as input to the controller. The controller acts on the robot's DC motors accordingly. The robot in the project can move in all four directions using an Android phone, this task will be done using an app and voice commands. In performing this task, the controller is loaded with a program written using the Embedded 'C' language.

We are designing a robot which can follow humans and carry weight for them and traverse rough landscapes due to its unique design.

The Robot uses a combination of Ultrasonic and infrared sensors to track an object. The device is really very simple to build and very effective.

We have added the rocker bogie mechanism to the robot to make it traverse through rough terrain.

The mechanism relies on the algorithms provided in the raspberry-pi which will help in recognition and mobility of the carrier Bot .

II. PROBLEM STATEMENT

We are all aware of the difficulties aged people face while carrying luggage from one place to another, the same goes for the people with physical disabilities. This carrier bot is designed to solve these problems at different locations like Airport, Malls, Warehouses by carrying all the luggage without much attention of the owner. The Bot is fitted with a Rocker boogie mechanism which helps it to traverse rough terrain as well as stairs, it follows the person with the unique Bluetooth address and uses algorithms from the Arduino to distinguish between things and plot a path for the destination.

III. LITERATURE REVIEW

The techniques used to calculate the relative positions of the transmitter and receiver use the PIR and RF localization system as a wireless pyroelectric infrared sensor fusion system to monitor the location information of robots and people. It reduces the error of high-frequency localization information using a dynamic triangulation (DTN) method designed by tiles. An algorithm called as WPIR interference algorithm is also used. This algorithm determines a fused position from both a PIR localization system and a radio frequency signal localization system that uses a received signal strength (RSS) tile propagation model. They developed and experimentally demonstrated a WPIR sensory fusion system that can be successfully used in the localization of targets such as humans and robots. With a precise localization mechanism for the indoor environment of the tiles, the provision of appropriate services to people can be realized.

A mathematical algorithm can also be used that uses DOA measurements from sources with known positions to estimate the vehicle's position and heading. The parameters ΘA and λA show the position of the vehicle and HA shows the direction of the vehicle. ΘEi and λEi show the position of the emitter and Bi shows the direction of the emitter. These values are calculated using mathematical formulas. The error in the calculation of these values is taken into account in the mathematical equations and the output is adjusted accordingly. If a new error appears in the system, it must be included in the equations.

A method to calculate the position of the receiver with respect to the emitter uses radio frequency identification (RFID) technology to navigate a location. A proposed cordic architecture with floating arithmetic operation is implemented and verified on FPGA chip. The cosine law is used to calculate the location of the reader with respect to fixed locations of high frequency RFID tags. The CORDIC algorithm is adapted to the cosine rule

An RF-based system for locating and tracking users inside buildings is provided. The signal strength information gathered at multiple receiver locations to triangulate the user's coordinates is used by RADAR. Both empirically determined and theoretically computed signal strength information is done using Triangulation. Experimental results are quite encouraging. With high probability, RADAR is able to estimate a user's location to within a few meters of higher actual location. Larger classes of location-aware services can be built over an RF local-area wireless data network. Using the synchronized timestamps, we mixed all of the traces collected during the off-line phase into a single, unified table containing tuples of the form (x,y,d,ss,snr,), where i E {1,2,3}corresponding to the three base stations. For each (x,y,d) tuple, we computed the mean, the standard deviation, and the median of the corresponding signal strength values for each of the base stations. For much of our analysis, we use the processed data set rather than the original, raw data set. To determine exact as well as closest matches we wrote routines to search through the processed data set. There is a lot of database research literature that describes efficient data structures and algorithms. The focus of the research is on the analysis and not on developing an optimal closest match implementation.

A Bluetooth controlled robot contains an RF transceiver; baseband and protocol stack and provide services allowing the connection of various devices and the exchange of different data classes. Bluetooth devices can be divided into slave and master, which are able to actively initiate and negotiate with other B1uetooth modules. They have various effective ranges in different situations. This is because of the influence of the environment, material coverage, battery's power and antenna configuration. The range is lower than the theoretical distance due to attenuation caused by signal reflections. For different classes of device and maximum power, their specified ranges are distinct. The distance for Class 3,2 and 1 radios are up to 1, 10 and 100 meters. Mobile devices are based up on class 2 radio are mostly found in industrial environments.

Another way to control the robot is by sending directions to the microcontroller with the help of Bluetooth module, then Arduino handles the motor driver which further supports the dc motors and enables the high signal at specific motor pins. The motor driver has several pins and those pins are for power supply, ground, and each dc motor has its own respective pins which when gets a high signal activates the dc motor. The distance of the robot from the obstacle is calculated by the ultrasonic sensor which gives an output on the app screen showing the distance

IV. METHODOLOGY

A systematic research methodology is adopted keeping in mind the ultimate goal of a fully functional and autonomous human following Carrier robot. A decentralized top down approach is used for this project. The project is divided in to three modules. Each module is independent from one another. Different phases were carried out step by step, starting from basic sensor testing and proceeding towards obstacle avoidance, object detection, object tracking and data transmission. Due to the decentralized approach, all modules and sensors act independently. Data obtained by different sensors and modules is collectively analyzed and an intelligent decision on the basis of information obtained is made that instruct the robot to follow a particular direction. Two separate units are used i.e. microprocessor and a controller. The processing is carried out by microprocessor and the information obtained by the sensors is controlled by a controller i.e. Arduino board. A serial communication between microprocessor and controller is established to exchange the visual sensing information. This approach was most suitable because if there is a fault in any one of the modules then it would not affect the entire system. Hence this provides the best possible results by maintaining accuracy. Human tracking, obstacle avoidance, maintaining a specific distance from the object and establishing a communication link between microprocessor and controller are the main aspects of this project..

The implementation of human interactive robot seems to be an easy task but there are some problems related to it. For example, detection of a particular tag. Similarly the tag needs to be unique so that it should not be merged into colors in a vivid environment. So we have designed a novel algorithm to overcome this problem. There are several features of the project such as the mechanical structure, design of circuits, tag detection and intelligent tracking system. The implementation of human interactive robot is as follows

A. *Design of a custom tag*

In order to make the target distinctive and unambiguous, a tag was designed in particular. This tag had four different colors in box arrangement. The whole research is based on the fact that the target has to be specific to the robot. The robot should only detect that target and not some other target. All these colors enable the robot to detect the person by tracking the tag. This tag is placed on the person that needs to be pursued. Once the tag is put on the person the robot detects the colors and recognizes the target through the detection

B. *Design of Mechanical Structure*

The mechanical structure of the robot is comprised of a rocker-boogie mechanism. It is designed keeping in view that the camera on robot has to be mounted over a certain height from the ground. The height of this camera is adjustable according to height of a person so that better visual information can be obtained. So initially the height of the camera is set up to 4

C. *Image Processing Algorithm*

A novel algorithm to process the real time video is used to detect and follow the unique tag. We have used a computer vision camera for recognizing the tag at the back of person and an OpenCV python Platform to develop this algorithm. In this algorithm, a tag having the four color are used. The algorithm is designed in a way that the tag is only detected when the four colors are all together and it that particular order. Once the tag is detected, the centroid of the common region of four colors is found to get the center coordinates of the tag. These center coordinates are then serially transmitted to control unit for further processing and to make an intelligent decision by fusing it with information obtained by the other sensors and modules.

V. APPLICATIONS

Looking deeply into environment or our surrounding, we will be able to interpret that “YES” there is a need of such robots that can assist humans and serve them. Such a robot can be used for many purposes. With a few changings, the robot can act as a human companion as well
Some other applications of the robot are –

- Can assist in carrying loads for people working in hospitals, libraries, airports etc
- Can serve people at shopping centers and public areas.
- Can help elderly people, special children and babies
- Can follow a particular vehicle.

VI. ADVANTAGES

- The use of both antenna and PIR technology ensures accurate calculation of position for direct line of sight.
- Calculation of position using only triangulation of the emitter is a fast process.

VII. DISADVANTAGES

- Combining PIR and antenna data requires lots of time.
- The use of only triangulation method may produce inaccurate results

VIII. CONCLUSION

A successful implementation of a prototype of human following Carrier robot is illustrated in this paper. This robot does not only have the detection capability but also the following ability as well. While making this prototype it was also kept in mind that the functioning of the robot should be as efficient as possible. Tests were performed on the different conditions to pin point the mistakes in the algorithm and to correct them. The different sensors that were integrated with the robot provided an additional advantage. The human following robot is an automobile system that has ability to recognize obstacle, move and change the robot's position toward the subject in the best way to remain on its track. This project uses arduino, motors different types of sensors to achieve its goal. This project challenged the group to cooperate, communicate, and expand understanding of electronics, mechanical systems, and their integration with programming. A successful implementation of a prototype of human following robot is illustrated in this paper. This robot does not only have the detection capability but also the following ability as well. While making this prototype it was also kept in mind that the functioning of the robot should be as efficient as possible. Tests were performed on the different conditions to pin point the mistakes in the algorithm and to correct them. The different sensors that were integrated with the robot provided an additional advantage. The human following robot is an automobile system that has ability to recognize obstacle, move and change the robot's position toward the subject in the best way to remain on its track. This project uses arduino, motors different types of sensors to achieve its goal. This project challenged the group to cooperate, communicate, and expand understanding of electronics, mechanical systems, and their integration with programming.

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Enabling High-Speed Wireless Communication for Hyperloop Transportation Systems

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***Abstract*—Hyperloop transportation systems require robust and reliable wireless communication to ensure seamless communication and control within the Hyperloop. In this study, we focus on four key concepts that are critical for enabling high-speed wireless communication in Hyperloop transportation systems: LTE-R, GSM-R, Wi-Fi 6, and 5G-NR. Our research aims to provide a comprehensive understanding of these concepts and their suitability for Hyperloop wireless communication. This includes evaluating the performance of LTE-R and GSM-R networks in a high-speed Hyperloop environment, exploring the capabilities of Wi-Fi 6 and 5G-NR for supporting high-bandwidth applications, and identifying the challenges and opportunities associated with these technologies. Our findings have the potential to inform the selection and implementation of wireless communication technologies for Hyperloop transportation systems and support the development of this innovative mode of transportation.**

***Index Terms*—LTE-R, 5G-NR, GSM-R, WiFi-6**

I. INTRODUCTION

The evolution of trains into new forms and a breakthrough in terms of transportation. With hyperloop, vehicles, referred to as pods, gradually accelerate through a low-pressure tube using electric power. After trains, planes, and boats, the Hyperloop intends to offer a new means of transportation. With the guarantee in improving the safety, speed, cost, and comfort of trains, vehicles, and boats. The hyperloop also aims to be convenient, weatherproof, and self-sustaining. Hyperloop Technology consists of a long vacuum tube, and it has a compartment like a capsule. Those compartments are called pods. These pods run at high speed inside the vacuum tube. These tubes are called loops. The inside of the pod has normal pressure while the tube is almost vacuum, creating a pressure difference that must be accommodated for in the design. As a result, the pod behaves like an aircraft-like pressure vessel. The fundamental feature of the pods design is a cylinder, which is an ideal shape for this pressure vessel. Since the tube cannot be brought to absolute vacuum, the Hyperloop pod's shape will still retain aerodynamic characteristics. It mainly uses two types of technology- Magnetic levitation and Air pressure. Because of this, there is very less friction between the pods and the tube. Due to this, its speed is so fast that it leaves the maglev train too far behind. Because in this technology transportation takes place in the loop itself, which means when passengers want to travel, they will travel through this loop. Hence this is named hyperloop technology. For such high speed hyperloop technology following wireless communication technologies has been given below:

GSM-R:

GSM-R is based on the cellular GSM technology, with further enhancements specific to the requirements of Railways. The Radio link uses both FDMA (Frequency Division Multiple Access) and TDMA (Time Division multiple Access[1].

LTE-R:

LTE for Railways (LTE-R) is a next-gen communications network dedicated for railway services, enabling high-speed wireless voice and data communications inside trains, from the train to the ground and from train to train. This network supports voice communication among drivers, control center operators, maintenance and other railway staff supporting; push-to-talk group communication, broadcasting, location-dependent addressing and multilevel prioritization.[2]

Wifi6:

IEEE 802.11ax, officially marketed by the Wi-Fi Alliance as Wi-Fi 6 (2.4 GHz and 5 GHz and Wi-Fi 6E (6 GHz), is an IEEE standard for wireless local-area networks (WLANs) and the successor of 802.11ac. It is also known as High Efficiency Wi-

Fi, for the overall improvements to Wi-Fi 6 clients in dense environments.

5G NR:

5G New Radio, or 5G NR, is a set of standards that replace the LTE network 4G wireless communications standard. An important goal of 5G NR is to support the growth of wireless communication by enhancing electromagnetic radiation spectrum efficiency.

II. THEORETICAL BACKGROUND

India has been consistently pushing efforts to promote high speed railways since 1980s. As a part of this venture, various feasibility and design reports have been prepared by MNCs to provide financial assistance, selection of appropriate technologies and initiation of construction tasks.
Along with the introduction of HSR, India is also trying to prioritize safety and this is evident through the utilization of multiple technologies in their implementation such as REMMLOT and 3D Technology.
However, as per the international standards, India so far lacks railways that can be classified as HSR as the speed of HSR is usually above 200 km/hr. Additionally, the country is putting in efforts to promote sustainability with making lives of the people easier.
The control systems used in HSR use “Global System for Mobile Communications - Railway” as major communication system.

Data is being collected by sensors which are placed in two ways. One way is placing the sensors at the pod to collect the current situation of the pod. The sensors placed at the infrastructure shall determine the speed of the pod. Along with speed, the location of the pod and air pressure inside the tube can be tracked easily by this setup. A centralised data processing system shall also be present to make maximum decisions related to the pod and the tube it runs through.[3]

To generate communication in the system, the part of this system is divided into two parts: Pod to Pod i.e. P2P and pod to infrastructure i.e. P2I which means the communication from the pod towards that centralised system.

Numerous Hyperloop components must be joined via digital buses or ethernet switches in order to carry out communications operations efficiently.

The taxonomy of communication-based services is constructed as follows:

a. Critical Communication Applications: address all aspect required for the Hyperloop service to run smoothly.

In the context of hyperloop, critical communication refers to communication systems that are essential for the safe and efficient operation of the hyperloop system. These communication systems might include train control, signaling, and safety systems.
These are mission-critical and safety-related, therefore various stakeholders must exchange the information produced by these apps (e.g., transportation operator and infrastructure operator). This set of systems demands the highest Safety Integrity Level (SIL 4) in order to reduce the risk brought on by equipment failure. Because the information supplied is authorizations for capsule position, speed, and movement, the bandwidth needed is minimal (less than 10 Mbps per capsule). Extremely stringent delay requirements—in the worst scenario, fewer than 5 ms delay and less than 1 ms jitter—are the most crucial in this situation. Because the signalling information has temporal caducity and because UDP packets without retransmissions are typically used in these sorts of communications to reduce jitter.

b.Performance Communication Applications: incorporate all programmes required to enhance capsule performance and closely resemble cutting-edge HST communications .
Performance communication refers to communication systems that are optimized for speed and efficiency and enable the real-time transfer of data between the various components of the hyperloop system, such as train location and speed, passenger information, and network status.
Since the security of the capsule does not depend on these applications, they will be classified as SIL 2. For this application, the onboard 4K real-time video CCTV surveillance is used to help automated driving. To enhance operating and passenger security, video surveillance is required for the region in front, back, and within the capsule and to make driving automatic. Although CCTV might technically be regarded a critical application (SIL 4), it would be extremely difficult (almost impossible) to meet the latency requirements of the critical communications system, hence they are typically treated as SIL 2. In addition to some basic internet services for the passengers like instant messaging, email, and voice calls that can enhance the performance of the capsule and the comfort of the passengers, other performance services include capsule diagnostics and monitoring and passenger information.
With regard to each of these services, a data rate of around 100 Mbps is needed, along with a latency of no more than 10 milliseconds, and two wireless communication networks—one for the Hyperloop services and the other for passenger performance services. On-capsule voice communication, station public address, wireless data communication for Hyperloop staff at platforms, capsule departure data communications, augmented reality data communication, and

real-time translation of speech data communication are just a few of the applications that will be supported.

c.Business Communication Applications: Onboard users anticipate having access to the internet for both work and play, including in-car video conferences, online gaming, chatting, live broadcasts, etc. In order to provide multimedia information systems and on-demand streaming services, these telecommunication services must have a high data rate and good QoS. However, there are no safety implications for this. Business communication refers to communication systems that support the decision-making and coordination processes of the hyperloop operator and other stakeholders, such as customer service, marketing, and financial management. These systems might include email, video conferencing, and enterprise resource planning (ERP) systems.
The Hyperloop passenger experience will be more immersive and connected than that of current transportation industries, which is typically delivered by telecommunication operators. In order to give passengers the impression that they are outdoors looking at the actual world even if they are inside a tube, capsules will include augmented reality windows. [4]

The design of communication network in hyperloop system follows a concept of Capsule-to-X which serves as a medium of transmitting data from capsule to any entity that may bring an effect in the capsule. The following types of communication are used in the system:
a. Capsule to Grid: "Capsule to grid" refers to the communication and control systems used to manage the movement of the hyperloop capsules within the hyperloop system. It involves the exchange of information between the hyperloop capsule and the central control system, or "grid," in real-time, allowing for the efficient and safe operation of the hyperloop system. This communication and control system can include real-time monitoring of the capsule's position, speed, and status, as well as the management of passenger information and other system-wide data. The capsule to grid communication system is critical for ensuring the safety and reliability of the hyperloop system.
b. Capsule to Passengers: "Capsule to passengers" refers to the communication and information systems that are available to hyperloop passengers, typically within the hyperloop capsule itself. These systems can include passenger information displays, audio announcements, Wi-Fi connectivity, and other in-cabin technology that helps passengers navigate the hyperloop system, stay informed about their journey, and have a more comfortable experience. Capsule to passengers communication systems play an important role in enhancing the overall passenger experience and making the hyperloop a more attractive transportation option.
c. Capsule to Centralized Network: "Capsule to centralized network" refers to the communication and control systems used to manage the hyperloop capsules within the hyperloop system. The communication and control system is typically centralized, meaning that all data and information from the hyperloop capsules are transmitted to a central control center, where it can be analyzed and used to control the movement of the capsules. This communication and control system is critical for ensuring the safety and efficiency of the hyperloop system. It allows for real-time monitoring of the capsule's position, speed, and status, as well as the management of passenger information and other system-wide data. The capsule to centralized network communication system is also essential for ensuring that the hyperloop system operates smoothly and reliably, and for responding quickly to any issues that may arise.
d. Capsule to Capsule: "Capsule to capsule" refers to the communication and control systems used to manage the movement of hyperloop capsules within the hyperloop system. This communication and control system allows for real-time exchange of information between the hyperloop capsules and the central control system, enabling the efficient and safe operation of the hyperloop system.
Examples of capsule to capsule communication in a hyperloop system include the exchange of information on the location, speed, and status of other hyperloop capsules, allowing the system to dynamically adjust to changing traffic conditions and minimize potential collisions. The capsule to capsule communication system is also essential for ensuring that the hyperloop system operates smoothly and reliably, and for responding quickly to any issues that may arise.
e. Capsule to Infrastructure: "Capsule to infrastructure" refers to the communication and control systems used to manage the interaction between the hyperloop capsule and the physical infrastructure of the hyperloop system. This communication and control system allows for real-time exchange of information between the hyperloop capsule and the various components of the hyperloop infrastructure, such as the guideway, propulsion system, and station platforms.
Examples of capsule to infrastructure communication in a hyperloop system include the exchange of information on the capsule's position, speed, and status, as well as the management of energy transfer, pressure control, and other physical parameters. The capsule to infrastructure communication system is critical for ensuring the safety and reliability of the hyperloop system, as well as for optimizing energy efficiency and system performance.[5]

III. METHODOLOGY

Parameter	GSM-R	LTE-R	Wifi-6	5G NR
Frequency Band	Uplink: 907.8–909.4 MHz · Downlink: 952.8–954.4 MHz	· Uplink: 1920 - 1980 MHz · Downlink: 2110 - 2170 MHz Width of Band: 60 MHz	2.4/5 GHz	24.25 – 27.5 GHz
Channel Bandwidth	0.18 MHz	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, and 20 MHz	20–160 MHz	50, 100, 200, 400 MHz
Data Rate	64 Kbps/channel	50/10 Mbps. Peak rates of up to 1 Gbps.	600 Mbps (80 MHz 1 SS) 9.6 Gbps (160 MHz, 8SS)	3Gbps
Max Power	50 dBm	50 dBm	23/27 dBm	50 dBm
Technology Used	Circuit Switching	Packet Switching	MU-MIMO, OFDMA	OFDM
Jitter	100-300 ms	3 ms	1 ms	10–100 _s

Advantages of GSM-R are:

- Improved safety: GSM-R provides real-time communication between train drivers and dispatchers, improving overall safety on the railway network.
- Increased efficiency: GSM-R enables more efficient train management, reducing delays and increasing the capacity of the railway network.
- Better coordination: GSM-R allows for better coordination between different trains and dispatchers, reducing the risk of incidents and improving the overall flow of traffic.

Limitations of GSM-R are:

- Cost: Implementing and maintaining a GSM-R network can be expensive for rail operators.
- Limited coverage: GSM-R coverage can be limited in certain areas, especially in rural or remote regions, where the network infrastructure may not be fully developed.
- Interoperability issues: GSM-R is a proprietary technology, and compatibility between different rail operators' networks may not always be guaranteed.

Advantages of LTE-R are:

- Increased bandwidth: LTE-R provides higher bandwidth and data rates than GSM-R, enabling the transmission of large amounts of data, including multimedia applications.
- Improved coverage: LTE-R provides better coverage and more robust network connectivity than GSM-R, especially in areas with challenging terrain or weather conditions.

Limitations of LTE-R are:

- Cost of deployment: Deploying an LTE-R network can be expensive, particularly for rail operators that

need to upgrade from existing communication systems.

- Interference with other services: LTE-R operates in the same frequency band as other communication services, which can result in interference and degradation of network performance.

- Network complexity: LTE-R networks can be complex to design, deploy, and maintain, requiring specialized technical expertise and equipment.

Advantages of 5G-NR are:

- Less tower congestion
- 5G networks allow users to avoid them due to better speed and more bandwidth.
- High resolution and bi-directional large bandwidth shaping.

- High resolution and bi-directional large bandwidth shaping.

Limitations of 5G-NR are:

- Limited global coverage
- The main disadvantage of 5G is that it has limited global coverage and is available only in specific locations.
- Decreased broadcast distance it requires more towers for coverage that is time-consuming and expensive. Rain can also cause problems to 5G coverage that needs more protection.

Wi-Fi 6 is the latest version of the Wi-Fi standard for wireless networking. It is also known as 802.11ax, referring to the technical specifications developed by the Institute of Electrical and Electronics Engineers (IEEE). Wi-Fi 6 builds upon the previous generations of Wi-Fi and introduces several new technologies that improve the performance and efficiency of wireless networks.[6]

Advantages of Wifi-6 are:

- Range and connection capacity

This model has a spectrum extension of 12000 MHz in addition to a wireless LAN capacity that helps to grow the networks and the capacity of connections supported without generating bottlenecks in the future.
This is ideal to implement in business networks that are constantly growing, changing, and use a variety of applications and equipment. And we know that with the increasingly accelerated digital transformation in all economic sectors, it is likely that your company requires this evolution

- Enhanced wireless performance

Wi-Fi 6 could potentially deliver up to three times your wireless capacity, offering dramatically better performance for more connected devices, increasing productivity and efficiency, and providing a new and improved end-user experience.

- Extended battery life and reduced power usage

This new version for Wi-Fi networks allows better management of energy usage as it takes advantage of the benefits of TWT (Target Wake Time) technology, that detects when a device is in use and disconnects it from Wi-Fi when it is not. The process is so smooth that most people will not notice the difference.

Limitations of Wifi-6 are:

- Lack of compatibility

One of the downsides of Wi-Fi 6 is that it has not yet been widely adopted.

- Cost

Another negative aspect of Wi-Fi 6 is that in order to make the most out of its advantages and benefits, it is necessary to upgrade the devices and part of the infrastructure such as cat6a o cat7 quality cables, a new router with 1Gbps support, or AI MIMO antennas.

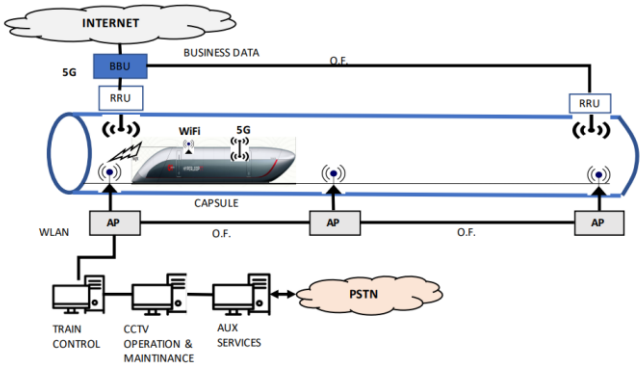

Figure 1: Communication network for WiFi-6

IV. CONCLUSION

Wi-Fi 6, also known as 802.11ax, is the latest iteration of the Wi-Fi standard for wireless networking. It offers several advancements over its predecessor, Wi-Fi 5 (802.11ac), including increased network capacity, improved network efficiency, and higher speed and reliability. Additionally, Wi-

Fi 6 is designed to support the growing number of connected devices and the increasing demand for high-bandwidth applications, such as streaming video and online gaming. These benefits make Wi-Fi 6 an attractive option for both consumers and businesses looking to upgrade their wireless networks.

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Sewage Cleaner & Waste Segregation System

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***Abstract*— The earliest form of sewer cleaning was hand excavation whereby labourers loaded sediment into barrows which were moved down the sewer and then lifted out at manholes by bucket. The work is not only dirty, unpleasant and dangerous. The major problem in manual scavenging is the health issues faced by the workers and more over the cleaning is done by human beings because of earning. Nowadays even though automation plays a very important role in all industrial applications, the proper disposal of sewages from industries and commercials are still a challenging task. Drainage cleaning system is proposed to overcome the real time problems. In this project our aim is to replace the manual work in drainage cleaning by introducing a automated system in an efficient way to control the disposal of wastages and with regular filtration of wastages. The amount of garbage produced is too large and the manual efforts required to process it is very tedious. With evolution of technology in every field, automated ways can be adopted to prevent the piling of the garbage. The waste segregator is designed to provide ease in the disposal of waste that is collected. The system consists of three bins, each one for wet, metal, and dry waste. The conveyer belt system detects the incoming waste and classifies it as metal, dry or wet using different sensors connected to the system and deflects it in the respective bin. The whole setup brings about automation and hence reduces the human intervention required in segregating the waste and provides successful collection of the garbage from the bin at the appropriate time. The system is driven by a microcontroller- Arduino, and the sensors are programmed.**

Keywords— Drainage , dry , wet , metal sensor , Arduino , segregation

I. INTRODUCTION

Manual Scavenging is the most nauseating thing to do; for others, it's the only way to make a living. From drains and sewers to septic tanks and railway tracks, more than half a million manual scavengers across the country are cleaning, carrying and disposing human excreta. They force themselves into choked sewers and septic tanks; hang on for hours, scooping out filth with bare hands and bearing the stench of sewage. Every year, hundreds of manual scavengers die, asphyxiated by poisonous gases. There are structural problems as well, which force people to

enter septic tanks. Septic tanks are designed badly. They have engineering defects which means that after a point, a machine cannot clean it. Adding to the problem is the fact that many cities do not have sewerage that covers the whole city. Sometimes, sewage lines are connected to storm water drains which get clogged and demand human intervention. Open drains, are also badly designed, allowing people to dump solid waste into them, which accentuates the problem. Improper disposal of plastic bags and bottles, napkins and other materials clog the drains. Few people take up this lowly job, not knowing that human faeces and urine harbour a variety of diseases. They may carry Hepatitis A, E. coli, Rotavirus, Nor virus, and pinworms. The community risks infection by coming in contact with 2 these wastes. That also explains why sewer workers die as young as 40, falling prey to multiple health issues: cholera, hepatitis, meningitis, typhoid and cardiovascular problems. In fact, repeated handling of human excreta without protection leads to respiratory and skin diseases, anaemia, jaundice, trachoma and carbon monoxide poisoning. It is not going to be possible to eliminate manual scavenging unless we create the right technologies. With proper use of technology, automated sewage cleaning machines can be built to save the lives of those unsung heroes.

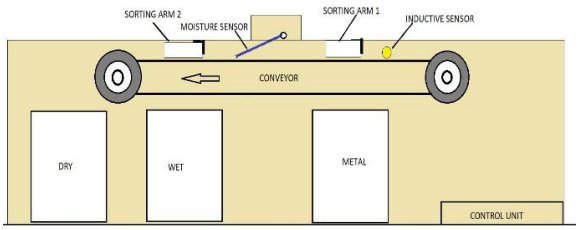
Every year, as the population grows, more waste is produced, which is a huge rise. Numerous risky issues have resulted from this. The landfills are created when garbage is accumulated across a big region of land, which can be dangerous. The scent of the decaying garbage pollutes the area by creating an offensive odour. The dumping of rubbish into water bodies contaminates the oceans and seas that connect them, which has an impact on the water's quality and the survival of aquatic life. The entire ecosystem is impacted when the hazardous chemicals are discharged into the atmosphere. As a result, waste management is a very important problem in the modern world. Many things can be altered and prevented if the waste created is properly managed at the source level. Waste may be properly disposed of and the Reuse, Reduce, and Recycle principle can be put into practise by classifying it into wet, dry, and metallic categories. The dry trash, metallic waste, and wet waste can all be recycled, and the wet waste can be broken down to make plant fertiliser. India demands an efficient waste management system due to its rapid urbanization and growing population. As a result, we've proposed automatic waste segregation. The waste is divided into three categories: dry, wet, and metal in this system.

II. METHODOLOGY

The concept behind this project is to automate drainage cleaning in place of the manual labour it actually requires. We all know how crucial water is to human existence, especially when it flows through a sewer clogged with trash like bottles

and polythene. These wastes in the water cause the drains to become clogged. Even though mechanical equipment is essential in today's industrial applications, properly disposing of sewage from businesses and industries remains a difficult issue. We use the "Automatic sewage cleaning system" design to solve this issue and save lives.
Nowadays, work is done automatically because it is important for all industries and requires no systemic effort. The automated method is being used to complete the work. However, automation now has a significant impact on all industrial applications. Industrial sewage waste disposal is a challenging task. This is a difficult challenge in businesses and commercials. Drainage pipes were used by people in earlier times to eliminate sewage water. When cleaning the block, there is a drawback that could result in human life loss: work in the drainage pipes. Some outside work is done in this project to help reduce the issue and save lives. The device is positioned across the drain so that only water flows through lower grids containing waste bottles, paper, etc. These grids are raised by teeth that are connected by a chain and are then withdrawn from the drain. The garbage is raised from the drain to the waste storage tank using a chain drive. The chain drive is powered by the dc motor. When the bucket is raised from the drain with the aid of a dc motor, the waste materials are divided by bucket and are kept in the waste storage tank. Dc motor control is crucial in a variety of applications. Every time the motor runs, automated drainage water cleaning eliminates all drainage issues and encourages a continuous flow of drain water without blockages. The second half, known as waste segregation, follows waste collection.

First, the trash is loaded onto a conveyor belt. As soon as the conveyor motor turns, an inductive proximity sensor detects the waste. Whether the waste is metallic is determined by the metal sensor. When waste is metallic, moving arm 1 slips it into bin 1, while the conveyor handles nonmetallic waste. It keeps rotating and is picked up by the moisture sensors. Waste is identified as moist if it is wet. If not, the waste is found to be dry. The moving arm 2 pushes the garbage into bin 2 if it is determined to be wet; otherwise, if it is determined to be dry, the waste goes directly into bin 3.



As illustrated in Fig 1, the detecting circuit is built using an inductive proximity sensor and a moisture sensor. To discriminate between different sorts of waste, each sensor has a particular purpose.The moisture sensor detects the presence of moisture in the waste, while the inductive proximity sensordetects the presence of metal.

Table no. 1: List of sensors

Type of Sensor	Type of detection
Metal sensor	Metals
Moisture sensor	Wet

A. Mechanical part

The mechanical portion of the project is the mechanism for rotating the waste separating section and dropping the waste into the correct bin. It consist one dc motor, one servo motor, and one sorting arm. Table 2 lists the motors used in this project, as well as their purpose.

Table no. 2: List of mechanical part

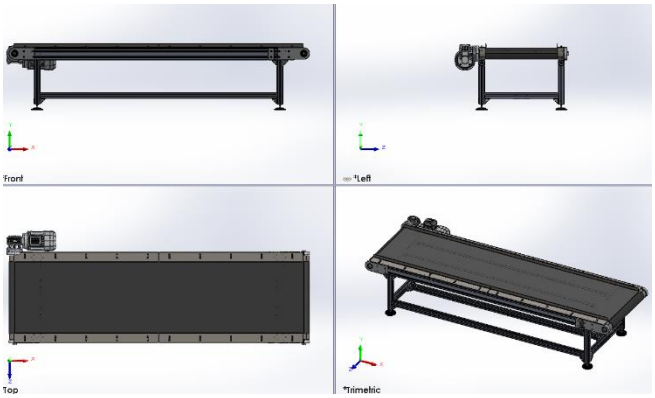
Parts	Working
DC motor	For rotating the conveyor belt withgarbage
Servo motor	For rotating the sorting arm to pushthe garbage
Sortin g arm	For pushing the waste into respective bin

A. Working

The segregation process in this system starts with a conveyor belt that rotates continuously with the help of a motor. We place the waste on this conveyor belt first. As waste moves forward, there is an inductive proximity sensor. It can detect whether the waste is metallic or nonmetallic. If the garbage is metal, the sensor sends an output to the Arduino, which then sends a signal to the sorting arm for push the waste into the metal waste bin. If the waste is not metallic, it goes to the next sensor station, which hasa moisture sensor.

Moisture sensors detect moisture in waste and provide output based on that. If the waste is wet, the Arduino sends a signal to the sorting arm, which causes the waste to be pushed into the wet waste bin. If the waste is dry, the Arduino does not provide any commands to the sorting arm, it will stay neutral. The dry waste is dumped straight into the dry waste bin at the end of the conveyor belt. As a result, the waste is separated.

CAD MODEL :



HARDWARE REQUIREMENTS

B. Hardware

ARDUINO KIT :

Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

1. *For Segregation :*

CONVEYOR BELT-

The belt is the moving object of the system. The system is a combination of at least two pulleys that ensure circular movement of the belt which pivots about them. The belt and the object placed on it move forward as the pulleys are powered. The pulley which is powered is the driver pulley and the unpowered pulley is the idler pulley.

DC MOTOR-

It is utilized to drive the conveyor belt. It is interfaced with the Arduino UNO by means of L298 bridge IC. The direct current energy is converted into mechanical energy with the help of the rotational motor. A variable supply voltage is used to control the speed of the engine. The speed is also affected by changing the quality of current in the field windings.

SERVO MOTOR-

It is used to deflect the waste to the respective bins. A servomotor is defined by "a rotary actuator or linear actuator that takes into account exact control of angular or linear position, velocity and acceleration." A suitable motor is coupled to a sensor for obtaining position feedback. The digital or analog input control signal represents the position directed for the output shaft.

MOISTURE SENSOR-

It is used to identify if the garbage is wet or dry. The content of moisture in the waste is tested and accordingly it is dropped in the appropriate dustbin.

METAL SENSOR-

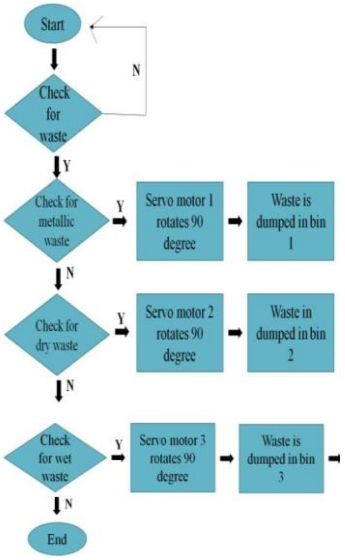
The presence of objects is detected without any physical contact with the help of proximity sensor. It detects objects by "emitting electromagnetic field or electromagnetic radiation and observes the changes in the field or return signal." The Inductive proximity sensor is used to identify the metallic waste. For the identification of paper and plastic Capacitive Proximity sensor is used. It also differentiates

between them as paper and plastic have different permittivity value.

IR SENSOR -

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation.

FLOW DIAGRAM :



III. CONCLUSION

The equipment is positioned across a sewer so that water can pass through the lowest portion of it. Plastic bottles, cans, diapers, and other floating items are gathered in the jaws of the device. Now that the motor is spinning thanks to Arduino, we can elevate. The chain begins to circulate as the motor operates at a lesser speed, lifting the jaws up. Jaws are used to lift the waste materials, which are then placed in a collection bin. The "safai karmacharis" (sewer cleaners) will come and empty the collection container once it is full, eliminating the need for hand scavenging.

India is a developing nation with the second-largest population in the world. It produces a lot of waste every day. There are 62 million tonnes produced. Urban India produces gallons of municipal solid waste (MSW) annually.

20% of which is processed, and 70% of which is collected.

It is highly challenging to dispose of the waste due to the nature of the many forms of waste. By promoting reuse, segregation significantly reduces waste. If segregation is carried out at the base level, treating the waste also becomes simpler. Figure 3 depicts the rise in garbage production from the year 2016 to the years 2030 to 2050 over the world.

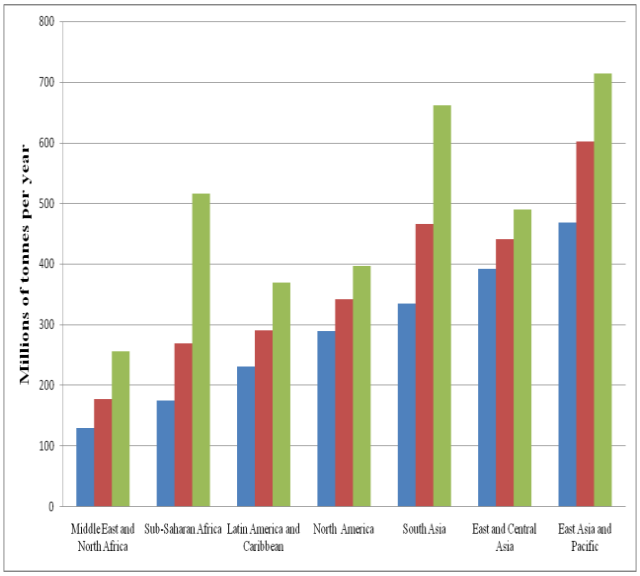


Fig. 3. Estimated increase in waste production across the world till the year 2050. The blue data represents the year 2016, red represents 2030,and green represents 2050.

Consequently, this shows the growing need for effective waste processing to preserve ecological equilibrium. Since there is no need for human supervision and the model described in this research uses less electricity, it is effective and long-lasting. The model can also determine when the trash can is full and request that the authorities come and pick it up. This effectively lowers the amount of labour, time, and fuel the collection van needs. This type is a great replacement for older trash cans and fits in nicely with the concept of smart cities. Future plans include making the bins solar-powered, using improved methods of garbage separation such digital image processing, and making the waste that is gathered in the bins compact to maximise storage space.

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Design Of Petrol Engine Flywheel For Variable Speeds

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Abstract — A flywheel is a type of reservoir that may be found in machines. It stores energy during periods in which there is an abundance of supply relative to the demand for energy and then releases that stored energy during periods in which energy demand is abundant. For instance, in internal combustion engines, the energy is only produced during the power stroke, which is far longer than the load on the engine. In contrast, in four-stroke engines, there is no energy produced during the suction, compression, or exhaust strokes. The flywheel stores the extra energy that is produced during the power stroke, and then releases it to the crankshaft during the other strokes of the cycle when there is no energy production. This keeps the crankshaft turning at the same speed throughout the cycle. The crankshaft has a flywheel attached to one of its ends, and this component performs a dual duty. To begin, its inertia helps to dampen vibrations by easing the transition from the power stroke to the power stroke of the next cylinder as it fires. Second, it serves as the mounting surface that is utilized to attach the engine to the weight that it is carrying. The project's objective is to create a flywheel for a multi-cylinder gasoline engine that makes use of a variety of speeds and then analyze the data to determine how to get improved outcomes. The calculations are used to create a drawing in two dimensions. CATIA, a 3D modeling program, is utilized in the creation of a parametric model of the flywheel. Additionally, the forces that are exerted on the flywheel are computed. By applying the forces that will be exerted on the flywheel within the analytical program Ansys, the flywheel's strength will be verified.
To compare the results, analysis is performed on two different materials: cast iron and aluminum alloy. CATIA is the industry standard for 3D product design because it offers productivity tools that are at the forefront of their field and encourage design best practices. ANSYS is a finite element analysis (FEA) software tool that may be used for a variety of purposes. The numerical approach known as finite element analysis is used to break down complicated systems into extremely small components, or elements, of a size that is specified by the user.

Keywords— Flywheel, Stress, ANSYS, Deformation, Energy.

I. Introduction

Flywheel

The flywheel is a disk of cast iron, aluminum, or zinc that is positioned at one end of the crankshaft to generate engine inertia. Inertia is characteristic of matter that allows any physical body to remain at rest or in uniform motion unless acted on by an external force. Inertia is a characteristic of matter, not a force.

Combustion happens at regular intervals throughout the operation of a reciprocating engine. The flywheel provides the inertia necessary to avoid engine speed decrease and probable crankshaft rotational halt between combustion intervals.
Variations in speed and force impact the flywheel, crankshaft, and other engine components throughout each stroke of an internal combustion engine. The crankshaft of a four-stroke cycle engine is rapidly accelerated during the power event by the fast action of the piston and connecting rod assembly. The flywheel's resistance to acceleration smoothes out part of the rpm and force deviation. The flywheel's inertia dampens the engine as a whole, evening off radial acceleration forces and rpm variations produced by the engine.

1.1 What is the function of a flywheel?

The flywheel, also known as a torque converter, aids engine performance by collecting part of the energy during the power stroke and releasing it during the other strokes.
The vibration damper (harmonic balancer) dampens torsional vibrations in the crankshaft caused by power impulses. As each cylinder ignites, the crank throw for that cylinder accelerates. The remainder of the crankshaft tends to lag, resulting in a twist. Torsional vibrations are produced, which are dampened or partially absorbed by the vibration damper.
The flywheel aids in the consistent spinning of the crankshaft and assists the engine in overcoming weights while starting the vehicle from rest as well as during operation. Even though a multicylinder engine's power impulses follow or overlap, extra smoothing out of the power impulses is needed. This is done by the engine flywheel. The flywheel is a massive metal wheel that is securely linked to the crankshaft. The flywheel gains kinetic energy as a result of its rotation; when the flywheel speeds up, it stores extra kinetic energy, and when it slows down, it releases that energy. The amount of energy stored by a flywheel for a given change in speed is determined by its

inertia, which is determined by its mass and effective diameter. The energy delivered to the crankshaft by the engine pistons varies, being largest when a piston begins its power stroke, considerably less on the exhaust and suction strokes, and negative during the compression stroke. These energy oscillations to and from the crankshaft. Cause equivalent changes in its speed; the flywheel's role is to lessen speed fluctuations by storing energy when the crankshaft accelerates and returning it when the shaft begins to slow down. The smaller the speed changes, the heavier the flywheel or the wider its diameter.

The flywheel is designed to withstand rapid changes in crankshaft (engine) speed. As a result, when a power impulse begins (with its initial high pressure), the crankshaft receives a brief forceful push (through the connecting rod and crankshaft). The flywheel, on the other hand, inhibits the crankshaft's desire to push ahead. As a result, the engine's brief power surges are smoothed out and it runs smoothly.

Because the flywheel also functions as part of the engine clutch, its back face is meticulously machined. A tiny depression on the flywheel's front face is utilized to identify the location of the piston in the first cylinder. The piston is at the top dead center when this indentation aligns with a particular hole in the bell housing (TDC). This indentation denotes the initiation of fuel injection into the first cylinder in certain engines. Some engines include markers on their flywheels that indicate the serial numbers of the cylinders where the compression stroke occurs. The flywheel markings and indentation are used to align the valve and ignition systems with the crankshaft's specified locations.

Furthermore, the flywheel features teeth on its outside edge; when the engine is cranked for starting, the electric-starting-moto pinion teeth mesh with these teeth.

A flywheel is often installed at the rear main bearing. Because it must carry the weight of the flywheel, this is frequently the longest and heaviest of the major bearings.

The flywheel's role is to help the engine idle smoothly by carrying the pistons through periods of the operating cycle when no power is produced.

The heavier the flywheel on the engine, the smoother the engine will idle. An extremely heavy flywheel, on the other hand, will cause the engine to accelerate and decelerate slowly due to inertia. Massive duty or truck engines feature huge and heavy flywheels for this purpose. Flywheels are light in racing engines and high-performance engines.

The flywheel's back surface is typically machined flat. This surface is utilized to match one of the clutch's surfaces. When no clutch is utilized in an automatic gearbox, a portion of the fluid flywheel or torque converter is joined to and becomes a component of the flywheel.

The energy differences during a whole cycle of a particular horsepower engine are largest if the engine has only one cylinder. To maintain the transient speed changes within normal bounds, single-cylinder engines require big flywheels. The energy changes in multicylinder engines grow smaller as the number of cylinders rises. The reason for this is that not only are the cylinders smaller, but their impulses are more frequent, and in the case of engines with several cylinders, one piston produces power while another is compressing. As a result, the needed size of the flywheel is quite tiny. The rotational weight of the cranks, crankpins, and big ends of the connecting rods is comparable to that of a flywheel. The rotor of a linked electric generator does as well. As a result, flywheels are not required in some big multicylinder engines and are hence not employed.

This is the large heavy metal disc attached to the crankshaft (and hence the pistons) on the engine side and has the clutch attached to it on the gearbox side, as well as the ring gear required to start the engine. The torque converter becomes the "flywheel" in an automatic gearbox; therefore this wheel is normally more of a plate.

II. LITERATURE SURVEY

A literature review is an assignment of a prior task that was completed by certain writers and a collection of information or data from research papers that were published in journals to advance with our task. It is a channel via which we might discover new ideas and ways of thinking. There have been many works of literature written in the past on the same topic; some of these articles have been taken into consideration and are the source of the concept for the project. Flywheels store energy more effectively than rechargeable chemical batteries, while also having certain advantages in terms of control, and as a result, mission-critical technology initiatives have lately shifted their attention to employing flywheels. The concept of storing energy in a rotating mass using a mechanism that is essentially no more complicated than a flywheel dates back millennia. This technique has only recently gained a lot of interest ever since the introduction of high-strength materials and magnetic bearings. The investigation of materials with great strength enables designers to achieve high working speeds, which results in the production of more kinetic energy. By utilizing magnetic bearings, it is possible to achieve high running speeds, resulting in bearing equipment that is cleaner, quicker, and more efficient even when subjected to harsh temperatures. Recent innovations in flywheel design have the potential to give orders of magnitude improvements in performance and service life, in addition to huge control torques and the capacity to store momentum for use in aerospace applications, launch vehicles, aviation power systems, and power supply.

The housing, magnetic bearings, motor/generator, flywheel rotor, and power transformation electronic system are the primary components that make up the flywheel system. Current investigations have concentrated on boosting the performance of the flywheel while still satisfying the safety factors, such as material, housing, and bearing failures. This is part of the development process for the flywheel. The computation of kinetic energy is the first step in the investigation of energy storage and the factors that contribute to its failure.

In 2012, Sushama G Bawane, A P Ninawe, and S K Choudhary developed a design for a flywheel and analyzed the process of selecting materials for it. To get a deeper comprehension of the mesh type, mesh size, and boundary conditions that must be implemented to finish an efficient FEA model, the FEA model itself will be discussed.

These algorithms were proposed by Hamid Reza Chamani and are based on the dynamic analysis of the crankshaft.

They were used in the design of flywheels for internal combustion engines.
It has been suggested by Sudipta Saha, Abhik Bose, G. SaiTejesh, and S.P. Srikanth that the value of the flywheel geometry design choices and their contribution to energy storage performance is significant. This contribution is presented utilizing computer-aided analysis and optimization processes on a few sample crosssections. The results of the proposed computer-aided analysis and optimization procedure show that intelligent design of flywheel geometry may have the potential to both have a significant effect on the Specific Energy performance and reduce the operational loads that are exerted on the shaft and bearings as a result of reduced mass at high rotational speeds.
It was recommended by Bedier B. EL-Naggar and Ismail A. Kholeif that the disk-rim flywheel be used because of its low weight. The mass of the flywheel is reduced as much as possible while still adhering to the limits placed on it by the necessary moment of inertia and the maximum allowable stress. The theory of spinning disks of uniform thickness and density is applied to both the disk and the rim in their own right, with adequate matching conditions at the junction between the two. After applying appropriate boundary conditions on the centrifugal stresses, the dimensional ratios required to achieve the desired minimum weight are calculated. It has been demonstrated that the desired design comes quite near to resembling a disk of uniform thickness.

III. OBJECTIVES AND METHODOLOGY

The goal of the work being done on this project is to effectively develop a design of a flywheel that can be used for a gasoline engine operating at variable speeds. This system is supposed to be dependable, easy to understand, and technically doable. This project of flywheel mechanism aims to produce a design that may be used in the engine of a vehicle when it is operating on unbanked curves. Because the side force felt by the flywheel at different speeds in an engine assuming a position is substantially smaller in a direct transmission system, this technology is also believed to improve the engine's comfort.
The technique that was selected to employ standard and currently utilized components in the design rather than designing each component from the ground up was accepted. Because these components have previously demonstrated their value in applications relevant to the real world, using this technique has the benefit that you do not need to invest an absurd amount of time and money in verifying the authenticity of each component.
The mechanism that was first designed was based on using the engine by its study to elevate and lower each wheel of the automobile. The design was first adapted from an already existing flywheel, and small alterations were made to suit our goal. Due to the conditions that followed, this system was eventually put through its paces in the testing phase.

1. Because of its inertia, it minimizes vibration by smoothing out the power stroke when each cylinder fires, and the flywheel itself will take on the load that was previously carried by the engine.
2. The amount of wear and tear on the flywheel and the contact surface is too high for their simultaneous usage in an engine to be considered satisfactory.
3. In addition, the forces that are operating on the flywheel are computed. By applying the forces to the flywheel, the strength of the flywheel may be verified. [Creative Commons]
4. An analysis is performed for both the Cast Iron and the Aluminum Alloy materials to compare the findings at different speeds.

As a result of these factors, the original concept for the flywheel was scrapped in favor of an entirely new design. Catia V5, which will be used for design, will be paired with Ansys, which will be used for testing the design.

3.1 A brief overview of capabilities

It is always being improved, just like any other program, to incorporate new features and capabilities. Instead of providing precise data on the unique feature of the product, the following information is intended to provide an overview by outlining the extent of available capabilities.
One of the many items that are comparable to Catia Elements can be found in the category of CAID/CAD/CAM/CAE software applications. Catia Elements is one of these applications.
Catia Elements is a modeling architecture that is parametric and feature-based, and it is combined into a single database philosophy. It also has powerful rule-based design capabilities.
The capabilities of the product may be roughly classified as falling under one of three primary categories: engineering design, analysis, or manufacturing. After that, the data is either captured in an industry-standard 2D production drawing or the ASME Y14.41-2003 standard for 3D drawings.

3.2 Engineering Design

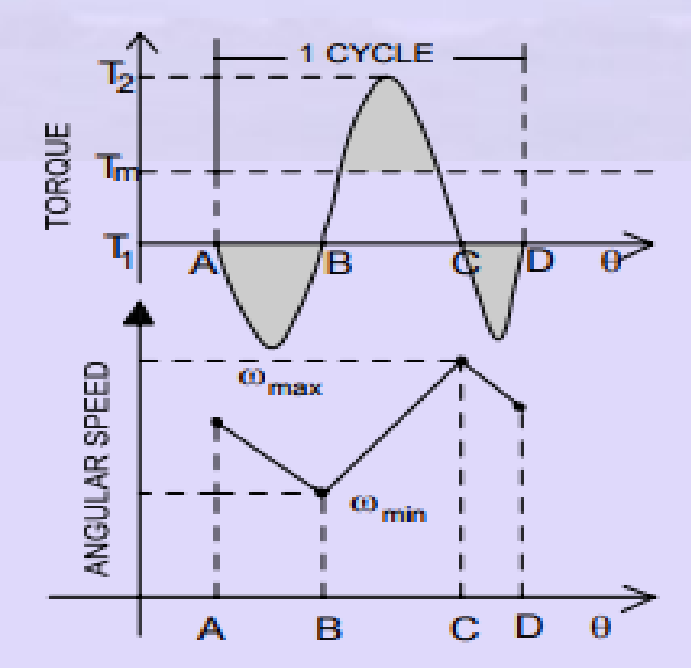
Catia Elements provides users with access to a variety of tools that make it possible to generate an accurate digital depiction of the product they are designing. In addition to the tools for general geometry, there is also the capability to produce the geometry of other integrated design disciplines, such as industrial and standard pipework and comprehensive wiring specifications. These capabilities are in addition to the tools for general geometry. Additionally, there are tools available to help development through collaboration.
The subsequent process of engineering the product might make use of a variety of concept design tools, which are those that deliver preliminary ideas concerning the industrial design of the product. These include reverse engineering using point cloud data, extensive freeform surface tools, and conceptual drawings for industrial design.

3.3 Analysis

Ansys Elements provides users with access to a wide variety of analysis tools, including thermal, static, dynamic, and fatigue FEA analysis, in addition to other tools, all of which are created to assist in the process of developing the product. Human factors, manufacturing tolerance, mold flow, and design optimization are some of the instruments that fall under this category. In combination with the FEA study, design optimization may be employed at the geometry level to determine which design dimensions are the most effective and efficient.

IV. DESIGN TERMINOLOGY OF FLYWHEEL

A device that stores energy using inertia is called a flywheel. It does this by taking in mechanical energy and acting as a reservoir, storing energy at times when there is a greater supply of energy than there is a need for it, and then releasing that energy during times when there is a greater demand for energy than there is supply.



Flywheels: Essential Functions and Methods of Operation The primary purpose of a flywheel is to even out changes in the speed of a shaft that is brought on by shifts in the torque being applied to it. If the nature of the source of the driving torque or the load torque is variable, then a flywheel is often required to stabilize the system. A great number of machines have different load patterns, which results in the torque time function having varying values throughout the cycle. Engines that run on internal combustion and have one or two cylinders are a good illustration of this. Other types of devices, such as rock crushers, punch presses, and piston compressors, are equipped with flywheels.
The flywheel stores energy by increasing its angular velocity and then releases it by slowing down. This cycle continues until the flywheel has absorbed all of the available mechanical energy.

4.1 Methodology of the Design

The design process for a flywheel is broken up into two sections. First, it is necessary to ascertain the quantity of energy that is needed to achieve the level of smoothing that is wanted, as well as the mass moment of inertia that is needed for absorbing that energy. The shape of the flywheel then has to be established in such a way that it can provide the necessary moment of inertia in a package of a reasonable size while also being resistant to failure at the rates of operation that were planned.

4.2 Design Parameters

The required amount of inertia (size) for the flywheel is directly proportional to the amount of variation in speed that may be tolerated.

4.3 The equation for the amount of energy that may be stored in a flywheel

The amount of kinetic energy that can be stored in a flywheel is a function of both the angular velocity and the moment of mass inertia.
The relation is given below

$$E_k = \frac{1}{2} I\omega^2$$

ω = angular velocity

I = the moment of inertia of the mass about the center of rotation.

For solid cylinder

$$I = \frac{1}{2} mr^2$$

For a thin-walled empty cylinder

$$I = mr^2$$

For a thick-walled empty cylinder

$$I = \frac{1}{2} m(r_{external}{}^2 + r_{internal}{}^2)$$

m = mass of flywheel

r = radius

4.4 Variability of the Speed

The change in the shaft speed during a cycle is called the speed fluctuation and is equal to ω_{max}- ω_{min}

$$F1 = \omega_{max} - \omega_{min}$$

We can normalize this to a dimensionless ratio by dividing it by the average or nominal shaft speed (ω_{ave}).

$$C_f = (\omega_{max} - \omega_{min}) / \omega$$

Where ω_{avg} is nominal angular velocity

4.5 The coefficient of the variability in speed

The above ratio is termed as coefficient of speed fluctuation C_f and it is defined as

$$C_f = (\omega_{max} - \omega_{min}) / \omega$$

Where a represents the intended average or mean shaft speed and ve represents the nominal angular velocity of the shaft. This coefficient is a design parameter, and the designer is responsible for selecting it.

If this number is decreased, then the flywheel will need to be larger, which will increase both the cost and the amount of weight that must be added to the system. However, the smoothness of the device's functioning improves in direct proportion to the value's decrease.

In precision machinery, it is normally fixed to a range between 0.01 and 0.05, but in applications such as crusher hammering machines, it may be as high as 0.20.

4.6 Design Equation

The kinetic energy E_k in a rotating system

$$E_k = 1/2\ I(\omega^2)$$

Hence the change in kinetic energy of a system can be given as,

$$E_k = 1/2\ I_m\ (\omega^2_{max} - \omega^2_{min})$$

$$\omega_{avg} = (\omega_{max} + \omega_{min})/2$$

Consequently, the relation is used to calculate the mass moment of inertia Im that must be present across the entirety of the rotating system to achieve the desired coefficient of speed fluctuation. Using the aforementioned equation, one can determine the suitable flywheel inertia Im corresponding to the known energy change Ek for a given value of the coefficient of speed fluctuation Cf. This may be done for any given speed fluctuation coefficient.

V. The Design Process for the Flywheel of a Gasoline Engine

In the Catia V5 program, the design of the gasoline engine flywheel is accomplished by a combination of part modeling and assembly modeling. The following procedures are being used to mimic this phenomenon:

Modeling of a Portion of a Gasoline Engine Flywheel

Sketch: It provides the profile, including the outer diameter and the inner diameter, through the intended use of the line and rectangle command.

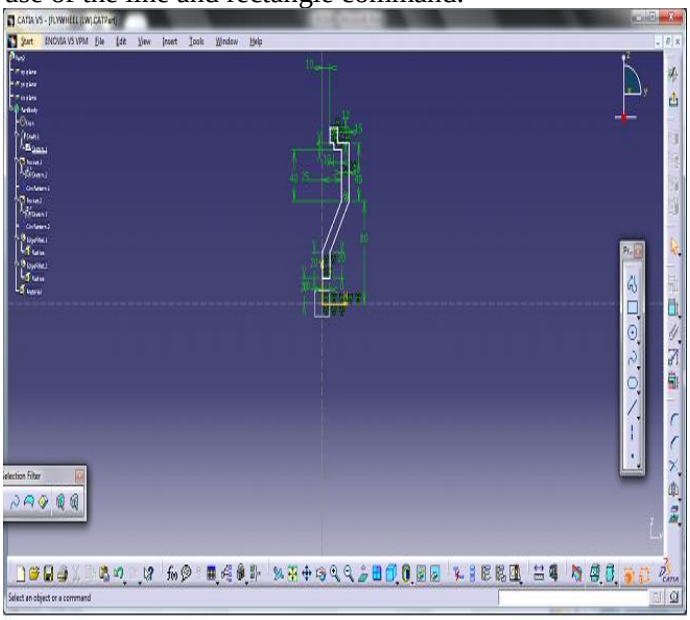


Fig: 5.4: Using Sketch Command for outer profile

Pad: This component adds the necessary thickness to the overall assembly. When you are finished with the drawing, click the icon that looks like a closed workbench. This will bring up the pad command, and when you click it, a dialog box will open where you may input the appropriate value.

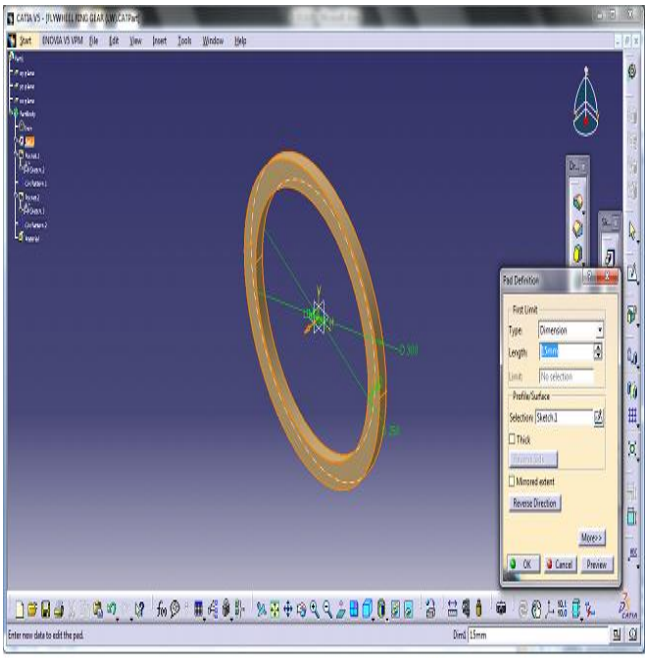


Fig: 5.5: Using Pad Command for thickness

Sketch: It gives the profile of the gear teeth, like a inner tooth or outer tooth gear by intended means of circle, arc, trim, reference line commands.

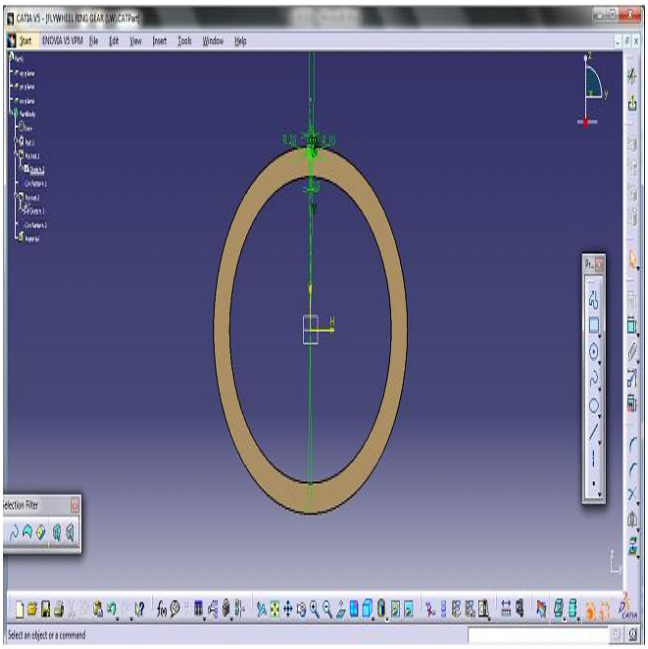


Fig: 5.6: Window for hook/ circles profile

Pocket: The gear component receives the necessary pocket, groove, or hole as a result of this feature. When you are finished with the drawing, click the icon that looks like a closed workbench. This will bring up the pocket command, and when you click it, a dialog box will open where you can input the appropriate value.

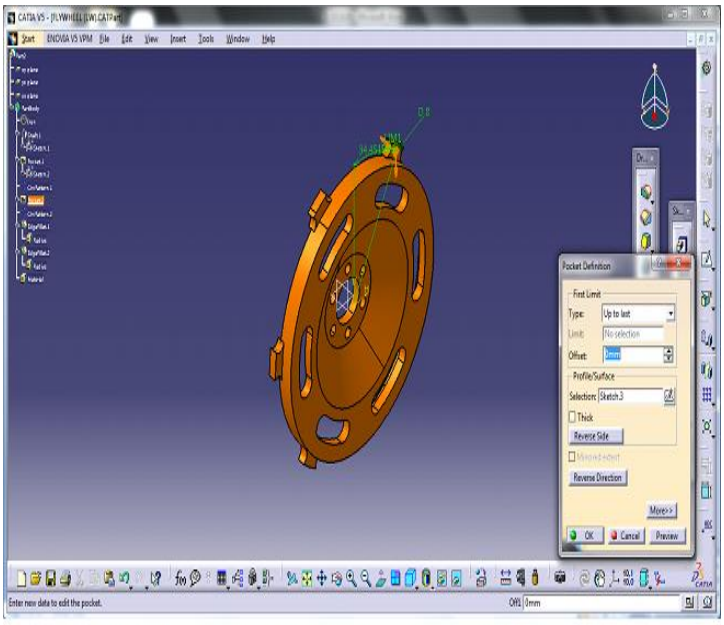


Fig: 5.7: Using Pocket Command for removing material/ thickness

Circular Pattern: This command is used to replicate the profile structure throughout the entirety of the specified workbench and is referred to as the Circular Pattern. This is the command that must be entered into the supplied dialog box to determine the number of profiles that are to be repeated on the workbench.

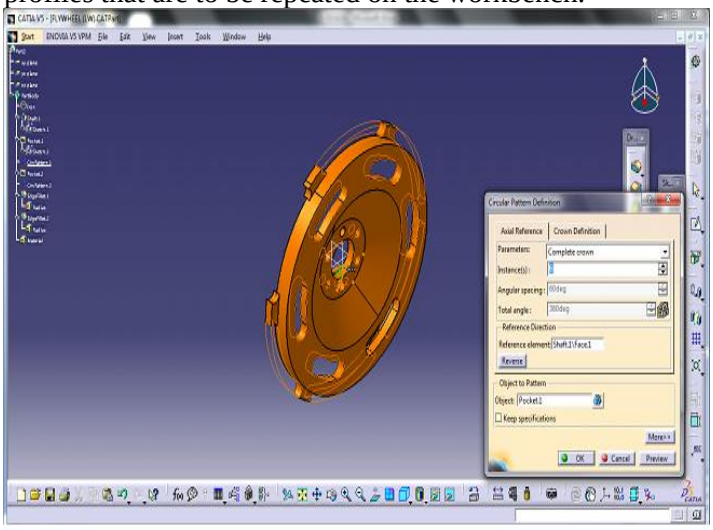


Fig: 5.8: Using Circular Pattern Command for gear tooth formation

VI. Procedure for the analysis of the flywheel:

The tetrahedral element that exhibits quadratic displacement behavior and is ideally suited for modeling irregular meshes (of the sort that may be generated by a variety of CAD/CAM software). The element is defined by 10 nodes, and each of those nodes has three degrees of freedom, which are translations in the x, y, and z directions relative to the node. In addition, the component possesses the capabilities of plasticity, creep, swelling, stress stiffening, big deflection, and large strain.

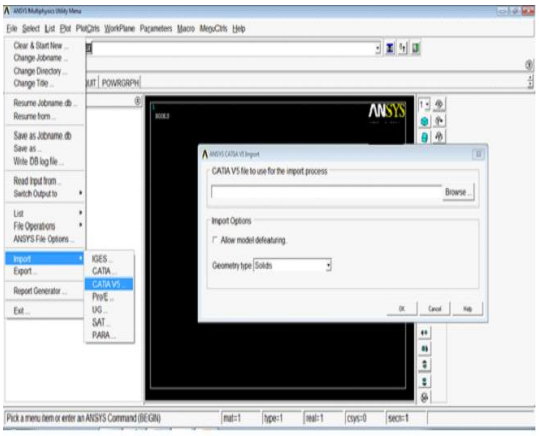


Fig.6.2: Importing file in Ansys.

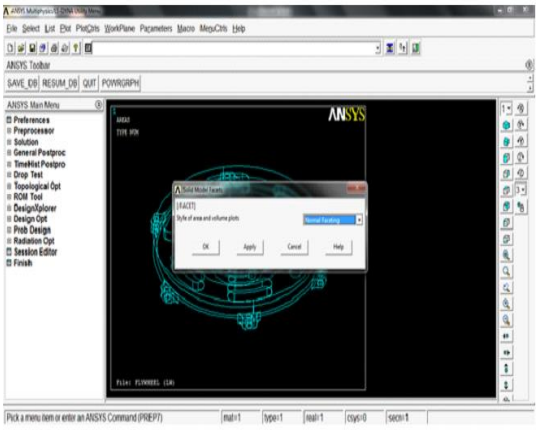


Fig.6.3: Imported file in Ansys from the system / directory

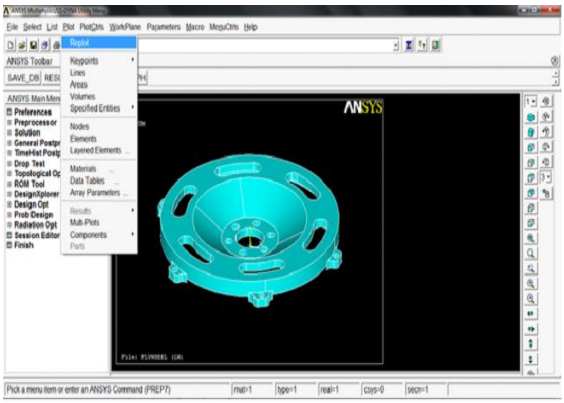


Fig.6.4: Replotting (Refresh) the component from the menu bar.

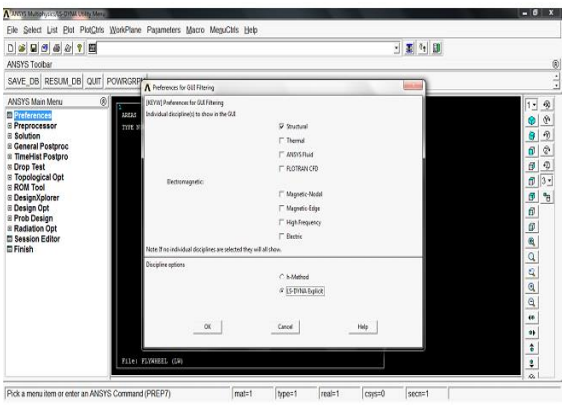


Fig.6.5: Giving Preferences to the solid component – Structural – ok

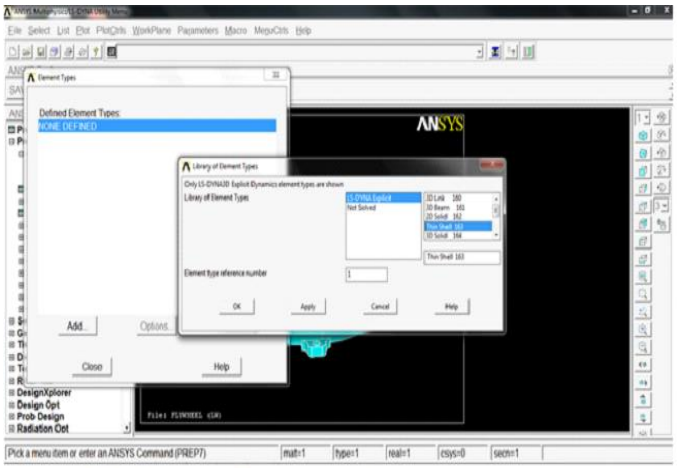


Fig.6.6: Entering into preprocessor for selection of Element Type.

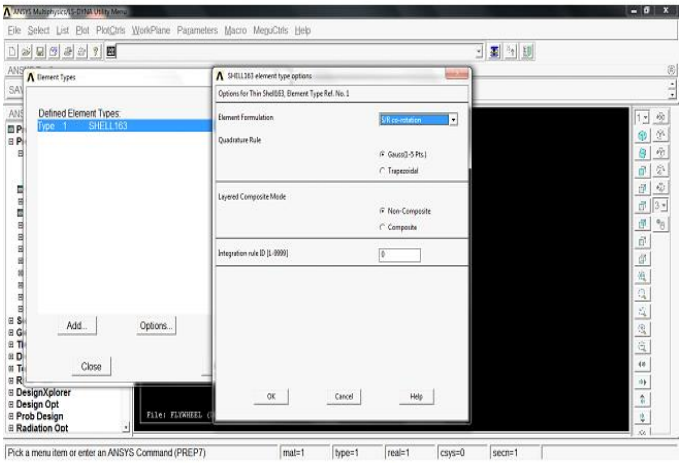


Fig.6.7: Entering into preprocessor for selection of element.

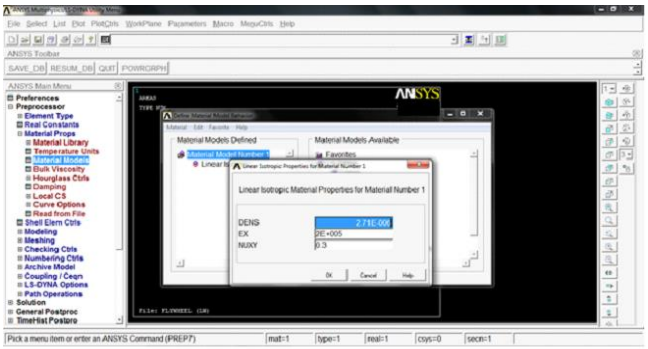


Fig.6.8: Entering into preprocessor for selection of Material Model properties.

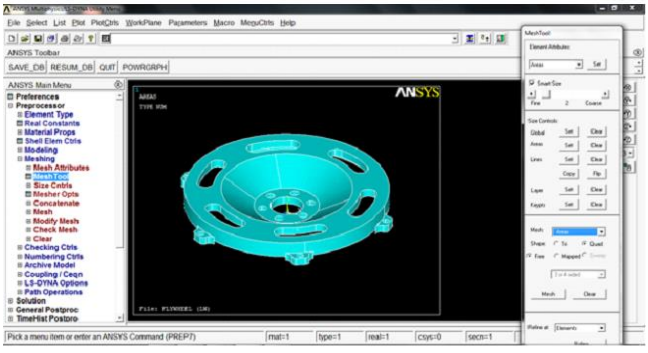


Fig.6.9: Entering into preprocessor for Volume controls values for mesh element size.

VII. DISCUSSION ON ANALYSIS RESULT

7.1 Structural Analysis Results for Flywheel:

7.1.1 Results of Displacement Analysis:

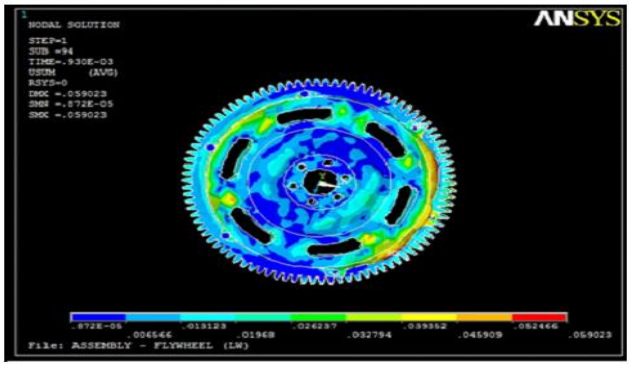


Fig: 7.1: Displacement of **FLYWHEEL ASSEMBLY**

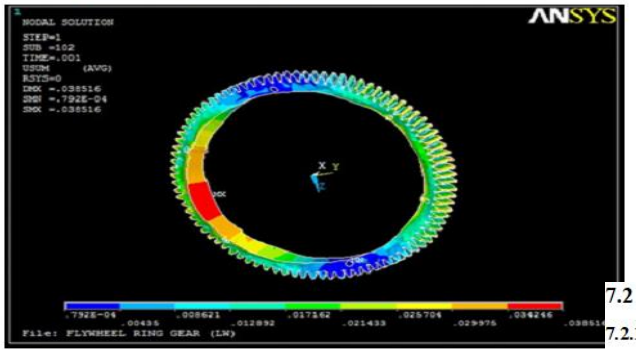


Fig: 7.2: Displacement of **FLYWHEEL RING GEAR**

7.1.2 Results of Stress analysis:

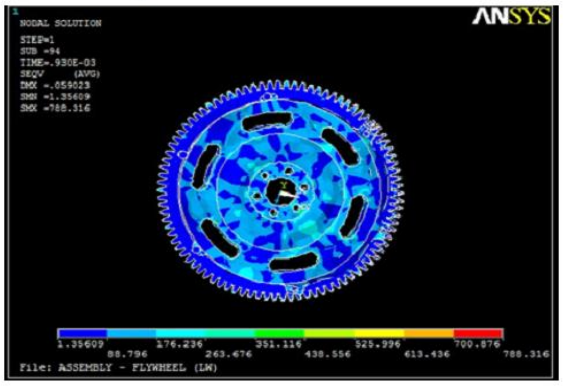


Fig: 7.3: Stress Analysis of **FLYWHEEL ASSEMBLY**

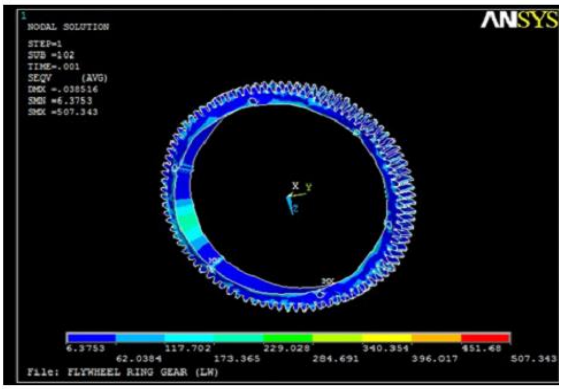


Fig: 7.4: Stress Analysis of **FLYWHEEL RING GEAR**

7.1.3 Results of Strain analysis:

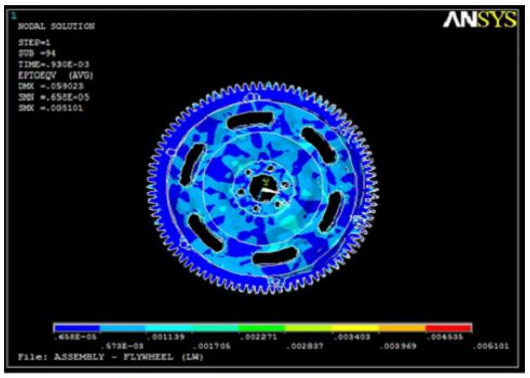


Fig: 7.5: Strain Analysis of **FLYWHEEL ASSEMBLY**

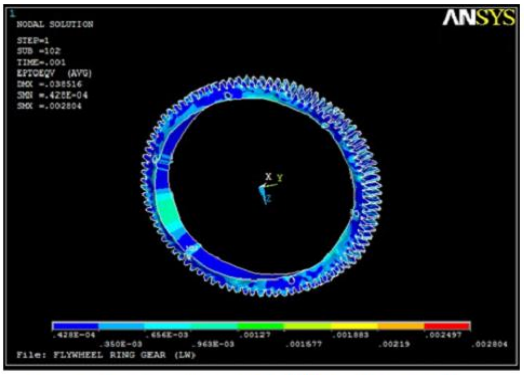


Fig: 7.6: Strain Analysis of **FLYWHEEL RING GEAR**

7.2 Dynamic Analysis Results for Flywheel:

7.2.1 Results of Displacement Analysis:

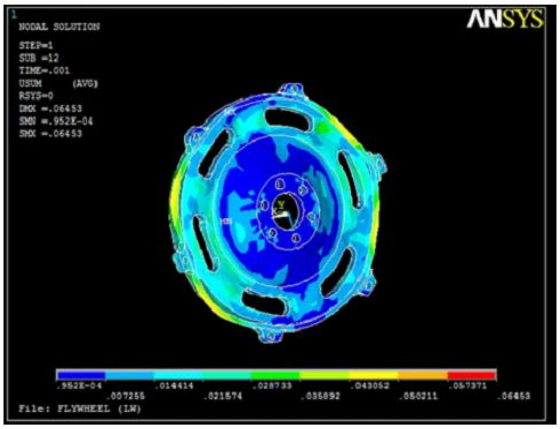


Fig: 7.7: Displacement Analysis CI – 3500

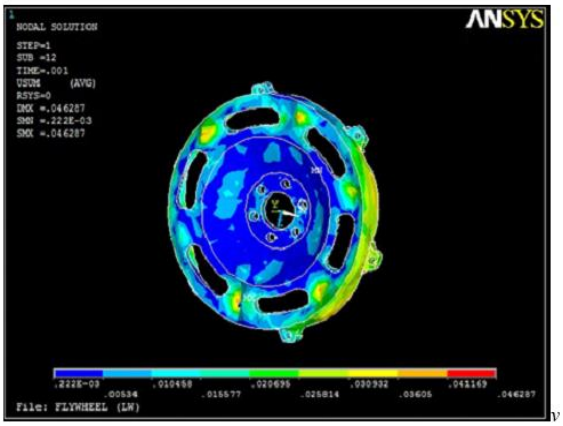


Fig: 7.8: Displacement Analysis AL – 3500

VIII. CONCLUSION

It is clear from the previous result that one of our goals was to determine what happened after the loads that had been placed on the flywheel of the petrol engine that had varying speeds. The plan has been carried out well. The displacement of the entire design assembly was meshed and solved with Ansys, and the results showed that it was just 0.059 mm, which is a very little amount. This was illustrated in the images displayed above. This demonstrates to us that each component in the assembly is experiencing some degree of displacement.

Analysis of the Structure

The source of the tension is at the fixing location (Minimum Stress which is acceptable). The number, 1.356 MPa, is significantly lower than the yield value; hence, it is lower than the point at which the yield begins.

The maximum stress is approaching; this problem is being solved with the assistance of the Ansys software to ensure that the maximum stress is only 788.31 MPa, which is a rather low value. As a result, we can draw the conclusion that our design parameters are approximately accurate. At the spot being fixed, the strain caused by the intended model may be felt. The result is 0.0051 MPa for the value.

Dynamic Analysis

S.No	Results	Al–3500	CI–3500	Al–10000	CI–10000
01	Displacement (in mm)	0.0462	0.0645	0.1341	0.0921
02	Rotational (in mm)	0.0899	0.0699	0.1767	0.0999
03	Von Misses Stress (Mpa)	518.96	657.47	937.91	1504.49
04	Von Misses Strain (Mpa)	0.0033	0.0037	0.0097	0.0053

The investigation showed that the design of the flywheel in the gasoline engine's system for varied speeds functioned perfectly. All of these details point to the achievement of our goal, which we hold in very high respect.

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• "Flywheels advance from steam age technology to Formula 1," Jon Stewart, 1 July 2012, accessed 2012-07-03 | "Flywheels migrate from steam age technology to Formula 1"

• Jump up to: "Breakthrough in Ricardo Kinergy's'second generation' high-speed flywheel technology"; Press release date: August 22, 2011; Press release source: retrieved 2012-07-03

Finite Element Analysis of Camshaft Using Ansys Software

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***Abstract*— The camshafts rotate at high speed, causing vibrations in the system. Therefore, modal and fatigue analysis of camshafts must be performed to ensure safety and determine component life. In this study, the finite element numerical technique was applied to the camshaft model to perform the above analysis. The camshaft end up modeled This study applied the finite element numerical technique further analysis. ANSYS software**

***Keywords*— Camshaft, CATIA V5, ANSYS, Chiled Cast Iron (CCI), Follower, Rocker Arm etc**

Introduction

The internal combustion engine (IC) is an important automotive system that consists of several components, including the camshaft. The camshaft consists of cylindrical rods with pear-shaped lobes that connect to a variety of other rotating components within the engine The role of the camshaft in the engine is designed to control valve timing, which allows the fuel-air mixture to flow into the engine and out the exhaust, affecting engine performance. The internal combustion engine system fails when the camshaft is broken or cracked, causing other components to fail.

Camshafts are of one of four types:

- Hydraulic flat-tappet
- Hydraulic roller
- Solid flat-tappet
- Solid roller

I. EASE OF USE

A. *Vibration and FEM analysis of the camshaft using the ANSYS program.*

We prepare the full synchronization mechanism of the SI engine in the modeling programs and analyze the causes of vibration. After calculating the causes and frequency of the vibration, we optimize the vibration by changing the material and try to find the most suitable material to manufacture the shafts and cams. Increase the performance of an engine

By controlling vibration and optimizing the camshaft, engine performance can be improved since vibration causes very high energy losses during engine operation.

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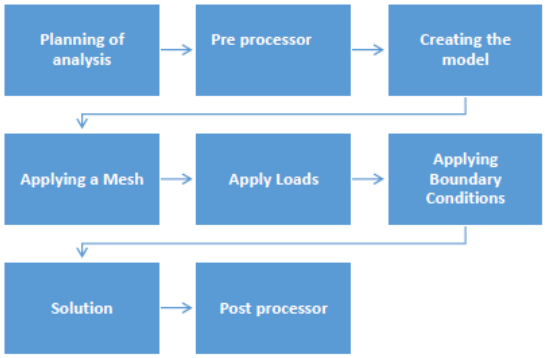
B. *SCOPE OF STUDY*

Thanks to the work we do here, the performance, efficiency and lifespan of any spark ignition engine that uses camshafts can be improved. This work can be helpful in calculating the exact loading and operating conditions of the camshaft in the engine. The main purpose of this test is to calculate the total camshaft vibration and the different vibration modes calculated at different frequencies.

These tests are also useful for analyzing vibration and friction of the cam mechanism and cam follower. The material tested for the manufacture and testing of the camshaft structure, namely EN8 D/EN24 steel, is a suitable material for the manufacture of the camshaft, has highly effective torsional resistance and exhibits serviceable properties.

II. METHODOLOGY

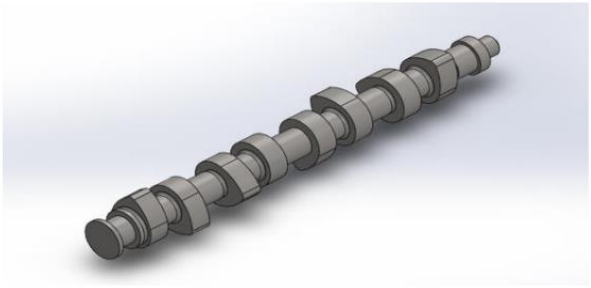
Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads-the template will do that for you.



A. *DESIGN MODELLING*

Using the SolidWorks software for this study is essential for the design of the camshafts. Computer-aided design (CAD) is a type of design software that allows developers to create, modify, evaluate, and optimize designs. CAD software was used to increase efficiency, improve overall design quality, communicate effectively through documentation, and create a manufacturing record. Camshafts are a rod-like component containing pear-shaped lobes and specifications must be accurate to avoid camshaft failure. Manufactured from gray iron and cast carbon steel, the camshaft has eight lobes, each rotated through multiple angles. The camshaft was saved to

a STEP file before being exported to ANSYS for the FEA software Units



B. *ANALYSIS PROCEDURE*

Planning the Analysis
Pre-Processor Creating a Model
Applying a Mesh
Apply Loads Applying Boundary Conditions Solution Post-Processor

C. *Material used for the analysis*

Cast iron
Structural steel
EN 8D steel
EN 28 steel
EN 24 steel

D. *TOTAL DEFORMATION IN CAMSHAFT OF DIFFERENT MATERIALS*

The camshaft is a rotating detail that incorporates vital loads. Accurate stress calculation is very important for the part compared to other rotating parts of the engine. This article provides guidelines for dealing with such situations. The aim is therefore to analytically design the camshaft and to analyze the frequency and vibrations in the modal analysis as well as the overall static deformation.

For EN8D
EN8 D is a medium strength carbon steel primarily used for steering knuckles, bolts, automotive and general engineering products or components. Can be heat treated when extra strength is required
is a medium carbon steel that can be strengthened by heat treatment after forming The 's run ability weldability is well and good

For Cast iron

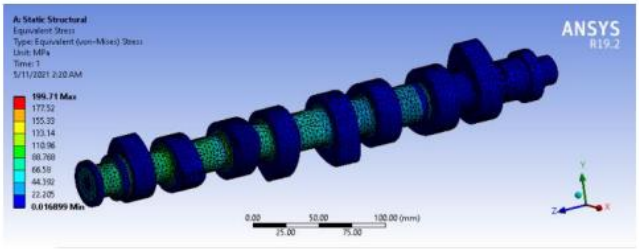
Cast iron is iron or an iron alloy that has been heated to liquefy after which poured right into a mildew to solidify. It is usually made of pig iron. The components of the alloy affect its color after fracture: White cast iron contains carbide impurities that allow cracks to pass directly through. Grey iron has graphite flakes that will deflect a temporary crack and initiate countless new cracks as the material fractures. It's a very good vibration dampener, but because it's brittle in structures, its strength isn't as high for applications like camshafts.

For EN 24

EN24 is a very popular hardened alloy steel best suited for making parts such as heavy-duty axles and shafts, gears, bolts and studs. EN24 can be further case hardened by induction or nitride processes, typically to 58 to 60 HRC, producing components with increased wear resistance. EN24 is able to maintain good impact resistance at low temperatures

E. *STATIC STRUCTURAL ANALYSIS*

Static structural analysis was another FEA method used to accomplish the research study's objectives. The implementation of this approach was extremely crucial in predicting the camshaft's fatigue performance. The total deformation, maximum von-Mises strain, maximum von-Mises stress, and safety factor of the designed camshaft were all determined and assessed using this analytical method.



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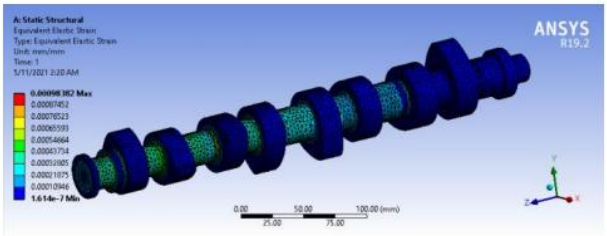
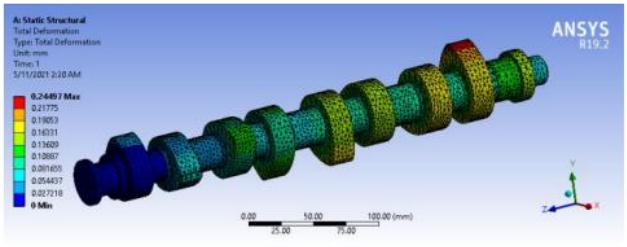


(b)

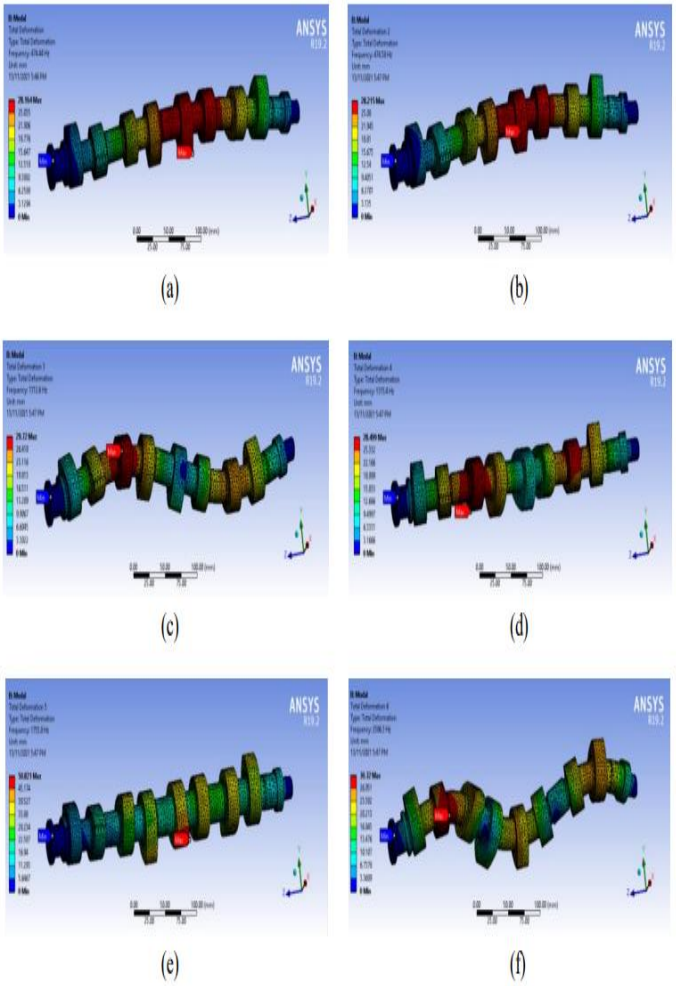


(a)

F. *MODAL ANALYSIS OF CAMSHAFT*

Camshaft Modal Analysis is a free camshaft vibration analysis that calculates the idle natural frequency. We used software to calculate and compare camshaft frequencies for different materials. The results are verified by a simple vibration analysis of a structural steel rod that was available as a test set in the laboratory. The results were validated under or during the same boundary conditions as for the warhead free shaft rotation.

Modes for cast carbon steel using modal analysis. (a) Mode 1, (b) Mode 2, (c) Mode 3, (d) Mode 4, (e) Mode 5 at, and (f) Mode 6.



- EN24

Following are the natural frequencies at different modes for the material EN24.

Showing the natural frequencies and deformation with different modes of EN24 camshaft

Mode	Frequency [Hz]	Deformation
1.	17505	64.724 mm
2.	17605	59.219 mm
3.	18131	63.392 mm
4.	18200	59.479 mm
5.	20268	97.121 mm
6.	20493	79.219 mm

- END8

For EN8D following are the natural frequencies obtained with respected deformations.

Showing the natural frequencies and deformation with different modes of EN8D

Mode	Frequency [Hz]	Deformation
1.	16036	67.055 mm
2.	16137	61.155 mm
3.	16645	65.871 mm
4.	16715	61.475 mm
5.	18593	100.89 mm
6.	18814	81. mm

- Structural steel

Following are the natural frequencies obtained for the structural steel camshaft.

Mode	Frequency [Hz]	Deformation
1.	15650	67.055 mm
2.	15749	61.155 mm
3.	16244	65.871 mm
4.	16312	61.475 mm
5.	18145	100.89 mm
6.	18360	81. mm

Showing the natural frequencies and deformation with different modes of SS camshaft

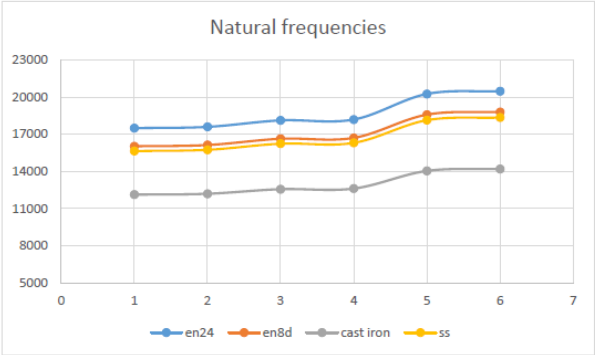
- Cast iron

Following is the table that is obtained for the natural frequencies and the deformation at different mode shape for cast iron camshaft.

Showing the natural frequencies and deformation with different modes of cast iron camshaft

Mode	Frequency [Hz]	Deformation
1.	12125	69.292 mm
2.	12196	63.329 mm
3.	12567	67.929 mm
4.	12616	63.62 mm
5.	14044	104.07 mm
6.	14204	86.32 mm

Graph showing the comparison between the natural frequencies of the different material camshaft



G. VALIDATION

a) Problem description:

The investigation of the vibrations and natural frequencies of the model is the main problem of this study. Deformation can only be determined by calculating the force generated by the cylinder, but no one can determine exactly the same load conditions and the exact environment in which the camshaft operates. There is no direct method to calculate the exact loading and boundary conditions. There will therefore be a slight difference between the two values. For the solution here, we used ANSYS software to solve the problem analytically, and the theoretical solution is realized through our own research.

b) Shaft specifications

Elasticity of shaft	189x 10^9 N/m
Length of shaft	106.5 Cm
Diameter	.3 Cm
Mass	80 gm
Gravity	9.8 m/sec^2

c) Boundary conditions for shaft

Boundary conditions for the shaft can be specify in three modes first when it's both ends are fixed second when it's simply supported and third when both the ends are freed. The rotational speed was given to shaft in each case and the frequency was calculated for respective cases.

I = π/64 × d4
7. Moment of inertia of cylinder
= π/64 (3×10-3)4
= 3.96×10-12m4
W= weight per unit length
= 0.080×9.8/1.065
=7.36 N/m
8.Natural Frequency (both ends fixed):
Fn= [π/2(n+1/2) √ (gEI)] / WL4
For n=1
Fn=10.152 Hz
For n=2
Fn=28.2 Hz
For n=3
Fn= 55.27 Hz
9. Natural frequency (both ends are supported):
Fn= [π/2(n2) √ (gEI)] / WL4
For n=1
Fn= 4.512 Hz
For n=2
Fn= 18.078 Hz
For n=3
Fn= 40.601 Hz
10. Natural frequency (both ends are freed):
Fn= [π/2(n -1/2) √ (gEI)] / WL4
For n=1
Fn= 1.128 Hz
For n=2
Fn= 10.152 Hz
For n=3
Fn= 98.2 Hz

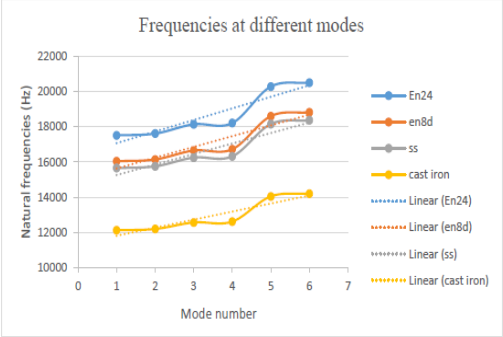
H. CONCLUSION

A finite detail evaluation of the camshaft became executed and we located that the appropriate material to manufacture the camshaft could be cheap and readily available on the market. Here we have seen the different parameters on which the manufacture and application of components is based, but sometimes when we talk about performance we need the least disturbed component or components in the system and therefore a point of performance. As far as performance is concerned, a cast iron camshaft is a real option for us, but it also has major disadvantages: high weight and more deformation over time, but very low vibration value because we all know that cast iron is the best anti-vibration mount, but it does not have the sufficient strength required for the application. Now looking at weight versus performance mild steel and EN24 steel are good options for fabricators but mechanically they do not appear to be a good option while service conditions show very high strain values at resonance. We only have one material left and that is EN8D.This material has good low distortion performance at resonant frequencies and is lighter than mild steel and EN24. They have good torsional strength, but higher than cast iron. If we have to choose a material from these four elements, we have to find a compromise between performance and component weight, so we can conclude that EN8D is a material that can be used to manufacture a camshaft.

I. RESULTS

Comparison between total deformation and frequencies of different materials.

Materials	Total deformation (Dynamic, w=2200 rad/sec)	Total deformation (Static)	Frequency (Natural)
EN8D	7.3881×10^{-4} mm	1.49×10^{-4}mm	16036 Hz
EN24	6.2958×10^{-4} mm	1.19×10^{-4}mm	17505 Hz
Structural steel	7.7575×10^{-4}mm	1.66×10^{-4}mm	15650 Hz
Cast iron	1.3135×10^{-3}mm	2.80×10^{-4}mm	12125 Hz



J.FUTURE SCOPE

With the assist of this paintings the producing strategies for the camshaft may be decided. With this work one can do more analysis related to the camshaft. For another application the material selection for camshaft become easier for the manufacturer. In today's fast-paced world, CAD/CAM systems have become an indispensable part of manufacturing companies around the world. Technology and communications are changing rapidly, driving the way organizations do business and requiring capitalization to remain competitive. Knowing before investing in the system is critical to ordering to maximize the benefits of developing CAD/CAM systems. In the rapidly developing modern manufacturing industry, many materials such as plastics and polymers are used to construct the camshaft, and the thickness is also one of the important factors in camshaft dynamic analysis. Therefore, the material properties of the camshaft system should be compared for small and large changes in speed and time.

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Machine Diagnostics using Machine Learning Approach: A Review

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Abstract— **Numerous studies in the past have focused on the previous techniques of developing a mathematical model, evaluating several factors, and then determining the machine's operating conditions. Machine learning approaches have been used extensively in the identification of mechanical faults during the past three decades. Several machining and manufacturing operations that use machine learning can be successfully monitored for condition. The potential for fault identification based on health monitoring methods and machine learning applications is tremendous. For fault detection, machine learning's potential can be effectively leveraged. A dependable and efficient solution for preventative maintenance is provided using machine learning algorithms in the fault detection industry. This paper gives the review of existing health monitoring systems and describes how machine learning methods are applied. This review includes supervised learning, unsupervised learning approaches.**

Keywords— ***Machine learning, fault detection, supervised learning, unsupervised learning, classification, sound & vibration analysis.***

I. INTRODUCTION

A fault detection system deals with monitoring and identifying faults in a machine. The fault is detected when the reading of any sensor or measuring machine device crosses a specific threshold that point is detected as fault. Fault diagnosis can be done with two methods: Model based and Signal based approach. Model-based method is used to determine whether a defect has occurred whereas in signal-based approach to extract meaningful features about the defect, a neural network algorithm is trained using samples and then various mathematical or statistical procedures are applied to the inputs.

Methods for data collecting, such as vibration analysis, sound analysis, etc., are performed to spot the flaws that are most likely to cause failure. These data are then processed using various machine learning techniques. To identify the underlying cause of the problem, the analysis outcomes are used in a basis for failure analysis. To correctly identify the redundancies, defects, and odd samples in a labelled dataset, mathematical classification models—which really fall under the category of supervised learning techniques—are trained on the training set. In this field of study, several classifications, and data pre - processing models have been created and presented over the years.

However, in engineering cases, the system user would prefer an automatic way to reduce the length of the maintenance and increase the precision of the diagnostic. It is believed that with the aid of artificial intelligence, the diagnostic process would be capable of autonomously detecting and identifying the health statuses of machines. The machine learning techniques include artificial neural networks supervised and unsupervised learning algorithms [4].

When monitoring the condition of certain types of machines, such as rotating machinery, it is crucial to determine the extent of the damage because early signs of a fault may not call for the replacement of the affected components, but they may indicate that this will be necessary in future and allow for proactive action. Therefore, it is essential to identify emerging malfunction and offer greater process management effectiveness. Depending on the state of development of the systems being utilised, the following failure types can be distinguished: Identification, Separation, Evaluation, and Classification.

II. OVERVIEW

Numerous studies in the past have focused on the previous techniques of developing a mathematical model, evaluating several factors, and then determining the machine's operating conditions. Machine learning approaches have been used extensively in the identification of mechanical faults during the past three decades. The capacity of sounds and vibrations to convey information about the working circumstances of a machine has made them particularly useful in damage detection systems.

Data collection: Image & Video data: An image data set reflecting the proper and improper operation of a mechanical system that vibrates is extracted from of the clip. A video as a set of images used for input data for a model of deep learning since videos often consist of several frames (such as photographs).

- Vibration data: Every minute and second of time-domain at vibration data were gathered. The feature

extraction, feature selection, fault prediction, and fault class prediction processes use this raw data.

- Audio data: Recording the audio clip at different frequency.

Feature extraction: There are multiple strategies for choosing useful features that solve a particular problem. Some statistical values are calculated for every data sound or vibration. The machine classifier will then take those numbers as inputs are the statistical properties used [16].

Feature Selection: Using time and the frequency used throughout the feature extraction procedure [11]. A dimensionality reduction method is employed to escape the curse of dimensionality. The goal of this approach is to maximise the variance of the data by linearly mapping it into a smaller dimension space. This is where the data's correlation coefficient is built.

Fault detection: Before the actual testing process starts, the technique uses several fundamental aspects of the system design to determine software components that are sensitive to faults. [8] It assists in achieving desired software quality with reduced work and expense.

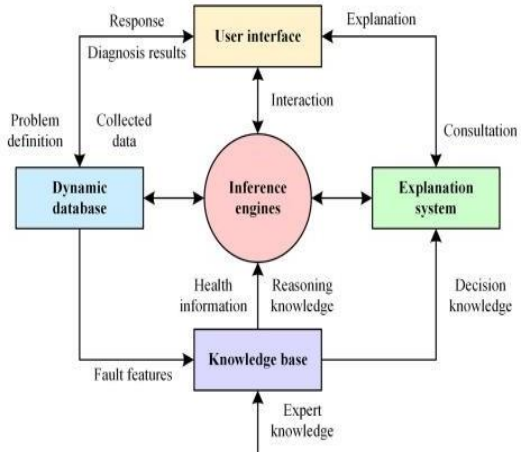

Fig. 1: Architecture of expert system models [2]

III. BACKGROUND

Artificial intelligence-focused computer programmes are incorporated into automatic processing systems, which automatically processes all the data from monitoring systems. The identification, localization, and evaluation of the severity of early faults—faults that are in the early stages of formation—is the primary goal of the merging of these systems in the functioning of a productive system. The next stage after basic monitoring is to structure and optimise the evolution of autonomous detection and diagnosis, which will be made possible by technical advancements in monitoring and supervisory systems.

These systems gather data from a monitoring system that is mostly made up of sensors, and by using expert machines and optimization algorithms, a "knowledge bank"—also known as the existing knowledge for decision making—is controlled. By analysing the data collected by the monitors and supervision system, it will be possible to identify problems, pinpoint their origins, and choose the best course of action to both ameliorate changes in the behaviour of the variables of interest and get rid of the triggers that lead to them. Finally, based on the complexity and seriousness of the issue, the algorithm will choose whether to execute this activity online or offline.

An intelligent system's monitor and supervision system makes it possible to locate, diagnose, and remove failures so that the best course of action may be taken to prevent them and find out what caused them in the first place. This will boost the effectiveness of the industrial processes. In general, a smart system or smart grid is a production system that integrates information technology with communications networks and an automated network architecture.

This method necessitates the integration of sensors into all essential production system components, the establishment of a dependable multiple communication system with broad device coverage, and the automation of physical assets. Monitoring is the process of seeing, analysing, and being alert to any potential abnormality warning indicators. In information technology, "not normal" might mean that one or more components of a system are unavailable or that a device's parameter has changed.

The realisation of the observation of modifications or changes in the parameters of time-transcending modules occurs in this phase. These adjustments must be documented in a system for gathering data known as the Databases, which will enable us to create a timeline of a specific variable or parameter's behaviour through time in comparison to a specified level or limit of behaviour.

It is required to set or specify fluctuation limits for the parameters regarded of interest to detect problems in a production system's device. Typically, these boundaries represent the highest values that these variables may take. It can be assumed that a parameter is exhibiting abnormal changes when the values of the variables approach certain boundaries. It can be inferred that the device is failing if these changes are either continuous or discrete.

IV. MACHINE LEARNING TECHNIQUES

Supervised learning: Supervised learning is a subset of machine learning where the output is predicted by using well-labelled data sets that has previously been used to train the machines [4]. Input data that is already allocated the proper output is referred to as "labelled data. “The dataset that is provided to the systems acts as the supervisor in supervised learning, and to teach them how to correctly predict the output [2]. The supervised learning procedure includes providing the classification model with the proper input and output data. A method for supervised learning searches for a similarity measure to link the input (x) and output (y) variables. Models are trained using labelled datasets in supervised learning, which enables the model to acquire knowledge about a variety of input types [17]. The model is assessed using test data (a sampling of the training sample) when the training phase is complete, and it then generates output predictions [10]. Classification and Regression problems solved by supervised algorithms [13]. It is mostly used, nevertheless, in Classification problems [20]. A deep learning algorithms to simulate high-level data

abstraction [20]. It belongs to a group of approaches for discovering data representation strategies. It is the process of creating specialised learning algorithms that automatically extrapolate features from a data collection for use in training machine learning systems. The outcome is significant because without these methods, features would need to be created and assessed manually before training. RNN is a tool for deep learning and for creating models that mimic the behaviour of the human brain's neurons. A deep learning-focused technique that employs a sequential method is the recurrent neural network. Recurrent Networks are made to identify patterns in data sequences, including text, genomes, handwriting, spoken language, and numeric time series data from sensors, financial exchanges, and governmental organisations. Apart from the addition of a memory-state to each neuron, recurrent neural networks resemble conventional neural networks in appearance.

Transfer Learning: In transfer learning, information from related or dissimilar domains with labelled data is used to learn a new skill in a domain with little to no labelled training data. A system that learnt to recognise distinct picture statistical correlations on very fundamental levels. This strategy has the major benefit of helping to solve the issue of not obtaining enough labelled data. Since transfer learning may reduce the quantity of labelled data required, one of the key hurdles in health applications [6]. Unsupervised learning algorithms used to evaluate and classify unlabelled datasets. Without the aid of a person, these algorithms locate hidden patterns or classifications. To find informational parallels and differences by making it the greatest alternative for exploratory data analysis and cross-selling strategies [3].

Unsupervised learning: Unsupervised learning methods are implemented for three main tasks: segment, correlation, and dimension reduction. Here is a definition of each learning technique, along with samples of typical implementations and algorithms.

1. Clustering: Using the data mining approach of clustering, unlabelled data are categorised based on their similarity or differences. To classify unprocessed, unstructured data items into categories that could be interpreted as patterns or features in the data, clustering algorithms are used. There are different kinds of clustering algorithms, such as an exclusive, overlaps, hierarchy, and statistical ones [9]. [7] The dimension reduction strategy is used when a data has too many attributes or dimensions. It maintains the dataset's integrity to the greatest extent possible while lowering the amount of data supplied to a manageable level approach.
2. The principal component method: A dimensionality reduction technique called principal component analysis (PCA) uses feature extraction to reduce duplication and to compress datasets. By linearly converting the data, this method creates a group of "main components. “The very first principal component is the direction that increases the dataset's variability. The second main component also identifies the biggest variation in the data, but it is wholly irrelevant to the primary singular value and gives a direction orthogonal to the first component, or perpendicular. This process is repeated according to the number of dimensions, with each new primary components pointing in the reverse direction of the preceding one that had the biggest variance [1].

V. PROPOSED METHOD

In this proposed system, applying machine learning to identify system flaws in the proposed system. With the use of sand and tea powder, the Chladni plate, mechanical vibrator, and signal generator for frequency will be utilized to collect various vibration patterns, and numerous tests will be carried out to obtain these patterns during the data collection stage. The video classification will be done using MATLAB and Python. We will turn the movies into images in the initial stage of data processing and store them as.jpg files. To extract the statistical correlation from a video's many pictures, use a deep learning model. The architecture of the model combines CNN and RNN. By maintaining a recall of previous images, RNN models seek to extract the statistical link between the images. To extract high-level features, a CNN model is given the video's pictures. The RNN layer's output is connected to a fully connected layer to produce the classification output after the features have been provided to it. The foundational CNN model will be ResNet18, which has been pre-trained on ImageNet. We must create an instance of a model class object to deploy the model. Next, pass the tensor containing the frames to the model to determine the predictions. To determine the trained model's accuracy, various supervised, deep neural networks techniques are used together with feature extraction, standardisation, and application. The objective is to use video monitoring to determine the precision and forecast the frequency of the system's vibration patterns.

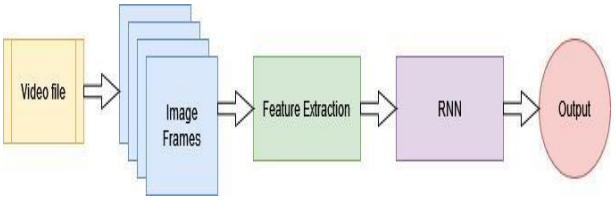

Fig. 2: Block diagram of proposed model

VI. EXISTING SYSTEM

Following points are identified in existing system.

1) Facial expression recognition for the diagnosis of Parkinson's disease was employed in video analysis, along with other more conventional machine learning methods, to make the diagnosis.
2) The use of artificial neural networks for the detection and categorization of defects on the transmission of electricity. lines. In the suggested design, the three-phase voltage, and currents with one end are used as inputs. The simulation results showed that the current neural network-based technology is effective in identifying and sorting transmission line defects with respectable performances.
3) In many engineering domains, condition monitoring (SHM) calls for approaches that can accurately

evaluate structural states and pinpoint any damages or flaws.

4) Bridge frequency response and damping ratios are detected by a traffic vibration - based system that works with a security camera to identify individual vehicles from the clip and foretell bridge damage. The technology takes pictures of each car and records video frames to detect extremely high natural frequencies. In this case, forms of the automobiles are extracted from the footage using ML techniques like CNN.

VII. LITERATURE REVIEW

Since the machinery used in these processes has improved, manufacturing techniques have boosted the capacity of the industries' productive systems. The dependability and availability factors of a technology are two of the most important considerations in today's automated system design. The quality, dependability, and robustness of a system's constituent components, including the sensors, actuators, controllers, and/or computers that are essential to contemporary monitoring procedures, is a classic technique to maximise the factors of systems [19]. The condition monitoring system has been created for the identification and isolation of predicted defects in rotary machines.

1. Soldiers are linked up with biomedical sensors and monitoring devices for the process of tracking soldiers' health. The focus of the effort is on the tracing of soldiers' whereabouts, which helps the control room unit determine the precise location of the soldier so they can provide guidance. The tactic involves having soldiers request assistance from the military control booth system from a fellow soldier when they are in a panic. It may be used for rescue operations without the need for a network, which is particularly helpful for the armed forces during wartime. the capabilities and ZigBee and LoRaWAN intermixing. The process will provide protection and safety for our soldiers.
2. Under the influence of considerable background noise, it is difficult to determine the initial weak defect impact. characteristics of rotating equipment, which reduces the accuracy of fault diagnosis [14]. An intelligent fault diagnostic approach of rotating equipment is based on a single-dimensional convolution neural network and an optimised adaptive learning dictionary to efficiently identify the early problems of rotating machinery.
3. A composite material's fundamental components rendered it extremely susceptible to damage, necessitating procedures for damage detection that are both accurate and effective. The major goal of this work, which focuses on the identification of damage using vibration analysis, is to use a structure's dynamic response to identify and comprehend deterioration. To verify the efficacy of the strategy, the experimental findings are contrasted with those anticipated by numerical models.
4. A method for monitoring construction noise to guard against damage to subsurface pipelines during work. In addition to ambient noise, construction noises like road cutters, electric hammers, and excavator breaking hammers are all noted. The system's brain utilizes a double-layer identification method using two classifiers based on random forests [12].
5. The principal components of the transformer current data are fetched using a Hebbian-based unsupervised neural network in a fully automatic, unsupervised manner. The fault is located using these primary directions, and the severity of the fault is determined by establishing a link between both the current component values.
6. Damage detection is important since it may reveal how serious a malfunction is and, as a result, help produce or manufacture processes more efficiently. Selected supervised and unsupervised supervised classification techniques are used in this research to achieve this goal etc.

VIII. LIMITATIONS IN EXISTING SYSTEMS

The most crucial aspect of any industrial challenge is that all machines to function normally, so fault prediction and diagnostics are required to keep the track of machine's condition. When faults do occur, it is important to identify them as quickly as possible because if this equipment are allowed to operate continually under adverse circumstances, it might cause significant harm, including the loss of human life.

Monitoring fault detections in machine using embedded devices like sensors and other measuring unit devices does not show the exact result as required. It consumes more time in training the process also requires a lot of data, more memory, and complex algorithms, all of which still can't be done successfully [14]. Low accuracy achieved due to overfitting issue. It cannot interpret trained data so there's a gap between theoretical and implementation knowledge. Using Machine learning advance techniques, it is possible to train the model in such a way that the system will have the ability to prevent any damage of the machine at the early stage. Once the machine learning models are trained properly with the given data, it can work much faster with less time consumption and best accuracy. Algorithms such as CNN, RNN and other advance algorithms work more efficiently than the traditional methods.

Transfer learning theories provide the potential to build diagnosis models that can transfer diagnosis knowledge across various diagnosis tasks, bridging the knowledge gap. The fact that it should be worrying that the efficacy of deep learning-based diagnosis algorithms hinges on having adequate tagged data [8]. In engineering contexts, such an assumption is unworkable.

IX. CONCLUSION

Machine learning applications for machine fault diagnostics are essentially separated into three stages. The procedures of data gathering, artificial feature extraction, and health condition recognition were previously used to create the system. The diagnosis models can instantly

identify the health statuses of machines by employing conventional machine learning ideas. The literature evaluations, however, show that the artificial feature extraction still depends on the knowledge of the experts. The emergence of deep learning has good effects on the enhanced benefits because of the machine learning field's recent rapid progress.

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Effect of piston geometry on the emission of alternate fuels

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***Abstract*— In the current investigation, a 3.5kw compression ignition (CI) engine was fueled with behada, chicken fat, and turmeric oil methyl ester with diesel. The goal of this study was to investigate emission characteristics such as carbon dioxide, carbon monoxide, hydrocarbons, Nitrous oxide, and Smoke. CI engine was modified by changing the piston head (square and tangential groove top) for methyl ester diesel blend operations. In the study diesel fuel is designated as B00 and methyl ester as B20. The consequence of higher compression (CR16 and CR18) with the recirculating of engine exhaust (EGR 0% and EGR 10%) on combustion parameters was studied. Tangential groove top piston with compression ratio 18 and EGR10% had shown a reduced carbon monoxide than EGR0%. CR16 has shown greater carbon monoxide than CR18 in all operations. When anticipated, as load operations increase, mean gas temperature (MGT) rises from 0.2 percent volume to 1.0 percent volume. Greater Carbon Monoxide than B20 fuel owing to its lower viscosity and higher calorific value. Tangential groove top piston with B00 and B20 at CR16 with and without EGR have shown greater promising results for carbon monoxide. Higher carbon monoxide values during the fast combustion phase and lower values during the after-burning phase was observed. It demonstrates that B20 fuels using 10% EGR and tangential groove top piston shape provide better emission behavior and the most promising results.**

Keywords— Methyl ester, Piston geometry, piston, injection pressure, performance, emissions, Carbon Dioxide, Hydrocarbon

I. INTRODUCTION

Internal combustion engines have been commonly used for transportation and power generation for over a century. However, the increased demand for energy and the concern for the environment has led to the development of alternative fuels such as biofuels. Methyl ester, also known as biodiesel, is one of the most commonly used biofuels due to its high cetane number, low sulfur content, and biodegradability. The use of biodiesel in internal combustion engines can significantly reduce the emissions of harmful pollutants, particularly particulate matter and nitrous oxides (NOx). However, the use of biodiesel can also affect engine performance, particularly the combustion process, which can result in changes in emission characteristics [1].

One of the parameters that can affect the combustion process is the piston geometry. The piston geometry, including the crown shape, dish volume, and pin offset can affect the compression ratio, charge motion, and heat transfer which can result in changes in the combustion process and emissions. Therefore, understanding the effect of piston head is essential for the development of efficient and environmentally friendly engines.

The VCR engine is a type of internal combustion engine that allows for the adjustment of the compression ratio, which can improve efficiency and reduce the emissions of the engine. The research will focus on the effects of the change of piston head on the emissions of the VCR engine when fueled with a methyl ester. The research will also investigate the potential trade-offs between emission reduction and engine performance [2].

The internal combustion engine is a prevalent power source in various forms of transportation and industrial applications. However, the emissions produced by these engines have a significant impact on the environment and human health.

The relationship between various piston geometries and the emission characteristics of the VCR engine when using methyl ester as a fuel will be investigated. Specifically, the effect of piston bowl shape, piston crown shape, and piston pin offset on the engine's emissions of carbon monoxide (CO), hydrocarbons (HC), nitrous oxides (NOx), and smoke will be focused. The results of this research will provide valuable insight into optimized wat to improve the emission from of VCR engines using methyl ester as fuel.

The transesterification reaction is significant due to the possibility of enhanced engine performance while lowering emissions. By understanding how the shape of the piston affects combustion and emissions, engineers and researchers can develop more efficient and environmentally friendly engines. Additionally, the use of biofuels such as methyl ester can reduce the need for fossil fuels and decrease carbon emissions. Overall, this study can contribute to the advancement of sustainable transportation technology. Previous studies show the implementation of EGR has produced a significant increase in the consumption of NOx with a negligible impact on peak brake thermal efficiency

(BTE). The effect of 0 and 10% EGR can be recirculated inside the engine without any modification at an injection pressure of 600 bar.

II. LITERATURE REVIEW

The engine alteration approach was reportedly one of the most recent advancements in engine development that motivates the achievement of total burning. Two innovative bowl designs Toroidal Combustion Chamber (TCC) and Trapezoidal Combustion Chamber (TRCC) were designed and contrasted to the conventional Hemispherical Combustion Chamber (HCC). The investigation then advanced to efficiency and energy assessment. TCC bowl geometry exhibited superior engine characteristics in comparison to TRCC and HCC. The TCC engine's strong swirl and squish action improve air-fuel interaction and leads to full combustion. Biodiesel samples include molecules, and decreased exhaust fumes emissions, with the exception of NOx, have been recorded. Overall, biodiesel may be regarded as a potential alternative fuel due to its exergy efficiency of 66.51 percent in the TCC engine [3]. The viscosity and ignition delay period (IDT) of biodiesel play vital roles in the combustion process. The chemical IDT may be shortened by a greater saturation, and the dynamic viscosity will rise in C18:0, C16:0, and C18:1. High dynamic viscosity may result in inefficient atomization and vaporization. Low flow rate methyl esters, such as C18:3 and C18:2, were advantageous for improved burning and fuel mixture, but they were shown to increase NOx emissions. Consequently, the link between emissions and ignition parameters and the amount of biodiesel was not clear. The oxygen concentration of biodiesel fuel increases in-cylinder combustion when compared to pure diesel. It was advantageous to reduce HC and CO pollutants while increasing NOx emissions. Nevertheless, it is not evident under low load [4]. Blends of jatropha methyl ester (JME) in diesel (5%, 10%, and 20% by volume) are used to evaluate engine performance metrics, combustion, and emission characteristics. To use the Ansys forte code, a thorough mathematical setup was constructed and evaluated against fresh observations. Results show that when CR was changed from 18 to 23 an increase in cylinder pressure was observed. In contrast, boosting CR increases NOx, CO, and unburned hydrocarbon (UHC). By changing CR from 21.5 to 23, a decrease in peak cylinder pressure was noted. This demonstrates the viability of pure JME in CI engines with lower emissions and little energy losses [5]. The Optimization problem test was conducted by S. Murugapoopathi et al. to get the best engine operational parameters with enhanced efficiency and emissions. The test was done using fuel mixes of corn oil (COB) in proportions with diesel. 160 bar inlet pressure was maintained. The findings of the experiment are compared to those of diesel, confirming that supercharging yields considerable increases in performance and emission characteristics [6].

The CeO_2 nanoparticle concentration with the COB10 was changed between 25, 50, and 75 ppm. With the inclusion of CeO_2 nanoparticles, the chemical qualities of the fuel were improved. According to the findings BTE of the engine was improved by 34.7%, but NOx production increased. At engine power load COB10, COB10+25 ppm, and COB10+50 ppm lowers the unburned HC by 11, 16.6, and 20.8%, respectively. The shortened injection timing decreased the generation of CO and HC. The optimal viscosity of nanofluids with COB10 was 50 ppm, which costs approximately Rs. 8. Comparably, the overall price of biodiesel including nanoparticles of cerium oxide was projected to be Rs. 76 per kilogram [7]. The redesigned piston profiles, HCC and TCC are constructed using a high compression of 17:1 as a base, and the impacts of higher compression were examined. To get a greater understanding, tests are carried out using pure diesel across situations ranging from low to full load. TCC piston shape has shown a significant benefit in BTE and CO emissions than HCC when the engine pressure ratio was increased. With a high CR and TCC piston shape, however, there was a decrease in NOx emissions [8]. A VCR engine was turned into a biogas-powered, double-diesel fuel by attaching a recirculation gas mixer to the engine's intake manifold. Trials have been done at various CR and under varied loading situations while maintaining the normal loading rate of 23 milliseconds before the top dead center. When the CR was adjusted from 16 to 18, there was a decrease in CO and HC emissions by 26.22% and 41.97% for the dual fuel mode. Nonetheless, given the same set of CR 16.5, oxides of nitrogen and CO_2 emissions rise by 66.65% and 27.18%, respectively. As a result of the dual fuel mode's lower flow rates, CO_2 and CO emissions are shown to be higher in all test conditions than in diesel mode. The experimental data indicate that the dual-fuel diesel engine should be operated with high ratios of compression. [9,10].

III. METHODOLOGY AND EXPERIMENTAL INVESTIGATION

Figure 1 depicts the total explorative research configuration for the VCR engines. To extend the efficiency of the CI engine one of the useful approaches is to change the piston top geometry. In this experiment, the standard piston of the CI engine was modified and replaced by a square groove top piston shown in fig. 2A and a tangential groove top piston in fig 2B. During the change of piston head, the engine's compression ratio is modified and observed to 16 and 18 whereas injection pressure (IOP) was maintained at 600 bar. The engine operating conditions are specified in Table 2.

The blend used for experimentation is B00 and B20. B00 indicates pure diesel fuel and B20 represents 20% methyl ester and 80% diesel fuel. This combination of the blend was fed to the compression ignition engine. The EGR technology is used up to an extent of 0% and 10%.

AVL 437 smoke meter was used with a part stream opacity measurement method with the range of 0-99.99/m. AVL 444N was used to measure the level of CO, HC, CO_2, and NOx. Both the analyzers were calibrated before experimentation.

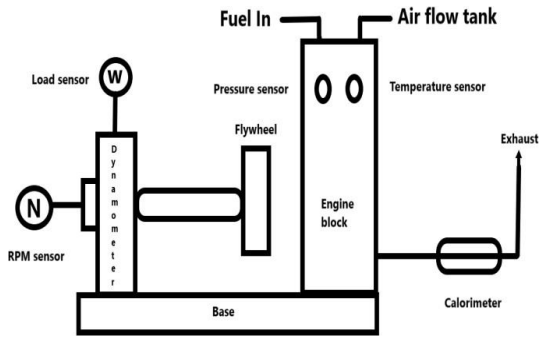
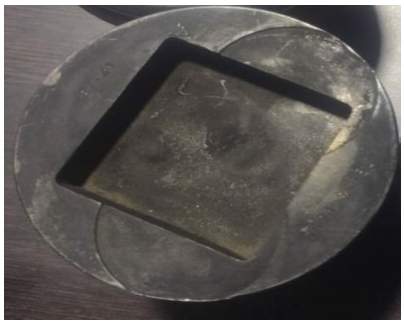
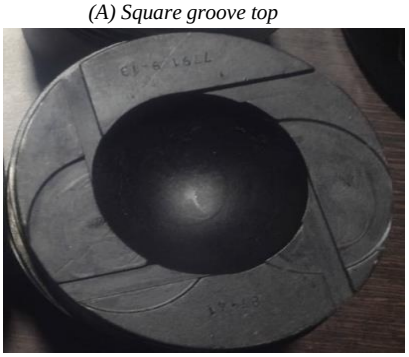


Fig. 1. Experimental research engine

Table 1 gives the detailed engine specification parameter.



(A) Square groove top



(B) Tangential groove top

Fig. 2. Square and Tangential groove top piston

TABLE I : DIESEL ENGINE PARAMETER

Parameter	Description
Engine Makes	Kirloskar Tv1 VCR Engine 3.5 kW at 1500 RPM
Number of Cylinders	1
Cycles	4 Stroke
Engine Timing	23º bTDC
Compression Ratio	12 To 18

TABLE 2. ENGINE OPERATING PARAMETERS

Run	CR	IOP (bar)	EGR
1	16	600	0%
2	16	600	10%
3	18	600	0%
4	18	600	10%

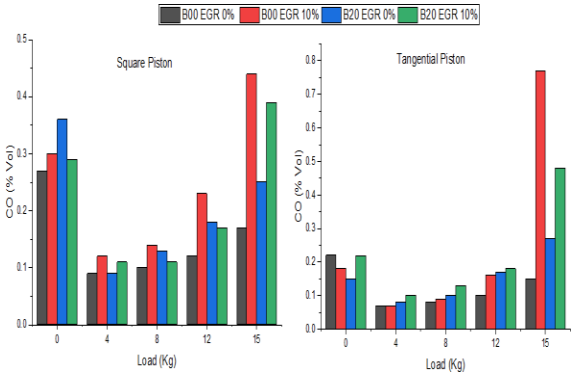
Table 3 gives the detailed properties of methyl ester as per the American Society for Testing and Materials (ASTM) 6751 standard.

TABLE 3 PROPERTIES OF METHYL ESTER

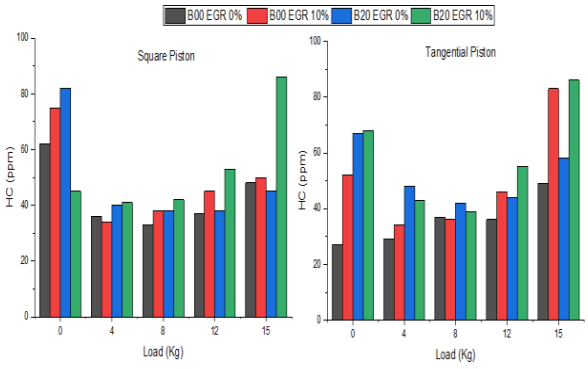
Description	Reference Standard ASTM 6751	Reference Unit	Blend ID	
			B00	B20
Density	D 1448	gm/cc	0.830	0.833
Calorific Value	D 6751	MJ/Kg	43.50	42.89
Cetane Number	D 613	--	49	49.52
Viscosity	D 445	mm^2/sec	2.70	2.84

IV. RESULTS AND DISCUSSION

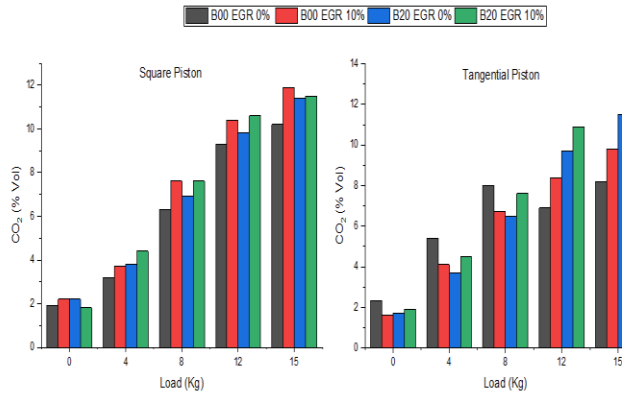
1) Emission characteristics at CR 16



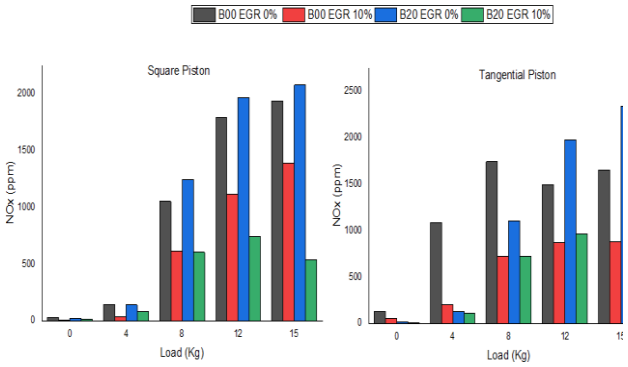
(A)



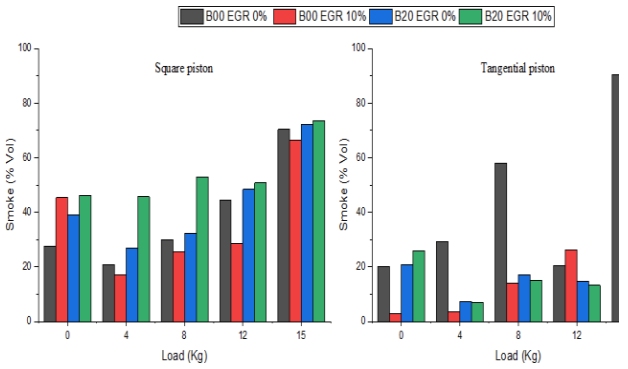
(B)



(C)



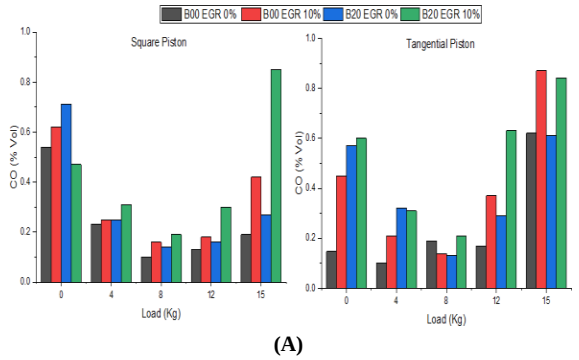
(D)



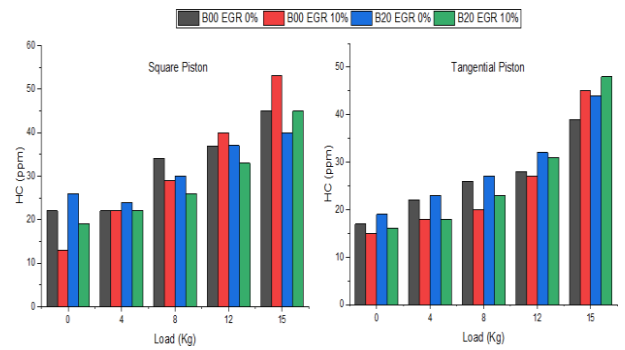
(E)

Fig 3 emission characteristics at CR 16 with load

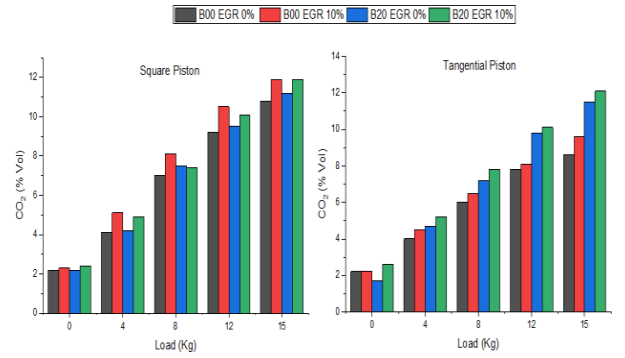
2) Emission characteristics at CR 18



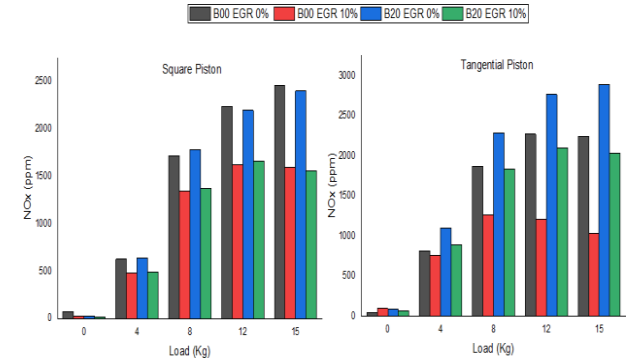
(A)



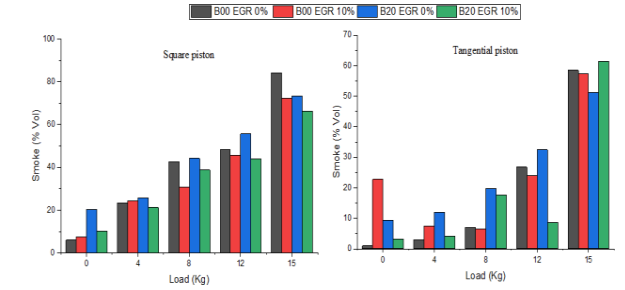
(B)



(C)



(D)



(E)

Fig 4 emission characteristics at CR 18 with load

Carbon monoxide vs Load reveals emission behavior including compression ratio (CR16 and CR18), piston shape (square and tangential groove top), exhaust gas recirculation (0 and 10%), and fuels (B00 and B20), have been demonstrated and shown in fig 3A and 4A. As a result, the carbon monoxide volume curve for CR16 was steeper than that of low CR18. Among the CR16 curves, the tangential groove top piston with B20 fuel and no EGR has shown greater emission within a shorter time.

The emission volume peak increases with load This might be because a lower CR has decreased initial emission volume and temperature. Moreover, that minimizes the time required to prepare pre-mixed fuels for burning. In comparison to CR16, a decrease in CR lengthens the ignition time and thus decreases the maximum CO volume. At half load, the maximum cylinder volume at CR18 is 30% lower than that of CR16, while at full loads, the maximum CO volume is 13% lower.

Exhaust gas recirculation (10%) had shown a reduced CO than EGR0%. CR16 has shown greater CO than CR18 in all operations. When anticipated, as load operations increase, MGT rises from 0.2 Percent volume to 1.0 percent volume. This might be because greater blend fuels are used at full load. Also, B00 has shown greater CO than B20 was used because of its reduced volatility and calorific value. Tangential groove top piston with B00 and B20 at CR16 with and without EGR have shown greater promising results for CO, with higher CO values during the fast combustion phase and lower values during the after-burning phase. That demonstrates the regulated, quick, and homogenous combustion of B00 and B20 fuel with and without EGR with a tangential groove top as compared to the piston having a square groove top. In addition, the CR16 piston with tangential groove top shape, EGR10%, and B20 fuel provides significant CO behavior.

Fig. 3B and 4B show maximum rise in HC volume for CR18 was lesser than that of CR16. This might be because a lower CR has decreased initial emission volume and temperature. Moreover, that minimizes the time required to prepare pre-mixed fuels for burning. In comparison to CR16, a decrease in CR lengthens the ignition time and thus decreases the maximum HC volume. At half load, the maximum HC volume at CR18 was 30% lower than that of CR16, while at full loads, the maximum HC volume was 13% lower.

When compared to operations that did not use EGR, all EGR operations for fuels and piston groove top geometry showed lower maximum HC values. This finding was significant. As a consequence of this, EGR brings about a reduction in the amount of HC oxygen, and as a result, the emission volume and temperature observed as well-controlled emission behavior. In addition, the piston shape with a tangential groove top and B20 fuels has reported approximately equal and greatest hydrocarbon volume maximum values for 0% and 10% EGR. It reveals that B20 fuels that use 10% EGR and a tangential groove top piston shape produce the greatest emission behavior in the HC and the most promising outcomes. This was the case because of the tangential groove.

Fig 3C and 4C show the CO_2 emission with an elevated load. The maximum rise in CO_2 volume for CR18 is lesser than that of CR16. This might be because a lower CR has decreased initial emission volume and temperature. At half load, the maximum CO_2 volume of CR18 was 30% lower than that of CR16, while at full loads, the maximum CO_2 was 13% lower.

CO_2 volume have been decreased for EGR operations for fuels and piston groove top geometry. As a result, EGR lowers CO_2. The piston design with tangential groove top and B20 fuels showed almost comparable and highest CO_2 volume maximum values for 0% and 10% EGR. B20 fuels with 10% EGR and tangential groove top piston form have the greatest CO_2 emissions and the most promising outcomes.

The emission volume peak in the load rises with an increase in load. The maximum rise in NOx volume for CR16 was lesser than that of CR18. In comparison to CR16, a decrease in CR lengthens the ignition time and thus decreases the maximum dioxygen volume. At half load, the maximum NOx volume of CR16 is 35% lower than that of CR18, while at full loads, the maximum NOx volume was 15% lower as shown in fig 3D and 4D.

It reveals that B20 fuels that use 10% exhaust gas recirculation and tangential groove top piston shapes produce the greatest emission behavior in the NOx and the most promising outcomes. When compared to operations that did not use EGR, maximum NOx volume values for all EGR operations, including those involving fuels and piston groove top shape, showed a reduction.

Smoke emission(ppm) curves in Fig 3E and 4E shows initial compressive volume and temperature for CR18 stay elevated during piston, EGR, and fuel operations. As a result, the smoke volume curve for CR16 is steeper than that of low CR18. Among the CR18 curves, the tangential groove top piston with B20 fuel and no EGR has shown greater emission Volume and a shorter Emission time.

At half load, the maximum smoke volume of CR16 was 35% a value lower than that of CR18, whereas the maximal Smoke volume was 15% lower.

V. CONCLUSION

The design of the piston top has substantial influence on heat release and temperatures of the engines. The combustion efficiency of the square and tangent groove top piston form was better. Transportation use of fossil resources is also one of the leading drivers of contamination and greenhouse gas emissions. There is a need to find an alternate fuel that is continuous and can reduce emission level.

- Various factors, including load conditions (CR16 and 18), piston form (square and tangent groove top), EGR (0 and 10 percent), and fuels (B00 and B20), have been shown to impact Emission characteristics.
- Among the CR18 curves, the tangential groove top piston containing fuel blends and 0% EGR exhibited a higher emission and long emission duration.

- CR18 pistons with a tangential groove on the top, EGR10%, and B20 fuels exhibit remarkable dioxygen behavior.
- EGR (10%) had shown a reduced CO than EGR0%. CR16 has shown greater CO than CR18 in all operations. When anticipated, as load operations increase, MGT rises from 0.2 Percent volume to 1.0 percent volume.
- Greater CO than B20 fuel owing to its lower viscosity and higher calorific value. Tangential groove top piston with B00 and B20 at CR16 with and without EGR have shown greater promising results for CO, with higher CO values during the fast combustion phase and lower values during the after-burning phase.
- CR 16 has higher Carbon Monoxide levels compared to CR 18 across all operations. This increase is likely due to greater fuel consumption at higher loads. B00 fuel shows higher CO compared to B20.

The Hydrocarbon, nitrous Oxide, and Smoke volume curves for CR16 are steeper compared to those of CR18. Among the curves, the tangential groove top piston with B20 fuel and 0% EGR shows the greatest emission volume and shortest emission time.

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A review on Machine Learning Algorithms for Vibration Analysis of unbalance fault in rotating system.

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Abstract: **Identification of faults areimportant to avoid the sudden failure in the industry. Offline and online condition monitoring techniques are used for the vibration analysis. Machine learning and Deep Learning algorithms are used as online condition monitoring techniques. This paper is reviewed the different Machine Learning algorithm for unbalance rotor.**

Keywords: ***Vibration Analysis, Machine Learning, Supervised Learning Algorithm.***

INTRODUCTION:

In the current commercial production industries, there is an increasing trend towards the need for higher availability equipment that can work nonstop 24/7. Thus, any type of failure, even minor, cannot be accepted as it can significantly affect the cost and the production. Hence, a very accurate monitoring of the machine condition and a proper fault diagnosis of the machine failure is necessary. The machine fault diagnosis had seen a vast improvement since the maintenance was provided after the machine had developed a fault and affected the production. After that, it developed into preventive maintenance in the past few years before all the industries started using the condition-based maintenance. Preventive maintenance can be defined as providing maintenance before the machinery faces any fault [1]. A vibration analysis system usually consists of four basic parts: Classification models of machine learning for vibration analysis of induction 1. Signal pickup, also called a transducer 2. A signal analyzer 3. Analysis software 4. A computer for data analysis and storage [2]. Rotor balancing is

required on all types of rotating machinery, including motors, to ensure smooth machine operation. Rotor balancing involves the entire rotor structure, which is made up of a multitude of parts, including the shaft, rotor laminations, end heads, rotor bars, end connectors, retaining rings (where required), and fans. The design and manufacture of these components must be controlled for achieving stable precision balance. Rotor misalignment generates reaction force in the coupling, which is often a major cause of vibration in machinery [3].

Most of the industry nowadays is evolving to industry 4.0 and need to adopt the internet of thing (IoT) technology to keep competitive. Industry 4.0 is the movement towards automation and data sharing in industrial technology and processes that include the IoT, the Industrial Internet of Things (IIOT), cloud computing, and artificial intelligence. Artificial intelligence is capable of performing tasks that substitute human intelligence, which can be known as machine learning. Last decade, machine health inspection is highly relying on human power. Consequently, there will be more automation technology in the factory for machine health inspection to reduce human power.

Machine Learning:

There are several applications of machine learning, the most significant is data mining. People are often proving to make mistakes when they do analysis on big data to establish the relationship between the data. Machine Learning can often be applied to these problems to improve the efficiency of the system and design of the machines.

Any instance in any dataset used by a Machine Learning algorithm is represented using the same set of features. The features may be continuous , categorical or binary. If instance are given by known label then the learning is is known as Supervised Learning. In contrast, Unsupervised Learning is unlabelled. Another kind of Learning is Reinforcement Learning, in which Machine tries to learn by their self. The training information is provided to learn the system behaviour [4].

Machine Learning Algorithms:

the supervised machine learning algorithms which deals more with classification includes the following: Linear Classifiers, Logistic Regression, Naïve Bayes Classifier, Perceptron, Support Vector Machine; Quadratic Classifiers, K-Means Clustering, Boosting, Decision Tree, Random Forest (RF); Neural networks, Bayesian Networks and so on [5].

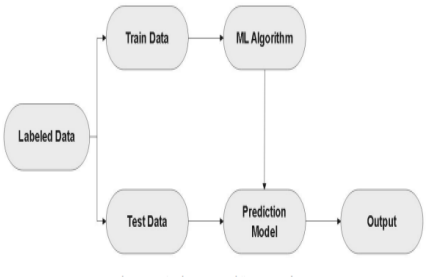

Fig.1. Supervised Learning [6].

I. Linear Regression Algorithm: It can be used to model continuous variables and do the predictions. In this algorithm two types of vaiables are considered. The independent variable is target and independent variable is predictor. In Regression we have the labeled datasets and the output variable value is determined by input variable values - so it is the supervised learning approach. The most simple form of regression is linear regression where the attempt is made to fit a straight line (straight hyperplane) to the dataset and it is possible when the relationship between the variables of dataset is linear.Examples of application of linear regression algorithm are the following : prediction of price of real-estate, forecasting of sales, prediction of students' exam scores, forecasting of movements in the price of stock in stock exchange[7,8].

II. Logistic Regression Algorithm: Logistic regression typically uses a logistic function to estimate the probabilities, which is also referred to as the mathematically defined sigmoid function in Eq. 1 [9]. It is between 0 and 1, and since this is a probability, the output value of y is generated by changing the value of x using the logistic function [10]. For example, a probability value higher than 0.50 for an input instance will classify it as 'class A'; otherwise, 'class B'. The LR model can be generalised to model a categorical variable with more than two values. This generalised version of LR is known as the multinomial logistic regression [11].

$$g(z) = \frac{1}{1 + \exp(-z)}.$$

III. Decision tree algorithm: Decision Trees (DT) are trees that classify instances by sorting them based on feature values. Each node in a decision tree represents a feature in an instance to be classified, and each branch represents a value that the node can assume. Instances are classified starting at the root node and sorted based on their feature values [12].

IV. Naive Bayes algorithm: It is very simple and it is based on conditional probability theorem. The naive Bayes algorithm is based on the Bayes' theorem with the assumption of independence between each pair of features is used to identify the output or class of given features. It works well and can be used for both binary and multi-class categories[7,9].

V. Bayesian Networks algorithm: Modern machine learning models often result in hard to explain black box situations: the inputs are known, but the path to the output and predictions are less clear. If data is also limited or too small to learn all intricacies hidden in the data, it can become hard to get meaningful results from the data and have high confidence in them.One of the methods in our arsenal is the use of **Bayesian Networks**.
This technique allows both for quick, good results as well as expert input.In Bayesian Learning a prior probability distribution is selected and then updated to obtain a posterior distribution Later on with availability of new observations the previous posterior distribution can be used as a prior. Incomplete datasets can be handled by Bayesian network. The method can prevent over-fitting of data. There is no need to remove contradictions from data[7]. Bayesian Learning can be used for applications like medical diagnosis and disaster victim identification etc.

VI K-nearest Neighbors: (KNN) Algorithm is a classification algorithm It uses a database which is having data points grouped into several classes and the algorithm tries to classify the sample data point given to it as a classification problem. KNN does not assume any underlying data distribution and so it is called non-parametric.It is lazy learner; it computes distance over k neighbours. It does not do any generalization on the training data and keeps all of them. It handles large data sets and hence expensive calculation. Higher dimensional data will result in decline in accuracy of regions [10].

Supervised Learning algorithm for UnbalanceVibration Analysis:The machine learning is used to preventive maintenance so one can identify the fault in the mechanical system in early stage. Therefore, the sudden failure can be eliminated and it will reduce the maintenance cost also.There are different kind of faults in mechanical system such as unbalance, misalignment, bearing breakdown, error in gear, fault in induction motor etc.. The most

common fault in mechanical system due to vibration is unbalance. Therefore the focus of this work is on unbalance fault to reduce the maintenance cost of the manufacturing industry.

The Signature Analysis tool is used to identify the spectrum of unbalance fault which gives maximum peak at 1X rpm speed. It means the behaviour of the unbalance system is known to the user. Therefore Supervised Learning algorithms are used to implement Machine Learning technique in predictivemaintenance of unbalance fault identification.

Analysis of Supervised algorithms in Unbalance Fault:

In the following setup the rotating disk is unbalanced by different kind of masses and SVM -supervised learning algorithm was used to predict the behaviour of the system. 7 different case were taken at 1KHZ frequency to collect the 2000 samples.

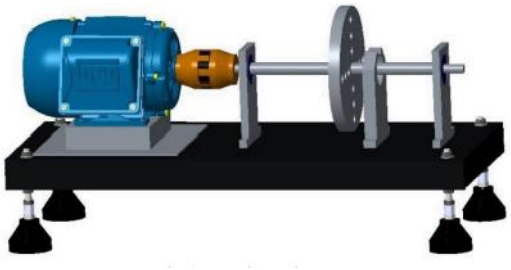

Fig.2 setup for unbalance fault identification [13]

The Labview software was used to implement the SVM alogorithm. The accuracy was found 90% [13].

Fig. 3 laboratory test bench for unbalance fault[14]

Analyzes were performed and validated by applying three classifiers from the Python open-source library sklearn (Scikit-learn, 2020). The 2,00,000 samples were taken. 80% samples were used as training data and 20% samples were used as test data which were collected at the 50KHZ frequency. The accuracy of the data was found as 93% by using SVM algorithm[15].

Conclusion: the different kind of supervised algorithms are used for the identification of unbalance fault. The accuracy and the selection of algorithm is based on the system not on the fault. Therefore different algorithms should be implemented to the mechanical system to identify the output of the system and the selection should be based on the accuracy given by the particular algorithm.

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A Review on Materials, Fabrication and Operating Principles of Sensors.

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Abstract- A brief overview of detectors drugs, accoutrements, types and operations is presented in this paper. Emphasis is placed substantially on aural detectors and optic detectors with their separate advantages and their specific operations in assiduity.

***Keywords*-Acoustic Wave (AW); Inter DigitalTransducer(IDT);FiberOpticSensor(FOS);FiberBragggratings(FBGs).**

I. INTRODUCTION

In recent times there's a growing demand of detectors over a wide range of operations which are presently used as resonators,Pollutants, detectors and selectors. The AW family of bias include consistence shear mode(TSM) bias, shear vertical aural plate mode(SH APM), the face aural surge(aphorism), shear vertical face aural surge(SH SAW). The major types of Optical detectors included microbending detectors, FBGs, optic fiber interferometers and polarization modulated fiber optical detectors. Some of their operations include automotive operations, medical operations and artificial and marketable operations.

II. SENSOR

A detector is a device which receives and responds to a signal when touched. In our diurnal life, we're girdled by detectors like microphone, touch screen tablet. There are also innumerous operations for detectors of which utmost people are ignorant.

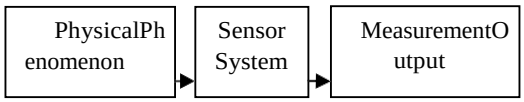

Fig1. BlockDiagramofSensor

Applications include cars, machines, aerospace, medicine, manufacturing and robotics.

III. SENSORSMATERIALS

Aural Detectors are made up of piezoelectric substrate accoutrements (1). The most common are quartz (SiO) and lithium tantalite (LiTaO), and to a lower degree, lithium niobate(LiNbO). Each material has specific advantages and disadvantages, which include cost, temperature dependence, attenuation, and propagation haste. An intriguing property of quartz is that it's possible to elect the temperature dependence of the material by the cut angle and the surge propagation direction. With proper selection, the first- order temperature effect can be minimized. Other accoutrements that have marketable eventuality include gallium arsenide(GaAs), silicon carbide(SiC), langasite(LGS), zinc oxide(ZnO), aluminum nitride(AlN), lead zirconium titanate(PZT), and polyvinylideneflouride(PVDF). Glassopticalfibers arealmostalwaysmadefromsilica.Other crystalline accoutrements like sapphire can be used for longer- wavelength infrared. Silica exhibits good optic transmission over a wide range of wavelengths. Silica can have extremely low immersion and scattering losses. Fusion splicing and adhering of silica filaments is fairly effective. Silica fiber also has high mechanical strength against both pulling and indeed bending, handed that the fiber isn't too thick and that the shells have been well prepared during processing. Indeed simple adhering of the ends of the fiber can give nicely flat shells with respectable optic quality. Silica is also fairly chemically inert. In particular, it isn't hygroscopic.

OPERATINGPRINCIPLES

Piezoelectricity(2) refers to the product of electrical charges by the duty of mechanical stress. The miracle is complementary. Applying an applicable electrical field to a piezoelectric material creates a mechanical stress. Again, by applying an applicable mechanical stress, an electric field will be created. Piezoelectric aural surge detectors apply an oscillating electric field to produce a mechanical surge, which propagates through the substrate and is also converted back to an electric field for dimension.

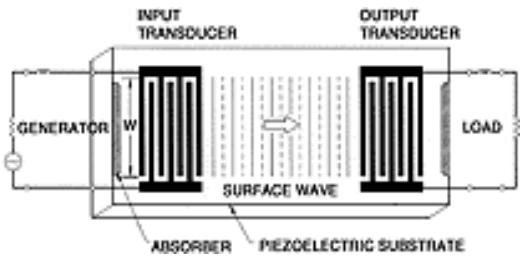

Fig2. IDT converts electric-field energy into mechanical waveenergyandvice-versa

An Electro- Optic effect is a change in the optic parcels of a material in response to an electric field that varies sluggishly compared with the frequence of light. The operation of an optic fiber is grounded on the principle of total internal reflection [3].

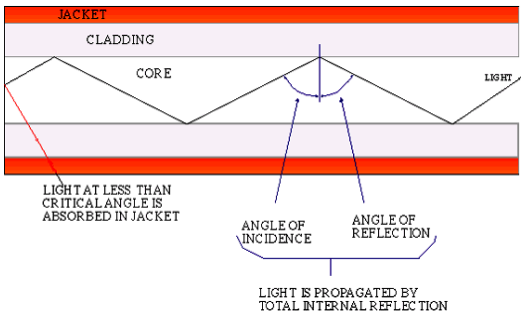

Fig3.Totalinternalreflectioninanopticalfiber.

Light reflects(bounces back) or refracts(alters its direction while piercing a different medium), depending on the angle at which it strikes a face. Controlling the angle at which the light swells are transmitted makes it possible to control how efficiently they reach their destination. Light swells are guided through the core of the optic fiber in important the same way that radio frequence(RF) signals are guided through coextensive string.

IV. SENSORSFABRICATION

The detectors are made by photolithography process(4). The manufacturing process begins by precisely polishing and drawing the piezoelectric substrate(SeeFig. 4(a)). Essence, generally aluminum, is also deposited slightly onto the substrate. The device is also carpeted with a print- repel, which is spun on and also ignited to harden it. The coated device is also exposed to UV light through a mask(seeFig. 4(b)).The mask contains opaque areas, which correspond to the areas to be metalized on the final device. The exposed areas undergoes chemical change, allowing them to be removed using a developing result(seeFig. 4(c)). This exposes areas of essence, which are chemically etched down. The remainingphoto repel is also removed, leaving the final device, as shown inFig. 4(d). The pattern of essence that remains on the device is called an interdigital transducer(IDT).

V. FIBEROPTICSENSORS

Fiber Optical detectors- can be classified as- Grounded on the seeing position, a fiber optical detector can be classified as foreign or natural(5).

Grounded on the operating principle or modulation and demodulation process, a fiber optical detector can be classified as intensity, a phase, a frequence, or a polarization detector [6].

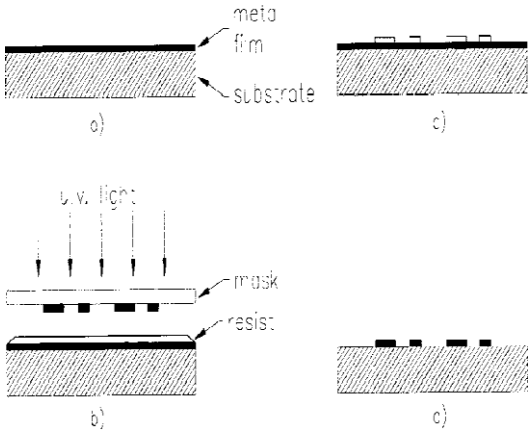

Fig4. Sensors are manufactured using the photolithographyprocess.

VI. CONCLUSION

An overview of fiber optics detectors and Acoustic Sensor is presented along with their operations. either lesser penetration in the automotive, medical, and artificial arenas, detector manufacturers also anticipate a multitude of operations in wireless dispatches and consumer electronics.Utmost of these detectors will be of the MEMS and MST type. In fact, Motorola and Analog biaspropose the use of inertial seeing modular clusters to manage the vast number of seeing functions that will be needed for vehicle dynamics, navigation, safety, and steer- by-line operations.

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Challenges and Approaches for 3w EVs to Be a Most Preferred Vehicle in India: A Review

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ABSTRACT

Apart from the deregulation of gasoline prices, there has been a lot of controversy in recent years about the cost of fuel. Also, the discussion over energy security has intensified due to the potential disruption of Middle Eastern supplies, which has prompted the use of alternative drivetrain technology. Electric cars (EVs) have the potential to revolutionise the automotive industry in India, but only if battery technology, driving range, government incentives, regulations, price reductions, and charging infrastructure all improve. Despite this, the market is anticipated to benefit from factors such rising end-user affordability, cost advantages over auto rickshaws, higher daily earnings than cycle rickshaws, and rising investments by manufacturers in the design and development of more effective and affordable rickshaws. This study aimed to familiarise the consumer with EV technologies and products for three-wheeled vehicles. It also examined the consumer's perceptions of the "fit" of an EV in his or her lifestyle given a variety of demographic factors, including price, brand, range, charging, infrastructure, and cost of ownership.

Key words – 3W vehicle, Electric Vehicle, Indian survey,

I.INTRODUCTION

India is currently one of the top ten automotive markets in the world, and with its expanding middle class and strong economic growth, it is projected that the country's increasing auto sales would continue. Apart from the deregulation of gasoline prices, there has been a lot of controversy in recent years about the cost of fuel. Also, the discussion over energy security has intensified due to the potential disruption of Middle Eastern supplies, which has prompted the use of alternative drivetrain technology. Electric cars (EVs) have the potential to revolutionise the automotive industry in India, but only if battery technology, driving range, government incentives, regulations, price reductions, and charging infrastructure all improve. There seems to be a lot of interest on the part of Internal Combustion Engine (ICE) based manufacturers to adopt electric technology, not just supplemental to the ICE, but as a stand-alone offering.

While many of the EV market's influencing aspects are cognitively acknowledged, we conducted a consumer survey to examine the needs and potential of electric vehicles (EV). It was fairly difficult to predict future demand for electric vehicles because it required gauging consumer preferences for a product with which they are mainly unfamiliar. We concentrated on educating consumers on EV technology and products, as well as their perspectives on pricing, brand, range, charging, infrastructure, and the cost of ownership. We also asked them to imagine how an EV may "fit" into their lifestyles given a variety of demographic factors.

In order to lessen the pollution issue created by conventional petrol models, rickshaw businesses have recently introduced alternate models that use compressed natural gas (CNG) and liquefied petroleum gas (LPG) as fuels. The main power source should be renewable; this is the greatest method to redesign the rickshaw. Because they travel a relatively short distance at modest speeds, rickshaws make a great candidate for electrification. As a result, we have set out to transform auto rickshaws into the poster child for environmental awareness in India by switching them out for electric models and recharging the batteries using a large percentage of renewable energy sources.

II. Literature Review

It is necessary to regularise the functioning of these rickshaws because they have grown to be a significant component of Delhi's transportation network. A significant number of city residents' socioeconomic status has been impacted by rickshaws, and its contribution to income generation can be seen in the fact that 89% of e-rickshaw drivers saw an increase in their salaries from their previous employment and that 39% of the rickshaw drivers surveyed had previously been either

unemployed or cycle rickshaw drivers. The lack of a legal framework and manufacturing standards for rickshaws has left them without a safety structure, which puts commuters at risk. The report urges the creation of strict regulations that guarantee the rickshaw's safe construction and effective operation within the city. A few useful suggestions for the creation of policies in the state of Delhi were supplied by the examination of the Tripura Battery Operated Regulations, 2014 document. The proposal suggests designated parking spaces for these vehicles and zoning for the rickshaws based on Tripura regulations. According to the results of the socioeconomic study, battery rickshaw drivers should have access to funding, credit/asset lending options, and insurance coverage. The expanded proposals suggest a future course of action that involves expanding the use of rickshaws to support the current insufficient Metro Feeder System and developing an infrastructure for electric vehicles with the help of the Delhi Metro. [2] According to the study, the state's e-rickshaws are more energy-efficient than other types of motorised public road transportation vehicles. Yet in order to properly adopt these e-rickshaws, the major obstacles must be overcome. To be compatible with modern traffic, the e-current rickshaw's technology needs to be improved. Vehicle design demands upholding passenger safety requirements, necessitating thorough examination of these vehicles by the appropriate authorities. E-rickshaws have the potential to decrease the amount of fuel oil used for passenger transportation, which could have positive effects on the environment and the economy. [3] E-rickshaws are a green alternative that require no gasoline, CNG, or mobile oil, require no maintenance, and may be the answer to last-mile commuting issues. It can help those from lower socioeconomic backgrounds gain empowerment in addition to promoting a clean environment. Due to poor planning, it increased the threat rather than reducing the strain on the public transit system. While efforts have been made in this direction, the majority of them have been experimental in nature, and a real answer has not yet been found.It is past time to address legal and safety concerns so that it can achieve its very goal of sustainable development[4]. The colonial-era concept of transportation planning and development serves as the foundation for India's transportation system. As a result, the majority of the nation's urban centres have various transportation-related issues. There is a critical demand for environmentally friendly transportation due to the speed at which cities are developing and the severity of the world's environmental issues. With careful design and supervision, these bio-tricycles could in this situation offer the municipality vital services in the near future. Some solutions should be found for the town's transportation issues.

Consider adding e-rickshaws as a crucial component of the transportation system [5]. This management system aims to provide reliable e-rickshaw riders with a safe and practical mode of transportation. By tracking the passenger's route and recording the starting and finishing points of their journey, the system uses GPS technology to address passenger safety. The ease of having additional information, such as the availability of e-rickshaws on a certain route at a specific time, helps to lessen human weariness and save time. The system offers a dependable and adaptable administration of E-rickshaws, making them a possible green transportation option that is suitable for sustainable development [6]. The overall situation for 3w EVs seen by the many researchers in India also leads to the conclusion that it is unfortunate [7–10]. An overview of the good and negative effects of battery-operated auto rickshaws on human life and the environment in Khulna city is provided by the examination of socioeconomic and environmental impact. The majority of individuals use battery-operated auto rickshaws for daily transportation and work-related purposes. They choose it since the cost is less than that of other forms of transportation. The analysis's findings show that it has a good effect on the area's residents' social and economic sectors Owners and drivers of the auto rickshaw both gain financially from operating it. And one of the main advantages of the battery-powered auto rickshaw is that it produces less pollution than other types of vehicles. Yet, it also causes traffic jams and uses a significant amount of electricity when the battery is charging. The analysis of the performance index reveals that the battery-operated auto rickshaw offers outstanding fare and trip comfort. Yet, the level of safety is not adequate. This study examines the low customer acceptance of three-wheel electric vehicles while highlighting market growth inhibitors and risks. In-depth discussion is had regarding potential initiatives and current programmes to address the problems facing 3W EVs.The said work is intended to improve the transportation system of Metro city by using the battery operated auto rickshaw in an effective way.

III. Challenges and Efforts for Electric Vehicle to Be a Preferred Public Vehicle:

1. Electric Vehicle Driving Range

Although if the driving range of the majority of electric cars has considerably increased in just a few short years, many drivers still find it challenging.

The electric car's range is quite limited. This is good for driving about town, but it can be difficult on longer travels especially in colder weather. An electric vehicle would need to be carefully planned for and probably make some unfavourable stops on a cross-country journey. According to a AAA research, when the temperature dropped to 20 degrees Fahrenheit and the heat was on, the vehicle's range decreased by 41%.

Automobile manufacturers have reacted by including larger batteries with longer driving ranges. For owners of electric vehicles, this will soon become less of a problem as lithium-ion battery technology advances. Electric cars aren't practical for all drivers in the meantime. When investing in a limited driving range, think about how you might be able to get around its restrictions.

2. Charging Speed

As usual, it takes longer time to charge the batteries. Most EVs may be fully charged using 220 volts in as little as 3–4 hours to as long as 10–12 hours (depending on the battery size). The charging speed of the electric BMW i3 is shown in Fig. 1. When charging electric vehicles on the road with 440-volt systems, the trip's duration is significantly increased.

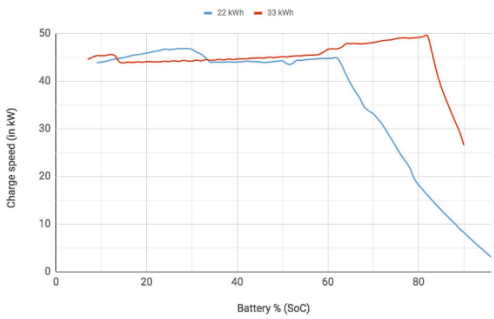

Fig.1 Charging with BMW i3

The clever algorithms used by smart charging solutions control and balance the power load during the daytime charging activities while taking into account the constraints of the local grid. When EVs are charging, it controls, supervises, and balances the energy delivery to them.

3. Cost To Purchase

When someone checks the cost of a new EV, it's simple to preach about the amount of money they may save by driving an EV. Without government subsidies and tax breaks, the price of a new electric automobile is, at the very least, $25–$30K. Figure 2 displays a cost comparison of the automobiles utilised in Delhi, the capital of India.

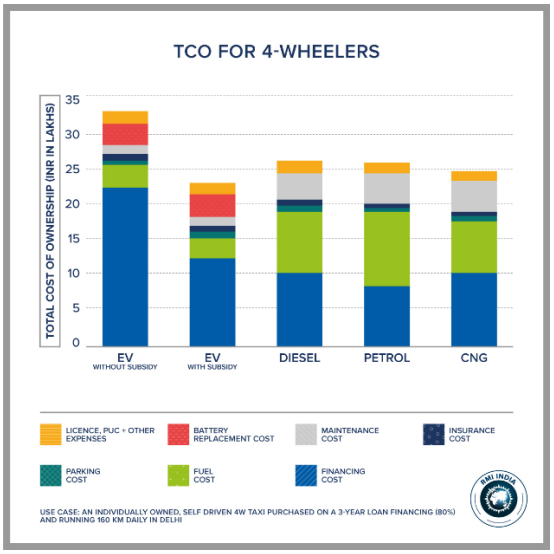

Fig.2 Total cost of ownership of Electric Vehicle in Delhi

The price of EV batteries has decreased as a result of technological advancements. Batteries are, in fact, the most expensive component of an electric vehicle, which raises the cost and reduces adoption rates. The cost of an EV battery in 2010 was approximately $1,100 per kWh, according to the IEA analysis. Yet in 2020, their cost dropped to about $137 per kWh or possibly to as little as $100 in China. The cost of EVs will reduce as this cost does as well. As a result, these cars will be in a better position to compete against gas-powered cars.

4. Finding Charging Stations

Concerns around the charging facilities for electric vehicles are among the most often asked topics.

There are recharge facilities every 40 to 80 miles in a large metropolis. Although there are numerous fast chargers in some areas, there is currently a robust, competitive charging network that any electric vehicle can access. Having said that, there are certain issues with that network. I am aware from personal experience that a charging station is first requested by a charging station operator or a local authority, the suitability of which has already been evaluated by the city. To locate prospective charging station locations and evaluate the cost of connecting them to the grid, this strategy necessitates tight cooperation across numerous parties.

5. Overcharging

Li-ion batteries might experience issues if they are overcharged due to faulty voltage regulators, alternators, or poor charger use. Overcharging like this can lead to overheating and eventually a fire. Owners may easily picture putting their electric car in the garage to charge overnight and having a mechanical problem with the charging port lead it to catch fire, causing the house to burn while the driver is sleeping (Fig. 3).

Fig. 3 Overcharging Events For Lithium

i) Evaporation: The electrolyte in a lead-acid battery is a mix of sulphuric acid and water, 35% sulfuric acid to 65% water. When a battery is overcharged, heat will accumulate inside of it more quickly than it can release into the atmosphere. The water in the solution will begin to evaporate due to the battery acid's higher temperatures.

The electrolyte solution gets thinner as water evaporates. The battery will continue to overcharge, raise the temperature, and finally experience thermal runaway if it is still attached to the charger. The solution that remains after water evaporation is made up of concentrated sulfuric acid, which is quite corrosive and will begin harming the battery plates and other components.

ii) Heat Build-Up: When a battery receives an excessive charge, the extra charge current is transformed into heat. When a battery's internal resistance rises as a result of heat buildup, the temperature will rise even more.

The internal chemical reactions of the battery are exothermic, which means that heat is produced. The battery acid functions as a heat sink, collecting extra heat and dissipating it into the environment when more heat is delivered into the battery. When a battery is overcharged, heat accumulates far more quickly than the battery can lose capacity. The battery experiences thermal runaway as a result of this.

iii) Melting: The battery shell, which is often constructed of plastic, will become too hot as more heat accumulates inside the battery. The plastic case and the battery plates inside will begin to melt if the temperature rises above a certain point.

The heated battery acid that leaks out of the melting shell will corrode and interact with the surrounding elements. Acid burns caused by interaction with the human body are very painful.

iv). Hydrogen Explosion

Overcharging the battery will speed up the electrolysis process. This is the process by

which water breaks down into its gaseous components, hydrogen and oxygen.

As a result of the gases that are created, the acid will "boil over" and spill. The battery will let its gases out into the environment. There is a considerable chance of hydrogen gas build-up when the battery is being charged in an area that is poorly ventilated. When exposed to heat or fire, hydrogen gas is likely to ignite and explode when its concentration reaches 4%.

When the hydrogen gas cannot escape to the outside, it may also accumulate inside the battery. The pressure inside the battery will rise due to the gas buildup, and if the pressure is too high for the battery shell to withstand, the battery may explode.

Discharging the batteries first and recharging them again at a normal rate is one of the main methods for "repairing" overcharged batteries. It's a smart move because overcharging has disastrous effects; by discharging it and bringing it to normal levels, your battery will be fully functional once more, with no glitches.

There are a few ways to discharge a battery, so the following safety measures must be taken:

Almost all batteries can be drained, but not all methods are suitable or safe for them.

Contact a professional to determine the best way of battery discharging, then follow their advice.

Make sure you've done all the required safety measures to prevent damage from occurring while discharging.

The harm might not be repairable.

While it is acceptable to reuse a depleted battery, it should be noted that during the overcharging process, the battery itself may have suffered some potential damage that rendered the battery unusable. If that is the case, you might not be able to reuse a battery without replacing its parts. So instead of just repairing the parts, it would be wiser to just get a new battery.

Batteries can't be thrown away like regular items by just dumping them in the trash. They must be disposed of correctly, and overcharged batteries in particular must be handled carefully because they are typically more harmful. They might, in the worst instance, represent a ticking time bomb.

6. Light Weight

Batteries lack the energy density of fuel, and as cars gain weight, they become riskier. Vehicles have been increasing heavier overall, even without batteries: Pickups are now 32% heavier than they once were. The average car weight for each segment is shown in Table 1. Someone in the lighter car is more likely to perish in an accident with a bigger vehicle. Pedestrians are more vulnerable. In addition to having a greater overall environmental impact, heavier vehicles emit more pollutants from microscopic particles that come off the tyres and take more resources and energy to generate.

Table 1 Segment wise weight of the EVs

Sr. No.	EV Type	Battery Weight (Kg)	Vehicle Weight (Kg)
1	Luxury Car	553	2100
2	Large Car	393	1750
3	Medium Car	253	1500
4	Small Car	177	1100

To encourage people to choose lighter cars, registration fees for heavier vehicles should be increased. (As fewer automobiles use gas, registration fees can also help offset losses from gas taxes.) Also, the government can contribute to the cost of R&D to advance technology and hasten its deployment. To cut weight, some automakers are experimenting with different ways to embed batteries into the vehicle's construction. To compensate for the heavy battery, the car might use new materials in other areas to make it stronger and lighter. Additionally, some cars already include cameras, sensors, and other

technology that can be utilised to prevent collisions.

7. Vehicle Balance

The tyres on the side of your automobile that is "lighter" may lose traction when you suddenly accelerate, decelerate, or turn. In extreme circumstances, losing traction on the surface of the road might cause skidding, spinning out, or rolling over. Remember that when driving at high speeds, on a wet road, or in any other situation where traction is already weak, the impacts of a shift in weight will be amplified.

Thankfully, loss of balance can be avoided with precision steering, steady acceleration, and moderate braking. Of course, it must maintain the car's functionality and keep it moving at a safe speed for the conditions of the road.

8. Thermal Runaway In Battery

Thermal runaway, which occurs when heat within the battery causes an uncontrolled chemical reaction, is one risk that is somewhat abstract but nonetheless very hazardous. The discharge of heat and energy causes a battery breakdown (the battery consumes itself) and a chain reaction, which can cause catastrophic equipment failure, a possible explosion, and fire, all of which can result in the total destruction of the vehicle (Fig. 4).

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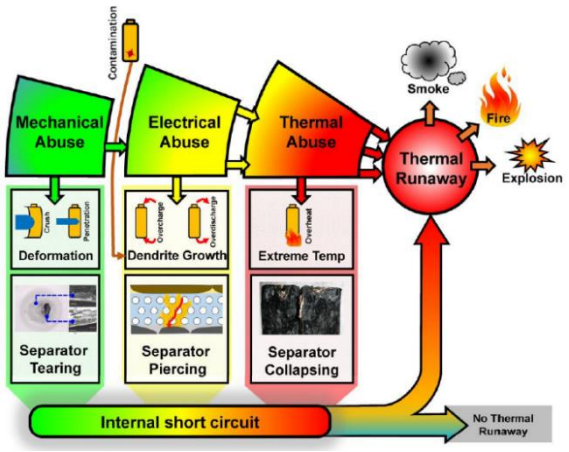

Fig.4 Thermal Runaway Propagation

Watch out for further battery anomalies like ground faults and shorted cells that might have a detrimental impact on charging voltages and eventually result in thermal runaway. In order to prevent runaway, it is necessary to regularly check the battery while it is in operation for overheating.

9. Enforcement Issues-Overloading of E-rickshaws

The most prevalent concern in these locations that causes accidents is overloading. The main cause is that because e-rickshaws go on secondary or intermediary routes without traffic police present, they are free to break the law. According to interactions with the drivers, the traffic police halt them and forbid them from driving on major thoroughfares, even if their vehicles are registered.

i) Undefined halt points: These are slow-moving vehicles with irregular stops and starts based on the demands of the passengers. They typically operate in confined roads or streets. If several rickshaws stop together on narrow roads, it increases the likelihood of congestion because the cars behind them must also stop.

ii) Insurance and claims: If the vehicle is stolen, insurance cannot be used. The drivers claimed that despite having a valid licence for their cars, they had a lot of trouble filing a complaint or obtaining insurance coverage. Lack of awareness contributes to this problem.

iii) Lack of production regulation: Assembling and manufacturing processes are not standardised. They don't have any definite rules or policies to follow. ICAT certification is required of the makers, however once approved, there is no quality control of the output.

iv) Absence of accommodations for those with disabilities: The 2014 modified rule makes no provision for those with disabilities to operate e-rickshaws. The e-rickshaws (which have handle brakes) can

be operated by hands by a person who has locomotive issues. A modification must be made to the rickshaws' braking system.

The neck ring might be provided to reduce the concentration of stress. To lessen joint failure, welding quality and welding joints should be created. There should be uniform distribution of stress. In order to give the chassis more strength, overload factors must be taken into account.

10. Infrastructure Related Issues

i) Gradient climbing capacity: When the vehicle's battery is depleted or the rickshaw is fully occupied, the drivers have trouble ascending flyovers. The drivers prefer to take routes without flyovers in such circumstances. If the routes are on flyovers, their charging is depleted in 40 to 50 km, when it would have lasted for roughly 80 to 90 km on plain routes.

ii) Absence of authorised charging stations: There are no subsidised or designated charging stations for autos. They spend roughly Rs. 3000–4500 per month when the drivers charge them at stores, compared to regular electric points at home. With the DERC's most recent notification, dated August 31, 2017, the drivers are now legally permitted to charge at their homes, which should ease the charging issues. The issue still exists for drivers who are unable to get their vehicles to their residences for a variety of reasons (narrow lanes, unavailability of facilities, etc.)They either go on the limited routes or don't pick up any passengers along the way when the drivers charge them at their homes, avoid their operational routes, and must travel to those routes in the morning and back to their homes in the evening. As a result, the "dead distance" grows (the distance between the operational route and residence of the driver on which the rickshaw is vacant and does not create any income for the driver). This minimises the distance that may have been travelled had the rickshaw been parked and charged along the trip. Just 17% of drivers have charging issues, according to Chart 15.The reason for this is that drivers include the dead distance in their operations. The reaction does not take into account the time and energy wasted.

iii) Absence of defined parking spaces: The rickshaws are unable to park. Rickshaw drivers who are unable to park them at their residences must do so in rented or commercial spaces. According to Chart 18, 91% of drivers do not have adequate parking spaces and must park their cars at their own risk. The remaining 9% do not experience any issues because they park their cars at home.

iv) Lack of stopping and resting areas: 98% drivers consider this as one of the problems during Operation. There is a lack of resting facilities or designated areas where these can wait for their passengers. In some areas, the drivers have to pay an amount of Rs.100-200 per month for standing in que to take the passengers. It is illegal to stop in those areas and they have to flee from that area in case any traffic official comes.

As per recent industry reports published, India’s electric vehicle market (EV) is estimated to emerge as a $7.09 billion opportunity by 2025. To attain 100% electric car mobility by 2030, the Indian government is also developing new policies. In fact, a strong CAGR development of 42.38% is predicted for the Indian EV industry. Foreign investors who want to grow their enterprises in India have a wide range of chances thanks to these encouraging developments in the country's electric vehicle (EV) market.

IV RESULTS

A. India Electric Rickshaw Market Overview

By 2025, the Indian electric rickshaw market, which was worth $786.2 million in 2019, is anticipated to have grown to $1,394.2 million, growing at a CAGR of 33.3%. (2020–2025). The industry is expanding as a result of increasing government incentives to encourage

the use of electric cars (EVs) and the implementation of strict environmental regulations in response to growing concerns over rising air pollution.

Additionally, the market is anticipated to benefit from and grow due to factors like rising end-user affordability, cost advantages over auto rickshaws, higher daily earnings than cycle rickshaws, and rising investments by manufacturers in the design and development of more affordable, efficient rickshaws.

The COVID-19 epidemic is anticipated to have a significant negative impact on the unorganised and local firms currently active in the sector. Additionally, it is predicted that 30% of these makers and assemblers will end operations permanently following COVID-19. The market is anticipated to gradually rebound after the sales statistics in 2022 approach the level of 2019.

In the upcoming years, the difficulties with imports and the escalating India-China conflict will encourage local and in-house development of EV components in India. In the near future, it is also anticipated that the cost of electric rickshaws will rise by roughly 8–10%.In addition, it is anticipated that throughout the forecast period, the share of load carrier electric rickshaws would rise significantly due to the demand for the last-mile transportation of logistic commodities, including fruits and vegetables.

B. **High Passenger Base Leading to Inflated Demand for Electric Rickshaws**

Throughout the historical era (2014–2019), passenger carriers dominated the Indian electric rickshaw industry. It is anticipated that they will continue to hold a bigger market share in the years to come, in terms of both value and volume. This is mostly due to the country's increasing requirement for first- and last-mile connectivity via public transportation. The country's rapidly growing urban population is another factor driving the market for products in this category.

C. **Cost Benefit of 1,000–1,500 W Electric Rickshaws**

The Indian electric rickshaw market generated the most revenue over the historical period from rickshaws with 1,000–1,500 W motor power, which accounted for more than 50% in 2019. This can be attributed to the vehicles' ideal benefit-cost ratio. The category of electric rickshaws with motor power greater than 1,500 W is anticipated to have the market's fastest growth over the anticipated period, as the demand for rickshaws with greater speed and range continues to expand in the nation.

D. **Higher-Battery-Capacity Rickshaws to Witness Strong Demand in the Future**

The Indian electric rickshaw market has also been divided into categories for rickshaws with battery capacities under 101 Ah and over 101 Ah. For the two, electric rickshaws with batteries larger than 101 Ah are predicted to have faster market growth during the projection period. A significant development driver for this market category is the rising demand for rickshaws that can go large distances between charges.

E. **Lack of Regulatory Policies Leading to Market Dominance of the Unorganized Category**

Throughout the past, the unorganised sector dominated the market. Lack of a legal framework, accessibility of inexpensive electric rickshaws, and their simpler powertrain have all contributed to the emergence of unorganised, regional companies in the sector.

F. **Huge Demand for Electric Rickshaws Led to Its Share as the Largest Market**

During that time, the biggest market for electric rickshaws. Since 2013, the sales of electric rickshaws have increased here. The Delhi government has also announced a subsidy of $413 (INR 30,000) on the purchase of electric rickshaws in response to the capital's rising levels of air pollution. This has further benefited the market by increasing the demand for them in the city.

G. Rapid Urbanization Resulting in High Demand for These Rickshaws

Because of the rising demand for these rickshaws across Tier-1, Tier-2, and the rural-urban fringe, Uttar Pradesh is anticipated to have the highest market for electric rickshaws in India over the forecast period. In addition, these rickshaws are in high demand in regions like Assam, West Bengal, and Bihar.

V CONCLUSIONS

The research's conclusion depended heavily on the questionnaire respondents' responses because the findings were both encouraging and consistent with expectations.

Since a significant portion of our society is still ignorant about the many Alternative Technologies employed in Vehicles, the perception of people towards EVS is still poor. Consumer expectations are not sufficiently met by the current EVS. Although numerous agencies have been established and a variety of ideas have been presented, the government's initiatives to promote EVS are still in the planning stages and are only on paper.A shift in consumer behaviour is crucial since consumers will only favour EVS if they are equivalent to the present automobiles on the road. People should progressively start to use greener technologies with greater awareness. As part of their CSR programmes, several businesses should take steps to support electric automobiles.

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6th Generation Aircrafts

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Abstract- The sixth-gen aircrafts will be the next generation aircrafts with increased speed, advanced stealth technology, longer range. Many technical breakthroughs and concepts such as advanced micro-electronics, Composite materials, hypersonic technology and things which may look like straight from fiction will be present. These new generation aircrafts will be expected to be in the field by 2030's.

Index Terms- Aircrafts, Design, Fuel, Dynamics, Stealth Technology, Engine, Speed, Weight.

I. INTRODUCTION

With the Emerging threat of cyber warfare and new technological breakthroughs the new generation air fighters are on the horizon. These fighters will have hypersonic technology, multi-spectral radar system, stealth airframes, AI, helmet mounted display with 360-degree vision for enhanced battle awareness. These aircrafts will be capable of unmanned warfares and it will be capable of carrying several drones for reconnaissance or spying purposes. Currently Hindustan Aeronautics Limited is developing a sixth generation aircraft named AMCA. In Japan i3 fighters are in development. The i3 stands for intelligence, informed and instantaneous.

Fig 1 : 6th Generation Aircraft Concept Image 1

II. THEORETICAL BACKGROUND

All types of aircraft researched or built prior to the invention of the modern aeroplane by 1910 are considered early flying machines. The history of modern flight begins thousands of years before the first successful manned aircraft and more than a century before the first powered flight.

Consequently, the history of aircraft can be divided into five eras:

- Pioneers of flight, from the earliest experiments to 1914.
- First World War, 1914 to 1918.
- Aviation between the World Wars, 1918 to 1939.
- Second World War, 1939 to 1945.
- Postwar era, also called the Jet Age, 1945 to the present day.

Period	Description	Example Aircraft
1943-55	High Subsonic , Convential armament	Me 262, DH Vampire, P-80, MiG-9
1955-70	Radar, air-to-air missiles, Supersonic & Multi-purpose fighter-bombers	F-4, MiG-23, Mirage F1, Shenyang
1970-80	Supersonic (multirole)	Panavia Tornado
1974-90	High manoeuvrability, High efficiency	F14, F-15, MiG-29, Mirage 2000
1990-2000	Enhanced capabilities, Advanced avionics	F/A-18, Su-30, Rafale
2000-present	Low observable stealth, Advanced integrated avionics	F-22, F-35, J-20

III. LITERATURE SURVEY

The significant technological advances in the historical development of the jet fighter are categorised into jet fighter generations. Different authorities have divided the development of fighters into various numbers of generations by identifying various technological leaps as the critical ones. There are currently five generations that are commonly acknowledged, and work on a sixth is ongoing.

1st Generation Fighters (1940's)

The Me 262 was the first operational Fighter Jet

Fig 2 : Me 262 – 1st Gen Aircraft

During and after the latter years of World War II, the early jet fighters first appeared. They resembled their piston-engined counterparts in most ways, including having straight, unswept wings and being made of wood or light metal. (The Me 262's wings were lightly swept, although this was done primarily for balance, and the sweep was purposefully kept too small to have a noticeable aerodynamic effect.

Transonic speeds could be obtained thanks to the invention of the swept wing, but controllability was frequently compromised at these speeds. Typically, these planes were designed for the air-superiority interceptor duty. [17] The North American F-86 Sabre and the Soviet Mikoyan-Gurevich MiG-15 are notable models that fought in the Korean War from 1950 to 1953. The Hawker Hunter arrived too late to participate in the initial conflict, although it was widely utilised in subsequent conflicts.

2nd Generation Aircrafts (1950's)

The Mikoyan-Gurevich MiG-21 was the most-produced supersonic jet aircraft in aviation history.

Fig 3 : Mig 21 – 2nd Gen Aircraft

The 1950–1953 Korean War necessitated a significant reconsideration. At such high speeds, guns proved to be ineffective, and the necessity of multirole capabilities in battlefield support was once again realised. After-burning engines were utilised by interceptor variants that emerged after the war to achieve Mach 2 speed, while radar and infrared homing missiles significantly increased their accuracy and potency. This period was typified by the American Century series, which included the Lockheed F-104 Starfighter, the Russian MiG-21, the English Electric Lightning, and the French Dassault Mirage III. Adaptations for wartime support tasks quickly compromised several kinds, and some of them would endure in new forms for several generations.

3rd Generation Aircrafts (1960's)

The Hawker Siddeley Harrier was the First operational attack aircraft with vertical/short takeoff and landing (V/STOL) capabilities.

The multi-role capabilities of the next aircraft were planned from the beginning. They were anticipated to be able to engage in air-to-air interception outside of visual range and carry a variety of armaments and additional munitions, including air-to-ground missiles and laser-guided bombs. Pulse-doppler radar, off-sight aiming, and terrain-warning systems were some of their supporting avionics.

Fig 4 : Hawker Siddeley Harrier – 3rd Gen Aircraft

While increasing power could only partially result in better performance and manoeuvrability across the speed range, the introduction of more economical turbofan engines allowed for an improvement in range. To balance these extremes, several designers turned to changeable geometry or vectored force. Different types, including the Hawker Siddeley Harrier, the McDonnell Douglas F-4 Phantom, the General Dynamics F-111 had varied degrees of success.

4th Generation Aircrafts (1970's)

The Grumman F-14 Tomcat was one of the first operational fourth generation jet fighters.

The development of advanced technologies such as fly-by-wire, composite materials, thrust-to-weight ratios greater than unity, hypermaneuvrability, advanced digital avionics and sensors like synthetic radar and infrared search-and-track, and stealth followed the mixed results of the multirole generation. Designers went back to the fighter in the initial place, but with

assistance and responsibilities outlined as planned developments, as things arrived piecemeal. While the Saab 37 Viggen pioneered aerodynamic design with its canard foreplanes, the General Dynamics F-16 introduced electronic flight control and wing-body blending.

Fig 5 : F-14 Tomcat – 4th Gen Aircraft

5nd Generation Aircrafts (2000's)

The Lockheed Martin F-22 Raptor is generally considered to be the first operational fifth generation fighter jet.

A new type of advanced forward C3 (command, control, and communications) presence over the battlefield was made possible by the enormous advancements in digital processing and mobile networking that started in the 1990s. Prior to the advancement of information technology, such aircraft had to be huge transport types modified for the task, but now the requisite data systems might be carried by a much smaller and more manoeuvrable aircraft. The complexity of automation and human interfaces may significantly lessen the effort on the crew. Now, a single, nimble aircraft could perform the C3, fighter, and ground support missions simultaneously. Such a fighter—and its pilot—would need to be able to loiter for extended periods of time, compete well in battle, stay aware of the battlefield, and swiftly change roles as the circumstances required.

Fig 6 : F-22 Raptor – 5th Gen Aircraft

Such a machine was made conceivable by concurrent advancements in materials, engine technology, and electronics. Advanced systems ideas like smart helmets, sensor/data fusion, and subsidiary attack drones started to materialise at the beginning of the new century. The fifth generation of fighters was built by combining and merging these advancements with those of the fourth generation. The Lockheed Martin F-22 is usually considered to be the first of them. The Lockheed Martin F-35, Chengdu J-20, and Sukhoi Su-57 are subsequent models.

6th Generation Aircrafts (2020's)

As the fifth generation gradually entered service, focus shifted to a successor sixth generation. The specifications for such a fighter are still up for discussion. The fifth-generation capabilities for ground support, air superiority, and combat survival are being improved and tailored to the incoming threat environment. Laying out realistic roadmaps is showing to be largely influenced by development time and expense. On the modern battlefields, drones and other remote unmanned technologies are being used more and more. They could function as satellite aircraft under a sixth-generation command fighter or possibly take the place of the pilot in an autonomous or semi-autonomous command aircraft by integrating sixth-generation fighter avionics.

Fig 7 : Tempest / F-X – 6th Gen Aircraft Concept

IV. THINGS TO KNOW ABOUT AIRCRAFTS

For the designing of the aircraft the following configurations must be done:

- **Wings:**

Modern high performance aircrafts have three types of wings these are trapezoidal, delta, swept back (with low aspect ratio). Lower performance fighters like trainers and ground attack aircraft can also have high aspect ratio sweptback wings, just like transport aircraft. Trapezoidal, Delta and low aspect ratio sweptback wings can fly at subsonic or supersonic speeds. Such wings have low aspect ratios and are thin in order to minimize wave drag . Aircraft with high aspect ratio sweptback wings cannot fly supersonic, except under special circumstances like dives. Such wings have high aspect ratios and are thicker in order to accommodate a thick main spar. While selecting shockwaves must be taken into considerat

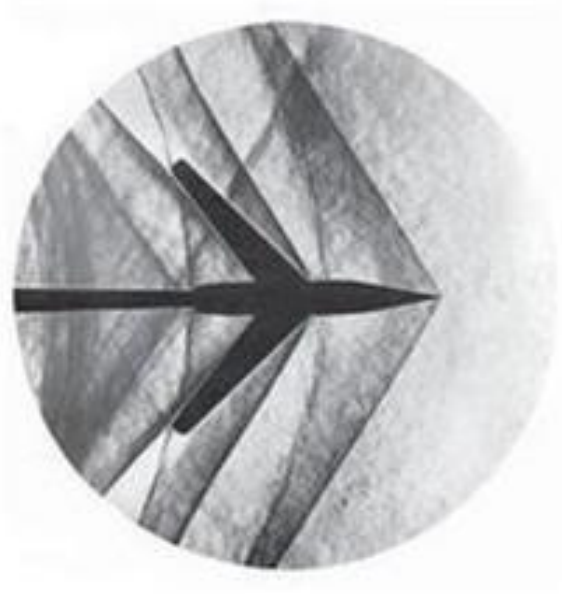

Fig 8 : Shock Waves Generated at Supersonic Speed

- Delta Wings:

As for delta wings have a long root chord and therefore can have a thick main spar while retaining a low thickness---to---chord ratio. They also have larger wing area than trapezoidal wings with the same aspect ratio. This means low wing loading even during maneuvers. At low speed conditions they can produce a lot of additional lift when placed at high angle of attack, thanks to the leading edge vortices. Delta wing aircraft do not require a horizontal tail. But there are some disadvantages to delta wings are Higher viscous drag due to the large wing area. High induced drag at subsonic conditions due to low aspect ratio. Bad deep stall. Pitch control is achieved by deflecting upwards the trailing edge control surfaces in order to produce a nose up moment. This reduces the total amount of lift generated by the wing . Fighters with these wings are MiG---21: Cropped Delta with tail, Mirage III, IV, V, 2000: Tailless cropped Delta

Fig 9 : Mig 21 – Delta Wing Structure

- Trapezoidal wings

In Trapezoidal wings the leading edge sweeps back but the trailing edge sweeps forward. Some Delta wings also feature a slight sweep forward angle at the trailing edge. It gives Better performance than Delta wings at transonic speeds and during transition to and from supersonic conditions. They do not require upwards deflection of the trailing edge control surfaces for pitch control and therefore do not lose lift. Their centre of lift lies further forward and therefore the tail must not lie too far back on the fuselage. They are preferred for stealth applications. Their Flaps can be easily used for maneuvering .These type of wings have High wing loading and They stall at much lower angles of attack than Delta wings. Trapezoidal wings are mostly used by the US. They are nearly always combined with a conventional horizontal tail and single or twin fin. Some trapezoidal wings look like highly cropped Delta wings (F---16 for example). Modern trapezoidal wings have very highly swept leading edges, approaching the sweep of Delta wings.

Fig 10 : F-16 - Trapezoidal wings Structure

- Swept back wings

The swept back wings have very similar characteristics to trapezoidal wings but have larger wing area. Their Higher wing area and hence lower wing loading. The centre of lift lies between that of trapezoidal and Delta wings. They have the trapezoidal wing advantages compared to Delta wings. These wings create higher viscous drag than trapezoidal wings. These wings are mostly associated with the Soviet design tradition. The leading edges of swept wings are highly swept, more than those of previous generation trapezoidal wings. All aircraft with swept wings have a conventional but several modern Sukhoi fighters also have canards. Most of these aircraft are heavy fighters with two engines and twin fins.

Fig 11 : Su-35 - Swept Back Wing Structure

- **Placement of Wings:**

Wings are Placed in following Positions:

- High---wing:

Stable in roll and therefore is generally required to reduce stability. Affords good ground clearance for external stores/engine pods/propellers. Short landing gear. High wings can block upwards pilot visibility (bad for turning and climbing).

- Low---wing:

Unstable in roll and therefore dihedral is generally required to increase stability. Very bad ground clearance for external stores/engine pods/propellers. Long landing gear if external stores/engine pods/propellers are necessary.

- Mid---wing:

Neutral roll stability, the dihedral can be zero. OK ground clearance for external stores/engine pods/propellers. Short landing gear

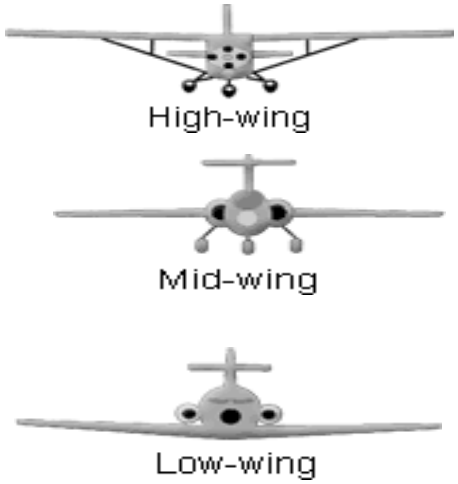

Fig 12 : Winng Positioning Types

- **Number of engines and intakes:**

For modern aircraft, the choice of engine number is relatively simple Heavy fighter aircraft requires 2 engines. A Light fighter aircraft and trainers requires 1 engine. There are several possibilities for intake placement , A single intake in the fuselage nose. A single or double intake under the fuselage or Two intakes on the side of the fuselage. Above the wing for a low---wing configuration. Below the wing for a high---wing configuration. In front of or below the wing for a mid--wing configuration. Note that the inlet shape, number and placement depends not only on the engine flow requirements but also on the flight Mach number (due to shock waves).

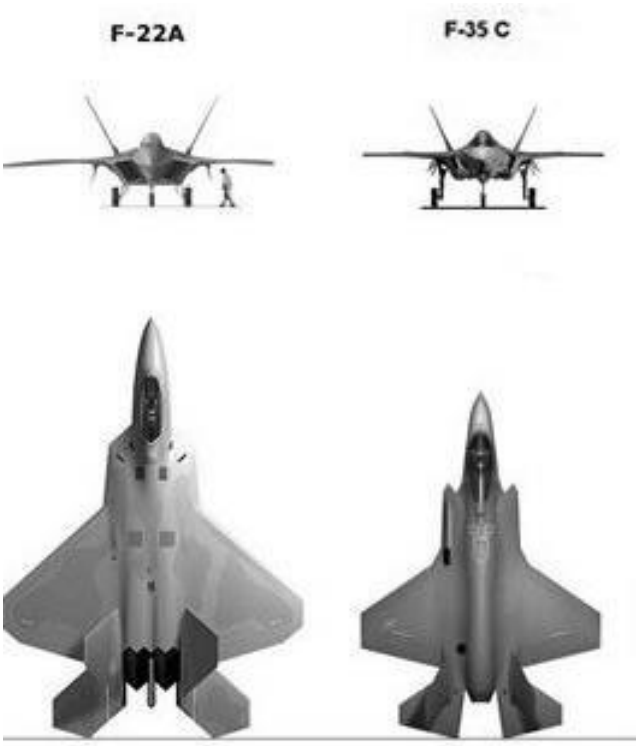

Fig 13 : F-22A Twin Engine Jet / F-35C Single Engine Jet

Aircraft flying at high supersonic speeds experience a severe nose---down moment known as Mach tuck. the aerodynamic centre of the wing moves backwards; the moment of the lift around the centre of gravity increases in the nose down direction. The downwash of the wing decreases; the effective angle of attack of the tail increases and so does the tail lift. All---movable tails are much better at dealing with this phenomenon than fixed tails with elevators. If a shock wave forms on a fixed tail behind the elevator hinge it can cause elevator buzz.

The fuselage of the aircraft consist about 70% of carbon fiber composite and 12% glass fiber reinforced composites to make it light weight and for achieving hypersonic speeds.

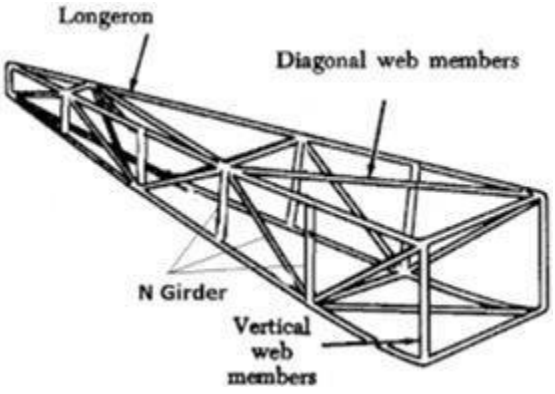

Fig 14 : Fuselage Of Aircraft

- **Canards:**

Canards are always all---movable and their function is pitch control only. They are known as control---canards. In steady level flight their angle of attack is zero and, as they are symmetric, they do not create any lift. They do not contribute to pitch stability, in fact their role is often to destabilize an otherwise stable aircraft. As they are all---movable they cannot stall even at very high angles of attack. The flight computer controls the canards, not the pilot. Lifting canards also exist but not for fighter applications.

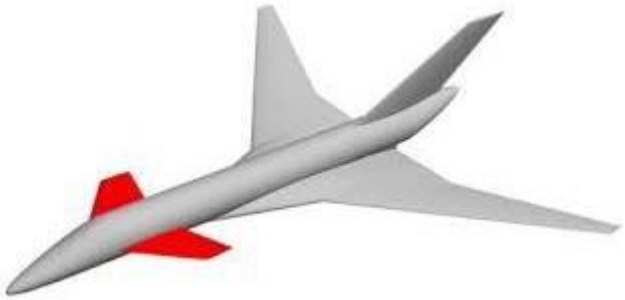

Fig 15 : Canards in Aircraft

The fuselage cross section is defined using a list of following parameters: Height, width, maximum width location, corner radius, top tangent angle, bottom tangent angle, top strength, bottom strength, upper strength and lower strength parameters.

- **Stealth technology:**

Denys Overholser, a Lockheed Aircraft mathematician in the 1970s, adopted a mathematical model to create Echo 1, a computer program. This was the first step toward the development of modern stealth aircraft. The radar signature of an aircraft with flat panels, or facets, was predicted thanks to Echo. In 1975, Lockheed Skunk Works engineers discovered that aircraft with faceted surfaces could have a very low radar signature due to the surfaces radiating nearly all radar energy away from the receiver. For the first time, designers realized that it might be possible to make an aircraft that was virtually invisible to radar.

Reduced radar cross section is only one of five factors the designers addressed in order to create a truly stealthy design such as the F-22. Advanced computers were available to control the flight of an aircraft that was designed for stealth but aerodynamically unstable. Infrared homing (also known as "heat seeking") surface-to-air or air-to-air missiles will have a harder time spotting the F-22 because it has been designed to conceal its infrared emissions. The first use of purpose-built stealth aircraft in combat occurred in December 1989 during Operation Just Cause in Panama. Other design considerations included controlling radio transmissions, making the aircraft less visible to the naked eye, and reducing noise. Two F-117 bombers from the United States Air Force struck a Panamanian Defense Force barracks in Rio Hato, Panama, on December 20, 1989. In the initial phase of Operation Desert Storm in 1991, the only jets permitted to operate within the city limits of Baghdad were F-117s, which were tasked with attacking the most heavily fortified targets in Iraq.

To increase the stealth of the aircraft the engine must be optimized to have less thermal emissions as it will be easier to locate a aircraft with a hot exhaust leaving its infrared footprint in radars and also to reduce the risk of heat seeking missiles that can destroy the aircraft.

Radiation-absorbent materials, or RAMs, are frequently used to make the skins of stealth aircraft. Some of these include microscopic iron spheres, while others include carbon black particles. Many of the materials used in RAMs, particularly those that are employed by certain aircraft, are classified.

The payload is constrained by the internal storage of all fuel and weaponry in fully stealth aircraft. In contrast, a non-stealth attack aircraft may carry a lot more than the two laser- or GPS-guided bombs that the F-117 carries. To engage targets that would typically require a single non-stealth attack aircraft, this calls for the deployment of more aircraft. This apparent drawback is countered by the fact that stealth aircraft are "force multipliers" because fewer supporting aircraft are needed to provide air cover, air defence suppression, and electronic countermeasures.

- **Aircraft Speed & Applied Forces:**

Speed : It is a very important aspect of building an aircraft. It depends on various factors like Shape of Aircraft, shape of wings, position of wings, canards, engine, number of engines and its locations, material of aircraft body, load carried by aircraft and overall aerodynamics. In order to increase the speed of aircraft, its weight must be as low as possible & engine must be powerful, and design must be best possible.

Aircrafts of previous generations like F-22 Raptor, SU-35, Mig-35, Shenyang J-11 Fighter, SU-27SK, etc fly at Speed of 2-3 Mach (i.e. at 2 to 3 times of speed of Sound)

All aircraft are affected by the forces of thrust, drag, lift, and weight when in flight. Flying requires an understanding of how these forces operate as well as the ability to manage them through the application of power and flight controls.

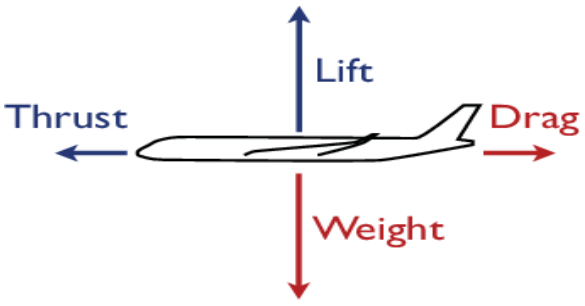

Fig 16 : Forces on Aircraft while in Flight

Thrust, drag, lift, and weight are the four factors that affect an aeroplane in level, unaccelerated flight.

- Thrust :

The forward force generated by the engine, propeller, or rotor is called thrust. It resists or defeats the drag force. It operates generally perpendicular to the longitudinal axis. However, as will be discussed later, this is not always the case.

- Drag :

Drag is an airflow disruption generated by the wing, rotor, fuselage, and other projecting surfaces that causes a backward, decelerating force. Drag often works in opposition to push and moves backward parallel to the relative wind.

- Lift :

Lift is a force that is created by the air's dynamic influence on the airfoil. It acts perpendicular to the flight path through the centre of lift (CL) and perpendicular to the lateral axis. Lift battles weight's downward force during level flight.

- Weight:

It is the total load carried by an aircraft, including the weight of the crew, fuel, and any cargo or baggage. Due to the pull of gravity, weight is a force that pulls the aircraft downward. It works vertically downward through the center of gravity (CG) of the aircraft and opposes lift.

- **Engine:**

Concept of Engines:

- Early Jet Propulsion Concept

The aeolipile was created about 150 BCE out of curiosity, however it was never utilised in a useful way. In actuality, it wasn't until Chinese chemists developed the firecracker rocket in the 13th century that jet propulsion was used in a sensible way. Lagari Hasan elebi, an Ottoman, used jet propulsion to successfully land a cone-shaped rocket in 1633. Then, he used a pair of wings to fly back to Earth. However, because rockets are ineffective for general aviation at low speeds, this usage of jet propulsion was simply a one-time stunt. In any case, his efforts led to a position being offered to him by the Ottoman Army.Between the 1600s until World War II, many scientists experimented with hybrid engines to power aircraft. A type of piston engine, such as an air-cooled or liquid-cooled inline, rotary, or static radial engine, served as the power source for various aircraft.

Despite working independently and being ignorant of one another's work, Dr. Hans von Ohain and Sir Frank Whittle are both recognised as co-inventors of the jet engine as we know it today. The origin of the aeolipile, which was developed approximately 150 B.C., is the development of the jet engine.Jet propulsion may be defined as any forward motion caused by the rearward discharge of a high-speed gas or liquid jet. When discussing engines and air travel, the term "jet propulsion" refers to the use of jet fuel to power the machine itself. Despite the fact that Von Ohain is widely recognised as the creator of the first functional turbojet engine, Whittle was the first to patent his prototype's designs in 1930. Von Ohain received a patent for his prototype in 1936, and his jet was the first to take flight in 1939. Whittle's underwent its first expansion in 1941.Although many people credit von Ohain and Whittle with developing the current generation of jet engines, several grandfathers.

- Sir Frank Whittle's Turbojet Concept

A test pilot since 1931, Sir Frank Whittle was an English pilot and aviation engineer who began his career as a Royal Air Force apprentice. Whittle was just 22 years old when he first thought about utilising a gas turbine engine to propel an aircraft. The young officer finally found himself having to conduct his research independently after making fruitless attempts to secure official backing for the investigation and advancement of his theories. He received his first patent for turbojet propulsion in January 1930.

Whittle once more sought money for a prototype with the help of this patent, and this time she was successful. His first engine, a single-stage centrifugal compressor coupled to a single-stage turbine, was built starting in 1935. The anticipated laboratory test rig was successfully bench-tested in April 1937, proving the practicality of the turbojet idea.A contract for a Whittle engine known as the W1, which was connected to Power Jets Ltd., was granted on July 7, 1939. The Gloster Aircraft Company created the W1 engine-powered Pioneer, a tiny engine aircraft, in February 1940. The Pioneer's historic first flight occurred on May 15, 1941. The contemporary turbojet engine used in many British and American aircraft is based on Whittle's prototype.

- Sir Hans Von Ohain's Concept:

A German aircraft designer named Hans von Ohain attended the University of Göttingen in Germany to earn his PhD in physics. After that, he worked for Hugo Von Pohl, the head of the university's Physical Institute, as a junior assistant.At the time, Von Ohain was researching a brand-new form of aeroplane engine without a propeller. In 1933, while he was just 22 years old, von Ohain originally had the concept for a continuous cycle combustion engine. He filed a patent for a jet propulsion engine design in 1934 that was conceptually comparable to Sir Whittle's, but was constructed differently on the inside.

On the mutual advice of Hugo von Pohl, Von Ohain joined the German aviation company Ernst Heinkel in 1936, who was looking for assistance with brand-new aeroplane propulsion concepts at the time. He persisted in developing his concepts for jet propulsion, successfully bench-testing one of his engines in September 1937. Heinkel created and produced the Heinkel He178, a tiny aircraft that made its first flight on August 27, 1939, to test this innovative propulsion technology. On April 2, 1941, Von Ohain's second, more sophisticated jet engine, the He S.8A, made its first flight.

Current jet engines that are used in fighter aircrafts:

- Jet engines:

Axial flow, air-breathing gas turbines make up the majority of jet engines used in aviation. Gases from combustion are flown through a rotary engine called a gas turbine, which produces energy. Prior to entering the combustion chamber, air pressure and temperature can be increased using either axial or centrifugal compressors. The engine intake draws outside air in. In the combustion chamber, fuel is combined with hot, compressed air and ignited there. Once there has been ignition, it is self-sustaining because constant fuel and oxygen supply allows for continued combustion. A high-energy exhaust stream (reaction mass) is produced during the combustion of a fuel/air mixture, and it exits the combustion chamber and travels through one or more turbines to power the compressor.

- Turbojet engines:

The high-energy gas stream that a turbojet engine exhales out of the exhaust nozzle provides all of the push for this particular type of jet engine. Unlike a turbofan or bypass engine, a turbojet engine's intake air completely flows through the engine core.

The component elements of a turbojet engine are the intake, gas turbine engine, which consists of a compressor, combustion chamber, turbine, and exhaust nozzle. The air is drawn into the engine through the intake, where the compressor heats and compresses it. The fuel is then poured into the combustion chamber and ignited. The burning fuel increases the energy in the exhaust stream by warming and expanding the air. The turbine uses the exhaust stream's energy to drive the compressor. Utilizing the residual exhaust energy, the shape of the exhaust nozzle makes it easier to produce thrust. As the exhaust gas passes through the nozzle, it is expanded and accelerated to a high speed, producing propulsion. To selectively increase the thrust the engine generates, an afterburner or re-heat can be added to the engine design.

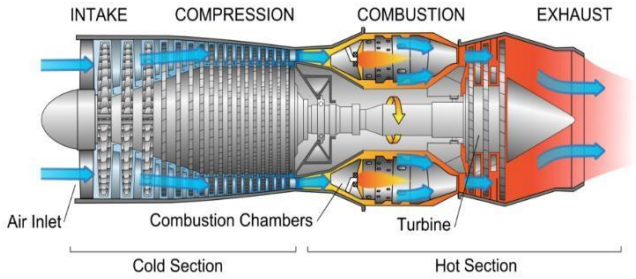

Fig 17 : Turbo Jet Engine

The purpose of turbojet aircraft is to propel a relatively little air mass quickly. At speeds near to Mach 2, turbojet engines operate at their peak efficiency when the speed of the accelerated air approaches that of the aeroplane. At sub-mach speeds, a turbofan engine is significantly more efficient and quieter because to the increased mass and slower exit velocity of the exhaust stream.

- Ramjets:

Because of their simplicity and absence of moving parts in their simplest form, ramjets are commonly referred to as "flying stovepipes". The engine is made up of an air intake, a combustion chamber, and an exhaust nozzle. In front of an item moving through the air quickly, a high-pressure region develops. High dynamic pressure air is sucked into the ramjet engine intake from this location, where shockwaves created by the intake arrangement cause the air to decelerate to subsonic speed before it enters the combustion chamber. In the combustor, fuel and compressed air are mixed and ignited to re-accelerate the exhaust to supersonic speed. When the exhaust gas exits the engine, it accelerates even more due to the geometrical layout of the exhaust nozzle.

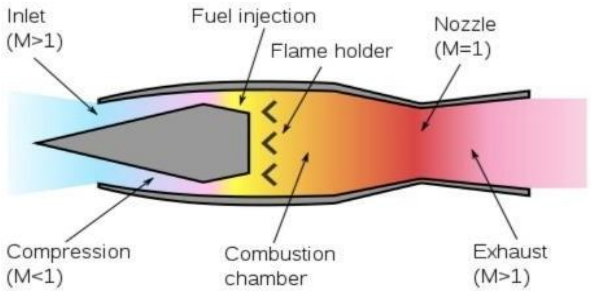

Fig 18 : Ram Jet Engine

Selection of jet engine by its Energy efficiency:

A jet engine consumes fuel and generates thrust while at rest, such as on a test stand. How successfully it accomplishes this is determined by how much fuel it uses and how much power is needed to control it. This demonstrates its potency. The engine will be less effective due to a phenomenon called performance degradation when the fuel delivers less thrust. The engine will operate more efficiently and use less fuel if an internal part is changed to improve the flow of air and combustion gases. To enable comparisons between engines and to assess how different variables impact engine efficiency, a single definition is employed. Specific fuel consumption in this definition refers to the quantity of fuel used to generate one unit of thrust. For instance, a certain engine design may be aware that by removing some bumps from a bypass duct, the air will flow more smoothly, reducing pressure loss by x% and the quantity of fuel needed to achieve take-off thrust. This understanding is included in the technical discipline known as "Jet engine performance." We'll discuss the impact of forward speed and supplying power to aircraft systems later.

The compressor pressure and the temperature of the combustion gases at the first set of revolving turbine blades, which are the working parameters within the engine, are principally responsible for determining the engine's efficiency. The pressure is the greatest in the engine. Despite not being the engine's hotter component, the turbine rotor's temperature is where energy is transported (higher temperatures are found in the compressor). The aforementioned pressure and temperature are displayed on a thermodynamic cycle.

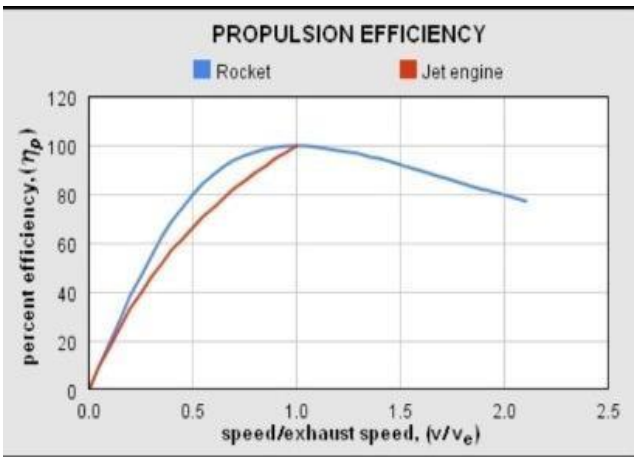

Fig 19 : Garph of Efficiency Vs Speed

V. 6TH GENERATION AIRCRAFTS

The design of the sixth generation aircraft will be like the stealth bombers where their engine will be places far inside the fuselage and air-intakes below the airframe. In this sixth generation aircraft twin engine even though they are heavy will be preferred because they provide a secondary backup and they faster speed and thrust making them suitable to operate on aircraft carriers. These aircrafts will probably have a tail-less design just like a Northrop Grumman YF-23 prototype
As said by Aviation analyst Prashant Prabhakar told EurAsian Times: "A tailless design could induce less parasitic drag and good stealth characteristics although, on the flip side, it could have a potential sensitivity to trim. The engines of stealth aircraft are often located deep inside the fuselage, which seems to be the case here as well.

Stealth is an inevitable characteristic of 6th gen fighters. I think the overall objective would still be to reduce the radar signature reflected from the fighter to the enemy radar."
However, a major disadvantage is that without vertical tails, achieving stability is much more difficult, and mobility is hindered.

As stealth of the next generation will of high priority the wings of the aircraft will be of trapezoidal shape as these wings have a small cross section which will be hard for detecting in the radars as compared to delta wings with high cross section area. Mid-wing structure is preferred for wing positioning since they provide greater stability.
Also such Designs have more Maneuverability and Aerodynamics making them perfect for spying purpose as well as for Dog Fight (Head to head Fight).

Fighters would be able to conduct an increasing number of crucial combat tasks at speeds well beyond the cognitive capabilities of human pilots thanks to the profusion of Al-enabled avionics and neural networks. Voice-activated instructions could communicate with avionics, and helmet-mounted displays with 360 degrees view might possibly replace cockpit instruments as standard equipment .Al is anticipated to transition from sharing the cockpit with a human pilot to operating it alone in the sixth generation. Thus, a fundamental feature of the sixth generation fighter is expected to be a "optionally manned cockpit" design. The Al-driven ability of manned fighters to collaborate with unmanned aerial vehicles (UAVS) and unmanned combat aerial vehicles (UCAVS) for carrying out a variety of offensive and defensive tasks is another byproduct of this characteristic. This Manned-Unmanned Team (MUM-T) concept has previously been shown in programmes, and those programmes continue to improve on it. One manned aircraft in charge of a group of unmanned aircraft that can operate on their own is a notion made possible by artificial intelligence and machine learning.

Fig 20 : 6th Gen Aircraft Concept Image 2

Directed energy weapons like lasers or microwaves as well as hypersonic/ramjet-powered missiles like the Meteor would be carried by sixth generation fighters. The sixth generation of electronic warfare (EW) suites are anticipated to be superior. Superior radar dodging qualities are anticipated to be key components, even though stealth or airframe geometries are not yet well defined. Communication, electronic warfare, and radars may all be included in onboard radio electronic equipment.

Common multitasking hardware and adaptive software with quick task switching would be part of the design. In order to aid in decision-making, onboard mission computers would evolve into massive, high-performance data processing and processing centres. Al would undoubtedly strengthen this feature by transforming data into current information.

VI. WHAT MORE CAN BE DONE

Design which can carry Missiles inside Aircraft, just like Stealth Bombers, to increase Its Stealth-ness.
6th Gen Aircrafts can have remotely controlled technology, so that Pilot can operate aircraft from Military Base itself, no need to be inside aircraft Cockpit. It can have Inbuilt Drone Swarm for Spying Purpose so that Spying will be done more smoothly in less time and Fuel. Also Life of Pilot & Aircraft will not be at risk for spying. Advancements in Radar Jamming and Improved Engine technology for faster speed can be done for better leverage over Previous Generation Aircrafts.

Fig 21 : 6th Gen Aircraft Concept Image 3

Lasers, microwaves, and hypersonic/ramjet-powered missiles like the Meteor would all be part of the sixth generation fighter's payload. It is reasonable to anticipate that sixth generation electronic warfare (EW) suites will be superior. Superior radar dodging skills are anticipated to be key components, notwithstanding the lack of clarity on stealth or airframe forms. Radars, EW, and communication devices may all be included in onboard radio electronic equipment.

A standard multitasking hardware setup would be used in the design, along with flexible software that can quickly move between activities. Mission computers on board would evolve into data processing and collection hubs with enormous high performance computing capabilities to aid in decision-making. Naturally, Al would enhance this element by transforming data into current information.

VII. Conclusion

In this work, we reviewed the historical conventional growth of fighter jets/aircrafts and the concept of 6th generation aircrafts. We reviewed over the components used or can be used (being suggested) that are wings: Delta wings, trapezoidal wings, swept wing with their placements; then engines, stealth technology, applied forces and speed, and for types of engines like jet engines, turboset engines and ramjets with the selection of jet engines were suggested briefly. We also reviewed about design of fighter aircrafts with AI enabled avionics with use of stealth technology and advancement in radar jamming and improvements in engine were suggested.

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ABSTRACT

In order to effectively prevent the spread of the COVID-19 virus, almost everyone wears a mask during the coronavirus epidemic. This almost makes conventional facial recognition technology ineffective in many cases, such as community access control, face access control, facial attendance, facial security checks at train stations, etc. Therefore, it is very urgent to improve the recognition performance of the existing face recognition technology on masked faces. Most current advanced face recognition approaches are designed based on deep learning, which depends on many face samples. However, there are no publicly available masked face recognition datasets. Compared to other datasets, Real-world Masked Face Recognition Dataset (RMFRD) is currently the world's largest real-world masked face Data set.VariouCOVID-1919 prevention measures are undertaken such as wearing masks, sanitization, social distancing and temperature monitoring. An artificial intelligent IOT (Internet of Things) system with temperature monitoring, auto sanitization and, mask detection is proposed. In this system, the machine is connected to a server by which, The admin can monitor everything live from any place. The system also has a face recognition feature by which the registered visitors and students can recognize it separately and the admin can maintain a proper student database with a temperature, and sanitization system for the door opening and closingsystem.

INTRODUCTION

The World Health Organization (WHO) has declared the coronavirus disease 2019 (COVID-19) a pandemic. A global coordinated effort is needed to stop the further spread of the virus. A pandemic is defined as "occurring over a wide geographic area and affecting an exceptionally high proportion of the population." The last pandemic reported in the world was the H1N1 flu pandemic in 2009. On 31 December 2019, a cluster of cases of pneumonia of unknown cause, in the city of Wuhan, Hubei province in China, was reported to the World Health Organization. In January 2020, a previously unknown new virus was identified, subsequently named the 2019 novel coronavirus, and samples obtained from cases and analysis of the virus' genetics indicated that this was the cause of the outbreak. This novel coronavirus was named Coronavirus Disease 2019 (COVID-19) by WHO in February 2020.The virus is referred to as SARS-CoV-2 and the associated disease is COVID-19. As of 4:22 pm CET, 9 December 2020, there have been 67,780,361 confirmed cases of COVID-19, including 1,551,214 deaths, reported to WHO.s

BASIC PRINCIPLE

There will be a unit with a contactless temperature sensor and AI-based camera mounted on the wall outdoors, classroom/ meeting room/ shopping centre etc. The person will be instructed to check his temp and mask if worn.

It will be displayed on an LCD and if they are within range, the door will automatically opened, otherwise, it will remain locked.

This system checks a person's body temperature and masks whether he/she has worn it.

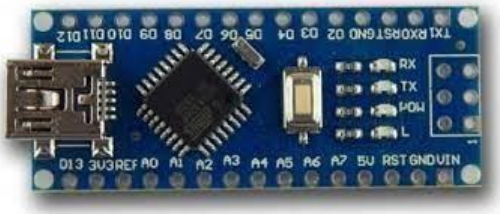
This system detects the temperature of the person using a Temperature sensor.

If any invalid status, then Access denied will appear in Lcd.

There will be a sanitizers dispenser for safety measures. It can save time and cover a large number of people.

REQUIREMENT SPECIFICATIONS

i. Arduino Nano - 1 unit.



ii. Arduino Nano Cable– 1 unit.

iii. Lcd Display (16x4).

jjIR Temperature sensor Mlx90614 - 1unit.

iv. Connecting Wires - 1 unit

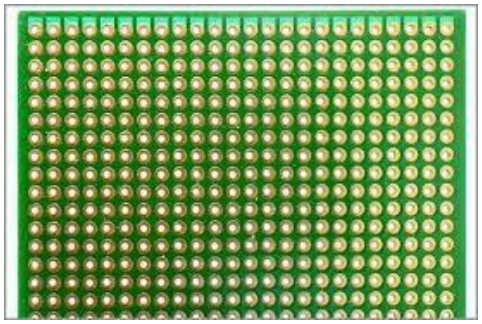
v. Laptop- 1 unit.

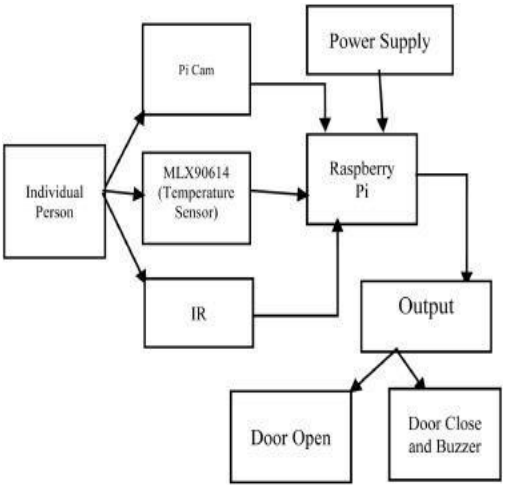
vi. Pcb Board- 1 unit.

PROJECT STRUCTURE

1) BLOCK DIAGRAM:

The overview of the connection structures that make up the solution. Anyperson attempting to enter the building should first pass through infrared sensors, which are used to track and manage the individual count of people entering the room and later exiting. Body temperature is tested only when the people's total count inside a room is less than the given limit. The MLX90614 body temperature sensor is used for this purpose. If the person's body temperature is too high, the door will not open;





if the person's temperature is average, the door will open and proceed to the next level, i.e., mask detection. The laptop camera is used for this function. The door will be opened if an individual wearing a mask is detected. If the individual is discovered without a mask, the door will not open. To ensure the guidelines and safety for indoor workers during this COVID-19, this IoT solution based comes into action.

TECHNOLOGY USED

1. AI TECHNOLOGY

Artificial intelligence (AI), is the ability of a digital computer or computer- controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience. Since the development of the digital computer in the 1940s, it has been demonstrated that computers can be programmed to carry out very complex tasks—for example, discovering proofsfor mathematical theorems or

playing chess—with great proficiency. Still, despite continuing advances in computer processing speed and memory capacity, there are as yet no programs that can match human flexibility over wider domains or in tasks requiring much everyday knowledge. On the other hand, some programs have attained the performance levels of human experts and professionals in performing certain specific tasks, so that artificial intelligence in this limited sense is found in applications as diverse asmedical diagnosis, computer search engines, and voice or handwritingrecognition.

What Are the Advantages of Artificial Intelligence?

Increased Efficiency. One of the greatestadvantages of AI systems
Is that they enable humans to be moreefficient.

Improved Workflows. ...

Lower Human Error Rates. ...

Deeper Data Analysis. ...

More Informed Decision Making. ... 24 /7 Availability.

1. SOFTWARE USED

FUTURE SCOPE

The new outbreak of pneumonia triggered by a novel coronavirus (COVID-19) poses a major threat and has been declared a global public health emergency. This outbreak had first been discovered in December 2019 in Wuhan, China and until now has spread to the world. Emerging technology such as the Internet of Things (IoT) and sensor networks (SN) have been utilized widely in our everyday lives in a diversity of ways. IoT has also played an instrumental role in fighting against the COVID-19 pandemic currently outbreaking across the globe. It plays a significant role in tracking COVID-19 patients and infected people in hospitals and hotspots. This paper exhibited a survey of IoT technologies used in the fight against the deadly COVID-19 outbreak in different applications and discusses the key roles of IoT science in this unparalleled war. Research directions on discovering IoT's potentials, improving its capabilities and power in the battle, and IoT's issues and problems in healthcare systems are explored in detail. This study is intended to provide an overview of the current status of IoT applications to IoT researchers and the broader community and to inspire researchers to leverage IoT potentials in the battle against COVID- 19.

SNAPSHOTS

CONCLUSION

In this work, we successfully construct a face mask detection system to detect and capture the temperature of a specific point inside a predicted bounding box. learned how to create a COVID-19 face mask detector using OpenCV, python, and Deep Learning. To create our face mask detector, we trained a two-class model of people wearing masks and people not wearing masks. We fine-tuned MobileNetV2 on our mask/no mask dataset and obtained a classifier that is ~99% accurate.

Acknowledgements

First and foremost, we would like to thank our mentor Sir Dipesh Moreshwar Tare for providing us excellent guidance and mentoring.
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www.electronicwings.com

Economic and User-friendly 3D Printer

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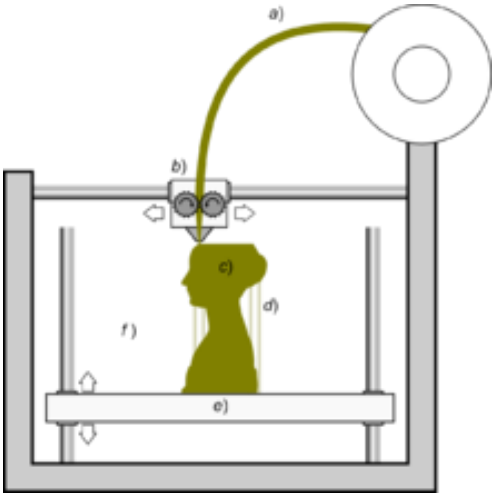
***Abstract*—** 3D printing is an additive manufacturing technique in which 3D objects are printed with the help of CAD (computer-aided design) software. Different processes are available in 3D printing technology such as (1) FDM (fused deposition method),(2) SLS(selective laser sintering) (3) EBM (electron beam machining,(4) LOM(laminated object manufacturing),(5) DLP (digital light processing),etc. In this paper, we have focused on the design and fabrication of a portable 3D printer of bed volume (250 x 300 x 400 mm) which can be constructed economically. We are using 4 axis mechanisms where 3 axes are x-y-z and the fourth axis is an extruder. The process adopted by us is FDM technology, in which different the materials like PLA (polylactic acid), ABS (acrylonitrile butadiene styrene), HIPS (high impact polystyrene), etc. By heating any of the filament material to its melting point and it is deposited layer by layer. Combination of many layers of such type will give us a final 3D model

I. INTRODUCTION

A 3d printer is an additive manufacturing technique where 3D objects and parts are made by the addition of multiple layers of material. It can also be called as rapid prototyping. It is a mechanized method where 3D objects are quickly made as per the required size machine connected to a computer containing blueprints of any object. The additive method may differ with the subtractive process, where the material is removed from a block by sculpting or drilling. The main reason to use 3d printer is for 90% of material utilization, increase product life, lighter and stronger. 3D printing is efficiently utilized in various fields such as aerospace, automobile, medical, construction and in manufacturing of many household products

(1) FDM (fused deposition method)
(2) SLS(selective laser sintering)
(3) EBM (electron beam machining
(4) LOM(laminated object manufacturing)
(5) DLP (digital light processing),



❖ Principle :-

Modelling :
The object or the model which has to be printed first it has to designed or modeled using a CAD (computer aided drawing) tool like solid works etc. By the 3D scanner or by the digital camera and a very unique photogrammetry software. These 3D printed models were created with help of the CAD results in the reduction of errors which were found and can be corrected before printing. In manual modelling process of preparing geometric data for 3d computer graphics is similar to plastic arts such as sculpting. Based on this data 3-dimentional models of the scanned object can be produced. After modelling in CAD tool the model often be (in .skp, .dae, .3ds or some other format) thenit needs to be converted to either a .STL or .OBJ format, to allow the printing software to be able to read it.

Printing :
After the model has been converted to STL, it must be first examined for “errors”, this step is called the “fixup”. In most of the cad applications produce errors in output STL files errors like sekf intersection, improper holes, face normal has to be corrected. Once the file is converted to STL, the file has to be processed by a software called “slicer” which will convert the model into series of layers and produces a G-code file containing instructions to a

specific type of 3D printer. This G-code file can be printed by using 3D client software (which loads the G-code and uses it to instruct the 3D printer during printing. In practice the client software and the slicer program exist, including Cura, Slic3r, repetier host, pronterface and skeinforge as well as closed source programs like simplify 3D and KISSIicer3D. 3D printer follows the G-code instructions to lay down successive layers of liquid, powder, paper or sheet material to build model from a series of cross sections. The such as plastic, sand, metal etc can be \used through a print nozzle. These layers, which correspond to the virtual cross sections from the CAD model, are joined or automatically fused to create the final shape. Depending on what the printer is making, the process could take up to minutes or hours. Printer resolution describes the layer thickness and X-Y resolution dots per inch (dpi) or micrometers(μm).The layer thickness which can be found can be around the 100gm mark, although some of these machines such as the object connex series and the 3D Systems ProJet series can be very much printed as thin layers as 16μm. These resolution of X-Y is comparable to that of laser printers. The particles (3D dots) are around 50 to 500μm (510 to 250 Dpi) in diameter.

Finishing :

The printer produced resolution is very much sufficient for many of the applications but the printing will be a slightly oversized version of these desired object which can be the standard resolution and then the process of removing material can give greater precision. Some printable polymers allow the surface finish to be smoother and improved using chemical vapor processes. There are some of the additive manufacturing techniques which are very capable of using multiple materials in these courses of constructing parts. These techniques are very much able to print in multiple colours and colour combinations simultaneously. Some printing techniques require internalsupports to be built for overhanging features during construction. These supports must be mechanically removed or dissolved after completion of the printing. The commercialized metal 3D printers which very much likely to involve in cutting the metal component of the metal substrate after deposition. The very new process for the GMAW 3D printing which will allow for substrate surface modifications to remove many aluminum components manually with hammer.

- **Application :**

Education : New learning material often you must want new teaching materials but may not be able to afford to budget for them. Now their resources can be made using a 3D printer, saving money on your department budget. When we will be Printing our own learning, materials is not only cheaper but it will be almost always quicker too. Even though students are traditionally taught through books and theory, kinesthetic learners prefer to learn through using aids and materials. 3D printing which also allows you to bring any of the subject matter to life as the physical aid to engage all of your students for a very long period of time increasing that their learning and improving their problem solving and critical thinking capabilities.

Apparel : 3D printing has spread into the world of clothing with fashion designers experimenting with 3D-printed fabrics, shoes, and dresses. When we talk about the commercial production, Nike is using 3D printing to prototype and manufacture the very same football shoe for the American football players and the company New Balance is 3D manufacturing custom fit shoes for all the athletes. 3D printing has come to the point where companies are printing consumer grade eyewear with on demand custom fit and styling (although they cannot print the lenses). On demand customization of glasses is possible with rapid prototyping.

Construction : With the help of 3D printers, we are able to build civil models like prototype of building or plan structures. So that the customers can easily visualized the models.

Dental : With the help of 3D printers, we are able to print jaws it can be a prototype or it can be a jaw bone which can be transplanted as per the needs. An 83-year-old British woman recently underwent the first-ever custom transplant of a lower jaw made by a 3D printer.

Domestic Use : The domestic market of the 3D printing was mainly practiced by hobbyists and enthusiasts and was very little used for many of the practical household applications which are inapplicable. A working clock was made and gears were printed for home woodworking machines among other purposes. 3D printing was also used for ornamental objects. Websites associated with home 3Dprintins include coat hooks, doorknobs etc.

Material	Description	Printing Temp	Bed Temp
PLA	PLA (Polylactic Acid) is one of the two most commonly used desktop 3D printing materials (with the other being ABS). It is the 'default' recommended material for many desktop 3D printers, and with good reason - PLA is useful in a broad range of printing applications, has the virtue of both odorless and low warp and it will not require a heated bed. PLA plastic is also one of the eco-friendlier 3D printer materials available; it is made from annually renewable resources (cornstarch) and requires less energy to process compared traditional (petroleum-based) plastics.	180 - 220	20 - 55
ABS	ABS (Acrylonitrile Butadiene Styrene) is another commonly used 3D printer material. Best used for making durable parts that need to withstand higher temperatures. In differentiating to PLA, ABS plastic is less brittle. It can also be post-processed with acetone to provide a glossy finish.	220-235 °C	80-110 °C
Nylon (Polyamide)	Nylon is an incredibly strong, durable,and versatile 3D printing material. It is very Flexible when it is thin but it is highinter layer adhesion and the nylon lends itself well to things like the living hinges and the different functional parts. Nylon filament prints as a bright natural to white with a translucent surface and can absorb color added post process with most common, acid-based clothing dyes. Nylon filament is very sensitive towards the presence of moisture so taking drying measures during storage and immediately prior to printing is highly recommended for best results.	235-270 °C	60-80 °C
PET (Polyethylen e Terephthalate)	PET (Polyethylene terephthalate) is an industrial strength filament with several great features. Its strength is much higher than PLA, it is FDA approved for food containers and tools used for food consumption, it barely warps, and produces no odors or fumes when printed. PET filament is not biodegradable, but it is 100% reclaimable	230-255 °C	55-70 °C
TPE	TPE filament is a flexible 3D printing material that feels and acts much like flexible rubber. TPE filament can be used to make parts that can bend or must flex to fit their environment - stoppers, belts, springs, phone cases and more.	210-225 °C	20-55 °C

3D Printer Parts

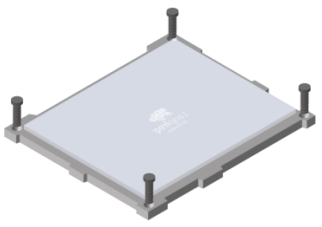
Extruders

Extruders are a crucial component in 3D printers. In simple terms, the extruder is the tool that holds the filament in place and controls the amount that is fed into a Hot-end. One key point is to highlight that hot-ends are not the same as an extruder, but rather they are attached to it and they are the main location that is tasked with the melting process

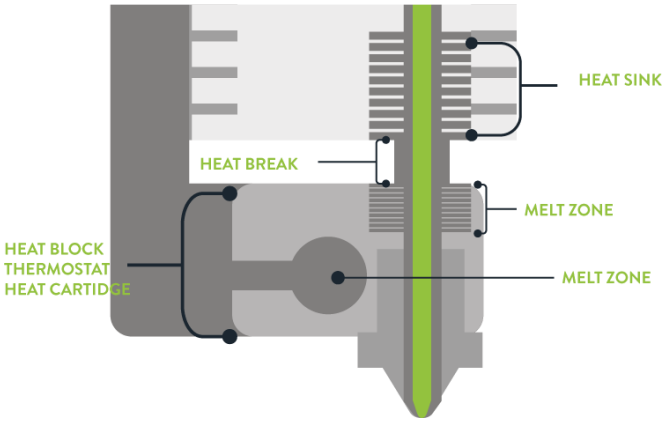
Print bed

A print bed is the part that the 3d printed object rests on during the printing process. As each layer is extruded, the print bed moves down to allow for the next layering step. Although being simple, a print bed is an important part of a 3D printer. Although a relatively easy process, 3d printing does require some careful calibration to ensure that you get a perfect print without deformities. Therefore, the most important step is to ensure that you print the first layer accurately.

The first layer is important because any mistakes in this layer will be magnified to the overall structure of the intended part. The first layer indicates if the print bed is levelled correctly, it indicates that you have the correct extrusion settings such as amount, temperature and more



Hot Ends

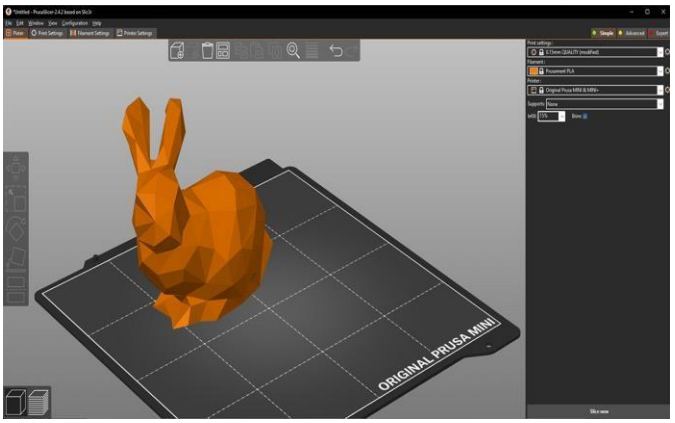


A hot end is where the filament is melted then extruded through a nozzle. Hot ends come in many forms but the standard ones consist of a feed tube, a heatsink, thermal barrier tube with a heat-break, heat-block and the nozzle in that order.

The feed tube guides the filament from the extruder, down through the heatsink and thermal barrier tube. The purpose of the heat sink and thermal barrier tube is twofold. The top most part of the thermal barrier tube is located within the heatsink and feeds the filament through. The bottom section of the thermal barrier tube is connected to the heat block where the filament is melted. Just before it however, the thermal tube is thinner and this area is called the heat-break. This is all done to ensure that before the filament reaches the heat block, that the temperature is lower, prevent melting of the filament before it reaches the heat block by a process called heat creep. The heat-break creates a sudden change in temperature so as to better have control of the melting process.

terminals and a higher powered device form a voltage divider.

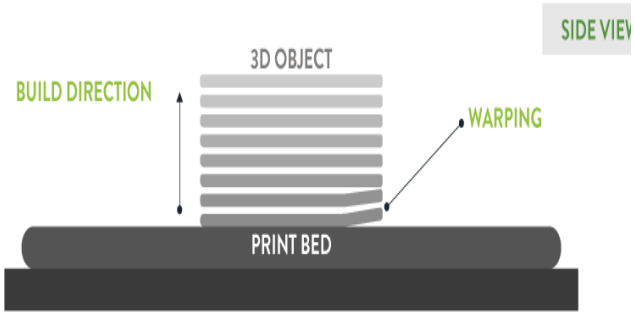
Slicer



Slicing software is a category of 3D printing software that is used to convert a basic 3D computer object into something that the printer can understand and print accurately. There are various options of slicing software but they all work with the same output. They can take a 3D object, convert the surface into miniature triangles, that come together to make the object. The amount of these triangles also determines the accuracy and detail in the 3D object that can be printed. Within the application, you can get detail controls about the printer, how to print the object, orientation, material settings and all settings possible for the 3D printer.

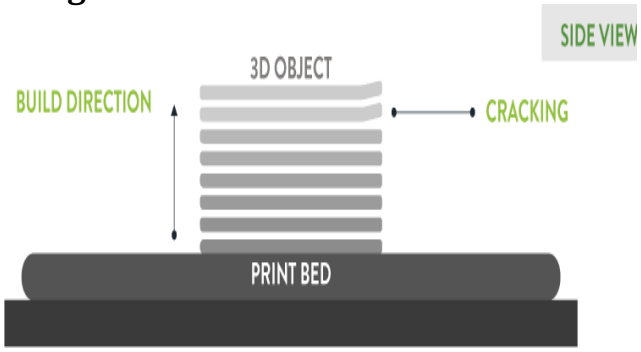
After setting the desired parameters, the slicer software can then slice the 3D object into the desired layer height and visualized the printing process. When this is completed, the object file is then converted into G-code, which a data type used in many manufacturing processes that stores information about how to print or in the case of CNC machine, how to mill an object. This G-code is what drives the extruders in the 3D printer to accurately create the object.

Warping:



Warping can be described as the shrinkage of a 3D printed object at the corners of the base, mainly attributed to temperature changes. Warping is due to the process of non-uniform cooling where certain printing layers cool faster than the heated parts. When this occurs, the cooler layers end up distorting the objects geometry since cooling causes shrinkage and this action affects the immediate molten layers. As the areas cool and harden, they pull on other layers as cooling increases. The main reason for warping is heated thermoplastics need uniformed cooling after being extruded to allow an object to accurately settle while maintaining the desired geometry. If the printing bed is not heated or the ambient temperature of the print chamber is not modulated then this leads to different cooling rates

Cracking:



Cracking is caused by the same issue as warping, being the non-uniform cooling of a printed object. The difference of cracking from warping is cracking occurs at different locations in the printed object. To offset the possibility of cracking, a printer with an enclosure allows to eliminate the ambient temperature fluctuations that may occur that could lead to cracking of a 3D printed object.

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❖ Specification :

Product	3D Prototype Machine
Printing technology	FDM (Fused Deposition Modeling)
Printing area	250*300*250mm
Nozzle diameter	0.04mm
Print bed type	Glass,Removeable
Calibration	Automatic
Safety elements	Temperature sensor, All Axis safe sensors
Recommended operation conditions	15–30°C (59–86°F), max. 60% humidity

❖ CONCLUSION

The term ‘3D printing’ encompasses numerous technologies and processes that collectively offer a wide range of capabilities for producing components using various materials. The key similarity across 3D printing types is the additive layer-by-layer production process where no subtractive methodology, molding, or casting is required. Applications of 3D printing are rapidly emerging across industry verticals as the solution becomes more effective and affordable and penetrates deeply and widely across sec

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Smart Glove for Blind People Using IoT

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***Abstract*— A lots of blind people suffer in their own lives because of their vision loss. Vision is one of the five important senses in the human body. People with Vision loss have their own disability. Many countries around the world provide special assistance to these needed people to improve their life quality as good as possible. They provide them with special equipment for their disability to improve their daily life like voice message service, electronic stick that guide them while moving around and other specialized equipment. This paper present a project idea to establish and provide ultrasonic gloves to blind people for guiding them to their right roads without the need for other people assistant. This Can be done through Ultrasound waves that will be sent to the surrounding then it will be collected by detector in the gloves then to be sent as vibration or Audio signals to the blind's so they can be aware of their surroundings and they can choose their own road and way without other people assistant.**

***Keywords*— Ultrasonic sensor, Pit sensor, Global Positioning System (GPS) ,Programmable Interface controllers (PIC) and Lilypad Arduino**

I. Introduction

In the morning, his suffering start and his daily needs start. Blind people need more care to avoid risk of injuries and that affect people around them; people need to be near for them to avoid being injured. People around them will be exhausted from being attention to them and giving them all what they need. So blind people should not depend on anybody but themselves, as such is the aim of this paper. Blindness is the condition of lacking vision due to various neurological or physiological reasons. For a blind pedestrian, one of the biggest problems is mobility. According to the World Health Organization: In 2012, out of 7 billion people around the world, there were over 285 million people with partial blindness and 39 million were totally blind, out of which about 48% (19 million) are children aged lesser than 15 years. So, some navigation system is required to assist or guide these people. Many researchers around the world are trying to come up with suitable solution to build navigation system for the blind. Most of these technologies have limitations as it involves great accuracy, interoperability, usability, coverage which is not easy to overcome with current technology. The disability and technology are considered as two cooperative words: by exploiting advances in bioengineering technology, smart solutions have been developed. Since ancient times, man used the stick and leaned on it. Also it used by a blind person in avoiding obstacles while walking and movement. Therefore, many countries are helping the development of researches and studies seeking to improve the lives of blind people with special needs to make them feel they are part of the surrounding community through associations and different courses that are giving to learn the mechanism of dealing with blindness and ignore the inability of weakness and inability to move around.

II. Implementation

The project consists of right and left gloves worn by the user. To begin the gloves activity user need to direct his hand to know if there was handicap objects around through feeling vibration from gloves. Gloves alarm when any object is on its side. In addition, it alarm when any object is in front of the user.

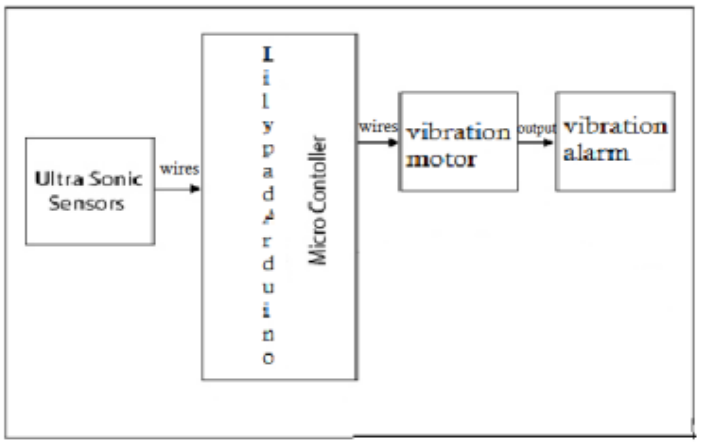


Fig 1

III. Hardware requirements

Any system, application or device requires some of available equipment to work efficiently and properly, so that this system requires a selection equipment and taken into consideration that every part,

System contains several tools , including Ultrasonic sensor which works as input data source ,vibration motor which work as output reaction ,microcontroller called Lilypad arduino board that programming by c++ language, fabric gloves worn by the user and superconductor fibers which connect all hardware parts together

IV. Ultrasonic Vibrator

Function:
To measures the distance to an object using ultrasonic sound waves.

Construction:
• There are two main parts in the ultrasonic sensor viz. transmitter and receiver.
• The transmitter part converts electrical energy into sound and transmits it.
• The receiver part receives the echo and turn this received sound waves into electrical energy.
• This returned echo is measured and used for distance calculation by the ultrasonic sensor. Basically, this sensor calculates time interval between signal transmission and reception of echo and determines the distance of the object from the sensor. As this sensor is used for distance measurement, it is known as **distance sensor**.
• Piezoelectric crystals are used in the ultrasonic sensor construction due to the fact that these crystals oscillate at higher range of frequencies.

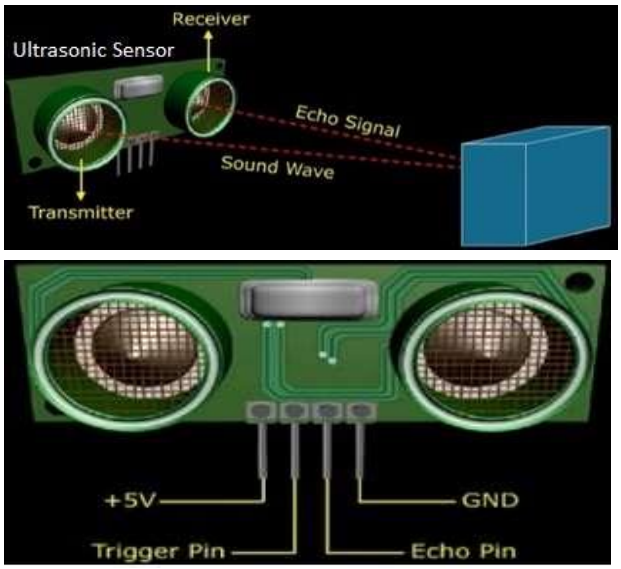
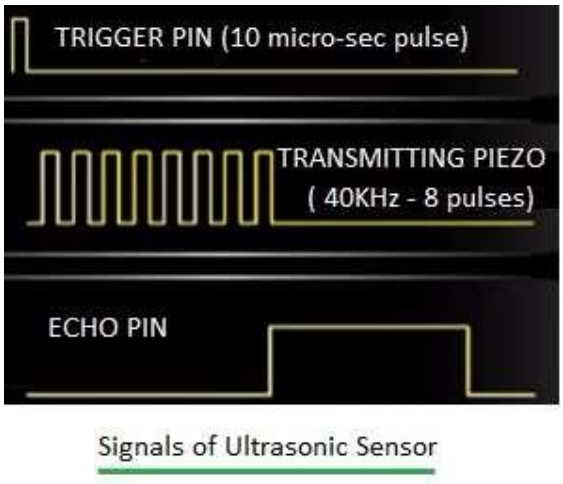


Fig 2. Ultrasonic sensor or distance sensor

The figure-2 depicts pin diagram of a ultrasonic sensor or distance sensor. As shown there are four pins viz. +5V (Vcc pin), GND, Trigger pin and Echo pin

WORKING:
Let us understand step-by-step working of ultrasonic sensor.
• STEP-1:
Make 'TRIGGER' pin of sensor high for some duration (say 10µs). This will initiate sensor cycle.
• STEP-2:
Eight pulses of 40 KHz are transmitted from transmitter part of sensor. After this is done, 'ECHO' pin goes high from low state.
• STEP-3:
After the transmission, transmitted signal gets reflected from the nearby object and returns back to the sensor.
• STEP-4:
When the ultrasonic sensor detects reflected wave, 'ECHO' pin of sensor goes low.
• STEP-5:
The time duration when ECHO pin is high will provide distance between sensor and detected object.
• STEP-6:
The ultrasonic sensor is programmed in such a way that if no object is found then ECHO pin remains high for 38ms and will go low again.



Signals of Ultrasonic Sensor

Fig 3. Signals of Ultrasonic sensor

MODEL USED:
Robotbanao HC-SR04 Ultrasonic Distance Measuring
SPECIFICATIONS:
Dimensions:
Ultrasonic Sensor: PCB size (LxW):45x20mm
Sensor Cover diameter:16mm
SG90: Motor (LxWxH):23x12.6x30mm
Cable length:25cm
Working Voltage: 5V(DC)
Static Current: Less than 2mA
Detection Distance: 2cm-450cm
High Precision: Up to 0.3cm
Echo Signal: TTL PWL signal
Frequency (Hz):40000
Sensing Angle:15°
Wiring: +5V(positive), Trig(control), Echo(receive), GND (negative)
SG90 Motor: Operating Voltage (VDC):3.0~7.2
Stall Torque @ 4.8V (Kg-Cm):1.2
Operating Temperature (°C): -30 to 60
Dead Band Width (µs):5
Rotational Degree:360º

V. Microcontroller

Function:
A microcontroller is a small computer on a single VLSI integrated circuit (IC) chip. It is used for controlling other portions of an electronic system. It is a compact integrated circuit designed to govern a specific operation in an embedded system. A typical microcontroller includes a processor, memory and input/output (I/O) peripherals on a single chip.

Model Used:
LilyPad Arduino

OVERVIEW:
The LilyPad Arduino is a microcontroller board designed for wearables and e-textiles. It can be sewn to fabric and similarly mounted power supplies, sensors and actuators with conductive thread. The board is based on the ATmega168V (the low-power version of the ATmega168) (datasheet) or the ATmega328V (datasheet). The LilyPad Arduino was designed and developed by Leah Buechley and SparkFun Electronics.

PROGRAMMING:
The LilyPad Arduino can be programmed with the Arduino software (download). the LilyPad Arduino should only be programmed with software versions 0010 or higher. You can program it with earlier versions, but all of the time related functions will be off (twice as slow as they should be). The ATmega168V or ATmega328V on the Arduino LilyPad comes preburned with a bootloader that allows you to upload new code to it with the Arduino software. You can also bypass the bootloader and program the ATmega through the ICSP (In-Circuit Serial Programming.

POWER:
The LilyPad Arduino can be powered via the USB connection or with an external power supply. If an external power supply is used, it should provide between 2.7 and 5.5 volts. This can come either from an AC-to-DC adapter (wall-wart) or battery. Again, don't power the LilyPad Arduino with more than 5.5 volts, or plug the power in backwards: you'll kill it.
PHYSICAL CHARACTERISTICS:
The LilyPad Arduino is a circle, approximately 50mm (2") in diameter. The board itself is .8mm (1/32") thick (approximately 3mm (1/8") where electronics are attached).

CLASSIFICATION:

- Microcontroller: ATmega32u4
- Flash memory: 32 kB, of which 4 kB are used by the bootloader
- SRAM: 2.5 kB
- EEPROM: 1 kB
- Operating voltage: 3.3 V
- Input voltage: 3.8–5 V
- Digital input/output pins: 9
- PWM channels: 4
- Analogue input channels: 4
- Direct current per I/O pin: 40 mA
- Clock speed: 8 MHz

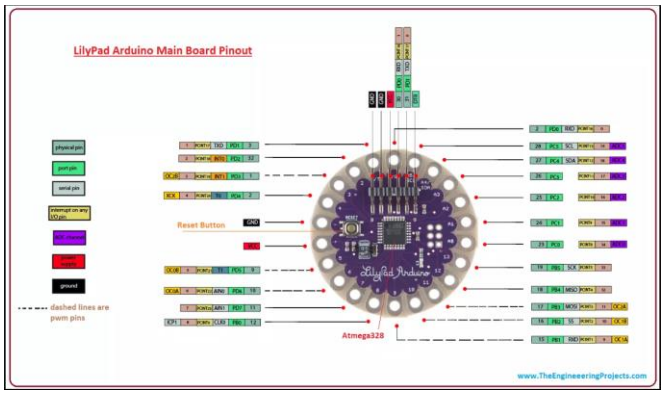


Fig 4. Port Diagram of LilyPad Arduino

VI. VIBRATING MOTOR

FUNCTION:

A vibration motor is a motor that vibrates when given sufficient power. It is a motor that literally shakes.

WORKING:

All we have to do is add the needed voltage to the 2 terminals. A vibration motor has 2 terminals, usually a red wire and a blue wire. The polarity does not matter for motors.

For our vibration motor, we will be using a vibration motor by Precision Microdrives. This motor has an operating voltage range of 2.5-3.8V to be powered.

Therefore, if we connect 3 volts across its terminal, it will vibrate really well this is all that is needed to make the vibration motor vibrate. The 3 volts can be provided by 2 AA batteries in series.

SPECIFICATIONS:

i. Min- max source voltage 2v-5.2v

ii. Input signal pwm, analog, I^2c

iii. Maximum output voltage 10.4v

iv. Shut Down Current 4uA.

v. Quiescent Current 0.5mA - Important for your battery powered

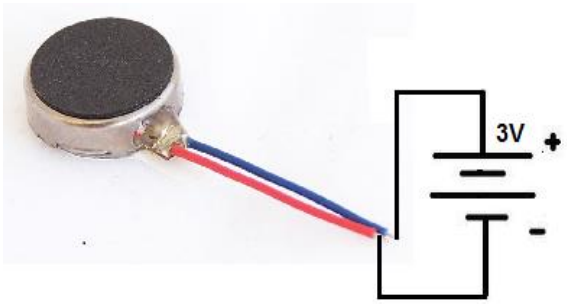


Fig 5. Ultrasonic sensor

VII. PHYSICAL INTERFACING

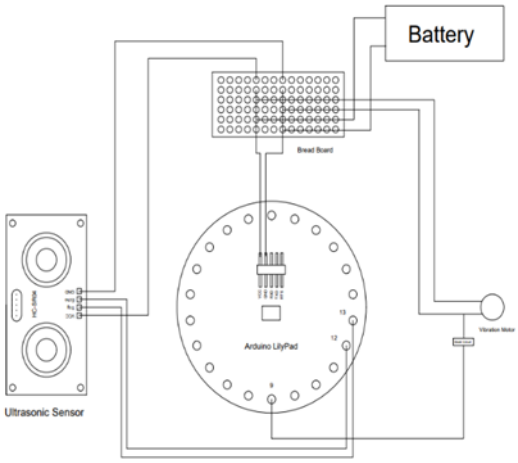


Fig 6. Physical interface

The work of electronic parts distributed in figure.7. Ultrasonic sensor works as input device, which sends data of objects around to Lilypad arduino microcontroller for processing, and sentencing which respond should give Lilypad Arduino command vibration motor, which work as output device to respond through, gives vibration alarm.

The proposed device is divided into two main parts:

- Ultrasonic sensor (input device)
- Vibration motor (output device)

Ultrasonic sensor exports inputs data about objects distance around it to a Lilypad Arduino to process this data then commanding vibration motors to give output in form of vibration in accordance with programming of Lilypad Arduino. Lilypad Arduino will give vibration motor order to alarm with continuous vibration when the object is close from the user. When the object keep away "few" from the user, the Lilypad Arduino will give vibration motor order to alarm with intermittent vibration. When the object keep away "more" from the user, the Lilypad Arduino will order a vibration motor to give not vibration. Ultrasonic will back to send waves to find objects.

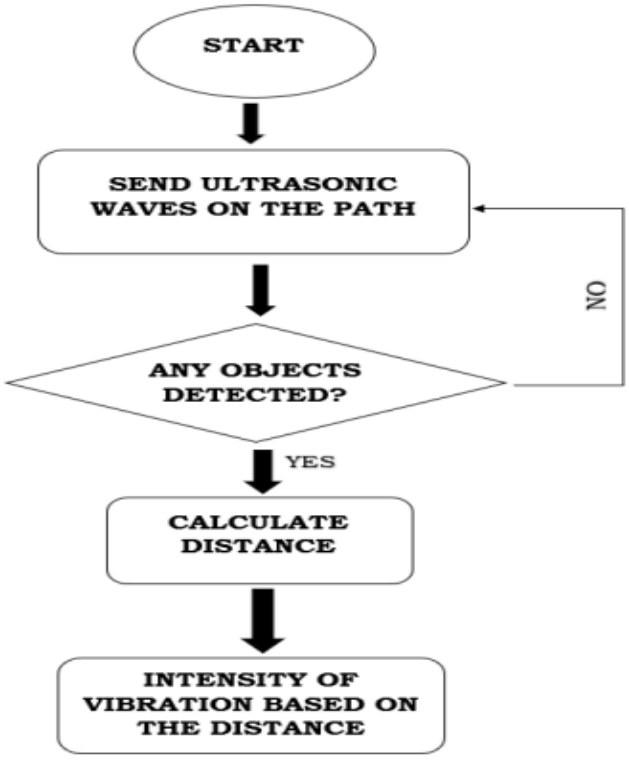


Fig 7. Interfacing flowchart

```
*/
// defines pins numbers
const int trigPin = 9;
const int echoPin = 10;
// defines variables
long duration;
int distance;
void setup() {
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
  pinMode(echoPin, INPUT); // Sets the echoPin as an Input
  Serial.begin(9600); // Starts the serial communication
}
void loop() {
  // Clears the trigPin
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  // Sets the trigPin on HIGH state for 10 micro seconds
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  // Reads the echoPin, returns the sound wave travel time in microseconds
  duration = pulseIn(echoPin, HIGH);
  // Calculating the distance
  distance = duration * 0.034 / 2;
  // Prints the distance on the Serial Monitor
  Serial.print("Distance: ");
  Serial.println(distance);
}
```

Fig 8. Interfacing code

RESULTS AND DISCUSSIONS

The overall result of the experiment gloves, came as follows:
i. The highest response was whenever it is closer to the object.
ii. Middle respond was found in middle distance from the object.
iii. No respond where found on far distance.

Obstacle	Test
From 0 to 30 cm	Hard vibration
From 30 to 60 cm	Intermittently vibration
From 60 cm to 100 cm	Intermittently vibration
From 100 cm and up V	Vibration not work

Befits of using the blinds gloves Wearing blind glove can make the user feel more secure from of the difficult things facing him. The blind person walks without knowing what are the hidden risks in the next step? It may be a hole or ladder or wall in front of him, the gloves here have a significant role in securing the next step for him. Also to feel blind person that he independent; he can go anywhere without waiting for someone facilities. That making him feel a degree of independence and self-reliance. On the other hand, it is easy to use and that because of the simplicity in its size

CONCLUSION

This paper proposed Ultrasonic sensors gloves for blind people using Lilypad Arduino. That it is a solution for the visually impaired and those who do not wish to carry on his stick give them the instructions of places and surrounding objects. The blind will be able to move from side to side and from one place to another without the need to help others to learn about the highs and surrounding objects. This system would be more setups sophisticated and assistant for the visually impaired around the world, and so high for his efficiency. Ultrasonic vibrator glove sometimes also can be called as a smart glove is to help the visually impaired to walk and estimate the distance of the objects before them. The main components include Arduino UNO, Vibrator motor and ultrasonic sensor. In addition to the low-cost of manufacture it, and according to the accuracy of the sensor.

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General Guidelines for Utensil/Clothes Washing Workstation to Reduce Risk of Musculoskeletal Disorders Among Indian Domestic Workers

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Abstract: **Domestic work is the oldest and most important informal occupation for millions of women all across the globe. This occupation remains unorganized, unrecognized and is at high risk of exposure to musculoskeletal disorders (MSDs) for domestic workers. The present study is carried out at Amravati district with the objective ofdetermining the prevalence of musculoskeletal symptoms, identification of important factors for development of musculoskeletal symptoms among domestic workers involved in utensil and clothes washing work and developing general guidelines for washing workstation design. 120 female domestic workers were randomly selected and participated in this study. A Nordic questionnaire was used to collect data of musculoskeletal symptoms among different body regions and the RULA score sheet was used for assessment of working posture. The result shows that musculoskeletal symptoms in different body regions were very high as compared to the general Indian women population (for back, neck, and large joints, p < .0001). The results of Chi-square test showed that ergonomic factors associated with musculoskeletal symptoms were working posture, washing platform height and seat height(P<.001). On the basis of results, general guidelines were developed for designing washing workstations for domestic workers. A test conducted on a prototype showed that the new washing workstation was well accepted by subjects.**

Keywords: **Musculoskeletal symptoms, Working Posture, Domestic worker, Workstation, Guidelines**

1. INTRODUCTION

Musculoskeletal disorders (MSDs) are the injuries of the muscles, tendons, ligaments, nerves, joints, cartilage and spinal discs aggravated by work [1-4]. It is the common health issue and cause of disability, ultimately affects the quality of life of millions of people worldwide [5-6]. Scholars across globe documented that awkward and constrained postures adopted at work is the major cause of development of musculoskeletal injury on different body region [7,8,9,10,11,12,13,14,15] The postural stresses arise due improperly designed and arranged workstation furniture [16]. The consequence of MSDs in terms of economic losses not only affects the individuals but also society too.

Even though earlier researchers revealed that there is a link between MSDs and work and its enormous global impact, MSDs have not received much attention like other fatal diseases. Ergonomists all over the world face problems of workplace arrangement and efforts were consistently made to cope with this issue. In recent days MSDs have attracted much attentiondue to increasing complaints all over the world. The prevalence of MSDs is high among industrialized nations where the work sectors characterized repetitive manual work for prolonged hours of work. Similarly, the prevalence of MSDs among the workers of informal or unorganized sectors is high due to intense laborious work, awkward working posture, prolonged work hours and improper workplace arrangement or improper-designed workstationwhich not only deteriorates their physical condition but also affects quality of life.

The backbone of the Indian workforce is the unorganized sector. Gangopadhyay et al. documented that almost 60% of the working population in developing countries work in informal or unorganized sectors. According to NSSO (2012), India has 39 lakh people employed asdomestic workers, out of which at least 26 lakh are women but some other agencies expected it to be 60 lakhs.

Domestic work is one of the oldest and most important informal occupations for millions of women around the world. In India women have limited options and enter the domain of domestic work in the absence of education, economic resources and other opportunities.

According to ILO, a domestic worker is "someone who carries out household work in private households in return for wages". More specifically, a domestic worker is one who carries out the household tasks either as a part-time worker or as a full-time worker.

The current fast pace of life in cities, help in domestic work becomes necessary for housewives. Domestic work is physically demanding with repetitive movements of hands including cooking, sweeping, dusting, mopping floors, washing utensils and clothes for prolonged hours etc. Most of the house owners employ domestic workers only for washing utensils and clothes because these tasks are comparatively more physically demanding than other housekeeping tasks, which require squatting of legs, twisting of body, bending of neck and trunk in forward direction. Studies conducted across countries showed a high prevalence of musculoskeletal disorders among different body regions among domestic workers (19-21). Escalation in musculoskeletal problems can lead to absenteeism, economic loss, reduced productivity and reduced employer's satisfaction. Domestic workers mostly neglect health related issues due tolow education and constraints of financial resources. Due to lack of regulatory standards and accountability, ergonomic strategies and methods are not widely implemented in this profession. The emerging medical outlook emphasizes on identifying health risk at workplaceand need of ergonomic interventions for maintaining occupational health. If ergonomic principles are integrated into existing domestic work tasks and work environments, then the risk of MSDs will reduce with hand to hand improvement in efficiency and productivity.

The present study has been carried out for this unorganized informal sector with following objectives;

1. Determining the prevalence of MSDs in different body region of domestic workers
2. Assessing the working posture of domestic workers and the workplace.
3. Identifying factors associated with prevalence of MSDs in domestic work occupation and
4. Developing guidelines for designing utensils and clothes washing workstations fordomestic workers.

2. MATERIALS AND METHODS

In this cross-sectional study 120 female domestic workers from Amravati District were surveyed for determining symptoms of musculoskeletal disorders. Working posture of domestic workers while washing of utensils/clothes and workplace arrangement were ergonomically assessed. In addition to this, 80 general women populations were surveyed to determine significance of prevalence of musculoskeletal symptoms among subjects under study and general women population.

A questionnaire and checklist were used for collection required information from selected subjects and workplace/workstation. The questionnaire consists of;

1. Personal details including age, job tenure, working hours, marital status, educational leveland medical background etc.

2. Translated General Nordic Questionnaire [23].

The Checklist for assessment of workplace/workstation consists of two parts.

1. Working of posture assessment checklist: RULA technique was used for assessing Neck,Trunk, Arm, Knee, Wrist postures etc [24].
2. Workplace/workstation assessment checklist
   :
   The checklist consists of points about washing area, washing platform height, seat height, leg space and leg position.

Firstly, all the subjects were interviewed and their response was recorded by using the General Nordic questionnaire. Secondly, the workplace/workstation was thoroughly observed by considering ergonomic aspects. After thorough observation domestic workers were asked to perform washing of utensils and clothes, observations were made while working. Observationsof workplace and working posture were recorded on the checklist. After completion of survey and data collection, the data was transferred to the computer for analysis. The Minitab 20.4 software was used for statistical analysis. The chi-square test was used to assess association between individual and ergonomic variables and musculoskeletal symptoms.

1. RESULTS

Table 1 shows the personal details of domestic workers under study. All the domestic workers work for seven days of week throughout the year. The leave will be taken as per their requirement. Most domestic workers worked at a space provided by the employer without any washing platform or proper seating arrangement for performing tasks.

Table 2 shows the prevalence of MSD symptoms in different body regions of domestic workersfor the last 12 months period

of time. Table 2 shows that neck (65.83%), lower back (77.50%), knee (65.83%), wrist (61.67%), ankle/feet (63.33%) were most affected body regions among the domestic workers.

According to the RULA assessment sheet for working postures adopted by domestic workers,neck, trunk, knee and wrist postures are deviated from neutral body postures. In almost all casesleg posture score was 2 that all the domestic workers sat on whatever is available at the workplace or work on ground in a squatting position on a piece of lumber/bath stool or withouta piece of lumber (Fig 1). Working posture shows that washing clothes and utensils within the provided workplace causes more deviated body posture of the trunk, neck, wrist and legs. Figure 1 shows postures adopted by domestic workers while performing a washing and cleaning of utensils.

Figure 1 : Utensil cleaning task

Table 4, present details about domestic workers workplace/workstation. Among all domestic workers 30.83% domestic workers use a bath stool for performing tasks, whereas 31.67% sat on ground with pieces of lumber and 37.5% domestic workers perform tasks with piece of lumber. In 5.83% of the workplace

was provided without a heighted washing platform and 94.17% cases used a heighted platform performing washing tasks. In 85.83% cases it is observed that legs domestic workers perform washing tasks in a squatting position with foldedknees which creates more postural stresses in the leg portion.

Table 1. Personal Information of Subjects (n= 100)

Subject	Domestic workers (Female)	100
Age (Years)	M(SD)	34.53(10.71)
	Min-Max	20-60
Daily working hours	M(SD)	6.56(1.06)
	Min-Max	4-9
Job Tenure(Years)	M(SD)	9.86(6.10)
	Min-Max	1-25
Education	Illiterate	7.50
	Primary	48.33
	Secondary or Above	43.33
Marital Status	Single	18.33
	Married	81.67

Table 2. Frequency of Symptoms among different body regions (12 months)

Body region	Frequency (%)
Neck	65.83
Shoulder	52.50
Upper Back	58.33
Wrist/Hands	61.67
Lower Back	77.50
Hips/Thighs	62.50
Knees	65.83
Ankles/Feet	63.33

Table 3. Domestic workers working Posture Assessment

Body region	Working Posture (%)	
	Neutral (%)	Deviated (%)
Neck	85.83	14.17
Trunk	87.50	12.50
Arm	58.33	41.67
Wrist	77.50	22.50
Legs	89.17	10.83

Table 4. Checklist in Workstation Assessment

Checklist Point	Type	N	% response
Seat type	Bathroom stool	37	30.83
	Piece of lumber	45	37.50
	On squatted legs	28	23.33
Leg Position	Well supported	17	14.17
	Squatted/folded	103	85.83
Washing/cleaning platform	Heighted platform	7	5.83
	No Platform	113	94.17
Sufficient space for washing/cleaning	Yes	68	56.67
	No	52	43.33

Table 5. Comparison of symptoms of musculoskeletal disorders.

Body region	Domestic workers (%) (Age 20 - 60 years)	General Population (%) (Age 20-60 years)	P-value
Neck		13.75	<.001
Upper and Lower Back		22.50	<.001
Large joints *		18.75	<.001

Note: * indicate shoulders, elbow, wrists, knees and ankles

2. DISCUSSION

This study shows detailed understanding of the occurrence of musculoskeletal complaints for domestic workers in utensil and clothes washing tasks. The significance of results was presented in the above paragraphs.

2.1 Prevalence of Musculoskeletal Disorders

From the response of the questionnaire, it indicates that musculoskeletal symptoms were found among domestic workers. 84% of domestic workers were having discomfort symptoms in oneor more body regions during the last 12 months. A comparison of musculoskeletal symptoms between the general Indian women population revealed that prevalence of musculoskeletal disorders were significant (Table 5). This shows that domestic workers can be considered to beat high risk for developing musculoskeletal disorders.

Analysis of prevalence of MSD symptoms among different body regions of domestic workersshows significantly different ($p<.001$). On the basis of results presented, the domestic workers are exposed to high risk musculoskeletal disorders and therefore high priority action is neededin terms of ergonomic intervention or awareness program for this occupation group.

2.2 Associated Factors with Musculoskeletal Symptoms

Statistical analysis shows that musculoskeletal symptoms in different body regions (low back, neck, shoulder etc) were significantly associated with working postures and working hours which arise to improper workstation facilities for performing tasks for domestic workers. There was a statistical significant relationship between workstation and musculoskeletal problems for each body region. The major ergonomic factors considered which were associated with musculoskeletal problems of domestic

workers are discussed with the aim to develop guidelines for cleaning of utensils and clothes workstations to improve working and reduce postural stresses of domestic workers.

2.2.1 Washing workstation platform and Seat Type

Table 2 indicates that musculoskeletal symptoms in the neck, back, wrists, knees, thighs and legs were higher among the domestic workers especially performing tasks of utensils and clothes washing. The Chi-square test showed a significant effect of washing workstation on deviated postures (i.e. trunk, neck, arm, wrist, knees, legs etc) of domestic workers while performing washing tasks ($p < .0001$). Chi square test also confirmed that washing utensils/ clothes at floor level without proper sitting arrangement were the significant influencing factors for musculoskeletal symptoms in almost all regions of the musculoskeletal system. The symptoms of musculoskeletal disorders can be due to highly deviated awkward postures of neck, trunk, hands and legs are completely folded due improper sitting arrangement (Figure 1).

2.2.2 Working Posture

For domestic workers the working posture stands for posture of trunk, neck, legs, wrists, armwhile performing cleaning tasks. In almost all cases all domestic workers adopt non neutral working postures ($p<0.001$). Working postures were highly associated with occurrences of musculoskeletal problems in different body regions. Statistical analysis shows that the non neutral posture of neck, trunk, knees, arms, wrist had significant influence on the occurrence of symptoms of musculoskeletal problems amongst domestic workers ($P<0.001$). Studies of earlier researchers documented a positive relationship between non neutral working postures and musculoskeletal symptoms [25,26,27,28,29,30]. Lack of implementation of ergonomic principles in workstation design can be the main cause of constrained awkward postures [31,32]. In case of domestic workers, no special workstation arrangement provided, these workers perform cleaning/washing task on the ground platform with/without improper seating arrangement. The washing platform height is a determinant factor for neck, trunk, arm and wrist postures. In addition to this seating height is a determinant factor for leg posture.

2.3 Workstation Design Guidelines

On the basis of the results of the present study, the general ergonomic guidelines for washing/cleaning workstation for domestic workers were recommended. The recommended guidelines emphasize on eliminating constrained, awkward posture and improving working conditions for domestic workers.

1. The washing/cleaning platform should be provided at sufficient height (i.e 35cm cm) topermit a neutral working posture of different body parts.
2. A washing/cleaning workstation should be equipped with an appropriate seat (a stool).Seat height kept at 25 cm to permit neutral posture of legs i.e. to avoid folding of legs.
3. There must be sufficient clearance for leg movement.
4. The controls for adjusting the physical dimensions of the workstation should be easy tohandle.

2.4 Implementation of the Guidelines and Its Evaluation in Prototype workstation

As per developed guidelines and thorough study of washing/cleaning workstation being used by the domestic workers, a washing platform of height 35 cm and seat of height 25 cm were used for performing utensil cleaning task (Fig.2). An experimental test was conducted in the laboratory to assess users' perception about the new workstation and working posture. Fifteen experienced female domestic workers participated in this test. In each task the subject performed her normal utensil washing task in a trial of 30 minutes. After completing each testdomestic workers' perception and working posture was evaluated with questionnaire (scaling techniques).

Figure 2. Prototype workstation. Legs are well supportedand overall body posture is neutral.

For evaluating a new workstation (i.e washing platform and seat height) firstly the subjects were asked to rate on 4 point scale ranges from very appropriate to very inappropriate and secondly comparison of new workstation with old workstation on five point scale ranges from much better to much worse. For investigation of perceived posture, the subjects were asked to rate her perception about neck, trunk, arm, knees, legs and wrist posture on a seven point scale ranging from very favorable to very unfavorable.

On the basis of results of tests, 86% of subjects washing platform height and seat height found appropriate and very appropriate and comfortable during performance of task. 94% of subjectsresponded that the new workstation was better and much better that the old workstation. Almost all domestic workers perceived the posture of all body regions, especially legs and knees, were favorable and very favorable while performing tasks on the new workstation.

5. CONCLUSION

Domestic workers are an indispensable part of today's fast paced life for the large urban population in India. Domestic work provides an opportunity and presumably a better quality oflife to mostly unskilled urban poor, it is an informal sector with a deregulated nature that creates conditions for a poor work environment. A large women population is involved in this profession hence it should receive appropriate attention from all aspects.

Present study showed high musculoskeletal problems and poor working conditions of domesticworkers in India. Proactive steps for controlling musculoskeletal disorder and improving working conditions seem to be very essential for this sector. Workstation parameters in consideration with ergonomic principles found to be important in relation with the musculoskeletal problems, especially washing platform height and seat height. Musculoskeletal symptoms in washing of utensils/clothes originated from ergonomic shortcomings in washing workstation. Therefore it can be concluded that for improving the working condition of domestic workers, one has to focus on designing ergonomic oriented workstations in washing workstations and the need for awareness programmes among domestic workers is essential.

The new washing workstation based on developed design guidelines was well accepted by domestic workers and contributed to neutral working posture. The results of the new workstation demonstrated in improving working conditions with less postural stresses, consequently might reduce the problems of musculoskeletal disorders among domestic workers. Further work is needed for quantification of washing platform height and seat height for optimization of work posture among domestic workers.

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Lateral load performance of C shaped earth-filled wall-panels with opening and confined by GI wire mesh - an experimental investigation

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***Abstract*— This study investigates the behaviour of earth filled C shaped panel confined with Galvanised Iron (GI) wire mesh against lateral load. The experimental program includes testing the reduced scale model to examine the C shaped earth-filled wall panel confined with GI wire mesh. This experimental research was conducted to study economical and readily available materials for low-cost housing structures and, subsequently, a construction technique. The results obtained from this experimental study can be used to infer strength and stability of this technology as compared to traditionally built rural houses such as brick masonry, compressed earth blocks, etc. and check the cracking pattern of the wall panel under lateral load. Ground story masonry / earthen buildings are common in the rural areas because they require easy workmanship. These structures are constructed with traditional techniques using locally available materials. Nearly no engineering services are used in these buildings. Failure of such structures during an earthquake is attributed to the heavy roof, poor roof to wall connection and failure of the corners.**

Keywords— C-shaped wall panel, lateral load test, earth filled wire mesh, wall with opening.

I. INTRODUCTION

New innovations are being introduced in construction industry along with their optimization. In the field of building construction, the concept of industrialization of construction technology has emerged reducing the requirement of in-situ construction. However, one should realise, this industrialization results in huge extraction of natural resources which always results in generation of waste products harmful for the environment. Developing countries, like India, where nearly 70 % of its 1.1 billion plus population lives in its villages face huge crisis regarding their housing facility due to high demand which leads to increase in cost. The traditional methods of housing cannot be considered as solution suitable for local environment conditions and the residents' basic hygiene needs.

The study focuses on development of an in-situ construction technology to minimize environmental degradation and at the same time find a viable solution to the housing crisis faced by developing countries. Efforts have been made to develop a technique with locally available materials that makes responsible use of natural resources, with minimum financial investment and generate an appropriate technology. The study gives more emphasis to the Earthquake resistant feature of a structure along with providing necessary basic hygiene needs to make the occupants feel a sense of security. An attempt has been made to study the cracking pattern at opening, failure mode of wall-to-wall connection, and the lateral load carrying capacity of C shaped earth filled wall panel, provided with opening as window and confined by GI wire mesh under lateral loads.

A considerable amount of research has been done for solving housing crisis in rural areas most of which considering the use of precast panel as structural members. L. Murari and E. John (2015) studies the performance of prefabricated ferrocement wall panels. Ferrocement wall panels were tested in laboratory and failure load was studied. Phalke R., Gaidhankar D. (2014) studied performance of flat ferrocement roof panels under two-point loading. The effect of using different number of wire mesh layers for the flexural strength of flat ferrocement panels is studied. The comparison of effect of varying the number of wire mesh layers and use of steel fibers on the ultimate strength and ductility of ferrocement roof panels was done. Ferrocement solves the problem of cost while prefabrication saves time. Battarai P. et. al. (2012) studied in detail about the housing parameters of straw bale. Study concluded that straw bale construction is good alternative as it is a renewable resource which is cost effective with thermal performance, fire resistance, light weight and eco-friendly in nature. Marcial et al. (2003) introduced and summarized various reinforcing methods for earth houses. Their study explored the reasons for the endurance of some historical mud structures and failure patterns of modern earthen buildings under seismic events and concluded that adobe houses reinforced with welded wire mesh gives best results for resisting earthquake.

Tarque et al. (2010) has developed numerical models of the in-plane behavior of adobe walls for seismic events. Illampas et al. (2013) studied adobe bricks under compression to develop a stress-strain equation for eventual modelling, both in load and displacement control. Schicker et al. (2009) demonstrated various ways to optimize adobe bricks' mechanical strength, both compressive and flexural, using different eco-friendly additives. Silveira (2011) worked on characterizing adobe bricks already used in a structure. Beatty et al. (2013) measured the compressive strengths of confined Adobe. As per Marcial BLONDET (2004), In 2001, a strong earthquake (magnitude 8.4) occurred in Southern Peru and destroyed most adobe houses in the affected region. However, the houses in the region that were reinforced with welded mesh suffered no damage, those were used as shelters.

As per Beria Bayizitlioğlu (2017) adopting the environmentalist catch-phrase of 'think global; act local', they additionally serve as a primary source for the construction today of affordable, energy-efficient, recyclable and sustainable buildings, designed to meet human needs in terms of comfort, health and well-being, and with minimal ecological impact. In the Earth filled wall panels confined with GI wire mesh with improvement in compaction of infill soil and its properties, these wall panels can be used in single story houses with aesthetics of safety and performance under gravity and lateral loads Sandep Ranshur (2022).

II. OBJECTIVES OF RESEARCH

1. To modify/alter/device a new technology with the locally available materials for affordable housing in rural India.
2. To cast and test the C shaped wall panel with opening to take up the lateral loads.
3. To design a wall-to-wall connection at the corner to take up the lateral loads.
4. To study the behaviour of C shaped wall panel wit opening under the lateral loads.
5. Observe the behaviour of wall panels during the test.
   Decide the suitability of these wall panels to take up lateral loads.

III. MATERIALS USED AND THEIR PROPEETIES

Soil

Around 30% of all constructions worldwide have at least one earthen component (Angulo-Ibánez et al., 2012). Even today earth is still widely used in construction in underdeveloped and developing countries (Jaquin et al. 2008; Craterre 1987). Main advantage of using soil is the ease of its local availability. In the present studies, soil has been used as a filler for the sandwich panel. Soil has mixed with straw and water in defined proportion and further, hand compacted in layers results in a firm and composed unit. The hand compaction of the soil contributes toward the increase in stiffness and provides better thermal insulation due to its lower density than compressed earth. The soil used in the present experimental studies was tested for sieve analysis and standard proctor test and the coefficient of gradation was 2.48, uniformity coefficient was 19.7, and optimum moisture content was 19 %.

Galvanized Iron (GI) Wire Mesh

GI wire mesh has provided sufficient stiffness to soil. Various openings of GI wire mesh of a diameter of 0.5 mm to 2.00 mm were readily available in the market. The wire mesh aperture was selected based on the D30 values of the sieve analysis, and D30 values for the soil were varying between 1.04 mm to 1.40 mm. The closest available wire mesh with an opening of 8 mm opening and 0.8 mm diameter was selected for the present experiments. Similarly, GI wire mesh of 30 mm opening and 1.8 mm diameter was selected for designing the wall to wall joint at the corners.

Straw

As per Oloruntoba (2013), the early use of straw was done by Mesopotamians and Egyptians in 1500 BCE. Straw had reinforced ancient products like boats and pottery. After the removal of chaff and grain, straw is obtained which is one of the byproducts of the agriculture industry. This straw is mixed with the soil to enhance the properties of the hand-compacted soil.

Mortar

Due to its various properties like, non-corrosive, the requirement of no surface treatment, increase in strength with time, less maintenance, and aesthetics look, cement mortar 1:4 was used here to plaster the earth filled C shaped panel confined with GI wire.

Plain cement concrete

Plain cement concrete (PCC) of M20 Grade, was used for the foundation of the wall panel. Average compressive strength (for 28 days) of concrete based on the concrete mix design is more than 20 N/mm2.

Specifications of earth panels

The dimensions of wall panel are 3.2 m x 1.7 m x 0.2 m (central long wall), 1.4 m x 1.7 m x 0.2 m (adjacent side walls) for the lateral load test as shown in fig. 1. Earth panel cross-section primarily consists of three layers. The core of the wall panel is of hand compacted earth-straw mixture. This earth-straw mixture is confined with GI wire mesh and on the outer surface of this wall, cement mortar in a 12 mm layer was plastered. The GI wire mesh was first embedded in the PCC of the foundation block along with the wall-to-wall connection. To maintain the width of GI wire mesh in line with the thickness of the wall, GI wire spacers were placed at regular intervals of 0.5 m center to the center along the length and height of the wall panel.

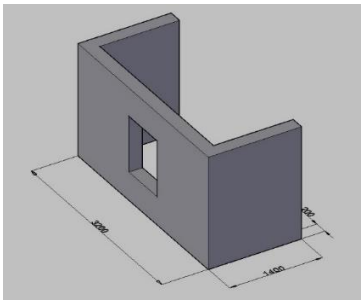

Fig.1 C shaped wall panel with opening

IV. EXPERIMENTAL SETUP

The experimental set up includes preparing and testing hand compacted earth filled panels against lateral load. For this the test specimens of dimensions 3.2 *m* x 1.7 *m* x 0.2 *m* (central long wall), 1.4 *m* x 1.7 *m* x 0.2 *m* (adjacent side walls) was prepared. The cross section of earth filled wall panel with different layers is shown in fig. 1.

Casting details

First, the formwork of the required size of foundation as per the size of the wall specimen is prepared to receive the GI wire mesh which is embedded in the foundation. This entire foundation formwork was suitably placed on the loading frame as the wall panel was tested at the location of casting to avoid any internal stresses during the transportation. Then, the mesh was cut to the required size of the thickness and height of the wall. This GI mesh is tied up with the help of GI wire spacers to maintain the required thickness of the wall. Foundation PCC was placed in the formwork along with GI wire mesh and corner connections as shown in Fig. 2.

After curing the foundation PCC for 28 days, the mixture of soil and straw at the required Optimum Moisture Content (OMC) was prepared and placed in layers of 300 mm height along the length of the wall panels up to a height of 1*m*. Each layer is hand compacted with temping rod used for concrete cube compaction. Excess soil particles oozing out of the mesh opening were removed. This part of the wall panel for 1 *m* height was then plastered with cement mortar. The process continued till the full height of the wall panel is achieved. The top of the wall panel was closed with the same GI wire mesh and additional soil at the top was placed to fill the wall panel with soil and straw mixture.

A cement mortar (1:4) of thickness, 12 *mm* was applied on all sides of the wall including the top as shown in Fig 2. Wall panel was cured for 28 days with gunny bags. Different layers of the completely casted panels can be seen in fig. 2 (a), (b), (c) and fig. 3.

Assembly setup for lateral load test

For the lateral load test, the hydraulic jack was fixed to the loading frame. To avoid overturning, the base of the wall panel was fixed using angles bolted to the base frame. This steel plate was welded to the loading frame and the model is fixed over it by using nuts and bolts. A line load with use of I section is applied on the central long wall at 20 *cm* from top by hydraulic jack. The load applied is measured by proving ring which is placed between I section and hydraulic jack. as shown in Fig 3.

The displacement sensors were placed on the backside of the load application face. Deflections at top, centre and bottom were observed for central wall and adjacent side wall. For measurement of deflection, 12 nos of linear potentiometer PM 50 5K MR of ELAP and dial gauges were used. Three potentiometers were placed at the end of each side walls and another set of 3 potentiometer each was placed along both sides of the opening in the wall. The potentiometers were placed at the same elevation in central wall and side walls of C shaped wall panel as shown in fig 3.

Fig.2 (a) Formwork for foundation and details of wall-to-wall connection

Fig.2 (b) provision of lintel at the opening

Fig.2 (c) Earth and straw filling, compacting and plastering of

Assembly setup for lateral load test

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Fig.3 Finished wall panel

Fig.4 Loading arrangement with hydraulic jack

Fig.5 Arrangement of potentiometer and dial gauge

V. RESULT AND DISCUSSION

The cracks formation was observed at lateral load of 29.17 kN and started increasing gradually after that. Maximum load applied was 52.7 kN. Initially, increase in load is proportional to deflection and later as test progresses, for a small change in load there is large deflection as shown in fig no. 6 and 7.

Crack formation has been observed to be started form the top edge of the opening provided in the central wall portion. Thereafter the cracks were observed at the bottom face of the opening provided. With further increase in the load, the cracks started wide opening and the plaster has been observed to start delaminating at the location of the cracks. We could be able to apply maximum load of 52.7 kN, but the wall panel neither collapsed nor dismantled. The corner joint between walls have been observed to be in good condition and no distortion at the corners have been observed at any location. The maximum lateral deflection at the top of the side wall in c shaped wall panel was 12 mm and that of central wall was 80 mm.

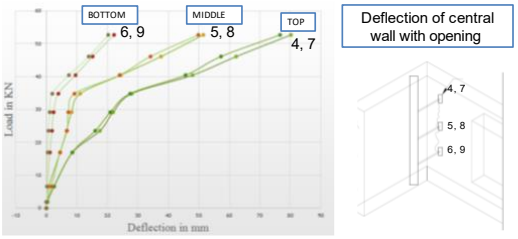

Fig.6 Load vs deflection of central wall portion

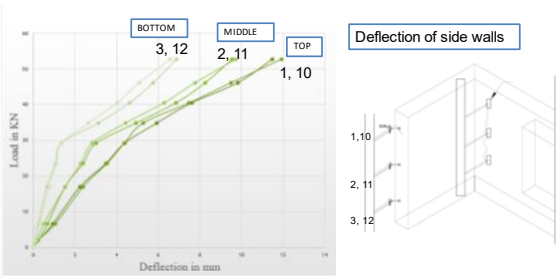

Fig.7 Load vs deflection of side wall portions

VI. FUTURE SCOPE

Behaviour of full-scale wall panel with various connection at the wall-to-wall and roof-to-wall need to be studied for effective implementation in the field.

VII. CONCLUDING REMARKS

• In lateral load test the C shaped soil infill panel confined by GI wire mesh started to crack at the top corner of the opening provided in the central portion of the wall, but the panel continued to take load with increased deflections, till the mortar started to crack and disintegrate.

• Important to note is the monolithic behaviour of the entire wall panels. Wall panel did not disintegrate into the pieces.

• From this behaviour it can be inferred that even under action of extreme load the wall panel will not collapse.

• The mortar can crack and fail but the wall will not collapse because of confinement provided by GI wire mesh which is also deeply rooted in foundation.

• As we know soil is weak in shear, so majority of lateral load is taken by mesh and mortar.

• Mesh is tied together using ties so buckling of wall is avoided. Soil inside gives dead weight and stability to mesh. It also provides rigidity.

• At the corner joint between wall to wall GI wire mesh of 1.8 *mm* diameter was used to strengthen the joint and joint has been observed to be in good condition even at the maximum load of 52.7 *kN*.

• This technology is developed for in-situ construction which eliminates the need of capital required for industrial setup, transportation and repair which is predominant in prefabricated construction and promotes sustainability.

The deflection of side walls 12 *mm* which indicates the localised failure of central wall portion as the deflection of central wall was 80 *mm*

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Effect of Variation in Stiffness of Transfer Girder on Stiffness of Floating frame

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Abstract - Most of the international codes require uniformity of the stiffness in the frame to resist lateral forces. I.S. 1893 :2016 (Part 1) (Sixth Revision) requires equal or more stiffness of lower storey than the storey above. For the ease in vehicular moments often basements are made column free and the columns of above structure are floated from transfer girders as per planning requirement. An analytical study is made here to understand variation of stiffness of frame in accordance with variation of stiffness of transfer girder through which it is floated from. Results indicate that soft storey condition of a frame founded from foundation remains unchanged when the same frame is floated from transfer girder with variation in stiffness of transfer girder and placement of frame on it.

***Keywords*—- I.S. 1893: 2016, I.S. 1893: 2002, Lateral Stiffness, Soft Storey, Transfer Girder, Floating Columns.**

Introduction

Most of International codes guide to avoid vertical irregularity such as soft storey condition in the structure as soft storey is subject to severe deformation during seismic episode demanding high strength and ductility in design. I.S. 1893: 2016 has become more demanding of uniformity of stiffness along the height of structure than what it allowed in its previous version of I.S. 1893: 2002 i.e., lateral stiffness of a storey to 70% of lateral stiffness of storey above or 80% of the average lateral stiffness of the three storeys above.

In the metro cities like Mumbai, as per development control rules certain number of parking has to be provided in proportion to the built-up area of the building. Sometimes, to accommodate this requirement, car parking towers, parking pit, podiums and basements are proposed. In case of basements the columns of the buildings come in between basement floor area and some columns may obstruct the movements of vehicles. To avoid this, such columns are floated from transfer girder. Ref. Fig. 1

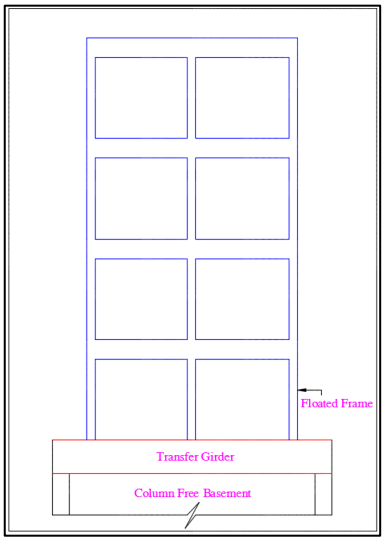

Fig. 1. Transfer Girder

The introduction of transfer girder introduces irregularity of lateral stiffness in the vicinity of its level. This may bring in soft storey formation under lateral loads and requires high ductility in the elements in the vicinity of transfer floors (Zhang and Ling [14], Abdelbasset et al. [1]). Thus, during design stages, such irregularities should be taken into consideration to resist building damage.

The flexural stiffness and strength of the transfer girder is higher than the columns or shear walls of upper structure floated from it. Transfer girders are usually idealized as deep beams. Engineers ignore the deformations of transfer structures and adopt rigid plate and rigid diaphragm assumptions in routine structural analyses of buildings with transfer structures, (Zhang et al. [13],[15]). However, local flexural rotations of transfer girder do exist and it cannot be ignored.

Variation in stiffness of transfer girder and end support condition of transfer girder may affect the stiffness of frame floated from it. Also, placement of frame on transfer girder, can create differential settlement in the frame under gravity and lateral loads bringing large ductility demand and increase in strength requirements. This aspect is not clearly addressed by the code and hence a systematic analytical study of effect of variation in stiffness of transfer girder on stiffness of frame floating from it is made.

I. ANALYTICAL MODEL DESCRIPTION

Model M **-** – Four Storey, Bare Frame having single bay span of 4.8m, with each storey height of 3.6m. The cross-section of columns at every storey and beams at all floor levels is kept constant as 300mm x 600mm. All members are considered having same Modulus of elasticity of concrete. Supports of frame are taken as fixed base on ground. Ref. Fig. 2

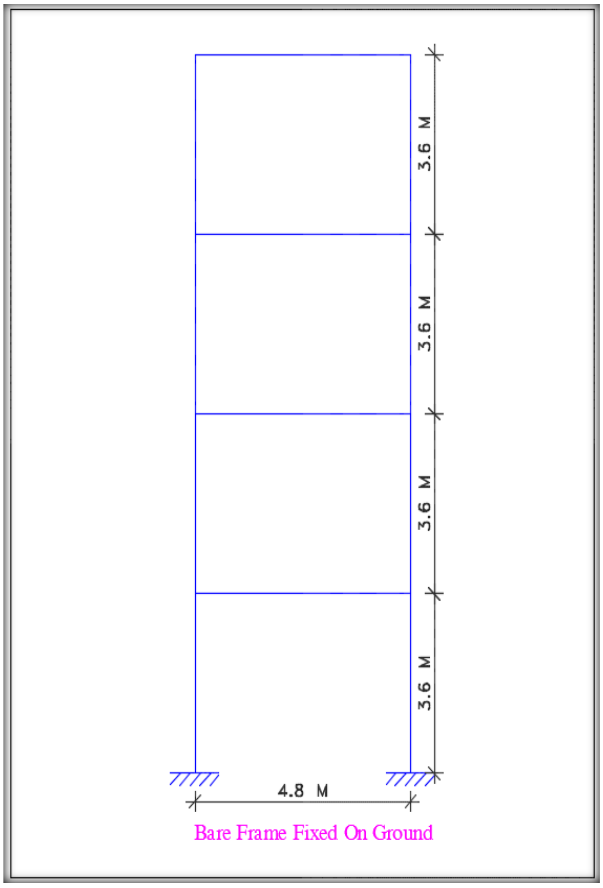

Fig.2. Model M

Model M1 **–**This model is similar to Model M but **t**he frame is placed centrally on a transfer girder having span of 9.6m. The connection between the frame columns and transfer girder is considered as rigid connections. Ref. Fig. 3.

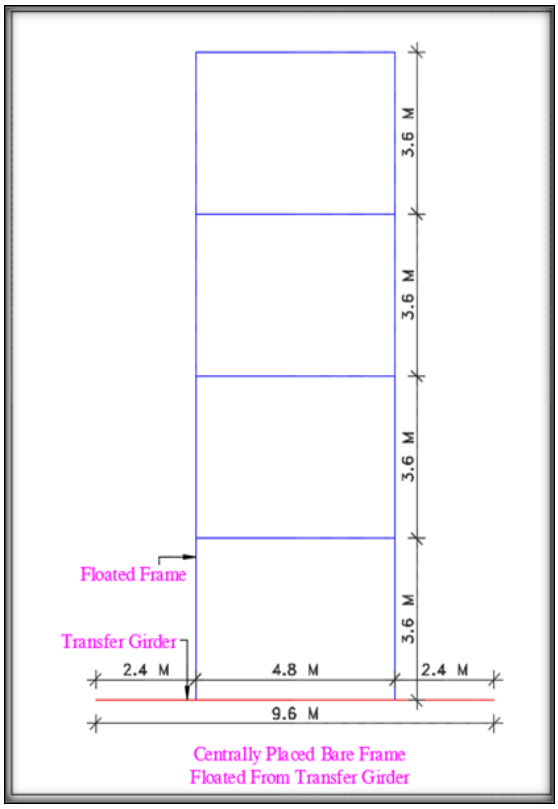

Fig.3. Model M1

Model M2 **–** This model is similar to Model M1, with addition of 230 mm thick concrete block wall in top 3 storeys only. First storey is kept open. Refer Fig. 4.

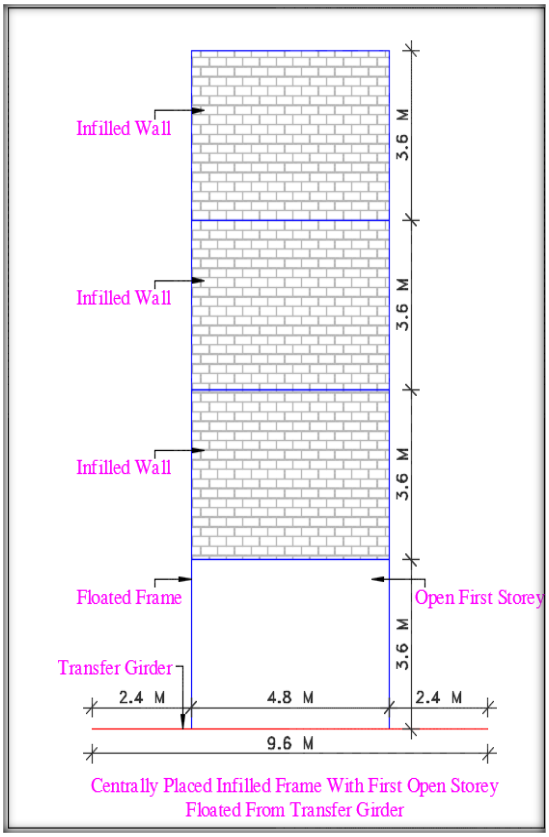

Fig.4. Model M2

For both the models M1 & M2, transfer girder depths were varied as 1000 mm, 1500 mm and 2000 mm. The support conditions for transfer girder were kept pinned and fixed for each of these variation in depth of transfer girder.

For the models M, M1 and M2 the graphs for floor level deflections w.r.t. floor level was plotted. Also graphs of stiffness of 1st storey to percentage ratio of stiffness of 1st storey to stiffness of 2nd storey and also graphs for stiffness of 1st storey to the percentage ratio of stiffness of 1st storey to average of stiffness of 2nd, 3rd and 4th storey were plotted.

Model M3 - This model is similar to Model M1, except that now the frame is placed eccentrically on transfer girder with left leg of frame spaced at 1.2m from left end of transfer girder. Refer Fig. 5.

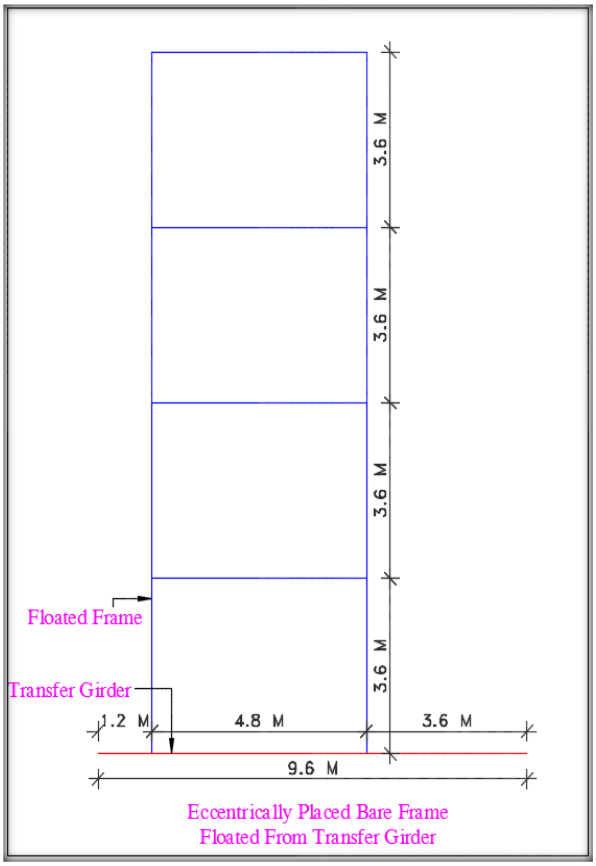

Fig.5. Model M3

The support condition of the transfer girder was kept pinned for both the models Model M1 & Model M3 and the depths of transfer girder, were varied as 600 mm, 800 mm, 1600 mm, 2400 mm, 3200 mm, 4000 mm & 4800 mm.

For the models M1 & M3, the graphs for stiffness of 1st storey to deflection under columns of frame and difference of deflection under column of the frame were plotted.

II. OBSERVATIONS FROM RESULTS

1. From the graphs G1 & G2 for Model M1 and the graphs G3 & G4 for Model M2, it is seen that,

- The deflections of all floor levels go on decreasing as the stiffness of transfer girder is increased. However, these deflections are not less than that of frame founded on foundations. As the deflections of frame floated from transfer girder were more, the stiffness of the fame was lesser than that of the frame founded on foundations.
- As the support condition of transfer girder is changed from pinned support to fixed support, the deflections of all floor levels go on decreasing, yet these deflections are not less than that of the frame founded on foundation.

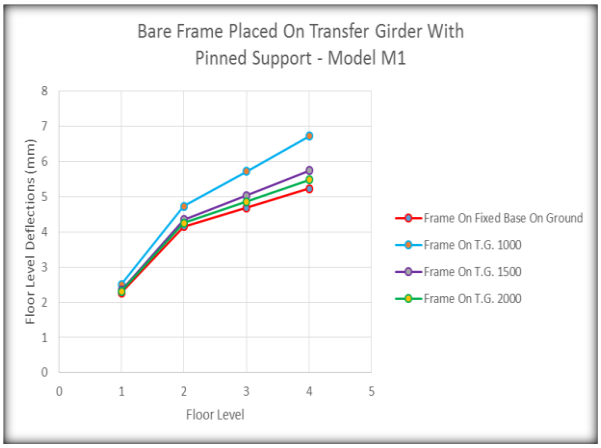

Fig. 6. Graph G1

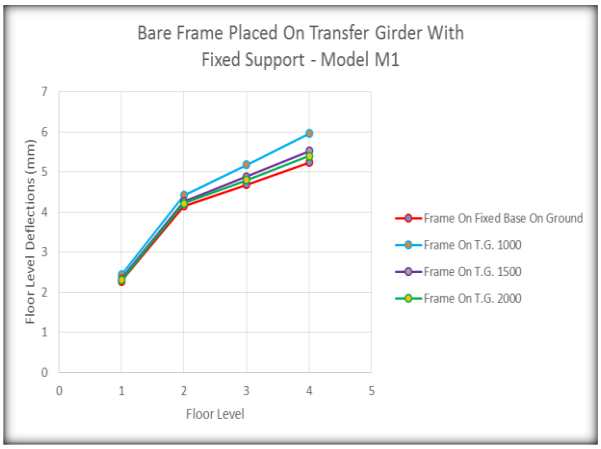

Fig. 7. Graph G2

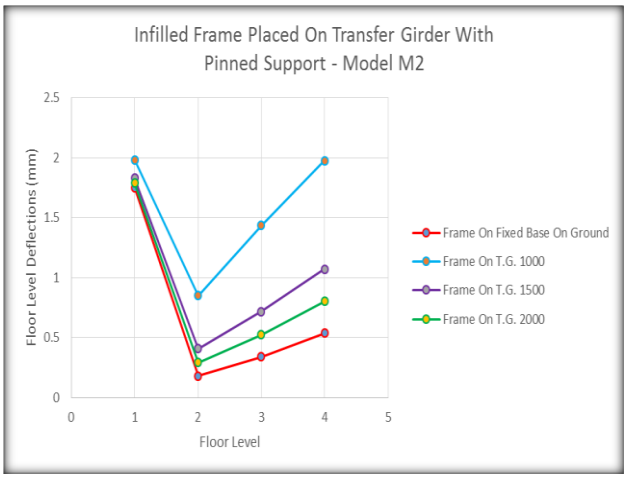

Fig. 8. Graph G3

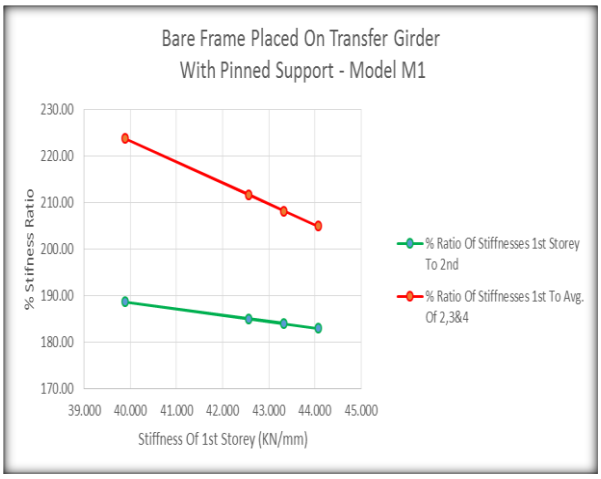

Fig. 10. Graph G5

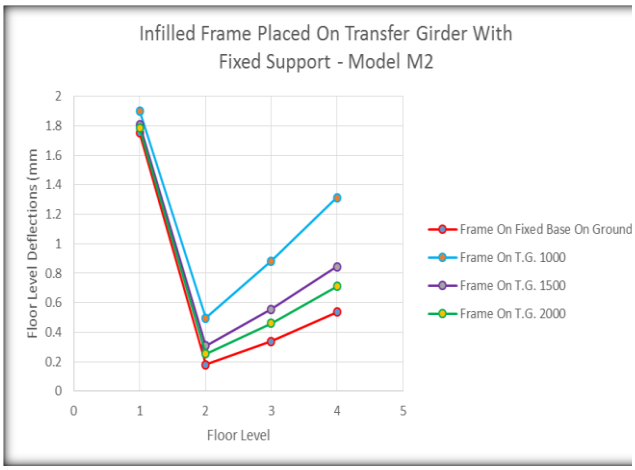

Fig. 9. Graph G4

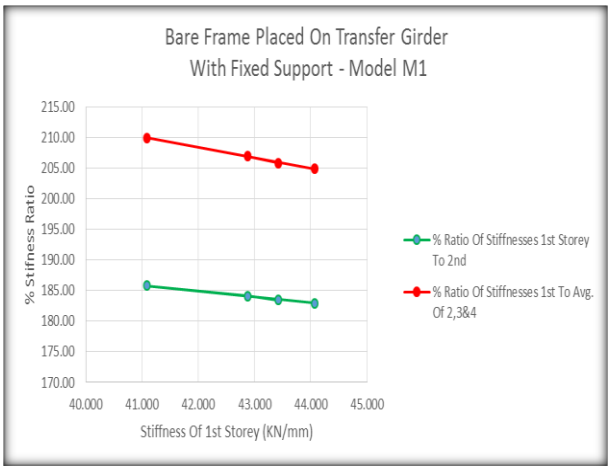

Fig. 11. Graph G6

2. From the graphs G5 & G6 for Model M1 and the graphs G7 & G8 for Model M2, it is seen that,

- The percentage ratio of stiffness of 1st storey to stiffness of 2nd storey goes on decreasing as the stiffness of transfer girder is increased. However, it is not less than that for the frame founded on foundations.
- The percentage ratio of stiffness of 1st storey to average of stiffness of 2nd, 3rd and 4th storey goes on decreasing as the stiffness of transfer girder is increased. However, it is not less than that for the frame founded on foundations.
- The soft storey condition of the first storey remains unchanged irrespective of the variation of stiffness of transfer girder.

From both points mentioned above, it is clearly observed that, the variation in stiffness of transfer girder affects the stiffness of frame as a whole and not to stiffness of any particular storey only.

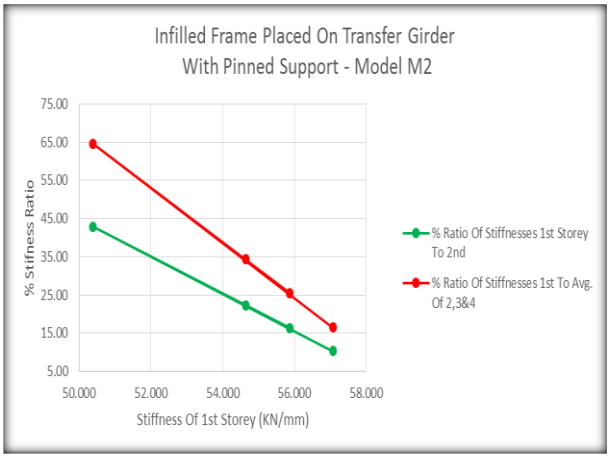

Fig. 12. Graph G7

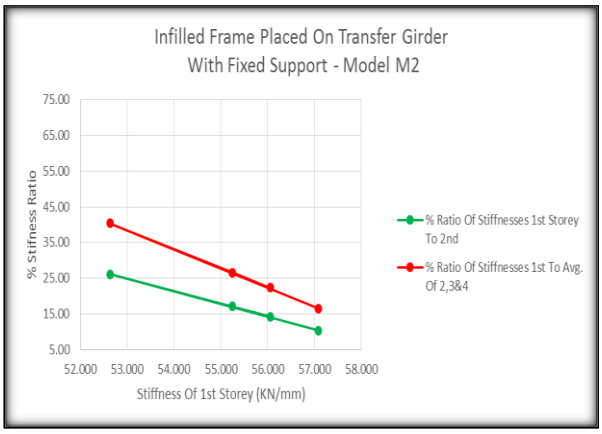

Fig. 13. Graph G8

3. From the graph G9 for Model M1 and the graph G10 Model M3, it is seen that,

- For the frame placed centrally on transfer girder, the deflections under both legs of frame are same. The deflection under both legs of frame goes on reducing as the stiffness of transfer girder increases. However, the difference of deflection under both legs remains zero. This indicates, the stiffness of the frame is affected by the variation in stiffness of transfer girder only.
- For the frame placed eccentrically on transfer girder, the deflections under both legs of frame are different. The deflection under both legs of frame goes on reducing as the stiffness of transfer girder increases. Also, the difference of deflection under both legs goes on reducing as the stiffness of transfer girder increases. This indicates, the stiffness of the frame is affected by the variation in stiffness of transfer girder and also difference in deflections of transfer girder at the points under the legs of the frame.
- For the very high stiffness of transfer girder, the stiffness of frame placed eccentrically is almost equal to that of the frame placed centrally, as the difference of deflection under both legs of the frame goes on reducing towards zero.

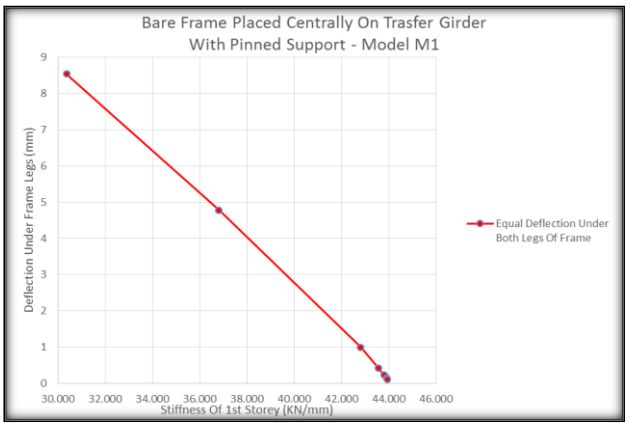

Fig. 14. Graph G9

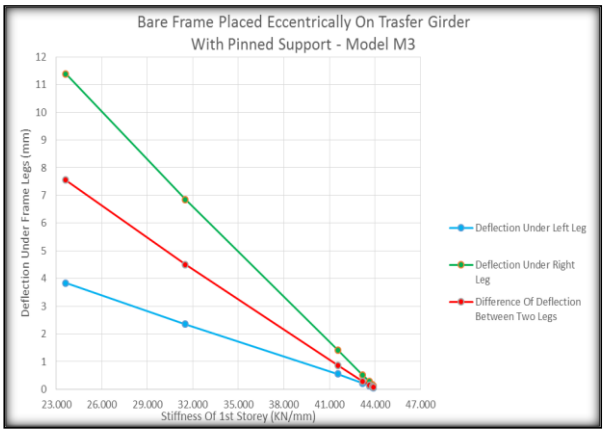

Fig. 15. Graph G10

III. Conclusion

1. When a frame, bare or with infilled upper storey, is floated from transfer girder, it will have larger deflections and lesser lateral stiffness than the same frames which are supported on foundations. Since frames floated from transfer girder may bring condition of soft storey, the revised I.S. 1893: 2016 rightly restricts to take floating columns as part of lateral load resisting system.
2. A frame on independent foundation, if has a soft storey condition, it remains unchanged when the same frame is floated from transfer girder irrespective of variation in stiffness of transfer girder. This is because these variations of stiffness of transfer girder due to change in its sizes or end support condition, affects the stiffness of frame as a whole and not to stiffness of any individual storey only.
3. Unlike the stiffness of the frame placed centrally and is directly affected by variation in stiffness of the transfer girder, the stiffness of the frame placed eccentrically is affected by both, the variation in stiffness of the transfer girder and the difference of deflections of the transfer girder at the points under the legs of frame. However, for very stiff transfer girder the later stiffness of frame placed eccentrically is almost equal to the frame floated centrally.
4. If frame is modeled along with the transfer girder, the advantage of lesser stiffness of frame can be taken to increase natural period of vibration and attract reduced forces under earthquake episode.

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Planning , Scheduling and Resource Allocation Of G+14 Residential Building Using Microsoft Project

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***Abstract*— Project duration and budgets are two highly important factors in the construction industry that affect any project's success. It is crucial to plan as well as arrange various activities of every project since, in this construction sector, each one has certain features. Expenditure rises significantly as a consequence of the postponement, resulting in an impact on the cost that was anticipated. To ensure the project's smooth operations and successful completion, planning and scheduling must be done and followed. The application of Primavera and Microsoft Project (MSP) for project planning and scheduling for residential construction projects is discussed in this review. There is a brief description of the research done in the areas of resource allocation, scheduling, and project planning is carried out. The papers that have been published in reputable journals are taken into consideration while creating a thorough evaluation. It was observed that Microsoft Project software is frequently utilized in the Indian construction sector because of its user-friendly interface and adaptable nature. Primavera, however, allows for multiple user access, making it useful for managing several projects using a single software interface. Additionally, the division of the major activity into smaller tasks with their own start and end dates can be helpful for the proper scheduling procedure. For the efficient administration of construction projects, a project management software strategy would be beneficial for the Indian construction industry. This review helps to understand the project planning, scheduling, and resource allocation and contributes to the construction management.**

Keywords: Planning, Scheduling, MSP, Primavera, Construction Management, etc.

I. INTRODUCTION

The economy of the nation is greatly influenced by the construction industry, which gives the populace numerous jobs. The project's aims must be met in order for it to succeed. [1] The economy and building sector in our country have grown incredibly rapidly in the decades after independence. The construction process is a series of several tasks that must be completed in order for the project to be completed successfully. [2] A result of the expanding population and the lack of available land. The construction of multi-story structures allows for the housing of several people in a small space. Rapid population expansion that has reduced the amount of land available is one of India's biggest problems. Additionally, the houses that are currently available are rented out at standard rates and include 52 homes on 13 storeys with all the essential conveniences. [3] The difficulty of projects is rising. The demand for teams and organizations to perform effectively is increasing as a result of the current economic situation. Businesses are having difficulty responding rapidly to shifting market conditions and customer demands. [4] The project schedule presents required task, milestone dependencies, resource needs, task durations, and deadlines graphically. [5]

Microsoft Project is made to help project managers create plans, allocate resources to tasks, and monitor progress, control costs, and review workloads. Budgets are created for projects based on resource costs and assignment work. When resources are assigned to a task, the software calculates the cost as work multiplied by a rate, rolling it up to the task level, any summary task level, and eventually the organizational levels. [6] Project managers can use the software to create schedules, assign resources to tasks, track progress, manage budgets, and measure workloads. [7] Additionally, to third-party plug-ins for the critical chain and event chain methodologies,

the application also generates critical path schedules. Using a Gantt chart, task networks can be viewed and schedules may be resource levelled. [8] Microsoft Project recognises user groups who behave differently. These users can access projects, views, and other data to variable levels depending on their class. Microsoft Project features that may be modified, such as views, calendars, filters, tables, and fields, are saved in a global enterprise that is accessible to all users. [9] Primavera is known as Enterprise Project Portfolio Management (EPPM) Software. This software at first developed by a company known as Primavera Systems, Inc. which was a private company which provides Project. Portfolio Management (PPM) software to the Enterprise Project Portfolio Management (EPPM) Software is the name given to Primavera. Initially, Primavera Systems, Inc., a private company that offers Project Portfolio Management (PPM) software to organisations, developed this software. PPM involves identification, prioritisation, and selection of investment plans, management, monitoring, tracking, and control of project portfolios of various sizes. [10] The P5, Posited, Contract Manager, Cost Manager, Pert Master, Sure Track, Evolve, and Inspire software packages are all Primavera products. The most recent addition to the suite project management system is Primavera P6, an integrated PPM solution that offers a real-time view of portfolio performance. P6 provides tabular scores, what-if scenario modelling, and capacity evaluations. [11] Management will be better educated to assign the labour. Constant management supervision of the cost and schedule execution can increase productivity by allowing staff to focus on problem areas. However, simply relying on the earned value approach will not guarantee effective construction management [12]. Small and medium-sized Indian construction enterprises face a variety of problems, including ineffective planning, project delays, inefficient use of resources, and many more. Project Management principles and discouragement toward the use of computer-based applications contribute to these problems. In order to effectively execute any construction projects, try to inform one such medium-sized construction company about the benefits of Primavera [13].

In this section the brief information about project management and planning, scheduling and resource allocation discussed. In the second section the application of Microsoft Project MSP features in the building construction project are briefly outlined. Some of the papers on MSP applications are briefly described and other are outlines in the tabular form. In the third section the integrated approach of MSP and primavera is described in section four. The comparative analysis of MSP and Primavera for the building construction project are also described in the last section.

II. APPLICATIONS OF MSP

1) Through multiple chart views, MS Project provides a variety of alternatives for the task visualisation inside an activity, including: One of the most well-liked types of graphical representation in MS Project is the Gantt chart. Charts in MS Project are used for more than just planning activities. The charts allow you to add new data and/or edit existing data under modifications.

2) MS Project enables the entry of activities with fixed durations as well as actions that may have delays owing to a variety of factors; the length of the delays can be specified.

3) With this software, you can choose the length of the activities' duration in units of time ranging from minutes to months. For the purposes of this example, days are considered as the length of each activity.

4) MS Project may be utilised efficiently in the creation of projects for the application of new technologies as well as the selection and commissioning of new mining equipment and machinery.

5) The Tracking Gantt chart is used to follow the implementation and enables you to see what proportion of a job is completed, which in turn decides what percentage of the stage has been completed.

6) MS Project provides a substantial collection of reports that may be used to track many facets of how each task performed. The amount of work completed by each participant or for each task (Fig. 11), the critical tasks to be completed, and many other things can be seen in the reports. For instance, tasks under implementation, tasks that haven't started, intermediate and final deadlines for tasks and stages, who does what, various financial crosscuts, costs exceeding the specified values, and many others can be seen.

7) The amount paid for time (referred to as the "Rate") is stated as the cost of the resource consumed per unit of time. In this situation, the amount of time spent working multiplied by the appropriate sort of charge will yield the resource's entire worth in an activity. Typically, the value of intangible (Work) resources is reported using the payment per unit of time.

Some of the Applications of MSP for building construction projects are summarised in the Table 1.

Table 1 – Application of MSP

Author	*Software*	*Summary*	*Finding*
K Priya and Kathiresn [14]	MSP	Planning and scheduling of various activities is an very important Step. Delaying it can cause increases in expenses which hampers the total budget.	The total baseline duration of the project is 632 Days and the total cost is found to be Rs.154,394,081
Nimisha. Kundra And Anjali Narayanan [8]	MSP	This paper explains about scheduling for a Linear Accelerator Bunker. It calculates the total project duration, slack, start &end dates for each tasks etc	Total duration for the project is calculated, finishing date for the project is identified after scheduling using MS project. Critical path is identified; slack/float is calculated for the project
Vinayak B.and Rashmi. J.V	MSP	In this paper they have shown material management technique which helps in efficient material flow, better quality control and reduction in material waste.	The adequate use of project management methods decreases building costs and time, without influencing quality and efficiency of materials.
P.Wale and N.Jain [6]	MSP	The time difference for construction of a building between MSP and Traditional planning technique is observed.	The total duration using MSP came out to be 210 days and in traditional technique was observed as 340 Days.
Ch. Chowdeswari , D. Satish Chandra and SS. Asadi [15]	MSP	Construction companies in India executes projects in traditional way which is uneconomical, tedious and time consuming.	This paper shows how to do planning and scheduling for a building with MSP by observing the site conditions, labour productivity, and available resources .

III. Applications Of Primavera

1) Through the reuse of best practises, Primavera enables an organisation to execute projects on schedule and under budget.

2) Primavera employs client/server architecture with normal Windows interfaces and is web-enabled. network-based data base, technology.

3) Primavera-aligned ongoing identification, prioritisation, and investment strategies.

4) resource allocation across the organisation is optimised for proper growth.

5) It functions as a project's structure for responsible management.

6) Through an integrated risk management tool, we are able to classify and rank possible hazards related to particular WBS items and resources. Data for risk planning can be produced all over the company.

7) Risk exposure levels are calculated using the exposure-impact probability formula.

8) It is a web application that offers company access via a browser to project, portfolio, and resource data.

Table 2 – Application of Primavera

Author	*Software*	*Summary*	*Finding*
Patil .C and Arun Kumar [2]	Primavera	In this paper they have used the Labour Resource Levelling, Smoothing and 1.25 Overtime Working factor technique to reduce the cost and time of the activities.	After carrying out Labor Resource Levelling process in Primavera P6 for Barbenders,Carpenters, and Masons, the Schedule Duration increases from 935 Days to 1012 Days with no increase in the Total Labor Units of selected Labor Resources.
Divya V.S and C Gayathri [16]		Primavera is used along with critical path method to reduced the duration by proper planning and scheduling.T	By critical path and building estimation they got the total cost as Rs. 5609600.87.T

	Primavera	hey have also studied resource optimisation, And resource Levelling by using histogram crashing method for leveling the resources	he twin house building constructed schedule duration is 167 days. The critical path method and primavera is done by the duration is reduced 140 days. The project will be done by 140days.
Shah Harsh and Mamta Rajgor [17]	Primavera	The important objectives of this study plan , schedule and track an Industrial project with the help of Primavera	The outcome of the project shows scheduled performance , appropriate risk management and real time tracking of the project which helps in keeping the project tasks run according to the schedule.
K. Priya, M.Kathiresan and D.Vengateshwari [3]	Primavera	With the help of Primavera and STAAD Pro creating a EPS , WBS and linking the activities for scheduling the activities for construction of a G+14 Residential Building	The project estimated days of Completion was 430 days which was successfully achieved with the help of Primavera . The analyzing and designing part of the building was completed using STAAD Pro.
Ankit Jain and K. K. Punjabi [13]	Primavera	Due to ignorance and lack of project management softwares, project faces backslashes. Therefore with the use of Primavera , planning and scheduling of a suspension bridge is done.	Here results concluded that using project management tool Primavera P6 assigning and monitoring each activity as per running conditions besides, also analyze water logging in excavation activity due to environment (rain water) which was resolved and 5 days are saved

IV. INTEGRATED APPROACH OF PRIMAVERA AND MSP

They have utilized software in several building projects and have their own opinions on the software. Primavera, according to several project managers, offers superior qualities over MSP. The table below displays the integrated strategy used by construction industries for various activities involved in construction

Table 3 – Integrated Approach of Microsoft and Primavera

Author	Software	Summary	Finding
Hani Gharaibeh [18]	MSP and Primavera	To investigate the effectiveness of primavera and MSP, the author has to collect an enormous amount of data for both software users and software vendors. The scoring model uses a score card which assigns scores for each software attribute in order to assess the effectiveness of the software package.	Finally, the results of the scoring module revealed that PRIMAVERA is ahead of MS-Project by 20 points in terms of operational and general system characteristics. However, a comparison between the two packages, incorporating the cost, will make MS-Project a better alternative
S Ragavi and R N Uma [19]	MSP and Primavera	In this paper they have used MSP, Primavera and CPM method for planning and scheduling of apartment building. And also they have demonstrated how this software helps in construction projects .	The Primavera Software provides user friendly options while performing any task. For resource constrained analysis resource levelling is arranged. Scheduling using Microsoft project Software gives good controlling and clear schedule to a project.
Sudarshan S and George Geena [20]	MSP and Primavera	Planning and scheduling requires huge amount of paperwork, which makes the management very burdensome..Purpose of MSP and Primavera is to analyse the project to know	A hotel building with B2 +G+11 storey building was considered for the study. Planning and scheduling is done with MSP and Primavera and detail analysis is conducted. Results of the analysis says 120 days was extra

	the completion dates.	the project in Msp as compared to P6

V. CONCLUSION

Time management systems play a crucial role in organizations, as they are accountable for finishing projects on time and staying within budget. The construction sector is now dealing with serious issues related to schedule and cost performance. This review establishes the appropriate planning and scheduling case studies of a residential building projects. This review offers various case studies of MSP and Primavera for the building construction project. It was observed that the Microsoft project software handles time management and time control. The detailed description of MSP methodology is outlined and its effectiveness is critically outlined. It was observed that many of the case studies are more familiar with the MSP for project management and scheduling work. But in some of case studies it was observed that Primavera is quite suitable to manage number of projects using sing interface. This study contributes to the project planning, scheduling, resource allocation and management.

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Planning and Development of Waterway Transportation for Coastal Cities – A Review.

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***Abstract*— The provision of smooth transportation facilities became crucial task due to Mumbai ranks eighth in the world and second in India in terms of population. Because of Mumbai's growing population and migration, the transportation system is being strained, resulting in traffic congestion and overcrowding. The Vasai-Virar region contributes a sizable population to the overall population of Mumbai. As a result, the transportation medium, namely rail and roads, fall short of meeting the needs for space and frequency of transportation. The presence of coastline in the Vasai-Virar region provides an opportunity to propose an alternative mode of waterway transportation in specific Mumbai cities. This paper briefly overviews the research carried out in the planning and development of waterway transportation along coastal cities. The various case studies throughout the world for inland waterways along with the roots and their applications are summarized. This review suggests the most important parameters such as environment, fuel consumption, economy, capital cost of infrastructure, maintenance, revenue generation, accessibility, etc. for planning and development of inland waterway transportation. Furthermore, in this review the application of GIS and other modelling software's for mapping and route defining purpose are also discussed. This review contributes to transportation engineering and management by assessment of critical survey in Inland Waterway and Coastal lines construction projects.**

Keywords*— *Inland waterways, routes, transportation, GIS, population

II. INTRODUCTION

Historically, civilization has flourished either in the coastal areas or near the river basins as water is an integral part of day-to-day life for human beings. Approximately 40% of the world's population now resides in coastal regions, and many of the largest cities are situated along rivers or the ocean [1]. The abundance of towns situated around coasts and accessible rivers is proof that waterborne transit has always served as a stimulant for human economic progress. While waterways provided safety and security, they also gave communities a method to bring goods to market instead of using more time-consuming and sometimes longer land routes [2]. Many Greek, Arab, Persian, and Roman traders and merchants who entered through the west coast of India used Vasai-Virar as a commercial hub. The significance of waterway transportation in the city has diminished throughout time due to the development of more roadways and railroads. A 50 km stretch of shoreline roughly surrounds the city and its surroundings. Mumbai is ranked second in India and eighth in the globe in terms of population. Mumbai's transportation infrastructure is severely impacted by the city's growing population and migration, which leads to concerns regarding congestion and overcrowding while travelling. The Vasai-Virar region contributes a significant amount of people to Mumbai's overall population. Because of this, the modes of transportation, such as rail and roadways, fall short of meeting the requirements for space and frequency. The coastline in the Vasai-Virar areas provides an opportunity to propose an alternative transportation mode via waterways in particular Mumbai cities. By doing so, it is possible to maximize resource use while decreasing issues like congestion, overcrowding, and pollution.

This paper presents review on planning and development of waterway transportation for coastal cities. The reviews are segmented in three sections II, III and IV respectively. Section II reviews the various case studies of Inland waterway transportation. The application of GIS and other modelling software in the inland waterway transportation are discussed in Section III. The most influencing factors which affects for the

planning and design of waterway transportation is discussed in Section IV.

III. CASE STUDY OF INLAND WATER TRANSPORTATION

Praveen. S and Rajakumar. S (2015) attempts to evaluate the viability of using Kerala's interior waterways for inland water transportation, namely for the movement of people and goods [3]. The nation's main waterways have been recognized as National Waterways. The West Coast Canal, which runs for roughly 590 kilometers from Hosdurg in the north to Poovar in the south, is the state's principal canal. The Inland Canals, whose construction is currently being done piecemeal, are crucial to the state's economy because they connect the rivers whose banks are home to key commercial and industrial locations. They also provide access from interior locations to the West Coast Canal System. In conclusion, the future of inland navigation is bright, provided that concerns about institutional support and inadequacies in the infrastructure are adequately addressed. The author Cezary Gołębiowski (2016) proposed that Waterway transportation is the most energy effective means of transportation as this mode uses less diesel per 100 tonne - kilometers than rail or road transportation [4]. The report concludes that inland waterway transportation is not very innovative in comparison to other forms of transportation. The capacity to integrate this form of transportation with other means of transportation, however, opens up new opportunities for structuring economic operations. By adopting this mode of transportation as a connecting element in an intermodal transportation network, the cost of transferring goods can be reduced. Shulin Duan *et al.* (2010) conducted a study on situation and problem faced by Inland Water transportation of China. The study revealed that transportation via inland waterways is crucial to China's economic growth [5]. China's inland water transportation capabilities and advantages have not yet been completely developed and utilized in comparison to the industrialized nations. The current problems with shipping capacity, ship type, competition, management, technical equipment, and security system, as well as the development condition of China's inland water transportation, were thoroughly examined in their study, and solutions to these issues were suggested.

Boadu Solomon *et al.* (2020) discussed all the constraints and its recommendation on inland water transportation [6]. They also discussed the benefit of improved IWT system which makes it effective and efficient movement of people and goods is an indispensable tool for the economic success of every country whether developed or developing. Danang Parikesit *et al. (2003)* compares characteristics of water transport operations in rural areas indifferent environmental and socio-economic conditions and use the results to identify success factors in connection with inexpensive rural water transport [7]. The study was carried out in South Sumatra, Riau and West Kalimantan provinces of Indonesia. Another issue for the researchers was to overcome the year-to-year drop in passenger and commodity numbers. M. S. Tannum and J. H. Ulvensøen examines autonomous short-distance ferries and provides an overview of existing urban mobility projects in Norway [8]. They also discussed State - of - the - art for autonomous vessels in Norway and the Project and activities related to small autonomous passenger ferries. The authors examined some of the active projects, focusing on their status, plans and schedules. They collected the data and prepared the concept, schedule and risk analysis of all the projects individually.

IV. APPLICATION OF GIS AND MODELLING SOFTWARE

Yue Cui and Edward Mahoney (2015) discussed the three major methods are used for capturing tourist/recreationist spatial behavior information, Incorporating Internet GIS in Survey Instruments, Google Map APIs [9]. They also proposed a method Incorporate the Google Map API in an Online Survey Instrument for Florida Saltwater Fishing Studies. The Florida Saltwater Fishing Panel Survey was carried out from August 2012 to April 2013 over a period of eight months. Over 20,000 respondents provided information to the survey instrument during the survey period, which was successful. The spatial information on fishing trips from boats that was gathered using this survey tool was written into database tables, then imported to ArcGIS as a collection of points, and where appropriate, reconstructed as lines or polygons. Micha Werner (2001) proposed a straightforward GIS-based technique for determining the extent and depth of flooding based on water levels computed with a l-dimensional flow model and an extended inverse distance interpolation algorithm [10]. The approach was demonstrated on a 9 km* floodplain region, with the effect of varying grid size on flood extent estimation and assessment time was explored. The proposed method proved very practical to estimate the extent of flooding based on water levels provided either as design level or calculated by a 1D flow model at cross section locations.

Justin Leidwanger (2013) outlined methodology which uses GIS to integrate environment and technology as tools for exploring the seaborne connectivity [11]. This first model shows how a more subtle geographical approach can illuminate the human geography. The prehistoric coastal communication through the need of sailing duration as beneficial elements of path length as well as the case studies of coastlines which are located in turkey are also considered. Ross Robinson (1976) suggested that the modelling approach for the effective coastline management provides an insight into the true bases of spatial tensions while also giving analytical approaches for assessing those tensions and options for creating ideal circumstances [12]. The paper also indicates that the port may be analyzed at various levels of complexity, but that three fundamental dimensions time duration, transportation through associated berth links and efficiency provides a foundation for an analytical framework. The objective of the article by M. A. Mueller *et al.* (2020) is to obtain insight into port selection decisions for European container imports from Asia [13]. The significance of selection of port

determinants and their influence on the market shares of hinterland port were explored. The model's response to the impact of rising gasoline prices on hinterland ports were explored. Containerized imports from European mainland regions were compiled together using shipping data, port statistics, modal split, and gross regional goods. Using various research sources, 11 port selection criteria were chosen; four of those were shown to be statistically important. These characteristics and their weights were used as input for the most sophisticated model yet, a logit port choice model, to analyze container port imports for 31 ports respectively. A changing oil price scenario was used to demonstrate the model's usefulness and response.

Table I: Tabular representation of reviews on application of GIS and Modelling Software.

Authors	Methodology	Summary & Findings
S. Buhur *et al.* (2004) [14]	Digital aerial images with 10 cm GSD and a digital elevation model (DEM) are main data used during the generation of the basic 3D city model.	3D City Model provided Visualization and compression of urban design proposals. These detailing helped in proper understanding.
Vipul Gupta *et al.* (2016) [15]	3d model of various blocks of campus was created using Revit Architecture and as a result a query-based mechanism of the campus was created using ArcGIS.	ArcGIS cannot combine REVIT 3D model into query mechanism.
Q. Adejare *et al.* (2011) [16]	This paper has used passengers travelling distances, travel duration, travel delays and speed variations in Lagos State to design a GIS and also designed a vector-based GIS for four different spatial locations.	By this case study the time taken through waterway transportation is reduced by 46.33%
Geoffrey Boyce *et al.* (2019) [17]	The modelling of ruggedness combines several factors including as slope, vegetation, "jaggedness," and ground temperature, and it gives an alternative to Euclidian distance as a means of measuring and comprehending geographical space.	This study uses GIS modelling to examine unauthorized migratory routes in southern Arizona's Sonoran Desert and discovers a rise in the roughness of terrain traversed by pedestrian migrants over time.
Geert Thiers and Gerrit Janssens (2020) [18]	Detailed modelling of maritime traffic on the river, including navigation logic, tides and lock planning, are included.	The research seeks to establish a mathematical traffic simulation model for maritime access to the port of Antwerp, as well as numerous simulations for sea traffic at the Berendrecht-Zandvliet lock complex, the already existing container quay, and the proposed container quay.

V. FACTORS AFFECTING WATERWAY TRANSPORTATION

Jason R. W. Merrick *et al.* made a proposal to the California legislature to increase the coverage of ferry service in the San Francisco Bay area. area [19]. To calculate the increase in vessel contacts brought on by the three different expansion plans, a simulation model was developed. A geographic profile that displays the frequency of ferry contacts throughout the research area—the output of the simulation model - represents the level of congestion under each choice. Denis Atehnjia *et al.* (2019) presents a review on the elements that impact the development of an inland port and its economic advantages to Ghana's rural villages [20]. A critical assessment indicates that much study has been conducted to assist planners and investors interested in understanding the many issues unique to a developing country in the building of an inland port. Further investigation finds that certain factors of reliance on transit neighbors are also critical in emphasizing the requirement for inland port categorization. Bruce Lambert (2010) outlines the numerous organizations involved in inland navigation, such as barge operators, shippers, infrastructure providers, and ports, as well as their interactions [2]. The future of inland waterways is then covered, along with how institutions, infrastructure, and data might enhance waterway operations. This paper explores inland navigation from a variety of angles, although it primarily focuses on inland waterways as a tool for fostering economic growth.

Olisa Chiamaka L *et al.* (2020) evaluated ferry accident instances on inland waterways in the Lagos metropolitan

area of Nigeria to identify practical strategies for enhancing ferry services [21]. In order to gather passenger perceptions of the main contributing causes to ferry accidents in the study area, a questionnaire instrument was used in the study. To supplement the findings of the primary analysis, secondary data was also gathered from pertinent agencies. In terms of statistics, descriptive analysis was performed to analyses the data, and Likert scales were employed to rank the main causes of the ferry disaster and pinpoint its root causes. The association between the state of navigable rivers and the type of ferry accidents was examined using Spearman's rho correlation. Ivan Stenius *et al.* (2014) determines the most significant research subjects and critical performance characteristics for personal transportation and city logistics systems on urban waterways for year-round service [22]. It also seeks to discover transportation systems and technology solutions for waterways that can be scaled and adapted to urban contexts all over the world, complementing land-based transportation systems, in order to achieve overall sustainable urban mobility. The most significant research subjects and critical performance characteristics for personal transportation and city logistics systems on urban waterways for year-round service. Robert A. Swett *et al.* (2008) proposed a new approach for waterway planning and permitting based on carefully mapped channel depths, a census of actual boat populations, and the spatial extent of natural resources [23]. The RWMS offers a thorough, regional assessment of channel conditions as well as the location and severity of any current barriers to safe navigation and resource protection. In order to accommodate water-dependent applications while avoiding environmental hazards and lowering public spending, regional-scale permitting is the outcome of RWMS information and assessments. The science-based RWMS is more impartial, objective, transparent, ecologically sound, and economical than conventional methods of managing waterways.

Table II: Tabular representation of reviews on factors affecting waterway transportation.

Authors	Methodology	Summary & Findings
Radaun Serap *et al.* (2017) [24]	Study of safety of ferry using concept KAP (Knowledge Attitude Practice)	Data is analysed to provide better safety to the consumers
ZI Awal (2006) [25]	The primary information sources for this study were national daily newspapers and accident reports of BIWTA.	The predominant causes of accidents are cyclone, overloading and collision of vessels which most occur in the monsoon season, March to July and in October. Most of the cyclone & overloading accidents have occurred in these months.
V V Karetnikov (2022) [26]	Engineering-cybernetical approach to determine the basic provisions of the concept for the construction of unmanned ferry lines.	The introduction of UMFL requires the availability of on-shore support infrastructure. Some elements of this infrastructure can be found on some of the river basins in the UDWS of European Russia.
Namireddy Reddy (2019) [1]	The advanced control strategies for energy management are used to achieve the optimal operation of shipboard power and propulsion system for the real time sailing profile	Autonomous passenger ferries could solve the problem of congestion and pollution in the urban areas while reviving the water transportation system. They could reduce operational costs by up to 30% by reducing crew, increase in safety and reliability especially at night and in bad weather.
Wenyuan Wang *et al.* (2017) [27]	The problems are identified by building a simulation model of the ships' navigation operation system	A simulation model, which considers factors, such as rules and regulation of ships entering and leaving port, navigation rules

VI. Conclusion

This review highlights the research carried out on Inland water transportation system of various case studies of different countries. The case studies offer different scenario about inland water transportation mode according to their geographical and climatic condition. Additionally, the software application of route mapping for site selection and their possibilities are also discussed. The most of the research studies included the GIS Software application for appropriate and effective route mapping. Data available from existing case studies was thoroughly studied and as a result GIS mapping for site and route selection is brought in action by the use of QGIS software successfully. The 3D modelling was carried out using Revit architecture software in most of the case studies. The 3D views play important role for the visualization of port and other water infrastructures. Furthermore, this review identified the various factors

such as Environmental assessment, Economic development, Time Estimation and Infrastructure budgeting. which are essentially required for water inland transportation mode.

The need for a future scope in concern with modelling is highly influenced by this literature review. The study caters all the factors for Planning and Development of Waterway Transportation Along Coastal Cities. This review offers a most economical approach for effective management and operation of Inland waterway transportation system. This study contributes to Transportation Engineering and Water Transportation System by Providing a thorough assessment of various case studies, application of software's and factors affecting on water transportation mode.

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A REVIEW OF INDUSTRY 4.0 IN CONSTRUCTION INDUSTRY

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Abstract— The productivity and efficiency in the construction industry is stagnant from decades. The methods and technologies used today in Indian construction industry are lacking from rest of the world. Implementation of Industry 4.0 in construction industry may help to improve the current working environment of the industry. Factors such as, productivity, management, efficiency greatly influence the time required to complete the project and resources utilization.

In this study, the review of literature which were available across various platforms. Research shows that most of the technologies used include computer-based technologies and sensors for monitoring and collecting site data to enhance the working environment. Also, the site survey of two project one was large scale township project and another was a small apartment development project. From the survey data was collected for time management, monitoring methods, safety, productivity, material management.

This paper summarises the gaps in the construction industry and factors which effect the overall construction project and also possible technologies and solutions which can be used to overcome the gaps. The Aim of this study is to provide a direction for the future engineers and designers to work on the industry 4.0 related technology and their implementation.

Keywords— Construction industry, productivity, Material management, Industry 4.0, Efficiency, Computer-based technologies

I. INTRODUCTION

Construction industry is one of the greatest contributors to the growth and economy of the India. The use of automation and AI technologies in other fields has help them to grow exponentially. In construction industry the use of automation and AI technologies has not been fully explored and most of the industry is unaware with these technologies and their use. Use of machine learning in the industry can also help to significantly improve the process and environment. Construction project have relatively large time span and monitoring time, productivity, material, safety, workers, equipment accurately is a challenging task. Use of advance technologies can help to ease the process and making the project management and operations efficient.

Time is the one of the most valuable assets in construction industry. The time period of the project decides the cost of its construction. The delay in completion of project increases the cost of construction. Thus, managing and monitoring the time of different activities is an important job. Monitoring various aspects of the project is necessary for tracking the progress and planning next event. Monitoring In the construction industry is done physically by site supervisors or site engineers. This method is not only inefficient but also has high probability of errors. Using automation for monitoring can help to improve productivity and can ease the process of tracking various aspects of a project. In construction project tracking material, workers activity, equipment, bills, payments, progress, quality are the main focus of an organization. Tracking them accurately can significantly benefit the organization as it will help in fund management and completion of project in given time duration.

The high frequency of work-related injuries and fatalities experienced on construction sites makes the construction process a very hazardous endeavor [1]. Construction industry is one of the most hazardous and has high rates of accidents. The aim of every

organization is to avoid as many accidents on site as possible. Labours avoid wearing construction gears which is also a major problem in the industry. Using IoT and Automation can be very effective in monitoring the safety as well as workers. Tracking the gears of workers can ensure that they are consistently wearing them. Predicting the accidents with the help of AI can significantly reduce the number of casualties on site.

One of the problems of construction sites is that inventory control is more challenging due to the nature of the work because of the lack of dynamically integrated warehouses [2]. Using the materials efficiently can help in cost controlling and wastage of materials. For construction industry managing, monitoring and security of the raw material is the main focus to avoid all sort of malpractices which are involved with them. Tracking of material and resources in the warehouse is necessary to know its utilization and to make sure that they don't run out of stock. Therefore, future application of IoT sensors and equipment could upgrade inventory management for this industry by designing and implementing better sensor systems in the whole construction site, even while working and when the gradual use of resources takes place in different parts of the site at the same time [2].

In this paper we have summaries the technologies which can be used for improving the various construction processes based on the survey which was conducted. These technologies can be very helpful in increasing the growth of the industry and can change the future of the construction industry.

II. LITRATURE REVIEW

By reviewing number of research papers, we have identified various technologies for various phases of construction project. The data was collected from various international journals such as IEEE, SCIENCE DIRECT, and ACM. Some of the research work done in this field are as follows:

Sofiat O. Abioye et al. Concluded that AI can be used to improve productivity and solve problems in industries. Finding in the study reveal that computer vision, robotics and NLP fall under emerging technologies; ML, automated planning and scheduling are ripe technologies while KBS and optimization are mature technologies [3]. This study also identified the future opportunity and trends like BIM, IoT, quantum computing, augmented reality, cybersecurity and blockchain. A clear understanding of the intrinsic opportunity as well as the potential barriers of the application subfields was presented in this study [3].

Christian Nnaemeka Egwim et al. Mentioned that how project delay leads to cost overrun and its effect on future project. Despite all these delay factors and recommendations towards mitigating delay in construction, delay still strives in the industry, hence the first motivation of this study [4]. In this study use of ensemble machine learning algorithms (EMLA) for predicting delay of construction projects was architected, built and presented. The aim of the study was to use AI and ML technologies to mitigate the construction delay.

Jee Woong Park et al. Aim was to create a low-cost safety monitoring system for construction safety monitoring process. The system is cloud-based real time on-site application. It consists of Bluetooth low-energy (BLE)-based location detection technology, building information model (BIM)-based hazard identification, and a cloud-based communication platform. The results indicated that the proposed approach can assist in the construction site monitoring process and can potentially improve construction-site safety [5].

Ibukun Awolusi et al. In this paper they have identified the wearables sensing devices (WSDs) and the internet of things (IoT) can be the potential technologies which can be used for tracking safety on construction site. This paper provides an evaluation of the potential applications of WSDs and IoT for the continuous collection, analysis, and monitoring of construction workers' safety metrics to mitigate safety hazards and health risks on construction sites [1]. The study evaluated wearable sensors and systems that can be used for physiological monitoring, environmental sensing, proximity detection, and location tracking of a wide range of construction hazards and vital signals which can provide early warning signs of safety issues to construction workers. The schematic model presented in this study can be used by manufacturers of WSDs as a tool for integrating wearable sensors and systems into a single device for interoperability and multi-parameter monitoring of construction safety metrics [1]. The factors and challenges which are faced for application of WSDs and IoT in construction are also identified.

Juha Häikiö et al. investigated the views of construction workers on using IoT technology for monitoring work safety. Involving construction workers actively in the design and development process of IoT applications can be seen as one of the key factors to promote technology adoption in the construction industry [6]. Interest of using wearable technologies and IoT for safety and health monitoring of workers is increasing significantly. The findings show that construction workers are interested in using wearables and willing to share their data if the data is used for work safety and wellbeing purposes [6].

Omar Sedeeq Yousif et al. This study shows that construction industry is lacking in adopting digital technologies. The major focus of the research was on the principle of IR 4.0, which enables intelligent, economically, productive, customized, and scalable construction at a low cost [7]. The technologies will help to make the construction process and building design more intelligent and flexible which will

indirectly reduce the wastage and make it more economical. These tools have many advantages, including assessing the performance of the construction process and providing the key performance indicators required for construction management and decision support [7].

Raihan Maskuriy et al. This study was subjected to the implementation of industrial 4.0 from the perspective of managerial activities, such as investment, project preparation and other management related activities. Technologies such as building information modelling (BIM), augmented reality (AR), cloud computing, automation which can be used for the effective management of construction tasks. Also, the benefits and challenges for IR 4.0 for the construction industry were identified. This study found that the majority of the articles used for synthesis employed systematic and scoping review techniques to display the importance of IR 4.0 to the construction industry [8].

Yasaman Mashayekhy et al. studied the impact of industry 4.0 technologies, particularly IoT, on inventory management was investigated. The future application of IoT sensors and equipment can enhance the inventory management by implementation of better sensor system on site. From the literature analysis, the trend and potential of IoT opportunities available in sustainable inventory management space were explored [2].

Patrucco A. et al. studied the role of industry 4.0 in improving process management in the supply chain. They used a case study focused on the inbound and outbound material management processes supporting a construction project, and assessed the benefits and impact of I4.0 by discussing them directly with internal and external process actors, using a bottom-up logic, in the spirit of collaboration between academics and practitioners [9].

Osama Ali Ibrahim et al. Mentioned that traditional methods are very much inefficient and lacking for material management. Because of which there are loss of important documents which makes it time consuming and unsustainable. The use of high amount of labour for inspection and reception stages impacts productivity. Lack of real- time data leads to delay in payment and ordering the material. Using RFID can be very helpful in improving the current conditions. Some project managers see that RFID systems would be more effective if applied in large projects with wide materials diversity and implementation periods of 5-10 years [10. labours on construction sites are not familiar with RFID systems so, there is a need to promote using such systems in different ways [10].

Narimah Kasim et al. has presented the use of RFID technology and employment of RFID technology for material management in construction project. The importance of RFID technology for effective management of material to improve performance of project in terms of time, budget and quality is explored. In this paper, the emerging technologies such as RFID are discovered to be a potential for improving materials management especially for tracking of materials [11].

Amanda da S. Barbosa et al. carried out the systematic review to identify and analyze the main existing methods for productivity monitoring on construction site using digital technologies. Results show that technologies based on computer vision and sensors are the most used for productivity monitoring on construction site [21]. Integrating computer vision and sensors can be a great addition to the industry for monitoring and measuring productivity. These technologies can automate data collection for the processes of work sampling and activity analysis, as well as to measure inputs and outputs, and monitor physical and emotional factors that can influence workers' productivity [12].

Zhijia you et al. provided the systematic review of the research and implementation status of industry 4.0 related technologies in construction industry. A framework of the cyber-physical system is proposed in this paper, in which the real-time construction model acts as the digital twin of the building under construction [23]. Under the framework real-time monitoring, simulation and the architecture of a data-driven decision support were discussed. This paper aimed to present a discussion on the integration of Industry 4.0 related technologies to establish a cyber-physical system for improving the overall capabilities of construction organization and management [13].

R.C.Y. Lam et al. This paper described an IoT monitoring system for the purpose of improving safety [14]. **T**he field validation test which showed that IoT monitoring system was able to provide continuous real time data, irrespective of weather, holidays and working hours. Installation on site was easy and no maintenance was required. In the long run, implementation of the monitoring system in the industry is expected to greatly enhance construction safety, preventing injuries and casualties due to structural failures while at the same time minimizing the associated economic losses [14].

III. LITRATURE SUMMARY

Table no 1: Researchers contribution analysis

Sr no	Author	Industry 4.0 technologies								Type of research
		AI	ML	IoT	RFID	Cameras	BIM	WSDs	Sensors And M	

									CU	
1	**Sofiat O. Abioye et al.**	*	*			*	*		*	
2	**Christian Nnaemeka Egwim et al.**	*								
3	**Jee Woong Park et al.**			*			*		*	
4	**Ibukun Awolusi et al.**			*	*			*	*	
5	**Juha Häikiö et al.**			*				*		
6	**Omar Sedeeq Yousif et al.**			*	*	*	*		*	
7	**Raihan Maskuriy et al.**	*		*			*			
8	**Yasaman Mashaykhy et al.**			*	*	*			*	
9	**Patrucco A.**	*		*	*				*	
10	**Osama Ali Ibrahim et al.**			*	*					
11	**Narimah Kasim et al.**				*					
12	**Amanda da S. Barbosa et al.**					*			*	
13	**Zhijia you et al.**	*	*	*	*	*	*	*	*	
14	**R.C.Y. Lam et al.**			*					*	

IV. FIELD SURVEY

We did the questionary survey on a construction site. The first site was split into different phases and the sector we visited consisted of 41 buildings. The second site a 3-apartment project. The survey consisted of total 27 questions. Total 10 personals on both sites participated in the survey. The participants included workers, safety officers, junior engineers, construction managers, project engineers. Most of the participants had an experience of about 5-15 years. The questions were based on the monitoring methods, safety, productivity, time management and material management. Based on the responses we understand that which are the processes and phases of the project that very inefficient. The traditional methods are not enough to optimal run and complete the large construction project. Thus, to conclude use of technologies is necessity for large construction project to improve productivity, data management, progress measurement and reduce the communication gaps.

V. CONCLUSION

This paper reviewed the technologies which can be implemented on monitor and manage various construction processes. Total of 40 papers were reviewed which were collected from platforms like

IEEE, SCIENCE DIRECT, ACM. The use of this technologies will make the construction industry more efficient and reducing its complex nature. The field survey we did helped us identify the gaps which are present in the process of monitoring, safety, productivity, time and material management. We then did the literature review on these aspects of project to find out which industry 4.0 technologies can be used to automate and improve them to reduce the inaccuracy and errors as much as possible. Some of these technologies are represented in the table no 2 shown below.

Table no 2: Technologies for different construction processes and resources

Sr no	Processes and resources	Technologies
1	Time management	Artificial intelligence (AI) Machine learning (ML) Internet of things (IoT) Building information modelling (BIM)
2	Material management	RFID Sensors and microcontrollers Cameras Artificial intelligence (AI) Machine learning (ML) Internet of things (IoT) Building information modelling (BIM)
3	Productivity	Artificial intelligence (AI) Machine learning (ML) Internet of things (IoT) Wearable sensing devices (WSDs) Sensors and microcontrollers Cameras
4	Safety	Artificial intelligence (AI) Machine learning (ML) Internet of things (IoT) Wearable sensing devices (WSDs) Sensors and microcontrollers Cameras
5	Monitoring	Artificial intelligence (AI) Machine learning (ML) Internet of things (IoT) Wearable sensing devices (WSDs) Sensors and microcontrollers Cameras

The technologies that are mentioned in the table are the future of construction industry. Replacing this technologies with the traditional methods will help the industry towards growth and will increase the overall sustainability of project. This study concludes that construction industry needs to upgrade its methods of data management and automating it will significantly Reduce the errors. As forward-looking research, this paper may also to inspire more efforts in this field.

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Study on Partial Replacement of Fine aggregate in High Performance Concrete

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***Abstract*— In today's scenario sustainability is playing a vital role in maintaining and bring up imperishable environmental conditions for wellbeing of mankind. The purpose of this paper is to present an idea on use of artificial replacement for fines so as to declare it as alternative to natural sand and also to fit the line of increasing demand for high performance concrete. With growing needs of finding substitute for fines, cement industry has already raised the beneficial use of supplementary cementitious materials in various combinations and its effect on requiremental aspects of concrete. This paper emphasizes the use of cementitious materials i.e. silica fume and GGBS in trial evolved proportion in combination with natural sand, crushed sand and processed slag sand. With the increasing need of natural cement the need of evolving the use of steel slag has come in picture. The evolution for sustainability is the need of hour. The Indian standard code permits the use of recycled aggregates in some percent but with the changing environmental conditions this has to be changed.**

Keywords— Fine aggregate, high performance concrete, silica fume, GGBS, compressive strength

I. INTRODUCTION

With the increasing need to use a cement substitute, the evolution of tailor-made materials has increased to a great extent. The use of cementitious materials then came into the picture such that the entire cement industry shifted the focus onto the use of the same and the proportion in which this could be cast off in varying site conditions, grade of concrete, workability and durability of concrete. Vahid Afroughsabet [17], investigated the use of calcium sulfoaluminate cement in fully and partial replacement to Ordinary Portland cement in combination of GGBS (ground granulated blast furnace slag) and analyzed the same for compressive strength, electric resistivity & SEM images. He further concluded that the trail having purely CSA ettringite crystal led to an increase in the strength of concrete. The use of GGBS helped in reducing the cracking potential, stress rate and cracking potential in the high-performance concrete by using GGBS in varying proportions of 0%, 20%, 35% and 50%. Increased dosages of silica fume increase tensile creep and autogenous shrinkage, cracking stress but decreased cracking resistance at early stage in the high-performance concrete by using GGBS in varying proportions of 10%, 15% and 20% [5].

A binary blended concrete containing ground granulated blast – furnace slag, when GGBS is replaced up to 50% the desired strength is achieved along with the similar nature of carbonation throughout weeks but when it goes beyond 50 % the carbonation depth increased however the chloride penetration depth decreased when the GGBS ratio was less than 25% [10].

Use of Supplementary cementitious material (SCM) improves the structure formation of concrete but also develops the C-(A)-S-H phase, which leads to better performance of concrete in terms of strength and durability [2]. When the replacement of fine aggregate with steel slag was about 20% or 80% high compressive strength and toughness was obtained in normal strength concrete but when the same replacement was 30% the compressive strength and toughness was superior in case of high strength concrete [18]. If silica fume is replaced up to 10 % the tensile strength increased by 26%, compressive strength by 13% and 5% modulus of elasticity but with all this when the replacement goes beyond 10% the concrete became brittle so it was recommended that not to use silica fume beyond 10% [15]. Similarly, many researchers have experimented the various proportions of these cement substitutes and the studied its effects on various properties of the concrete in terms of performance and durability [4], [3], [11], [9].

The tailored material is defined to be the one which can be developed by the unproductive product such that it acts as a sustainable option for the environment. Among these materials the most common ones used are silica fume and ground granulated blast furnace slag (GGBS) as discussed above.

The experimentation done in this paper refers to the use of supplementary cementitious materials such as silica fume and ground granulated blast furnace slag in combination with processed slag sand as a partial replacement to natural and crushed sand as fine aggregate. These materials were used in varying proportions but the optimum mix in relation to the processed slag sand was yet to be investigated. This processed slag sand added an advantage as fine aggregate, the properties are identical to that of natural sand and as per codal provisions. There is a lot of research done on various percent replacement of cement by silica fume and ground granulated blast furnace slag (GGBS) in varying proportions of 5%, 10%, 15%, 20% up to 60 %. Along with the increasing need of cement

replacement the need of replacing natural sand also came into existence. But the sudden ban on the drenching of natural sand made it compulsory to shift to manufactured sand which is also known as crushed sand or tailored made sand. This research was carried out to analyze the behaviour of crushed sand in comparison to natural sand or river sand and examined for compressive strength and flowability of high-performance concrete of M60 grade. The trials were carried out using silica fume and GGBS with varying replacement percentage as 5%, 10%, 15% and 30%, 40%, 50% respectively.

II. Proposed Framework

The trials were done for M60 grade of concrete with water cement ratio 0.27 and varying proportion of supplementary cementitious material. The preliminary stage included, finding the optimum proportion of silica fume and GGBS, satisfying the required design specifications. The effects of silica fume and GGBS was studied with respective to strength and workability. The trials with various proportion of 5%, 10%, 15% of silica fume and 30%, 40%, 50% of GGBS in combination with natural sand, crushed sand and processed slag sand.

Materials Used

Ordinary Portland Cement (OPC)

Ordinary Portland Cement (OPC) of 53 grade was used for all trials. The cement was tested for specific gravity, initial setting time and final setting time for basic specifications.

Silica Fume

Silica fume is amorphous form of silicon dioxide. It's a It's a fine grain, thin and more surface area component varying around 20,000 m2/kg when measured by nitrogen absorption techniques, with particles approximately one hundredth the size of the average cement particle. It makes the concrete structure less permeable and hence enhances the durability of the structure. But in high temperature areas it should be used very carefully and in an optimized way or else it may lead to early age shrinkage crack rate (14)

Ground granulated blast furnace slag (GGBS)

Ground Granulated Blast furnace slag (GGBS) is a by-product of pig iron manufacturing and obtained by quenching molten slag. The processed slag develops hydraulic properties as same as cement and so can be used as a pozzolanic material (14). The need to reduce carbon emission in the atmosphere with massive production of cement, it has become a necessity of an hour to use such supplementary cementitious materials for production of concrete.

Processed slag sand

The GBS is processed at site by passing it through a vertical shaft impact machine assembly. The GBS undergoes some amount of crushing and the particle shape gets altered. This intervention is mainly aimed at increasing the bulk density of the GBS sample and making the flaky GBS more spherical**.** The figure below gives an over view of particle size distribution for all the kinds of fine aggregates used in the experimentation.

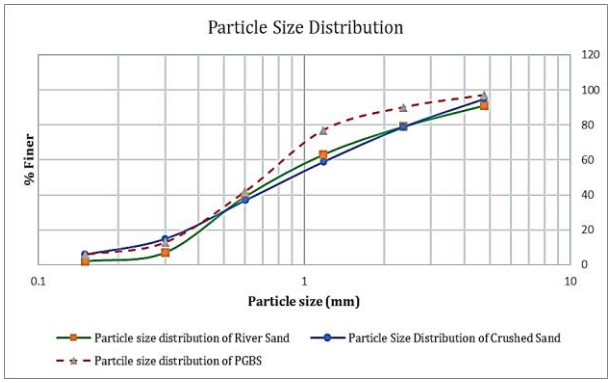

Fig.1. Distinctive particle size distribution of various fine aggregate used in experimentation

III. Proposed Methodology

This research involves casting concrete cubes of standard dimension 150 x 150 x 150 mm, with different combination of fine aggregate, PGBS being 25% replaced in river sand and crushed sand for M60 grade of concrete in combination with 5%,10%,15% and 30%,40%,50% of silica fume and GGBS. The cube moulds were filled with concrete in 3 layers, compacting each layer by tamping rod and thereafter placing them on vibrator table so as to remove all the entrapped air and obtained a finish concrete surface on hardening. There was total 180 cubes casted during this process. They were further immersed in water for curing and then tested for 3 days, 7 days and 28 days. For each proportion trail, the workability of the concrete was checked so as to satisfy the clause of being pumpable along with high strength. The results of each in the graphical representation is shown further. Various materials used are listed below

- Cement: Ordinary Portland Cement 53 grade
- Coarse aggregate: Granite conforming IS: 383-2016
- Manufactured aggregate: Crushed sand of Zone II conforming IS: 383-2016
- Processed sand: Processed sand of Zone II conforming IS 383-2016
- Water: Portable water conforming IS 456: 2000
- Mineral Admixtures: Silica fume, Ground granulated blast furnace slag
- Chemical Admixture: CAC – Hyper fluid R 100 (M4)
- The basic test on materials is given in table no. 2 & table no. 3

Secondary part of this experiment included the usage of optimum mix i.e. using the determined percentage of silica fume and GBBS with 30% of processed slag sand in combination with natural sand and crushed sand. These combinations were examined for compressive strength and water penetration test for analysing the performance of concrete. The table below depicts preliminary trials

Table 1: Compressive strength test on cement

Compressive Strength of 3 days	29.5 N/mm^2
Compressive Strength in of 7 days	39.5 N/mm^2
Compressive Strength in of 28 days	53.42 N/mm^2

Table 2: Specific Gravity of materials

River Sand	2.70
Crushed Sand	2.89
Processed slag sand	2.47
Metal 1	2.77
Metal 2	2.81

Table 3: Preliminary trials

Trial 1 (T1)	100 % Natural sand	5% silica fume + 30% GGBS
Trial 2 (T2)	100 % Crushed sand	5% silica fume + 40% GGBS
Trial 3 (T3)	75% Natural sand + 25% PGBS	5% silica fume + 50% GGBS
Trial 4 (T4)	75% Crushed sand + 25% PGBS	10% silica fume + 40% GGBS
		10% silica fume + 50% GGBS
		10% silica fume + 60% GGBS

Table 4: Secondary trails

Trial 5 (T5)	75% Natural sand + 30% PGBS	10% silica fume + 30% GGBS
Trial 6 (T6)	75% Crushed sand + 30% PGBS	

After determination of material property the trials were conducted as mentioned in the table above to check the effect of silica fume and GGBS mixture combined with natural sand, crushed sand and processed slag sand on M60 grade of concrete.

IV. RESULT

The results of the trials done are shown below:

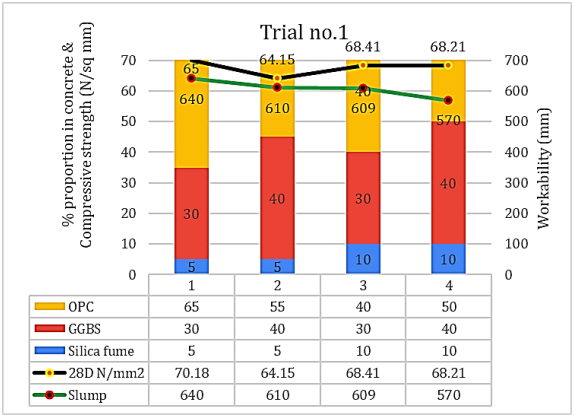

Fig.2. Results of Trial no.1

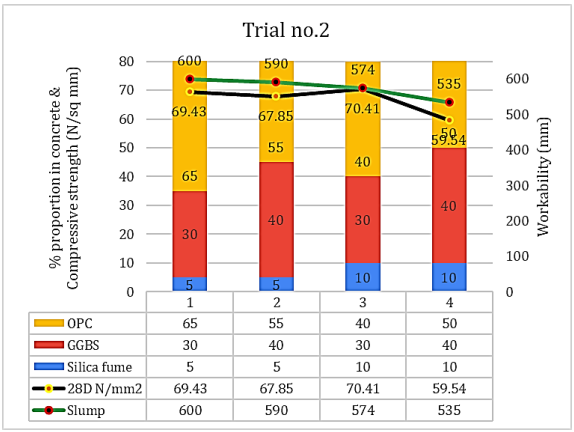

Fig.3. Results of Trial no.2

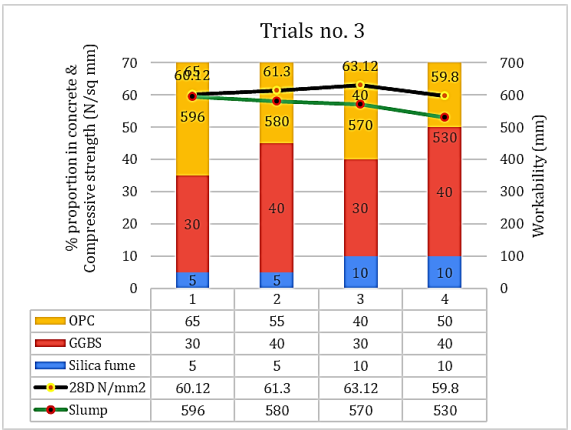

Fig.4. Results of Trial no.3

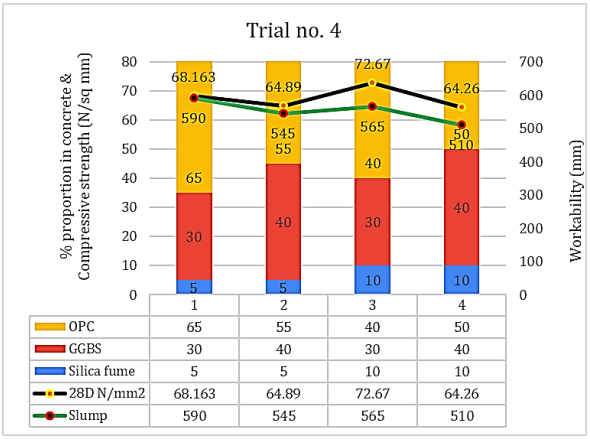

Fig.5. Results of Trial no.4

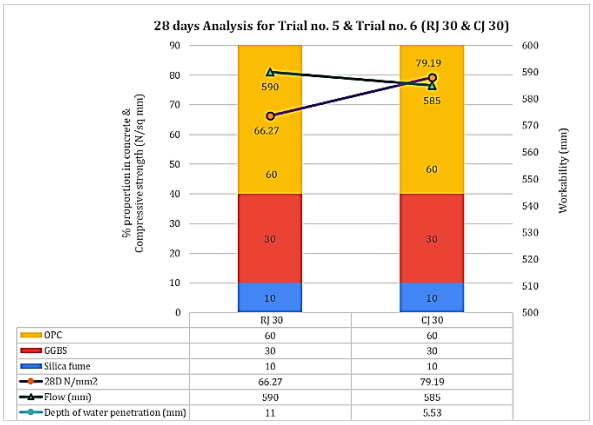

Fig.6. Results of trial 5 & trial 6

V. Future Scope

As far as Indian scenario is concerned, the health of concrete is the most crucial aspect to be maintained in the coming future. In order to develop the solution for this, there needs to be research conducted in the field of construction industry with various combination of substitutes for cement as well as for the fine aggregate. Research needs to be conducted going beyond the codal provisions for replacement of fine aggregates or sand. In future the percentage of processed slag sand in combination of natural sand and crushed sand will be increased to analysis these trials for the behavioural aspect of concrete.

VI. Conclusion

The behavioural modification in concrete is examined for various trials taking into account the processed slag sand as the partial replacement for fine aggregates along with natural sand and crushed sand. For the preliminary trials i.e., from trial no. 1 to trial no. 4 , it has been observed that the trial in containing 10% silica fume and 30% GGBS combinedly satisfies this requirement of compressive strength and workability with natural sand, crushed sand and processed slag sand. This optimum proportion of supplementary cementitious material (SCM) was further analysed for durability aspects with increased percentage of processed slag sand from 25% to 30% used as partial replacement for natural sand and crushed sand. These results were interpreted for the compressive strength and water penetration test of concrete for comparing it with natural sand with respect to crushed sand. It was then observed that when crushed sand partially replaced with processed slag sand performs better than with river sand. The packing of concrete for this trail proves to be denser leading to less permeability of concrete and more compressive strength.

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Rain Water Harvesting & Waste Management for Community Building– A Review.

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Abstract — **Nowadays, water scarcity is a severe problem and the liquid and solid waste generated cause's environmental pollution so rainwater harvesting system, sewage treatment plant and waste composting respectively, are the best practices that needs to be adopted everywhere. Through rainwater harvesting, the rainwater can be conserved, stored & used as per convenience. The sewage treatment plant is designed as a primary treatment for the sewage water of households. Along with the rainwater harvesting system and sewage treatment plant, in-house composting of organic solid waste will help in reducing the quantity of solid waste reaching landfills. This paper briefly overviews the research carried out in the designing of rainwater harvesting system, sewage treatment plant and management of organic waste. Based on these review papers, we are going to adopt these techniques in our case study of a community building which is located in Dahanu (Palghar), in which we are going to design a rainwater harvesting system, along with the design of sewage treatment plant for sewage treatment. Our survey of that area showed that the solid waste management system is poor, so we are also going to plan the collection, handling, storage, segregation, disposal, and treatment of organic waste by composting for that community building. This review paper concludes that the adoption of such best practices in societies will help in solving the problem of water scarcity, disposal of solid and liquid waste in the premises itself.**

Keywords— Best Practices, Rainwater Harvesting, Sewage Treatment Plant, Composting

I. INTRODUCTION

As the world population increases, the demand increases for quality drinking water. Also, surface and groundwater resources are being used faster than they can be recharged. Therefore, rainwater harvesting is an old practice that is being adopted by many nations as a viable decentralized water source [1].Rainwater harvesting is one of the most effective methods of water management and conservation. It is the term used to indicate the collection and storage of rainwater used for human, animal, and plant needs. It involves the collection and storage of rainwater at the surface or in a subsurface aquifer before it is lost as surface runoff [2].

Water consumption is increasing, but availability is decreasing, so the demand for water is increasing [3]. So, sewage treatment is the process of removing contaminants from waste water, primarily household sewage. Physical, chemical and biological processes are used to remove contaminants and produce treated waste water that is safer for the environment [4]. Therefore, proper sewage treatment is essential, and sometimes treated sewage can be used for other purposes. To assess the STP's technical efficiency, the quality of its influent (raw) sewage and effluent (treated sewage) needs to be studied [5]. Thus, proper treatment and management of sewage become an essential process for ensuring the health and quality of life of living beings [6].

The study shows the generation of waste has increased from 0.26 kg/day to 0.85 kg/day, and close to 90% of waste is disposed of without proper treatment, causing environmental pollution [7].Therefore, waste management involves the collection, transportation, processing, recycling, or disposal of waste that is generated from different sources, like residential,

industrial, commercial, institutional, construction sites, municipal services, processing or manufacturing, agriculture, etc. The wastes from different sources are mainly in solid, liquid, and gaseous forms. Solid waste comprises wet waste and dry waste. Wet waste is generally referred to as biodegradable waste, like food waste, vegetable waste, and cooked or uncooked waste. Monitoring of waste materials the biodegradable waste is treated before its disposal, which will help us reduce its size and weight. So, composting can be done by different methods, but it depends on the quantity, type of waste, and time of composting of biodegradable waste. Compost converts the waste into a useful soil nutrient that can easily be mixed with soil to make it more fertile, and it also adds nutrients to the soil [8].

This paper presents review on Rainwater harvesting & Waste management in community building. The reviews are segmented in three sections II, III and IV respectively. Section II reviews the various case studies of Rain water harvesting. The case studies on sewage treatment plant are shown in the III section. The case studies on organic waste management is discussed in section IV.

II. CASE STUDY OF RAIN WATER HARVESTING

Kumar M (2015) conducted a study which evaluates the potential for water saving by using rainwater in Shilpa Hostel a residential building at JNTUA College of Engineering in Ananthapuramu town located in the southern state of Andhra Pradesh in India [9]. This project deals with aspect of improving the rain water availability in the Ananthapuramu campus by implementing rain water harvesting (RWH).In this, Using average rainfall data, calculation for rainwater endowment and water harvesting potential were made, Volume of water was calculated for 686.4 m^2 catchment area which can be collected in one year and also suitable hydrocyclone for removing suspended particle and reducing turbidityhas been proposed. The water demand per year had been calculated and found as 1,03,97,025 liters. Rainwater endowment was computed 401.111m^3 and assuming a runoff coefficient 0.9, rain water harvesting savings were calculated as 3,61,000 liters/year. Annual monetary savings were calculated based on the volume of water collected by rain water harvesting and payback period. The cost estimation for RWH system was 76,150rs. Through the rain water harvesting system, annual savings was found as Rs.36,100 and the payback period was calculated as 2.11 years.

Patel U. and Patel V. (2014) describe the rooftop rainwater harvesting at SPSU Campus visnagar, Gujarat. Author analysis the present water use as campus, determine the problem with current system and did the feasibility study of RW collection system [10]. He concluded that the average rainfall ranges between 700-800 mm/annum. The campus have total catchment area of 31,342.28 m and Total quantity of rainfall is 26671.37 m^3. He suggest RWH will be the best approach to fight with water scarcity in all aspect Wheather it is from financial point of view or from optimum utilization of land surface by implementing ancient old technique of RWH.

Krishna S. and Mishra J. (2020) conducted a study on joda township was surrounded by the hill with steep slope sand at a distance of 67 km from keonjhar town, india [11]. The total population of the area was around 1,50,000. The area is rich in hematite, geothite, pyrolusite, and psilomelane with traces of pyrites. That mineral rich area, water consumption. There present sona nadi and baitrani river was very bad condition located in township. Underground water and public water supply have been the source of water for Joda Township.

Anchan S. and Prasad H. (2021) conducted a study on feasibility of roof top RWH potential for south Indian university [12]. The study revealed that approximately 1,13,678.9 m^3 of strom water may be captured with rooftops of 19 buildings. Author suggested RTRWH because water is conveyed from Netharavati river with long distance pipeline to fulfil the water of campus. RWH could help SIO to be self sustainable for water resources rather than completely depending upon conventional water supply system. The captured rain water could be directly utilized for interior operation like gardening, cleaning, flushing and washing purpose. They concluded that designed storage tanks may effectively fulfil the water demand for two or three months and the payback period for cost is about 13 years.

Sunil B (2016) conducted the study in 2014 which explored the awareness about rooftop rainwater harvesting systems, attitudes towards them and their acceptance among the people of Dehradun, India [13]. The study highlights the fact that the Government of Uttarakhand MDDA and the local authority are aware of water management issues and have accordingly made policies to promote water conservation and management, using techniques such as RWH in buildings. Also the people of Dehradun city wanted to installed the RWS in their houses. Three urban localities (Location 1, Location 2 and Location 3) were chosen on the basis of stratified random sampling. Household were chosen randomly in each of these three localities. the study frond that a large percentage of respondents were aware of general utility of RWH and were willing to adopt RWH systems for their households. The results indicate that rooftop rainwater harvesting is acceptable to the people but the government needs to provide supportive implementation plans. Some of the case studies of rain water harvesting system are briefly outlined in Table I.

Table I: Tabular representation of reviews on Rain water harvesting

Authors	Methodology	Outcomes
S.Kalia YBhirud (2019) [14]	Declined water level trends has been observed. They try to enhance availability of ground water at deluxe hostel by utilizing rainwater.	The 71,884.27 litres of rainwater to be stored in 1 underground tank 2,87,537.08 litres of rainwater stored in 4 underground tank. The total cost estimated for 4

	Also assessed quality of rainwater harvested in storage tanks.	tank is Rs.28,52,768/-
P. Anant; S. Pratima (2015) [15]	By using rain water harvesting methods they tried to harvest and store rain water into ground aquifer or into percolation well.	They obtained 1,46,27,284 lit. of water annually which is 29.68% of total water demand. So by using rain water harvesting methods they can harvest and store the rain water into ground aquifer or into percolation well.
K. Anmol, R.Sujata (2018) [16]	Designed rain water harvesting system for institute which have two types of terrace. Each terrace was coupled with a drain manifolds and V type parapet which collected water & guide it to the drain during rain and also proposed U-shape piping channel.	The rain water harvested was useful to meet the demands of the campus for 78% of the time. The cost of the project was very reasonable, and it has a huge ROI and also a very small break-even time period.
M. Amit (2021) [17]	Suggested to design rainwater harvesting for the residential building of composite climate and smart monitoring of it using IOT (Internet of Things).	IOT based rainwater harvesting provides better results for collection and recycling of rainwater. It helps in solving most of the problems of traditional RWHS. The proposed system reduces the labour cost, time consumption and reactive service.
D. Shubhra. D. Patil (2016) [2]	The artificial recharge process was used in which ground water reservoir was augmented at a rate exceeding that under natural condition of replenishment.	As per the calculation, they tried to save more water than demand. Cost of installation- An individual building of an average area of 300-500 sq.m. having average cost 30,000/- to 35,000/- in building.

III. CASE STUDY OF SEWAGE TREATMENT PLANT

Janaki V. and Aenumula M. (2018) approached the design for Sewage Treatment Plant in Guntur City, Arunachal Pradesh, India (2018) [3]. In India from urban areas, the waste water generated about 5 BLD in 1947 which has increased to about 30 BLD in 1997. Guntur Greater Municipality of Guntur city, the Municipality waste water/sewage treatment is the process of removing contaminants from waste water by using physical, chemical and biological process. The utilization of treated water will reduce the ground water consumption and also supplied for irrigated lands of sewage generated from Guntur city were analyzed. The treated sludge is used as manure, will increase the fertility of soil and design of sewage treatment is for the predicted population of 1, 79,000 and estimated sewage of 22.2 MLD. The constructed sewage treatment plant will prevent the direct disposal of sewage in Krishna River and the use of treated water will reduce the surface water and contamination ground water.

Mahmood B. (2016) gave the case study on the Sewage Treatment Plant of Hussain Sagar Lake, Hyderabad in the year 2016 [18]. The lake water was used as drinking water source until 1930's and the water polluted, thus the blue water gradually changed to a brownish black in color and the lake became biologically dead by 1990's. This lake has been receiving untreated waste and industrial effluents through the four main nalahs. The lake is mainly fed by the Kukatpally nalah, which contributes domestic and Kukatpally industrial area. The other nalahs, Picket, Banjara and Balkapur carrying untreated waste also have outfalls into the Hussain Sagar thereby deteriorating the water quality of the lake. The 20 MLD Sewage Treatment Plant at Madarsa-Maktha nearly Hussain Sagar Lake was established to treated the polluted water entered the Lake. The waste water from various nalahs is diverted and are not allowed to enter the lake, which was previously let into the lake. The waste water was treated in the plant and the disposed into the lake. The sewage treatment process was designed by M/s. AIC Watson, Mumbai and the plant constructed by M/s. SACEDE Engineers and Consultants, Chennai, at a cost of Rs.60 Million. This entire project was been completed with the World Bank Aid and appointed the National Environmental Engineering Research in September 1997.

Elangovan G. and Rajnandhini V. (2019) designed and analysis the Sewage Treatment Plant in Nagore [19]. Nagore is a town in the Nagapattinam district, Tamil Nādu, India. In Tamil Nadu, Nagore Dargah is not only the Islamic religious center but also common religious gathering point by which many hundreds of thousands of devotes attended to get the peerless spiritual empathy which can cause gathering to deliver more amount of Sewage, which could be harmful, if left untreated. Since, there is no proper treatment plant for sewage in Nagore Municipal Corporation, it was necessary to construct a Sewage Treatment Plant. The plant is designed perfectly to meet the future expansion for the next 30 years in accordance with Indian Codal provisions and also, it

plant to meet the needs and demands of appropriate 44,624 population with a very large time period. The treated sewage water was further used for the irrigation, fire protection, and toilet flushing in public, commercial and industrial buildings and if it was sufficiently clean, it can be used for ground water recharge.

A. Singh and A. Kazmi (2016) gave the review on Sewage Treatment Plant and Management in Goa, India [20]. This paper gave an overview on sewage treatment plants in Goa - a costal state in India. A majority of Sewage Treatment Plants in Goa are managed by private authorities like hotels and resorts. Four municipal plants under Goa Public Works Department were evaluated. According to a study by The Energy Research Institute, only 13% of Goa's urban population was served with sewerage system as against the Indian average of 28%. Most of the population was still dependent on traditional septic tank and soak pit for waste water disposal, which increased the chances of ground water contamination or drinking water. To bridge the increasing water demand, there was a need to understand the importance of private Sewage Treatment Plants installed in hotels as well as residential complexes. Extended aeration, Moving Bed Bio Reactor, and Sequencing Batch Reactor are some of the technologies used for treatment of sewage water in Goa; out of the plants they studied in Goa, Extended Aeration and Sequencing Batch Reactor are the technologies used in maximum plants to treat sewage. Sewage Treatment Plants in Goa had potential for reuse of treated water for various purposes such as gardening, flushing, fire, construction, fire brigade, irrigation, etc., but none of the plants are following best practices.

M. Bhargavi and R. Ananta (2018) analysis and designed the Sewage Treatment Plant on Vizianagaram Municipality [4]. Vizianagaram is the major town of the district in north eastern, Andhra Pradesh. The Sewage Treatment was usually semi-solid waste or slurry called sewage sludge. The sludge has to undergo further treatment before being suitable for disposal or application to land. Sewage can be treated close to where the sewage is created, which may be called a decentralized system. The treatment process has a series of treating units which are categorized under primary treatment, secondary treatment and tertiary treatment. This project deals with design parameters of sewage treatment plant and designed has been done for predicted population of 30 years. Also, the plant was designed perfectly to meet the needs and demands of appropriate 3,00,000 population with a very large time period. The treated sewage water was further used for the irrigation, fire protection, and toilet flushing in public, commercial and industrial buildings and if it was sufficiently clean, it can be used for ground water recharge.

Shreya Gupta (2018) was conducted study on Sewage Treatment and Disposal in Delhi, India [6]. Delhi Jal Board is in charge of treatment and transfer of waste water through a proficient system of around 7,000 km of sewage lines crosswise over Delhi. Around 3,909 million liter per day of sewage is generated, however only 2,90.66 MLD is treated. A large gap between Sewage generated and treated was found i.e., 1,706.4 MLD. The Sewage Treatment Plants are based on ASP, BIO-FAR, EA, MBBR, OP, ISBR and Vermifiltartion Technologies. Vermifiltartion was found to be one of the creative, new and sustainable innovation, which involves primary, secondary and tertiary forms and treatment in it. Some of the case studies of sewage treatment plant are briefly outlined in Table II.

Table II: Tabular representation of reviews on Sewage treatment plant

Authors	Methodology	Outcomes
S. Sahil & P. Premchand (2021) [21]	Sewage water treatment techniques, factors affecting selection and design sewage systems were discussed briefly. After the process of primary treatment the sewage is taken to C-Tech basin & the entire process of Primary unit to SBR Basin is done by gravity.	They constructed wetland technology for water reuse in irrigation purpose was suitable because of its good efficiency and it was beneficial to green belt areas. The cost of project was 464 Cr. The area of city was 138sq.Km. and for this area 4 numbers of STP's were installed
J. Vinayakam, T. Marcus (2020) [5]	They treated almost 100% of the sewage water generated by the Navi Mumbai Municipal Corporation (NMCC) area before it is released in the creek. The NMMC area had seven STP's in which they treated around 454 MLD using the sequencing batch reactor technology. To study STP's spillover effects, they had collected data from various department of the NMMC office.	Around 80% of the total drinking water supply ends up as wastewater. Based on the analysis, they found that the maximum flow rate of raw sewage reached 93.6 MLD during the monsoon period. Their study revealed positive effects such as improvements in public health, hygiene condition and air quantity.

S. Rahul, A. Pritesh (2017) [22]	They collected water from 25km surrounding with gravity flow and pumping was not used for sewage upliftment to send it to the plant also checked sustainability of development by using treated water without any harmful cause, proper management of waste water.	The treated water used for recharging ground water or cultivation for crop and planting trees. This practice used to reduce power consumption. The STP produced biogas, which helped in meeting about its 75%-80% energy requirement for operation and maintenance.
S. Swati (2016) [23]	Designed STP for 10,000 population including every building and also design the proper management and step wise chamber for long time and large population.	Project consist the design of complete STP and the components starting from receiving chamber, skimming tank, secondary clarifier, activated sludge tank and drying bed for sewage.

IV. CASE STUDY OF ORGANIC WASTE MANAGEMENT

Ashna Mehra and Akshey Bhargava (2020) highlighted the importance and scenario about the enormous waste production in the Kanpur city. Additionally, the need of the sustainable and economic waste management system was introduced [24]. Their observations shown that the attempt has been made to workout sustainable municipal solid waste management for the city and effort has also been made to estimate the quantity of compost, bio fuel and energy that can be produced from the generated of solid waste during different years. The prediction of solid waste generated in Kanpur was 1 kg/capita/day for the year 2021 and the management strategy was formulated for the next 30 years to make sustainable on a time scale. The present paper highlights a case study of Kanpur wherein trends of population and solid waste generation from 1951 to 205 were estimated and that how much quantity of compost, bio fuels and energy that can be produced from waste generated in city on a time scale coupled with economic value likely to be generated from products.

B. L. Chavan and N. S. Zambare (2013) provided an effective solid waste management approach for the Solapur city. This city is administered as Municipal Corporation and it has in all 98 wards and are divided into 6 zones where, each zone consists of 16 to 17 wards [25]. The existing solid waste management in City was scheduled as zone wise. The combined effects of uncollected wastes, poor handling for municipal wastes have always implications for public health and environment. The total quantity of solid waste generated was 75,00 kg/day of which 50% was biodegradable, 25% recyclable, 15.3% wet and 9.9% debris and slit and also, the total waste generated in Solapur corporation area was 420 MT/day.

Vishruti Gupta (2012) proposed a mechanism behind the process of disposal, collection and segregation of the waste in Delhi and the study was also based on the A to H categorization of all the areas by MCD [26]. The survey was held in 27 colonies with the households, the dhalao workers, the waste collectors, the segregators and the primary data was also collected. The results showed unawareness and ignorance amongst the households in all categories and find the alternatives available practices by the households for the disposal of waste. Collected Waste was followed by transportation, storage and segregation and the most efficient system would be such that emphasizes on the segregation at source, but this not hold in reality. As per the data, the total number of households visited was 170 and the number of respondents was 72 and the waste was transported by hand driven carts or small vehicles in most of the areas as told by 54 households. The existence of MCD collection point, the result is found to be significant.

Er Alok Gupta, Dr. Anupam Jain (2020) described the Case Study on Various Waste Processing Composting Techniques Prevailing in India [8]. In this case study, they have study the different types of Composition techniques prevailing in India market, to get the best results depending on the waste generated per day by different sources. The waste was generated from different sources like Residential, Industrial, Commercial, Institutional, Construction sites, Municipal services, Processing or Manufacturing, Agriculture, etc. Solid Waste comprises of Wet waste and Dry waste. West waste was treated before its disposal which will help to reduce the size and weight of waste. Compost is a best solution till date which can be used to convert the organic decaying substances into a soil nutrient. This study will help waste generators and the society to select the appropriate method of composting depending on their needs. This will help the Country and the world to treat the organic waste into compost – reducing the waste and enhancing the soil fertility.

F. Sean (2016) conducted study on environmental support group's interventions on sustainable waste management in Bangalore [27]. Article revealed few successes that some Indian cities have with their Waste Management system and implementing new procedures, regulation, infrastructure related to sanitation, waste collection (door to door) and segregation. Decentralised waste management system has been effective in some of

the case studies. Some wards managed to achieve zero-waste & zero-landfill. Even some wards committees are effective and efficient in their educational efforts and the actual waste management, the cities benefitted greatly. The efforts towards creating truly sustainable wards and wards committees are being mirrored by Environmental support group.

Laura Michelle Goris and sMohan T. Harish (2017) in this paper, they approached the methodology, which are Community involvement system and Awareness in this, the study shown the Community and Private individual participated in the waste management system, it was an impacting factor reflected in the effectiveness of the structure [28]. Waste management needs to be understood as resource management, protection, and utilization. And the work is carried out which are - Waste receiving stations and source segregation, Waste collection, Waste storing and Organic waste management facility. In organic waste management, they approached the methods, which are Aerobic Thermophilic composting and Vermicomposting. Overall, as all waste produced in the community has an outlet for value and very little get wasted at the end as well as all these methods helps in uplifting the quality of life for the entire community. Some of the case studies of organic waste management are breifly outlined in Table IIIS.

Table III: Tabular representation of reviews on organic waste management

Author	Methodology	Outcomes
M.Ashish, M.Shweta (2014) [29]	The community bin collection carried out once in 24 hrs, requires manual and multiple handling of waste to dump into transportation vehicles & then to the disposal site.	As per the data the total SW generation is 24 tonne/day in Yamatmal city. So for dicompose they use following elements associated with MMCSW:Waste generation, Storage, Collection, Trasportation, Segregation & Processing and then Disposal.
K. Sudarshan, K. Somendra (2016) [30]	The work carried out regarding collection, transportation, handling, storage, disposal and treatment of solid waste generated in jaipur city. The data acquired related to SWM was collected throught site visits and interfacing with people.	They suggested that the inorganic portion of municipal household waste can be divided into recyclable & non recyclable materials and also landfill sites must be large enough to last for 20 to 25 years.
V.Gurav, R.Pathade. (2011) [31]	They used vermicompost phenomenon to compost the formation by earthworms(Eudrilus engeniae) which played an important role in the cycling of plant nutrients, turnover the organic matter and maintain the soil structure & decomposition for 30 days at 30 C.	The organic waste after partial decomposition works as an excellent raw material for vermicompost by using earthworm which produced good fertilizer value and which was used for plantation.
Harri Moora, Harshad Barde (2019) [32]	Closing loop initiative of the united nation economic and social communication for asia and the Pacific(ESCAP). Working on informal employment by using hybrid model,sorting and recycling of plastic waste.	The Pune municipal solid waste management model shows that informal waste workers are active and effective in recovering and valorising, it can also achieve plastic waste segregation and high recycling levels.

V. CONCLUSION

This review paper highlights the effective strategies for dealing with water consumption and environmental pollution. The review suggests Rainwater harvesting system, sewage treatment plant and Organic waste composting as a solution to the issues related to water scarcity, waste water, and solid waste management respectively. The paper discussed the necessity of Rainwater harvesting as it is one of the most significant and effective way of conserving and sustainable form of managing rain water. The case studies reviewed in this paper present different scenario for the need of sewage treatment plant to protect environment and public health from waste water. Furthermore, this review identified the Organic waste compost which can convert waste into useful soil nutrient.

This study contributes to Environmental Engineering by providing a thorough assessment of various case studies, design of Rainwater Harvesting system, Sewage Treatment Plant and suggesting the composting of Organic Waste. This review offers a most economical

approach and management of rainwater and waste. Based on the study of these literature and research that are carried out by various intellectuals, authors, in future work, are going to adopt these best practices and design the same for tour study area which is located in Dahanu (Palghar).

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Selection Of Construction Equipment Using Analytical Hierarchy Process (Ahp) And AnalyticalNetwork Process (Anp) – A Review

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***Abstract*—Project duration and budgets are two highly important factors in the construction industry that affect any project's success. Reinforced constructions, sustainable development, and development of life and housing enhancement. To continue to exist in today's aggressive marketplace calls for complete expertise in recent construction technology that could enhance safety, sturdiness, and the construction speed. The demanding situations in construction enterprise are useless and cause huge delays and flaws. This paper briefly overviews the application of Multi-Criteria- Decision-Making (MCDM) strategies for selection of correct construction machine and equipment. The methodologies of the decision-making processes for selection of equipment's and machinery are also highlighted. The application of Analytical Hierarchy Process (AHP) and Analytical Network Process (ANP) in the construction equipment selection processes are thoroughly described. In this review, the important key parameters for the selection of various equipment's are also discovered which influence the choice of system and preservation of system. This review offers a system productivity at a construction project and selection procedure of construction equipment's.**

Keywords— Strategy, Productivity, Infrastructure, Analytical Hierarchy Process (AHP) and Analytical Network Process (ANP), MCDM, etc.

INTRODUCTION

Equipment choice is one of the choices to be taken with inside the preliminary segment of layout multi-characteristic gadget choice is a completely essential pastime for a powerful production machine. The delight of customer necessities forces businesses to emerge as extra touchy and to make deep analyses in choosing gadget Furthermore, right gadget choice is a very essential pastime for production structures considering fallacious gadget choice can negatively influence the general overall performance and productiveness of a construction project. In addition to this, gadget choice has a chief impact on the businesses' international competitiveness and is likewise an essential selection-making factor for the layout of a bendy production machine . Using the right gadget can decorate the manufacturing technique, offer powerful usage of manpower, boom manufacturing, and enhance machine flexibility. The choice of outsized gadget can disturb the company's coin waft and additionally the problems including immoderate stock and idle gadget may be met.

On the contrary, the choice of below-sizing gadget cannot satisfy asked best ranges and capability necessities. Selecting gadget below confined operating situations is a complex task, because of many viable options and conflicting objectives. In addition to these, as a huge style of gadget is to be had today, every having a wonderful traits and value that distinguish from others, willpower of the right gadget for a designed production machine is a completely complex selection The choice system is observed to be unstructured, characterized via way of means of substantial area structured expertise and requiring the software of an powerful and green multi-standards selection making device The standards taken into consideration in an gadget choice may be categorized into groups: expenses and technical traits. In evaluating the gadget in step with the technical traits or expenses, the position of the gadget, a good way to be used with inside the production machine, is very essential. Ghada Elshafei et al. (2022) contributes a complete state-of-artwork evaluation for the contemporary past due synthetic intelligence-primarily based totally practices (2000–2021) the usage of strategies, technologies, models, and strategies which have been used withinside the inexperienced constructing for evaluation to be able to locate the great inexperienced constructing solutions, strategies [23]. They confirmed that a growing fashion of hobby in optimization is maintained on the grounds that corporations and producers apprehend the excessive functionality of the AHP method including its combinations (for example, Fuzzy and GA schemes) on the grounds that they're confronting greater excessive demanding situations than ever. More growing calls for environmentally and economically layout desires greater optimization strategiesto acquire all the demands.

This review offers the use of the Multi-Criteria Decision-Making (MCDM) process for choosing construction equipment. The use of the Analytical Hierarchy Process (AHP) for the selection of construction equipment is briefly explored in Section II. In section III, the use of the Analytical Network Process (ANP) in the procedure for choosing construction equipment is methodically reviewed. Some other methods like Promethee selection is also considered and discussed to identify the effectiveness of MCDM

approaches.

APPLICATION OF ANALYTICAL HIERARCHY PROCESS (AHP)

William Ho and his team (2010) discovered that several individuals and incorporated approaches have been proposed to remedy the dealer choice problem [21]. They are all able to manage more than one quantitative and qualitative factor. The maximum general person method is DEA, while the maximum famous incorporated method is AHP–GP and that charge or price isn't the maximum broadly followed criterion. Instead, the maximum famous criterion used for comparing the overall performance of providers is quality, accompanied through delivery, charge or price, and so on. This proves that the conventional unmarried criterion method primarily based totally on lowest price isn't supportive and strong sufficient in cutting- edge delivery management. The conventional price- primarily based total method can't assure that the chosen dealer is globally most desirable due to the fact the customer-orientated criteria (quality, delivery, flexibility, and so on) have been no longer considered.

Abdolreza Yazdani-Chamzini et al. (2012) studied the FUZZY and TOPSIS approach for the choice of TBM (Tunnel Boring Machine) [18]. In this paper, a selection version is advanced primarily based totally on fuzzy AHP and fuzzy TOPSIS. Fuzzy AHP primarily based totally on pairwise assessment is carried out to gain weights of the assessment standards, at the same time as fuzzy TOPSIS is used to prioritize the possible alternatives.In order to rank the potential options, TOPSIS is employed. Fuzzy TOPSIS computations are used to include the weights produced from fuzzy AHP into the TBM choice problem, and the ranking order is determined based on these weights. Last but not least, the ideal opportunity is chosen. In order to determine the effect of standard weights on the difficulty of selecting a TBM, sensitivity analysis is also carried out.

Anirudh Kumar Maurya and Manoj Kumar Sharma (2022) identified that during the Project control, the complicated identifying equipment’s conditions, capabilities, and techniques are useful for the decision making [19]. This examination has offered the AHP as a decision-making technique that lets in the attention of more than one criteria. Study of contractor requalification turned into created to illustrate AHP utility in task control.

Jin Si et al found that The AHP technique lets in a comparison of alternative technologies that might be retrofitted into existing homes to reduce carbon emissions and electricity use. The method enables consideration of the effects of several generation selection standards. To calculate the respective overall performance ratings for technologies, AHP has been employed. Annual electricity savings, funding fee, and payback term were the standards considered in the case study. Based on the weight values, it was determined that installing variable speed drives in air handling units and integrating fan coil units with building management systems are the best uses of various technologies..

Zakaria Soufi et al. (2021) suggested an approach for selecting material handling equipment in manufacturing processes. [1]. This paper addresses how to select the right material handling machinery for your operations. These paintings' main goal is to suggest a regular approach to the MHE Selection Issue as well as a list of standards that can be used to this challenge. MHE class and MHE version options are available for selection at assessment levels. There is currently no entirely unique listing of standards for any MHE choice dilemmas, as evidenced by the literature and discipline evaluation. It shows that some standards are lacking from the literature of today and that discipline methods disregard the advice of various pieces of literature. This artwork presents cautiously constructed units of standards and recognises that standard decision-making depends on every circumstance. According to them, the standards and associated classes are utilized in an AHP to useful resource the selection of MHE choice.

M. Yavuz (2015) found that the mining engineers often must pick out a most fulfilling alternative amongst options associated with the mining operation [3].In every mining operation, a mining engineer is free to make their own decisions, but they must follow the proper procedures to make the best choices.A quantity of strategies is to be had for fixing one-of-a-kind sorts of selection problems. In this study, the AHP and Yager’s methods, that are comparable MADM strategies, are used to clear up a system choiceproblem.

Shrikant Panigrahi et.al (2019) have used the Multi-Criteria Based Decision Framework for Malaysia's Sustainable Creation Equipment Procurement: Analytical Hierarchy Process. Sustainable procurement is a topic that is becoming more and more important to the global creation industry. [16]. Regarding this, decision standards in such procurement methods typically support considering price and engineering specifications as major parameters. The analytical hierarchy process (AHP) was used to raise the sustainable procurement index while maintaining a consistent sensitivity assessment of the outcomes.

Kumar Thakur And Arvind Keprate (2022) proposed Equipment for civil engineering projects is chosen using the Analytic Hierarchy Process (AHP). They claimed that the AHP method was an efficient, reliable, and valuable one for the selection process. In this study, a simple analytical strategy for prioritizing the device selection process at a production challenge site is proposed (for example Power Plant Construction Project). This approach also offers financial analysis.

Solomon Belay (2022) carried out the observe and explored the ability fulfillment-associated elements which can significantly influence the hit shipping of infrastructure creation tasks in growing countries [10]. According to the AHP review, the Owner is the key stakeholder who has a significant impact on the accomplishment of infrastructure activities. While the second, third, and fourth priorities inside the hierarchical structure are taken up by consulting companies, creation organizations, and construction related aspects. The fact that prior studies also stated that ownership is vital in determining the success of infrastructure projects must be emphasized.

PREPARE APPLICATION OF ANALYTICAL NETWORK PROCESS(ANP)

Jarosław Becker et al. (2017) offered withinside the article with the community shape takes into consideration special configurations of affects withinside the community among the additives and their constituents [20]. The Analytical Network Process (ANP) is proposed for construction decision making purpose. The realistic

verification of the version has showed that it may be carried out in pc selection assist structures and utilized by the customers as a ready-made proposal (pattern).

Latif Onur (2019) developed an The preferred method for the construction projects is the Analytical Network Process (ANP) model. [7]. The Analytical Hierarchy Process (AHP) is no longer needed because the ANP method considers interactions among the components involved in the decision-making process and does not use it. This eliminates the necessity to organise the problem using a top-down hierarchy. ANP articulates issues as a community by describing the connections and contributing factors among the contributing variables.. The goal of this has a look at is to choose a price supervisor to paintings in a production project. The selection-makers' judgement will have a bearing on the outcomes of this model, which compares both quantitative and qualitative features. The ANP method and the Super Decisions programme have significantly lessened the streamlined nature of a complex issue that looks to be difficult to resolve. A quicker solution was found in the end.

Shih-Tong Lu et al. (2007) proposed a scientific version of Analytic Network Process (ANP) to evaluate the elements of city bridge challenge [11]. It was observed that such approach might be beneficial for contractor for preparation of bid and contract of city bridge. The Analytic Network Process (ANP) works well to determine the impact of danger elements while coping with the qualitative features in subjective evaluation.

INTEGRATED APPROACH OF MULTI-CRITERIA-DECISION-MAKING (MCDM)

Mark Velasquez and Patrick T. Hester (2013) assessed the extra not unusual place techniques of MCDM if you want to gain practitioners to select a technique for fixing a selected problem [5]. Identification of not unusual place MCDM techniques and identity of strengths and weaknesses is a chief step in organizing the muse of studies on this area, however it's far most effective the primary step. These studies should result in a survey of customers to evaluate which blessings and downsides are extra usual for every method. The enterprise should then start to investigate new techniques which make use of and contain blessings, even as accounting for or altogether putting off disadvantages.

Vahid Balali et al. (2014) studied numerous MCDM techniques including AHP, PROMETHEE, PROMETHEE I, PROMETHEE II and GAIA [6]. But withinside the case of many criteria, it could come to be very hard for selection makers to reap clean view of the hassle and to assess the results. The quantity of interplay with the consumer will increase dramatically with a growth withinside the wide variety of options and this growth prevents the consumer from persevering with the evaluation and main to a few inconsistencies. The PROMETHEE II is the favored approach for comparing answer options for an appropriate structural machine choice process. The approach is consistent, smooth to recognize and calls for little interplay with the selection makers.

Serdar Ulubeyli and Aynur Kazaz (2009) proposed the ELECTRE III method, that's one of the maximums not unusual place strategies amongst a couple of standard decision-making (MCDM) approaches, which have become taken into consideration in a choice hassle of concrete pumps [8].It enhances the learning environment by serving as an ELECTRE III application exercise that matches with the nature of system selection and as a potent method for the formalisation of knowledge held by employing commercial practitioners. In addition, the instance illustrated withinside the gift look at may be beneficial for decision-makers managing comparable system choice issues.After that, the information for the three quantitative standards included in this analysis has to be gathered from a number of alternatives, and the information for the final qualitative standards needs to be obtained through a thorough market analysis.

Abbas Aghajan et al. (2011) investigated deciding on an open pit device The open-pit design and manufacturing planning are significantly impacted by inconvenience, a strategic challenge.[26]. The majority of existing open pit device selections rely on goal enter data, with no room for subjectivity or awareness of a single parameter, and as a result, are poor device selections due to the MADM aspect of the device selection process. Uncertainty in practise frequently leads to mining equipment selection problems. Also, because it's difficult or impossible to determine the actual values of the qualities, it's more appropriate to think of them as linguistic phrases, fuzzy integers, or C programming language terms. In this study, the VIKOR, a recently added MADM approach, is extended to all types of information environments (crisp, fuzzy, linguistic and c-programme language period numbers) is proposed to address each qualitative and quantitative standards and choose an appropriate loading–haulage device in open pit mine effectively.

Ali Lashgari et al (2012) observed that it's almost essential to choose the best equipment for loading and hauling given the particular characteristics of mining operations and high equipment costs. [18]. It can be difficult and confusing to choose the most suitable device because there are many factors to consider that might not always be in alignment. This article's goal was to transmit knowledge on the advanced multistandard selection that led to the choosing of loading equipment in open-pit mines. Fuzzy- units are advantageous for dealing with innate uncertainties because this burden is reduced by uncertain and ambiguous data. In this study, the selection of loading devices in open- pit mines is done using a hybrid strategy that combines fuzzy AHP, ANP, and fuzzy TOPSIS..

A. Balamurugan and S. Senthamilkumar (2014) investigated the forms of machines used withinside the production enterprise which have a huge have an impact on withinside the production enterprise [31]. As the fee of the system performs a first-rate role, the development enterprise primarily based totally on the dimensions of the tasks. Small, medium or huge scale tasks make use of the forms of system primarily based totally on their need. From the look at it may be ascertained that excavators are exceptionally used huge scale tasks because of its fee effectiveness and trenching machines are deployed in medium and small scale tasks. However, they concluded that the optimism amongst production system vendors stays high.

E. Triantaphyllou et al. (1998) proposed a number of the demanding situations dealing with practitioners and theoreticians in a number of the methodological troubles in MCDM theory [24]. Although it's miles dubious that the "perfect" MCDM method will ever be found, it's

constantly a prudent concept for the person to be aware about the principle controversies within side the field. Although the look for locating the pleasant MCDM technique might also additionally by no means end, studies on this place of selection making remains crucial and valuable.

Temiz and G. Calis (2017) propose a Briefly describing the trends in the manufacturing and production industry, a wide range of production tools are created for extraordinary uses.[9]. However it can be difficult to choose a manufacturing device because there are so many options available on the market with unique features and costs. This is why it is common practise to tackle the development device choice problem using MCDM approaches, which take into account many standards and analytically rate the possibilities.

CONCLUSION

For the successful completion of every project, the effective management of resources and duration are the important aspects. The resources are mainly categorized as a human, material and equipment's which are required for the civil engineering projects. For the smooth operation of various civil engineering activities, the equipment's selection plays a vital role.

This review offers the various methods for selecting the appropriate construction machinery and equipment for a civil engineering project that use Multi-Criteria Decision-Making (MCDM). It was observed that, both the Analytical Hierarchy Process (AHP) and the Analytical Network Process (ANP) performs effectively in the selection process. Additionally, the obtained results from the published case studies shows very minimalistic difference in the output. In the AHP, every component in the hierarchical is thought of as independently of every other factor. The choice factors are thought of as distinct of the other, as well as the possibilities are thought of as independently of both the decision matrix and one another. However, there is dependency between the things as well as the options throughout most civil engineering situations. Since ANP does not really demand isolation between components, it may be utilized as a powerful technique. This review contributes the equipment selection process and construction management.

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Influences of Fly Ash and Chemicals on Swelling Soil

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***Abstract*: Expansive soil cause serious problem in the civil engineering practice due to swelling and shrinkage. Volumetric changes (swelling) of expansive soils in presence of water are undesirable for stability reasons. As a result, damage to foundation systems, structural elements and architectural features defeat the purpose for which the structures are erected. In this paper, the effect of fly ash and chemicals on free swell index of expansive soil was studied. The fly ash and chemicals such as Aluminum chloride ($AlCl_3$), Magnesium chloride ($MgCl_2$) and Ammonium chloride (NH_4Cl) were used in varying percentage to reduce the free swelling index of soil. Reduction in swelling index was observed by using fly-ash, chemicals and combination of both. Also, the results were compared among them to get a percentage concentration of above mentioned additives which gives lower value of swelling index.**

Keywords– Expansive Soil, Fly ash, Chemicals, Free Swelling Index

I. INTRODUCTION

The term expansive soil applies to soils that have tendency to swell when their moisture content is increased and shrink when their moisture content is decreased. The moisture may come from rain flooding, leakage water from or sewer lines or from reduction in surface evapotranspiration when an area is covered by a building or pavement. To achieve the economy and for proper performance of structure it is necessary to improve the geotechnical properties of expansive soil.

Expansive soils occurring above water under go volumetric changes with changes in moisture content. Increases in water content causes the swelling of the soils and loss of strength and decrease in moisture content brings about soil shrinkage. Swelling and shrinkage of expansive soil cause differential settlements resulting in severe damage to the foundations, buildings, roads, retaining structures, canal lining, etc. The construction of foundation for structures on black cotton soils poses a challenge to civil engineers. Owing to moistures variations, this clay exhibit considerable variation of shear strength and compressibility and swelling, which causes differential movement, results in severe damages to foundations, buildings, roads, retaining structures, canal lining and more. In such situations, the undesirable characteristics and performance of expansive soil can be altered and improved with chemical additives like lime, cement, fly ash, inorganic salts, chemical compounds etc. Cement and lime are most commonly used for the stabilization of expansive soils to ensure high strength. As high strength may not always be required, cheaper additives such as chlorides and gypsum have been used to stabilize soils. Utilization of fly ash is a better solution as per Govt. rules sand reduces waste material to save the environment. The Indian coal is of low grade having high ash content of the order of 30-

45% generating large quantity of fly ash at coal/lignite based thermal power stations in the country. The management of fly ash has thus been a matter of concern in view of requirement of large area of land for its disposal because ofits potential of causing pollution of air and water. A large number of technologies have been developed for gainful utilization and safe management of fly ash under the concerted efforts made by fly Ash Mission/Fly Ash Unit under Ministry of Science & Technology, Government of India since 1994. As a result, Fly ash earlier considered to be "hazardous industrial waste" material, has now acquired the status of useful and saleable commodity.

Expansive soil characteristics can be altered and soil performance can also be improved with chemical admixtures. The selection and success of the used additives depends on economy consideration, soil condition, level of modification required and availability of material and instrumentation required for particular techniques. If the soil is expansive in nature, the problems of construction increase as these soils have low shear strength, high compressibility, high swelling potential and so on. The phenomenon of swelling response is isotropic in nature, and hence, is a suitable additive technique that is effective in all direction is likely to be useful. In this paper a comprehensive experimental work undertaken to study the free swelling index of expansive soil treated with fly ash and chemicals (chloride salts). And the results of work were comparing for the development of knowledge base in this regard.

II. OBJECTIVES

The main aim of the study is to determine the performance improvement of swelling soil by adding different additives. The fly ash, MgCl2, NH4Cl and AlCl3 chemicals were used for addition. Following are the objective of study.

- To determine free swelling index of expansive soil by adding varying % of fly ash.
- To determine free swelling index of expansive soil by adding varying % of chemicals.
- To determine free swelling index of expansive soil by adding varying percentage of chemicals with varying percentage of fly ash

III. METHODOLOGY

Materials Used

Soil sample:

The soil sample used in the project work for the experimental purpose is excavated from a depth of 2.6m below the ground level from our college campus. The collected soil sample is expansive in nature and yellow in colour. Fig 1 shows a typical photograph of soil sample.

Fig. 1 Soil Sample

Fly ash:

Fly ash is finely divided residue resulting from the combustion of powdered coal, transported by the fuel gases and collected by electrostatic precipitator. The fly ash used in this study for reducing the free swelling index of soil has been collected from Ready Mix Concrete Plant, Amravati. Fig 2 shows a typical photograph of fly ash.

Fig. 2 Fly Ash

Chemicals:

Chloride compound chemicals chosen in the present study are Magnesium Chloride (MgCl2), Aluminum Chloride (AlCl3) and Ammonium Chloride (NH4Cl). These chemicals are easily soluble in water and uniform mixing can be easily achieved. These chemicals are added to the expansive soil samples in varying percentages of 0.5%, 1.0%, 1.5%, 2.0% of dry weight of soil.

Aluminium chloride: Aluminium chloride (AlCl3) is a salt of white colour and when contaminated with iron tri-chloride becomes yellow. This salt has low melting and boiling points. It is mainly produced and consumed in the production of Aluminium metal, but large amounts are also used in other areas of chemical industry. It is an inorganic compound that cracks at mild temperature and reversibly changing from a polymer to a monomer. Fig 3 shows a typical photograph of aluminium chloride.

Fig. 3 Aluminum Chloride

Ammonium chloride: Ammonium chloride (NH4Cl) is a white crystalline salt that is highly soluble in water. Solutions of ammonium chloride are mildly acidic. Nushadir salt is a name of ammonium chloride. The mineral is commonly formed on burning coal dumps from condensation of coal-derived gases. It is also found around some types of volcanic vents. Fig 4 shows a typical photograph of ammonium chloride.

Fig. 4 Ammonium Chloride

Magnesium chloride: Magnesium chloride salts are typical ionic haldies, they highly soluble in water. The hydrated magnesium chloride can be extracted from brine or sea water. Magnesium chloride is also extracted out of ancient sea beds. Fig 5 shows a typical photograph of magnesium chloride

Fig. 5 Magnesium Chloride

IV PERFORMANCE ANALYSIS

a) Effect of fly ash

To determine the effect of fly ash on swelling index of expansive soil the percentage of fly ash varies as 45% to 70% are shown in fig 6.

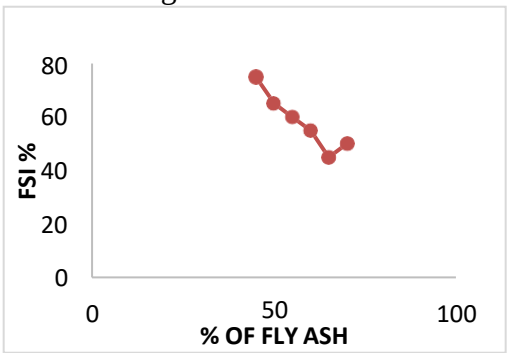

Fig.6 FSI of Original Soil + Fly Ash

From figure 6 it was observed that when varying percentage of fly-ash was added to the soil, the free swelling index decreases from 75% to 45% with increase in percentage of fly-ash from 45% to 65% respectively and further increase in fly-ash increases the free swelling index of the soil. Thus the optimum percentage of fly-ash observed was 65% on which the free swell index reduces to 45%.

b) Original soil + chemicals

To determine the effect of chemicals ($AlCl_3$, $MgCl_2$ and NH_4Cl) on swelling index of expansive soil the percentage of chemicals varies as 5% to 30% are shown in Fig.7.

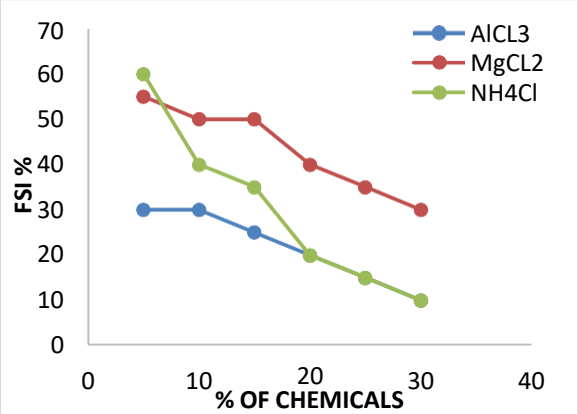

Fig.7 FSI of Original Soil + Chemicals

From figure7 it was observed that when percentage of magnesium chloride was varied from 5% to 30% with untreated soil, the free swelling index reduced from 55% to 30% whereas in case of aluminium chloride it reduces from 30% to 10% and on adding ammonium chloride it reduces from 60% to 10%. Thus comparing all three chemicals it can be concluded that aluminium chloride is more effective in reducing free swell index.

c) Original Soil + Fly Ash + Chemicals

i) Original Soil + 50% of Fly Ash + % of Chemicals

To determine the effect of chemicals ($AlCl_3$, $MgCl_2$ and NH_4Cl) on swelling index of expansive soil the percentage of chemicals varies as 0% to 2% at constant % of fly ash i.e 50% are shown in fig.8

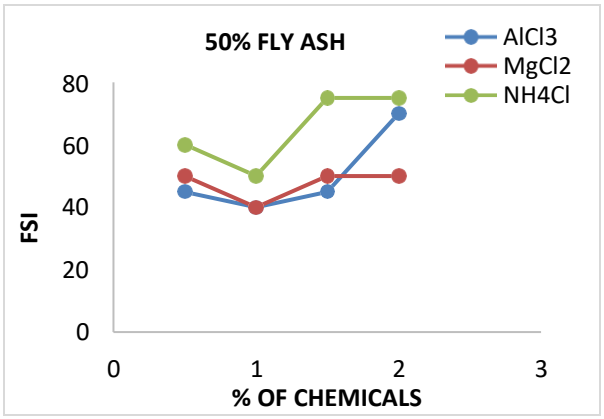

Fig.8 FSI of Original Soil + 50% of Fly Ash + Chemicals

From figure 8 it was observed that when varying percentage of chemicals was added to the combination of soil and 50% fly-ash, the optimum percentage of all chemicals was found to be 1%. On addition of 1% of ammonium chloride the FSI decreases to 50% whereas on addition of aluminium chloride and magnesium chloride it reduces to 40%. Thus aluminium chloride and magnesium chloride are more effective rather than ammonium chloride.

ii) Original soil + 55% fly ash + % of chemicals

To determine the effect of chemicals ($AlCl_3$, $MgCl_2$ and NH_4Cl) on swelling index of expansive soil the percentage of chemicals varies as 0% to 2% at constant % of fly ash i.e 50% are shown in fig.9.

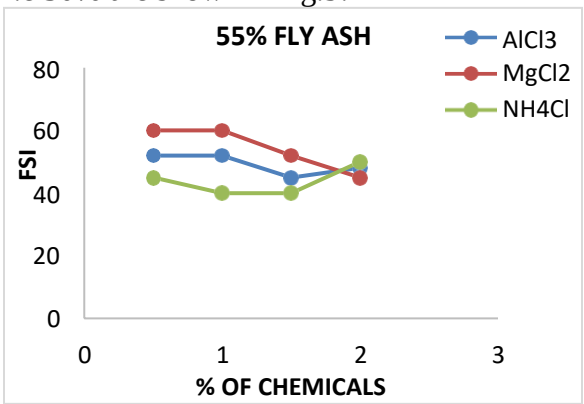

Fig.9 FSI of Original Soil + 55% of Fly Ash + Chemicals

From fig.9 it was observed that when varying percentage of chemicals were added from 0.5% to 2% with combination of 55% fly-ash and soil, the optimum percentage of aluminium chloride was observed as 1.5% on which FSI reduces to 45% and for ammonium chloride the optimum percentage was observed as 1% on which FSI reduces to 40%. Ammonium chloride was found to be more effective and economical as its optimum percentage is less than aluminium chloride.

iii) Original soil + 60% fly ash + % of chemicals

To determine the effect of chemicals ($AlCl_3$, $MgCl_2$ and NH_4Cl) on swelling index of expansive soil the percentage of chemicals varies as 0% to 2% at constant % of fly ash i.e 60% are shown in fig.10.

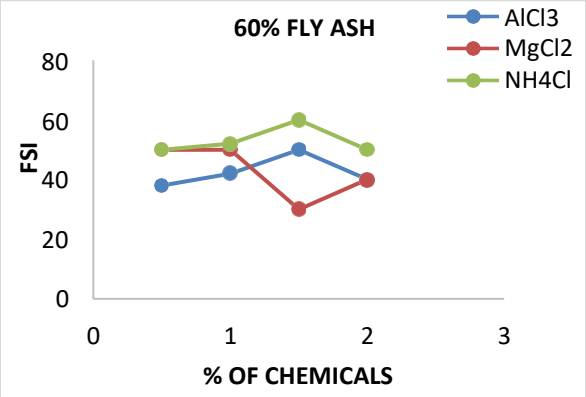

Fig.10 FSI of Original Soil + 60% of Fly Ash + Chemicals

From fig.10 it was observed that when chemicals were added from 0.5% to 2% with combination of 60% fly-ash and soil, best result were obtained from magnesium chloride. Its optimum percentage was found as 1.5% on which FSI decreases to 30%.

iv) Original soil + 65% fly ash + % of chemicals

To determine the effect of chemicals ($AlCl_3$, $MgCl_2$ and NH_4Cl) on swelling index of expansive soil the percentage of chemicals varies as 0% to 1.5 % at constant % of fly ash i.e 65% are shown in fig.11.

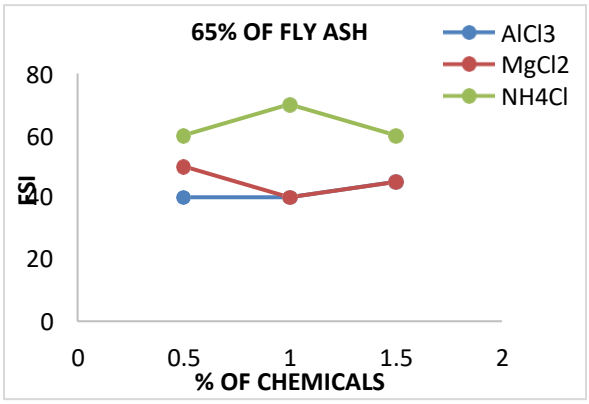

Fig.11 FSI of Original Soil + 65% of Fly Ash + Chemicals

From fig.11 it was observed that when varying percentage of chemicals were added to the combination of 65% fly-ash and soil, the optimum percentage of magnesium chloride was found to be 1% for which FSI decreases to 40%. Whereas for aluminium chloride same optimum results were obtained on 0.5% and 1%. But from economical point of view 0.5% is considered as the optimum percentage for aluminium chloride.

V CONCLUSIONS:

The study was conducted to investigate the effect of fly ash, chemicals (AlCl3, MgCl2, and NH4Cl) and combination of both on swelling properties of expansive soil from P.R.Pote (Patil) college campus Amravati. Based on the present laboratory study, the following conclusions are drawn:

- The engineering prosperities of soil tested showed that the soil is classified as high plastic clay of high expansiveness, PI is 46.31% and FSI is 90%
- On addition of fly ash with expansive soil swelling index decreases with increase in fly ash % from 45% to 65%. The optimum % of fly ash was calculated as 65%.

- A significant decrease in swelling characteristics of the expansive soil with addition of NH4Cl, MgCl2 and AlCl3 were observed. Maximum reduction of FSI of 88% was observed on addition of NH4Cl and AlCl3 individually. Whereas on addition of 30% of MgCl2 FSI decreases upto 66%.
- The combination of 1.5% MgCl2 with 60% of fly ash was found to be most effective treatment for reducing swelling of expansive soil.

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Development of MS Excel Software for Civil Engineering Problems

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Abstract— As one of the fundamental engineering disciplines, civil engineering is frequently burdened with tedious work when determining the quantity of various materials to be required to complete an activity, particularly in cases of estimating and costing work. Spreadsheets have grown in popularity as a tool for tackling engineering-related issues over time. Spreadsheets' intuitive cell-based layout and user-friendly features are among their strong points. Spreadsheets' user interface is interactive, making it simple for anybody to use for day-to-day tasks. They may also be used to easily do simple to sophisticated civil engineering calculations that might otherwise take several hours of hard effort. The use of Excel spreadsheets and VBA in teaching civil engineering topics and developing practical applications is highlighted in this study. The emphasis is on Quantity Estimation and structural design concepts. For approximate estimation, cost of painting, cost of flooring, bar bending schedule for slabs, concrete mix design, and structural beam design, several spreadsheets were created. Seven illustrative examples are provided to show how spreadsheets can be an effective teaching tool for civil engineering concepts.

Keywords: Civil Engineering, Spreadsheets, Quantity Estimation, Structural Design.

I. INTRODUCTION

Civil engineering branch is one of the oldest and core branches of engineering. This field have number of design and analysis problem in its domain area. These problems are complex and time consuming, so need of software application on is must for arriving the solution for the given problem. There are some software packages available in the market with the aid of which one can find the solution for the various design problem, but the available software packages are costly and also no full access is provided during trial period. Also, most of the software packages don't provide perpetual license, which means after certain time duration one has to pay heavy amount to get back the access for the same. The security is also an issue if there rises problem in the operating system or some hardware related problem in desktop/laptop, most of this already completed files gets deleted as there is no provision for data backup in cloud.

Hence to overcome this problem we will develop software application to address some design an analysis problem in various domains of civil engineering.

II. OVERVIEW OF LITERATURE

Excel has been widely utilized in different branches of civil engineering because of its easy accessibility and the user's ability to solve complex systems without much prior knowledge of the software [1]. Huddleston [2] utilized Excel in branching pipe flow networking piping system analysis, several studies were conducted on the application of Excel in engineering hydraulics in that year. Hegazy and Ersahin [3] developed an information system for subcontractors and small to medium-sized contractors using Excel and VBA. Weiss and Gulliver [4] demonstrated how to analyse hydraulic design projects using Excel. Jewell [5] has demonstrated to undergraduate students the value of equation solver in the instruction of hydraulic design. Several spreadsheets were created by Thiriez [6] as teaching aids for pupils. One instance is animating a presentation using window switching and macros while using Excel's drawing features to show decision trees. Another illustration given by Thiriez [6] is the use of Excel in stochastic or deterministic dynamic programming, where Excel features make it easier to create specific models. Huddleston, Alarcon and Chen [7] examined how to analyse water distribution networks using Excel. Ickert and Huston [8] created a spreadsheet that can be used to assess various engineering solutions quickly and accurately, as well as to create graphs that show the solution to users. Kaarahan and Ayvaz [9] used spreadsheets for modelling groundwater that is time-dependent. Rivvas, Gomez-Acebo and Ramos [10] explored the use of spreadsheets in the teaching of hydraulic and thermal engineering for system analysis and process optimization. Grabow and mccornik [11] proposed an Excel algorithm for managing water quality and allocation. Bhattacharjya [12] shows how to determine the critical depth of an open channel using the Excel solver. Zaneldin and El-Ariss [13]employed spreadsheets in the disciplines of structural engineering and construction management. These programmes fit into the first group: Management of construction data, Time-cost tradeoff (TCT) analysis, Optimum markup estimation, Simulating and Scheduling of Construction Activities with Uncertain Durations, Scheduling of Linear and Repetitive Projects, Schedule and Cost Control, and Optimization of Construction Operations are some of the topics covered. Contributions to the latter category come from structural calculations of reactions, internal forces, stresses, strains, deflections, and slopes. Barati [14] calibrated Muskingum

parameters using Excel Solver. Sana [15] added brief VBA programmes to elaborate the improvements to the curricula for hydrology, water resources, and coastal engineering. In his study, common examples of how to use such a programme include: 1) Friction factor calculations, 2) open channel design, 3) sanitary sewer design, 4) cumulative infiltration calculation using the Green-Ampt formula, and 5) solution of wave dispersion relation. This upgrade would encourage students to fully exploit Excel's sophisticated features, which would later improve the respective engineering areas, similar to other improvements in the curriculum that have been mentioned. As of date many, spreadsheets have been widely used for solving complex engineering problems. Because of its simplicity MS Excel is widely used in the field for various estimation work, but on the contrary, there is very less use for teaching purpose. Hence, the aim of this study is to prepare MS Excel spreadsheets in the area of estimation and design, such that it can be incorporated for teaching purpose as well.

[III] Methodology.

The brief methodology flowchart for this study is presented in Fig.1

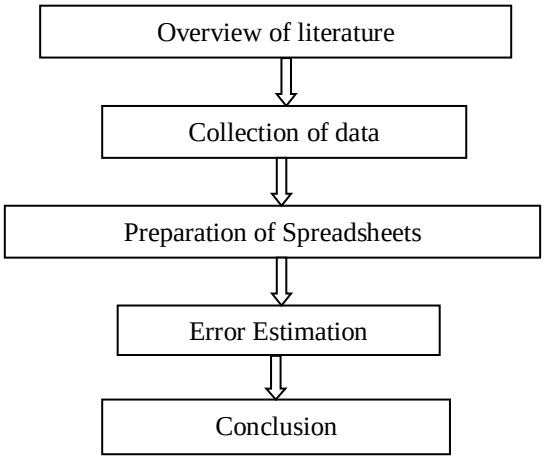

Fig 1: Proposed Methodology for the development of Spreadsheets

COLLECTION OF DATA

In this step, the data will be collected regarding preparation of spreadsheets such as types of paints available and their coverage area, labour cost for completing various activities, deduction rules for painting and plastering work etc.

PREPARATION OF SPREADSHEETS

After collecting the required data for individual Spreadsheets are prepared for Approximate Estimation, Wall Painting Work, Internal Plastering Work, Floor Tiling Work, Design of beam etc. All these spreadsheets are easy to use with minimum information required to get the final output.

[I] PREPARE APPROXIMATE ESTIMATION

This rough estimate is generated for early examinations of many parts of the work, as well as to determine the financial status and policy for administrative approval by the competent sanctioning body. This estimate is based on actual historical experience with performing comparable services as well as those costs. This estimate includes separate mentions of the approximate costs of all significant works, including the cost of the land, roads, buildings, water supply, sanitary improvements, and electrification. There are numerous methods of preparing approximate estimate but out of those Plinth Area method is most common and same methodology is adopted for making the spreadsheet in our case.

[ii] Paint Estimation

The paint estimation spreadsheet will enable users to find exact cost of painting that will be incurred for completion. The spreadsheet will enable users to select the paint type and to add the input variables i.e., length and width. The final output will be total cost/ sq.m and all other calculations will be automatically presented to the users.

[iii] Prepare plaster work Estimation

The Plaster estimation spreadsheet will enable to find exact cost of plastering that will be incurred for completion. The spreadsheet will enable users to add the input variables i.e., area, plaster thickness and cement-sand ratio. The final output will be the total cost /sq.m and all other calculations will be presented automatically to the users.

[iv] Flooring Work

The Flooring work spreadsheets helps us to get exact quantity of flooring materials i.e., tiles, marble, granite. This spreadsheet helps users to add the input variables i.e., area of flooring, size of tiles and to select the types of tiles. The final output gives us the quantity of tiles and materials.

[v] Beam Design

The Beam design sheet helps users to add the input variables i.e., length of the beam, width of the wall/ width of the column(support) and loads combination acting on beam. This sheet gives the final output as the depth, reinforcement details and section types.

[IV] Results and conclusion

1. Approximate Estimation Spreadsheets

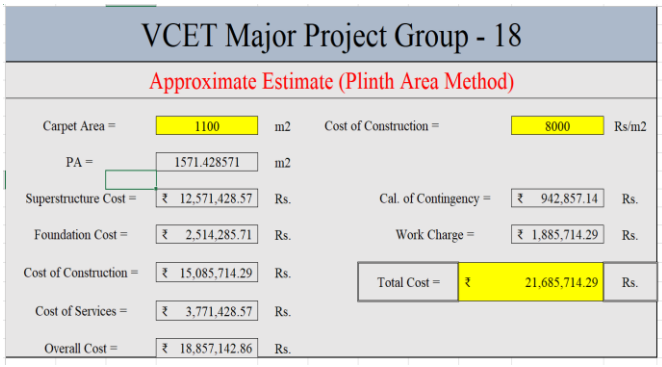

Fig. 2: Prepared Spreadsheet for Approximate Estimate

In this individual spreadsheet for approximate estimation, one have to give the input values for carpet area and for cost of construction because these values can differ from place to place, hence such cells are marked with yellow colour in the spreadsheet. The other cells such as Plinth area, cost of services is freezed and hence the users won't be able to edit it. We have taken some examples from our refence books, lecture notes and also from some individual books and found

the error in the observed values from spreadsheet in comparison to actual values which is presented below. It was observed that, during the calculation of approximate estimate very negligible error occurred. The errors between the actual (Performed by Quantity Estimation by Chakrobarthy) between observed (MS Excel spreadsheet) was 0.26.

2. Paint Quantity Estimate

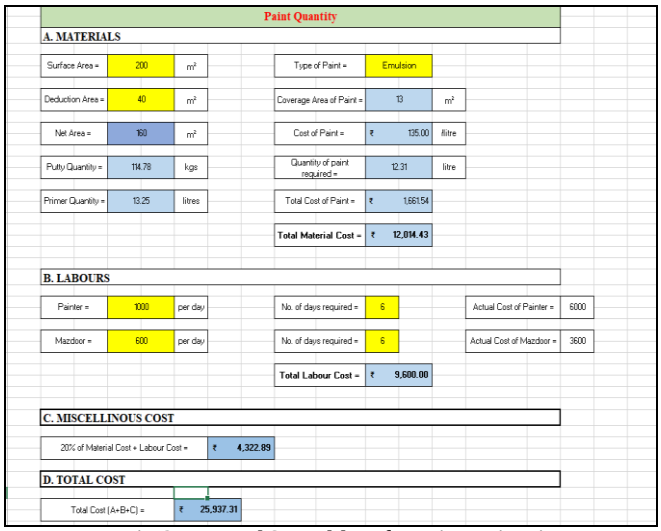

Fig. 3 Prepared Spreadsheet for Paint Estimation

In this individual spreadsheet for paint estimate one have to give the input values as surface area, deduction area, type of paint and the values of labour as their cost per day and for how many days we required, so we get the total cost for the paint in rupees. And other values marked in blue are fixed. For painting work, one have to give the type of paint because this is an dependent variable because it depends on person to person choice of paint. For these individual spreadsheets we have check the results and matches with the manual calculation as well as with the websites available for paint and we get to know that our spreadsheets get's an error less than 2% because there are some small-small changes in structural design. Also in this spreadsheets we have excluded the ceiling.

3. Plaster Quantity Estimate

Ratio of Mortar Used in Plaster		Sum of ratio	Plaster work in	Plaster thickness	Plaster dry	Cement in cu.m	Cement bags in	Sand in cu.m	Materials cost	Labour Cost	Total Material & Labour Cost	Total Cost of Construction
1	3	4	100	1.2	1.95	0.49	13.93	1.46	7704.87	298491.4	306196.25	₹ 79,611.02
1	3	4	300	1.5	7.3125	1.83	52.23	5.48	28893.25	895474.1	924367.39	₹ 240,335.52
1	3.5	4.5	400	2	13	2.89	82.54	10.11	47903.14	1193966	1241868.66	₹ 322,885.85
1	4	5	200	3	9.75	1.95	55.71	7.80	33849.77	596982.8	630832.53	₹ 164,016.46
1	5	6	60	1.25	1.21875	0.20	5.80	1.02	3841.67	179094.8	182936.50	₹ 47,563.49
1	1.25	2.25	500	0.5	4.0625	1.81	51.59	2.26	23626.34	1492457	1516083.24	₹ 394,181.64

Fig. 4: Prepared Spreadsheet for Plastering

For this individual spreadsheet on have to input the values marked in green and rest is output. In this spreadsheet the input is more because of its mortar ratio, so basically mortar ratio depends on individual contractor to contractor.

4. Flooring quantity estimate.

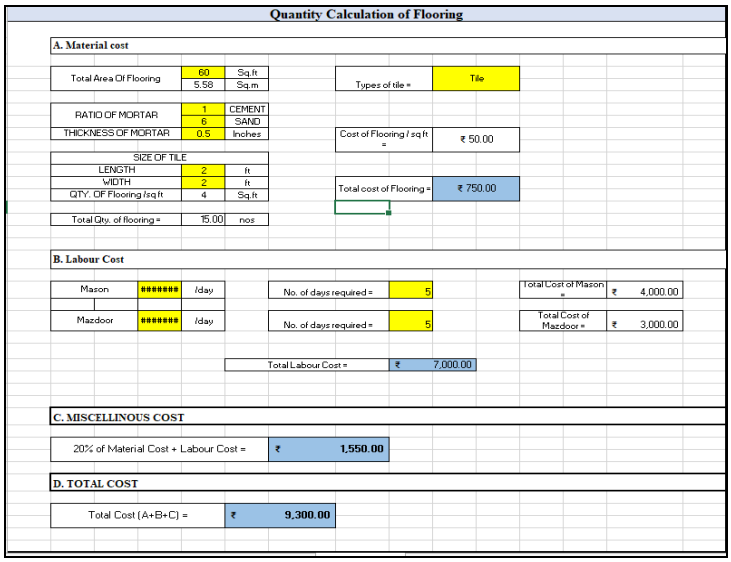

Fig. 4: Prepared Spreadsheet for Flooring Estimate

In this individual spreadsheet for Flooring estimate, one has to give the input values for total area of flooring in sq ft and type of flooring includes tile, marble and granite. Also have input the values of labour charges and their days required because they are dependent on the work. For these individual sheets we have come to an conclusion that its error is less than 2.5% of the manual and other reference materials. For these spreadsheets we have fixed some of the values such as miscellaneous cost and flooring cost per foot.

Conclusion:

Estimation and Valuation along with higher level of accuracy plays n important role for success of every project. The civil engineering projects are mainly categorized into residential building structures and infrastructure project. For both type of structures, quantity survey and estimation are the major criteria for the preparation of bid as well as assessment of budget. The work breaks down structures for both the projects includes several activities.

This paper provides estimation process using Microsoft excel software. The approximate estimate is prepared in the planning stage of construction, which is helpful to manage the fund and to prepare the budget. In this paper the ms excel spreadsheet is prepared to provide approximate estimate for building construction project. It was observed that the error criteria between actual calculation (manually performed) and MS excel spreadsheet is very less and acceptable.

This paper also offers to MS excel spreadsheet for finishing work such as painting, plastering, flooring and beam design. It was observed that there was no error between the observed and actual calculation. Additionally, the beam design MS excel spreadsheet was prepared.

Such MS excel spreadsheets is very helpful to reduce time and errors in the estimation process. This MS excel spreadsheet for the design of foundation, column, plinth beam and slab can be considered for the future scope of the project. Further more the brick work, earthwork, soil investigation and mix-design of concrete MS excel spreadsheets can be prepared.

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A Review on Sustainable Planning And Design Of Kelthan Village

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***Abstract*—The sustainable development of rural regions in India is significant important since it aids in the effective increase of agricultural production and productivity.; hence, a specific balance in economic and social development should be maintained. This research paper examines the Kelthan village of Vijeshwari in Wada Taluka, Thane District, Maharashtra, India., which addresses the concerns and challenges pointed forth by current amenities and provides the best economical alternative. A survey was undertaken to determine several issues that the community was experiencing in the following areas - facilities, infrastructure, and renewable energy. Based on our understanding and research of the issues plaguing the community, the following recommendations were made – installing solar street lamps to illuminate the village, building a new biogas plant as a sustainable energy source, and modifying the current school building. Hence a survey was conducted to identify all the problems faced by the people and the following set of solutions were been proposed School, Biogas, and Solar Street lamps. Based on the survey results, we made the following decisions: to modify the current school building; construct a new biogas plant as a sustainable energy source; and install street lighting to illuminate the village. Therefore, improving the current school will aid in both the socioeconomic development of the community and the academic growth of the children. A biogas plant can assist in meeting the daily need for cooking gas, and the finished product can either be sold to create income or utilized as fertilizer. By installing solar street lighting in the community is expected to, it'll increase people's security and the safety of driving. This study will help in our understanding of rural regions' bad situations the issues faced by rural economies and significantly improve our ability to assist them in becoming sustainable.**

Keywords—Biogas, LED street lamp, Proposal of redevelopment, Sustainability development.

I INTRODUCTION

Sustainable development has the potential to drive economic growth in small villages, while concurrently preserving the environment and conserving resources for future generations. This can be accomplished through the adoption of environmentally conscious practices, such as the use of renewable energy sources, the conservation of natural resources, and the promotion of eco-friendly industries. Moreover, it serves to enhance the quality of life for those living in these villages by providing access to essential amenities such as better infrastructure facilities, healthcare services, education, and employment opportunities. The project was carried out for a small village name Kelthan located in Palghar. The main aim of the project is to help in the sustainable development of the village. And by doing so we can help the people by providing the necessary animates, and infrastructure which is needed to satisfy both the present-day population and future generations. As a result, the community in that village will be able to sustain itself and avoid having to relocate due to a lack of basic resources and inadequate infrastructure in the rural areas ***[1]***.

This document presents a review of Sustainable development and planning of Small rural villages. The reviews are divided into four sections as follows. The First section, deals with the Sustainable Development and Planning Phase. The application of the Biogas plant is briefly described in the Second section. The Third section is based on the Is Codal provision used when designing a school. The Fourth Section gives a brief application of solar street lamps [2].

Table-1 Sustainable development

Author	***Title***	***Summary***	***Finding***
Anushka Umesh Sawarkar [3]	A CASE STUDY ON SELF-SUSTAINABLE VILLAGES OF IND	The primary goal of this case study is to comprehend the key factors that contributed to the growth of the villages. Due to water shortages, these villages' agricultural output was low, which had a negative impact on their economy. However, they were able to sustainably increase the economic power for the entire community today by applying the five concepts mentioned in the study	By putting into practice a few of these fundamental ideas such as the prohibition of grazing, family planning, the prohibition of tree cutting, and shramdan after village can become self-sufficient. The benefits of watershed management have spread to increase agricultural productivity, improve health and education, empower women, and maintain a clean environment

Amitabh Patnaik, Pallavi Kudal, Sunny Dawar and Prince Dawar [4]	Sustainable Rural Development through Renewable Energy Technologies: Identification of Potential Methods to Increase Rural Incomes	The main objective of this study is to comprehend how consuming clean energy might lower post-harvest losses of perishable agricultural items in rural areas. This study sheds some light on the pattern of energy consumption in rural India, the use of energy in agriculture, and the expansion of rural renewable energy sources	Food availability, safety, and quality will all improve with lower post-harvest losses. By using equipment that can run on renewable energy, post-harvest losses and greenhouse gas emissions can be decreased. Farmers in rural areas can make money by storing and processing their agricultural products using renewable energy technologies if authorities create an effective plan for promoting renewable energy technology. This arrangement can be advantageous for both the government and the farmers.
Manish Dwivedi [5]	Sustainable Development Practices in Rural India: A Case Study of Jayapur village of Varanasi, India.	The study's goal is to analyze the sustainable development and CSR efforts made by the corporations in creating and developing Jayapur as a model town. The study focuses on the equal involvement of corporate, public-sector banks, government, and the local community in the growth story of the ordinary village, which has completely changed in a short period of time and acquired its own identity, and has proven to be a model village for other villages in India.	Corporate houses willingly expressing interest in advancing the village as part of their CSR. Through energy conservation, the installation of environmentally friendly solar street lighting, and provision of solar lights for homes, the town serves as an ideal example of sustainable development.

II NECESSITY AND IMPLEMENTATION OF BIO GAS PLANT

India's term for the biogas is "Gobar gas." Wet gas, swamp gas, and marsh are some of its alternate names. Methane compensates about 55 to 65% of both the biogas, and carbon dioxide compensates about 30 to 40%. A very minor amount of nitrogen, hydrogen, sulphide, and ammonia are also present in biogas besides these. The calorific value of biogas ranges from 5000 to 5500 kcal/kg. It can be usedas fuel for internal combustion engines as well as for lighting, cooking, and drying. Biogas is challenging to store and liquefy. Anaerobic digestion of organic material can be used to produce biogas through fermentation. Digesters are the structures in which digestion occurs. Animal waste, crop by-products, urban garbage, etc. are examples of materials frequently utilised as feedstock. They also employ other materials including tree branches and leaves, tobacco waste, cotton dust, tea waste, sugarcane waste,rice husk, cotton dust, and waste from the processing of wastes like sugarcane. A potential source material for biogas generation is any easily biodegradable organic cellulose material from plants or animals [6].

Types of biogas plant used in India [7]

The biogas plant types used in developing countries are as follows:

1. Bag digester plant.
2. Fixed dome digester plant.
3. Floating drum digester plant.
4. Vacvina biogas plant.

1. BAG DIGESTER PLANT:

The term "balloon plant" also refers to a bag digester plant. The initial construction of this digester occurred in Taiwan in 1960. Typically, it consists of a digester bag made of plastic or rubber that is UV-resistant and is composed of RMP, rubber, and neoprene (red mud plastic). The organic waste and slurry are fed to the biodigester's input and outflow ducts through which they are degraded. Despite the fact that in some circumstances it may be feasible to collect the gas in another bag, the biogas created tends to collect near the top of the bag. The lower area is where the leftovers are gathered.

2. FIXED DOME DIGESTER PLANT:

Bacteria in the digester transform the biomass into biogas and a liquid called slurry (digested waste). The predominant gases in the gas are CH4 and CO2, with traces of other gases. The slurry is moved to the offset tank after being collected in the gas holder, which has a dome shape. The feed loading rate, how it is used, and the amount of gas produced all affect how much slurry is produced. Slurry is pressed backwards and sideways while gas is being produced, and it is subsequently transferred to an offset tank. Slurry from the offset tank is pumped back into the digester as the gas is utilised. With a lifespan of roughly 20 years, the fixed dome digester is reasonably priced and thus economical. Because the majority of it is buried beneath the earth's surface, the fixed dome digester can safely withstand cold temperatures. Additionally, there is a difference in temperature between day and night inside the biodigester, which is better for methanogens producing biogas.

3. FLOATING DRUM DIGESTER PLANT:

The primary or reactor tank is encircled by a concrete wall. It is made up of two parts: I an inlet that feeds slurry into the tank, and (ii) a stainless-steel cylindrical dome that sits on the slurry and has an outlet pipe for collecting the gas that is produced. Decomposed matter expands, causing the slurry to overflow into the next compartment where it can be

used as natural fertiliser. As a result of the weightof the drum, the floating drum digester has the advantage that the gas pressure is always the same inside. Due to the high cost of stainless steel used in the floating chamber's construction, the floatingdrum digester has this drawback. To prevent rusting, it requires ongoing upkeep and scrutiny.

4. *VACVINA BIOGAS PLANT.*

The fixed dome and plastic container types of earlier biogas designs were upgraded by the VACVINA model. The digester has a rectangular design. It is built to accommodate a small animal farm and hasa volume capacity of over 5 m3. In a trench behind or below the animal shed, the VACVINA model is fed animal waste as food. The digester's biogas output, which is collected and kept in two or three plastic bags, is used to power the kitchen range (GTZ 2007).

Data Collection Methods [8]

- House hold survey by using Questionnaire.
- Interview method.
- Visit/ physical verification of the biogas plants.
- Information collected from Department of Agriculture.

For the calculation and designing of bio plant it is appropriate use Is code [9] method after data collection and select most effective and efficient type of bio

III REPLANNING OF SCHOOL BUILDING.

Only if policymakers recognize that retrofitting existing structures is essential for attaining sustainability in the built environment will the problem of sustainable construction in the 21st century be addressed. Despite the emphasis on the potential for energy savings in new construction projects, existing buildings account for the majority of global energy consumption and around 40% of it. Additionally, just 1% of new construction is added to the building stock annually, but 27% of all carbon emissions globally are produced by 99% of existing structures. The stock of already-existing buildings is the main focus of energy-efficient measures, however, the pace of retrofitting existing buildings is now just 1% to 3% yearly [10].

Douglas (2006) asserts that the term of adaptability is where the idea of retrofitting comes from. "Any alteration to a structure beyond ordinary maintenance to modify its capacity, function, or performance" is how he describes retrofitting. In other words, any alterations made to a structure to meet brand-new needs or specifications. Retrofitting includes renovations, adjustments, and enhancements to fulfill user demands, but in more recent years, it has developed a strong connection to sustainability through "sustainable retrofitting." This refers to capital expenditures whose price extends the life of the structure, lowers its energy usage, and improves its predictability [10].

Author	***Title***	***Summary***	***Finding***
João M. C. Estêvão , Antonio Morales-Esteban , Luis F. Sá , Mónica A. Ferreira , Bruno Tomás , Carlos Esteves , Vítor Barreto , Ana Carreira , Alfredo Braga , Maria-Victoria Requena-Garcia-Cruz , Emilio Romero-Sanchez , Jaime de-Miguel-Rodriguez , Maria-Luisa Segovia-Verjel , Beatriz Zapico Blanco and Carlos Sousa Oliveira [11]	Improving the Earthquake Resilience of Primary Schools in the Border Regions of Neighboring Countries	Increasing the population's capacity for earthquake resistance is the aim of these papers. According to the created criteria, several initiatives were undertaken to train instructors on seismic safety, receiving favorable comments from them in the process	The seismic retrofitting of two pilot schools allowed for the observation of the primary implementation flaws of the most popular options used for masonry structures. Additionally, it emphasized that all personnel involved in this sort of work should receive training, rather than only structural designers, and that this should be done through training programs.
H H Ali* and R Al-Hashlamun [10]	Building Envelope Thermal Upgrade for School Buildings in Jordan	The purpose of this study was to provide a comprehensive envelope retrofitting strategy for Jordan's typical government school models, with a particular emphasis on lowering yearly energy consumption for cooling and heating in classrooms in a practical way.	The study evaluated the energy saving potential and economic feasibility of various retrofit alternatives for the building envelope using a simple payback period analysis. The best combination of retrofits was found to save 59.2% annually for cooling and 36.4% for heating. It was recommended to use low U-value insulation in external walls and 100mm EPS insulation covered with concrete blocks for roof retrofitting, while avoiding PUR insulation due to its high cost and long payback period. Solar heat gain control systems are recommended for the south and west elevations.

Table- 2 Replanning of school building.

IV SOLAR STREET LAMPS.

The increasing demand for energy and limited traditional energy sources are challenges for countries. Policymakers prioritize energy efficiency and sustainability for projects. Solar street lighting reduces power consumption and CO2 emissions while maintaining road safety. Electric street lighting consumes 114 TW h annually, emitting 69 million tonnes of CO2. Solar energy can be converted into electrical energy through the photovoltaic effect and stored in batteries. The system has automatic control, including optical, time, and time-optical control methods, reducing energy waste [12]

The Indian government planned and began using LED luminaires in streetlights in December 2014. India will save 5,500 crores of rupees annually and reduce CO2 emissions if all current streetlights were replaced with LED lights. This is advantageous from a variety of perspectives, including economic, environmental, illumination performance, a decrease in traffic accidents, theft, and crime. According to statistics, every year in India, 77 crores incandescent, V fluorescent, and 40 crore CFL bulbs are purchased for home illumination. These bulbs have a lifespan of one to four years at most and need power consumption of 60 to 100 Watts and 30 to 40 Watts, respectively. Using effective, long-lasting LED lights that last 10 to 15 years would therefore be a sensible choice. [13]

Table-3 Solar Street Lamps

Author	***Title***	***Summary***	***Finding***
Power Saving Solar Street lights. [12]	Badri Narayan Mohapatra, Aishwarya Dash	This project is based on the idea of maintaining maximum utilization and minimum loss of available energy. The plenty of solar energy available during the daytime is stored in a solar cell and the stored energy is used to glow the street lights during the whole night. Also, the system provides a power-saving mode of operation by adapting the method of automation. A dark sensor and a light sensor provide the automatic "ON"/"OFF" facility to the street lights so that it will glow automatically when it is required	By Proposing Street light model can be considered as a best proposal from energy saving point of view. It is not only a way to save energy but also an idea to make a proper utilization of available solar energy which is radiating every day without being used. Though the Initial Investment is very high, still it can be considered as to be economic if we will think about a long term period, because we are using here the solar energy, which is available free of cost
Badri Narayan Mohapatra, Aishwarya Das [14]	SOLAR STREET LIGHT	The demand for energy has increased in the world now. So, to fulfill the demands of energy more and more fossil fuels are used, as a result, fossil fuels will extinguish in the future if they are used at such a rate. To replace the loss of fossil fuels we can use renewable energy as they are freely available and adequate. Today, LED (light emitting diode) lamps have replaced the HID (high-intensity discharge) lamps that were used in urban streetlights.	This paper of SOLAR STREET LIGHTING SYSTEM is cost efficient, practical and Eco-friendly and very safe way to save energy. It very efficiently tackles with two main problems of today: saving of energy and disposal of incandescent.

CONCLUSION

By providing gobar gas/ bio gas plants which helps in sustainability growth of village. It will produce approximate 60% of methane by suitable bio bas plant describe by [7] .

Despite the focus on the potential for energy savings in new construction projects, existing buildings account for the majority of global energy consumption—roughly 40% of it. Although existing buildings are the major target of energy-efficient measures, they are currently only being retrofitted at a rate of 1% to 3% annually. Douglas (2006) claims that the concept of retrofitting originates from the phrase adaptability. He defines retrofitting as "Any modification to a structure beyond routine maintenance to modify its capacity, function, or performance."

Solar street lighting reduces power consumption and CO2 emissions while maintaining road safety. Electric street lighting consumes 114 TW h annually, emitting 69 million tons of CO2.

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Alignment and Design of Elevated Railway Track at Dahisar – A Review

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***Abstract*—** Due to the surge in population in "The City where Dreams become Reality", the transportation circumstances are chaotic for the travelers. It takes a while to reach the destination from one point to other by road. Consequently, all commuters have no other choice than the "Mumbai Locals," the city's means of survival. It is the quickest and cheapest mode of commuting, especially during rush hours, but it appears to result in heavily overcrowded circumstances. Whenever commuters board a heavily congested local train, it may cause an accident. Nine people die on the Mumbai local train tracks every day, according to an India Spend analysis of data from the Government Railway Police, Maharashtra. An average of 31% of victims remain "untraced", which means they are unidentified. The Mumbai Urban Transport Project (MUTP) has identified several sub-projects to strengthen the suburban rail transport and road transport in Greater Mumbai and Mumbai Metropolitan Region (MMR) as a whole. The Mumbai Urban Transport Project places considerable emphasis on improving public transport including the railway capacity. This study pertains to the assessment/audit of the 5th and 6th line construction between Borivali and Dahisar stations on the Western Railway. This paper presents a review of the analysis and design of various types of tracks and stations for public transport.

***Keywords*—**Transport,Track,Bridge.

I. INTRODUCTION

When we think of the development of Mumbai, a lot of times the suburbs are given the least significance even though a majority of the population lives in them. If we look from Borivali – Virar, there are only 4 railway lines. It creates a bottleneck situation where the queuing of trains can be observed. There has been an irregularity in the train timings which lead to the formation of a huge crowd on railway platforms. In 2021-2022, about 36% of the total accidental injuries/deaths were caused due to falling off running trains. Thus, there has been an immediate need for a new network line to ease the railway traffic occurring in one of the most densely populated localities of the "City of Dreams".

In recent decades, India has undergone rapid economic growth, resulting in the increased movement of people and goods around the country. To meet this demand, Dedicated Freight Corridors (DFC) is being constructed to haul freight from Delhi to Mumbai and Kolkata. As for passenger transport, in December 2009, Ministry of Railways (MoR), Government of India, formulated the "Indian Railway Vision 2020". This vision aims to modernize existing conventional lines and enhance capacity as well as develop high speed railway lines.

The Mumbai Urban Transport Project (MUTP) has identified several sub-projects to strengthen the suburban rail transport and road transport in Greater Mumbai and Mumbai Metropolitan Region (MMR) as a whole. The Mumbai Urban Transport Project places considerable emphasis on improving public transport including the railway capacity

This review paper pertains to the assessment/audit for the 5th and 6th line construction between Borivali and Dahisar stations on Western Railway (CR).

II. CASE STUDY

Miss. Priya Sharma, Dr. Hemant Sood in his paper "Design Methodology for Feasible Railway Alignment" stated, the Track design is a very sophisticated process. With increasing urbanization, urban transportation systems are facing new challenges. Transportation planning within the region is complicated by modes of transportation, mixed traffic, and multiple countries of origin. The task of adopting specific route choices for transportation systems is complex and difficult. This is because decisions must be made based on a large number of spatial dimensions. To perform this analysis, engineers consider a number of alternatives and select viable paths based on factors such as soil conditions, land acquisition, topography, socioeconomic factors and cost-effectiveness. This research paper aims to design a railway layout for a specific possible route from Nimerhedi railway station in Madhya Pradesh to a power plant in Kagon (M.P) to link coal. In this study, a trial-and-error method is used to fix the slope and curve of the laying track [1]. P C Sehgal and Teki Surayya in their paper "Innovative Strategic Management: The Case of Mumbai Suburban Railway System" (2011) mentioned a case study of the $2.5 billion expansion and upgrade of the suburban rail network as part of the multimodal Mumbai Urban Transport Project (MUTP). Growth in Mumbai's suburban trains has not kept up with passenger demand, resulting in increased occupancy.

rates on existing suburban trains and making train travel conditions intolerable. This paper provides insight into the process of building social and political consensus, taking into account people's desire for conducive and comfortable interactions [2]. This work includes a computer-assisted description of geodetic activity and plot support for the construction of transport objects in railway engineering. Among the most common surveying methods, the main principles of principles of monumentation and adjustment

of the setting-out network are presented. Equipment requirements and their measurement accuracy. Two-stage staking of traffic objects and control measurements during the construction process. Measurement of deflection values in structural load tests. The required precision ratio between the deflection value and the probe precision. Modified periodic measurements for diagnosing spatial traffic objects. Computer-aided geodetic survey for the construction of a bridge across the Vakh river in Zilina. Software utilization support for railway geodetic surveying and drafting [3]. This paper unprecedentedly describes an life cycle analysis supported by a digital twin to evaluate a subway station. The Dadongmen metro station in Hefei is served as a case study. This new study assesses cost estimates and carbon footprints at each stage of the project lifecycle. The construction phase of the project is the most costly, accounting for 78% of the total cost. However, CO2 emissions from maintenance are 67% higher than from the production of building materials. Among them, concrete was mainly used in the construction of subway stations, but only accounted for 43.66% of CO2 emissions from building materials. The carbon emissions of steel bars and aluminum alloys are 29.73% and 17.64% respectively. In addition, new risks in metro stations can be identified. The digital twin was used to show vulnerabilities and potential solutions to emerging risks and assess suitability based on lifecycle costs and carbon footprint. This initiative is relatively new to the industry. New insights into Life Cycle Assessment or LCA (especially Life Cycle Carbon Footprint) integrated into digital twin applications enable sustainable development that improves the resilience of metro systems around the world [4].

III. USE OF SOFTWARE FOR MODELLING

Based on the block feeler vector definition and some effective algorithms, a new intelligent computer-aided design method was developed for the line chart type. The contribution of this work is to define feeler vectors for CAD blocks so that the relationship between adjacent blocks can be recognized in a rough plan and the design can be calculated from this relationship. Based on the provided structure and stylus, a rough plan is created interactively in the CAD system. Rough plans can be transformed into blueprints using mathematical models for intelligent recognition and coordinate calculation. The combined application of sketch inputs and structural models developed in this work will enable railway stations to be designed in an automated and optimized manner [5]. Alcínia Z. Sampaio, Miguel M. Ferreira, Daniel P. Rosário, Octávio P. Martins mentioned in their paper that virtual reality (VR) technology can be used to complement three-dimensional (3D) modeling and lead to better communication, whether in professional education, training, or professional practice.

They applied 3D modeling and VR technology to develop a model related to the construction process. 3D models created to support rehabilitation planning have proven to be an important tool for monitoring structural abnormalities and supporting decisions based on visual analysis of alternative solutions. Created to support the management of lighting systems in buildings, VR models enable the visual and interactive transmission of information related to the physical behavior of elements defined as a function of time variables. In addition, a didactic interactive model was developed to demonstrate the construction work. These applications allow you to visually simulate the physical progress of any type of work, and also help you find out what equipment you need and how it works in the field. The introduction of CAD and VR technologies in schools helps prepare students to consider these technologies as important supports for later professional practice [6]. With the rapid development of urban roads, especially the construction of subways, it is an effective way to alleviate urban traffic congestion. Limited site space, complex resource allocation, tight schedules, and complex underground pipeline engineering challenges. BIM technology, 3D visualization, parameterization, virtual simulation and many other advantages can effectively solve these technical problems. Based on the Shenzhen Metro Line 9 project, BIM technology is innovatively explored throughout the life cycle of BIM technology in the context of a currently largely unused metro transportation project. Import the model information file into Navisworks for a 4D animation simulation to determine the optimal shield machine design scheme. An application platform for subway construction management based on BIM and private cloud technology, using cameras and sensors to achieve electronic integration, dynamic monitoring of underground facility operation and maintenance. Maximize the many advantages of BIM technology to improve the technical quality and construction efficiency of subway transportation projects, and complete operation and maintenance [7]. This paper analyzes the different models and implementation levels used in building information models suitable for metro projects. It also proposes workflows and process flows to be implemented in complex projects such as subways. In India, the implementation of BIM in transportation projects follows a traditional approach, with the construction sector being conservative in its implementation at the design stage. The study also mentions case study of Nagpur Metro success output of BIM at 5D level [8].

IV. FACTORS AFFECTING THE RAILWAY TRANSPORTATION SYSTEM

J Padaya, J Juremalani, I Prakash in their paper “Design of railway alignment: conventional and modern method” (2017) mentioned planning of new rail routes using traditional methods can be an expensive and time-consuming process. There are many issues that need to be addressed. The problem is knowing where registration is affected by site characteristics and land use such as geographic, topographical, soil and slope variations. This tedious process would take a lot of time and would cost a lot of money if all these were found by traditional methods. GIS is a hardware and software system used to collect, store, analyze, manage, and distribute spatial data. Traditional manual methods are cumbersome, time-consuming, cumbersome and costly. This document distinguishes between traditional and modern methods. The factors that concern us are mainly land use, slope, drainage and soil. GIS-based thematic maps and network analysis in ArcGIS provide optimal routes from a variety of alternative directions based on nearby service areas, number of stops, river crossings, populated locations, and more [9]. S Kadam in their paper “Apprehension Study of Passengers Travelling by Mumbai Suburban Trains” (2015) mentioned since their introduction, passenger numbers on Mumbai's suburban trains have increased exponentially, but capacity has not increased sufficiently from 9 to 12/15 rakes. The ultra-dense crash load of a train floor is approximately 14-16 standing passengers per square meter. Between 2002 and 2012, more than 30,000 people died on suburban trains in Mumbai from preventable causes such as overcrowded falls, trespassing and hitting power poles. All passengers face great difficulty and fear of traveling on suburban trains most of the time, especially during peak hours. This is primarily due to the chaotic and unplanned flow of passengers on platforms, boarding and alighting, and on trains. This will continue for the next few years in Mumbai as demand will

always outstrip local train supply. The results of this study are based on analysis of a sample of 122 respondents and sensitivities on boarding, disembarking, and trains. A 5-point Likert scale questionnaire is used to understand the anxiety of passengers travelling on Mumbai commuter trains [10]. The paper by Richard Lusby, Jesper Larsen, Matthias Ehrgott, David Ryan reviews an overview of the model and methods that has been suggested in their literature to assist planners in finding migration routes. Since the problem of routing trains in a railway network involves the non-conflict allocation of the network's (or parts of it) line capacity over time, all studies that model track allocation in some ways are deemed relevant. Therefore, they are reviewing train timetables and train operations, platforms and routing issues, group them by rail network type and discuss route assignments at the strategic, tactical, and operational levels [11]. The purpose of their current pre-feasibility study aimed to assess the pre-feasibility of the expansion, to provide transparency on the various aspects and prospects of their project, and to determine the next steps after completion of the pre-feasibility study including decision making process by BPG, its owners and relevant stakeholders. In structured, transparent and modular way, this study analyzed the intended broad-gauge expansion from different perspectives [12]. J.Sadeghi in their paper, "Investigation on Modelling of Railway Track System'' explores limitations and requirements for modeling rail track systems. Consideration is given to the minimum number of sleepers required, the minimum required depth and width of bedding layers, and the tensile stress of ballast. Their investigation is carried out using finite element models, taking into account different properties of the track components and applying different analysis methods. The results of the dynamic analysis of two different analytical models are compared with experimental results to assess the accuracy and reliability of the analytical method in predicting track behavior [13]. This research focuses on economic growth, dynamic land use and urban mobility. The focus is on testing hypotheses about whether HSR enables socioeconomic development. Real case studies with big data from major cities in China, i.e. Shanghai province and Minhang district are considered. Socio-technical information such as employment rates, real estate prices and domestic economic agglomerations will be collected for analysis by the China Bureau of Statistics and the China Academy of Railway Sciences. This study aims to reexamine the practical factors arising from the impact of high-speed rail on cities by analyzing urban dynamics and property prices using ANOVA analysis and dummy variable regression. The study also improves prediction results leading to urban planning strategies for business districts. Results show that various effects (regional accessibility, urban development planning, etc.) are necessary to enable the success of HSR infrastructure to enrich urban dynamics and land prices. The paper also highlights important perspectives related to sustainability that are important for social and economic impact. Furthermore, this study provides important perspectives for the sustainable development of his HSR project in the future [14].

V. CONCLUSION

- This review paper examined the urben transportation system in a number of case studies from variousnations.
- The AutoCad for Planning software tool for site selection and its potential is also discussed.
- Utilize all of BIM's advantages to improve the technical quality and efficiency of underground transportation project construction, as well as the expansion of operation and maintenance.
- Towns would grow around the 5 and 6 track, and people would need a speedy mass transit system to getthem to their places of employment.
- Urban mobility, dynamic land use, and economics are the main topics of this work.

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STUDY OF PLANNING & DESIGN OF A COMMERCIAL STRUCTURE

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Abstract— Planning and design of Commercial building structures is increasingly becoming one of the most challenging task in todays world. An engineer has to carefully take into consideration while designing a building structure such as basement, sheer wall, lift, escalators taking into consideration the aesthetics of the building proposed by an architect. Building frame in the three-dimensional structure as space which consist of rigidly interconnected beams, slab & columns. It produces greater number of the redundancy thus reduces the moment & facilitates the even distribution of the load. This project will enable us to acquire knowledge on how to work with multiple requirements from multiple people involved in the project and perform proper analysis & design a building according to the client's preferences. The process of designing commences with planning and designing of the structure which has been done by taking consideration of various Indian Standard Codes. Detailed Architectural drawing pertaining to the structural drawing. The planning & design of the structural members will be done by software's like AutoCAD & Etabs. Comparing various models of buildings structures, primarily to meet its functional requirements but also satisfying the outer looks. Initially, the requirements proposed by the client has to be taken into consideration. After this we need to carefully consider all the parameters of building the structure safely, responsibly while also satisfying the clients requirements. These requirements are in most cases vague, ambiguous and even unacceptable at first from an engineering perspective. The role of an engineer is in carefully negotiating and finding a way to turn these requirements into a solid plan with proper numbers and calculations backing it up. This study focus on various factors need to consider from asthetical, strength and durability point of view while for planning , analysis and design of commercial structures.

Keywords— Planning Analysis Design Software

I. INTRODUCTION

In recent time planning and designing a commercial structures is becoming a challenge , to adjust the design parameters according to architecture aspects to get an asthetic view to the structure and to fullfill the complex architectural design . Commercial structure means a structure designed or used for human habitation, or human occupancy for industrial, educational, assembly, professional or commercial purposes. This project deals with the study of planning, analysis and designing of a shopping mall. As an engineer we have to take into consideration all parameters required for getting a durable and an asthetic structure.With this project we aim to over come all the difficulties faced while planning and designing a complex structures.In this project the software we going to use AutoCAD for planning, and Etabs for modelling and analysing the structural design .

II. SITE DETAILS CONSIDERATIONS

A. Selection of A Plot

A commercial building's worth is influenced by its position, including whether it is in the middle of the area, on the boundaries, on the main road, or off the main road. A great commercial building should be placed in the centre of the neighbourhood and along the main road. The project's chosen land is in the city's centre, in the Mumbai Suburbs neighbourhood of Malad (East), next to the Western Express Highway. It is also just 500 metres from from a metro stop. As a result, choosing this plot can satisfy the needs of the majority of the city's residents.

B. Survey of Plot

For surveyors, measuring vast distances and greater areas has always been a difficult task because it takes more time, is difficult to do in bad weather, requires the use of inaccurate instruments, etc. Also most of the time the permission is been

denied for the survey of plot for case study or for a research project purpose. To precisely determine the area of a specific location, civil engineers need preliminary survey data on the distance between two points or area of a given spot rapidly. Chains, taps, levelling machines, and other manual surveying tools are time- and money-consuming to use. However, recent advancements in the Global Information System (GIS) have made this task simple to complete through remote sensing and the use of GPS-based applications.

Google Earth Pro is used for the plot survey and area of the plot, nearby building and road locations is located on the Google Earth Pro. After that this file is exported in Global planner and is exported in dwg file and by doing proper setting of Autocad, Site and Location plan is plotted on Autocad. a)The boundaries of the site and of any contiguous land belonging to the owner of the site; b)The position of the site in relation to neighboring streets; c) The names of the streets on which the building is proposed to be situated if any; d) All existing buildings contained in the site with their names (where the buildings are given names) and their numbers. [1]

Plot Area – 10229 sqm

Width of Road – 54.4 m

Fig 2.1 Snapshot from Google Earth Pro locating the plot

Fig 2.2 Snapshot of location plan from Autocad

III. PLANNING CONSIDERATIONS

A. Floor Space Index.

Mumbai's premium FSI rate is set by the municipal corporation. The municipal corporation uses several crucial factors to determine Mumbai's FSI, including the following:

- Size of the land
- Building type (residential flats, commercial buildings, etc.)
- Location of the building
- Amenities availability
- The FSI in Mumbai is computed in accordance with new regulations. [2]

Table 3.1 Permissible FSI according to DPCR

Sr No.	Minimum Road Width	Maximum Permissible FSI
1	12m	Upto 3
2	18m	Upto 4
3	27m	Upto 5

The ratio of built-up space on a plot to the plot's area is known as the "floor space index," and it is a requirement that many cities adopt in their development control standards.
The width of the road is 54.4m, therefore the maximum permissible FSI is 5. i.e. the permissible built up area will be 51145sqm. Therefore, to plan a commercial structure of 8 floors (including basements and ground floor).

B. Main Access

If there are any bends or curves in the approach road, enough room must be left at the curve to allow the fire appliances to turn, with the turning circle having a minimum radius of 9.0 metres. A building must abut on a street or streets, or upon sp aces directly connected from the street, by an approach road with a hard surface, not less than 9 metres wide.
When entering the plot through a slip road, the gate's width must be at least 6 metres to allow for the admission of the fir efighting apparatus.
The main entrances to the premises must be wide enough to allow easy access for the fire engine, and they must never be less than 6 metres. For the traffic management / holding bay, an additional 3.0 m of front open space must be supplied.
There must be a minimum of 6 m of open space on all sides from the plot's edges. As a result, the construction is positioned on the plot so that its exterior walls are more than 6 metres away from the plot's border walls. [3]

C. People Traffic

Table 3.2 Area Required per person [4]

Occupancy	Area per person (m2)
Overall allowance for public areas	2.3 to 2.8
Waiting areas (e.g. lift, lobby)	0.5 to 0.65
Circulating people in corridors	0.2

Considering the number of people inside the mall or shopping center or inside an individual store, at any given time to a density of not more than one person per two square meters. [3]

Vacant area in Basement B1 & B2 (Circulation area) - 3674 sqm

Ground floor Area by deducting the staircase room and washroom is 3614 sqm. Considering only 75 % area as circulating area – 2710 sqm multiplied by 5 i.e. no of floors. Total Area – 17224 sqm x 0.5 = 8612 people

D. Floor to floor height

Table 3.3 Floor to Floor heighht according to DPCR

OCCUPANCY	MINIMUM HEIGHT	MAXIMUM HEIGHT
Assembly halls, hotels departmental stores, malls, entrance halls and lobbies to departmental stores and assembly, Data Centre, Data ware house, Large/ Big Box Retailors	3.6 m	6.0 m

For basement the floor to floor height taken is 4m and the height for ground floor to last floor is taken as 5m for the project.

E. Basement

The height of the basement from the floor to the underside of the roof-slab or ceiling or under side of a beam when the basement has a beam shall not be less than 2.4 m. The height of basement below soffit of the slab shall not be more than 3.9 m. The height of the basement taken is 4m. By deducting the slab thickness the height of the basement comes under the limit. The ceiling of an upper basement shall be at least 0.6 m and not more than 1.2 m above the average surrounding ground level within the building line & may be flush with the average surrounding ground level beyond building line, Provided further that the height of basement above average surrounding ground level within building line may be reduced up to 0.15 m case of stilt and 0.30 m in case ground floor, when basement beyond building line is flush with average surrounding ground level, subject to provision of artificial light and ventilation. Adequate arrangements shall be made to ensure that surface drainage does not enter the basement. The walls and floors of the basement shall be water-tight and the effect of the surrounding soil and moisture, if any, should be taken into account in design and adequate damp-proofing treatment shall be given. [2]

F. Basement Parking

Permissible ECS [3]

Table 3.4 ECS according to Bye Laws

Sr No	Use Premises	Permissible Equivalent Car Spaces (ECS)
1	Residential	2.0
2	Commercial	3.0
3	Industrial	2.0
4	Public Building	1.8
5	Semi-Public Facilities	2.0
6	Mixed Land use	2.0

Parking Dimensions [2]

Table 3.5 Parking Dimensions

Type of Vehicle	Minimum size/Area of parking space
Motor vehicle	2.5 m x 5 m
Scooter, Motor-cycle	3 sq.m (Least dimension shall be minimum1.2 m)

Dimensions considered for the case study are, for four wheelers – 2.5m x 5m, for two wheelers – 1.2m x 2.5m. Both the dimensions are satisfying the condition.

The following guidelines must be followed when parking automobiles belonging to people with disabilities:

a) There must be two surface parking places close to the building's entrance for people who are physically unable, with a maximum travel distance of 30.0 m.

b) A parking space must be at least 3.6 metres wide.

c) There must be a clear sign indicating that the area is designated for people in wheelchairs.

d) It is required to offer guiding floor materials, a device that provides audio cues to visually impaired people, or other technologies that serve the same purpose. [3]

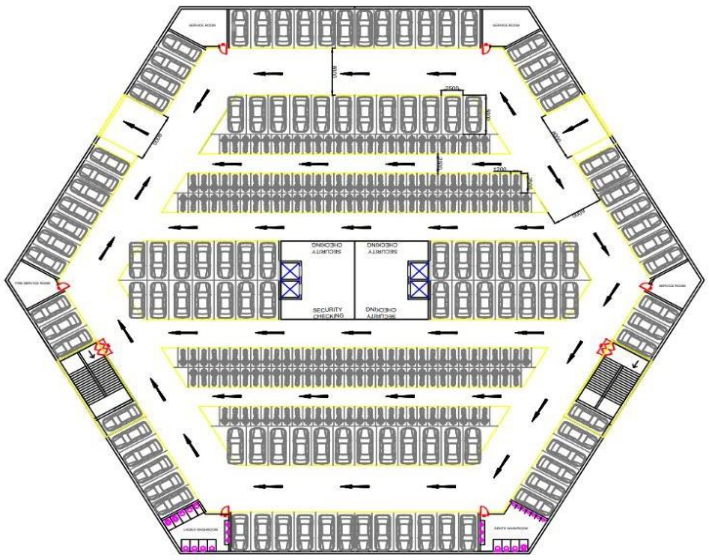


Fig 3.1 Shopping Mall Basement Parking

G. Stairways

Each landing of the staircase must have a vent that opens to the atmosphere, and the staircase's top must have a vent with an opening of 0.5 square metres. If used in a staircase, glazing or glass bricks must have a minimum 2-hour fire resistance rating. The following table lists the minimum stairway width requirements:

Table 3.6 Width of Stairs for type of buildings

Types of Building	Width
Residential buildings	1.0m
Residential hotel buildings	1.5m
Assembly buildings like auditorium, theatres and cinemas	2.0m
Educational buildings up to 30 m in height	1.5m
Institutional buildings like hospitals	2.0m
All other buildings	1.5m

For stairs in residential buildings, the tread width must be 0.25 metres. The tread requirement for other buildings is 0.3 metres. The treads must be made and kept in such a way as to prevent sliding. There can only be 15 risers per flight and a maximum riser height of 0.19 metres for residential buildings and 0.15 metres for other buildings. A minimum height of 0.9m from the centre of the tread is required for handrails. A staircase's landing and the space beneath it must have a minimum headroom of 2.2 metres. [3]

The dimensions considered for the project are Riser – 150mm, Tread – 300mm, Hand rail – 200mm, Height of hand rail – 1m, Width of the staircase – 2.27m (Basements), 2.185m (Ground to last floor), Double Swing Double Leaf Door – 2m.

H. Elevator

The walls of elevator enclosures must have a two-hour fire rating. A vent at the top of a lift shaft must be at least 0.2 square metres in size. The lift motor room must be situated, ideally on top of the shaft, with the room's floor acting as a barrier between it and the shaft. The landing door of a lift enclosure must have at least an hour's worth of fire resistance. One lift bank may not contain more than four elevators. Individual shafts in a bank must be separated by a wall with a two-hour fire rating. The lift car door must have a one-hour fire resistance rating. Collapsible gates are not allowed for lifts and solid doors in structures that are 15.0 m and taller. There cannot be no additional machinery put in the elevator machine room, which must be kept separate. The elevator's floor area must be at least 1.4 square metres. It must have automatic closing doors and a loading capacity of at least 545 kg (8 people lift). One or more of the elevators must be built with direct access to every residence or rentable floor space on each floor and be available for the fireman's exclusive usage in an emergency in order for firefighters to reach the top floors with the least amount of delay possible. [4]

Dimensions of Lift – According to IS 14665 – Part 1 (2000)

Table 3.7 Dimensions of Lift (IS 14665 – Part 1)

LOAD		CARSIDE		LIFT WELL		ENTRY
Persons	KG	A	B	C	D	E
4	272	1100	700	1900	1300	700
6	408	1100	1000	1900	1700	700
8	544	1300	1100	1900	1900	800
10	680	1300	1350	1900	2100	800
13	884	2000	1100	2500	1900	900
16	1088	2000	1300	2500	2100	1000
20	1360	2000	1500	2500	2400	1000

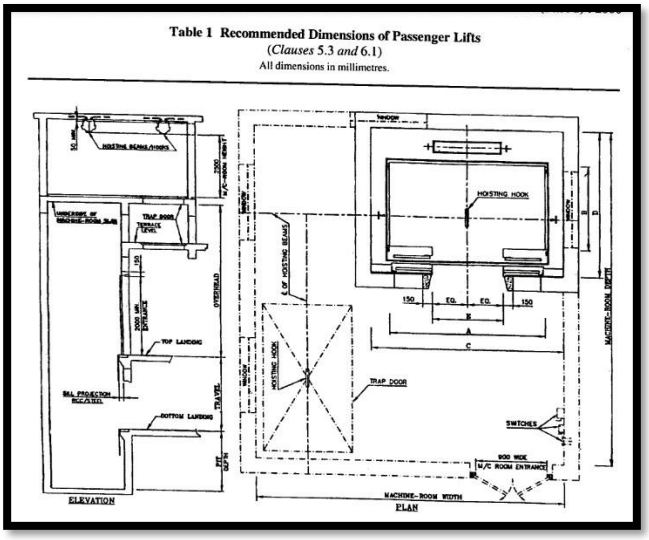


Fig 3.2 Sectional Drawing for Elevator

I. Escalators

Entrance-exit platforms include components for turning the stairs as well as a driving electric motor and gearbox. The drive and primary gearbox are located on the higher landing platform, and the drive chain tensioning device is located on the lower landing platform. The ends of the supporting structure are also located in these portions. Platforms are installed, along with flooring and combs. Floor plates make it simpler to reach the stairs. The floor plane contains this plate. Between the escalator and the stationary floor plate is a plate with a comb. It was given that name because the wedge-shaped edges resemble comb teeth. The comb's teeth fit into the stairwell grooves. This design makes it easy to escape or enter and avoids various objects from being trapped by shortening the distance between the stairs and the immovable floor plate. People stand on the step during transportation. The distance between any two steps cannot differ in height by more than 0.24 m. The height between steps shall not be greater than 0.21 m when the escalators are used as an alternate exit. The notional length of the stairs

cannot be less than 0.58 m or larger than 1.1 m, and the width of the steps must be at least 0.38 m. [5]

J. Ramps

The ramp to the parking levels and basement must be at least 7.2 metres wide for two-way traffic and 4 metres wide for one-way traffic, with a gradient of 1:10 for the model building. The slope of curved ramps or circular ramps shouldn't be greater than 1:12. Ramps must lead directly to ground-level outdoor open space, courtyards, or other safe places.

Table 3.8 Ramp Details [2]

Level Difference	Minimum gradient	Ramp Width	Comments
≥ 0.15 m < 0.30 m	1:12	1.2 m	----------
≥ 0.30 m < 0.75 m	1:12	1.5 m	Landing every 5 m of ramp run
≥ 0.75 m < 3.0m	1:15	1.8 m	Landing every 9 m of ramp run
≥ 3.0m	1:20	1.8 m	Landing every 9 m of ramp run

K. Atrium

The word "atrium" is frequently used to refer to offices, hospitals, libraries, hotels, courthouses, and other types of public and commercial structures. Glazed courtyard areas and multistory spaces are included in the atrium space category. Atria are frequently employed as important architectural elements in grand entrances, common areas, or as particular locations inside a building.

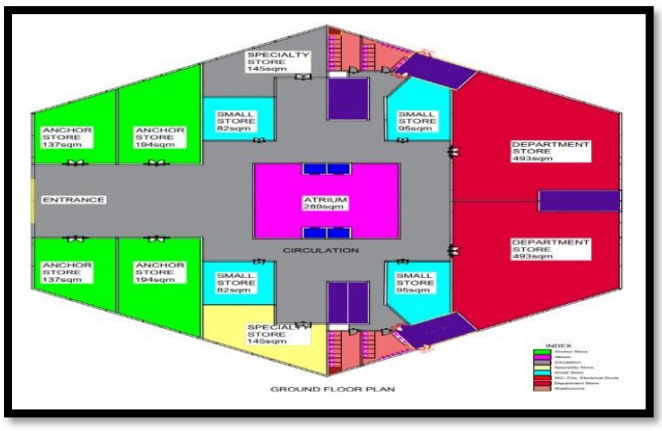


Fig 3.3 Ground Floor Plan

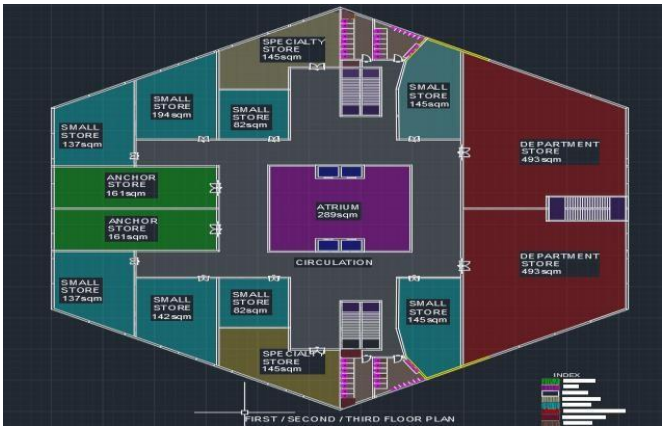


Fig 3.4 Remainig Floor Plans

IV. STRUCTURAL PLANNING

The structural planning of the building frame is completed after receiving an architectural plan of the buildings. The following must be determined in order to do this.

A. Position & Orientation of Columns

following are some construction concepts that can be used to guide column placement.

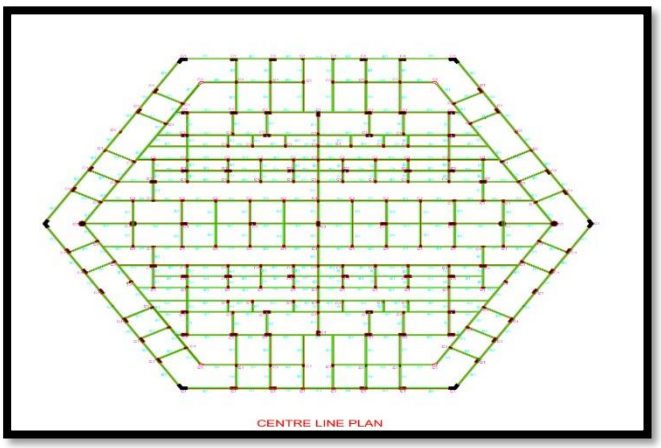
- Columns should ideally be placed at (or close to) a building's corners as well as at intersections of the walls and beams.
- Column placement should be chosen to minimise beam bending moments.
- Avoid using beams with a wider span.
- Avoid placing columns closer together.
- Especially ones that are on property lines.

The adjacent column or beam in either direction should be connected to every column in the structure. This tying of columns is necessary for lateral resistance. All buildings must be built to resist earthquakes in seismically active areas. By connecting the columns, the building's lateral resistance is increased.

B. Positioning of Beams

Beams should typically be placed below walls or below a heavy concentrated load to prevent the load from falling directly on slabs.

Fig 3.3 Orientation of Column & Positioning of Beams



V. CONCLUSION

This review concise and cover the topics like planning of architectural plan, modelling and site selection. There are various commercials structure with own unique design in India.In this review paper, the planning and design of commercial structure is briefly overviewd. Furthermore the floor plan for basement, ground floor and other floors are design using Autocad by considering the Development Regulation of Municiapal Corporation of Greater Mumbai, National Building Code, Model Building Bye – Laws and all other parameters. Additionally the parking plan is designed according to the population requirements. The parking plan is planned by having an overview of various papers and reference books related to design of commercial structure and Building planning. The architectural plan is also planned by having an overview of various papers and reference books related to shopping centres and other commercial structure occuping large amount of people and large amount of space.

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Comparison of Pavement Analysis Software for Indian Scenario

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***Abstract* — The nation's social, economic, and industrial development depends heavily on the road transportation system. Different vehicle classes use roads, which causes the pavement to fail due to early deterioration. Modern long-lasting pavements called perpetual pavements are made to survive for roughly 50 years without needing extensive renovation and only require periodic surface replacement. These kinds of pavements are excellent for building things like airports and significant motorways. The study and design of permanent pavements mainly follow the mechanistic empirical approach. When designing or analysing the performance of permanent pavements, various limiting values of strain for various pavement layers are taken into account. Fatigue cracking and rutting deformation are the main causes of bitumen pavement failure. This opened the door for the creation of software like IITPAVE and Kenpave, which calculate the values of stress and strain at crucial points in various pavement layers. This study focuses on comparing the results produced by using these softwares with the aid of data appropriate to the Indian context.**

Keywords — Road Transportation, Motorway, Perpetual Pavement, Fatigue, Rutting, IITPave, Kenpave

I. INTRODUCTION

The design of flexible pavement substantially depends on strength and CBR value of the subgrade soil. The pavement design depends on colourful factors like wheel cargo, subgrade soil parcels, climatic factors, stress distribution characteristics of pavement accoutrements and environmental factors. Pavements are constructed as per IRC guidelines. The main reason for failure of bitumen pavement is due to inordinate strain and distortion at critical locales in the pavement.

The layers of flexible pavement consists of Surface course, binder course, base course, subbase course, frost protection course, subgrade. Flexible pavements contain bitumen or asphalt subcaste as wearing course and supports loads through bearing. They've low flexural strength. Wheel load strains can be spread out over a broader area thanks to the flexural strength of rigid pavements. Unlike flexible pavement, rigid pavement is installed directly on the prepared sub-grade or on a single layer of granular or stabilised material. Since there is only one layer of material between the concrete and the sub-grade, this layer may also be referred to as the base or sub-base course. In rigid pavement, the slab action distributes force, and the pavement acts like an elastic plate resting on a viscous medium. Portland cement concrete is used to create rigid pavements (PCC).

MORTH (Ministry of Road Transport & Highways), IRC (Indian Road Congress), PWD (public workshop department) and other agencies. The original road networks were designed for lighter loads and lower business volumes than those which are present moment. As a result, the pavement structures are demanded to be enhanced performing in increased consumption of construction accoutrements and its backing. The general practice in India is to accommodate adding business to similarly increase the pavement consistence which results in uneconomical and environmentally unsustainable pavements. similar conservative designs ply a heavy fiscal burden on developing countries like India. The use of the perpetual pavement design conception and if possible, monitoring of these pavements to understand its superiority over conventional pavements is necessary for a sustainable pavement development in India. A Perpetual pavement is an asphaltic road designed to last for nearly 50 times without taking major structural recuperation or reconstruction. In India, not numerous sweats have been made in adaption of ultramodern perpetual pavements. Indian Road Congress, in one of its rearmost publications (IRC 37- 2012) is also championing use of mechanistic-empirical design for pavements and perpetual pavements and also suggested that the guidelines given in publication are conditional and detail field study is recommended for verification of guidelines which requires study of dynamic responses, it also indicates that the guidelines may bear a modification from time to time in the light of unborn developments and experience in the field. It's also suggested that all the associations intending to use the guidelines should keep a detailed record of the time of construction, subgrade CBR, soil characteristics including flexible modulus, pavement composition and specifications, business, pavement performance, overlay history, climatic conditions etc. and give feedback to the Indian Roads Congress for farther modification.

IITPAVE software is an advanced interpretation of FPAVE which is developed by exploration scheme R- 56 of MORTH. This multilayer analysis application is used to

build and analyse flexible or bituminous pavement in accordance with IRC 37-2012 standards. In this software we enter consistence of pavement layers, loads applied over the face of pavement, tire pressure, distance between the bus and Poisson's rate as inputs. After running the software factual vertical tensile strain and perpendicular compressive strains at critical locales of the pavement are attained as affair. IITPAVE is a multilayer elastic subcaste analysis programme developed in India. Any combination of business and pavement subcaste composition can be tried using IITPAVE. The developer will have full freedom in the choice of pavement accoutrements and subcaste consistence. The business volume, number of layers, the subcaste consistence of individual layers and the subcaste parcels are the stoner specified inputs in the Program, which gives strains at critical locales as labours. The acceptability of design is checked by the Program by comparing these strains with the permissible strains as prognosticated by the fatigue and rutting models in Indian standard law 37- 2012. A satisfactory pavement design is achieved through iterative process by varying subcaste density or, if necessary, by changing the pavement subcaste accoutrements.

For the design of both rigid and flexible pavements, Huang, Y.H. created the finite element analysis programme KENPAVE. It's relatively simple, easy to understand and operate. Also, it offers expansive features that can be used to dissect the pavement subordinated to different conditions grounded on stiffness matrix system. This software can be used to dissect both rigid as well as flexible pavements considering different lading conditions. Kenpave software was developed by Huang, 1993 (Huang, 2004). It's a Microsoft- Windows grounded interpretation that combines the old Kenlayer flexible pavement software and Kenslabs rigid pavement software. It accepts the use of direct elastic, nonlinear, and viscoelastic parcels of the accoutrements for the different layers. The programme does damage analysis and can handle up to 19 layers. The interface between the different layers can be specified as either unbonded or completely clicked. KENLAYER can be applied to subcaste systems under single, binary, binary tandem, or binary-tridem bus with each subcaste carrying else, direct elastic, nonlinear elastic, or viscoelastic. Damage analysis can be made by dividing each time into a outside of 12 ages, each with a different set of material parcels. Each period can have a outside of 12 cargo groups, either single or multiple. The damage caused by fatigue cracking and endless distortion in each period over all cargo groups is added up to estimate the design life (Huang, 2004). There are so numerous input parameters in this computer program. The input of the parameters is possible in both SI and US customary units. Respectable parameters for direct elastic analysis are business cargo, material parcels, consistence of each subcaste, number of ages, number of cargo groups etc. For a single and multiple cargo groups, a outside of nine and ten responses can be attained, independently. Only the perpendicular compressive strain on the face of subgrade and the tensile strains at the bottom of asphalt subcaste are used for damage analysis. As it's the case in other softwares, there's need to convert data in asked unit forms applicable in Kenlayer software. Also season wise material characteristics data isn't available.

II. IITPAVE – PAVEMENT DESIGN AND ANALYSIS SOFTWARE

Design of flexible pavement using experimental and software approach by Ayush Pandey, Kumar Vanshaj, Gaurav Singh, Saurabh Yadav, J.B. Srivastav, [1] This paper explains and describes the designing of the flexible pavements using pavement analysis software. Because the entire pavement structure bends or flexes when loaded, flexible pavements get their name. Typically, a flexible pavement construction is made up of numerous layers of components. Each subcaste receives loads from the below subcaste, spreads them out, and passes on these loads to the coming subcaste below. therefore, the stresses will be reduced, which are maximum at the top subcaste and minimum on the top of subgrade. In order to take maximum advantage of this property, layers are generally arranged in the order of descending loading bearing capacity with the loftiest loading bearing capacity material (and most precious) on the top and the smallest loading bearing capacity material (and least precious) on the bottom. IITPAVE software has been developed for the analysis of direct elastic concentrated pavement system. The stresses, strains and desertions caused at different locales in a pavement by a slightly distributed single loading applied over a indirect contact area at the face of pavement can be reckoned using this software. The effect of fresh loads (which should also be slightly distributed loads over indirect contact areas) was considered using superposition principle.

Analysis of Flexible Pavement using IITPAVE Software and Economic Analysis of the Project using HDM-4 Software, [2] This study aims at studying the road transport and its analysis. Road transport plays a vital part in social, profitable and artificial development of the country. Different vehicle classes use roads, which causes the pavement to deteriorate owing to early deterioration. The failure of bitumen pavement is due to fatigue cracking and rutting distortion. This paved a way for developing the software like IITPAVE which determines the stress and strains values at critical position at different subcaste of pavement. This design aims at collection of data related to business studies and subgrade soil CBR values from the field and designing the flexible pavement as per the guidelines of IRC 37- 2012. Later, it is analysed using the IITPAVE Software to see if it fits the requirements.

Harish G R's [3] presented study aim at expanding the compass of pavement design by including alternate accoutrements like cementitious and reclaimed asphalt accoutrements, and subjugating them to analysis using the software IITPAVE. In this study a road stretch is named around Bangalore and engineering parcels of subgrade soil has been studied. The different pavement composition accoutrements like Cementitious Base and Cementitious Sub-base of aggregate interlayer for crack relief. The breakdown of asphalt pavement is typically attributed to fatigue cracking and rutting deformation, which are brought on by excessive vertical tensile strain at the bituminous subcaste's base and perpendicular compressive strain on top of the subgrade. Use of different composition accoutrements in pavement structure decreases the needed design consistence for the same subgrade parcels and design business. and also improves the utility. Horizontal tensile strength which causes fatigue cracks in the bituminous subcaste is also dropped in other compositions compared to grainy base and grainy sub base composition. Also, there's considerable drop in perpendicular compressive strain which

causes rutting in different compositions structure compared to conventional grainy base and sub base structure.

III. Studying Kenpave Pavement Design and Analysis Software

Shubham Pandey, Anupam Rawat, A.K. Sachan, Saurabh Singh's [4] current study's objective is to identify the rigid pavement's crucial spots under a range of load and boundary circumstances. The middle four loads of the Class A train vehicle load from IRC 6:2016 were used in this study. The load positions and the type of foundations used in this investigation are varied. The three load circumstances are regarded as loads that have just been placed on the slab, those whose centres are in the middle of the pavement, and those whose leading ends are on the pavement. All of these different situations are included in the FEM-based software KENPAVE, and all of the analysis's results, graphs, deflected forms, and figures are reviewed before the crucial spot is identified. In this report, the roadways and pavements are introduced briefly. In order to have a better understanding of the important stress regions, the KENPAVE programme is also introduced. The paper discusses every one of the results and graphics that were produced. The findings in these cases indicate that the strains are greatest in Case No. 1 (when all four loads are suddenly applied to the pavement and liquid foundation). Accordingly, rather than employing a general technique for the entire pavement, this study's local structural health monitoring (SHM) technique can be employed at specific locations to assess the rigid pavement's health.

Naveen B C [5] in this study presents the results of an experimental and logical work related with the failure and mechanical behaviour of Recycled Aggregate (RA) under different loading scripts. The end of this exploration is to consolidate the being knowledge related to RACs by assaying the declination in physical and mechanical parcels when reclaimed coarse summations are used. A rigid pavement was modeled on KENPAVE using the characteristics value attained from experimental results. This was anatomized for different loading groups, thermal loads and loading combinations. The results from the analysis are explained in the following points. With respect to bane's rate a slight change in stress was observed for a given loading group. The corner stress was set up to increase with the consistence of the slab. This may be due to increase in the tone- weight of the slab. Comparing with different loading groups, loading group D creates further stresses compared to the other loading groups. The variation of temperature stress was set up to be lower for different bane's rate. It was set up that the temperature stress takes an optimum value with variation in consistence. The optimum value of the thermal stress was set up between a consistence of 20 to 25 cm. The thermal stresses were set up further than the wheel loading stress.

[6] This paper describes some features of the KENLAYER computer program. The proposition presented in paper was used in developing KENLAYER. This paper also presents the finite- element system for analysing concrete crossbeams on liquid, solid, or subcaste foundations and describes the KENSLABS computer program. The introductory element of KENLAYER is the elastic multilayer system under a indirect loaded area. For multiple bus involving two to six indirect loaded areas, the superposition principle can be applied, because the system is direct. Three styles can be used in KENLAYER to acclimate the vertical stresses for determining the modulus of grainy layers. In damage analysis, each time can be divided into several ages and each period can have a number of loading groups. KENSLABS can be applied to three different types of foundation liquid, solid, or subcaste. KENSLABS can be applied to a outside of 6 crossbeams, 7 joints, and 420 bumps. Results attained by KENSLABS compare favorably with those from logical results, influence maps, and the ILLI- SLAB model. When the loading is applied in the innards of a slab, good agreement also exists between KENSLABS and KENLAYER results.

Fatigue and Rutting Analysis of Asphaltic Pavement using "Kenlayer" Software [7] concludes that Rutting and Fatigue are taken as main unseasonable failures among all torments, as these torments have wide effect on performance of pavement. unforeseen variation of heavy axle loaded vehicles, indecorous blend design and traditional design methodologies used in pavement design diligence are major factors behind these failures. therefore, there's a need of using a Mechanistic grounded design methodology like KENPAVE software, so that traditional design crimes should be overcome. KENLAYER is a part of KENPAVE software. KENLYER software tool is employed to calculated directly stresses and strains in asphaltic pavement that are eventually used in calculating allowance for rutting and fatigue failure exercising Asphalt Institute design models or formulas. This exploration work was carried out to dissect the effect of altering the density of asphaltic wearing and base course consistence on pavement performance. Grounded upon results following conclusions are made 1. KENPAVE or KENLAYER software tool is used friendly and dependable software and it can be used in trace design diligence. 2. As the consistence of asphaltic wearing course and asphaltic base course were adding, the micro strains were dwindling and allowance for number of lading reiteration increased. 3. As the consistence of asphaltic wearing course and base course were dwindling, the micro strains were adding and allowance for number of loading reiteration dropped.

Prof. Baswakumar Biradar [8] in this study determines the adequacy of recycled aggregate for the construction of pastoral roads, which will in achieving the frugality for the road construction and also helps in guarding terrain declination in terms reducing the mining and pollution. For the construction of pastoral roads requires large volume of fresh summations, relief of fresh summations by recycled summations is considered in this study. Also, the rigid pavement analysis has been carried out in Finite Element Method (FEM) grounded KENPAVE software. Variation of middle, edge and corner stress is set up for the different slab consistence. For the analysis single axle with single wheel and binary wheel are considered. The rigid pavement slab is anatomized on KENPAVE slab by inputting the experimental values attained. Analysis was made for two different loading classes. The wheel loading stresses are dwindling with increase in slab consistence. For all cases of

lading, outside stress occurs at corner region than edge and centre regions.

This research by Shinta Gabriela, and Adelia Dwidarma Nataadmadja [9] was accepted on TNC Main Road to CBD design with the end to find an optimum design, by using Manual Perkerasan Jalan 2017 and Kenpave software. The being pavement was redesigned to achieve a design life of 40 times, rather of 20 times. The design was also compared with other indispensable designs that were attained from once exploration study. The analysis was done by comparing the outside stress values, maximum deviation values, and material cost per cadence. It can be concluded for this study that the pavement revision using sediment summations in concrete admixture as the face subcaste was the most optimum pavement design as it has the smallest outside stress and deviation values, and therefore smallest cracking indicator and longer designed life, with a reasonable construction material cost.

IV. Comparison of IITPave and Kenpave

Saurabh S. Kulkarni, Magadeo Randive in Software Based Analysis of Perpetual Pavement in Indian Scenario gives that [10] perpetual pavements are ultramodern long-lasting pavements designed for a life span of about 50 times, without demanding major recuperation and taking periodic face renewal only. These types of pavements are veritably useful for structures like fields and important roadways. For study and design of perpetual pavements, it is typically noted to use the mechanistic empirical technique. colorful limiting values of strain for different layers of pavement are considered while designing or analysing the performance of perpetual pavements. For this purpose, colorful software is available like MEPDG, PerRoad, KenPave, WESLEA, IITPAVE, etc. This study focuses on comparing the labors attained through the use of some of these software with the help of a data suitable to Indian script. The study further focuses on the process of selection of a particular design and analysis software according to the region and also highlights the problems associated in using similar software in environment with Indian Conditions.

Manoj Kumar Sahis, Partha Pratim Biswas [11] in this paper, two major modes of failure as rutting and fatigue have been considered for structural design of bituminous road pavement on strain- grounded criteria. So, different combinations of bituminous and grainy subcaste are possible against fatigue or rutting in a bituminous road pavement for a specified axle loading reiteration. But the findings from the present study reveals that only a typical single combination of bituminous and grainy subcaste consistence is possible to save the pavement section both against rutting and fatigue for a specified axle loading reiteration. It has been set up in this study that the variation of grainy subcaste consistence is more sensitive than the bituminous subcaste consistence on pavement performance in terms of rutting than cracking. The rate of increase in bituminous subcaste consistence was set up to be less with the changes in axle loading reiterations beyond 50 msa. still, the variation of grainy subcaste consistence with axle loading reiterations was set up nicely advanced for lower subgrade CBR than the subgrade with advanced CBR. But the variation of bituminous subcaste consistence was set up to increase significantly with increase in axle loading reiterations for subgrades with lower to advanced CBR. The deviation of the pavement section determined using present system were compared with results attained for analogous sections using KENPAVE and IITPAVE software have been set up good in agreement, which in other way establishes better trust ability of present system of pavement design.

[12] AASHTOW Software, PAVERS Software, CIRCLY Software, PAKPAVE Software, IITPAVE Software, KENPAVE Software, PaveXpress Software, Win PAS 12 Software, Street Pave, MXROAD Suite, and Infra Works Software are just a few examples of the free and paid software used in road design that are covered in this review. The issues with design and analysis of on-road will be resolved by using a software system in design, and road failure will also be eliminated.

Kiran S., Kavitha Madhu [13] in this paper refers to previously published research papers about analysis of pavements. Pavements are the vital part of any trace system. Due to harsh climatic conditions and unseasonable torments, pavements are falling piecemeal in original times of construction, indeed though they're designed for 15- 20 times. likewise, pavements constantly fail precociously due to poor quality control during construction, high axle loads, extreme rainfall conditions, and inadequate conservation backing. To decide whether to strengthen the pavement, it is vital to comprehend the pattern of pavement deterioration. unseasonable failures like rutting and fatigue in flexible pavement causes severe torments in the pavement. The contrivers borrow the new Mechanistic Empirical (M- E) pavement design procedure rather than the old empirical design approach for designing pavement structures effectively and efficiently. KENPAVE and IITPAVE software give the pavement responses in terms of stresses and strains and have significant influence on performance vaticination which is grounded on the M- E design approach. This paper reviews the being literatures on the response analysis of flexible pavement using KENPAVE and IITPAVE. The selection of accoutrements for the pavement and the performance of pavement can be estimated more directly with KENPAVE and IITPAVE.

V. Conclusion

Software for pavement design and analysis is employed in this work to compare the findings. Even though the software's mechanistic approaches vary slightly depending on where it came from, the horizontal strain values at the base of the surface layer and the vertical strain values at the top of the subgrade are remarkably similar, with only a small amount of variation that falls within acceptable bounds. This demonstrates how the mechanistic approach is becoming more widely understood. Since the practical application of the mechanistic design approach is new to India, problems can develop if the necessary data or even standard codes are missing. In light of the Indian context, KenPave and IITPAVE were simple to utilise when using the aforementioned tools. The necessary data inputs for KenPave are available, and more crucially, if the data isn't, there are a number of instructions for figuring out the input information. The local loading configuration data is the main source of availability problems; without it, the accuracy of outcomes

suffers. The study further emphasises the need for India to switch to a mechanistic empirical design approach because, when using KenPave for the analysis, the IRC method's predicted design period seemed about 15% shorter.

This study contributes to transportation engineering and highway engineering by Providing a thorough assessment of various literature studying about the road pavement designing and analysis software, promoting their application in India for designing and analysis of Road pavements.

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A Review on Enhancement of Public Transportation System

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***Abstract*—As we all know that the increase in the number of populations leads to an increase in the growth of vehicles. So, this rise in population directly impacts on Environment and the usage of several vehicles for the same reason of work. For this access use of Own vehicle leads to more Traffic Congestion in certain cities In India. As we all know that India is in Second Rank in Population the use of Own vehicles is more Compared to Public Transport, so my research is to Design Public Transport Systems like BUS, LRT, METRO, etc. As this growth in the number of vehicles makes an adverse effect on Traffic conditions which leads to severe problems. This research is based on the Design and Implementation of a Public Transportation System using the latest Software used in Transport Management Systems. Also, the implementation of an Intelligent Transportation System to improve the Safety and Efficiency of Transportation. This will reduce Pollution by using Such Public Transport and also reduces the travel time of passengers, by making proper Route Surveys for easy vehicle Availability from one Stop to Another, so that one may not face any problem while approaching the Destination. For such a problem Statement Bus Signal Priority (BSP) Operation is to be implemented which is mainly focused. VISSIM Software is used to simulate the Bus Travel Time, pedestrian travel Time, and waiting time at certain various transit stops for Network and analysis the travel time and Delay at various intersections in the network.**

Keywords*— *data collection, public transport, BSP, its, travel time and delay

I.INTRODUCTION

As stated in the Abstract above that the increasing number of populations in India, the world is facing this problem. India is the seventh-largest country by means of Geographic size, which shows the use of vehicles in the general mean of usage so we have to face problems like vehicle fuel emission pollution and also several serious health issues. In this research, there is a Review of the literature of several Researchers who have already done their research on my research topic. Basically, my research is on Planning Public Transport System to make a proper channel for the use of Passengers, so that the use of the Public Transport System should increase due to which the use of Private vehicles can be reduced which may lead to a reduction in population. Various Cities in India face problems like chronic traffic jam that leads to traffic congestion and consumes very much time and money due to Congestion vehicle fuel emissions approximately 30 % of this Congestion. Besides this, while preferring to own vehicles in place of using Public Transport to mitigate congestion in several intersections it is a most challenging region of the city which have to encounter a collection of demand for good vehicle flow in Urban Areas. From such use of public Transport Mode travel time and delay time can be reduced. To encourage people to change their own vehicles to public transport to reduce traffic congestion use of Bus Signal Priority is having an efficient mode of public Transport, by such mode of transport accelerates the interchange of Buses by Implementing Pre-Signal Timing alteration of design to improve or moderate waiting time at Bus Stop, travel time, Delay time, etc. which results to a reduction in expenditure in the amount of fuel.

II.REVIEW OF LITERATURE

A. Assessment of Bus Signal Priority using Vissim

This research is mainly concentrating on the encouragement of the use of Public Transport in place of Owning vehicles, so by using Public Transport the Reduction of traffic congestion problem can be reduced. By Implementing B.S.P which make ease in movement of traffic due to which the travel taken by the passengers get reduced. Application of temporary Signal Timing Alteration is used to design to reduce consumption of fuel, bus waiting time, travel time and delay time. B.S.P. was Bus Signal Priority (BSP) was recognized through the experiment and applies in the year 1962. [1]

Basically, Traffic Signal Control System is classified into four types-

Traffic Signal Control System –

1. Pre-Timed which is the easiest mode of Signal

Control Systems, in this System phase, are operated for fixed intervals of each traffic cycle time, Irrespective of the number of traveller passengers or pedestrians.

2. Actuated- in this stage length is to be accustomed to the reaction of traffic flow as recorded by the propulsion of vehicles or Pedestrians detector.

3. Traffic Responsive Signal Control, in this System has the ability to switch plans of timing to get implemented in the traffic network as per needed traffic variations. In this System, as its application is the best proper time of plan for the current traffic flow pattern timing plan for the existing traffic flow pattern, overall system performance rises by reducing delay and number of Stops.

4. Real Time Signal Control also stated as Adaptive Signal Control System in this system as is stated Adaptive Signal Control System uses adaptive measures so that offer a cycle time of green to every junction.

Research Outcome: make Accelerates good interchange of bus Services for 3 Junction in Kuala-Lumpur City. by using VISSIM travel time and delay timer get reduced by applying signal priority with VISSIM also Behaviour or action Based Simulation Model which under Fixed Time Signalization and another B.S.P i.e. BUS SIGNAL PRIORITY.

B. Kostikj A., et.al.

Basic Concepts: The research basically concentrated on traffic movement in Urban Regions. As the workload of the driver is increased, also due to which several conditions may affect such as weather, other side actions using a cell phones, etc. Methodology Used: Due to excess use of vehicles behaviour of traffic users making heavy effects in an urban regions. Due to more traffic in such urban region concentration of drivers get decreased also decreasing road capacity and traffic flow. As this is mainly a problem due to which the flow of traffic gets disturbed for free movement of traffic flow one must take adaptive measures to reduce such traffic congestion conditions.

Parameters: In this Research, parameters were studied as follows. The first one is The Intelligent Transportation System (ITS) next one is the Several Advanced Driver Assistance System (ADAS) which is planned to get minimize the load of a driver which will reduce traffic congestion and also improve safety measures in periods of more congested areas like a market. Also, Adaptive Cruise Control ACC) this System is implemented for vehicle safety and to get ease traffic flow It is the first system to lead towards boosted traffic flow and traffic safety. Mainly Adaptive Cruise Control System has adopted tor Low -peed vehicles i.e., Stop & Go System.

Findings: The part of the Methodology is to be used in my research i.e., the Replication of traffic flow which is adaptable for Arterial Roads, next part it requires more engineering value As the Developed Virtual Model of Harmonized Traffic to improve driver safety so that Harmonized traffic can be obtained.[2]

C. Traffic Congestion Impacts-

Basic Concepts: The Impacts of traffic Congestion on Bus, in this research paper Author describes traffic congestion and flow of traffic in Northern New Jersey where buses need additional travel time because of Congestion.

Methodology Used: Author try to make a regression model by which journey period or travel time period is a function of Bus also Car traffic time rate, number of passenger's hoarding at per mi (mile) Bus Stop at per mi (mile) is to be estimated.

Parameters: Following Examination was observed:

1. Comparison of Speed of Car and Bus was observed.
2. Bus delay & Bus-Travel-Time also observed.
3. Estimation of Bus-Travel-Time by using dwell times, the flow of traffic, actual acceleration and deaccelerating rates and distance between their stoppages.

Authors' Findings: Authors try to explain various studies to examine the Impacts on Vehicles traffic flow based on Empirical Evidence. Mainly in Peak hours the reduction of speed in such vehicles causes Impacts on vehicles like buses. Bus Speed in Peak Hours Stated Below. These studies estimated the m / h in Sub-Urban Areas, impact of automobile m / h in City Areas and m / h in Central Business District (C.B.D).

Our Findings: Evaluation of the amount of bus and car i.e., the flow of traffic at certain intersections at a given posint. So, as it forms the total vehicles travelled (motorized and non-motorized vehicles) in a peak hour (9:00am to 10:30 m).and the speed flow of the bus or car. [3]

D. Analysis of Traffic Congestion

In this Research, the author tries to resolve the difficulty of Traffic congestion in Nagpur City. Mainly author tries to focus on impacts on the Environment i.e., several impacts due to excess traffic flow in certain regions. In this research data collection was done in peak hours i.e., from 9 AM to 11 AM in the morning every day. No. of vehicles, the count was observed Manually. By using HVS Apparatus PM10 is to be estimated from a study it is observed that more value of PM10 is at Industrial Areas. As this paper give suggestion about Bus Bay Design the flow of vehicles in a particular intersection or the Bus Stop region the congestion may reduce by designing Bus Bay total area Required for Bus Bay is 20m+18m +15m. [4]

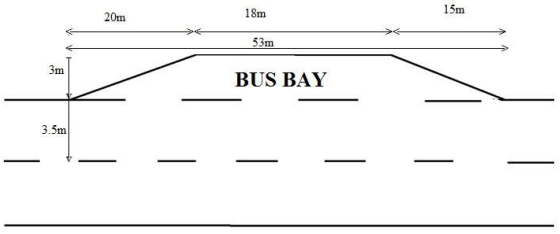

Fig-1: Bus Bay Stop Dimension

E. Design of Public Transportation System

In this Research paper estimation of population was done of City and further, the Research Survey is to be taken from the research. As the researcher stated the Design of the Public Transport System in detail which also explains how to make the fair collection and also to Design of Route map of selected Route also to design Bus Bay in this research paper author mainly focus in design parameters.

Outcomes: Authors explain Route map of Public Transport i.e., Bus intercity to get good transport Route which can be utilised as good Transit Route Network for selected Route

in Chandrapur District Maharashtra also Public Transport demand data collection is to be obtained.[5]

F. Mr. Singh et.al.

As per this research in which author try to elaborate about Management System in Bhopal City as per to Developing Authority of Bhopal i.e. Bhopal Development Authority and Bhopal Corporation combines setup with Bhopal City Link Limited as their Stales controller. Research on the Urban Public Transport System of Bhopal City. The Management System which is used to make the full operation of buses there were 39 buses came in Jan 2007 and it was started since 2007 March. As per the Average Schedule of the Vehicle consumption is 223 km though actually it reached nearly 198 km / Day. As there is decreasing in kilometres addition nearly for about 11% of vehicle flow which results very low travel efficiency of Operation System in general. Author Conclusion stated such as Designing and planning of good road network plan concept also using the Principles of Right Network Design and for small city the application of public transport get fails in small region. [6]

Assumption from Research the Principles of Right Network Design to make correct cost of Public transport.

G. B. Vamsi Krishna-

In this Research mainly focus on Improved Public Transport System which has Hardware approaches, which are mainly supported to sensors and micro-controllers utilizes. By this hardware approach which involves bundling jointly for different other parts of Single Hardware Framework. As this Hardware based framework also undergo with several problems cause by electrical-noise, wear & tear etc.

Author outcomes of this research as the Implementation of I.P.T.S. for making traffic congestion reduction using various hardware accessories like smart phones by using application. Every time application get refresh for the regular update for the bus position by such use of public transport traffic get reduced so by using of Public Transport make efficient and economical Public Transportation System on medium and Regular Basis. for such demand information of services so the Driver can make journey with less consuming time to travel to the destination, leads to less haul time of passengers at Bus Stop. [7]

H. Dr. Singhal

In this research author try to explain about Compressed Natural Gas and Biogas generated by several sources.

Conclusion from Research is BIO-CNG fuel for transportation Fuel in Public Transportation

The System which is more economical and lowers air pollution. [8]

III.SOFTWARE TO BE IMPLEMENTED

A. VISSIM Software: **VISSIM** software is basically used to Simulate the travel time of vehicles and pedestrians. It is also Microscopic Simulation Model. VISSIM can Analyse Pubic Transport and Private Transport operation which makes it useful for assessment of various option for Transportation Planning. VISSIM Software is used to find actual vehicle travel times from origin to destination, pedestrian travel time, travel time, waiting time, etc. at various Bus Stop and Transfer positions. It can analyse all type of vehicle i.e., Buses, HCV'S, LCV'S Two-Wheeler, Auto, Rickshaws and Cycles. Traffic Sign can also be placed at needed locations Sign like warning, prohibited and informative.

B. Intelligent Transportation System (ITS)

As many Research on Intelligent Transportation System (ITS) which includes several regions in Public Transportation System Control Frameworks, In Road Traffic Management System Appropriate vehicle observation can be seen with vehicle details by using ITS Proper Management of traffic control can be done. Intelligent Transportation System is also can be used in proper vehicle monitoring operating System. [9] [10]

Intelligent Transportation System (ITS) allow various Technologies which is useful in making appropriate Management of Transportation System and which is use to collect traffic data information for the road users for transport. [11]. Also, Vehicle Monitoring System is used to get vehicle position to get travel by the passengers' vehicles like Bus, Auto or other mode of Transport. As we know that the mainly problem of not using Public Transport is, we did not get easily vehicles from our starting point to destination so in this research this problem is to solved, such that passengers need to know about Predicted time of arriving Bus at Stop. So, the excess of time wastages at Bus Stop make passengers anxious. Correct Timing of arrival of next upcoming vehicle which will let passengers know to select another alternate transport mode, also due to which experience can be improved. Real Time bus arrival time will help many Bus users to meet Bus at time as well. By Implementing Such Operation Systems which makes lesser in cost also. [12] [13] [14]

C. Proposed Transportation Structure System

As in this research paper as Public Transport Management System Network explains in figure no.-3 where data transferred between the main Servers, the Buses and

Internet. The use of Hardware Units and Firmware Units at every Bus Stops this Units control and displays Information of Bus which is controlled and displayed from Computer Server. The Bus-stop Units are Android Base Unit also it is termed as Hardware Based Units or Systems. As the mechanism of this Hardware Structure is explained in fig-3 main Server hosts the System Management next Processing algorithm next System Database and last Web Applications. Portal is involved to collect and share mandatory information to the User. [15]

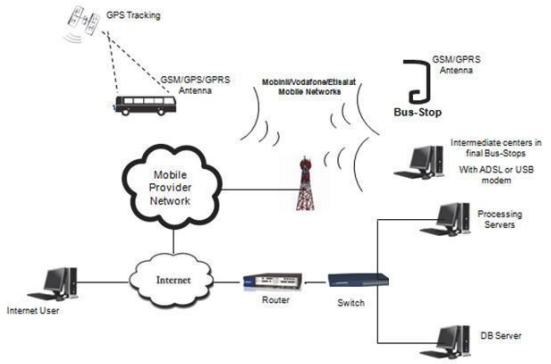

Fig 2-: Main Structure of proposed system

D. Existing Bus Transport System

Bus Transport Management System (B.T.M.S) mainly used for the Management of Reservation and maintenance of increasing Bus Transportation System. Appropriate timing of availability of bus ticket should be known about their ticket availability status, ticket reservation Status, timing for arriving and Departure, Halt Time and Route map of Bus. Centre of Information are unable to serve such queries at peak hours. There are no Call centers for such problem. Although such well- organized System which fails to have great Productivity and valuableness. B.T.M.S is Web Based application.by Implementing B.T.M.S such critical problems can be minimized. For more comfortable travel practice in Future B.T.M.S is the option for Transport mode. Similarly, minute changes with the System in programming and implementation of user interface for Railways and Metro's. from this research well organized Computerized System implementation which is helpful instead of standing in line ques for Booking. For much better transportation the Implementing of Bus Transport Management System is Adopted.

E. IRC and IS Recommendations

Basically, the Bus Bay Design Recommendations were observed from Authors Research for Bus Bays and Bus Shelters. In general The Bus Bay use to design at various Stop of the Public Transport to halt or to Pick up points, IRC guideline IRC: 080- 1981 which explains Typical layout of lay byes as per the design of Layout on specific location, it must be based on Local Factors, Halt Time, Number of traffic, amount of travelers stopping at the Stop, Number of Buses Stopping at a time, etc. Selection of Layout at particular location should be based on such local factors, the time of halt, amount of traffic on road, number of passengers alighting at the bus stop, No. of Busses stopping at a time, etc. [17]

F. Traffic Congestion in Peak Hours

Generally, Term Traffic Congestion deals with Exchange of People, goods or vehicles between the various points at various Intersections to all types of vehicles i.e., Mechanized, Motorised, and Non- Motorized. Now a days the man problem of transportation is only Traffic congestion mainly in Peak Hours, Peak hours which hours or period of time having more traffic in any Signal or at Road. Generally, the data collection was observed only at Peak Hours in Morning as well as in Evening time Time selected for Peak Hours was 9:00 am to 12:00 pm in morning and 05:00 pm to 07:00 pm in Evening. As is stated Peak hours, the greater number of vehicles flow is observed in such time as one going to office, School, Colleges or any organization or coming from office, School, Colleges or any organization. Traffic Analysis is done in Peak Hours to get research about reduction of traffic congestion in Peak hours. By using Public Transport by Travellers which may leads to Betterment of Environment and also it is the Safer Mode of Transport in Metro Cities. By using Such Public Transport Traffic Congestion problem may get Reduced. As the use of Public Transport is more Efficient in cost.[18]

G. Traffic Congestion Minimization

As Traffic Congestion is widely problem in Globe as well as in Local. Congestion major cause is On Street parking of vehicles, Irregular parking, buses Parking, less width road, etc, Road widening should be done for narrow roads. Implementation of heavy fine should be on vehicle parking on roads, restricting of Rickshaws in Congested areas Design of Public Transport can be implemented also Metro can be designed for reducing Congestion, lastly fly over can be designed to reduce traffic congestion. By implementing Public Transport Less is traffic Congestion and also reduces Pollution which make relief in Environment Impacts.[19]

IV. DESIGN PARAMETERS

A. Bus Bays Location

There are some certain Principles on which basis Location of Bus Bays can be designed. Following are the Principles-

i) As Bus Bays is used to Design for Bus Stopping area on Running Road it should be away from high rise Super Structure like Bridges and other Important Structure and Embankment Section must be 3m High.

ii) Next one is, generally bus bays used to design on road which do not have Curves in Roads like Summit Curves or Horizontal Curves.

iii) For design location of Bus Bays, it must be having Good Visibility with having good safe Stopping Sight Distance (S.S.D).

iv) As in figure No. 4 it sows the Typical Layout of Bus Bay which shows detail explanation about Bus Bay Design so, Bus Bays Should not designed on any Intersections. For Bus Movement the Gap of 3m is to be provided in between road and Bus stop. Generally, Bus Bays Location right-hand side as well as left-hand side of road, exact location can be fixed on basis of public Users of that area which is expected to use of such amenities.

v) Generally, design of Bus Bays on Four Lane Road is critical to make large span of Bus Bay which may reduce traffic Speed of the vehicles travelling near Bays region. Suitably the less stop in such areas as to improve speed of such major lanes.

vi) Also, in Hilly Areas the design of Bus Bays can be designed if possible where the Road is Straight on both the lanes. For selecting such straight path, the visibility is good generally not less than 50m. It is advisable to select Bus Bays road ways are having wide roads and which is more economically.

B. Bus Bays Design

i) Design of Bus Bays main advantage is, by implementing Bus Bays on Road ways the traffic flow does not affect due to Bus Bay have certain area to Stop and Go for Buses so that there is no disturbance in traffic flow. As figure no. 4 shows Bus Bays area in details. Total area of Span i.e. L required for Bus Bay design is 63 M. It is Sufficient to Halt Bus at Bus stop.

ii) Bus Bays Should be provided on Both side of Lanes, design should be so proper that two buses may not get across the road at Bus stop. As Bus Bays location should be located on Both sides i.e. Up side and Down side every Intersection.

iii) Bus Shelter should be provided for halt of passengers at Bus Stop, seating capacity should be as per to the no of passengers aboard or halt on particular Bus Bays. Bus Shelter should be Structurally Safe and having artistic design appearance. Bus Shelter also can be utilized for protection from Rain, Sun and wind. Bus Shelter is optional in some Bus Stop so the halting of Passengers is not up to mark so we can neglect Bus Shelter on such location..

C. Road Marking at Bus Bays

Proper Marking is to be done on Road Way near Bus Bays so that it can be easily observed that there is Bus Bays at certain distance Road Marking is done by using Thermoplastic Paint which is having Glass Beads which Shows Bus STOP as shows in figure No. 4 it is shown Bus where Bus can Halt and passenger can board on Bus. Also, the marking for Footpath and Pedestrains and also No Parking Marking should be done on Road pavement so that other than Bus no other vehicle can Stop at Bus Bays.

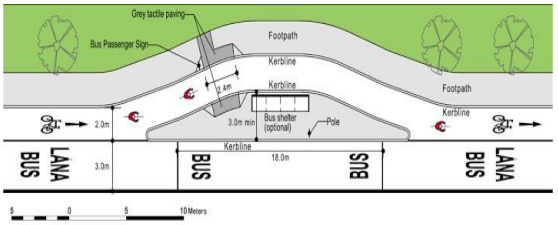

Fig. -3: Typical Layout of bus bay

V. RESEARCH OUTCOMES

In this Research, mainly focused on Public Transport Management System i.e., Bus Transportation System. Easy route availability and Bus availability is to be done so that to reduce passengers' halts timing. It is also required to make use of Public transport so that less pollution and the usage of private vehicles may get reduced. As Use of buses for such "Bus Priority" has emerged as one of the best affordable Methods in the Public Transport System. Proper Road Network Design planning is to be recognized for the special methods of Buses Network which reduces the flow of vehicles. Research papers try to find the comparison between various Transportation Management Systems using Hardware or Software units.

From the Research parameters above and the Design point of View, the following outcomes can be obtained.

1. Public Transport is the need of the Future Generation.
2. To reduce Pollution emitted by vehicles, more and more use of Public Transport should be made.

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Traffic Study and Control System of Chandrapur City

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***Abstract*—Traffic engineering is one of the most challenging and versatile fields in civil engineering. As there is an increase in vehicular traffic day by day, the existing road will be insufficient to carry this increasing traffic. Road traffic is composed of various categories of vehicular traffic and pedestrian traffic. Each category of vehicular traffic has two components, the human element as the driver and his machine as a vehicle, and their behaviours are different for different traffic situations.**

This project deal with the comparative study of various field of traffic engineering such as traffic volume study, collection of accident data at various location of Chandrapur city, origin and destination point of various vehicle, road geometry such as the width of the road, gradient, speed limit etc. intersection, signal timing, island, traffic sign, road lighting, various parking location, the capacity of parking etc.

According to the result obtained from the above studies, the further procedure of control of traffic volume, minimizing traffic accident spots, providing suitable and sufficient parking areas, and footpaths areas, providing good street lighting facilities during the night, proving flyover wherever necessary, model preparation of new developing road.

Keywords: traffic volume studies, accident data collection, analysis of data, smooth flow of traffic, model making.

I. INTRODUCTION

Traffic on roads consists of road users including pedestrians, riders or herded animals, vehicles, streetcars, buses and other conveyances, either singly or together, while using the public way for purposes of travel. Traffic laws govern traffic and regulate vehicles, while rules of the road are both the laws and the informal rules that may have developed over time to facilitate the orderly and timely flow of traffic.

Traffic is formally organized in many jurisdictions, with marked lanes, junctions, intersections, interchanges, traffic signals, or signs. Traffic is often classified by type: heavy motor vehicle (e.g., car, truck), other vehicle (e.g., moped, bicycle), and pedestrian. Different classes may share speed limits and easement, or may be segregated. Some jurisdictions may have very detailed and complex rules of the road while others rely more on drivers' common sense and willingness to cooperate.

Generally, Traffic is defined as the movement of a person's vehicle or any type of goods or person in between the site locations, and thus includes pedestrians and all types of vehicles mechanized, motorized or non-motorized. The seven intersections the vehicles are stopping for their turn to clear a particular patch of road, on the signal point the vehicle traveler us to keep their vehicle engine on so that it leads to loss of fuel and they also keep unnecessary Thus it leads to delay in vehicle & noise pollution generally increased at the signal or seven intersections. This used to reduce congestion on the particular intersections the Bus Bay is to be provided for the city buses moving on the particular patch. Today man has his own vehicles to get transport from one place to another place. The Noise pollution, congestions and air pollution and the results in ill effects to the health and frustration have become addicted now a day.

Due to increase in population day by day in Chandrapur city the road capacity is insufficient, as these design was done ago , the flow of vehicles was low ,but now a days the flow of vehicles is increasing as per the population.

Objectives

1. The main object of this project is to reduce the traffic by diverting or by proving proper flow to the vehicle.
2. Study of various types of traffic volume, parking and accident types.
3. Reduction or preventive measure of above mention parameter.
4. Proving proper road geometry and providing fly over whenever necessary, proving public transport if required.
5. Designing of signal timing, road intersection, islands etc.

II. REVIEW OF LITERATURE

Review of Literature helps to identify the concepts relating to the research topic and potential relationship between them. It also helps in appropriate analysis of data. Moreover it gives broader vision and even the secondary data to the research.

Following literature is carefully reviewed and studied.

1. The latest edition of the well known reference book 'Indian Economy', by Ruddar Datt and K. P.

Sundharam was read, especially the chapters on the infrastructure in India. It helped in understanding the importance of transport, especially the road transport, for development of all the sectors in the Indian economy. It also guided to realize and understand various issues related to road transport.

2. Indian Economy Since Independence', edited by Uma Kapila includes various articles and reports on various aspects of Indian economy. Various articles from this book also helped to understand the meaning and importance of a well developed road network in India.
3. Economics of Growth and Development', by S. K. Misra and V. K. Puri is also one of the standard and well praised book which further broadened the view of the researcher in understanding the role of roads and highways and therefore the importance of the NHAI in the development of road network in India.
1. Motor Transport Statistics of Maharashtra' for various years especially for the year 2009 – 2010 compiled by Transport Commissioner Office, Maharashtra State, Mumbai gave the statistics regarding various types of vehicles registered in Maharashtra. It helped to know the Motor Vehicle Population in Maharashtra and the issue of road accidents in Maharashtra with official data.
2. A review 'Accident Analysis of Selected Indian Cities / States / Corridors', published by Centre For Road Safety, Central Institute of Road Transport, Pune 26, included various papers on corridor studies, accident investigations, accident analysis in various cities all over India. It helped to understand the importance of well developed, safe, lane, divided highways with smooth surface and other required road safety features.
3. Various Reports Of Government Of India were reviewed. Some major reports are mentioned below.
   a. Government of India, Economic Survey (various years).
   b. Chaturvedi Committee Report, 2009.
   c. India Infrastructure Report (2000-2001 onwards till 2009-2010).
   d. Ministry of Finance, Budget Speech of the Finance Minister (Various years).
   e. Planning Commission, Five Year Plans.
   f. Rakesh Mohan Committee Report.
   g. Report of the Committee on Transport Policy and Co-ordination, Planning Commission, 1996.
   h. Report of the National Transport Policy Committee, Planning Commission, 1980.
   i. Report on the Steering Committee on Transport Planning, Planning Commission 1988.
   j. Report of Working Group on Road for Ninth Plan, Ministry of Surface Transport, 1996. Various suggestions and recommendations given by these committees for the development of roads and highways were studied.
4. Ministry of Works and Transport, Roads Department, Private Bag 0026, Gaborone, Botswana, Phone + 267 – 3913511, Fax + 267 - 39 14 278 which helped in volume counting by manual method.

III. SITE MAP

The selection of site is one of the major tasks because it controls the project.

In this project we select the origin point as Gandhi square and destination point as Maharashtra electrosmelt limited MEL Shown in figure marked. And 7 area of conflict as a station point, which is represented by triangle these are given below

1. Bengali campus square
2. Ramnagar square
3. Bus stop
4. Priyadarshani square
5. Girnar square
6. Panchshil square

We select this above location as station points because, there is more number of conflict and these are the junction of road at this point number of vehicles available are more for counting and the vehicle are required to slow or stop before passing so that counting will be easily at that point

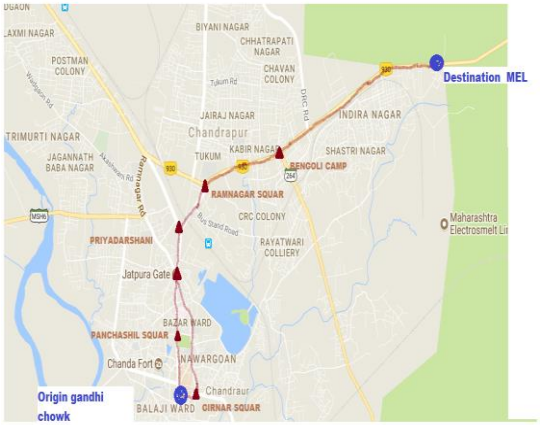
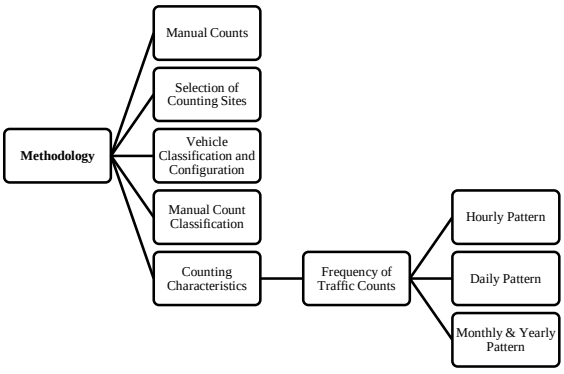


Fig. no. 1 Site Selection

IV. METHODOLOGY



STUDY PARAMETER

1) Time of survey

As per the data collection the traffic volume survey is done while the peak hour the peak hour refer time on morning high traffic volume and same for evening (10:30 to 12:30) and(5:30 to 7.30) pm where taken into attention for getting of the maximum traffic moving on the seven intersections. The term peak hours defined by the number of office bus travelling

people shop owners school and college going student majorly the maximum flow of traffic .peak hours are the time at which traffic volume is maximum .

2) Up Flow / Down Flow:

The Up flow (MEL to Girnar Chowk) and the Down flow (Gandhi Chowk to MEL) of the seven intersections was recorded by manual count so that the total number of vehicles count on that road on that particular Peak hours were done respectively at in between seven intersections from MEL to Gandhi Chowk.

V. DATA COLLECTION

1) Traffic Volume of various location

1. Up vehicle i.e. up from city

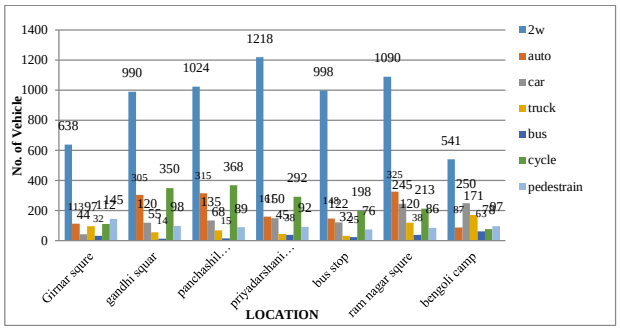


Fig. 2 graph showing traffic volume of peak hour

2. Down vehicle i.e. out from city

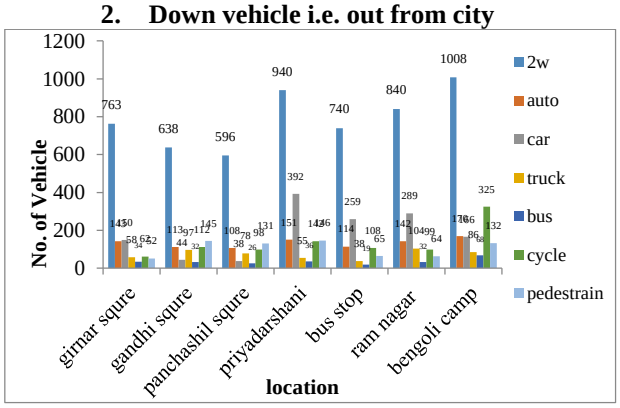


Fig. 3 graph showing traffic volume of peak hours

2) Parking Data Collection

1. *Location: Gandhi Chowk*

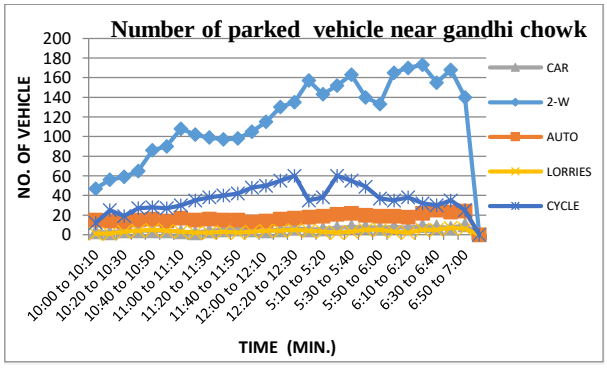


Fig. 4 graph showing of no. parked vehicle vs time near gandhi square

2. Location : Panchasil Chowk

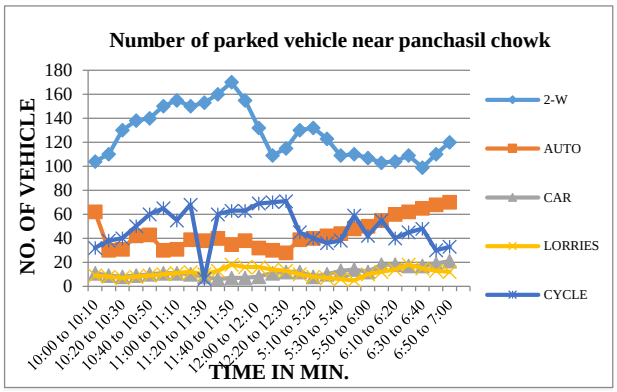


Fig. 5 graph showing no.of parked vehicle vs time near panchasil chowk

3. Location : Bus Stop

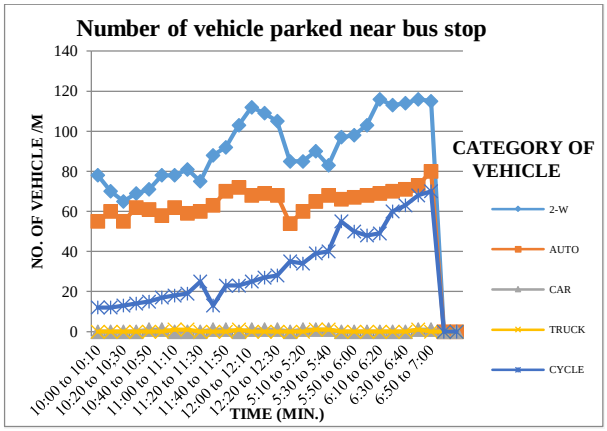


Fig. 6 graph showing no. of parked vehicle vs time near bus stop

2) Accident Survey

1. Accident data of year 2017

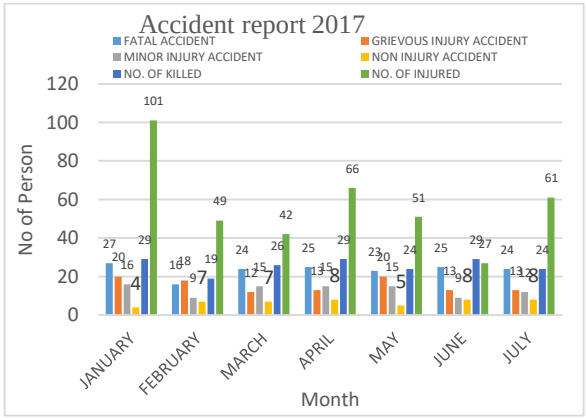


Fig. 7 Graph showing no. of data vs months of accident

2. Accident report of year 2018

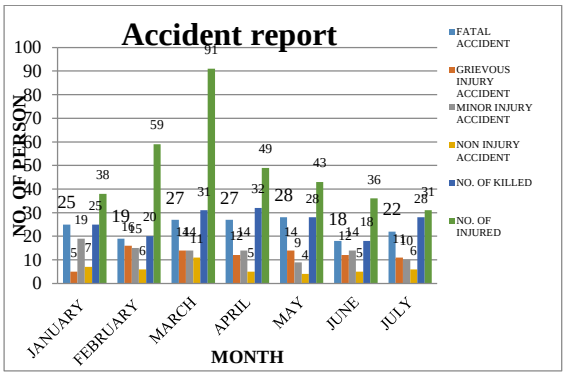


Fig. 8 Graph showing no. of person vs months of accident

3.Preventive Measures

If you drive frequently traffic condition can be a major daily headache. With a few simple driving techniques however you can be a part of the solution. If driver you can help to speed up the flow of traffic, but you can also take alternative transportation such as buses. You can even plan your routes and trips strategically to reduce the time you are on the road helping relieve the burden on the other driver.

1. Maintain a gap between vehicles
2. Stay at a consistent speed
3. Avoid changing lens to often
4. By providing fly over
5. Buy providing parking
6. My proper Geometric design
7. By using sign and signals

From this we will discuss fly over & Parking details

By Providing parking

1) Roof Parking

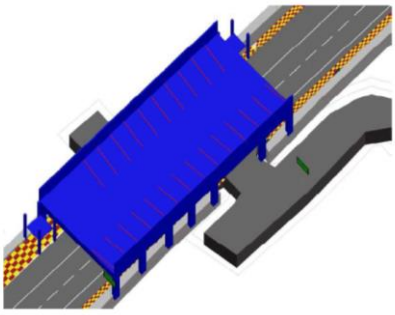


Fig. 9 Roof Parking

2) Kerb Parking

Fig. 10 Parking Kerbs

3) Road Marking

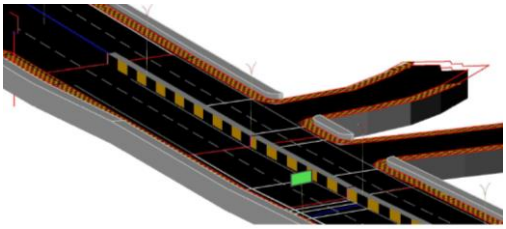


Fig. 11 Road Marking

VI. MODEL DESCRIPTION

We have obtain this model by using AUTO CAD Software

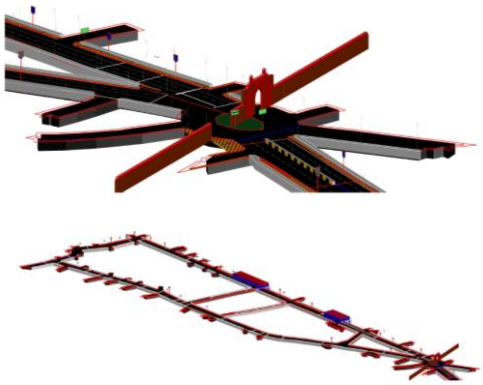


Fig. 12 Model design at Jatpura gate

VII. FUTURE SCOPE

This model shows the well-developed plan of Chandrapur city road and thus it will show a good image of Chandrapur city by reducing the traffic volume and properly parking the traffic. And thus if this project will be adopted by the government there is a smooth flow of traffic, a reduction of accidents and parking facilities will be developed. This project shows the developed plan of the road and thus it will help with the structural design of various components of the road. Design of parking area, flyover, electric lamp , etc.

.

VIII. CONCLUSION

The following result and conclusions obtained from the research are given below:

1. As there is insufficient capacity for existing railway bridge (beside of post office), the traffic in front of bus stop are so much, so these fly over will provide from the existing bridge to front of ramnagar police station (for mul road users) which will successfully reduced the congestion in front of bus stop. Also the capacity of exiting Railway Bridge is increased by providing two new bridge on both side of exiting bridge which will discharge and carry the traffic from bus stop and other offices near that location and thus, smooth flow of traffic.

2. The roof parking (parking stale) provided over the road near the Maulana Abdul Kalam Azad garden and near the Government Hospital for a car only, which will reduce the area required for kerb parking and also it helps to reduce the traffic on road and thus the smooth and proper flow of traffic.
3. The alignment of the road from Girnar Square to Gandhi Square is irregular and there is no footpath width and no sight distance available and this increase in the possibility of an accident, and thus these possibilities of road accident are reduced by road marking, sign, etc.
4. There is an insufficient capacity of road width (4m only) near jatpura gate as this is an ancient gate of Chandrapur city, we cannot dismantle it. So consider as a narrow width of the road near jatpura gate.
5. Providing the number of kerb parking for 2-W and 3-W the traffic on road will be reduced up to a certain extent and thus, smooth and orderly flow of traffic on road.

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Conventional Steel building design vs PEB (Pre-Engineered Building) design including MBMA guidelines

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***Abstract*— Steel buildings have become increasingly popular due to their durability, strength, and cost-effectiveness. In the construction industry, two primary methods are used for steel building design: conventional steel building design and pre-engineered building (PEB) design. Each method has its benefits and limitations depending on the building's intended use, size, and complexity. This review paper aims to explore the differences between the two design methods, including their advantages and drawbacks, and to provide an overview of the guidelines established by the Metal Building Manufacturers Association (MBMA) for both conventional and PEB designs. The paper will serve as a useful resource for architects, engineers, contractors, and builders in selecting the most appropriate design method for a particular project while complying with the established industry standards.**

Keywords*— *Conventional steel building design, PEB design, Metal Building Manufacturers Association, MBMA guidelines, Steel buildings, Building codes, Customization, Cost-effectiveness, Energy efficiency, Durability.

I. INTRODUCTION

As the demand for steel buildings continues to grow, architects and engineers have been exploring different design options that can improve the construction process's speed, efficiency, and affordability. Conventional steel building design and pre-engineered building (PEB) design are two popular methods used to construct steel buildings. Conventional steel building design follows a customized approach where each component is designed and fabricated as per the specifications of the project. PEB design, on the other hand, uses pre-fabricated building components that are manufactured off-site and assembled on-site. Both methods have their benefits and limitations, and the choice of design method depends on the building's intended use, size, and complexity. This review paper aims to compare and contrast conventional steel building design and PEB design, highlighting their unique advantages and limitations. The paper also aims to provide a comprehensive overview of the design process for each method, including their essential elements, construction considerations, and best practices. By providing an in-depth analysis of both design methods, this paper aims to provide architects and engineers with the information they need to make informed decisions when selecting the most appropriate design method for their steel building projects.

II. BUILDING CATEGORIES

The category of a building is based on its primary function or intended use. Buildings can be broadly categorized into several types, including residential buildings, commercial buildings, industrial buildings, institutional buildings, and recreational buildings. Residential buildings are those that are designed for people to live in, such as houses, apartments, and condominiums. Commercial buildings are designed for businesses, including office buildings, retail stores, and restaurants. Industrial buildings are used for manufacturing, warehousing, and distribution activities. Institutional buildings are used for educational, healthcare, and government purposes, while recreational buildings are used for leisure activities such as sports, entertainment, and social events. These categories of buildings help to define the characteristics and requirements of each type of building and are used to guide the design, construction, and operation of buildings. The construction industry has witnessed a constant economic competition between various materials, such as concrete, steel, and others, for the construction of structures.

A. Reinforced Concrete Structures

Reinforced concrete structures are a popular choice for buildings, bridges, and other structures due to their strength, durability, and cost-effectiveness. This construction material is made up of concrete, which is reinforced with steel bars, also known as rebars, to increase its tensile strength. This combination of materials allows reinforced concrete structures to withstand significant amounts of weight and pressure, making them an ideal choice for a variety of construction projects. In this paper, we will provide an overview of reinforced concrete structures, including their design principles, construction considerations, and applications.

B. Conventional Steel Structures

Conventional steel structures are a popular choice for a variety of construction projects, including commercial buildings, industrial facilities, and bridges, among others. These structures are designed and built using traditional construction techniques, which involve cutting and shaping steel beams, columns, and other components to create a custom structure. The use of steel in construction provides several benefits, including high strength, durability, and resistance to fire, corrosion, and pests. In this paper, we will provide an overview of conventional steel structures, including their design principles, construction considerations, and applications. We will also compare and contrast conventional steel structures with other types of construction methods, such as pre-engineered building design and reinforced concrete structures.

C. Pre-Engineered Buildings [PEB]

Pre-engineered buildings (PEB) are a popular choice for many construction projects due to their efficient and cost-effective design. PEBs are pre-fabricated structures, with their building components manufactured off-site and then

assembled on-site, often in a fraction of the time it would take to build a conventional structure. These structures are typically made of steel, which provides high strength, durability, and resistance to fire, corrosion, and pests. In this paper, we will provide an overview of pre-engineered buildings, including their design principles, construction considerations, and applications. We will also compare and contrast PEBs with other types of construction methods, such as conventional steel structures and reinforced concrete structures.

III. LITERATURE REVIEW

Sai Kiran Gone, Pradeep Kumar Ramancharla, Kailash Rao[1] "The introduction of Pre-Engineered Building (PEB) design concept in recent years has shown promising results in the optimization of building designs. PEBs offer various advantages, such as cost-effectiveness and ease of fabrication, over the conventional steel building (CSB) design. This study aims to analyze and design an industrial structure (warehouse) according to Indian standards IS 800-1984 and IS 800-2007, and American codes MBMA-96 and AISC-89. The study considers a structure with a length of 187m, width of 40m, clear height of 8m, and R-slope of 1:10, and carries out analysis and design for 2D frames (end frame, frame without crane, and frame with 3 module cranes). The conclusion of the study highlights the differences in weight between Indian and American codes and the impact of loading conditions, as well as the preference of AISC/MBMA codes in PEB structures due to their economical solutions. The study also reveals that the use of thin webs in PEB designs often results in sections that do not comply with the codal provisions of IS 800:2007, leading to a preference for American codes."

Neeraj Kumar, Dr. K.S. Grover[2] "A study was conducted on industrial buildings of different spans, ranging from 10m to 50m, using conventional hot rolled sections and PEB tapered sections designed according to the Indian Standards, IS 800-2007. The relationship among building parameters was analyzed to identify patterns of steel reduction in the primary frames of structures of varying spans. The study was carried out using STAAD PRO Connect edition. The results of the study showed that PEB structures are lighter than conventional steel building structures for all spans of structures, leading to substantial reductions in steel quantity. While the displacement in PEB structures is higher due to their lightweight and varying depth, the use of plate girders in long span structures enables customization to reduce displacement, similar to PEBs."

Sudhir Singh Bhadoria, Yash Pathak[3] "The construction industry has seen a revolution with the introduction of pre-engineered buildings (PEBs) which are custom designed to meet specific requirements, unlike conventional steel structures that result in high steel consumption and cost. This paper aims to resolve these issues by comparing PEBs and conventional steel structures of various models and span lengths. The analysis was carried out using STAAD Pro software under various loads, and it was concluded that PEBs are an economical option up to a specific value of clear span. Tapered sections in PEBs make them even more economical, as they are designed as per the bending moment diagram. Steel consumption in PEBs is around 30% lesser than conventional steel structures, and PEB frames are lighter, more flexible, and provide higher resistance to seismic forces. PEBs are ideally suited for modern engineering needs, with high-speed design and construction capabilities for buildings of different categories."

Aijaz Ahmad Zende, Prof. A. V. Kulkarni, Aslam Hutagi [4] "The use of pre-engineered buildings (PEBs) in the construction industry offers numerous benefits, including reduced time and cost compared to conventional structures. This paper presents a comparative study of static and dynamic analysis and design of PEBs and Conventional steel frames, which shows that PEBs are a more economical solution for long span structures where large column-free areas are required. The study includes examples of various span lengths, and the comparison of PEBs and conventional steel structures was done using Staad Pro software. The analysis of dynamic forces, including wind forces and seismic forces, was also conducted. The weight of steel can be reduced by up to 27% in PEBs, providing lower dead load and higher resistance to seismic forces. For longer span structures, PEBs are the best solution. However, they are costlier for smaller span structures. The weight of PEBs depends on the bay spacing, with a decrease in weight up to a certain spacing and an increase in weight with further increase in spacing. In conclusion, PEB construction provides a more economical and better solution for long span structures where large column-free areas are required."

Sharayu S.Patil, Prof.S.P.Nirkhe, Dr. G.R. Gandhe[5] "The study was conducted using the software Bentley STAAD PRO, and a pre-engineered building was designed and compared to a conventionally designed building of the same configuration. The analysis involved evaluating the buildings' deflection values and time periods, comparing the base shear values for both pinned base and fixed based PEBs and conventional steel sheds. The results indicate that PEBs are more sustainable than conventional steel buildings in terms of cost, construction time, and maintenance. The deflection values of PEBs were found to be lower than those of conventional steel buildings, and the time period for PEBs in both pinned and fixed bases was less than that of conventional steel sheds. Additionally, the base shear values of PEBs were lower than those of conventional steel sheds. Overall, the study suggests that pre-engineered steel buildings offer a more cost-effective, time-efficient, and structurally sound alternative to conventional steel buildings. However, a more comprehensive literature review would require a detailed understanding of the research methodology, limitations, and contributions of the study, as well as an analysis of the relevant literature on pre-engineered buildings and conventional steel buildings."

Bishbu Jacob, Althaf M [6] "The study aims to investigate the economic advantages of pre-engineered buildings, which are designed using tapered members and cold-formed steel sections as secondary members to reduce self-weight.

The results of the study suggest that pre-engineered buildings are more economical in terms of steel take-off, with the pre-engineered structure being 43.24% lighter than the conventional portal frame structure. The secondary members in the conventional structure were 51.65% heavier than the secondary members in the pre-engineered building, and the weight contribution by secondary members was 36.1% and 30.93% of total weight for the conventional structure and pre-engineered structure, respectively. The study's results suggest that the use of pre-engineered buildings can offer economic advantages in comparison to conventional steel buildings.

There has been considerable research in the field of pre-engineered buildings that has shown that these structures are more cost-effective and quicker to construct than traditional steel buildings. Additionally, pre-engineered buildings can offer a high level of flexibility in terms of design, as the use of tapered members and cold-formed steel sections enables structures to be customized to meet specific needs. The use of cold-formed steel sections in pre-engineered buildings has been investigated in numerous studies. These sections can provide a high strength-to-weight ratio, which can help reduce the overall weight of the structure. Cold-formed steel sections can also be used to create complex shapes, which enables designers to create unique and aesthetically pleasing buildings.

Furthermore, the use of pre-engineered buildings is increasingly popular due to the speed of construction. These buildings are prefabricated off-site, which reduces construction time and minimizes on-site disruptions. The reduced construction time can also lead to cost savings and make pre-engineered buildings a more attractive option for construction projects."

Humanaaz Arif Qureshi, Dr. Kuldeep R. Dabhekar, Amol Shahakar, Dr. Isha P. Khedikar [7] "The study is focused on the comparison between Pre-engineered building (PEB) and Conventional steel building (CSB) in terms of design and analysis. The study aims to determine the most economical frame in terms of tonnage and to identify the possible reasons for the variation of results. In addition, the paper also compares the hot-rolled section used in CSB with cold-formed purlins used in PEB.

In general, the use of PEB in steel structure design is gaining popularity due to its several advantages such as cost-effectiveness, eco-friendliness, and sustainability. The conventional steel building (CSB) system, on the other hand, is known for its time-consuming and costly design. The CSB is also costly due to more consumption of steel because of using a uniform cross-section of the hot-rolled section throughout the member length."

Ms. Darshana P. Zoad [8] "The paper discusses the use of Pre-Engineering Structures (PES) in the construction industry in India. PES has accelerated the rate of construction while maintaining safety standards and meeting a wide range of aesthetic and structural design requirements. The paper also discusses the differences in design methodology between the Indian Standard (IS) code and the American Institute of Steel Construction (AISC) code, particularly in calculating live loads, wind coefficient, and load combinations for strength and deflection. The paper concludes that the load calculated by IS code is higher than that of the MBMA, and load combinations for strength and deflection are different in IS and AISC codes."

IV. CONCLUSION

The main conclusion of a comparative study between conventional steel building design and pre-engineered building (PEB) design would depend on the specific parameters and criteria used for the comparison. However, some potential general conclusions are:

Cost-effectiveness: PEB designs are often more cost-effective than conventional steel building designs due to their standardized design and manufacturing processes.

Construction time: PEB designs can be constructed more quickly than conventional steel building designs since most of the components are manufactured off-site and simply assembled on-site.

Customizability: Conventional steel building designs may offer greater customizability in terms of architectural design and size, whereas PEB designs may be more limited in this regard due to their standardized nature.

Structural integrity: Both conventional steel building designs and PEB designs can provide sufficient structural integrity, but the specific design and manufacturing processes used can affect the final result.

Overall, the main conclusion of a comparative study would depend on the specific parameters and criteria used for the comparison, as well as the context and specific needs of the building project in question.

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Review of Life Cycle Assessment of Buildings

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***Abstract*— There is growing interest in studying the environmental impacts of buildings. This is due to the increasing awareness of the environmental impact of buildings, as well as the availability of tools for assessing building impacts. There are a number of reviews of building LCA but none focus specifically on the challenges of building LCA. The purpose of this paper is to provide an up-to-date overview of life cycle assessment of buildings, and to discuss the major challenges in building LCA, ongoing studies and potential solutions to address the identified issues. The methodology involves a detailed literature review to provide an overview of existing studies in building LCA, and a systematic selection and study of review articles/books to investigate the benefits and challenges of building LCA. A summary of the research outputs and recommended further studies on building LCA are outlined in the conclusion section. The major challenges in building LCA were identified as data intensity and quality, subjectivity in environmental impact characterization and valuation, inadequate definition of functional units, assumptions for building life span and service life, lack of procedure for system boundaries, lack of uncertainty analysis, and limitation as a decision-making tool. In addition to discussing ongoing studies to address the issues, this paper also proposes research trajectories to resolve the major challenges identified in building LCA.**

Keywords*— *Life cycle assessment; buildings; sustainability

I. INTRODUCTION

The building sector has a significant environmental impact and is responsible for a substantial proportion of the world's energy and resources consumption. Buildings construction and operations together account for 36% of the global energy end-use and nearly 40% of energy-related carbon dioxide emissions. As buildings become more energy efficient, there has been a shift to a more holistic life cycle analysis of buildings. This is known as LCA (life cycle assessment), and LCA is a state-of-the-art tool that assesses the environmental impacts of a product over its service life. LCA can be defined as the assembly and estimation of resource inputs, outputs and the potential environmental impacts of a product system, including their processes and designs, throughout its life cycle. Although LCA of buildings has been studied extensively no up-to-date systematic review article addressing the challenges in building LCA has been found. After the oil crises of the 1970s, many concerns were raised within the design and operation of buildings. One of the main concerns was to reduce the need for operational energy, which in turn would reduce the need for oil-based heating and electricity. Due to increasing awareness of environmental concerns and pressure from various government bodies, clients, and environmental activists, many studies have been conducted to reduce building energy consumption and its environmental impact.

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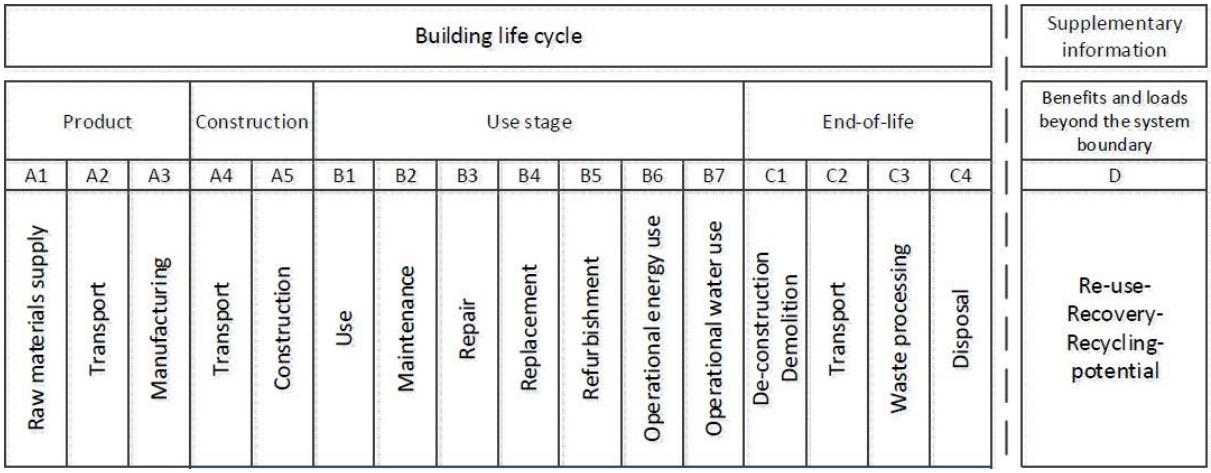
II. OVERVIEW OF CURRENT RESEARCH IN BUILDING LCA

The LCA is a method of studying the impacts of a product, process, or system over its entire life cycle. The life cycle of a product includes the raw materials that are used to make the product, the transport of the product to the production site, the manufacturing of the product, the transportation of the product to the construction site, the use of the product, and the end of life of the product. The life cycle of a process includes the raw materials that are used to make the process, the transport of the process to the production site, the manufacturing of the process, the transportation of the process to the construction site, the use of the process, and the end of life of the process. The life cycle of a system includes the raw materials that are used to make the system, the transport of the system to the production site, the manufacturing of the system, the transport of the system to the construction site, the use of the system, and the end of life of the system. There are three methods used to conduct LCA: process, economic input-output, and hybrid methods. Process LCA focuses on the impacts of the process itself, economic input-output LCA focuses on the impacts of the inputs and outputs used to make the process, and hybrid methods combine the two approaches. The general objective of building LCA is multi-faceted and involves the minimization of environmental impacts, carbon emissions, energy, and cost. The main goal of this section is to present an overview of current focus areas in building LCA. The focus areas were identified from both published review studies such as [11, 16, 19] and



personal 'desk study'. A summary of the research goals for the focus areas is provided to present recent study areas in building LCA, a shorter time frame is used in this section, which is different from that used (i.e. 1990 – 2019) to discuss the major challenges in building LCA (see sections 3-5). The identified focus areas are limited to studies published within the last decade and include the following:

life cycle energy analysis/assessment (which includes streams such as embodied and operational energy): reviewed in Ramesh et al. [40], Cabeza et al. [11], Srinivasan et al. [41], and Chau et al. [6].

•life cycle carbon (or greenhouse gas) emissions assessments: reviewed in Chau et al.[6] and discussed in Roh and Tae [42-43], Mostavi et al. [44], and De Wolf et al. [45].

•life cycle assessment of building refurbishments: reviewed in Vilches et al. [16] and discussed in Nicolae and George-Vlad [46], Pomponi et al. [47], and Weiler et al. [48].

•dynamic life cycle assessment of buildings: discussed in Levasseur et al. [49], Collinge et al. [50], Su et al. [51], Beloin- Saint- Pierre et al. [52], and Negishi et al. [31].

•uncertainty analysis in life cycle assessment of buildings: discussed in Wang and Shen [53], Hong et al. [54], Huang et al. [55], Tian et al. [56], and Zhang et al. [57].

•integration of LCA in building rating systems: discussed in Mateus and Bragança [58], Bueno et al. [59], Alshamrani et al. [60], and Collinge et al. [61].

•Integration of LCA with Life Cycle Costing (LCC) and other sustainability assessment tools: reviewed in Cabeza et al. [11]; Islam et al. [12] and discussed in Kneifel [62]; Hoogmartens et al. [63]; Mostavi et al. [44].

•BIM-based life cycle assessment of buildings: reviewed in Soust-Verdaguer et al. [18], and in Nwodo et al. [34], and discussed in Antón and Díaz [64], Lee et al. [65], Eleftheriadis et al. [66], Rezaei et al. [67].

Life cycle energy assessment, being a simplified version of LCA, accounts for energy inputs to a building in its life cycle [6, 40]. It is the sum of the embodied energy, operating energy, and energy incurred at end-of-life, including transportations. The goal of life cycle energy assessment is to formulate strategies to reduce primary energy use and associated emissions in buildings [40]. For instance, understanding the trade-off between embodied energy and operating energy for various classes of energy efficient buildings will determine the priority areas for energy reduction efforts.

The goal of life cycle carbon emissions assessments is to evaluate the carbon dioxide emissions as an output over the whole life cycle of a building in view of the global warming problem caused by greenhouse gas emissions [6]. Understanding the assessments framework and methodological differences will lead to informed decision-making to reduce greenhouse gas emissions in buildings life cycle.

The study of life cycle assessment of building refurbishments arises due to high percentage of existing buildings [16]. Building renovations is a key factor in building LCA as shown in EN 15978 [35] LCA standard. The usual approach is to consider different refurbishment scenarios with the aim to compare retrofit measures of interest and choose the scenario and measure with low life cycle environmental impacts [16].

The dynamic life cycle assessment of buildings was introduced to consider building properties that vary in time in building LCA. Collinge et al. [50] developed a model which considered four categories of time series in an LCA calculation. These categories include a) building operations e.g. changes in usage patterns or energy use; b) supply chain dynamics e.g. changes in fuel mix and efficiency of electricity grid; c) inventory dynamics e.g. changes in emissions, resource, and efficiencies of industrial processes; and d) environmental system dynamics e.g. changes in environmental conditions.

The study of uncertainty analysis in life cycle assessment of buildings became relevant due to uncertainties in LCA data [53] and parameter, scenario, and model uncertainties [32]. Due to complexities in data and material types in building LCA, Wang and Shen [53] proposed a hybrid method, which is a combination of data quality indicator, and statistical method, instead of the use of individual methods for data uncertainty analysis. Zhang et al. [32] used both deterministic (process method) and stochastic (Monte Carlo simulation) approaches to conduct building emissions assessment and suggested the definition of system boundaries and energy efficiency to control

uncertainties, as well as to apply statistical distribution for key parameters in building LCA.

Due to the emergence of building rating systems, a congruent effort to integrate LCA into building rating systems became evident to encourage building sustainability assessment in practice. For example, Alshamrani et al. [60] proposed a model to integrate LCA into the LEED (Leadership in Energy and Environmental Design) building rating system. The model was implemented in the selection of the most sustainable structure and envelope type for school buildings.

Increasing interest in sustainability especially, as a decision-making mechanism led to the development of other sustainability assessment tools such as LCC and Cost-Benefit Analysis (CBA). Studies for integration of LCA with LCC, CBA, etc. became relevant because of methodological disparity between the tools and conflicting assessment results, which make it difficult to make informed decisions for sustainable buildings [63].

BIM-based life cycle assessment of buildings became inevitable due to the need to simplify LCA application to buildings such as reduce time and effort in managing building information and LCA data [18]. Some studies have focused on achieving BIM-LCA integration such as [67-73]. An example of BIM-LCA integration tool is Tally, which is a plug-in to Autodesk Revit for conducting LCA for both whole building and comparative design options assessments. An overview of major BIM-LCA integration tools with features and limitations can be found in Bueno and Fabricio [74].

Now that an overview of the current major focus areas in building LCA research has been presented, it was considered interesting to identify the key challenges and ongoing or potential solutions to solving the identified challenges. The approach adopted in undertaking this is presented below.

III. Methodology

On The methodology involved a detailed literature review to provide an overview of existing studies in building LCA , and a systematic selection and analysis of review articles/books to investigate the benefits and challenges of building LCA. The review articles were filtered from a list of journal articles that were published between 1990 and April 2019. It should be noted that this study is delimited on the traditional understanding of LCA, which is life cycle environmental impact assessment. Therefore, the design for the search of the articles excluded other assessments of interest such as life cycle energy assessment/analysis, life cycle emission assessment/analysis, life cycle carbon footprint assessment/analysis, and life cycle cost analysis/assessment. In fact, the above-mentioned assessments, except for life cycle cost analysis/assessment, are contained in LCA. The source of the systematic selection of articles for the analysis is the Web of Science Core Collection, maintained by Clarivate Analytics. The Web of Science is a multiple-database platform that includes Science Citation Index Expanded (SCI-Expanded), Social Science Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI), and Emerging Sources Citation Index (ESCI). It contains more than 12,000 high-impact international journals and is regularly used by researchers around the world [75]. The main procedure involves creating a design for a search of the articles. To retrieve articles for the topic “Building LCA”, three title (TI) record fields were created:

1.TI= ("building LCA*" OR "building life cycle assessment*")

2. TI= ((building* OR single-family OR multi-family) AND (("life cycle assessment*" OR "life cycle analysis")))

3. TI= ((building* OR single-family OR multi-family) AND (("life cycle environmental impact assessment*")))

4.0 Analysis/Findings

The 22 review journal articles retrieved from the Web of Science Core Collection searches for LCA of buildings, in addition to the 2 textbooks that discussed building LCA were analyzed to investigate the benefits and challenges in LCA of buildings. An overview of the analyzed articles in terms of their aims, methodology, results/discussions, and relevant conclusions. The results/discussions and conclusions from the review articles are not limited to those presented in, which are regarded as the most relevant in this article. Some of the reviewed articles covered scopes beyond LCA of buildings such as building- related sectors [77]; built environment at neighbourhood, urban, and transnational scales [15, 77]; and life cycle costing analysis [11-12]. Some others covered an aspect of LCA of buildings such as life cycle energy analysis [6, 11]; life cycle carbon emission assessment [6]; LCA of building refurbishment and renovation [16]; and LCA studies on the pre-use phase of buildings [17].

A summary of the findings from the reviewed articles on building LCA include the following:

•there is a rapid growth of building LCA-related publications; the USA being the leading country in the study of building LCA [14],

•a basic trend is in the use of BIM tools, as enablers, to enhance data collection and storage for building LCA [18],

•Lack of methodological consensus in goal and scope definitions causes difficulty in comparisons of results of building LCA [6, 11, 77]. There is a need for transparency in the definition of system boundary and data sources [7, 15],

•Clear definitions of input data, assumptions, and consistency in methodology are required for comparisons of results of building LCA [15-16]. Making the correct assumptions is vital [12],

•Decent knowledge of LCA methodology and transparency in LCA parameters are necessary to make informed decisions [17], and

•Both research developments and industrial involvements are required to integrate LCA into buildings industry [19].

Article	*Aim*	*Methodology*	*Result/Discussion*	*Relevant Conclusion*
Lee et al. [78]	To develop an LCA program for a building'splanning stage	Case study	Impact assessment and improvement analysis results are variously expressed in terms of its purpose for analysis	A sustainable buildingLCA program is designed around the stages of goal, scope, and inventory analysis
Sharma et al.[10]	Review of LCA of buildings and to determine which buildingtype and life cycle phase have more energy and emission impacts	Literature review ofcase studies	Commercial buildings have more environmental impactsand energy use than residential buildings. Operational phase contributes the highest (80-85%)	Buildings contribute significantly to global energy use and environmental impacts
Zhang et al. [79]	To conduct the LCA of air emissions at a building construction stage	Case study	Operation and maintenance stages contribute the most of all emission types in the building life cycle	It demonstrated that airemissions during building life cycle can be measured quantitatively
Cabeza et al.[11]	Review of LCA, life cycle energy analysis, lifecycle cost analysis of buildings and their relatedindustry	Literature review ofcase studies	Most studies focus on low energy buildings in urban areas. Most of thestudies in America are in LCA of building industry or buildings	Difficulty in results comparison due to differences in goal andscope
Lamnatou et al. [80]	To review the LCA of building-integrated solar thermal systems	Literature review	There is a gap in thefield of LCA of building-integrated solar thermal systems	Embodied energy andCO_2 emissions are themost commonly studied issues
Chau et al. [6]	Review of LCA, life cycle energy assessment,life cycle carbon emissions assessment of buildings	Literature review ofcase studies	Operational phase of building contributes the highest life cycle environmental impacts with their structural materials dominating the share	Varieties in choice of functional units lead todiscrepancies in results
Islam et al. [12]	Review of LCA and life cycle cost implication on residential buildings	Literature review, case study using ISO14040	The environmental impacts and costs due to building materials are high and sensitive to assumptions	Making the correct assumptions is important to achieve robust model outcomes

Rashid andYusoff [7]	Review of LCA methodfor building industry	Literature review	Most research used ISO 14040 series as a basic guideline. Energy use pattern differs with climate region	There is a need for standardized LCA methodology
Kylili and Fokaides [81	To review the LCAs of Phase Change Materials (PCM) incorporating building systems	Literature review	Although consistency exists in findings, the findings depend on goal and scope of each LCA	There is a positive environmental impact from the incorporationof PCM in buildings
Soust- Verdaguer et al.[13]	Review of simplificationsin LCA of single-family houses	Literature review ofcase studies	Simplifications to building LCA focus on system boundary and scenario definitions, and results communication	There is a need to further develop simplification strategies that retain results representativeness while allowing comparability
Geng et al. [14]	Investigation of buildingLCA studies published between 2000 and 2014	Bibliometric methods	There is a rapid growth of building LCA-related publications with the USA being the leading country	Subtopics such as energy, materials, environmental impacts,and sustainable development will be prominent future directions in building LCA research
Mastrucci et al. [15]	Review of selected bottom up LCA, evaluating the environmental impact ofbuilding stocks from urban to transnational scales	Literature review	Computer modelling such as Building Information Modelling(BIM) enhances data collection and storage	In LCA, transparency and clear definitions of system boundaries, functional units, and service life are still central questions
Vilches et al.[16]	Review of LCA of building refurbishmentand renovation	Literature review	Most considered lifecycle stages are pre-construction and use stages. Most of the studies used process analysis for the life cycle inventory	Clear definitions of input data and assumptions required for results comparisons
Säynäjoki et al. [17]	Review of LCA studieson the pre-use phase of buildings to	Literature review ofcase studies	The variance in results was caused by methodological (e.g. whether process, EIO,or	Decent knowledge of LCA methodology andtransparency in LCA parameters are

	analyse the variations in results		hybrid approach is used) and subjective choices	necessary to make informed decisions
Soust- Verdaguer et al.[18]	Review of BIM-basedLCA of buildings	Literature review of case studies analyzedusing the information flow structure: input, analysis, and solution	The results show the viability to develop methods based on BIM models for organizing building information used for LCA	There is a growing interest in BIM-based LCA of buildings, evenwith the existing methodological challenges
Anand andAmor [19]	Review of the use of LCA in the building industry, reporting the challenges and research opportunities	Literature review ofcase studies	The major research areais the comparison issuesof LCA studies	Both research developments and industrial involvementsare required to integrate LCA into buildings industry
Lee et al. [82]	To develop building integrated LCA model to support building rating systems	Case study	An integrated building LCA model with building rating systemsis proposed	The case analyses confirmed the feasibility of the integration
Zhang et al. [57]	To review LCA and performance of Building-Integrated Photovoltaic (BIPV) systems	Literature review	LCA of BIPV systems confirms their environmental and economic performance	The LCA of typical BIPV systems is still limited
Ingrao et al. [83]	To investigate LCA as a tool to support the design of buildings	Literature review	Life cycle potential impacts of building on occupant's health and behaviour are required	Midpoint and endpoint LCA studies are required for decision- making in practice
Hasik et al. [84]	Review of approaches to merge LCA methods with seismic loss estimation methods	Literature review	Data uncertainty, variability, and randomness are critical parts of the domains	Studies on uncertainty analysis and functional life are required to merge the two domains
Thibodeau et al. [85]	To establish the state ofthe art of building rehabilitation LCA methodology	Literature of case studies	Reference Study Period (RSP) of 50-60 years were used in 75% of the reviewed studies	Definition of functionalunit, and determinationof RSP are challenges
Simonen [86]	Concepts and applicationsof life cycle techniques and environmental impactevaluation in	Case studies; book chapters	Depending on the simplicity/complexity of the analysis, a conclusive/inconclusive	LCA method provides quantifiable metrics to evaluate environmental

	architecture		result may be reached	impacts of buildings
Hauschild et al.[3]	Comprehensive state-of- the-art description of LCA methodology and itsbroad range of applications	Case studies; book chapters	Solutions to attain sustainable development goals require a life cycle perspective/thinking	LCA is a tool that hasthese characteristics

IV. Discussion

LCA of buildings

Based on the findings and further study of the reviewed articles ,the benefits and challenges, as well as trends and opportunities in LCA of whole buildings, can be summarized as follows:

Benefits of LCA of buildings

The benefits of life cycle assessment (LCA) of buildings include:

•LCA provides insights into building materials choices and their environmental impacts, and thus, can be used to evaluate design options [86],

•LCA is required for a building to achieve green building certification (e.g. in LEED v4 and Living Building Challenge) (see [60]),

•LCA can be used to assess the environmental benefits of new building products [3],

•It offers an application to policy formulation for building products e.g. Integrated Product Policy (IPP) of European Union in 2003 [3],

•In policy implementation and evaluation, governments may use LCA as decision support to advice the introduction of novel building technologies in the market [3, 86],

•LCA has the potential to state that a building is environmentally preferable to another [3, 86], and

•Building industries may utilize LCA as a decision support in product and process development, marketing purposes, and in selection of suppliers or subcontractors [3, 86].

Challenges of LCA of buildings

The identified major challenges of life cycle assessment (LCA) of buildings in its use and methodology include the following (not stated in any order):

•The focus of LCA on environmental impacts as a criterion may not be enough for informed decision-making (see [11-12, 63].

•Life cycle inventory and impact assessment phases of a whole building can be data- intensive [18, 64, 73].

•Conventional LCA usually requires weightings to achieve a single score for the environmental impacts. This adds subjective judgements to the results (see [33]).

•Inconsistency in use of functional units create difficulties in results comparison [13, 19].

•The choice building life span and service life used in the analysis varies and may not be reliable [9].

•There is lack of a procedure for choosing relevant system boundaries [19].

•There is a challenge related to uncertainty analysis [3, 19, 86].

•There is a lack of comprehensiveness of indicators within the scope of impact categories resulting from oversimplifications [3, 19].

•Conducting a building LCA demands time and effort [18] and requires expertise to make informed assumptions.

•While the idea of a dynamic LCA can improve LCA results, it will be challenging for building LCA due to the complexity and interplay of building properties and processes [50

Challenge of dynamic building LCA: dynamic LCA is an improvement on traditional (static) LCA to consider time variation of influential factors such as technological progress, and occupancy behavior (linked to building processes), impact characterization factors, and weighting factors (integral with LCA method) [51]. Although dynamic LCA is still at an early emerging stage, few studies have developed framework for its application to buildings (see [117-119]), including an actual application to institutional building [50]. However, limitations in dynamic building LCA include lack of dynamic characterization methods, lack of data availability to consider dynamic variations, lack of spatial availability, and uncertainty of future scenarios [50]. These limitations are issues yet to be fully resolved in traditional (static) LCA. Moreover, dynamic building LCA is still predictive just like static building LCA.

Summary and Conclusions

A review of life cycle assessment of buildings using a systematic approach was conducted to investigate the benefits and key challenges in building LCA. In addition, ongoing work and potential solutions to address the identified key challenges in building LCA were discussed. The methodology included a detailed literature review that involved a systematic selection of review journal articles through search of the databases of Web of Science Core Collection. The limitation of the study is the use of only one database (Web of Science) for the systematic selection of the articles. However, the database was assumed to be large enough to contain the most relevant and important articles in building LCA. The following conclusions can be drawn from the study:

•to increase the usefulness of building LCA for decision-making, a multi-objective assessment including other assessment tools is required,

•BIM-based LCA reduces the time and effort involved in building LCA,

•a more scientific approach is required to eliminate the subjectivity in characterization and valuation during the life cycle impact assessment phase of building LCA,
•the objective of studies in building LCA should be clearly stated in their title/topic to avoid confusion in selection of related articles,
•specifications on building life span and service life for building LCA should be based on the science of the building case study instead of being based on common practice,
•a process modelling notation is required to show procedure and transparency for choice of system boundary for building LCA,
•data quality indicator-based analysis and sensitivity analysis are recommended to solve uncertainty issues in building LCA,
•embodied energy/carbon and exergy indicators can respectively enable trade-off and objective comparisons in building LCA; however, their system boundary and methodology need to be properly defined, and
•Dynamic building LCA is promising to improve the temporal and spatial accuracy of traditional LCA; attempts should also be made to resolve their challenges.

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Assisted irrigation and agricultural practices based on measured moisture contents of farmland soils

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***Abstract*— Productive agriculture has been the prime importance of any nation, which not only is a measure to decide upon the economic status but serves as major energy source for living organisms of the entire globe. Studies on morphological and physical properties of the soils were carried out. The samples of soils extracted and used represents Black cotton soil from the Kodoli village and Laterite soil from the Kale village farm lands of Kolhapur district, in the state of Maharashtra, India. The black cotton soil was more of sandy clay to clay texture where as laterite soil exhibited clayish texture. Regular practiced agriculture pattern in these regions were more of cash crops at high cost of water usage resulting in below potential yield. Farmers need assistance and tested research knowledge to educate them with better agricultural practices.**

The observations and test analysis made on the extracted soil samples indicated the deficit between field capacity and crop water requirements. The field capacity of laterite soil was 35.53 % and that of black cotton soil was 42.63 %. The soil management that must be done is by short term land management by sprinkling irrigation and terracing making.

Keywords*— *Field capacity; Soil moisture;, Agriculture; Irrigation system;

I. Introduction

In any scientific discipline (climatology, hydrology, agronomy, etc) and practical fields (crop management, irrigation, civil engineering, etc), soil water retention and soil hydraulic conductivity are important concern. Determination of these parameters helps to understand the potential of soil and decide upon the agricultural crops, the pattern and irrigation schedule, Hence, avoid loss of time, money and energy of the personnel's engaged in agriculture field.

Innovative and effective practices are being followed by the personal associated with the agricultural domain to ensure effective utilization of the resources mainly the scarce resource the 'Water'. There is always a concern about retain the water sources and recharge it for push forwarding its usage for near long time. The sole responsibility in agricultural field is lonely held by soil system to retain and pass the water as per need and availability.

Soil moisture one of major contributing factor for high crop yields. For the plant, water serves not only as an agent of moisture restoration, but also as a temperature regulator. Owing to hydrological cycle, the plant sheds up to 99% of all water obtained, utilizing only 0.2% to 0.5% for the formation of vegetative mass (Fischer and Turner, 1978). Hence, plants rely on varied moisture content available to them depending on the weather conditions and growth stages.

As a counter part of hydrological cycles, plants do receive a specific amount of water in the form of condensed water vapor, provided favorable climate, topography, type of vegetation, as well as the hydro-geological conditions. The water spread is measured in mm (millimeters): 1 mm of rainfall over a land piece of 1 ha (hectare) corresponds to 10 tons of water [1], [2]. This leads to farmer's key task in maximizing the accumulation, storage, and efficient usage of moisture. Of course, it is always challenging and requires skill and creative practices in the farm lands.

Water contained in soil volume is of prime importance in many agronomic and hydrologic practices. This assists in deciding the type of agriculture and irrigation pattern to be followed to achieve the potential yield. Studies carried out in 1981, implies that soil is a reservoir of water and the ability of soil to store and release water slowly to plant roots is one of the important factors influencing the productivity of land [2]. Taking concern of the scarcity of water resources, studies demonstrated the water relations of plants and their beneficial effects of an adequate supply of soil moisture on plant growth. Similar studies carried out reinstate the knowledge of the soil water content at field capacity (FC) and permanent wilting point (PWP) which is important for irrigation scheduling, assessing plant water requirement and assessing soil suitability for different land uses [3]. Further studies conducted during 1980 provided a framework for estimating FC as a source of information regarding PWP [4]. Knowledge of the soil moisture parameters would assist effective irrigation scheduling, agricultural practices and thereby choosing appropriate crop patterns.

A. Objectives of the study:

1. To determine the field capacity of different farm lands in Kolhapur.
2. To determine water content of different farm lands in Kolhapur.
3. To understand present pattern of agricultural crops followed by farmers.
4. To suggest appropriate crop pattern to farmer for sustainable agriculture
5. To suggest efficient irrigation method to the farmers according to the field capacity

available.

B. Study area

Kolhapur district is the southernmost district of Maharashtra state in India and is renowned for its industrial and agricultural growth. The research was conducted in Kale and Kodoli villages of Panhala tehsil, Kolhapur District. The geographical map representing Kolhapur is as shown in figure 1. Total area of Kale and Kodoli villages are 1355 hectares and 2236 hectares respectively. Average temperature in these regions is 20°- 30° C. Kale Village is located at 16.72° N, 74.05° E. Whereas Kodoli Village is located at 16.87° N, 74.19° Annual average rainfall of Panhala tehsil is 1441 mm.

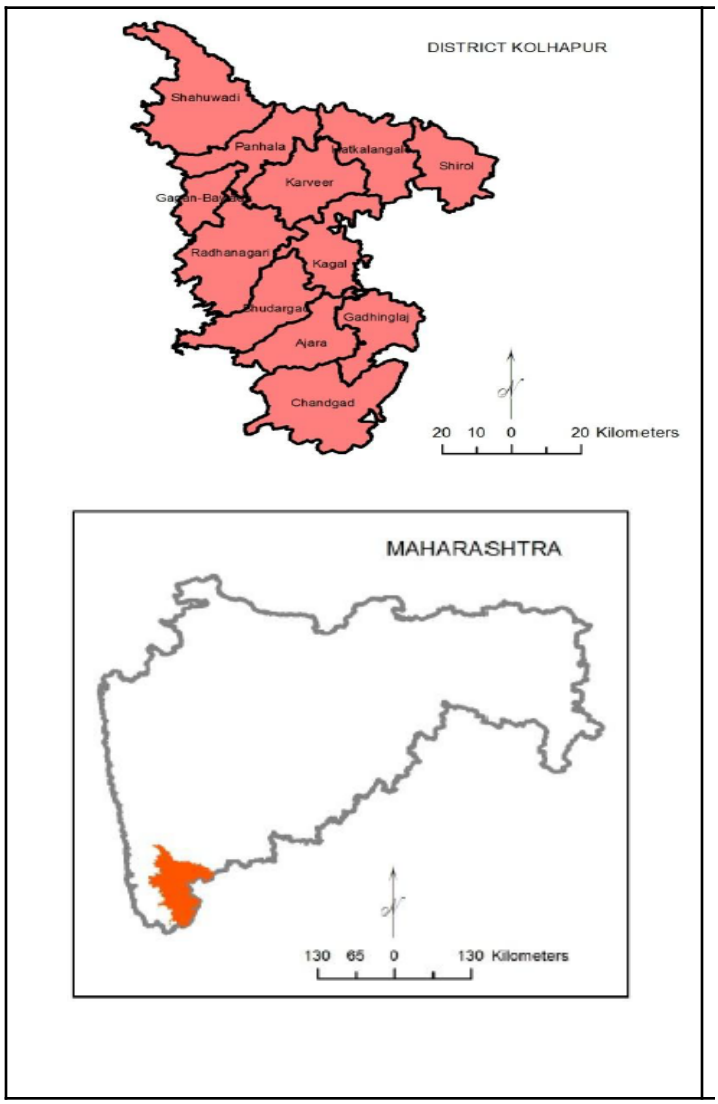

Fig. 1 - Geographical Map of Kolhapur district, Maharashtra state, India.

C. Soil Moisture Associated Parameters

i. *Field Capacity*

The field capacity is the amount of water retained in the soil after complete saturation and after subsequent drainage under gravity. The matric potential at this soil moisture condition is around - 1/10 to – 1/3 bar. Under equilibrium condition, this potential would be exerted on the soil capillaries at the soil surface when the water table is between 3 to about 10 feet below the soil surface, respectively. The larger pores starts draining than smaller pores. Gravity drainage, necessarily be restricted otherwise water escapes to larger depth that roots find difficult to catch hold of. Whereas in clay soils (without macro pores); gravity drainage may take two to three days. [6]

ii. *Available Water Capacity*

The plant roots absorb the water, which retains with until its demand for the further stage of growth, considered to be total available water (holding) of soil system. That means the amount of water available, stored, or released between field capacity and the permanent wilting point water contents. The percentage of total water content available for roots development varies depending upon the soil type and texture. This water moisture is very crucial as it is the only reserved moisture content that plant roots heavily depend upon. This is more conducive to high biomass productivity because they can supply adequate moisture to plants during times when rainfall does not occur. Sandy soils are more prone to drought and will quickly (within a few days) be depleted of their available water especially when evapo-transpiration rates are high. This condition becomes more severe for shallow rooted crops. As these have limited access to the available soil water, and so shallow rooted crops on sandy soils are particularly vulnerable to drought periods [3]. It is advisable to be wise in choosing type of irrigation and schedule. This plays vital role and is generally quite beneficial on soils with low available water capacity [6].

iii. *Drainable Porosity*

The combined aspect of low available water holding capacity and high drainable porosity for sandy soils causes these soils to have a high leaching potential. It will not take much rain or irrigation (or application of liquid manure) to replenish the available soil water and to raise the soil water content to a drainable state. Applying the proper amount (depth) of irrigation to these soils will both conserve water and enhance irrigation and nutrient use efficiency [7]. Soil Texture and Structure

The soil's texture is based on size and percentage of individual soil particles, but when the bulk arrangement of these particles is considered, the term structure is used. The clustering or aggregation of primary soil particles into compound particles of naturally formed peds or separate soil aggregates can greatly modify the textural influence on soil air and moisture relationships. The soil texture and structure fundamentally determines the number and sizes of soil pores, which will influence the fate and transport of air (gas) and water exchange.

v. Soil pH

Soil pH is important because a soil’s acidity or alkalinity determines what plant nutrients are available to plant roots.

Nutrients in the soil—elements such as nitrogen, phosphorus, and potassium—become available to plants when they dissolve in water or soil moisture. Most plant nutrients will not dissolve when the soil is either too acidic or too alkaline [8].

The standard parameters and their indicative values are represented in Table 1 for quick reference to the results analysis.

Table 1 - Standard parameters and their Indicative Values

Sr. No.	Test	Standard value
1	Bulk Density	1.1 to 1.2 gm/cm3
2	Particle Density	2.44 to 2.66 gm/cm3
3	Porosity Black cotton soil	51% - 58%
	Porosity Red soil	36 % - 43%
4	Water Content	25 to 60% depending on soil type
5	Field Capacity	15 to 25% for sandy soil, 35 to 45% for loam soil and 45 to 55% for clay soil
6	Hydraulic Conductivity	2.15 x 10^{-7} m/s

Suggestions for crop choices based on pH of soil are represented in Table 2.

Table 2 - Indicative Values of pH and crop suggestions

Types of soil	Calculated pH	Suitable pH range	Suitable crops and suggested
Black cotton soil	7	5.5 to 7.5	sugarcane, paddy, groundnuts , green peas, tomato, garlic, cauliflower, cucumber
		6 to 7	wheat, soya been, carrot
Red soil	6	4.5 to 6	potato ,sweet potato
		6 to 7	soybean, wheat, watermelon , sugarcane, paddy

D. Methods and Implementation of Research

The method used in this research is direct measurements in field and laboratory analysis. The study includes following stages.

i. Field Survey and Soil Sampling

The location of the study is a located in a land that is not cultivated. In the research area some sample points were taken. Soil samples obtained in the field were mixed composites and analyzed in the laboratory. Soil sampling was done at a depth of 0-30 cm. Soil samples obtained in disturbed form. Soil sampling in the form is disturbed for texture observation, particle density, moisture content and field capacity. Direct observation in the field to observe: infiltration, soil structure, soil color and growing vegetation. Field observation was done on the soil of each sample point sampling in Kale and Kodoli Villages. Parameters observed include Infiltration. The term infiltration refers specifically to entry of water into the soil surface.

ii. Analysis of identified soil hydrological characteristics

a. Water Content: Due to the fact that soils hold water (moisture) is due to their colloidal properties and aggregation qualities. The water is held on the surface of the colloids and other particles and in the pores. This refers to the energy concept in moisture retention relationships. The force with which water is held is also termed as suction.

Water Content=((Weight of moist soil-Weight of dry soil))/(Weight of dry soil)

b.Field Capacity by Pressure Plate Apparatus

Field capacity indicates the superior limit of available water and represents the moisture of the soil after drainage of the water contained in the macro-pores by gravity action. This moisture condition enables higher absorption of water and nutrients by the plants. It is important to maintain and keep enhancing this limit to attain full growth of plants in all the stages. The experimentation carried to determine field capacity by pressure plate apparatus is as shown in Figure 2.

Fig. 2- Field capacity determination by pressure plate apparatus

Permeability Of Soil (By Constant Head-Permeameter Method)

An important soil property in the behavior of the soil flow systems is the conductivity of the soil to the water. Quantitatively the conductivity is the ability of the soil to transmit water. Permeability (K) is defined by Darcy's equation:

$$K = (Q * L)/(A * t * h)\ K = (Q * L)/(A * t * h)$$

(1)

Where,

Q= Volume of water passing in time, t

A= Cross sectional area of the soil sample

h/L= Hydraulic gradient, h is the head of water and L is the length of soil column.

The experimental setup for hydraulic conductivity by constant head method is displayed in figure 3.

Fig. 3 - Experimental setup for Hydraulic Conductivity by constant head method

***c.** Bulk Density (By Clod Method)*

Soil bulk density is defined as the oven dry weight of soil per unit of its bulk volume. The bulk volume includes the volume of the soil particles and the pore space. It is determined by clod coating method, pit method and from gravimetric moisture content at crack initiation stage in the field. It is expressed similar to particle density as Mg/m³. The Figure 4 shows the testing procedures.

Fig. 4 - Bulk density experimentation

e. Particle Density (By Pycnometer Method)

The mass per unit volume of the soil particles in technical work usually expressed as metric tons per cubic meter or mega gram per cubic meter (Mg/m³). A given amount of dry soil when immersed in a definite volume of water expels air and results in the displacement of equal volume of water. The volume of soil particles is determined by measuring the volume of water displaced in pycnometer bottle. The samples prepared for testing is shown in figure 5.

Fig..5 - Particle density experimentation (by pycnometer method)

f. Porosity

Total porosity is defined as the ratio of the volume of the pores to the soil bulk volume i.e. the volume of the so bowls plus voids. It is calculated from the formula given Below:

$$\text{Porosity of soil} = 1 - \frac{Db}{Dp}$$

Where:

Db = Bulk density Dp = Particle density

E. Test Observations

i. Observations for Black Cotton soil samplesWeight of thread =0.35gm
Weight of thread + clod =20.72 gm
Weight of clod =20.72-0.35 = 20.37gm
Weight of thread+ clod+ wax in air =22.91gm
Weight of wax in air = 2.19gm
Vol. of water displaced by coated clod,(V1) =12 mlVol. of wax= weight of wax = 0.91
Water content of soil = 12.15

Volume of dry clod (V1-V2) = 13.6cm³

ii. Observation for Laterite soil samples
Name of the soil sample= Laterite soil
Weight of thread = 0.35 gm
Weight of thread + clod = 21.32 gm
Weight of clod = 21.32- 0.35 = 20.97 gm
Weight of thread+ clod+ wax in air = 25.45 gm
Weight of wax in air = 4.13 gm
Vol. of water displaced by coated clod, (V1) = 18 ml
Vol. of wax= weight of wax / 0.91 = 4.53 cm³
Water content of soil- 16.16%

Volume of dry clod (V1-V2) = 13.87 cm³

II. Results and Discussions

Based on the tests conducted on soil samples, several parameters were measured. The obtained results were gauged against the standard values and subsequently based on their indications the discussion on agriculture practices such as irrigation scheduling, selections of crops are made in this section.

Bulk density results for black cotton soil and red soil were 1.46 gm/cm^3 and 1.58gm/cm^3 respectively and the standard value is 1.1 to 1.2 gm/cm^3. Particle density black cotton soil and red soil has the 2.41 gm/cm^3 and 2.55 gm/cm^3 respectively and the standard value is 2.44 to 2.66 gm/cm^3 respectively. Water content observed for black cotton soil and red soil has the 16.16% and 12.15% respectively. Field capacity determined from the observations for black cotton soil and red soil revealed 42.63% and 35.53% respectively. Hydraulic conductivity results obtained for black cotton soil and red soil has 9.47x10^{-4} m/s and 8.61x10^{-7} m/s respectively.

A. Measured parameters and their inferences

i. Determination of moisture content of soil.

For most of the soil types, the water content serves as very important index for understanding the soil pattern. The consistencies of a fine-grained soil largely depend on its water content. There are six samples used for determining moisture content of soil types consisting of black cotton and laterite. The observations are tabulated in table 3.

Table 3 - Measured parameters of six samples for moisture content of soil

Sr. No.	Observation	M1	M2	M3	M4	M5	M6
1.	Mass of can with bowl. W1	7.60	7.19	6.75	6.68	6.60	6.28
2.	Mass of can with bowl + Wet soil .W2	27.66	27.02	27.06	22.70	23.16	23.75
3.	Mass of can with bowl + Dry soil.W3	24.61	24.08	24.19	19.64	19.94	20.34
4.	Mass of water Ww	3.05	2.94	2.87	3.04	3.22	3.41

	= W2 – W3						
5.	Mass of Dry sample Ws = W3 – W1.	17.01	16.89	17.44	12.96	13.34	14.06
6.	Moisture content W = Ww/Ws x100 (%)	17.93	17.40	16.15	23.45	24.13	24.23

Inference (i) Average water content for Black cotton soil W(%) = 16.16 %

(ii) Average water content for Laterite soil W (%) = 12.15 %

ii. Determination of field capacity by pressure plate apparatus

Field capacity is an important parameter for determine soil moisture availability which can suggest for irrigation scheduling, assessing plant water requirement and assessing soil suitability for different land uses. Field capacity determined by pressure plate apparatus is as shown in Table 4.

Tab. 4 - Results for field capacity

Soil Type	Field Capacity
1.Black cotton soil	42.91%
2.Lateite soil	35.53%

iii. Determination of hydraulic conductivity of soil by constant head method

Hydraulic conductivity is an essential parameter in environmental engineering, in estimation of velocity of flow of water in soils. This parameter indicates amount of soil moisture available to plant roots at various depths. Results of hydraulic conductivity is as listed in Table 5.

Table. 5 - Results for hydraulic conductivity

Soil Type	Hydraulic conductivity
Black cotton soil	9.47×10^{-4} m/s
Laterite soil	8.61x10-7 m/s

iv. *Determination of Bulk Density (By Clod Method)*

Bulk density is not considered to be an intrinsic soil property but depends on external conditions, with changes associated with a variety of factors. The measured parameters for determination of average bulk density are tabulated in Table 6.

Tab. 6: Measured parameters for determination of average bulk density.

Sample No.	Bulk Density	Average Bulk density
Black soil		
Sample 1	1.49 gm/cm^3	1.46 gm/cm^3
Sample 2	1.60 gm/cm^3	
Sample 3	1.29 gm/cm^3	
Red soil		
Sample 1	1.51 gm/cm^3	1.58 gm/cm^3
Sample 2	1.98 gm/cm^3	
Sample 3	1.33 gm/cm3	

v. Determination of Particle Density of Soil (By Pycnometer Method)

Particle density is a fundamental soil physical parameter that represents the density of the solid soil particles (mineral and organic) and is expressed as the ratio of the mass to the volume of the solid. The estimated parameters for determination of average particle density is shown in table 7.

Table 7: Estimated parameters for determination of average particle density

Sample No.	Particle Density	Average Particle Density
Black soil		
Sample 1	2.48 g/cm³	2.41 g/cm³
Sample 2	2.56 g/cm³	
Sample 3	2.19 g/cm³	
Red soil		
Sample 1	2.33 g/cm³	2.55 g/cm³
Sample 2	2.60 g/cm³	
Sample 3	2.72 g/cm³	

vi. Determination of Porosity of soil

Restricting the drainage rate, will avoid erosion and hence, crop production increases in a compacted soil. Soil porosity helps to understand and analyse the soil compaction. This will assist in agriculture by optimising soil and water relations and suggest farmers in deciding irrigation schedule. The measured parameters for determination of porosity are tabulated in Table 8.

Table 8 - Measured parameters for determination of porosity

Sample No.	Porosity	Average Porosity
Black soil		
Sample 1	39.91 %	39.5 %
Sample 2	37.50 %	
Sample 3	41.09 %	
Red soil		
Sample 1	35.19 %	37.63 %
Sample 2	23.84 %	
Sample 3	53.87 %	

vii. Determination of pH of soil

Color of pH paper change to light green for Black cotton soil and light orange color for Laterite soil.

Result –

1. pH value of Black cotton soil = C1= 7
2. pH value of lateritic soil = C2 = 6

B. Summary of Experimental Results

The summary of the results is tabulated in Table 9.

Table 9 - Summary of results of determined parameters

Properties	Black cotton soil	Red soil
Bulk density	1.46 gm/cm^{3}	1.58 gm/cm^{3}
Particle density	2.41 gm/cm^{3}	2.55 gm/cm^{3}
Porosity	39.5 %	37.63 %
Water content	16.16%	12.15%
Field capacity	42.63%	35.53%
Hydraulic Conductivity	9.47x10^{-4}m/s	8.61x10^{-7}m/s

C. Summary Of Experimental Results

i. Red soil

a. Paddy:

Climate:

Cultivated in sub tropical & Temperature Region.
Requires hot and Humid climate.
Rainfall requirement 900-1300 mm layer.
Tolerates heavy rainfall and standing water.
Soil:
Clayey soil and high organic matter is Ideal for Rice cultivation.
Irrigation: Rice is semi aquatic plant and requires abundant supply of water.

Irrigation should be given at critical growth
Stages:-
-Tillering stages

-Internode Elongation stage

-Boot leaf stage

-Flowering stage.

Flowering stage-irrigation is must

In Transplanted Paddy: Water is allowed to stand in field at depth of 2.5cm.

ii. Black Cotton Soil

i. *Sugarcane*–

Climate –

Sugarcane is tropical crop , it requires warm and humid climate for growth while cool and dry climate ripening.
Temperature requires 20 – 30°c. Rainfall when grown – 1375mm annual.Soil -
Sugarcane can be grown in wide range of soil

Sugarcane can grown in well drained fertile medium to heavy soil
Black soil is good because water holding capacity is good
Irrigation required -
10-12 days

Condition and stage of condition

3. Turmeric–
Irrigation –
20-25 times irrigation is required throughout the crop period.
Light irrigation is required before and after the planting
Second light irrigation 3 to 4 days after planting.
After that it is given 8-10 days interval.

4. Ginger –

First irrigation immediately after planting two are given 10 days interval.
Throughout the crop period ginger requires 16-18 irrigation.
Water stagnation condition should be avoided as it leads to rottening of development rhizomes.
5. Wheat-

Irrigation interval is 8-12 days.

III. Conclusion

The field capacity of Kale and Kodoli soil samples by pressure plate apparatus experiment are 35.53% and 42.91% respectively. For given ranges of field capacity the appropriate crop suggestion is done along with the irrigation scheduling. The current crop pattern or the most of the cultivated area is under Sugarcane in Kale and Kodolli, though the field capacity of kale is lesser the sugarcane crop pattern has been adopted by the farmers. The average rainfall intensity in kale is 1441 mm so the most suitable crops are of short durations like paddy, soybean.

A wetting soil and drying soil hold different amounts of water. A soil that is saturated and then dries has a higher FC than a soil that is being wetted. A water content percentage present in soil mass affects the crop yield as well as the productivity of soil. An average water content for Kodoli soil sample is 16.16% and that of for kale soil sample is 12.15%.

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Talaos as public spaces for the neighborhood: Case of Gopi Talao, Surat

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***Abstract*—** Ancient towns & cities have developed around water bodies since the river valley civilizations of the world. Some were gifted with a natural water body; others have built water tanks to ensure water supply to the urban population.

Water bodies have always been the center of social interaction with numerous daily activities being carried out on its banks. They become an integral part of the social fabric of the urban settlement. The talaos were active in the social fabric due to the need of the people to come there to fetch or use water for various activities. Most of the water bodies are still actively supplying water. Due to the mechanical water supply through pipelines, today the active interaction on the banks of these water bodies has been eliminated making these spaces a haven for undesirable elements. The paper tries to understand the parameters of analysis for such talaos as public spaces. The paper also aspires to create a strategy of redevelopment through case studies and analysis for other ancient water bodies.

Keywords—talaos, social spaces, water bodies, social fabric, ancient, urban settlements

I. INTRODUCTION

Talaos are defined as a pond, lake, puddle or a reservoir of water. Talaos are natural or man-made water bodies which were used to supply water to the human settlements around them or within ancient walled cities. They are not just water bodies that facilitate water supply but are also an integral part of the social fabric of the settlement.

Today due to pipelines reaching every household for water supply, the activities around the periphery of these water bodies have undergone transformation. They are attracting undesirable elements from society, such as squatters, informal tenements, etc. These create a negative impact on the water body itself, such as contamination of the water due to unauthorized use to drain waste water and few others elaborated further in the paper. To ensure safety many times these talaos are walled creating an impermeable edge and eliminating the presence of the water body from the vision of the people. An urban intervention is required to ensure safety of the periphery of the water bodies & elimination of undesirable elements from its edge.

Indian cities today, due to exponential development have become deficient in open public spaces these talaos have the potential to become these centers of social interaction which is becoming missing with further densification of the city fabric. Talao can be optimally utilized by initiating development along its periphery to facilitate social interaction & simultaneously ensure maintenance of sanitary conditions around the water body.

II. METHODOLOGY

The paper through data collection & analysis tried to identify the parameters of study. It uses case studies as a methodology to identify issues, analyses inferences to create strategy to implement guidelines of development for similar urban Water bodies as a potential public space within the city.

III. PARAMETERS OF STUDY

The parameters of the study are essential to the outcome of the paper. Each Talao will have its unique characteristics, in order to be able to compare them in the analysis it is essential to set the parameters of the study before the commencement of the analysis. The parameters of the study are as follows:

- Existing land use
- Issues around the edge

- Outcomes of the redevelopment

Future strategies to overcome the negative impacts of the redevelopment

IV. CASE STUDY

PURPOSE OF DEVELOPMENT

The Gopi Talav had lost its existence & identity so the main concern was to give an identity to itself. In 2012, the Gopi Talav was renovated by Surat Municipal Corporation and the area surrounding it was redeveloped as a recreational facility. A water body of 3.30 ha Step well, conservation Theme parks, Public plaza, jogging track, Open –air theatre, Viewing deck, jetty, food court, Water sport facility, Boating, Central feature – aeration fountain.

INTRODUCTION

Gopi talav is a lake in the gopipura locality in the city of Surat in Gujarat state of India. It was built in circa 1510 ce by Malik gopi, who was an affluent merchant and governor of Surat during the Mughal empire. In 2012, the lake was renovated by Surat municipal corporation and the area surrounding it was redeveloped as a recreational facility. The lake was renovated by Surat municipal corporation and the area surrounding it was redeveloped as a recreational facility.

In Surat, gopi-talao is a heritage water body. It was constructed by malek gopi. Its main purpose was to provide water supply to Surat city, but the pond has dried out & is filled only during rainy days. In the other duration, the bed is used as a playground. Gopi-talav has the only step-well in this area having steps to go down from all four sides availing groundwater. History suggests that centuries ago, “gopi-talav” was among renowned objects having worldwide attention.

LOCATION MAP

Image 1: Location Map

DESIGNER- Ar. Vishal Shah

YEAR OF THE COMMENCEMENT AND COMPLETION- YEAR: 2016 (COMPLETED)

COST OF PROJECT- 22 crore (US$3.4 million).

AREA OR SCALE OF PROJECT INITIATED – AREA: 9 HA (90,000 SQ M) (970,000 sq ft)

212 meters (696 ft) diameter lake covered almost 35,000 square meters (380,000 sq ft) of area.

Chief designer, Urban initiatives for Gopi talav, Architect Vishal shah said, *"the people of Surat, especially residents of walled city, will benefit from this project. It will establish this area as a must visit tourist spot. The introduction of a large water body and open space combining an area of 10 hectares will recharge the groundwater table and greatly affect the microclimate of the place."*

BACKGROUND AND CONTEXT OF PROJECT

HISTORY

Malik gopi, a Brahmin merchant, settled in Surat and the development of the city has been attributed to his contributions. The area he developed was called gopipura, in his honor and the king of Gujarat gave him the title of "malik". The king disliking the Hindu inclination of the name altered it to "Surat" (meaning headings of the chapters of the Quran gopi also finds mentions in Portuguese literature as "lord of Surat and Bharuch"

RENOVATION AND REDEVELOPMENT

Around 90,000 square meters (970,000 sq ft) of land was renovated, where the 212 meters (696 ft) diameter lake covered almost 35,000 square meters (380,000 sq ft) of area.

The lake can hold 120,000,000 liters (26,000,000 imp gal; 32,000,000 US gal) of water.

The renovated surroundings include Amphitheatre and fountain plaza.

The area has been divided into seven zones; the diamond zone, food zone, environment zone, history zone, communal harmony zone, textile zone and Surat nu Jaman.

Water to the lake will be piped from the Tapi river on whose banks the city lies.

After remaining a dumping ground for several years the lake was surrounded by slums spread on around 2 lakh sq mt area. Redevelopment of the lake and bringing it back to its lost glory took around seven years. After planned efforts, SMC succeeded in relocating a large portion of the slums between 2008 and 2014.

The lake has a diameter of 212 meters with an average depth of four meters. When completely filled it could accommodate 141 MLD (million liter per day) of water.

The redeveloped lake attracts nearly 800 visitors on normal days while during holidays and festivals more than 10,000 people visit it daily.

CONCEPTUALISATION AND INITIAL THOUGHTS

PROJECT DESCRIPTION

The lake lost its importance due to neglect in the 19th and 20th century and became a health and social menace in the coming times. Gopi talao is located in the walled city of Surat, the walled city area of Surat city is one of the densest urban areas with an average density of five hundred to eight hundred persons per hectare. In the middle of the city, between the inner ring road and the outer ring road, a large open land was accessed by people and became a place for antisocial activities.

Historically and environmentally important public places. The project site is located in the heart of the old city (previous walled city) of Surat measuring 10.0 hectare (1, 00,000 sq.mt.)

PROJECT SIGNIFICANCE

Gopi talao was directly connected to the makkai (mecca) creek; the creek named after the place from where the Muslim pilgrims boarded for the holy city of mecca. The project redefines the role of gopi talao in the historic water management system by becoming an important part of the storm water network.

The project is a very significant public place (the biggest in the city of Surat) and it is going to benefit the old city area immediately and also the greater city of Surat with a population of 5 million people. The project of rejuvenation of gopi talao as lake and creating an inclusive public place for the people of old city of Surat is helping in Improving the living conditions of the people in the immediate surroundings as well as making the old area more and more desirable for the people to reside, this project has given back the people discouraged outward migration in the newer areas of Surat thus retaining the essence of the old city of Surat. By creation of this state of the art public place the neighborhood and the old city at large is provided with an essential recreational space. The project is a torch bearer in the Indian context and is seen as a catalyst for renewal of the mediaeval towns

SALIENT FEATURES

1. Central feature as a water body of 33.0 ha. With facilities for boating.

2. Peripheral submersible area of 36.5 ha. Developed in seven distinct theme zones with special attention towards landscaping.

3. Division of zones demarcated through steps leading to water and viewing platforms.

4.promenade surrounding the waterbody as a major feature of the design providing opportunity for travelling through all the zones and acting as jogging track.

5. Internal ring road as a major approach to the site with parking facilities and peripheral walkway.

6. Special features such as the ancient vav, amphitheater and food court acting as important pause points in the journey.

7. Landscape based on the theme of the zones depicting the specialties of Surat and various facets of the lifestyle of 'surtis'.

MASTERPLAN AND VISION

Real challenge for urban local bodies through developers, architects, and professionals is to protect and preserve the built heritage. Most difficult task ahead is to conserve the local traditional and cultural values of communities for future generations to appreciate. This paper discusses a case for the renewal & restoration of historical Gopi-talao, Surat that is accomplished by Surat Municipal Corporation and on the verge of completion. This study comprehends the past, and present conditions and development undertaken for restoration and redevelopment. Further, the administrators of the city have planned for a grade separated road along the partial periphery of Gopi-talav that will add to the beautification feature of the lake.

Image 2: Gopi Talav Masterplan

AREA STATEMENT (as per the survey)

Total site area: 82,962.8 sq.mt.

(open area) water body area: 33,494.0 sq.mt.

Internal road (60'0"): 762.33 r.mt.

Submersible development: 36,517.0 sq.mt.

Image 3: Location of Gopi Talao (Ancient map) & Development around.

ZONES AREA

1. History zone : 3588.0 sq.mt
2. Environmental zone : 5048.0 sq.mt.
3. Diamond zone : 4184.0 sq.mt.
4. Surat nu Jaman zone : 4577.0 sq.mt.
5. Future zone : 9418.0 sq.mt.
6. Textile zone : 4404.0 sq.mt.

7. Communal harmony zone: 4888.0 sq.mt.\

Image 4: Gopi Talav Masterplan

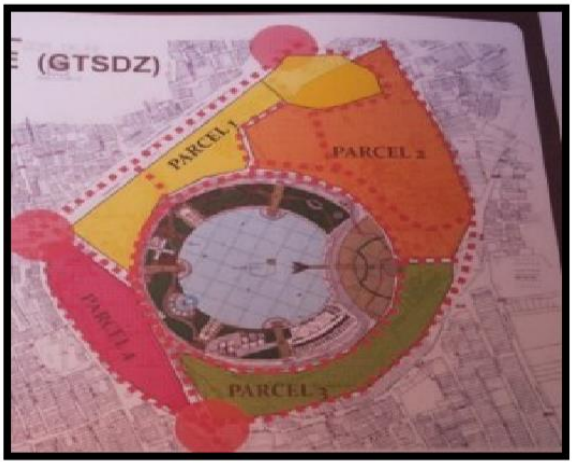


Image 5: Divided Parcel of land

WALLED CITY & GOPI-TALAO

Having various features like,

• strategic location: it is a place which will give the better indicator for development because it is in the central area of commercial activity.

• sources of water storage: it was the prime source of water storage & storm water management point in ancient time.

• topographical condition: it is a low lying area that leads to water logging problems in that field.

• significant recreational activity: it has recreational activity like boating & places of attraction like gardens, mango orchards.

• Socio-cultural importance: The main reason for the construction of Gopi-talao was economic to cultural development.

PRESENT DEVELOPMENT

The development of Gopi-talav area has reached up to a stage where the realization of the project has triggered many positive changes in the development scenario of the old city of Surat. Main four features of Redevelopment:

•Redevelopment of Gopi-talao as a lake

•Restoration of the heritage vav, development of play area & fountains

•Development of a snow park, IMAX & other allied entertainment activities as a part of Gopi-talao area redevelopment

•Development of a newly acquired land parcel on Kotsafil road A. Gopi-talao Special Development Zone (GTSDZ) For practical implementation of the project, it is proposed to divide the entire SDZ into parcels.

Parcel 1: Commercial Development

Parcel 2: Slum Rehabilitation – Site & service scheme Parcel

3: Graveyard development Parcel

4: Informal & Formal market redevelopment with parking Total area of Gopi-talao is approximately ten hectares with several zones in the below table with its area.

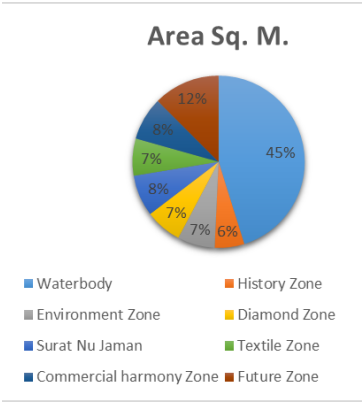
DESIGN DETAILS & PHASING (PLANNING)

SMC is carrying out the redevelopment in 3 phases:

PHASE-1: work completed in this stage is 3 nos. Of platform, two no. Of Ghats, open amphitheater, viewing jetty with approximately 6 crores.

PHASE-2: work completed in this stage is inner, outer & d. P. Roadside compound wall, c.c road development cost of about 3.40 crore.

PHASE-3: development of different types of zone (approximately cost of 10 crore).



Other developments development of snow park, i-max, laser show & other entertainment activities in Gopi talao area as ppp arrangement with following vision:

Taking the project of Gopi-talao lake development to the next level so as to make it the ultimate tourist destination for the locals & the visitors to Surat.

Initiating the latest activities for entertainment so as to have the world class experience of recreation in the city.

Giving guidelines to develop ppp model to suit the vision

Providing such types of entertainment activities so that all age-group & income group people can get involved.

Generating a financially viable model for SMC to generate revenue to maintain other facilities at Gopi-talav. Other activities planned at Gopi-talav are speed & paddle boating, balloon riding, water zorbing, trampoline, tramping, mechanical bull and indoor play zone.

COMPOUND WALL

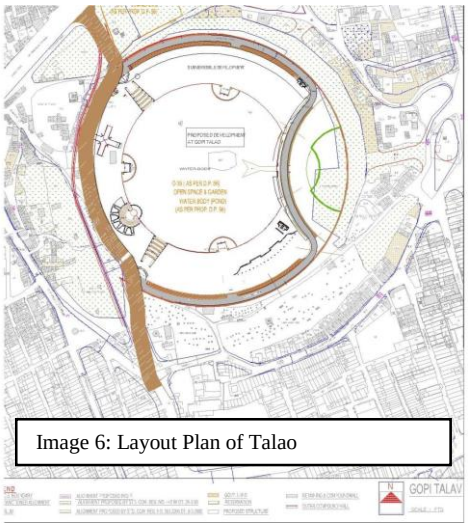


Image 6: Layout Plan of Talao

Image 7: Current Scenario

Image 8: Main entrance Gate

Image 9: Jetty View

Image 10: View from beside the wall around talao

Image 11: View of Surrounding

CONCLUDING REMARK

 This project develops a unique activity plaza for the people of the immediate surrounding & the city at large.

 it creates an identity & opportunity for the city & will trigger the regeneration of the surrounding & subsequently the entire old town.

 This project will also motivate other cities to restore their built heritage & to maintain their cultural values.

V. INFERENCES

The Gopi talao was developed as the source of water to the walled city. Due to the pipelines today the edge was contaminated, to overcome this issue the talao was redeveloped

The redevelopment was done by cleaning the water body and creating green spaces around it. During this redevelopment to ensure that the area remains clean there was a wall created at the edge. This wall has completely cut off the waterbody from its surroundings. Though the redevelopment initiative was essential the outcome has cut off the waterbody from the settlement.

VI. STRATEGY

The talao needs to become part of the city again, at the same time the contamination of water is a serious issue which needs to be resolved.

The following are the issues and the probable strategies to create this talao into a much needed public amenity space for the city.

Overcome the issue of water contamination through adequate measures such as creating landscape buffers etc.

The wall needs to be removed so that the talao becomes a visible landmark of the city and the locality.

The human settlements should get adequate sanitation facilities to ensure cleanliness of the edge of the talao once its wall is removed.

There are several such talaos around the country in various cities. This could be a benchmark to create a strategy for the redevelopment of similar waterbodies.

Issue	Strategy
No Specific Land Use Classification Under The Public Amenity Category	The talaos should be identified as a public amenity space under the Development plan of the region.
Talaos need to be redeveloped with time due to dilapidation nature of its construction	The redevelopment of the talao should not allow the same to be disconnected from the public by any structural feature such as embankment, walls etc.
The edge of the water is susceptible to contamination due to the activities on the edge of the Talao.	The activities around the talao should be such that the edge of the water is protected from contamination through adequate interventions such as landscape buffers etc.
The organic growth of the human settlements around the talao generate undesirable activities around the edge such as garbage accumulation, defecation etc.	The human settlements need to be rehabilitated with adequate sanitation facilities around the periphery such that their undesirable activities cannot take place

THE FOLLOWING STRATEGIES ARE GRAPHICALLY REPRESENTED BELOW THROUGH SECTIONS & DIAGRAMS

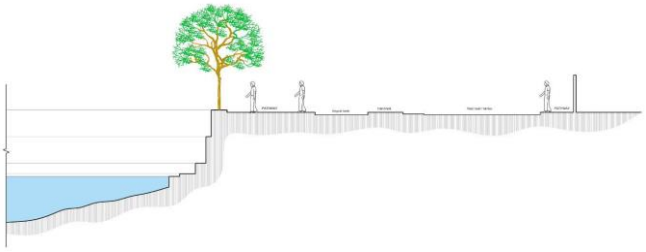


Image 12: Section through pedestrian way

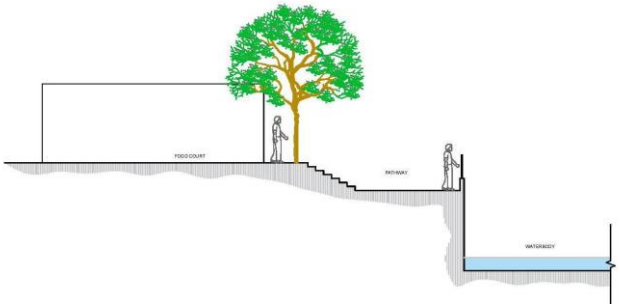


Image 13: Section through Food court

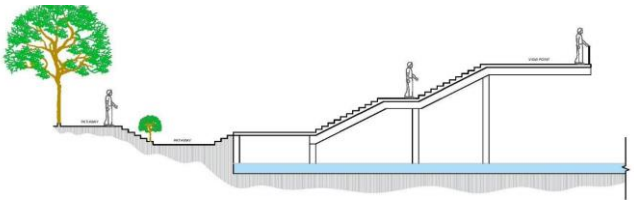
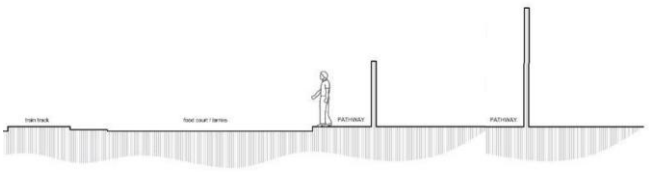


Image 14: Section through viewpoint deck



Section through External Tall wall

Image 15: Section through external tall compound wall

Image 16: Gopitalao Views

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Decay and conservation of stone in heritage structures

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Abstract:

Natural stone is a fine example of a building material presenting the different stages of development of society. It clearly shows the relationship between materials, technology and Architecture. The primogenital integral Architectural compositions, which followed the laws of architectonics, were megalith structures as dolmens and 'Menhirs'. Vulnerability of stone in tension became deterrent for complicated type of structures. Material visibly has strength in compression and weakness in tension for long span structures. The characterization of stone materials is not only essential for predicting their durability and behavior in service, but also helpful for selecting the most compatible and performing restoration strategy. Knowledge regarding the nature, properties, and decay of stone materials is a key step to identify the remedial needs and plan for appropriate conservation actions. On the other hand, several approaches and a wide range of products have been designed to avoid, or at least reduce, stone decay.

The deterioration of stone is all too familiar to anyone who has looked closely at a historic stone building or monument. While there are a few stones that seem little affected by centuries of exposure to the weather, this will not matter much if the affected stone is a part of a massive wall. A high proportion of the world's cultural heritage is built of stone, and it is slowly but inexorably disappearing. If we are to do anything to reduce or prevent this loss of our heritage, we must first be able to characterize the many stones involved. We need to be able to describe the decay and to measure its extent, severity and rate. We then need to understand the causes and mechanisms of decay. Only then can we hope to understand the behavior of any particular stone in a given environment.

The problem of conserving Architectural Heritage is not simple. To prolong the life of a structure there needs to be a proper understanding regarding the mechanism of decay, deterioration and conservation. The conservation of cultural heritage constitutes of different disciplines that include co-ordination of aesthetic, historic, scientific and technological methods.

Architectural works demand the treatment in open and uncontrollable environment. Conservationists need to study the effects of time and weather on the stone. Because of the size and complexity of Architectural conservation, contractors, technicians and the craftsmen need to perform various functions together hence a proper co-ordination is required between the teams.

Key Words: *Decay, conservation, consolidation, Architectural heritage.*

Stone Architecture: Ghats, temples and palaces

1.0 Elements of stone structures-

1) **Arches and domes-**Hindu methods of dome construction were categorized roughly into two parts. One was construction of ribbed domes, which was categorized from bamboo construction of dwellings where bamboo canes were tied at vertex and a horizontal member added at the base. 'Corbelled domes' were constructed by placing stone slabs one over the other. The outline of these domes was usually conical, a typical feature of temple 'Shikhara'.

Corbelled arch was frequently used over wide openings. Stones were arranged in courses with the end stones projecting out to support the stones above .The courses could be piled up till the width of corbelling approached thickness of wall. North Indian temples especially reflect the usage of corbellings over their square plans of 'Garbhagriha' and 'Mukhashala'. Centering was required for construction of vaulting and cross vaulting. Jain Sculptures used low-corbelled domes supported over well-designed pillars.

After Muslim invasion new ways of dome construction were introduced. Construction of pointed arch was introduced as well as the shape of the dome transformed into ogee rather than tapering became Ogee.

Coved ceilings and flat ceilings form two significant ways to cover ceilings in palaces. They were constructed on square rooms. The ribs formed the basic framework and stone panels were filled in between. To make the construction strong at the base these ribs are not only secure in masonry but also tied together by iron cramps.

Arches and domes: Significant part of the stone construction

2) Stalactites-These formed an important external feature in treatment of external facades of palaces, temples, mosques and other buildings. Pendentives are a part of architectural ornamentation. It resembles the

geological formations called stalactite. It is one of the prominent characteristics of Islamic architecture and ornamentation. It consists of a succession of little niches. They are bracketed out one above the other, or they project in prismatic forms in rows and tiers, which are connected at their upper ends by miniature squinch. In 14th and 15th century they became regular features for decoration for door heads, niches, and the bracketing under cornices and minaret galleries.

Stalactites as a decorative part of different stone structures.

3) Rock Cut Architecture-Instruments at pick axe, mallets and pointed chisels were used for digging the caves.

2.0 Causes **of stone decay:**

There are several factors involved in a stone decay. Some causes are gradual and over years while others are sudden. The main causes can be enlisted as earthquake, fire, flood, terrorism, vandalism, neglect, tourism, previous treatments, wind, rain, frost, temperature fluctuations, chemical attack, salt growth, pollution, bio deterioration, intrinsic factors, and so on. There is an increasing emphasis on doing something not only to the stone itself but also to the environment in which the stone is found.

i) Air pollution–Is considered to be a major reason for stone decay. Acid rains cause the stones to dissolve. Limestone, marble, lime mortars, and carbonate-cemented sandstones are the most vulnerable to acidic pollution. Sulfur oxides, nitrogen oxides, and carbon dioxide as per many researchers are main culprits in stone decays.

ii) Salts - Soluble salts are one of the most important causes of stone decay. Salts cause damage to stone in several ways. The growth of salt crystals within the pores of a stone, generate stresses in the stone structure. They are sufficient to overcome the tensile strength of the stone and turn it to a powder. It is a cause to deterioration of world's greatest monuments.

iii) Bio deterioration -Many organisms contribute to the deterioration of stone, and it is necessary to find the right balance between appearance and longevity. Organic growths on stone are both a blessing and curse. Vegetation such as lichens and creepers, ivy, can make the monument look ancient and romantic. Their removal can leave the stone looking plain and stark. Latest research has been focused on lichens, algae and bacteria. The effects are on both levels-chemical and physical.

iv) Shear stress-The general idea is that treatments, salts, water films, or biofilms—anything that causes the stone surface to react differently than the interior—can result in a shear stress, crack propagation, and, eventually, surface parallel detachment. Salts naturally tend to accumulate near the stone surface, setting up differences in how the two parts of the stone (surface and interior) react to environmental changes.

v) Intrinsic Problems-These problems occur due to individual characteristics of the stones.

Substantial recent research has found that differential expansion of calcite enhanced by moisture, microstructure, and differential residual strains in the marble is the main cause of these problematic and still somewhat mysterious phenomena.

3.0 Preventive, Active and Remedial conservation:

Preservation: Preservation includes both temporary and provisional measures to protect or stabilize the place. The long-term actions can help to retard deterioration or avoid damage.

Preventing damage can look into a very wide range of topics such as pollution control, traffic control and legislation to protect individual buildings and monuments, control of groundwater, visitor management and disaster planning.

Active Preservation: This action makes it possible to continue or make compatible, the contemporary use of a historic place or a monument, through alterating, repairing or adding in it while protecting its heritage value.

3. **Cleaning:** Cleaning is a necessary action in the conservation of stones exposed to the environment or soluble incrustations, soot particles present in polluted environments and sulphur- dioxide oxidations catalysts, microorganisms, parasitic vegetation, bird or animal droppings and prepares it for the application of a consolidant or a protective agent.

1) Laser Cleaning-Using lasers to clean stone is now routine, and large-scale commercial application of laser cleaning has become more common over the past fifteen years.

2) Latex Poultice Method- The development of one innovative response to this challenge over the past fifteen years is of the latex poultice method; it is known popularly as ‘Arte Mundit’. It was originally developed as an improvement to the ‘Mora poultice’ (a spray-on film containing EDTA (ethylene diamine tetra acetic acid) and other additives). It is adapted and applied to a wide range of sites.

3) Biological cleaning-Some of the researchers experimented on use of microorganisms in cleaning.

4) **Targeting the dirt-**Researchers have focused on removal of dirt on the surface of the stones through various methods as using of dilute hydrochloric acid or potassium carbonate to dissolve the layer of calcium sulphate on the surface of stone.

2.Consolidation: Consolidation aims at improving the cohesion of mineral constituents and the mechanical characteristics of the stone. It also aims to achieve the adhesion between the deteriorated and unaltered parts. Consolidation cannot be successful if there are major faults in the building causing deterioration in the masonry. If stone consolidation is to be successful, deep penetration is necessary.

The penetration should be deep enough to connect solidly all disjointed material to the sound core of the stone, and full impregnation is necessary where there is no comprehensive core. The consolidation of stone can be obtained with inorganic and organic products. The majority of products that have been tried, as stone consolidants have been organic polymers

(Organ silicones), but there are also inorganic products as calcium hydroxide and barium hydroxide. Organic products are stone consolidants and water repellents that present different properties: elastic, adhesive, low penetration ability, pores of treated stone are not fully closed, so internal water can exit.

n may be necessary to restore some strength, and to make the stone at least as

strong as it was originally, so it might resist further decay. One just has to find something that will

penetrate the altered stone, the properties that a consolidant must have: to improve cohesion and
adhesion of the constituents, to improve pore structure and to diminish water accessibility.
Consolidants are usually applied to the surface of the stone by brush, spray, pipette, or by
immersion, and are drawn into the stone by capillarity.
In situations where soluble salts are a major agent of decay, it makes sense to try to remove the
salts (desalination). Desalination of masonry is usually attempted through the use of poultices [6,11,
13, 14]. A wet poultice (bentonite, sepiolite, paper pulp or cellulose) is applied and after drying the
poultice peels off spontaneously and extracts the salts. There are other methods of desalination:
laser (removal of gypsum black crusts), sprays (solubilization of crystalline salts) and additives may
include EDTA (the calcium from gypsum may be removed but also from calcite).
Protection, one of the properties that have been most sought in surface coatings is water
repellence. Water is involved in most forms of stone decay, hence, a treatment that prevents the
ingress of water should help to reduce decay.
The majority of products that have been tried as stone consolidants have been organic polymers
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Organic products are stone consolidants and water repellents that present different properties:

elastic, adhesive, low penetration ability, pores of treated stone are not fully closed, so internal
water can exit.
Inorganic products are consolidants; they show chemical, physical and structural affinity to stone,
weak improvement of mechanical properties and low penetration ability, and they are fragile and
non elastic.
Organosilicon products or “silanes” have been the most widely used stone consolidants; the
requirements of silanes involve stability against chemical attack (acid rain) and UV light,
waterproof to liquid water, permeability to water vapour, easy removal, lack of byproducts, easy
application, penetration ability, upon their application, pores are not fully covered.
Protectives and consolidants must have the following requirements:

- Easy and deep penetration, remaining after drying
- Resistant to attack, but not stored in subsurface forming crusts
- Prevention of humidity penetration, allowing exiting of water
- No modification of stone aspect (aesthetic requirement)
- Uniform contraction and expansion with the stone substrate
- Cheap, non corrosive, non reactive
- Long-lasting properties
- Able to be applied in a wide range of humidity and temperature
- Resistant to acid and alkaline attack
- Unable to crystallize

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- Resistant to attack, but not stored in subsurface forming crusts
- Prevention of humidity penetration, allowing exiting of water
- No modification of stone aspect (aesthetic requirement)
- Uniform contraction and expansion with the stone substrate
- Cheap, non corrosive, non reactive
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3.Protection-One of the properties that have been most sought in surface coatings is water repellence. Water is involved in most forms of stone decay, hence, a treatment that prevents the
ingress of water should help to reduce decay.

Among the synthetic polymers used for conservation, the most employed are epoxy and acrylic
polymers, organic silicones as well as fluoro-polymers, differing in their properties and their impact on treated objects. Epoxy resins can effectively penetrate and seal porous substrates. When polymerized they form a cross-linked network with outstanding mechanical strength. Inorganic products are consolidants; they show chemical, physical and structural affinity to stone, weak improvement of mechanical properties and low penetration ability, and they are fragile and non-elastic. Organosilicon products or "silanes" have been the most widely used stone consolidants. Application of 'Silanes' involve stability against chemical attack (acid rain) and UV light, waterproof to liquid water, permeability to water vapour, easy removal, lack of byproducts, easy application, penetration ability, upon their application, pores are not fully covered.
Protectives and consolidants must have the following requirements:
•Deep and easy penetration through the stone surface.
• They should prevent humidity penetration.
• No modification of stone aspect (aesthetic requirement).
• They should contract and expand uniformly with stone substrata.
• Cheap, non-corrosive, non reactive.
• Long-lasting properties.
• Able to be applied in a wide range of humidity and temperature.
• Resistant to acid and alkaline attack.
• Unable to crystallize.

4.Gap filling

After cleaning and consolidation processes and before final protection, it is necessary to obtain a
smooth surface without open cracks and holes. Consolidation materials cannot fill cracks larger than 1-2 mm. Therefore, it is necessary to use a suitable adhesives or fillers to fill larger gaps. The filler should match with the original one; its strength and its thermal expansion coefficient should be similar to those of the original stone. Fillers are prepared by mixing a binder with an inert material (silica, glass powder, powder ground from the stone to be repaired). Hydrated lime mixed with a calcareous filler (crushed marble or travertine are the best) is a suitable filling compound for limestone or marble.
Synthetic resins, which are acrylic emulsions, silicones or polyester and epoxy adhesives, can also be used as binders. Epoxy resins are the most advisable as binders because of their high adhesive power and their mechanical characteristics.

4.0 Case Study-Restoration of JagganathPuri Temple-

One of the most outstanding monuments at Puri, Orissa in India

The state of Orissa is a well known for its great culture in art and architecture.

Jagannath Temple, Puri is one of such grand monuments. It is situated near the seashore. This amazing Vaishnava Temple is dedicated commonly known as Jagganath temple.

AnantaVarman Chodaganga Deva, the illustrious king of the Ganga, raised the Temple. Archeological Survey of India, Bhubaneswar Circle, preserves this temple since 1975. This area is in charge of its maintenance and preservation. The edifice is a grand and towering shrine of Orissa.

This massive structure along with other secondary shrines were covered heavy coats of

lime plaster many times, thereby buried the beauty of immaculate carvings of the monument. These plasters affected the existence of the monuments rather than preserving them. They made the structures predisposed to destruction. The coat of lime plaster had become so porous and spongy, that it developed the profuse leakage in the temple. The Temple complex suffered sizeable erosion and corrosion due to its nearness to the sea. Along with these factors, lime plaster applied lost its strength and in rainy season the water percolated inside the structure giving a chance to corrosion. The water percolation affected the iron clamps and dowels binding the structure by increasing their volume, forming the cracks in the structure. The deteriorated stones in one part of structure might have affected the stones in other part of the structure causing overall tension in the structure. Also heavy mass of lime plaster affected the structure below adding to structural damage and weakening the stones underneath.

The further damage of the temple must have been due to its proximity to the seashore and heavy rainfall. There is a heavy penetration of rainwater into body fabric of this shrine.

Conservation Problems Remedial Measures of Lord Jagannath Temple, Puri

Crystallization of soluble salts- The progression of salt migration depends on the cycles of wet and dry phases. Since the Temple had been covered with plaster many years after construction, the salt encrusted stones had not been removed before plastering and subsequently the applied coat of lime plaster itself might have been contaminated with salt. Thus the double action of salt on stone as well

as on plaster continued to migrate as long as moisture is present. Accordingly, the salt themselves, change the chemical balance of stone they inhabit by absorbing moisture and accelerated the decay of the structure.

So with a view to examine the weakness and consolidation of the shrines of the monumental complex, an expert committee was constituted under the Chairmanship of Sri M.N. Deshpande, the-then Director General, Archeological Survey India in 1973. Successively, Archeological Survey of India undertook the conservation of temple in 1975.

The main objective of conservation was to strengthen and consolidate this grand monument. Taking required measures followed the archeological norms. The aim was also to remove the unnecessary enormous load of dead plaster, which no longer served the intended purpose.

The conservation works which started from 1975 ended in 1992. It included de plastering and another simultaneous works.

The conservation measures after removal of lime plaster were carried out in 2 stages

(i) Structural Conservation and

(ii) Chemical preservation.

(i) Structural Conservation: - The techniques involved in structural conservation start from resetting of the old stones by means of proper documentation of large stone members. The small architectural pieces were reset using cement, lime and sand mortar in the ratio of 1:1:3. To reset the bigger ones, non-corroding stainless steel dowels/clamps were used. Finally the consolidation of core masonry was done with

epoxy mortar and all cracks were stitched thereby.

New 'Khondalite' stones were obtained from Tapang quarry. It did the renewal of the missing and worn out stones. They were cut, dressed and finished into shape to be fixed properly in place. Epoxy resin was used in the resetting process of stone members. Again replacement of deteriorated portion of stone was done, while its architectural originality was maintained as far as possible. The new stainless dowels replaced the old rusted iron dowels/clamps wherever possible. These old and rusted structural members were responsible for cracks and damage to the structural stone members. Hard grouting, gravity grouting as per requirement, were executed in order to fill the vertical cracks and voids with a mixture of Portland cement and water. Then they were pointed with epoxy putty.

Corbelled stones were anchored with stainless steel rods. They were fixed by drilling 1.5 to2 meter holes. Lastly epoxy pointing sealed them. To arrest further falling of corbel

stones in garbhagriha, it was decided to provide a second line of defense by resting a stainless steel truss or space frame below the corbels.

(ii) Chemical preservation: There was hardened lime accretion on the surface of stone after the removal of lime plaster. The lime accretions were removed by 2% dilute acetic acid. That was followed by careful pulp treatment to de saline the stone surfaces. Stone surfaces were applied by 2% zinc silica fluoride solution to prevent biological growth on it.

Again with the recommendation of expert committee, one coat of 2% methyl methacrylate solution was applied to slow down the weathering of exposed stone surface .The works of conservation is ongoing since some of the problems are perpetual in nature.

Conclusion:

Conservation of heritage buildings is very important because it provides a sense of identity and continuity in a fast changing world for future generations. Heritage structures basically symbolise the past history and culture of a nation. They constitute the architectural heritage of an area. The restoration of historic monuments is to preserve and reveal the aesthetic and historic value of them based on scientific principles. For this reason, it is essential to preserve the original materials during the process of restoration. The conservation problems of building materials in the historic monuments are among the subjects, which have been investigated with an importance at the international level. It is necessary that, the conservative interventions which will specially be determined for each building, each material and each deterioration process must be determined according to theoretical and technical principles.

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Rejuvenation of Nag River: Need, Considerations, and Approach

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***Abstract*— Rivers are freshwater sources on the earth's surface and a part of ecosystems on local, regional, continental, and global levels. They create a huge impact on the social, economic, and cultural dimensions of communities, societies, and nations. Clean and plentiful water in any surface and groundwater sources is one of the essentials for survival of all leaving beings and all kind of development. But in today's scenario, many rivers across the globe are under threat in terms of qualitative and quantitative aspects. This will lead to an adverse impact on ecosystems, and societal matters and economy as well. Conserving these resources is a need of any given time and some measures are to be taken by all levels; individual, communal, governmental, and nongovernmental, as well.**

River conservation directly relates to sustainability in terms of social well-being, economic progress, and environmental quality. The River Nag is one of the prominent natural features in Nagpur City, Maharashtra State, India. The river is highly polluted and has lost its social, cultural significance and environmental quality on a local and regional level. This has an adverse impact on the overall city fabric and regional landscape as well. To mitigate these impacts some measures need to be taken by all stakeholders. This paper discusses the importance and current scenario of the river Nag and recommends rejuvenation measures need to be taken for the river. The recommendations are derived from the data gathered from various reliable sources and analysis. The conclusion will be based on the inferences and a relevant case study.

***Keywords*— River, Rejuvenation, Conservation, Sustainability**

I. INTRODUCTION

"Keep the Rivers Clean and Earth Evergreen" - The Dharma Trails.

Rivers in Indian society are worshiped and respected as Mother. Its social, cultural, and economic significance is certainly related to humanity. But are these rivers in good condition to sustain themselves, human life, and ecosystems? The answer is certainly not affirmative. The rivers are polluted and shrunk due to human activities and created adverse impacts on the environment and ecology. These impacts are contributing to global challenges and threats such as social inequality, environmental degradation and economic crisis.

About SDGs

In 2015 Unite Nations (UN) declared Seventeen Sustainable Development Goals (SDGs 17) and targeting to achieve them by the year 2030. These goals comprise 169 targets and 231 indicators. The aim of these goals is Development for All with inclusive, equitable and participatory approach. All 193 Member States of UN has agreed to work on these goals through the Policies and Programs in their respective nations.

Fig.1.Sustainable Development Goals by UN

River Conservation also pertains to SDGs and are primarily associated to following SDGs and the targets.

The table below shows the relevance of River Conservation with SDGs and their targets.

Table 1: SDGs and Targets Pertaining to River Rejuvenation

SDG 6	Targets		
	6.3	6.5	6.6
6 CLEAN WATER AND SANITATION	Reducing water pollution caused by untreated sewage, effluent, solid waste, Industrial Waste	Implementing Integrated Water Resources management at all levels: local, regional, national and international	Protect and Restore water relatedeco systems, including mountains, forest, wet lands, surface water bodies and aquifers

SDG 11	Targets		
	11.4	11.5	11.7
11 SUSTAINABLE CITIES AND COMMUNITIES	Protecting World's cultural and natural heritage	Reducing deaths and economic loss caused by disasters, including water related disasters such as floods	Access to safe, inclusive green and open spaces

SDG 13	Target
	13.1
13 CLIMATE ACTION	Strengthening resilience and adaptive capacity to climate-related hazards and natural disasters

SDG 17	Target	
	17.16	17.17
17 PARTNERSHIPS FOR THE GOALS	Promote multi-stakeholder partnerships interms of knowledge, expertise, technology and financial resources	Encourage and promote effective public, public-private and civil society partnerships

II. AIM, OBJECTIVES AND METHODOLOGY

Aim and Objectives

Aim: To recommend rejuvenation strategies for the River Nag through data analysis and inferences.

Objectives:

- To improve the quality of water in River Nag its tributaries
- To restore the river course by through Urban Design and Uraban Planning solutions
- To revive the ecological balance in and around the river.
- To retain social and cultural significance and reconnect the city and its people to the river.

Methodology

Research is carried out through the following stages.

Fig.3.Methodology

Preliminary Study mainly comprises literature study through various online and offline information sources. Also, the peer discussions are conducted for orientation of the topic.

Data Collection mainly carried out through primary, secondary sources of information. The qualitative and quantitative data is gathered from the reliable sources.

Analysis of qualitative and quantitative data is carried out for understanding of the various aspects of the topic.

Inferences are derived from the analysis of data and information gathered.

Conclusion is based on the inferences of the data, analysis and other information.

III. RIVER CONSERVATION

A. Need of River Conservation:

In today's scenario many rivers are polluted due to lack of awareness and insensitivity towards water resources. This creates adverse impact on human health and well-being, ecosystems, economy as well as sub surface water sources (aquifers).

The relationship between surface water and aquifers is mutual. The sub surface water levels are maintained due to surface water.

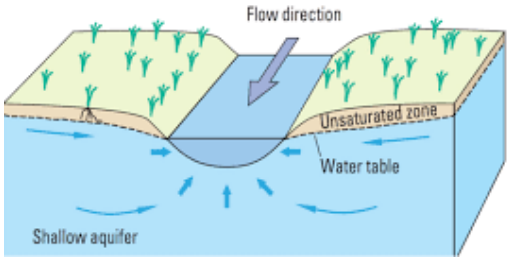

Fig.2.Ground and Surface water

B. Considerations of River Rejuvenation:

Considerations are the parameters for baseline study.

i. Climatology

Climate is the foremost consideration of water infrastructure and mainly refers temperature, precipitation, wind pattern, UV index as well as their seasonal variations. Temperature and precipitation pattern can be the deciding factor for the authority to design and cost of the scheme.

ii. Hydrology

Hydrology refers the study of Surface water bodies and Ground water aquifers, Soil moisture, their qualitative and quantitative assessments. The hydrology directly influences the human activities and local ecosystems. The type and amount of precipitation in any form plays a prime role in hydrology.

iii. Geology

The geological characteristics of the area determines the pattern of surface run off and infiltration of the storm water. This study helps to derive hydrological patterns on local and regional level as well as Rain Water Harvesting techniques.

iv. Topography

Topography or land form decides drainage pattern of the local as well as regional level. It is also a major consideration while designing the water supply

scheme. This decides the capital cost as well as Operation and Maintenance cost of water supply scheme.

v. **Ecology**

Local and regional ecosystems need to be considered for various reasons. Interdependency between living organisms and non-living matters in the environment drives not only environmental quality but social and economic progress as well. Ecosystem services are directly related to this.

vi. **Demography**

The trend of population either growth or regression decides the level of service delivery. The demographic data of any settlement either rural or urban helps to analyzes birth rate, death rate as well as migration trend. Demographic analysis is required for the population forecast which is the base for water supply scheme for 20 – 30 years.

vii. **Land use**

The landuse refers the land cover and use of land for human activities. The land cover is natural features on land (forest, water bodies) with least human interventions; land use for human activities is deliberate attempt of land for built environment (human settlements) and land alterations (agricultural, plantation purpose).

viii. **Governing Agencies**

Water supply schemes are implemented by water supply departments under state government and managed by local governing agencies such as Gram Panchayat, Special Planning Authority. Operation and Maintenance (O & M) of the scheme is a responsibility of local governing agency; also levies the water charges to recover the capital and O & M cost of the system.

C. Approach for River Conservation:

The measures for river conservation to be taken by all the stake holders. The approach should be **inclusive, participatory and equitable.** This will ensure the social justice and progress by all means.

- All the stake holders must be **included** while making and implementing any policy/ programs of river cinservations. Their needs, opinions and suggestions must be taken into consideration for long term goals.
- For any development **participation** of stake holders decides the sustainability. The participation in implementation and operation and maintenance of the development.
- All the stakeholders of the development must be **equally** benefited in terms of facilities and other gains; especially vulnerable class of the society. This will lead to social integrity and Human Development Index.

D. **Components of River Conservation**

1. Pollution abatement:

- Inception and diversion of raw sewerage and provision of decentralized sewage treatment plants Sewage water which is currently being directly let into the rivers is proposed to be treated through decentralized sewage treatment systems and clean and pure water would be let out into the river.
- Revival of edges through Biotechnologies Biotechnologies that can be seen, experienced and managed shall be proposed to maximize the reuse of water, improving the quality of water as well as maximizing the retention of rain water. Bio swales and infiltration basins /buffers for street storm water channels shall be proposed.
- Redesigning storm water outfalls green edges and incorporation of various landscape elements to soften the storm water outfall pints at the junction of nallas and main river course. The master plan hence looks into all the aspects such as identification of the unique character and strength of each water course and lake. Identification of opportunities, problems and needs, and existing resources, funding, uses and constraints for each water body shall be documented and analyzed. The analysis includes all the physiographic aspects as well as the environmental planning.

2. Protecting the river courses: (remove encroachments, control siltation on river bed)

Defining the water edge: Today the water edges have either been encroached or are treated as backyard of all buildings in the dense urbanized areas. It is important to redefine or re-introduce the more natural edge through various techniques which will serve the purpose of the overall rejuvenation of the rivers.

3. Developing the social spaces – Riverfront developments; (Cultural, recreational)

Restructuring the water edge

This will include improving the scenic/aesthetic qualities and restructuring the accessibility to the water edge. The approach through strategic points shall be made more inviting and visually accessible from key nodes/locations.

Heritage and Religious nodes: they are points that have a heritage value such as ‘Sangam’ and/or religious value such as temples, ghats, etc along them. These nodes would strengthen the historical context and connectivity with the rivers and help in reestablishing their importance in the current context of the urban city.

Ecological nodes: they are nodes that have an intrinsic ecological value, which is still intact and needs to be conserved. These are nodes along existing green belts and at the origins of the rivers. the areas are still rich in biodiversity and have the river still intact in its natural form. These nodes are proposed to be developed as ecological pars or educational centres.

Physical connectors: areas which serve as connectors to the river waters and offered opportunities for physical interaction between people and water have been identified; for eg. Ghats. They are proposed to be revived to strengthen the connectivity and encourage public participation.

Visual connectors: areas have been identified which offer good views of the riverfront, which can be developed as public areas with passive recreation. The nodes would be developed to enhance the aesthetic appearance of the riverfront and to encourage people to visit them. These nodes can also be used for employment generation, like provision of informal markets where villagers from surrounding villages can display and sell their products. This would help in establishing the bonds between the city and the water and also encourage socio economic development.

4. Creating Livelihood Opportunities

Apart from water consumption by human (domestic, commercial, industrial, agricultural etc.) there are many economic activities dependent on rivers; such as fishing, water transport, water sports, etc. are dependent on the rivers.

5. Flood and Aquifer Management

Rivers are the channels of storm water drainage. The storm water from developed areas is channelized through road side drains and ultimately discharges in to the rivers. The system reduces the risk of flood hazards to the great extent.

It also helps to maintain the aquifer levels and reduces the risk of dry soil.

IV. ABOUT RIVER NAAG

Contextual Study: Nagpur city and Nag River,

The river Nag originates from Ambazari Lake located at Western side of the city.The name of the city 'NAG-PUR' has been derived from the name of the river 'NAG'.

Nagpur is a city and District in he state of Maharshtra and located in the central part of India.

The district is located between $21^0$45" N to $20^0$30" N and $78^0$15" E to $79^0$45" E.

Nagpur is among the 15 largest cities in India and is one of the fastest growing. Nagpur is also the second capital of Maharashtra. The city is the commercial and political center of the state's eastern Vidarbha region.Being one of the few metropolitan (million plus) cities in Central India, it has considerable influence on the hinterland. Nagpur City's hinterland contains extensive agricultural areas as well as forested areas

The adjoining districts are Bhandara on the east, Chandrapur on the south, Amravati and Wardha on the west and in the north shares the boundary with Madhya Pradesh. The Nagpur district is located in the Deccan Plateau region of Maharashtra.

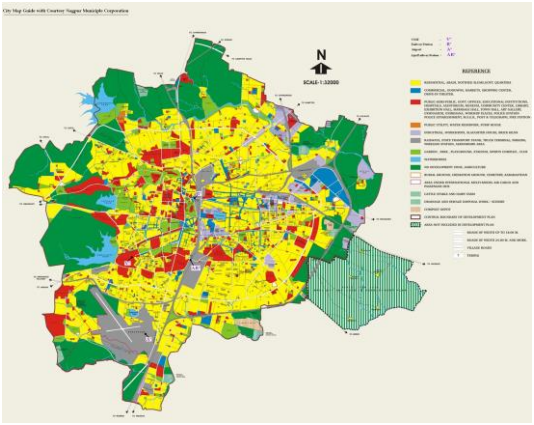

Fig.4.Map of Nagpur Municipal Corporation [1]

The Nag River has three tributaries Namely Pili River Phutala Nalla and Pora River. All of them originate from hilly areas near Nagpur.

Climate:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average High ©	29	31.8	36.4	40.7	42.7	38	31.8	30.7	32.3	32.9	30.9	28.9	33.8
Average Low ©	13.4	15.6	19.7	24.1	27.8	26.5	24.3	23.8	23.2	20	15.8	12.9	20.6
Average Rainfall (mm)	14.9	13.1	20.4	12.5	19.1	190.6	347.7	277.2	193.7	53.3	13.1	5.5	1,151.10
Average Humidity (%)	42	31	24	19	22	49	72	76	71	58	51	47	47
Average UV Index	7	9	12	12	12	12	12	12	12	10	8	7	10

Table 2.Climatic Data of Nagpur
Source: (Nagpur Wikipedia)

Nagpur falls in the composite Climatic Zone and faces extreme variations in temperature with very hot summers and very cold winters and a relative humidity of 60 percent.

Topography

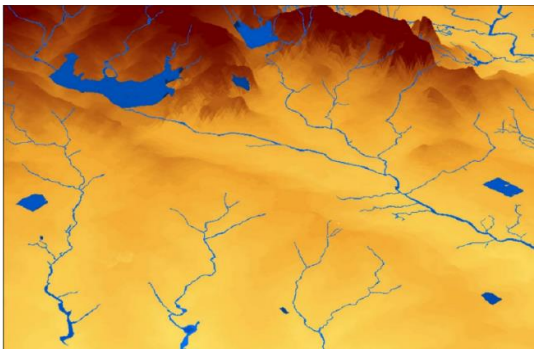

Fig.5.Map showing Regional Topographic Profile of Nagpur[1]

Nagpur lies in a plain at the southern base of the Satpura hills. The general slope of the land is from the west to the east, ranging from about 350 meters towards the west to 250 meters to the east side The ranges are mainly located to the north and western side of the city.

Within the city, the higher ranges are located towards the western side.

Hydrology

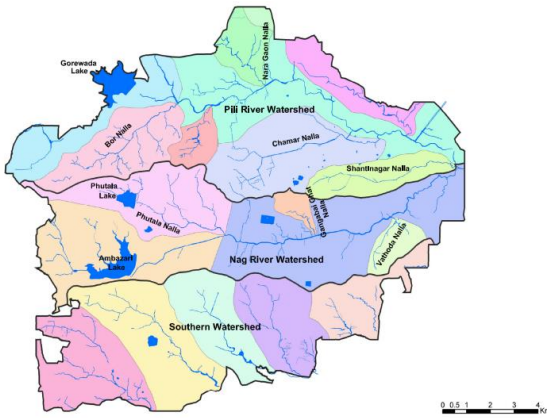

Fig.6 Micro-Watershed Map of Nagpur City [1]

The river and its tributaries, the Pili river to the north, Phutala Nalla in the center and the Pora nadi to its south; all originate from the hilly region to the west of the city and flow from west to east following the natural slope of the landform.

Nagpur can be divided into three major watersheds: namely the Northern watershed comprising of the PILI river, the central watershed comprising of the historical NAG River and the southern watershed draining into the PORA river.

Geology:

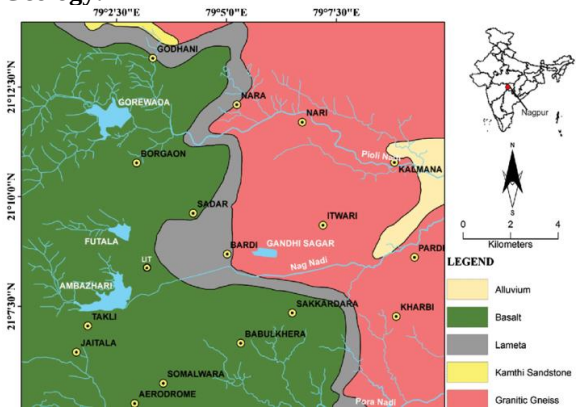

Fig.7 Geological Map of Nagpur [1]

The District can be divided into two main areas, namely the country to the west of Nagpur occupied by the Deccan Trap formation and the country to the east of Nagpur occupied by the metamorphic and crystalline series; the two other formations, the

The underlying rock type in the Western and Southern localities is Deccan Trap, the lava flows gave rise to flat topped and terraced features. The Eastern halfs covered by crystalline Metamorphic Rock such as gneiss's, schist and granites. In the Northern part of the city, yellowish sand stones and clays of the lower Gondwana formations are found. In maximum part of the town, the underlying rock strata are covered with alluvial deposits resulting from the flood plain of the Kanhan River. In some places these gives rise to granular, sandy soils, but in many places, particularly in low lying, poorly drained areas, the soils are alluvial clays with poor permeability characteristics

Coal, manganese, dolomites, clays and copper are important minerals occurring in the district.

Ecology & biodiversity:

The vegetation of the ever expanding, fast developing city of Nagpur is fairly rich and varied. There are around 850 plant species of the flowering plants and over 160 species of trees. The diversity is not only limited to the flora; but the city is also a haven for a large number of bird varieties. Nearly 240 bird species are found in the municipal limits of Nagpur city as per checklist prepared and updated from time to time by the Nisarg Seva Sangh of Nagpur. As recently as fifteen years back animals like the fox, blackbuck and hares could be encountered at the outskirts of the city.

The city shows a clear vegetation pattern, with the western hilly regions consisting of forest areas of the deciduous and semi deciduous type with patches of evergreen; while the plains to the east and south having agricultural farm lands.

Some of the biodiversity hotspots of the city include the Ambazari, Telankhedi, Gorewada lake and its surroundings, the Seminary Hills, NEERI Campus, sections of the Institutional zones and the Nag and Pili Nadi & their smaller tributaries.

Demographic Data

In 2001, the urban population was 2,129,500, and there were around 410,000 households in the city. 7,26,664 people lived in slums making Nagpur second most slum populated city in Maharashtra after Mumbai. Around 99.4% of the population was engaged in non-agricultural activities, attesting to the overwhelmingly urban character of Nagpur city. People of Nagpur belong to different religious communities giving it a cosmopolitan character.

Table 3: Population Data of Nagpur City

Year	Population	% of Growth
1981	12,19,500	-
1991	16,64,000	36.40%
2001	20,52,066	23.30%
2011*	24,05,665	17.20%
2023 (Estimated)	33,16,000	37.84%

Issues of Nag river:

Urban expansions and rampant construction activity in the city have had a negative impact on water systems as the site developments have ignored the local environmental and hydrological considerations. Over the years the rivers of Nagpur city have been subjected to heavy sewage ingress, indiscriminate dumping of

solid waste etc. as a result which these rivers are highly polluted and have been reduced to mere carries of waste.

Fig.8 River Nag in Nagpur City

The following are some observations outlining the status of the rivers:

- The rivers are highly contaminated due to direct disposal of untreated sewage and waste water into the rivers and its nallas/rivulets.
- Solid Waste and garbage is directly dumped into the rivers, thereby contamination it and clogging them.
- Heavy siltation is seen along the river banks, especially along areas of dense developments along the banks and along shallow stretches of the rivers.
- No buffers have been left along the rivers along most of stretches, thereby exposing them to the direct impacts of development and human interactions (open defecation etc).
- The river basin shows alterations especially along areas that flow through dense developed pockets. The rivers and nallas feeding them have been channelized and made straight along certain sections. This can be observed along the Nag river and the Chamar nalla and Shanti nagar nalla.

Fig.9 Contaminated River Nag in Nagpur City

- The rivers flow through sections of various landuses, which have invariably affected the quality of water flowing through it and the edge conditions along the river. Towards the western side in the initial stretches the river Nag and its major nalla Phutala are in good natural state as they flow through institutional areas. Further down as it flows through the main city core, the river edges skirt many residential developments, formal as well as informal, where the major issue is the heavy ingress of waste water into the river. towards the east the river flows through agricultural fields and low-density low-level housing. Here the river edges are in a fairly good condition but the river water is highly contaminated.

- The concretization and paving of land in highly developed areas, especially along the western and central sections of Nag and Pili rivers, has considerably reduced the ground water percolation and affected the natural seepage of water into the rivers during the summer months, thereby rendering them dry during the summer months.
- The developments have also affected the river edge by construction of compound walls, heavy siltation, destruction of wetland vegetation, encroachments, etc.
- The river Nag and its tributaries the Phutala Nalla and the Pili river all not only form the main drainage channels for the city but also have their origins located within its municipal limits. Any alteration to these rivers will not only affect the city but also the areas located along its downstream.
- The rivers within the city are important components of the larger regional level ecosystems, forming continuous biodiversity corridors for movement of small animals, birds and insects. In addition, they also offer rich habitats for the flora and fauna. However, this continuous corridor has become disjointed along many sections along the river, due to developments coming right upto the river edges.
- Historically the rivers, especially the main Nag River, enjoyed cultural and social significance and value, which is quite evident from the number of religious and social elements existing along them even today. However, their importance in the current times has been diminished and they are lying in a neglected state. If this trend is not addressed and steps taken to change the attitude towards the rivers, it is not long before the rivers will turn into a mere drainage channel. The challenge remains to restore the faith back in our water bodies and recognize their significance.

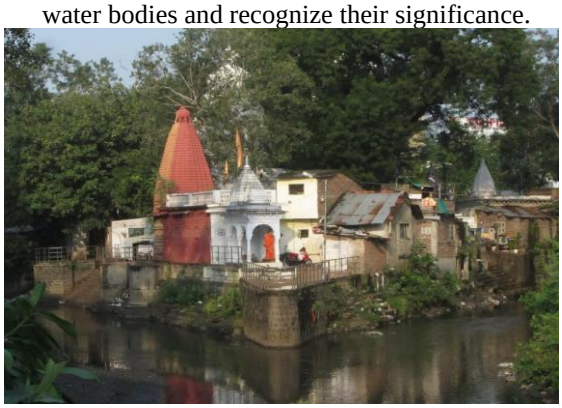

Fig. 10 Temples along the River Nag [3]

Industrialization improves the economical as well as livelihood standards of a region or country. It brings along the job opportunities for locals and uplifts the

country's financial status. At the same time the other side of the coin is often overlooked or purposely ignored which talks about pollution. Such pollution occurs in various parts of the environment. Water, air, and noise are the straight forward aspects which deteriorate with industrial activities. Water pollution amongst all is considered to be the most dangerous as it does affect not only human life but aquatic life also. Such situations become extremely difficult to tackle because in such conditions priorities are impossible to set. One can neither stop infrastructural development nor can keep polluting the natural resources. However, to control such absurd situations local and central government bodies do set directives so that pollution can be kept below certain hazardous levels set by the experts.

The Environment Protection Act 2002 mentions parameters of Effluent which is discharged in natural resources. These parameters are change according to the type of industry. Example of the same is mentioned in the table below:

Everyday discharge of swage into Nag and Pili river is humongous. These rivers receive a volume of around 430 MLD each day. Both the rivers run through the city's municipal limits.

Nag River: Water quality and status of pollution control initiatives and rejuvenation project

Nag river flows through the urban part of Nagpur city. The water quality of Nag river comes under threatening figures due to various socio-economical activities carried out along in addition to the effluent discharge by industrial development. The ecosystem of the river is extremely hampered due to all these reasons.

Recommendations For Nag River

- Ecological measures for filtration and purification of water through natural methods and techniques
- Creating spaces and opportunities for people to connect and interact with the river, which would restore their faith and value for the water resources, thus encouraging them to take active participation.
- Measures and proposals to be implemented in the watershed and catchment areas to ensure water quality and quantity reaching the rivers

V. CASE STUDY OF SABARMATI RIVER

Success and failure of lot of parts of a country depends on the natural resources it possesses. Water is a prime requirement for activities like agriculture, industries, construction in addition to daily needs for human settlements. During the development phase of such regions, rivers play an extremely important role because of naturally available water can reduce a major burden of growth. Having ready availability of water resources can be considered as prospective plus point for infrastructural development. In a way Rivers are very important to improve country's economy. During the development process of these regions, rivers if available are used for various purposes including using fresh water.

Riverfront development has been seen in various stretches along few of the major rivers in Indian context. Riverfront is an area where land and waterbody connect and could be very much vulnerable to pollution if not attended. Major rivers in India have heavy infrastructural development done which has bunch of pros and cons attached to it. Following are case studies which reflect the benefits of Riverfront development.

Sabarmati Riverfront development:

Fig.11 Sabarmati River in Ahmedabad City

Sabarmati River flows through Ahmedabad dividing it into two halves. The river was the main source of water supply to the city for long before other distant sources were identified. However Sabarmati river still remains an integral aspect of the city for various reasons. Historically also the river has got a lot of importance as Mahatma Gandhi selected the banks of the river to set up his Ashram. The famous 'Salt March' led by Gandhiji also started from the banks of Sabarmati river.

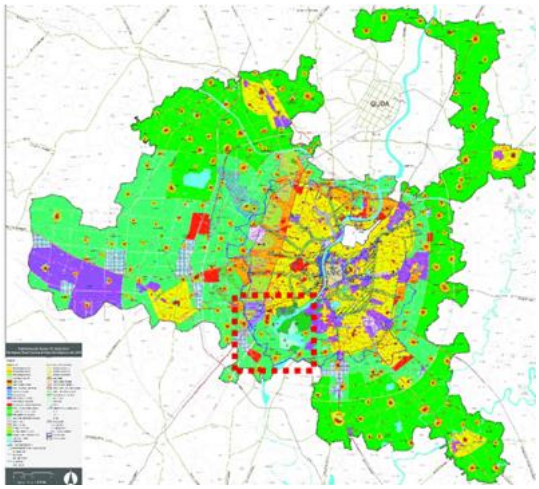

Fig.12 Land Use Plan of Ahmedabad.

Being the Monsoonfed river, during the dry period the banks of the river were used for various activities. Some of the activities were to launder clothes and to dye textiles, farming and also informal activities like Sunday flea market known as 'Ravivari'. Due to this

settlements started growing along the banks. This was the point where the major pollution started occurring along the banks of Sabarmati River.

Fig.12 River Front Development stages of Sabarmati River in Ahmedabad City [5]

Objectives of Sabarmati Riverfront development:
The project was developed keeping major three aspects into consideration

Environmental Improvement
Primary objective was to reduce the erosion as well as flood to safeguard the city. Clean the river water and improve recharge.

Social Upliftment
Rehabilitation and resettlement of riverbed dwellers and activities creation of parks and public spaces; provision of socio-cultural amenities for the city.
Socio-culture activities and amenities happening along the banks including public entertainment and market activities needed rehabilitation and resettlement. This was another objective of Sabarmati riverfront**.**

Sustainable Development
Sustainable development achievement through Generation of resources, revitalization of neighborhoods was the identified need to take up the project.

Fig.13 River Front Development of Sabarmati River in Ahmedabad City [6]

Case study analysis:
However, the Sabarmati Riverfront development project has also received equal criticism from various experts. Having said so the project was undertaken with a lot of positivity and futuristic angle considering rejuvenation of the river. Intention behind taking up the project was to eliminate the unorganized settlement which had started grooving near the banks of the river and also to curtail the pollution proportion getting discharged into the river. The Dhobighat rehabilitation and encouragement for socio-cultural activities including recreational activities was also stressed during the process. it is considered as a facelifting project for Ahmedabad city which already had a historical importance attached to it.

The way forward:
Nag River Rejuvenation project is under Nagpur Municipal Corporation (NMC) and cleared by National River Conservation Directorate (NRCD). The Central Government will bear 60%, the State Government will bear 25% and the NMC will bear 15% of the total cost of the project. the project also covers rejuvenation of Pili River.

The integrated Rejuvenation of both the rivers will assure long term sustainability of the river and the city of Nagpur as well.

VI. CONCLUSION

In Indian context many river conservation projects are successful in terms of environmental quality, social wellbeing and economic gain.

- The River Sabarmati is one of the examples of River Front Development. The development created quality public spaces and enhanced overall city ambience.
- River Nag is highly polluted in the city of Nagpur due to the discharge of untreated Domestic and Industrial Waste Water, dumping of Solid Waste etc. The pollution abatement measures need to be taken on the high priority.
- The rehabilitation and resettlement of the existing settlements along the river Nag will help to improve the city fabric in terms of social spaces, environmental quality and livelihood opportunities.
- Urban Planning strategies and Urban Design solutions will surely achieve the Sustainable Development of the city.

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Uniting Structural Elements With Architectural Forms

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***Abstract*— The purpose of this paper is to present an idea of uniting structural elements with architectural form and understanding its mutual connection. This will lead us to better selection of architectural form and its support structural system. This paper discusses different types of structural systems which can holds different forms of architectural design. The paper highlights the relationship between structural elements and architectural form, the basics of structural forms, their properties, material used, advantages and disadvantages of making decision to select the suitable form for the architectural design. Through different examples around the world of architectural forms and structural system, the relationship between Structural elements with Architectural form is derived.**

Keywords—Structural Elements, Architectural form, structural system, Architectural design.

I. INTRODUCTION

Structure is fundamental part of designing Architectural form since the historical age. From the beginning of the Stonehenge to the construction of the world's biggest tower in current times, design of structural elements and architectural form fulfills the purpose/function of the structure, aesthetic view and its serviceability. Therefore, the present paper is important for creating interest in Architects, Students and Civil Engineers to learn the relationship between structural elements and architectural form for creating strong and stable structure which are aesthetically enjoyable and functionally enhanced. The paper discusses appropriate examples around the world, which will help in designing the structure and selecting the form and structural system.

Fig.1. Heydar Aliyev Center, Baku, Azerbaijan, by Zaha Hadid

Figure no.1 shows the museum structure designed by famous architects Zaha Hadid, this architectural form is created using multiple curves and as supporting element Steel, glass and other construction materials were used.

Fig.2. International Finance Tower, Hongkong, China

Figure 2 shows International Finance Tower in Hong Kong, China, this Architectural form is created using straight vertical lines, both the forms have its own beauty, its own purpose and its own function, but this both forms are just a line work in visualization and imagination, to make this kind of form stable, strong, functional and Serviceable in real life, appropriate structural system is needed.

Fig.3. Ancient Egyptian pyramid and Modern pyramid Louvre Museum, Paris

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Figure.3 indicates the duration range in which the people have always invented different types of forms, structure and shelter, here in figure 3, it is seen that from Ancient Egypt pyramid to modern pyramid louvre, the form is constant but the structural system, material and technology is developed, which says that one types of form can be achieved in real life construction using different structural system and materials.

The form of structure can be multiple curves as shown in figure 1, it can be in the form of straight line as shown in figure 2., it can be in the form of triangular shape as shown in figure 3. It can be also in the spherical form, it can be cuboidal form, it can be in canonical form or sometimes it can be complex curve may be hyperbola or parabola or mixed curve. So, from this we can define that the form is just the visual shape of any structure or it can be the configuration of any structure, whereas structural element is defined as a frame work which gives strength & stability to the architectural form and resists different loads, stresses and strain coming on the structure.

II. RELATIONSHIP OF STRCTURE TO ARCHITECTURE

Relationship of structure to architecture can be understood in relevant to the building, the structural elements are the part of building that resist the stress, strain and load that imposed on it. Load is the force on that surface or the object , the element which resist it from collapse and support the building is known as structural element.

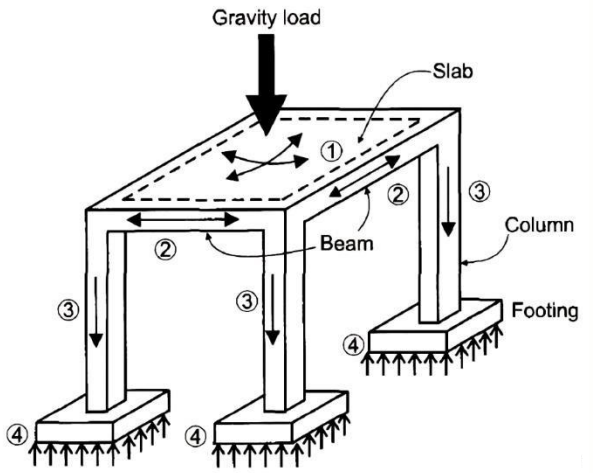

Fig.4. Structural elements in building structure

The above figure 4 depicts the structural element of the architectural system which is actually taking loads, stresses and strain.

The Architectural form concepts are of different types such as Stability, Instability, Floating, and Order. following figures are examples of this types of concepts

Fig.5. Pantheon, Rome, - Order and Stability

Figure 5. Church at Pantheon, Rome indicates the architectural concept as order, it is seen that columns in front maintains order, as well as structure gives the sense of stability.

Fig 6. Forum Barcelona solar plant, - Instability

Figure 6 indicates Instability in visual appearance but actual structure remains stable, this is again the architectural design in the form of instability.

Fig 7. Gas Natural Headquarters Barcelona, - Floating

Figure 7 shows sense of floating in visual appearance but actual structural system is grounded, this is again the architectural design concept in the form of floating.

All these examples are basically the architectural concept. So, to create these concept in reality suitable structural system is needed, The synergy between architectural forms and structural element is important to bring these concepts into real world. anything to be created as very dynamic, having large span, having very light weight structure, suitable structural element is essential.

Conventionally there are very limited straight forward structural system is available, that is typical beam and column, and if we follow this only, Architectural forms may have to be compromised, but to achieve different concepts of architectural form in reality we have do continuous evolution in structural system also. To achieve this architectural form, the material selection, materials property in terms of durability and taking strength is also important. Different types of materials give a visual look as well as strength to structure.

III. SYNTHESIS OF ARCHITECTURAL AND STRUCTURAL FORM

The form is observable entity which is said as shape. The Form in general considered as shape or three-dimensional massing. one object having three dimensions that gives a sensation to our eyes and one can

see that object as a form, but it also includes additional architectural aspects. It is not only like dull three-dimensional shape, in order considered as architectural form. There are various aspects like space creation, different arrangements including structural configuration to be taken into consideration.
In order to give the form of architecture, structure is indispensable. Without structural stability, structural support, form cannot be created the way it is required, which may organize and unify architectural design.

Three-dimensional object with some architectural aspects with some space to live-in and in order to maximize your utility and, also this should be supported with some structural configuration.

The shape is basically creating a visual representation along with some property of the size, colour, texture, position, orientation and visual inertia. So, these all are very important thing, whether structure will be in human scale or in monumental scale. nowadays there is shortage of spaces that's why there is need of optimization of the space also.
colour, definitely can give a contrast to the background. Simple form like rectilinear form can also be beautifully designed using contrast colour or pattern in colour.
Textures like smooth and rough, for e.g. smooth glass surface is used in Elevation or rough texture like raw plaster in external surface gives some different sense of design.
Orientation is again very important not only for the aesthetic purpose, but also sometimes in order to tackle with the lateral load.
Visual Inertia is also very important which gives a visual sense of stability.
Structural form is the primary or most visually dominant structural system of a building, structure is basically the backbone of the dominant structural system. looking at the building, most of the cases a building may have more than one structural system, one to just give the structure stability and other is to provide facilities.

The structure can be defined with 4S's: Strength, Stiffness, Stability and Synergy.

Strength: Strength is some property by which breaking can be prevented. Beam which is having good strength, may be made up of good quality concrete; so, it will resist more load. Strength is very important property of a structure depending on the load condition appropriate materials needs to be selected.

Stiffness: stiffness is a property which will prevent the excessive deformation. while selecting material of construction stiffness of that material needs to be taken into consideration.

Stability: stability will depend on the arrangement of structural elements. Stability basically prevents from the collapse. Stability depends upon the composition or arrangements of forms in design, symmetrical arrangement gives more stability compare to unsymmetric arrangement, stability plays vital role during earthquakes, symmetric structure behaves more stable during earthquake compared to the unsymmetrical structure.

Synergy: Good strength material along with the stiffness, also the arrangement and assured the stability, but then still there is something missing, which is very important to bring the result as per the requirement, that is the synergy, if synergy is not attained in form as well as in structural element design may fail.

IV. Structural System in Architecture

One of the most crucial elements of every form in the universe, that has a physical dimension is the structural system. This system's primary function is to enable any form to withstand all physical as well as induced loads, transfer it safely to supports and to guarantee the form's performance. But, in general, this system may also play crucial aesthetic, organisational, and even cultural functions. The art and science of developing a structural system in the natural or artificial environment is referred to as structural design.

The structural system is one of the most important architectural and structural components in architecture (including industrial products like furniture, cars, airplanes, ships etc.). This system usually functions parallel to other systems and together they create the whole architectural creation. During the planning and design process the architectural designer is the main entity responsible for the overall view of the project, taking into account many aspects, including the structural aspects. A structural consultant typically serves as one of several consultants in addition to the architectural designer. Contrary to nature, their work lies to design a structural system by calculating various loads, forces, its reactions and support safely the entire form with its utility. Their design variables of structural systems are as shown in chart below figure 8:

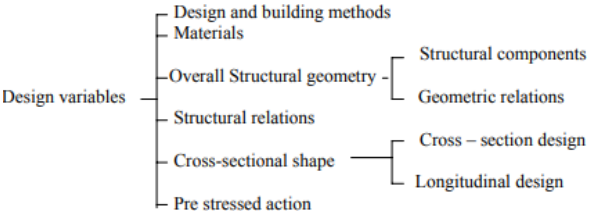

Fig 8. Design variables of structural systems in nature and in architecture

Any structure's overall structural form, which determines the general layout of the structure (macro geometry), can have a significant impact on the architectural image, the movement of forces, the stability of the structure, and other features. These categories apply to this variable:

1) The structural elements

2) geometric connections among structural elements.

If the overall structural shape generates a small volume of less severe stresses, it is structurally efficient. If there is a relationship between the geometry and the qualities of the material, that is also significant. There are two key components to the relationships between structural geometry and overall geometry:

1. how well other systems and structural geometry are integrated
2. the degree of the structural system's visual expression.

This can be attained by various structural components as shown in figure 9 below.

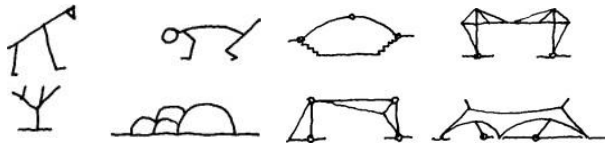

Fig 9. Overall structural geometry in nature and in architecture

The primary structural components that make up a structure are called structural components. These components can be found in nature as shells, membranes, muscles, tendons, etc. These elements can include beams, columns, members, slabs, domes, arches, barrel vaults, rings, cables, textiles, etc. in architectural designs. The following categories can be used for the structural elements in architecture and nature:

1. Pointed components
2. Linear components
3. Surface components
4. Spatial components

The majority, if not all, of the structural component concepts found in nature appear to be successfully used by humans in structural design in architecture. we can classify our structural systems in many ways; so, one way of classifying it with the overall shape of three-dimensional shape and other thing. But structure systems can also be defined with other parameters like its nature whether it is like your compressive structure or it is your tensile structure or so on or else, we can also define it in other terms like your supporting structure or supported structure.

V. Conclusion

Strength, Stiffness, Stability and then, the Synergy. These four components are essential to create any structure and next to that of the synergy the synthesis between architectural and structural form depending on the predominant structural system that is installed to the building. Structural elements and architecture form are acts together when the design process starts at the same time, so, basically structure, can nicely build with symmetry and all. So, it cannot put it in a single category, but depending on the dominance of something like either architectural dominance or the form dominance or sometimes structural dominance will classify those things into different categories. to summarize the first category was about structure as architecture. For e.g Eiffel Tower or some high-rise building for e.g Burj Khalifa, where basically it is the structural arrangement to protect building from gravity or lateral load, all imposed load on it and finally, the outcome is really a form. So, structure act as architecture.

In the second category is about accept structure. So, structure accepted that means whatever the form like in order to make the structure, make the architecture whatever the structural requirements come into picture it is accommodated and fit into it, form is not deviated, but in order to give completeness other arrangement is done and balance is maintained between whatever the structure is required.

The last category, the structure ignored in form making, where the form was given emphasis and for that the typical or optimal use of structural arrangement is done and requirements was not followed being ignored to give this particular form. But again this ignorance will not have any relation with the compromisation of the structural stability,stiffness and safety.

It is observed that, overall ambience in all these examples, there are somethings which are predominating. So, different dominance either sometimes in architectural form, sometimes with the structural elements, sometimes the combination of both and sometimes the total ignorance of structural elements in architecture form making, and it is a free flow design by the architects, with that it is concluded that structural element is considered as a single entity along with the architectural form design to create it in reality , it cannot be considered as different entity.

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TRANSIT SHELTERS OF CONSTRUCTION WORKERS : A Review

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***Abstract*— The construction sector is one of the largest seasonal employment providers in India, next only to agriculture. The sector is highly unorganized. The laborers have maximum transit because of the nature of their work. Labour migration from rural to urban areas is a feature of developing countries. Mumbai, like many growing and flourishing cities, has been attracting a large number of migrants from all over the country. This group of migrant workers comes to cities for a longer period in search of work and stays on the construction sites till the site is handed over. The present study is a review of past research work of onsite living conditions of construction workers. The major focus of the study is to identify the key factors related to the accommodation facilities which affect the living condition of onsite construction workers.**

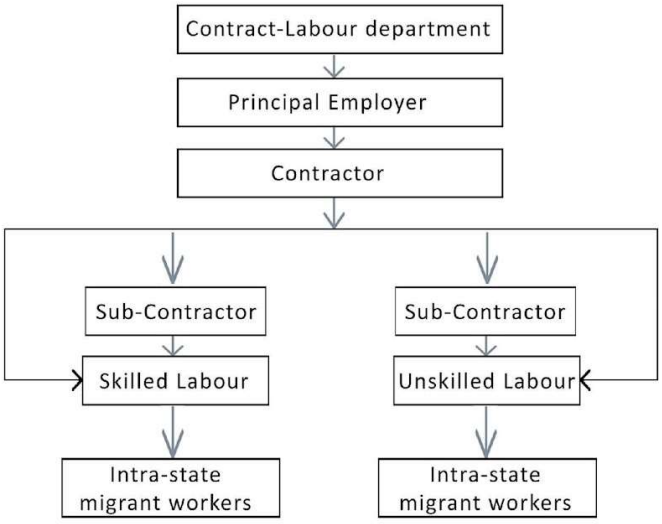
Keywords*— construction industry, onsite construction workers, accommodation, living conditions,health and hygiene.

I. Introduction

Modernization has paved a way for the construction industry. With the rapid urbanization the demand for housing has emerged which has boosted the growth of the construction industry. The expanding and growing construction sector resulted in employment opportunities which have drawn a larger number of construction workers in this sector.

Construction workers are laborers who migrate from different regions and States leaving their native villages in search of a job. Of the total estimated 15.2 million laborers, more than 36.2 percent are employed in the construction industry alone and only 9.8 million construction workers of the total 32 million workers are registered in the country. (Human resources and skill requirements in the building construction and real estate sector, 2013-2017)

The laborers are hired under a contracting system in the construction sector. The contractor either hires workers directly or further hires subcontractors who then hire the workers. The principal leader therefore is the only one who is responsible to the labor department for the fulfillment of all the specified norms and legalities underneath the relevant Acts. (Kundu, January-June 2014).



These hired workers travel from one area of work to another area along with their families and live in a place, which is provided by the contractor of the construction company by building onsite labor camps which are temporary in nature. The labor camps are

made up of individual hutments made of tin sheets where living conditions are so poor that they deprive the workers of basic facilities and human dignity. The sanitation hygiene of the construction site and the laborers hutments are sometimes of sub-standard quality. The rate at which the development occurs comes at a cost; the construction industry thrives on exploitation of migrant construction workers by maintaining a low standard of their accommodation. Laws and regulations exist for the rights of construction workers, but are many times overlooked by the authorities.

II. DOCUMENTING THE EXISTING CONDITIONS

The parameters of better Living conditions for workers includes accommodation facilities, on site amenities, hygiene and safety conditions.

- **Accommodation facilities**

A major problem faced by the migrants in the city is housing, thus accommodation facilities should be set up according to norms and rules which should fulfill the basic requirements of livable conditions.

The study carried out by the interview process to understand the onsite living conditions of the migrant workers mentioned that the hutments provided by the contractor aren't safe stay and a sense of insecurity prevails among the workers. The housing conditions of the workers lead them to an unhealthy condition as a result of the lack of protection from adversaries like extreme climate, dust, and mosquitoes. (Piu Mukherjee, September,2011) .

By surveying 12 construction sites in Karnataka through personal and focused group interviews of 363 construction workers the researcher concluded that about 5-6 workers live in one hutment, which are made with plastic sheets having no opening for ventilation. This leads to uncomfortable and claustrophobic conditions. Out of the 12 sites visited there was electricity only in 3 sites provided by the construction company, but none of them had provided sanitation and bathroom facilities. (Kundu, January-June 2014).Another survey of construction sites in Bengaluru was conducted which stated that the construction workers' huts were dirty and overcrowded, prone to mosquitoes and other pests. The temporary sheds were not provided with electricity power, and had poor ventilation. (Muniraju, March 2015).

Similarly the study on housing quality of the construction workers in Ahmedabad identified two on-site settlement typologies (i) shelters on private-sector construction sites were made entirely from tin sheets which are prone to overheating, leading to extreme discomfort and posing health risks and (ii) shelters on public-sector construction sites which consist of brick walls with tin sheet roofing ,these were less vulnerable to weather. (Renu Desai, December 2014)

- **Amenities, hygiene and Safety**

Portable drinking water, bathing facilities, toilets and cooking facilities comprise the basic amenities for onsite settlements of workers. Migrant workers narrated about circumstances of poor sanitation facilities which make them ill. According to them, the lavatories they use were in very unhygienic condition and their complaints regarding this were attended with an undue delay. (Piu Mukherjee, September,2011) Research revealed that drinking water facilities were provided by many but the bathing did not exist. Many residents build temporary enclosures for bathing, thus women face privacy issues which require them to bathe early in the morning or at night when it is dark. Temporary toilets were made but were not maintained leading to unhygienic conditions. Overcrowding, uncontrolled surface water drainage and poor rubbish disposal are some of the conditions which also lead to poor hygiene. The amenities such as canteen mess for workers to have their meals were not provided and eating outdoors,

exposed them to dust which may lead to unhealthy conditions. (Renu Desai, December 2014)

Studies have shown that there is a total negligence either by contractors and employers on matters related to safety factors. It was revealed that only 10% of workers were provided with safety equipment. (Muniraju, March 2015).A survey carried out at two construction sites in Guwahati for the purpose of studying the existing living conditions of construction workers revealed that the toilets and related facilities provided were miserable. A few Katcha latrines were erected for them in a corner of the work-site. A hand pump was installed very near to their huts and its water was used for all purposes. The worksite was fenced with high brick walls but there was no security arrangement. Similarly in one of the construction sites in Shillong the survey found that the accommodation for the workers was made of straw walls and roofing which led to discomfort due to climatic conditions and water was supplied for only one-hour in the morning and one-hour in the evening. (Deshkal society, 2013).

III. GRIEVANCES OF CONSTRUCTION WORKERS (CONTEXT-LIVING)

The construction workers undergo various problems such as unsafe working environment, occupational diseases, injuries, ignorance and illiteracy, absence of social security, improper implementation of labour law, and lack of labour welfare activities and are uncomfortable due to noise and temperature.

Study on problems faced by workers has been carried out by many researchers which focused on the problems mentioned above. One such study conducted in Kanyakumari district by selecting 25 samples randomly, a total of 100 respondents were interviewed who were engaged in different construction activities such as constructing, carpentering, painting, plumbing and helping. The study concluded the problems faced by the workers in the construction industry at micro level. Problems such as lack of safe working conditions causes labour absenteeism, allergy and other health hazards. The study found that out of the 100 total respondents, 57% have this problem. The occupational diseases like cough, asthma and body pain because the construction workers work in unsafe conditions. (K.Ponnaian, November 2016).A very common health problem that these migrants face is malaria. Only when the construction project is towards completion,the mosquito problem reduces significantly. .Hence workers are at high risk of malaria, dengue and other diseases due to poor sanitation and unhygienic drinking water. (Kulkarni, April 2007).

Another study that looked into the effects of noise on the hearing capacity and working efficiency of construction workers.It was analyzed and concluded that the noise causes giddiness, vibration and loss of hearing. Moreover, a sudden and violent noise shocks the workers. Out of the total 100 respondents 49 % suffer from noise pollution. Also there is a total absence of social security schemes in the construction sector which affects the hope of the workers and discourages them. It was seen that out of the total 100 respondents, 93 per cent suffer due to lack of social security. Thus, this problem cannot be neglected in the construction industry. (K.Ponnaian, November 2016) The literacy rate in this sector is low, Hence, the workers are not much aware of the rules and regulations of their working conditions. Besides this the construction workers have no social security & benefits in terms of Labor welfare measures & provisions. They don't have provisions like pension and insurance schemes, accident and death claims, financial aid for children's education and medical needs. (Deshkal society, 2013).These problems lower the efficiency and working productivity of workers which leads to project delay, causing monetary loss.

IV. ACTS AND GUIDELINES FOR CONSTRUCTION WORKERS

The construction workers are unskilled, migrant and socially backward. With a view to regularizing the working conditions, safety and health, welfare measures, etc. Acts such as the Building & Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996; and The Building & Other Construction Workers' Welfare Cess Act, 1996 are enacted by central government of India.

Under the Building and Other Construction Workers Act 1996 (BOCW) the contractor has to provide various amenities to the workers but the survey done by (Muniraju, March 2015) stated negligence of violation of the norms. The survey reveals the majority of the 81% are not members of any welfare scheme. The discussion with stakeholders provided the insights that the provisions of BOCW Act often led to harassment of contractors by the concerned government officials. As per the provisions of the Building & Other Construction Workers' Welfare Cess Act, 1996, 1% cess collected from the employer on construction projects costing over Rs. 10 lakhs. The money was to be used for Welfare Boards. However throughout the discussions it had been reflected that although the money was being collected from the builders/contractors, yet it had been not utilized for the welfare of the workers. It might have been lying unused. (P.K. Saxena, 2013)

The Contract Labour (Regulation and Abolition) Act was enacted in 1970. Under this act provisions are made for the welfare and health of labour by establishment of canteens, restrooms facilities, first aid, wholesome drinking water, latrines and urinals. In case of failure on the part of the contractor to provide such facilities, the Principal Employer is considered as responsible and he has to provide the amenities. (Labour welfare, 2011). The state level labour agency has the power to take action against the contractor and enforce the terms of contract but itself it does not utilize the given powers. More typically than not the review reports of the labour wing are not acted upon. Thus the agency lacks the power to execute the labour laws. (Deshkal society, 2013) .

Other than the acts amended by state and central government there are some guidelines framed for the labour camps .Major categories covered under the guidelines includes site selection, toilet facilities and hygiene. The guideline states that the construction camps shall be located at least 200 - 500 m away from habitations at identified sites. All sites used for camps must be adequately drained. If located near any water surface it shall be subjected to mosquito control measures. Also the drainage from and through the camps should not endanger any domestic or public water supply. There shall be adequate supply of water close to latrines and urinals .Toilet facilities adequate for the capacity of the camp must be provided. Each toilet room must be located so as to be accessible, without any individual passing through any sleeping room. For multifamily shelters where the toilets are shared, separated toilets must be provided for each sex. At all camps, good and sufficient water supply shall be maintained to eliminate chances of waterborne diseases to ensure the health and hygiene of the workers. (The Department of Science, 2017)

V. CONCLUSION

In India, Most of the workers are migrants who come alone or along with their family members in search of work. The studies show that though the contribution of migrant construction workers to the construction sector and to increase the economic growth is immense, they remain largely invisible in terms of better living conditions. These workers are provided with onsite temporary shelters which have poor living conditions and lack hygiene. The worker's job is not easy as they have to face several adverse problems because of the unsafe working environment, occupational diseases and injuries. More research is required in this area to suggest practical solutions to the existing problems of housing quality, comfortable living conditions and on

health related issues mentioned above. A need exists for trying to enhance the accommodation facilities and condition of onsite construction workers. Most of them are illiterate hence are not aware of their rights needed for a decent living. The situation only can be modified with the government intervention and by implementing the guidelines strictly. The contractors ought to be cheeked from time to time and there should be a positive impact of unions and labour Acts on the workers.

A solution for providing appropriate shelters must be worked on which will not only provide enhanced living spaces but can attain the comfortable living , hygiene and safety conditions for the workers .The design of shelter is required to be context specific for climate. Once the construction project is over and construction workers relocate, the workers community shall disassemble the shelters and use them for other construction projects. The materials used for building shelters shall either be reused in a new project, or will be recycled. Thus the shelter itself shall be self-sufficient and viable for both contractors and workers.

Acknowledgment

The following work 'The transit shelters for onsite construction workers: A review', would not be possible without the constant support and contribution of multiple bodies involved. We would like to appreciate the site coordinators to allow us to discuss the issues and requirements with the aforesaid set of users. This study was successful through the guidance of our varied mentors during the process of review and documentation. We appreciate the contributions of the NGO's and information sources utilized for the document details.

Lastly, but most importantly a note of special appreciation to the workers who spared their time, information and experiences for the completion of the document.

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Determination of Road Profile in An Area

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***Abstracts*- This paper focuses on theidentification of a road profile disturbanceacting on vehicles. Vehicles are subjectedto many kinds of excitation sources such asroad profile irregularities, which constitute a major area of interest when designing suspension systems. Indeed, determining the road profile is important for passive suspension design on the one hand and fordetermining an appropriate control law for active suspensions on the other. Directmeasurement techniques of the road profile are expensive, so solutions based on estimation theory are needed. The aim of this paper is to characterize the road excitation using the independent Component Analysis (ICA). This proposed method can reconstruct original excitation sources by using physically measurable signals of the system under study. Here, the estimation of road disturbances is considered as output sources and identified from dynamic responses of the vehicle. These responses can be measured via sensors or can be numerically computed. In our case, they are numerically simulated using the Newmark method and consider different types of road profiles. The obtained results are validated after using a comparison with the Kalman filtering. The robustness of the ICA is confirmed via parametric study**

***Keywords- Road profile, vehicle, ICA*.**

I.INTRODUCTION

Over time, roads and bridges often become damaged due to vehicle overloading, bridge strikes and due to environmental effects. Undoubtedly, this damage may impact the safe running of the transportation network and consequently, infrastructure monitoring is an important area of research. Road profiles are often monitored using profilometers, particularly for highwaysand major roads but these specialist vehicles are expensive and do not run frequently. Highway structures such as bridges are most commonly monitored by visual inspection that requires large numbers of inspectors and significant cost. Furthermore, due to human subjectivity and differing experience, it is oftendifficult to achieve consistency in the results.

When applied to roads this meansthat a profile is **a longitudinal-sectionview of the earth along the centerline**, and it is always viewedperpendicular to the centerline Like the profile,the grade line is alongitudinal section taken along thecenter line and shows the elevations towhich the road is built.

II.LITERATURE REVIEW

The following Research Papers were referred by us for our knowledge regarding this topic.

Sr. no	Year	Title of paper	Authors	Results & Gaps
1.	2014	Surveying with construction applications	Barry Kavanagh, Diane K. Slattery	Up to date guide to modern surveying for construction & engineering
2.	2010	Surveying for engineers	John Uren, Bill Price	The fifth edition of this of this classic textbook sets out the essential techniques needed for the solid grounding in the surveying
3	2015	Pavement Asset Management	Ralph Haas & W. Ronald Hudson	Comprehensive & practical, pavement asset management provides an essential resource for educators
4	1991	Highway Engineering	C.E.G. Justo & S.K. Khanna	The book is useful for student specializing along various categories under engineering.

Objectives: The main objectives of road profile are: -

- Planning the fast and easynetwork
- Planning for future developmentof area

III. EXPLANATION:

Method used for building roads

Concrete: It is a common option for road construction purposes as they area solid material and can be used for building walls and local roads. This method is considerably less prone to wear and tear defects like rutting, cracking, stripping loss of texture, andpotholes. This is the main reason for itswide usage.

Asphalt-:

This method of construction replacingconcrete method in these days. Theyare very durable, water-resistant andcan go more longer then the concrete. The major advantage of asphalt overconcrete is its price. Concrete is veryexpensive as compared to asphalt. Moreover, asphalt includes low noiseduring pavement and it is easy to handle it for repairing and maintenance. That is why it is widelyaccepted and used by the people forthe purpose of pavement surfacing.

Bituminous: The solvent from the bituminous material will evaporate andthe bitumen will bind the aggregate. It is used inroad constructionbecause it is easy to produce,reusable,non-toxic, and a strong binder.

Advantages: -
there are many advantages of road like easy transportation the connection between two cities will be good the transportation will be easy because of roads it will be doorto door service road transport possesses has a huge benefit from other modes of transport, that is theflexibility which it provides. the routes and timings can be altered easily and quickly according to individual needs without much problem.

Types of roads-: earthen roads

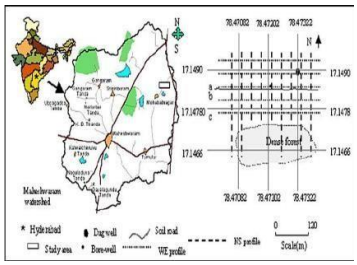
- Gravel roads
- Murrum roads
- Kankar roads
- WBM Roads
- Bituminous roads
- Concrete roads

Road alignment-: The alignment is theroute of the road, defined as a series of horizontal tangents and curves. The profile is the vertical aspect of the road,including crest and sag curves, and the straight grade lines connecting them.

- **step to build road :**
- **PlanningEarthworks**
- **Laying pavement**
- **QC**
- **Maintenance**

IV. DIFFERENT TYPE OF SURVEY :

1] Map study -This is the first step of the Engineering survey, using a topographic map of the area under consideration, which can be availed from the Survey of India, we can propose different alternatives of the road alignment.



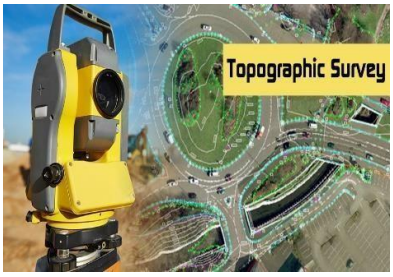
2] Location survey - The establishmenton the ground of points and lines in positions which have been determined previously by computation or by graphical methods, or by a description obtained from data supplied by documents of record, such as deeds, maps, or other sources.

3] Preliminary survey – Preliminary survey includes gathering geospatial data about the proposed route and the project requirements for data outputs.

4] Engineering survey - Engineeringsurveyors do planning, design,develop, maintenance and operate systematic process to collect and analyzing spatial information about theland, the oceans, natural resources, and man-made features.

5] Topographic survey

Topographical land survey measures and identifies theexact location and specifications of natural and human made features within anarea of land.



V.CONCLUSION

The main objective of this thesis was to toestimate the road profile and classify the road based on the

roughness of the road. The introduced many techniques used in the current market forestimation of the classes of the road and road profile. Response based road profileestimation s the one considered. The gives insight into the vehicle modeling. The continuous damper in the semi-active suspension model is explained along with a quarter car model of the left wheel suspension model. Road profile estimation model is also defined. The later used to estimate the road profile. In nextexplains about the method in which the estimation and classification is done. The choice of filter specifications and loop shaping for the robust observer is explained. The ISO standards for classification of the road profile based on power spectral density in the spatial frequency domain is introduced. The last chapter is used to explain the resultsobtained from the simulations from Carmaker data and the experimental results from the sensor data collected from the measurementsrun on the test tracks.

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Vertical Farming: Using Hydroponic System Towards a sustainable India

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***Abstract*—The invention of the vertical farm, which will change the world, has arrived. Imagine living in a society where every town has access to locally grown food that is produced in the safest manner possible and where not a single drop of water or speck of light is wasted. For the 21st century to be sustainably fed, smart farming is essential. The cause is that plant development is directly impacted by environmental and water management. A contemporary method for feeding the growing global population by 2050 is vertical farming. building a farm close to the population it will service, offering them less expensive, disease-free organic food, and maintaining finite natural resources.**

Keywords— Smart Farming,Food Sustainability, World-Changing Innovation

I.INTRODUCTION

Growing crops in vertical layers is known as "vertical farming." It frequently uses soil- less farming methods like hydroponics, aquaponics, and aeroponics as well as controlled-environment agriculture, which tries to optimize plant growth. Buildings, shipping containers, tunnels, and abandoned mine shafts are a few examples of frequent structures used to host vertical farming systems. Around 30 hectares (74 acres) of active vertical agriculture will exist worldwide by the year 2020. Professor of Public and Environmental Health at Columbia University Dickson Despommier first put forth the current idea of vertical farming in 1999. With the help of his students, Despommier created a plan for a skyscraper farm that could provide food for 50,000 people. Despite not having been built yet, the design was successful in spreading the vertical farming. Current vertical farming's coupled with other state- of-the-art technologies, such as specialized LED lights, have resulted in over 10 times the crop yield than would receive through traditional farming methods.

Fig 01- Vertical farming.

II OBJECTIVES

1. On Increasing in food demand due growing population
2. To produce sufficient food for fulfilling need of society
3. With the use of VE we want to reduce 75%water then traditional farming
4. With the use of hydroponic system, artificial intelligence and IOT system, led lights we are using this system in housing society and on smallscale inside home
5. Create a great job opportunity for people in India.

III LITERATURE REVIEW:

1. BARBOSA GL, ALMEIDA GADELHA FD, KUBLIK N, PROCTOR A, REICHELM L, WEISSINGER E ET AL.

Agriculture and the city: A method for sustainable planning of new forms of agriculture in urban contexts

In this study, technology as one of the important factorsof Vertical farming is discussed and reviewed by qualitative approach. The technologies offered can be a guide for implementation development andplanning for innovative and farming industries of Vertical Farming in cities

2. BENKE K, TOMKINS B. FUTURE FOOD-PRODUCTION SYSTEMS: VERTICAL FARMING Future food-production systems: vertical farming andcontrolled-environment agriculture

Solutions for improving future food production are exemplified by urban vertical farming which involves much greater use of technology and automation for land-use optimization. The vertical farm strategy aims to significantly increase productivity and reduce the environmental

3. GREEN SPIRIT FARMS. MICHIGAN, 2017.

After failures and losses, vertical farm operations expand on growing trend

Vertical farming not only produce crops year-round and is more environmentally friendly, it will also enable a more efficient use of waste

4. MARKS P. VERTICAL FARMS 2014.

Vertical farms sprouting all over the world for vertical Farming

The plant racks in a vertical farm can be fed nutrients by water-conserving, soil-free hydroponic systems and lit by LEDs that mimic sunlight. And they need not be difficult to manage: control software can choreograph rotating racks of plants so each gets the same amount of light, and direct water pumps to ensure nutrients are evenly distributed.

IV METHODOLOGY

Vertical farms come in different shapes and sizes, from simple two- level or wall-mounted systems to large warehouses several stories tall. There are three processes usually adopted in vertical farming system

1) Hydroponics 2) AeroponicsAquaponics

Hydroponics:

Hydroponics is a method of growing plants without soil. Instead of having their roots supported and nourished by soil, the plant is supported by an inert growing medium like cockpit and are fed via a nutrient-rich water solution and uses about 70% less water than traditional farming. Hydroponic systems may be as simple as a glass ofwater filled with pebbles and water containing fertilizer or as complex as a large greenhouse structure containingbeds of clay pellets/troughs filled with cockpit that are periodically supplied with a nutrient solution. Nutrient Film technique (NFT) is also a kind of hydroponic farming that is adopted by many commercial farmers these days. Plants are grown in grow tray is filled with a nutrient solution few times a day using a reservoir below the tray, a water pump and a timer. The timer is set based on the parameters such as the size of the plants and water and nutrient requirement of the plants thegrowth cycle of the plants as well as the air temperature. The essential nutrients used in hydroponics system are calcium nitrate, potassium sulphate, magnesium sulphate, etc. Best example of hydroponic vertical farming we can see in Triton food- works, Delhi.

THE FEATURES AND BENEFITS OF NFT METHOD INCLUDE:

1. No soil is needed.
2. The water stays in the system and can be reused,lower water consumption
3. Nutrition levels can be controlled
4. Stable, higheryields and shorter times between harvests
5. Produces highly nutritious, attractive crops
6. Less pest and disease attack, easier to get rid ofthan in soil
7. Easierto harvest and source of income from direct sales

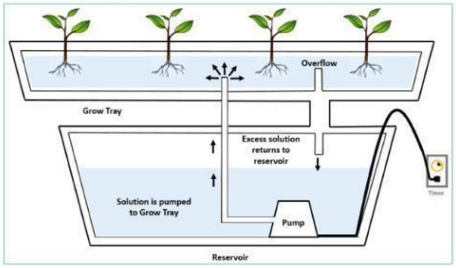

Fig 02: Hydroponics

Aeroponics:

Aeroponics is the process of growing plants in an air or mist environment without the use of soil or an aggregate medium. The basic principle of aeroponic growing is to grow plants suspended in a closed or semi-closed environment by spraying the plant's dangling roots and lower stem with an atomized or sprayed, nutrient-rich water solution Plants in a true aeroponic apparatus have100%

Aquaponics:

Aquaponics is a recirculating system that combines hydroponics (growing plants in water without soil) and aquaculture (fish farming) to create an efficient closed loop system. Aquaponics uses these two in a symbiotic combination in which plants are fed the aquatic animals' discharge or waste. In return, the vegetables clean the water that goes back to the fish. Along with the fish and their waste, microbes play an important role to the nutrition of the plants. These beneficial bacteria gather in the spaces between the roots of the plant and convert the fish waste and the solids into substances the plants can use to grow. The result is a perfect collaboration between aquaculture and gardening.

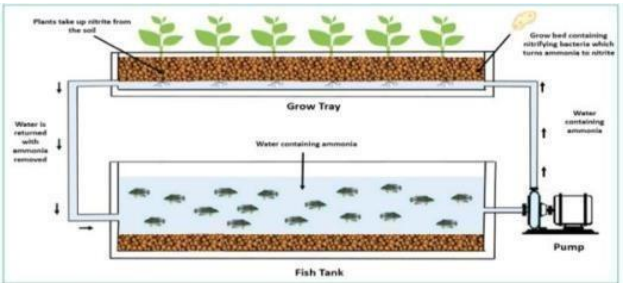

Fig- 04 Aquaponic

CASE STUDY-1

Singapore's Sky Green Vertical Farming, as an example: Sky Greens is the first hydraulically powered, low carbon vertical farm in the world. produces safe, delicious vegetables with little use of land, water, or energy

resources by utilizing green urban solutions. The farm at Sky Greens, which is the innovation Centre ofits parent business Sky Urban Solutions Holding PTV Ltd., can produce up to 30 kg of vegetables each day, or 6 to 7 kilogram per square metre per month.

In contrast, conventional farms produce 2 to 3 kg per square metre each month. The farm employs natural sunshine and 40W electricity to power a 9-meter tower with a special hydraulic system for stack rotation. It also uses 0.5 litres of water to rotate a 1.7-ton vertical structure.

Fig 05: Vertical farming Singapore

CASE STUDY -2

Triton Food Works, Delhi: Triton food works pridesitself on building and operating technologically advanced, climate-controlled greenhouses. The company has built and operates over 150,000 sq. Ft. of greenhouses across India. Triton food works is actively looking for expansion projects across the country. Technologies used are CEA, hydroponic, aeroponics and non-GMO grow about 18 varieties of crop including oregano, thyme, tomato, iceberg, broccoli, and strawberries.

V. ADVANTAGES OF VERTICAL FARMING

1. Reliable year-round crop production

The biggest vertical farming benefit is the fact it's not dependent on the weather – meaning you can achieve a consistent year- round crop production without worrying about the impact of adverse
weather conditions can have both on quality and profiling of production and yield

2. **Unaffected by adverse weather conditions**

Growing in a fully enclosed and climate- controlled environment completely eradicates the need to rely on - or worry about - the weather. Whereas crops ina field can be ruined by excessive rain, wind and drought (or pests!); vertical farming provides 100%harvest certainty.

3. Better use of space

It goes without saying that traditional farms need fertile arable land. But vertical farms can be designed and built in any climate or location - irrespective of weather conditions or temperature extremes. And because their stacking grows systems allow them to expand upwards, it's also possible to achieve higher productivity on a small land area.

4. . **Minimize water usage**

One of the main vertical farming benefits is that the Hydroponic growing process only uses about 10% of the amount of water, and as a result the nutrients and fertilizers, compared to traditionalmethods

VI.DISADVANTEGS OF VERTICAL FARMING

1. No Established Economics: The financial feasibility of this new farming method remains uncertain. The cost of building skyscrapers for farming, combined with other costs such as lighting, heating, and labor, can be more than the benefits we can get from the output of verticalfarming.
2. Difficulties-with Pollination: Vertical farming takes place in controlled environment without the presence of insects. The pollination process needs to be done manually, which will be labor intensive and costly.
3. Too Much Dependency on Technology; Losing power for just a single day can prove very costly for a vertical farm.

VII DESIGN REQUIREMENTS OF VERTICAL FARM BUILDING

1. To design a new building specifically for a self-sufficient vertical farm following parameters have to be incorporated.
2. multi-stores construction Shape of the building canbe narrow to rectangular.
3. Windows can be large or small depending on the usage of sunlight.
4. Ventilation should be controlled.
5. Floors should waterproof and resistant to-conducting heat and vibration, not slippery under any condition.
6. High rise structure with a core.
7. Effective warehouse and storage layout.
8. Shipping and receiving areas at a convenient location.
9. Wind turbine can be accommodated for electricalresources (Euro wind wind turbines).
10. Solar photo-voltaic cells for energy renewal.
11. Light system-network of reflectors and fiber opticscable.

VIII. APPLICATIONS IN ACTUAL SCENARIO

As is common knowledge, sewage treatment plants arelocated in all new housing societies (STP). Since more communities are reusing this water to flush tanks, there is a facility for dilution/purification of water to 70%. So that we may utilize this water in our HYDROPONICS (vertical farming) method, nutrients must first be given in the correct proportions to the roots before water is introduced. As we will be using the vertical stake method and walls as support, we may set up the situationso that water will be flowing downward under gravity from higher to lower ends, and after the water has reached the ground.

ON SMALL SCALE INSIDE HOMES:

In homes with available space, vertical farming can be used to efficiently produce green veggies by producing the warmth or artificial light they require for their healthy growth. We can even employ IOT for quality monitoring, which would be more efficient. We can now employ vertical stake farming to enhance the aesthetic appeal of our home or community. Although it is not a vertical

farming technique, it can be one that uses less soil to produce the same amount or quality of flowering crops and, occasionally, green vegetables and salads as well.

IX. MATHEMATICAL MODELLING:

The type of mathematical modeling which represents our project the most is CONTINOUS MODEL. It represents the objects in a continuous manner, such as the velocity field of fluid in pipe or channels, temperatures and electric field.

PROTOTYPE:

1. To build inexpensive, space saving wall mounted hydroponics system on terrace
2. In this model we will be using,4" PVC pipe, 4pieces each 1 meter, 8 pieces 4" PVC socket 110 mm, 110x50 mm, PVC reducer 7 pieces, end cop4" 1 piece 50 mm PVC elbow 7 pieces, 4 feet PVC pipe 55 mm.
3. Then by inserting socket on both each of pipe we make holes on pipe at convenient say 20cm.
4. Connecting the bush reducers to the sockets on any side of the tube and connecting end cop to the socket on another side
5. After completion of all arrangements with the help of pipe fixture and fastening, fix it on wall with the help of nutrient mixture, mix adequate amount of nutrient according to the plant which will be chosen.
6. With the help of pumping mechanism allow water enrich with nutrients to flow through it then we willput desired plants to grow. With regular monitoring and controlled mechanism, we will harvest the crops/vegetables.

X. RESULTS

The setup of hydroponics using pvc pipes motor for embedding oxygen, electricity saver, spectrum lights within space which is less than 1.2square meter. We grew lettuce which was completely off season. By traditional method it takes around 40 to 45 days for a lettuce to

mature completely, whereas, by using hydroponics we achieved it within 20 days with less water and no soil and it was completely organic. After this batch of lettuce, we are trying to grow bell paper, lettuce as well as strawberries all together using their combination. Results of bell papers are amazing they started budding within 15

fig 06: Vertical farming model

days. Thus, we can use hydroponics which consumes less electricity with helpof energy saver to yield 4 times that of traditional farming

fig 07: Vertical farming setup

XI. CONCLUSION

Vertical farming technologies are still relatively new. Companies are yet to successfully produce crops at scale and make it economically feasible to meet the growing food demand. The visionaries behind this new farming technique are working toward a networked agricultural system that looks to the open-source software movement for inspiration. In future by in cooperating image processing and mobile applications we can control this module remotely by the using mobile application software. We pose a question which is how much percentage of vertical farming can incorporate to create a balanced environment, although landscape agriculture has to be maintained as long as we get accommodated to this new technique. **"Vertical farming needs to be heard, learnt and done."**

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A review on management of dairy waste

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Abstract: Demand of dairy products is increasing in different countries, which results in the development of the dairy industry and increases in the generation of wastes. The main wastes generated are whey, dairy sludges and wastewater (processing, cleaning and sanitary). They have high nutrient concentration, biological oxygen demand (BOD), chemical oxygen demand (COD) and organic and inorganic contents. Furthermore, they can contain different sterilizing agents and a wide range of acid and alkaline detergents. Pollution due to dairy industry affects the air, soil and water quality. The continuous disposal of dairy waste into the environment negatively impacts ecosystems.
The purpose of the paper is to review the data on various treatments methods given to dairy waste.
Keywords: dairy, BOD, COD, pollution, treatment

I. INTRODUCTION:

Dairy plants are found all over the world, but because their sizes and the types of manufactured products vary tremendously, it is hard to give general characteristics. The dairy industry can be divided into several production sectors. Each division produces wastewater of a characteristic composition, depending on the kind of product that is produced (milk, cheese, butter, milk powder, condensate).[1]

Demand of dairy products is increasing in different countries, which results in the development of the dairy industry and increases in the generation of wastes. The main wastes generated are whey, dairy sludges and wastewater (processing, cleaning and sanitary). They have high nutrient concentration, biological oxygen demand (BOD), chemical oxygen demand (COD) and organic and inorganic contents. Furthermore, they can contain different sterilizing agents and a wide range of acid and alkaline detergents. Pollution due to dairy industry affects the air, soil and water quality. The continuous disposal of dairy waste into the environment negatively impacts ecosystems.[2]

Types of waste:

Solid waste: These refer to those wastes which are obtained in solid form either as a result of processing or are generated during maintenance. Examples are: Minute particles in the exhaust air coming out of a drier,Solid ghee residue in ghee section, Ash from Boiler, if solid fuel is being used, Packaging section, where considerable packaging materials may be discarded in the form of LDPE films, cartoons, bottles etc.Wastes generated by adverse events. (Explosions, fire etc.).Damaged and contaminated equipment and contaminated soil.

Liquid wastes: These refer to those wastes which are obtained in liquid form as a result of processing, cleaning, flushing etc. The wastes resulting from processing may include un-reacted raw materials, impurities or byproducts generated in process because of operational deterioration, e.g., if the milk is not pasteurized at the right time and if it becomes sour then it will be dumped in the drain. Water used for cleaning purposes, acid, and lye as used in the CIP also comes under these wastes.

Oily wastes: These wastes results from the leakage in compressors, hydraulic machines, crankcase, and coolant leakage and motors where oil is required for lubrication. These wastes are differentiated from liquid wastes because they need a different disposal method.

Gaseous wastes/water vapors: These wastes refer to those released in the air in the form of gases or volatile vapors. The obnoxious fume from the chimney is a gaseous waste and pollutes the environment to a major degree. This chimney fuel consists of various gases like CO_2 and CO. Apart from it; the refrigerant leakage from pipe lines of the compressors also comes under this category. Gaseous wastes from processing plants include the water vapors formed in a concentrating section. These vapors increase the relative humidity of the surrounding and the energy they carry with them is wastage to the plant. Steam leakage from various points decreases the life of the tees and knobs used for regulation purpose, nuts and bolts because all of these corrode with time. [3]

Treatments of dairy wastewaters include the application of mechanical, physicochemical and biological methods. Mechanical treatment is necessary to equalise volumetric and mass flow changes. It also reduces parts of the suspended solids. Physicochemical processes are effective in the removal of emulsified compounds, but reagent addition increases water treatment costs. Another disadvantage is the very low elimination of soluble chemical oxygen demand (COD). Therefore, biological wastewater treatment systems are preferred due to the highly biodegradable contaminants. [4]

The purpose of the paper is to review the data on various treatments methods given to dairy waste.

II. Review on waste management:

Wastewater Volume:

The bulk of wastewater comes from manufacturing processes. Contaminated water, including sanitary activities, reaches 50–80% of the total water consumed in the dairy factory, whereas the remaining 20–50% is conditionally

clean. It has been estimated that the amount of wastewater is approx. 2.5 times higher than that of processed milk in units of volume. The amount and characteristics of the wastewater depend largely on the factory size, applied technology, effectiveness and complexity of clean-in-place (CIP) methods, good manufacture practices (GMP), *etc*.. However, the introduction of GMP can reduce the world's wastewater mean volume from 0.5–37 to 0.5–2 m^3 of effluent per m^3 of processed milk. Nowadays, the designed volumetric load is 1 m^3 of effluent per tonne of manufactured milk.

1) Dairy wastewater composition

Milk processing effluents have an increased temperature and large variations in pH, TSS, biological oxygen demand (BOD), COD, total nitrogen (TN), total phosphorus (TP) and fat, oil and grease (FOG).

With annual temperatures of 17–25 °C, dairy waste streams are warmer than municipal wastewater (10–20 °C), which results in faster biological degradation compared to sewage treatment plants. Following flow chart shows various ways of the dairy waste water disposal.

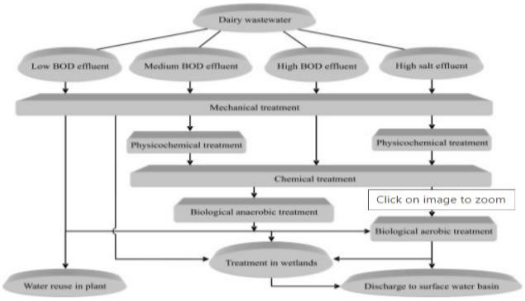

Fig 1: Flow chart of dairy waste water disposal

Discharge in nature without treatment

It is not recommended that raw dairy wastewater be discharged directly into water bodies because this would lead to different pollution problems, including rapid dissolved O_2 depletion due to the high organic loading, which results in anaerobic conditions, the release of volatile toxic substances, aquatic life destruction and subsequent environmental damage. Higher water temperatures decrease O_2 solubility and increase biota sensitivity.

2) Treatment in wetlands

Wetland systems use natural processes that include self-supported microbial communities to improve wastewater treatment. The simple construction and the lack of sludge recycling make them preferable for dairy effluent utilisation in developing communities.The main drawbacks of their application include the need for a large surface area, the potential risks for surface and groundwater pollution, the presence of dangerous volatile substances and the presence of insects. The easy exploitation of the systems counteracts with the complexity of the biological processes, which exceeds that of other treatment systems applied in wastewater purification. Also problematic is the generation of Fe^{3+}, Mn^{3+} and Ca^{2+} ions. They precipitate and reduce bed permeability with time. As a result, anaerobic conditions prevail and the NH_3 removal is limited.

Generally, dairy wastewater is treated in wetlands under aerobic conditions. Five days are enough for an 85% BOD_5 reduction in aerobic ponds with milk wastes at 20 °C, while high-load dairy wastewater is treated mostly in facultative wetlands. [4]

3) Purification in urban or in-factory wastewater treatment plant

In-plant effluent treatment is the most common strategy for dairy wastewater purification. Typically, it includes mechanical, physicochemical, chemical and biological methods.

a) *Mechanical treatment*

Mechanical treatment removes suspended solids from wastewater. Conventional mechanical procedures reduce insufficiently the organic load because of the low settleable solid concentration in dairy wastewater. Nevertheless, the faster the wastewater is screened, the better, due to less TSS biodegradation and a low soluble COD increase.

High variations of dairy effluents can bring about an instability of the subsequent treatment facilities. Adequate equalisation will smooth the fluctuations in the flow, organic loading, pH and temperature, neutralise residual cleaning agents and completely destroy excess oxidisers. In practice, a 24-hour flow pattern at the highest load can be effectively handled by effluent equalisation for at least 6–12 h with a basin dimension from 25 to 50% of the total effluent volume.

b) *Physicochemical treatment*

Physicochemical treatment destroys and reduces milk fat and protein colloids in the dairy wastewater. FOG removal is a major problem in the plants producing unskimmed milk, in milk and whey separation, cheese and butter production, as well as milk bottling. Skimmed milk production rarely creates such problems.

c) *Chemical treatment*

Chemical treatment removes mostly colloids and soluble contaminants from milk processing effluents. It includes reagent oxidation or pH correction. During cheese wastewater reaction with $FeSO_4$ and H_2O_2, up to 80% of fat (initial concentration of 1.93 g/L) is removed. Extreme pH values of dairy wastewater below 6.5 and above 10 can increase the corrosion of pipes and be highly detrimental to microbiological assemblages in biological processes. Therefore, they should be corrected to reduce side effects. If a dissolved air flotation (DAF) unit is used, then the pH control is a necessary step to achieve optimal coagulant conditions. However, coagulants work best at an acidic pH, which requires a second pH adjustment to a neutral value before biological treatment. It is very suitable to collect independently used CIP solutions and outflow them constantly during the whole wastewater plant exploitation.

d) *Biological treatment*

One of the most reliable methods for dairy effluent purification is biological removal. Such methods can assimilate all dairy wastewater components but they mostly utilise soluble compounds and small colloids. These processes have not been fully studied. Moreover, because of their unlimited adaptation potential, they can be jointly used in various sequences to meet certain component biodegradation requirements. Biological treatment has two main branches depending on oxygen requirements: aerobic and anaerobic processes.

Aerobic processes. Nowadays, most dairy wastewater treatment plants are aerobic although they have been less efficient, mainly due to filamentous growth and rapid acidification caused by high lactose levels and low water buffer capacity, respectively. Problems generally encountered with activated sludge processes are bulking and foaming, which diminish sludge settling.

Aerobic biological systems give a very positive response during synthetic dairy wastewater treatment.

Aerobic filters are applied to a lesser extent in the treatment of high-strength dairy effluents rich in FOG. High fat and heavy biofilm blockage are possible, which results in biomass loss, filter fouling and corresponding reduction in productivity.

The sequencing batch reactor (SBR) is preferred in dairy wastewater treatment because of its various loading capabilities and effluent flexibility. A traditional technology with free sludge flocs is mostly applied. after system optimisation due to the limited excess sludge disposal.

Moving bed biofilm reactor (MBBR) shows very high performance when applied to dairy wastewaters: OLR increases dozens of times compared to conventional activated sludge systems.

Various alternatives for aerobic treatment of dairy effluents are also used. Pure oxygen is another possibility in the biodegradation of milk wastewater. Oxygen can be applied directly in the homogenisation tank during a traditional physicochemical treatment and stable operation is achieved under a broad initial COD and TSS range. This modification improves effluent quality and reduces process costs. Such oxygen injection systems can replace the expensive anaerobic treatment and are naturally safer. Cheese whey can also be successfully utilised as a cheap medium for edible mushroom cultivation.

Cheese whey effluents can be treated successfully in municipal wastewater treatment plants. Factories with onsite treatment technologies should collect sanitary wastewater independently from processing effluents and discharge them directly into municipal wastewater treatment plants. Nevertheless, such a treatment option can lead to operational problems with secondary treatment units. Periodic sludge bulking is possible and is caused by intermittent high soluble COD levels in the receiving sewage plant.

Anaerobic processes. Anaerobic systems are more suitable for the direct utilisation of high-strength dairy wastewater and are more cost-effective than aerobic processes. If properly operated, these systems do not produce unpleasant odours. The major problems of anaerobic dairy wastewater treatment include long start-up periods due to complex substrate degradation, preliminary biomass adaptation prior to protein and fat utilisation, fast drop in pH and a resultant inhibition of methane production (as a consequence of the high concentration of easily fermentable lactose and low substrate alkalinity), sludge disintegration by fats in the form of triglyceride emulsions and subsequent biomass flotation, presence of inhibitory compounds (long-chain fatty acids, K^+ and Na^+ ions), inability of ammonia biodegradation and phosphorus removal, careful management, increased sensitivity to various OLRs and shock loadings, *etc*.

Milk processing effluents are predominantly treated in conventional one-phase systems: upflow anaerobic sludge blanket (UASB) reactor and anaerobic filter (AF) are most commonly applied. UASB reactors have been used in industrial dairy wastewater treatment for more than 20 years. Dairy effluents with a low TSS can be successfully utilised in AFs in an all-scale range. The COD decreased by between 60 and 98%. A large specific surface of the filter media creates a precondition for higher biomass accumulation which is less affected by shear stress. A five-time higher load

than with the non- -porous filler under the same conditions is achieved.

Milk processing effluents can be treated in hybrid systems too. An anaerobic contact digester may reach a COD degradation of over 80–95% under mesophilic conditions. The main disadvantage is the difficult sludge settlement. However, the technology is applied worldwide in dairy plants although it is quite old. Anaerobic packed-bed bioreactor (PBB) can be successfully applied for dairy wastewater treatment of various organic loads.

Membrane applications in anaerobic systems are good options for improved effluent filtration combined with a higher concentration and an effective differentiation between HRT and solids retention time. The application of the ultrafiltration system made it possible to achieve a higher biomass retention for more efficient wastewater treatment.

Depending on the operating temperature, dairy wastewater can be treated in a two-phase separation. The basic configuration presupposes that thermophilic acidogenesis is followed by mesophilic methanogenesis. The information on these processes in the literature is scarce. The overall improved performance showed that the thermophilic-mesophilic system with respect to total coliform reduction, TSS removal and biogas production, is preferable to the mesophilic-mesophilic SBR couple. Despite that, higher energy consumption during the thermophilic phase should be taken into account from an economical point of view.

Combined (anaerobic-aerobic) processes. Since an anaerobic technology reduces mostly C-containing contaminants and has a weaker effect on nutrient removal, it needs to be considered as only a preliminary step which must be polished. This can be achieved by incorporating a local aerobic step or, occasionally, by directly discharging anaerobic effluent into the municipal wastewater treatment plants.

A mixed dairy wastewater was purified on a full- -scale level in consecutive UASB reactor and aerobic denitrification steps. When 95% COD removal was achieved, the produced CH_4 was sufficient to cover the plant energy requirements. SBR great flexibility makes it an adequate post-aerobic step in combined dairy wastewater treatment. [4]

III. CONCLUSION

The discontinuous manufacturing process and high production heterogeneity in milk processing make it hard to outline the general dairy wastewater characteristics. Nevertheless, it can be concluded that dairy factories are large water consumers and therefore produce unstable waste streams with increased temperatures, variable pH values, high COD, BOD, FOG, N and P concentrations in combination with inhibiting cleaning agents and strong fluctuations in all factors. However, there is little information on the composition of wastewater streams from certain dairy industry branches, such as the production of yoghurt and whey products, which require more attention in future research. Conventional aerobic activated sludge systems and percolating filters are not appropriate for dairy wastewater treatment. The high soluble COD values in wastewater account for the vast filamentous growth, which obstructs proper treatment and plant management. The application of immobilised biofilm technologies offers the opportunity to treat concentrated wastewater. MBBR are promising systems. However, many studies should be performed on other dairy wastewater streams, such as high FOG effluents, acid whey, *etc*. High organic contamination levels create conditions for the preference of anaerobic digestion over aerobic processes in dairy wastewater utilisation although anaerobic treatment rarely produces clear streams. This necessitates the development of novel, more effective fermentation technologies to deal with high-strength dairy effluents. Insufficient information on temperature-phased anaerobic biodegradation paves the way for new research on dairy wastewater management. A major problem in the anaerobic fermentation of dairy wastewater is ammonia, known for its toxicity if generated in high concentrations. Research can contribute a lot to the anaerobic ammonium oxidation application in the treatment of anaerobic effluents from dairy manufacturing for an improved nitrogen removal.The consecutive combination of fermentative and oxygen processes may be a solution for appropriate milk processing wastewater treatment. However, innovative and more compact equipment should be designed to meet the challenges associated with wastewater treatment limitations and water-quality requirements. Moreover, the replacement of outdated equipment with new machines needs to be supported by more, real-case studies, which will help us understand better dairy wastewater treatment.

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Use of Eco- Friendly Construction Materials for Sustaining the Strength in Concrete

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***Abstract*— The purpose of this paper is to present an idea The production of concrete has increased and consequently constituting depletion of the natural resources. Hence, various studies are focusing development of green concrete, which is a beneficially conserves natural resources and reduce carbon emission when compared to conventional concrete. Concrete is essentially consisted of four ingredients, i.e., coarse aggregate, fine aggregate, cement and water. Green concrete may be achieved by replacement of binder or adding discarded or recycled material**

Keywords—Internet Of Things(IOT), IIOT, DHT11, Dust Sensor, Monitoring and Controlling

I.INTRODUCTION

The use of waste materials as workable alternative to the traditional material in concrete has increased popularity in current years, which is due to the over exploitation of the natural material sources. Waste utilization in concrete has two advantages, discarding of waste in green manner and improving strength and durability properties of concrete. Concrete is one of the most utilized man-made material on the planet, and is mostly used substance next to water on the planet.

The production of concrete has increased and consequently constituting depletion of the natural resources. Hence, various studies are focusing development of green concrete, which is a beneficially conserves natural resources and reduce carbon emission when compared to conventional concrete. Concrete is essentially consisted of four ingredients, i.e., coarse aggregate, fine aggregate, cement and water. Green concrete may be achieved by replacement of binder or adding discarded or recycled material.

We are traditionally used to using, earth bricks, concrete, and wood in construction.

They have been, and continue to be used in everyday construction, meaning the continued destruction of trees for timber, and the mining of resources to produce cement for binding sand, gravel, and bricks.

For a better world, there are new processes, and sustainable as well as green building material alternatives that can be used in construction today.

Advancement of new solid added substances could deliver a more grounded, increasingly functional material while decreasing the measure of concrete required and the subsequent CO2 emissions.

So, in this we are going to use Coconut shell has a waste and eco-friendly material to Construction Materials for Sustaining the Strength in Concrete.

Overall, this study presents the cases of alternative construction materials and their effects on the strength development in concrete.

Fig. 1 Eco-Friendly Building Materials

II. LITERATURE REVIEW

Behaviour of Green Concrete (Blended Concrete) using Agro-Industrial Waste AS Partial Replacement of Cement [1]: The slump value of 20% replaced SCBA, RHA and saw dust combination showed minimum workability in comparison with other values • There is no significant reduction in compressive strength values of 5%, 10% SCBA, RHA and saw dust ash combinations in comparison with conventional concrete mix.

The flexural strength of 10% replaced concrete samples showed highest strength values than all other mixes.

The compressive strength values of 15% and 20% replaced combinations showed very less strength values than all other concrete mixes.

Impacts of adding jute fibers to concrete [2]: It is hereby concluded that by adding jute fibers the

compressive strength and split tensile strength increases to 33% and 10% respectively. Also, the reduction in weight due to sulphate attack is within permissible limits. But increase in fiber proportion beyond a certain limit leads to decrease in compressive strength and tensile strength of concrete as due to increase in fiber proportion the water absorption increases which leads to increase in porosity thereby decreasing the strength characteristics.

Increase in fiber aspect ratio also leads to decrease in the strength characteristics.

Environmentally friendly building materials [3]: In terms of reducing global environmental impact from building materials production and use, one of the most pressing needs if for the transfer of low pollution and energy efficient production technology and resource management programs to developing countries.

The distribution of urban growth worldwide has large implications for resource demand, environmental degradation, technological development and global trade in building materials.

With the exception of a few periods of recession, demand for building materials has been very strong for most of the post-war period in the expanding economies of the developed world.

Impacts of nonconventional construction materials on concrete strength development: case studies [4]: Glass fibre incorporation in concrete increased the compressive strength in minimum of 2%, for 10% replacement.

Overall, the significance of alternative construction materials on strength development of concrete is has been explored by numerous researchers.

Addition of Carbon fibre Reinforced Concrete decreased the compressive strength of the concrete; hence it is not recommended.

Rice husk ash can be replaced by cement due to its pozzolanic property and notable increase in strength was observed.

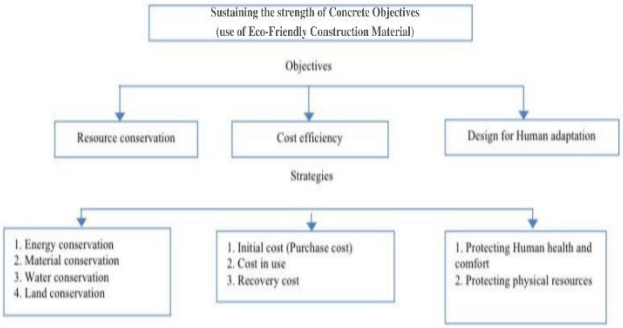
GGPS is replaced even up to 40% and notable increase in the strength of about 30% when compared to control mix as achieved.

Sustainable Construction Materials & Technology in Context with Sustainable Development [5]: The use of sustainable material & technology not only reduces transport & production cost, carbon emissions but also provides avenues for employment & skill development for community members.

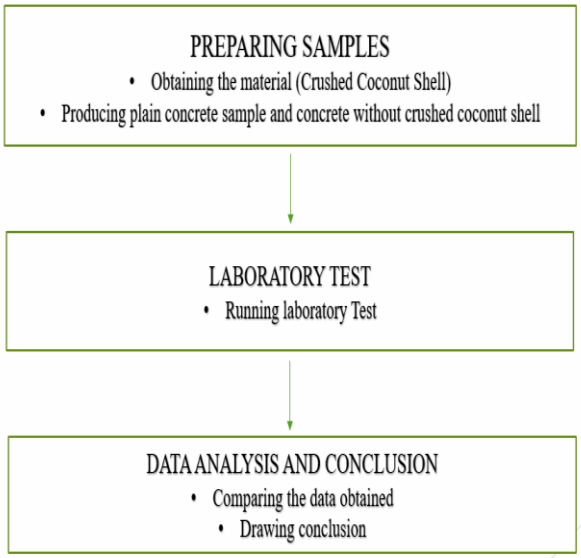
The advantages in selection of sustainable building material lies in the fact that they are not only economically viable but also reduce toxic emissions thereby reduce overall environment impact.

III. OBJECTIVES

1. To reduce consumption of non-renewable resources, minimize waste, and create healthy, productive environments.
2. The improvement of environmental properties of its products and to decreasing environmental risks
3. Sustainable Concrete has sufficient strength and durability in comparison with standard concrete
4. To produce High Strength Eco- Friendly Concrete.
5. To create sustainable concrete that are cost-efficient, environmentally friendly, and durable



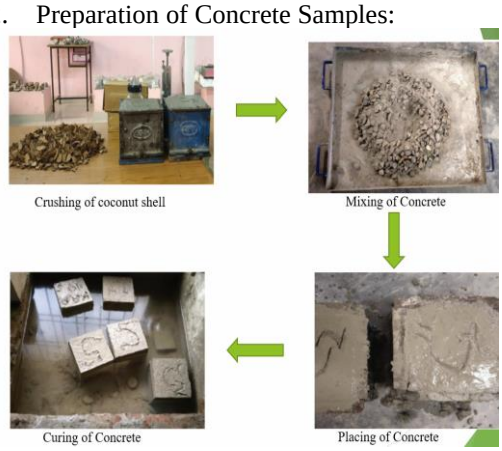
IV. METHODOLOGY



1. Obtaining Material: Collecting coconut shell required for the project work. Crushing of coconut shell to be used as coarse aggregate

Fig. 2 Obtaining Material

2. Preparation of Concrete Samples:



3. Laboratory Testing

Various tests will be carried out on the prepared sample Tests such as Compressive Strength can be performed on the prepared sample cube compressive strength, Tensile Strength etc.

V. CONCLUSION

Conclusion of our project is under process, but the conclusion we derived till now through the literature reviews is that we can use different sustainable material in concrete.

Using sustainable material increase strength of concrete according to the material used.

Using eco-friendly material can reduce the cost of construction and also achieve the required strength.

By using eco-friendly material, we can save naturally available material such as sand, etc which are about to get depleted. This also reduces environmental impact.

Thus using such material can conserve resource, become cost effective and also be beneficiary to humans.

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Sustainable electricity Emanated By Electro-Kinetic Roads

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Abstract— Renewable energy resources are more important in day-to-day life. Fossil fuels renewable energy sources are more important in day-to-day life. Fossil fuels such as oil, coal, and natural gas on the contrary are available in finite quantities only. As we keep extracting them, they will run out sooner or later. Although they are produced in natural processes, they do not replenish as quickly as we humans use them. In this paper, electro-kinetic roads are implemented as a renewable energy source. For meeting up the regular demand for energy we need to design a system that will produce electricity without destroying nature. We will see how kinetic energy is used to produce electricity. The medium of collecting this energy are piezoelectric roads, solar roads, Electrokinetic roads the energy is converted and can be then used for traffic lights and powering streets. Kinetic Road is a term that refers to a system that harvests energy from moving vehicles' kinetic energy and converts it into electric energy. Energy harvesting technologies from road infrastructure are a new research area in civil engineering that encompasses technologies that capture and store the wasted energy that occurs at pavements. Their most appealing feature is that they already have extensive pavedsurfaces.

Keywords— Renewable energy, kinetic energy, electro- kinetic roads, sustainable electricity.

I.INTRODUCTION

Renewable energies are, as we all know, regarded as clean. So credible alternative energy that reduces CO2, it thus includes renewable energy sources such as wind power Solar, tidal, biomass, and geothermal are all non-hazardous energy sources. By fulfilling the regular demand for energy, we need to design a system that will produce electricity without destroying nature. Mechanical energy exerted bytraffic, especially heavy trucks, can be converted into electricity in several ways. The mechanical stress traffic can be captured by piezoelectric material or causerelative movement in the electromagnetic generator. Also, significant solar energy absorbed by pavement can be harvested using photovoltaic cells, heat flux, or thermoelectric materials. Paved surfaces with conductive pipes, PV sound barriers, nanomaterials, or phase changematerials Piezo sensors, thermoelectrical generators, and induction heating techniques are just a few of the most recent examples. Their outputs include the generation of electric energy and district heating and cooling, the dicing of surfacesor the powering of wireless networks, the monitoring of pavement conditions, and the enhancement of their self-healing process. Underground Power, an Italian start-up, is investigating the potential of kinetic energy in roadways. It has created Lybra, a tire-like rubber paving that converts the kinetic energy produced by moving vehicles into electrical energy.

When a car drives over a road, most of the kinetic energy is lost as heat. In this paper, we will see how kinetic energy is wasted on the streets and roads where many vehicles pass by every day. We can supply this energy to urban and remote areas for lightning purposes by conserving this kinetic energy and generating electricity by it. Kinetic energy is an object's movement energy. A moving bicycle or car's kinetic energy can be converted into other forms of energy. To achieve a sustainable world, energy production alternatives must be used so that our fossil fuels do not run out and cleaner energy generation methods are used.

India is a populated country; This population can be used to generate electricity. Energy wasted from activities such as walking, jogging, or running can be stored and converted into electricity. This will not only create an alternative method of power generation but will also reduce the burden on fossil fuels when used on a large scale.

The demand for electricity will continue to increase as the population increases. Energy harvesting is nothing

more than extracting wasted energy from naturally occurring energy sources and then storing it properly for a later period. This is one of the most efficient ways to solve the problem of depletion of natural resources. The human body generates a amount of energy while performing the most common activity such as walking. Any footfall causes pressure when the foot hits the ground that is not being hit. With the ground surface designed for the extraction of energy, the energy of human steps can be generated, stored and used effectively.

When vehicles run over the energy harvester apparatus, electrical energy can be generated by even mechanical movement after the vehicle has passed, which solves the problem of regenerating energy from pulse vibrations. A design approach and a dynamic model are presented to show the mechanism of action of the energy conversion. One of the most critical decisions was how power would be converted from mechanical to electrical. When it comes to power generation, the induction generatoris more commonly used because it provides significantly more power due to being more developed and understood. Induction generators, on the other hand, must spin at much faster speeds to produce the same amount of power. Because the rotor of an induction generator is a glorified electromagnet, it would also require an input current to produce power. The main reasons for using a permanent magnet generator were its size and ease of maintenance. One of the most important aspects of this product is that it fits in the road so that it can do its job. The size must be very small, especially in terms of height, because mostlayers of pavement are only about three inches thick

II.HISTORIC BACKGROUND

The rate of energy consumption has been faster thanthe rate of regeneration of natural resources for many years.For the problem of the scarcity of natural resources, the “energy crisis” is just a small example of what will happen to us in the future. Numerous researchers are working on technologies for collecting renewable energies and doing research on increasing the energy collection efficiency of the energy collection system.

III.LITERATURE REVIEW

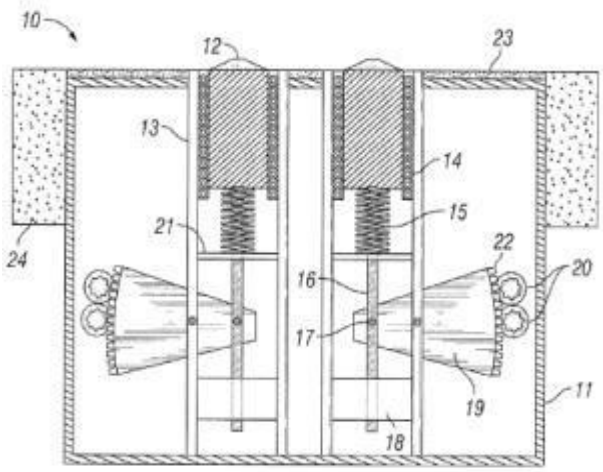
As one of the most popular types of street energy collectors, many researchers are working on piezoelectric materials. Piezoelectric materials are widely used in energy harvesting field to generate power to power low power consumption equipment. The other popular type of street energy collector is the electromagnetic energy collector. The electromagnetic energy collector generates electricity by absorbing external vibrations in the moving part of the collector. If the moving part is a magnet, the fixed part of thecollector must be a coil large amount of current, theelectromagnetic combine harvester can make a unit strong byusing strong magnets and a large weight of moving mass. If we look at the performance of a combine, the performance ofan electromagnetic combine can be much higher than that of a combine made of piezoelectric material. The electromagnetic collector also generates a relatively high current output. Conversely, most of the electromagnetic energy collector is larger in size than the piezoelectric material collector and generates a relatively low voltage.

One of the most sensible electromagnetic avenue electricity harvester company is Highway electricity provider LTD, in United Kingdom. The inventor of the harvester says the output strength of a one unit of harvester is relies upon on the rate of the automobiles and length of strolling over automobiles, however commonly capable of generate five to 10kW of electricity.

We determined numerous mechanical vibration power harvester patents. Calvo proposed a type of toll road strength generator in 2004, as When an automobile runs over the actuator buttons 3, enter load is transmitted to the recoiling spring 30, with a purpose to hit the relationship component fifty-six and it'll rotate the principal shaft 15 to power generator. The downside of the gadget is that because of such a lot of additives withinside the gadget, the shape is simply too complicated, which can also additionally boom the renovation cost. Meanwhile, the complexity will bring about low power harvesting efficiency.

Another type of road energy harvester is shown in Figure, when a car drives over potholes 12, the potholes are pushed down and this vertical movement turns the cranks 19, which rotate the alternator 20 and generate electricity. The drawback is that it takes up a lot of space under the road and the design is not compact enough.

Figure 1: Roadway power generating tool



Martinez proposed a “dual carriageway turbine” electricity harvester, as proven in Figure 3. The machine makes use of a ratchet mechanism to rotate the large gear.The downside of this layout is the pedal component 39 on the street surface, which allows you to sluggish down the traffic. According to the dual carriageway law of NYC, they do not permit any extruded shape at the dual carriageway for protection purposes. The capacity catastrophe is that after an automobile adjustments lane, however, the pressure didn’tword the pedal structure on the street, it's going to purpose large coincidence or at the least excessive harm to the automobile

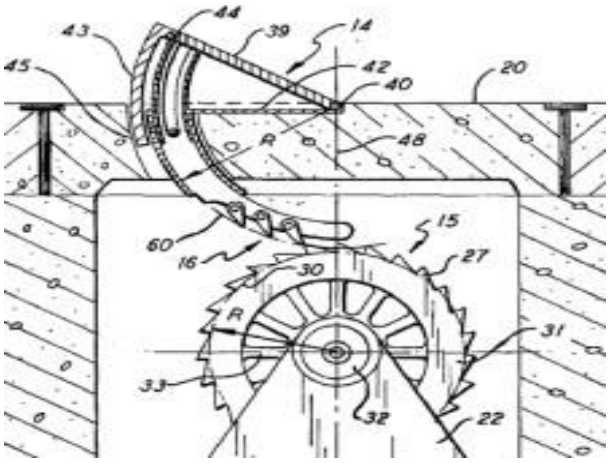


Figure 2: Highway Turbine

IV.METHODOLOGY

Energy harvesting is split into essential groups: macro-electricity harvesting sources, related to solar, wind, hydro, and ocean electricity; and micro-electricity harvesting, related to electromagnetic, electrostatic, heat, thermal variations, mechanical vibrations, acoustic and human frame movement as electricity sources. Different transportation infrastructures are constantly uncovered to distinct electricity sources. From those, it's far viable to extract electricity, which, the usage of precise technology, may be converted into electric electricity. This study pursuits to check the electricity harvesting technology with viable implementation at the fundamental transportation infrastructures wherein a few studies have been advanced in latest years, particularly in street pavements and railways.

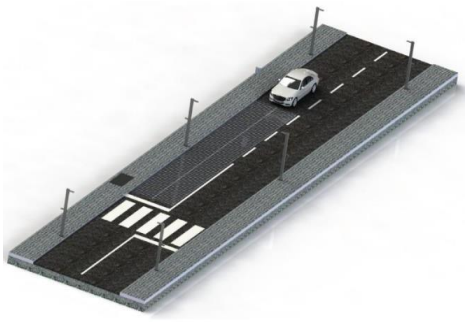


Figure 3: Electro Kinetic Roads

From the electricity harvesting technology recognized via way of means of Harb (2011), corporations of technology have a remarkable ability for implementation on pavements: one makes use of solar radiation as an electricity supply and the alternative makes use of the mechanical electricity from automobile loads. Considering those electricity sources, unique technology andstructures were evolved and beenexamined in current years. The foremost electricity harvesting technology relevant on street pavement may be divided into foremost corporations, as provided in the first organization is associated with technology that employs the sun publicity on the street pavement. Solar radiation may be immediately harvested via way of means of photovoltaic(PV) and converted into electric electricity; it may set off thermal gradients among the street pavement layers, which may be used to strengthen thermoelectric generators (TEGs), which produce electric electricity, or be harvested via way of means of asphalt sun collectors (ASC), which extract the temperature amassed on the street pavement. Induction heating is an idea wherein introducing conductive debris withinside the asphalt combination offers self-recuperation capacities autonomously at excessive temperatures via way ofmeans of harvesting sun radiation. The 2nd organization is associated with technology that employs the mechanical electricity transferred from cars to the street surface. This may be harvested immediately via way of means of piezoelectric harvesters, which generate electric electricity; or it may be harvested via way of means hydraulic, pneumatic, electromechanical, or micro-electromechanical structures (MEMS) that switch the harvested electricity to electromagnetic generators, which produce electric electricity.In the case of MEMS, they also can switch the harvested electricity to piezoelectric generators.

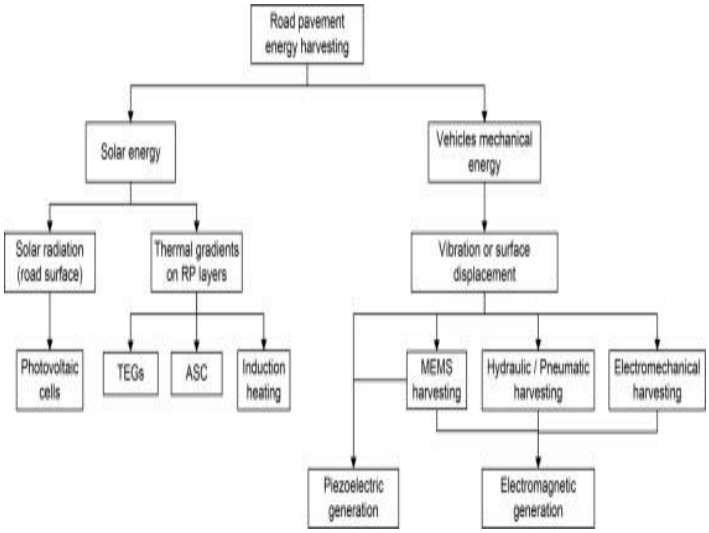


Figure 4: Road pavement energy harvesting technologies

- PHOTOVOLTAIC CELLS

Researchers from the Korea Institute (Kang-Won and Correia, 2010) have investigated the opportunity of harvesting solar power from avenue pavements, the use of solar cells embeddedinto the pavement infrastructure. They have concluded that the cutting-edge thin-film sun cells are tough to apply on surfaces that get hold of mechanical hundreds and environmental situations can reason untimely corrosion and wear. For those reasons, the researchers are growing new thin-movie sun cells that meet the necessities to be used on avenue surfaces.

Julie and Scott Brusaw proposed a sun collector gadget toupdate the higher layer of the street pavement, referred to as Solar Roadway (SR, 2015). The Solar Roadway is a chain of structurally engineered sun panels that might be capable of assisting visitors hundreds and is implemented on the street floor reworking sun radiation into electric energy. One of the fundamental demanding situations of this venture is to provide protection and the correct situations for the mobility of the motors passing over the panels. At the identical time, the higher layer

desires to assure the transmission of the solarradiation to the PV cells underneath it to right conversion efficiency

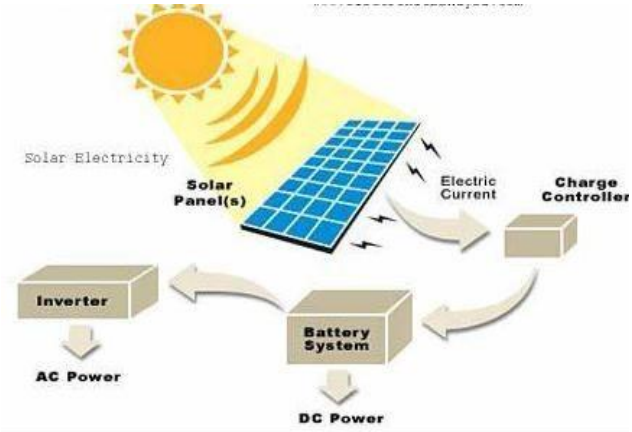


Figure 5: Electricity generated through photovoltaic cell

- PIEZOELECTRIC TECHNOLOGY

This technique is right for evolved nations because the set-up system calls for sales and the strength era are an excessive voltage which calls for the right transmission set up.

Piezoelectric power technology makes use of the stress as a result of motors over asphalt street floor because of gravityand harnessing kinetic power or vibrations from shifting motors. These vibrations from shifting motors are notanything however imbalanced as a result of the stress of a tire on gravel street (asphalt street). In order to seize and harness such power, a piezoelectric transducer through nature is a really perfect tool as piezoelectric substances react to "compression" to provide electric output. Since asphalt street contains finer gravel and a shape nearly just like cement roads, the piezoelectric generator must be especially touchy and toward effect in theory. Nelson et al. (2007) to begin with advanced a gadget primarily based totally on the piezoelectric era to reap the mechanical strength furnished via way of means of shifting trains to the rail, with inside the shape of mechanical vibrations and pressure, and to transform it into electricity. They concluded that the most electricity technology with this era turned into approximately 0.05 mWin keeping with every educate passage, a completely small price this is inadequate to deliver electric powered system via way of means of itself.

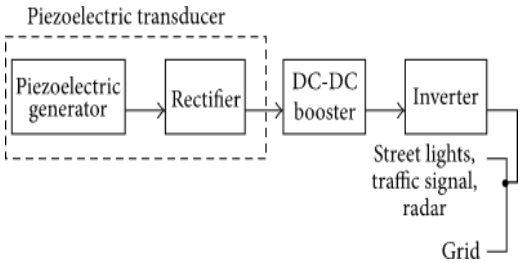


Figure 6: Electricity generated through Piezoelectric technology

The machine accommodates a piezoelectric transducer this isto be embedded in the floor of the street at 5 cms under the floor. These piezoelectric transducers seize the stress because of the mass of the vehicles, the kinetic strengthbecause of shifting traffic, and the vibrations brought about because of the touch among the tire and the asphalt street floor as its enter supply of strength. The "piezoelectric generator" block then converts this enter mechanical enter (stress) strength supply into electric strength output (AC strength generation). Then this strength is rectified into DC strength supply through the "rectifier" block. These blocks collectively shape the piezoelectric transducer level as discovered in Figure. However, as referred to in advance in the literature review, the layout shape of the piezoelectric generator and the method of street basis are the principal systems of producing electricity. Then the rectified output from the piezoelectric generator as visible from the Figure is doubled through the "DC improve converter" machine for the motive of transmission. Next, the strength produced is surpassed via the "inverter" block as indicated in Figure that produces AC strength output earlier than presenting it to the grid for similarly transmission.

V. PROTOTYPE

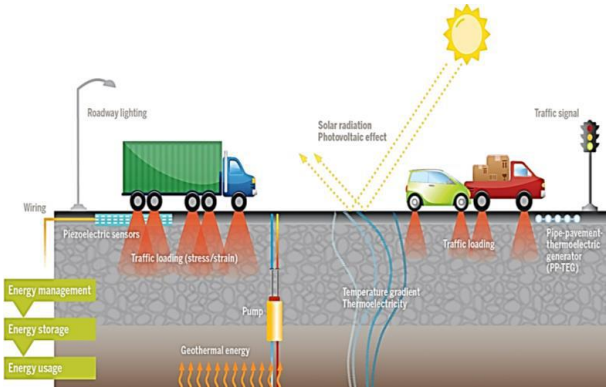


Figure 7: Electric generated via different methods.

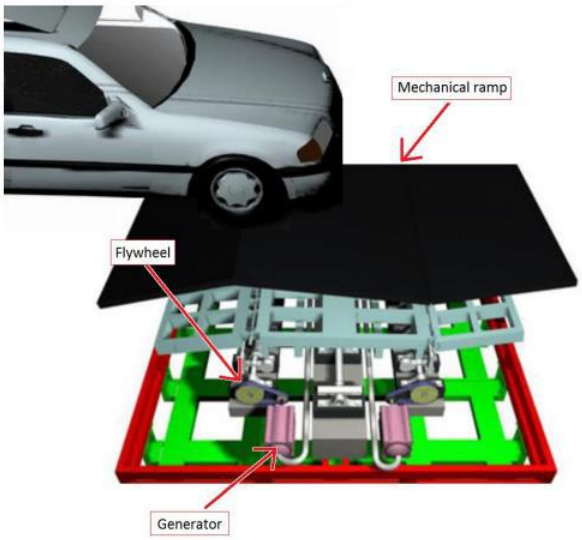


Figure 8: This is an artist's interpretation of the Electro-Kinetic Road Ramp. When the car drives over the mechanical ramp, the flywheel spins, causing the generator to produce electrical volta

VI.MATHEMATICAL MODELLING

The energy that can be produced can be categorized in three ways,

- Through Photovoltaic Panels

For our considerations, we have used a 60-cell solar panel spanning about 5.4ft. in length and 3.25ft. wide. This panelis capable of producing 290 watts of energy considering its efficiency of 80%. So, from this we can assume for a sunny region like Mumbai, considering 5 hours of direct sunlight, the energy generated is 290*5 = 1.5Kw/hr. The annual energy generated by an individual panel can be around 500to 550 kW/year.

- Through Piezoelectric Materials

The electricity that can be generated by these piezoelectric materials is obtained by calculating the total deformationexperienced by the road surface. This can be achieved by theuse of Kirchhoff-Love plate theory or commonly known as classic plate theory.

$$D\nabla^4\omega(x,y,t)+\rho h\frac{\partial\omega(x,y,t)}{\partial t^2}+K\omega(x,y,t)=F(x,y,t),$$

$$D\left[\frac{\partial^4\omega_m(x,t)}{\partial x^4}-2\left(\frac{m\pi}{b}\right)^2\frac{\partial^2\omega_m(x,t)}{\partial x^2}+\left(\frac{m\pi}{b}\right)^4\omega_m(x,t)\right]$$

$$+\rho h\frac{\partial^2\omega_m(x,t)}{\partial t^2}+K\omega_m(x,t)=f_m(x,t),$$

Here, K is the modulus of subgrade, ρ is density, and t is time. The flexural rigidity of the pavement(D) is determined by,

$$D=\frac{Eh^3}{12(1-\mu)}, \tag{3}$$

Here, E is the Young's modulus, μ is Poisson's ratio, and h isthe thickness of the pavement. These equations relate road structures as plates or Winkler foundation because of itselastic nature foundation. The piezoelectric materialdetermines the frequency range of the impact signal. The fourth-order displacement gradient is addressed with the Winkler foundation represented by the second and third termof,

$$\nabla^4\omega(x,y,t)=\left[\frac{\partial^4\omega(x,y,t)}{\partial x^4}+2\frac{\partial^4\omega(x,y,t)}{\partial x^2\partial y^2}+\frac{\partial^4\omega(x,y,t)}{\partial y^4}\right].$$

By using this equation, displacement of pavement causeddue to the load intensity of vehicles taking into considerationthe coefficient of friction was computed. The length of pavement is considered to be infinite in the direction of motion and is simply supported at the edges. The overall output voltage and the power produced by the piezoelectric generator can be determined by,

$$C_0=\left[\epsilon_{33}-(s_{11}+s_{12})^{-1}2d_{31}^2\right]\frac{l_p b_p}{h_p}.$$

Where, C_0 is the output capacitance, ε_{33} is the permittivity, s_{11} ans s_{12} are the Elastic compliance constant, d_{31} is the piezoelectric constant, l_p is the length of piezoelectric transducer, b_p is the width of piezoelectric transducer, and h_p is the height of piezoelectric transducer. On average, the power yielded is 250kWhr/km per lane witha traffic rate of 20 vehicles per min. when the transducers areplaced 5cm beneath the surface of the road. https://www.hindawi.com/journals/jre/2017/9643858/tab9/

- Through Electro-Kinetic Ramps

The ramp can produce energy around 10kW to 30kW of electricity. Assuming 20kW, we can estimate that the annual energy generated by these ramps is around 7300 to 7500kW/year.

VII.FUTURE SCOPE

The world today is in the transition to be able to implement self-driving automobiles which will design the traffic landscape. Hence, adding up to all of these advancements, even the roads on which these vehicles are to be driven should be competent in the mere future. This project of generating electricity will not only be the future but also will be one of the finest methods to solve the problem of the fossilfuel crisis. It will be the best solution to counter the issue of fossil fuel depletion, as a huge amount of these resources are being consumed to generate electricity which in turn are used to light up the streetlamps running along the pavements. To achieve a net-zero environment where the energy produced and the energy consumed is equal, we must come up with a solution that optimizes the use of the alternative approaches. Hence, the concept of Kinetic Roads will surely boost up the future and it will be a favorable outcome in the forthcoming years up ahead.

VIII.CONCLUSION

In a growing country like India, road traffic and congestionon the roads is a huge problem. Instead of considering this situation as a problem, why not make the best use of this condition with all the proper resources that would be required to establish an optimum solution. The vehicles running over the roads during traffic are in large numbers, thus the stress and energy dissipated to the immediate layers of pavement get wasted. A solution is necessary to solve these problems with the probe of smart infrastructure in association withcommunication and ITS, which is a step toward being a developed nation. The best solution for making ideal use of this energy, we can build kinetic roads which use piezoelectric sensors which help in producing electricity due to the mechanical stresses experienced by the roads. Also, along with this technology, Solar power can be used to ignite the streetlights during the night to provide visibility to the drivers. This concept will not only help in saving resourcesbut will also help the country's economy by reducing theneed for fossil fuels for generating electricity. The electricity generated can be used for

multiplepurposes such as lighting up the streetlights, charging the electric vehicles, ventilation in tunnels, etc. The efficiency and

the capacity of the environment will surely be evolved to the ultimate extent. Through these developments, the needs of citizens will be met, and the quality of life will be improved.

IX.RESULT AND DISCUSSION

The world today is in the process of developing alternatives for all sorts of energy for a cleaner and greener future. Sustainable Energy is the need of the hour, and we should paymore attention to developing more sustainable technologies. With the help of these Sustainable methods, the energy that was wasted before can now be stored and used for future applications. By using these techniques, the need for burning fossil fuels for generating electricity would be reduced by a significant amount. By installing such Sustainable technologies, there would be noteworthy changes in the levels of Greenhouse gases in the environment The concept of “Kinetic Roads” and “Solar Roads” is going to be one of the major solutions to battle problems such as Global warming, Climate change, etc. These kinds of advanced improvements are already installed in developed countries such as the United Kingdom, United States of America, Israel, and other countries. The results generated from these roads were remarkable. Also, the energy was stored in the cells which were placed beneath the surface layer of the pavement. Andit is very sure that within the range of 5-10 years, this technology would be the need of the hour

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Indoor water Efficiency

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***Abstract*— India has 16% of the world's population and only 4% of the world's water resources, which are**

depleting rapidly. The demand for water is expected to grow from 40 billion cubic metres

(bcm) currently to around 220 bcm in 2025. Water is one of the most important inputs essential

for crops. Both its shortage and excess affect the growth and development of the plants, yields and quality of produce. There are numerous methods to reduce such losses and improve soil moisture. These are mulching, cropping, planting of trees, utilization of fog or dew by net-surfacing traps or polythene sheets, contour farming, transfer of water from surplus areas to deficit areas by inter-linking water systems through canals, desalination technologies such as distillation, electro-dialysis and reverse osmosis, use of efficient watering systems such as drip irrigation and sprinklers will reduce the water consumption by plants. The most important step in the direction of finding solutions to issues of water and environmental conservation is to change people's attitudes and habits; this includes each one-off us

Keywords—Water, conservation, technology, Rainwater-harvest, drip-irrigation

I.INTRODUCTION

Water, Paani Jal Tanni, L'eau, Wasser, Acqua perhaps the most familiar and widely used word in the world. Water needs no introduction, the importance of this is known to one and all. However, despite water being the basic human need, this precious resource is being wasted,

polluted and getting depleted. Every drop of water is precious, but we continue to waste it like it is a free natural commodity. 98% of water on this planet is salty and is not fit for human consumption. Out of the 2% of fresh water reserves, 1% is locked up in form of ice in various regions around the world. Hence, only 1% of total water reserves are available for our domestic & industrial use. Many cities in India and around the world are already facing sever water shortages due to reduced rainfall, man-made climatic changes, reduction in ground water levels, population explosion, industrialization and staggering amount of water wastages because of negligence by users & dilapidated water supply systems. The importance of water in a country's economic growth should not be undermined. Water pollution, unavailability of drinking water, inadequate sanitation, open dumping of wastes, loss of forest cover are some of the problems faced by many parts of India. Heavy toll of infant mortality due to water borne diseases, the daily struggle for procuring water, mismanagement of wastewater, improper sanitation are common features and are leading to serious consequences on human health and the economy of the country. The situation demands. immediate intervention in the management of these rapidly growing problems, especially through an integrated approach for water, sanitation and related issues.

WATER CONSERVATION

Water conservation can be defined as:
1. Any beneficial deduction in water loss, use, or waste.
2. A reduction in water use accomplished by implementation of water conservation or water efficiency measures; or,
3. Improved water management practices that reduce or enhance the beneficial use of water a water conservation measure is an action, behavioral change, device, technology, or improved design or process implemented to reduce water loss, waste, or use. Water efficiency is a tool of water conservation. That results in more efficient water use and thus reduces water demand. The value and cost-effectiveness of a water efficiency measure must be evaluated in relation to its effects on the use and cost of other natural resources.(e.g. energy or chemicals)

GOALS

The goals of water conservation efforts include: water from an ecosystem should not exceed its natural replacement rate. consume a significant amount of energy. In some regions (e.g. California) of the world over 15% of total electricity consumption is devoted to water management habitats for local wildlife and migrating waterfowl, as well as reducing the need to build new dams and other water diversion infrastructure.

CONSERVATION TECHNOLOGIES

Process of conservation may be synonymous of preservation against loss or waste. Briefly stated it means putting the water resources of the country for the best beneficial use with all the technologies at our command. Water conservation basically aims at matching demand and supply. The strategies for water conservation may be

demand oriented or supply oriented and/or management oriented. The strategies may vary depending upon the field of water use, domestic, irrigation or industrial use.

1) Rainwater harvesting- Rainwater harvesting essentially means collecting rainwater on the roofs of building and storing it underground for later use. Not only does this recharging arrest groundwater depletion, it also raises the declining water table and can help augment water supply. Rainwater harvesting and artificial recharging are becoming very important issues. It is essential to stop the decline in groundwater levels, arrest seawater ingress, i.e. prevent seawater from moving landward, and conserve surface water run-off during the rainy season

Advantages

1. Provides self-sufficiency to water supply
2. Reduces the cost for pumping of ground water
3. Provides high quality water, soft and low in minerals
4. Improves the quality of ground water through dilution when recharged
5. Reduces soil erosion & flooding in urban areas
6. The rooftop rainwater harvesting is less expensive & easy to construct, operate and maintain. In desert, RWH only relief.
7. In saline or coastal areas & Islands, rainwater provides good quality water

2) Better Irrigation Practices- Conservation of water in the agricultural sector is essential since water is necessary for the growth of plants and crops. A depleting water table and a rise in salinity due to overuse of chemical fertilizers and pesticides has made matters serious. Various methods of water harvesting and recharging have been and are being applied all over the world to tackle the problem. In areas where rainfall is low and water is scarce, the local people have used simple techniques that are suited to their region and reduce the demand for water. For crop irrigation, optimal water efficiency means minimizing losses due to evaporation, runoff or subsurface drainage. An evaporation pan can be used to determine how much water is required to irrigate the land. Flood irrigation, the oldest and most common type, is often very uneven in distribution, as parts of a field may receive excess water in order to deliver sufficient quantities to other parts. Overhead irrigation, using center-pivot or lateral-moving sprinklers, gives a much more equal and controlled distribution pattern. Drip irrigation is the most expensive and least-used type, but offers the best results in delivering water to plant roots with minimal losses.

3) Use of Saline Water for Irrigation- Saline water is widely available but rarely used for agriculture because it restricts plant growth and yield. Salt resistant varieties of crops have also been developed in recent times.

4) Mulching, i.e., the application of organic or inorganic material such as plant debris, compost, etc., slows down the surface run-off, improves the soil moisture, reduces evaporation losses and improves soil fertility.

5) Fog and dew contain substantial amounts of water that can be used directly by adapted plant species. Artificial surfaces such as netting-surfaced traps or polyethylene sheets can be exposed to fog and dew. The resulting water can be used for crops.

6) Contour farming is adopted in hilly areas and in lowland areas for paddy fields. Farmers recognize the efficiency of contour-based systems for conserving soil and water.

7) Tippy Tap for water conservation: - Tippy Tap is a simple device which dispenses a limited amount of water slowly and facilitates a thorough hand wash. In case of piped water supply, every time the tap is opened for a hand wash, an average of 300 - 500 ml of water is utilized. Using Tippy Tap it is possible to have a good hand wash with only 60 to 80 ml of water

8) Propagation of Dry Garden / Eco Lawns- As a step towards water conservation and propagation of native plant species, drought resistant plantation (plants requiring less water) should be carried out.

9) Soak pit construction- Water run offs and water logging are combated by constructing soak pits near water points like hand pumps. This is a sanitation measure and also helps in recharge of ground water.

10) Tree plantation in water catchments area/riverbanks and clean-up drives near water bodies are some of the other initiatives taken up to preserve our water resources.

11) Desalination- To augment the depletion of fresh water resources in coastal areas due to excessive abstraction, desalination like distillation, electro-dialysis and reverse osmosis are available. Selection and use of these processes is site specific.

12) Long Distance Transfer of Water- Transfer of water from surplus basins by creating storage at appropriate locations and inter-linking various systems is yet another strategy for increasing the benefits considerably.

MEASURES OF WATER CONSERVATION

Water conservation measures in industries should include: (i) review of alternate production.
processes and technologies from water consumption point of view.
(ii) ensuring sound plant maintenance practices and good housekeeping, minimizing spills and leaks; and
(iii) optimization of treatment to achieve maximum recycling. Another established technique for
maximum water recovery is the water pinch analysis technique. However, this technique only
focuses on maximizing freshwater and wastewater reduction via reuse and regeneration.

WHAT WE CAN DO TO CONSERVE WATER?

a) Use only as much water as you require. Close the taps well after use. While brushing orother use, do not leave the tap running, and open it only when you require it. See that there are no leaking taps.
b) Use a washing machine that does not consume too much water. Do not leave the tapsrunning while washing dishes and clothes.
c) Install small showerheads to reduce the flow of the water. Water in which the vegetables &

fruits have been washed - use to water the flowers & plants.

d) At the end of the day if you have water left in your water bottle do not throw it away, pour it over some plants.

e) Re-use water as much as possible

f) Change in attitude & habits for water conservation.

g) Every drop counts

IMPROVE WATER MANAGEMENT

1. The close link between forests and water, and the traditional relationship between agriculture and water, need to be recognized and protected to ensure sustained productivity.
2. National water management policies should take account of the impact of trade inwater-intensive goods on water availability and ecosystems integrity. For example, in water scarce regions, people should grow crops with low water requirements, or of high value compared to the water used. Options for improving the water balance by importing water intensive goods from water-rich regions should be explored, where appropriate and cost-effective.
3. The potential of rainwater harvesting for augmenting rural and urban water supply isincreasingly becoming recognized. This alternative should be further explored and utilized.
4. Proper water pricing must be an integral part of water policies. However, care must betaken to ensure that the poor and socially disadvantaged are not denied access. Moreover, there must be adequate monitoring and control of market mechanisms.

PUBLIC EDUCATION AND AWARENESS

1. Public awareness and education on the importance of protection of the coastal and ocean environment helps to meet social and economic needs and aspirations of the country in the long run.
2. Awareness campaigns on existing regulations for management of coastal areas need tobe conducted. Education and communication material on the need for conservation and protection of rare and endangered species need to be developed.
3. Research findings on marine resources, their development and management have to be demystified. The educational and communication material targeted at the public has to be developed in local languages.
4. Opportunities for interactions between communities, policy makers, regulating agencies, NGOs, scientists, etc. need to be increased.
5. Appropriate strategies and decision-making tools that would enhance the capabilities of professionals, Government, and non-government organizations to take up local and
6. community level action programmes need to be developed.

II.CONCLUSION

Water problems will not go away by themselves. On the contrary, they will worsen unless we, as a global community, respond and use water responsibly. So, before it is too late, let us all, as individuals, families, communities, companies & institutions, pledge towards using water wisely. Intelligence is not in lavishness but in conservation, so that our future generations can continue to enjoy the blissful feeling and touch of water.

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Water & wastewater management in sustainable net zero water efficient building.

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***Abstract*— Water, air, food, shelter, etc. are the primary needs for all living things, for which water is the most important. "Water is the best of all," said Pindar. In ancient times, each individual or family was responsible for providing water supplies. There was no collective effort, but as time went on urbanization began and with it a collective effort to provide water. However, this urbanization has caused a serious problem of depletion of resources such as water. Therefore, it is of utmost importance to manage water resources in the best possible way so that future generations can survive. His two immediate answers to addressing this challenge are the efficient allocation of scarce resources and the development and use of alternative water sources. While 'water markets' are seen as a means of efficiently allocating scarce resources, treated wastewater and substandard water are now seen as potential sources of supplemental freshwater supplies. The latter option uses treated water as an alternative and uses well-planned reuse systems to help achieve water resource sustainability around the world. Reuse of wastewater has been shown to reduce pressure on the aquatic environment and prevent water pollution. Gray water is a type of wastewater generated from household activities such as washing, dishwashing, and bathing, which can be reused for uses such as landscape irrigation, flushing, and building wetlands on site. The purpose of this paper is to evaluate the role of greywater reuse for sustainable water management in urbanareas. It also discusses different approaches to gray water recycling and reuse.**

Keywords—Netzero building, Water management,wastewater management, Green building, Sustainable building,

I.INTRODUCTION

Net Zero Energy Building refers to a structure that is designed to be environmentally friendly and to minimize and efficiently use resources. When designing net zero building, the emphasis is placed primarily on the efficient use of resources such as energy, water, etc., while simultaneously reducing various negative effects on the environment and residents during its use. Nowadays, many innovative technologies are used, such as the use of solar panels, green roofs, rain gardens, rainwater harvesting, gray water recycling and reuse,

etc. “Net Zero Building is perhaps best understood as

the convergence of two trends:

(1) the architectural movement emphasizing conscious, integrated, efficient and innovative design; and

(2) the environmental movement resulting from the principle of sustainable development”.

The five main components of Net zero building include site and design efficiency, reduced energy use, reduced water use, environmentally safe building materials and improved air quality. This article focuses on water efficiency and conservation in green buildings and its importance.

We have been working on a 'Net Zero Building' project in collaboration with Doshi Enterprise and Proprietorships in association with Solar Decathlon India, Thakur School of Architecture & Planning and Thakur College of Engineering & Technology. The place is located in Palghar, Maharashtra. The aim of the project is to create multi-family housing for the residents of Palghar on an area of 1858 m2.

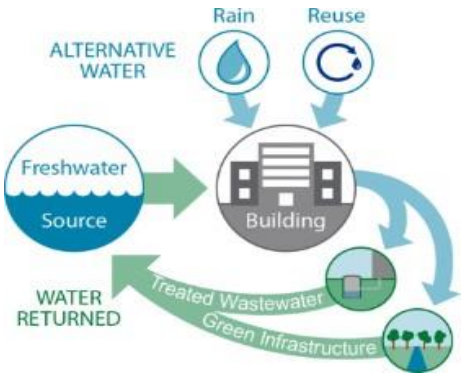
The name of the building is VIRATI Residence with a combination of 1RK, 1BHK and 2BHK units with variations in occupancy from 2 to 5 as described by the project partner. The project will have a commercial block on the ground floor and the upper 4 floors will be occupied by residents. The preliminary construction budget is 3.2 Cr (17222 / m2)

II.WHY? ZERO WATER EFFICIENTBUILDING

Virathi residency, was planned and designed to achieve net zero water building as it is capable to:

- Minimize total water consumption
- Maximize alternative water sources
- Minimize wastewater discharge from the building and return water to the original water source.

Net zero water creates a water-neutral building where the amount of alternative water used and water returned to the original water source is equal to the building's total water consumption. The ultimate goal of Virathi residency, is to preserve the quantity and quality of natural water resources with minimal deterioration, depletion, and rerouting by utilizing potential alternativewater sources and water efficiency measures to minimize the use of supplied freshwater.



Ultimately, a net zero water building completely offsets water use with alternative water plus water returned to the original water source.

As the Virati residency project was located within the watershed or aquifer of the original water source, returning of water to the original water source is likely.

III.PLANNING & APPROACH FOR CALCULATION OF NETZERO WATER BUILDING

Understanding how net zero water can be measured is important so that you can determine if your building hasmet the net zero objective. Net zero water can be represented by a simple formula where:

$$\frac{\text{ALTERNATIVE WATER USE} + \text{WATER RETURNED}}{\text{TOTAL WATER USE}}$$

Total water: use is the amount of water consumed within the boundaries of a building from all sources (potable and non-potable including freshwater and alternative water) over the course of a year.

Alternative water: use is the amount of water consumed within the boundaries of a building from sustainable water sources not derived from freshwater sources over the course of a year. In a net zero building, the total annual water use should be offset by alternativewater in part or completely.

Water returned: is the amount of water collected from the building systems (green infrastructure and on-site treated wastewater) and returned back to the original water source over the course of a year. In a net zero building, the total annual water use should be offset by water returned to the original source in part orcompletely.

To verify that the our planned building is operating at net zero, we have collected annual water use data for each water flow:

- Potable water use
- Non-potable water use (from freshwater sources)
- Alternative water use
- Wastewater treated on-site and returned to original water source
- Stormwater infiltrated the original water sourcethrough green infrastructure.

All freshwater use and alternative water use is calculated to estimate the building's total annual water use. Next, summed the alternative water use and treated wastewater and stormwater returned to the original source. If this sum is equal to or greater than the total annual water use, then the building is considered net zero water

IV.METHODOLOGY

An integrated systems approach to building water management allows for the best allocation of potable water drawn from the municipal supply. These options include practices that regulate the inflow of water and recycling of water throughout the building system, but also decrease the outflow of water through efficient wastewater and infiltration processes. Management encompasses all aspects of the water cycle, from start to finish. Conventional water allocation is compared to the appropriation of water in a green building.

For making the building as netzero, following are the steps taken

- Water conservation.
- Recycle & reuse.
- Treat & let it back to its original source.

A. Water conservation

The leading option for water management is conservation. Common tactics include the implementation of water-conserving fixtures such as low-flow water closets and waterless urinals to reduce the demand for potable water. Although the Energy Policy Act (EPAct) of 1992 already sets maximum values allowable by water fixtures as shown below in table, netzero buildings often implement hardware that goes beyond the set requirements.

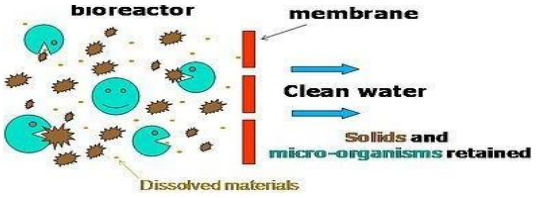
For example, water closets are mandated to use no more than **1.6gallons** per flush **(gpf)**; however, there exists high-efficiency toilets (HETs) that use less than **1.3gpf.** Low-flow options are also available for other fixtures such as showerheads and faucets. Sensors and aerators installed in faucets can further reduce water use.

Conservation requires knowledge about current water use patterns, and resolution is critical when applied to water monitoring. Water companies and utilities keep track of water pulled from wells and additional sources, but they also measure water used by individual residences and buildings to better evaluate where water is going. Water use can be assessed further through submetering. Submetering provides better resolution regarding water usage.

Plumbing fixture	Maximum requirement
Water closets	1.6 gallons (6 liters) per flush
Urinals	1.0 gallon (3.8 liters) per flush
Showerheads	2.5 gallons (9.5 liters) per minute at 80 psi (550 kPa) 2.2 gallons (8.5 liters) per minute at 60 psi (410 kPa)
Faucets	2.5 gallons (9.5 liters) per minute at 80 psi (550 kPa) 2.0 gallons (7.8 liters) per minute at 60 psi (410 kPa)
Replacement aerators	2.5 gallons (9.8 liters) per minute
Metering faucets	0.25 gallons (0.98 liters) per cycle

I. Recycle & reuse

The quality of water is of great importance when determining where it will be discharged or reused. In a sense, all water is reused. Water discharged upstream is used as a drinking water source for populations downstream, and water discharged into 13 larger water bodies is recycled in the aquatic system. Wastewater is often defined as water that has been contaminated or polluted, but the definition of contamination is up for interpretation. All water contains some form of impurities, but regulations set contaminant levels that label water as polluted. While water remains a pure substance, it is the impurities within it that need to be removed in order to improve the level of quality. All wastewater can potentially be recycled within a building system. Wastewater exiting the building generally falls under one of two streams: greywater or blackwater. **Greywater** consists of water from sinks, showers, and other low-strength sources. **Blackwater** contains higher amounts of organic material and exits from toilets and urinals. Toilet flushing can make up 35% of overall water consumption, but utilizing alternative sources such as rainwater can help offset the potable cost. Kitchen wastewater can be grouped into either category;it does not come into direct contact with human excrement, but does have a high organic loading. Greywater reuse systems have been shown to be economically feasible and offset potable water consumption (Ghisi and Ferreira, 2007). Because water recycling has associated human and ecological risks, political regions often have unique sets of guidelines that outline appropriate approaches to ensure safety (Anderson et al., 2001). Water can be treated for reuse on-site using technologies such as the membrane bioreactor or off-site at municipal wastewater treatment facilities.



Membrane bioreactors (MBRs) operate using both biological treatment methods as well as permeable membranes which provide an absolute barrier and

prevent solids within the influent water from passing to the effluent. MBRs differ from traditional wastewater treatment systems in that secondary clarification and tertiary treatment solutions are replaced by the membrane, providing an opportunity to decrease the overall area, as well as resources required for treatment. Several variations of the MBR exist; namely aerobic and anaerobic MBRs, and those which may utilize the membranes in submerged or external applications. MBRs are assumed to be suitable for use in a sustainable water management plan because they allow production of high-quality effluent which can be used for greywater and blackwater reuse applications. Since they are compact, MBRs can then be implemented in proportionally smaller systems while still maintaining effluent quality.

However, pitfalls also exist; the most significant of which is the issue of fouling which reduces and may eventually prevent flow through the membrane. Foulingsignificantly affects the sustainability of membranes because it not only requires increased energy consumption associated with necessary increases in pressure over time, but it also shortens the useful life of a membrane, requiring premature replacement and thus an added cost.

B. Reclaimed water

An important resource from wastewater treatment is the water itself. Reclaimed water is an example of recycling and reuse, techniques also implemented toward solid waste management. Through the treatment process, water is removed from the waste stream, and the use of reclaimed water offsets demand for finite potable water resources. Highly treated reclaimed water can be delivered to the building site from a regional or satellite wastewater treatment facility. Although normally associated with irrigation, the applications of reclaimed water extend to other non potable uses such as cooling towers and toilet flushing, similar to the uses for greywater.

V.NET ZERO WATER

The difference between net-zero water and zero water isthe amount of interaction with infrastructure. With Regard to energy, the term ‘net’ is used to compare inputs and outputs of the grid system (Hernandez & Kenny, 2010). A net-zero energy building sells to thegrid as much energy as it acquires from the grid on an annual basis. The grid requires that the same electrical currency is used in order to facilitate bidirectional flowensuring consistent quality; electricity produced by cen-tralized power plants and electricity sold back to the grid by building sites maintains the same functionality.The lack of a bidirectional water distribution system places buildings pursuing a net-zero water goal at a dis-advantage, and the quality of water exiting the building system is generally much lower than the water entering the boundary due to the acquisition of contaminants from end uses. In practice, the quality difference is evident by separate water delivery and water discharge infrastructures. Conceptually, the inequality of the building input and output streams does not allow for mathematical computations regarding offsets, but quantity balance may be achievable using equation (2)by expanding the building boundary so that it includes centralized water facilities that directly affect flows Cand W. For example, in regions that provide municipal reclaimed water, utilizing this centralized source (C)is analogous to wastewater recycling; the origin and ter-mination points are the same, and balance results.Therefore, the volume of wastewater generated by the building (W) and treated at a centralized reclaimed water facility may be offset by utilizing reclaimed water from that facility

(C) for building demands.The example implies that net-zero compliance not only relies on quantity and quality equivalence of building consumption and generation streams, but also the timely return of water sources to the natural origin location. The equality presented by the net-zero equation infers that nothing has changed, yet relocat-ing water sources alters the original water cycle. There-fore, demonstrating that water generated from a centrally served building site

(W) is returned to the ecosystem from which it originated is necessary for full net-zero credit. In some cases, the originating eco-system may encompass the building site, which would allow for on-site treatment and infiltration (G)to count towards the net-zero goal.

VI.NET POSITIVE WATER

The discussion regarding balanced water management reveals the opportunity for net-positive building water performance as a result of restorative impacts. Main-taining a balanced system prevents the acceleratedeterioration of resources and environments, but growthis encouraged by net-positive water schemes which increase the sustainability, resilience, and carrying capacity of urban and natural environments through responsible water management based on quantity, quality, location and time.

VII.FRAMEWORK FOR NET POSITIVE WATER

An understanding of current and ideal hydrologic and urban water flows connecting the building system tothe anthropogenic and natural environments is a prerequisite in order to design and manage a net-positive building water system (Figure 2). Desirablepositive outcomes must be explicitly determined based on the current conditions and needs of the urban and natural systems supporting the building; and distinct volume,quality, spatial and temporal thresholds must be devel-oped in order to achieve net-positive results. The base-line hydrologic conditions should be identified in order to determine spatial and temporal thresholds for the maintenance or revival of supporting ecosystems.Specific project outcomes may be further definedbased on the needs identified from the baseline study.Building water consumption depends on the sum of land uses and degree of water recycling. Building water demands should be cataloged and grouped by

impor-tance, as well as all potential sources. The resulting inventory of building demands and available sources creates the foundation for fit-for-purpose connections to be made for water balance attainment and discloses the magnitude of water offset that the project goal requires. A zero water building project will require the total water demand to be balanced solely by source acquired on-site. A net-zero project served by municipal water within a shared watershed may determine that consumption volumes exceeding precipitation require offset from alternative water reuse of wastewater recy-cling strategies for net-zero balance. Net-positive build-ings require the tracking of quality, discharge and time of allocation in addition to water flows, and must demonstrate improvement in the combination of these areas. Therefore, net-zero and zero water balance become prerequisites for net-positive success.Quantitative water management steps follow the hier-archy used in other resource management schemes,such as those adopted by the USEPA and US Army. An additional explicit step is added to evaluate whether all building water demands are necessary, such as landscape irrigation or aesthetic features, and eliminate avoidable con-sumption (Hoekstra, 2008). Reducing source con-sumption is accomplished using conservation measures directed at water fixture installations and occupant water use habits. Further water offsets require water reuse, followed by water recycling.Water reuse measures require limited treatment of source waters and extend the residence time of water within the building through repurposing. Water recycling is achieved by creating closed loop water cycles that require treatment stages in order to maintain water quality. Irrigation using low-strength gray water from showers and faucets is considered a reuse strat-egy; a water recycling loop is achieved by collecting,treating, and reapplying blackwater from toilets forflushing. Conservation, reuse, and recycling measures should be revisited until the project goal is realized.Integration of quantitative, qualitative, spatial, and temporal water management is necessary in order toachieve a combined net-positive result. If the building water management scheme does not yield a positive response, these four properties must be evaluated to identify weak performance areas and revisited inorder to improve deficiencies. If a final evaluation determines that the building generates a net-positive effect, frequent verification and monitoring ensures that the building water system operates as intended and remains restorative

VIII.CALCULATIONS

Reserving rainwater from rooftops of dwelling units and other parts of the building. As the region is prone to regular rainfall, collecting rainwater is crucial to meet the demands of maintaining the ground water table. Besides the roof-top harvesting, additional inverted-umbrella shaped devices are placed around the site to increase the potential for collecting rainwater. Other water-related services like, Overhead tanks and STP were located after considering gravity and site contours.

IX.RESULT

Virati Residency Net Zero Water system enables reduction in water consumption and use of alternate water to meet the water demand. This will in future benefit the residence by adopting Net Zero Water concepts in the project are as below:

- Improvement in water efficiency and hence reduction in annual water consumption to the tune of about 30-50% with respect to the National baseline.
- Overall reduction in water cost by 30%.
- Reduce dependency on raw water.

There are also some intangible benefits of Net Zero Water include compliance to local regulation and promote water conservation. The rating system evaluates buildings on a performance-based approach. The rating system has evolved to be comprehensive and at the same time user-friendly. The programme is fundamentally designed to reduce the water demand of abuilding and address national priorities such as:

- Reducing the National water demand byenhancing water efficiency.
- Harnessing alternate water to reduce waterdemand.
- Reducing dependency on raw waterconsumption.
- Promote water conservation at National level,to ensure water security.

ACKNOWLEDGMENT

We are pleased to appreciate the kind efforts of people who have been a part of the project right from its inception.We would like to pay a deep sense of gratitude towards our college THAKUR COLLEGE OF ENGINEERING & TECHNOLOGY, Kandivali, Mumbai, for providing us this opportunity.We would also like to thank our project partner M/s Doshi Enterprise, Palghar, for allowing us to work on their project, the Virati Residency,Located in Palghar.
We would also like to thank Dr. Seema Jagtap who played a great role in mentoring & guiding us. Finally, we thank all our friends & other faculties for their support, motivation and providing immense knowledge.

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Calculations

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual rainfall
2019	0.0	0.0	0.0	0.0	0.0	483.3	1151.1	561	589.8	156.6	0.0	0.0	2942.2
2020	0.0	0.0	0.0	0.0	0.0	513.2	638.8	552.4	529.6	107.0	0.0	66.5	2407.5
2021	0.0	0.0	0.0	0.0	21.3	544.8	1252.7	153.8	16.8	0.0	0.0	0.0	1989.4
2022	0.0	0.0	0.0	0.0	0.0	470.7	1287.7	586.0	1055.2	77.1	58.4	0.7	3535.8
Average of total rainfall of 4 years data (in mm)													2718.7
Average of total rainfall received by each square meter of area (in litres)													2718.7

Table 8: Annual rainwater

Total Built-up area of the building= 16000 sqft = 1490 sqm

Total rainwater collection area= 1490* 2718.7= 4050863liters/ year

Table 9: Water usage

Purpose of use	Water required (% of total water required per capita per day)	Water required (inlpcd)	Grey Water(in lpcd)	Black water(in lpcd)
Toilets	21.6	29.16	-	29.16
Bathing & Shaving	23.7	31.99	31.99	-
Utensils	17.4	23.49	23.49	-
Cooking	1.7	2.29	-	2.29
Cleaning Clothes	24.3	32.80	32.80	-
Cleaning House	6.6	8.91	8.91	-
Drinking	4.2	5.67	-	5.67
Others	0.5	0.675	0.675	-
Total	100%	135 liters	**97.865**	**37.12**

Therefore,
Average number of people per flat: 5 Nos.
No. of flats: 24
Total no. of people in the apartment:120
Total water required for a dwelling apartment (As per NBC): 135 lpcd So, total water required by the apartment is: 135*120 = 16200 lpd **Total water required: 16200*365= 5913000 litres/ year**
Total requirement of piped water= 5913000- 4050863= 1862137 litres per yearTotal reduction in water requirement (in %) = 68.50

Customizable smart window technology could improve energy efficiency of buildings

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Abstract— This paper presents the detailed study on Customizable smart window technology to improve energy efficiency of buildings. Due to the technical advancement in recent years, people are relying in several forms of automation systems, which tend to make their life easier. Considering this trend, we haveproposed to build a smart window system. The system can be controlled by the users at their will and it is also smart enough to detect changes in its surrounding and work accordingly. Customizable smart windows can also be pre programmed as per the users requirement.Customizable smart windows also adapt as per the environment and as per the seasons.

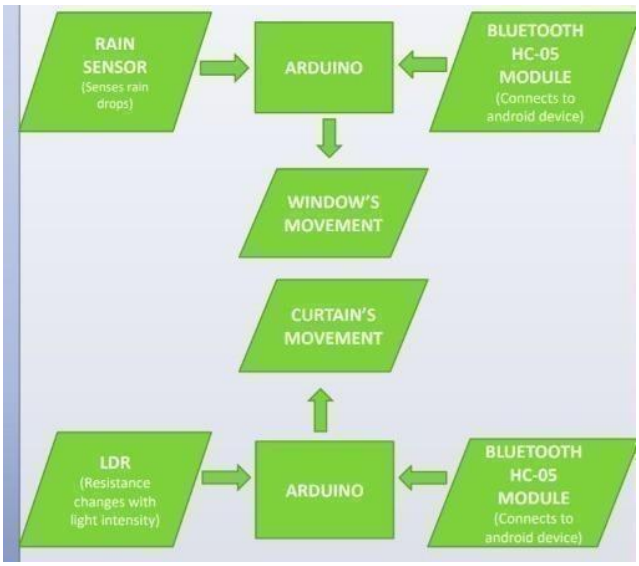
I.INTRODUCTION

Scientists developed a smart window device for concurrently harvesting and regulating solar energy Windows play multiple crucial roles in our homes. They illuminate, insulate and ventilate our spaces while providing views of —and protection from — the outdoors. Smart windows, or windows that use solar cell technology to convert sunlight into electricity, present the additional opportunity to leverage windows as energy sources. However, incorporating solar cells into windows while balancing the other complex, and often conflicting, roles of windows proves challenging. For example, juggling luminosity preferences and energy harvesting goals throughout changing seasons requirescomplex and strategic approaches to material design. *"*This design framework is customizable and can be applied to virtually any building around the world." — Junhong Chen, scientist at Argonne and professor at the University of Chicago's Pritzker School of Molecular Engineering Scientists from the U.S. Department of Energy's (DOE) Argonne National Laboratory, Northwestern University, the University of Chicago and University of Wisconsin- Milwaukee recently combined solar cell technology with a novel optimization approach to develop a smart window prototype that maximizes design across a wide range of criteria The optimization algorithm uses comprehensive physical models and advanced computational techniques to maximize overall energy usage while balancing building temperature demands and lighting requirements across locations and throughout changing seasons. This design framework is customizable and can be applied to virtually any building around the world," said Junhong Chen, a scientist at Argonne and the Crown Family Professor of Molecular Engineering at the Pritzker School of Molecular Engineering at the University of Chicago. "Whether you want to maximizethe amount of sunlight in a room or minimize heating or cooling efforts, this powerful optimization algorithm produces window designs that align with user needs and preferences." Climate protection and the reduction of carbon dioxide emissions have been on top of global development agendas. Accordingly, research and development projects have been conducted on national and international levels, which aim forthe improvement of the CO2-footprint in diverse processes. Apart from particularly energy-intensive sectors of the industry, the building sector in particular is among the biggestCO2-emitters: from residential homes, manufacturing facilities and storage depots to big commercial buildings, about 40 percent of the energy consumption within the EU aredue to the heating, cooling, air conditioning and lighting of buildings.

Considering next-generation smart windows and façade devices, one aspect of this problem is addressed in the research project Large-Area Fluidic Windows (LaWin) which has been coordinated at the Friedrich Schiller University Jena, Germany, since 2015. A new type of such smart windows was now presented in the upcoming issue of Advanced Sustainable Systems. In their paper 'Large-Area Smart Window with Tunable Shading and Solar-Thermal Harvesting Ability Based on Remote Switching of a Magneto-Active Liquid' the Jena materials researchers introduce prototypes of a window that changes its light permeability at the touch of a button, and, at the same time, can be used for solar-thermal energy harvesting.

There has been increased attention to sustainable architectural designs for better light and heat management in buildings in recent years, and deploying smart windows is the first step for such structures," said Debabrata Sikdar, Assistant Professor, Department of Electronics and Electrical Engineering, IIT Guwahati.

" Smart windows can be the solution for it. It will make peoples lives more easier and more comfortable. This type of windows are bit expensive then thenormal ones but are really worth it. Rain sensor, kept outsideof the window, detects water that completes the circuits on its sensor boards' printed leads.The wetter the board the more current that will be conducted, which is sent as an analog signal to the arduino.If the data ,that is converted from the signal, passes the calibrated threshold value, the high torque motor is initiated.The motor is attached to a pinion, which is meshed with the rack.The rack is fixed to the window, so thewindow close The LDR detects the intensity of light entering the room.High intensity of light causes the resistance of the LDR to drop.As a result, higher current flows through the circuit.The LDR sends an analog signal based on the amount of current through the LDR to the arduino.The signal isconverted to a corresponding value, which, if crosses the calibrated threshold value, the motor is initiated.The motor isconnected to a belt pulley system, which moves the curtain. Bluetooth modules are also used for the system.They providea way for the user not only to control the motion of the motors, but also to activate the sensors at the user's will. Coustomizable smart windows are going to replace todays normal windows very soon and will be the next big thing of the future. The world is getting smarter day by day then why shouldn't the windows get smarter. The design of windows haven't been changed since years. People should keep evolving and also the things they use should be evolved. Thissmart customizable windows will be the biggening of evolution of items which are used in our day to day life.



II.OBJECTIVE

- The objective of this idea is to make peoples life more easier and simpler.
- TO Conserve energy of the building.
- Reduction to up to 60% of the needs of artificial lighting by increasing the light transmission through the windows resulting in increased visual comfort for the occupants and reduced energycosts.
- The ability to adjust the lighting levels in indoor environments while maintaining transparency and the exterior vision resulting in greater satisfaction for the occupants, who have the opportunity to enjoy the outdoor views both during the day and at nigh
- The possibility of use in all cases of upgrading the energy efficiency of existing buildings

III.LITRATURE REVIEW

By automatically opening and closing the windows inyour home at precisely the right time, fresh air from the outdoors can circulate seamlessly through your home,flushing out dirty, stuffy and stale air in the process. Not only that, the increased air flow allows you to decrease theuse of your A/C which helps lower your energy bills. It's that simple.

Did you know , the lack of air movement throughout the home can lead to a buildup of toxic pollutants that are 10x greater inside a home than outside? Not only that, new construction techniques that utilize energy efficient windows and doors worsen the problem and decrease the movement of outside air throughout the home. Our team has developed fenestra, the first and only smart window technology (Patent Pending) which solves indoor air qualityproblems. By automatically opening and closing the windows in your home at precisely the right time, fresh air from the outdoors can circulate seamlessly through your home, flushing out stale and dirty air in the process. During summer, temperatures rise, A/C use increases considerably, as does electricity consumption. fenestra helps cool your home easily and conveniently with fresh morning air. As the day goes by and temperatures begins to rise, fenestra conveniently responds by closing windows.

IV.METHODOLOGY

1. COLLECTION OF RAW MATERIALS:

a. Glass To make the center part of the windows .
b. Motors – To do the opening and closing of the window,
c. WOOD OR METAL- TO MAKE THE FRAME WORK FOR THEWINDOW.

V.CONCLUSION

Then winter arrives and stale air accumulates as people seal and heat their homes. Indoor air is degraded to an unhealthy mixture of high levels of carbon dioxide, contaminants, odors, and even viruses. fenestra monitors real-time weatherdata and chooses the time when the outdoor temperature is warmest, to automatically open windows and allow

fresh air into your home.comparison. AS per temperature changes weexpect the window to work accordingly and as per the program.

- This research indicates that the windows will bereally helpful to the man kind.
- People are looking for ways to make there lifeeasier and this does the same'.
- Due to vast expansion of technology it will bereally good startup idea.

*VI.*RESULTS

- The results svhow that the smart window transitions froman infrared transparent to blocking state as soon as direct sunlight hits the window and ambient temperatures are above 20°C.
- The transition back to the infrared transparent state usually happens over night when the glass surface coolsdown.
- This ensures an optimized use of solar heat leading to reduced energy demand for heating and cooling simultaneously. This can lead to additional energy andcost savings of up to 8% and 23.70 €/m2 glass per yearwhen compared to state of the art HR++ windows.

When the outside temperature is high, the heat from the sunis blocked. As soon as the window falls below a certain temperature, the heat is admitted.

ACKNOWLEDGMENT

At the outset of our project, we take this opportunity toexpress our sincere heartfelt gratitude to our project guide and mentor **Dr. Seema Jagtap**, who with his guidance and valuable advice helped us in the project. We are also thankfulto Dr B. K. Mishra, Principal TCET, Mumbai, Head CED, TCET, Mumbai, for giving a lot of freedom and encouragement and the faculty members of TCET, Mumbai, for providing all kind of possible help throughout for the completion of research work.

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Vertical Farming

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Abstract: The Vertical Farming is the new way or approach in the advanced level and this paper deals with the methodology, harvesting technique, water management, crop cultivation & yielding process. The Vertical Farming is the advanced level of agriculture technology where this has to be practised when there is a lack of land and other requirements for the perfect structure of farming mode. And certain naturally occurring renewable resources are used, such as wind turbines, solar panels, etc., but as these do notfollow the conventional agricultural process, extra techniques must be followed for the process to providegood yields.

KEY WORDS: Harvesting Technique, Vertical Farming, Agricultural Technology.

I.INTRODUCTION

In vertical farming, Crops are cultivated indoors with artificial lighting and temperature. Crops are raised indoors in artificially heated and lit environments. It seeks to increase productivity in constrained spaces. Such techniques as hydroponics, aquaponics, and aeroponics are used instead of soil. Growing food in vertically stacked layers is known as "vertical farming." The technique may employ hydroponic, aeroponic, or soil growing techniques. In tough circumstances, such as those where arable land is few or unavailable, vertical farms try togenerate food. The technique uses skyscraper-like designs and precision agriculture techniques to assist mountainside settlements, deserts, and cities grow various varieties of fruits and vegetables. In order to maximise natural light exposure, most vertical farms use enclosed structures resembling greenhouses that stack vertically, either directly above or staggered. If reducing space is a top priority, using hydroponic. methods instead of soil as a growing medium allowsfor reduced weight and up to 70% less water usage. Aeroponics further minimises the amount of water and weight needed. Most vertical farms use hydroponic or aeroponic growing methods instead of runoff, which would add weight to the potted plants. Natural light and artificial light are frequently combined in vertical farming. Artificial lighting is frequently based on LED technology and may be powered by a renewable energy source, such solar or wind energy.

II.LITERATURE REVIEW

The following Research Papers were referred by us for our knowledge regarding this topic:

1. A REVIEW ON PLANT WITHOUT SOIL – HYDROPONICS (Ms. Mamta D. Sardare , Ms. Shraddha V. Admane)

Future industry growth is anticipated to be exponential as soil conditions for growing become more challenging. There is no other choice but to embrace soil-less culture to help improve the yield and quality of the produce in order to secure food security for our nation, particularly in a country like India where urban concrete conglomerate is rising every day. However, the deployment of this technology may be accelerated by government action and research institute interest.

2. Hydroponics: An upcoming and innovative way of future farming (Madhuri Shrikant Sonawane) Hydroponics is emerging as a significant method to address these issues in a sustainable and ecological

responsible manner in a society where fresh water and food supplies are becoming increasingly scarce.The hydroponics sector is predicted to develop enormously in the future, especially as the circumstances for soil-based cultivation become more challenging. Soilless culture will eventually replace conventional agriculture in a country like India where urban growth is outpacing all predictions, increasing the amount and quality of theproduce and ensuring the country's long-term food security. However, increased attention through governmental action and the emphasis of research organisations might speed up the development of hydroponics.

3. Hydroponics in Agriculture Research Paper: (Estrella, L. H. (2014)

Due to the revenue collected from exportations and other sales made locally, the usage of hydroponics systems has generally beensignificant to the economy and the agricultural sector. The quality of the harvest obtained from the schemes has in fact improved thanks to modern irrigation technology. Since there is good water management with hydroponics, the crop won't be water-logged and the plants won't be harmed by fungi. Because the fruits on hydroponically grown plants are larger, the harvest quality is also good. Thewater used by the plants is conserved greatly with this modern irrigation technique. With this irrigation technique, farmers reuse the water they consume throughout the process rather than waste it on leaching and field moisture. This farming technology also controls energy use and carbon (IV) oxide emissions. If the farmer has implemented any hydroponics system approaches that don't require a lot of pumping activities, the energy consumption onthe farm will be lowered. As a result of the farm's minimal use of machinery, CO2 emissions would also be decreased. Hydroponics reduces CO2 emissions, water use, and energy consumption.

4. Water stream hydroponics as a new technology for soilless production of valuable essential oil and medicinal plant peppermint:(Mahsa Daryadar) The planting material for peppermint obtained through the use of various hydroponics techniques, with the exception of continuous, is 1.5–2.7 times greater than soil culture with dry weight. In addition, cylindrical hydroponics systems are preferable to gully and continuous systems, which have led to a 1.8–2.2-fold increase in dry weight of peppermint raw medicinal material. During the third cut, essential oil biosynthesis was more active. Additionally, during vegetation, hydroponic systems that were cylindrical and conventional produced the highest levels of essential oil (1.6–2.6 times). High levels of menthol (71–73%) were found in the essential oil under soil culture, classical, and cylindrical settings. Isomentone was present in considerable concentrations (11–15%) in the gully and continuous variations, though. Menthol content in cylindrical hydroponics was highest in September (71%) and lowest in August (40%).

III.OBJECTIVES

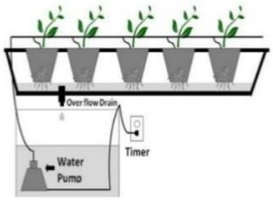
The main objectives of Vertical Farming are: -

- To get higher productivity in smaller place.
- To provide fresh and healthy food to the consumers.

IV.EXPLANATION

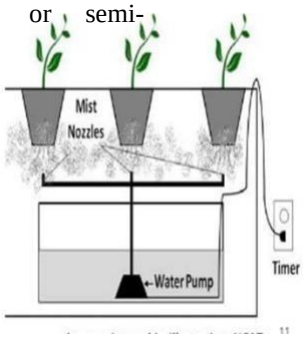
Methods used for Vertical Farming: -

1. Hydroponics: This is the type of vertical farming method that is most frequently employed. Here, plants are cultivated with their roots immersed in a nutritional solution based on water. Using a water pump, the fluid is continually pumped throughout the system while being fertilised with nutrients.



To meet the needs of the plants in the system, regular monitoring is done to measure the temperature, salinity, and nutrient level. It is a technique for growing food in water without soil using mineral nutrition solutions. The main benefits of this approach are that it lessens soil-related cultivation issues such soil-borne pests, illnesses, and insects.

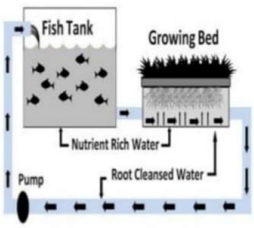
2. Aeroponics: - Plants are cultivated floating in a closed or semi-closed mist environment without soil in this kind of setup. The roots of the plants hang below and leak into the mist chamber through a mesh-like top while the plants are grown on a foam-like substance.



The 1990s NASA (National Aeronauticaland Space Administration, USA) mission to discover an effective method of growing plants in space served as the impetus for the development of

aeroponics. There is no growth media and hence no need for crop containers in aeroponics. Instead of using water, aeroponics makes use of mist or nutritional solutions. It requires extremely little room, very little water, and no soil because the plants are attached to a support and the roots are treated with nourishing solution.

3. Aquaponics: Hydroponics and aquaculture are combined in the farming method known as aquaponics. Pumping nutrient-rich waste water from the fish production unit to a hydroponic setup allows plants to get nutrients and cleans the water before being returned to the fish unit.



The symbiosis is achieved by feeding hydroponic production beds with "fertigate," which is nutrient-rich waste from fish tanks. In turn, the hydroponic beds serve as bio-filters that purge the water of gases, acids, and substances like ammonia, nitrates, and phosphates.

To achieve the objective's following methodology isproposed:

Hydroponics: Continuous-flow solution culture:

The nutrient solution continuously flows past the roots in a continuous-flow solution culture. Because monitoring and modifications to the temperature, pH, and nutrient concentrations can be made in a sizable storage tank with the potential to accommodate thousands of plants, it is considerably simpler to automate than the static solution culture. The nutrient film technique, also known as NFT, isa well-liked variation in which a very shallow stream of water containing all the dissolved nutrients necessary for plant growth is recirculated in a thin layer past a bed of bare-root plants with an upper surface exposed to air in a watertight channel. As a result, the roots of the plants receive a plentifulsupply of oxygen.

Using the proper channel slope, flow rate, and length is the foundation of a properly constructed NFT system. The NFT system's key advantage over other hydroponic systems is that the plant roots are exposed to sufficient amounts of water, oxygen, and nutrients. Since too much or too little of one causes an imbalance of one or both of the others, there is a conflict between the supply of these requirements in all other kinds of production. The architecture of NFT allows for simultaneous fulfilment of all three conditions for healthy plant growth, provided that the straightforward idea of NFT is always recalled and used. These benefits lead to increased yields of superior food being obtained over a longer time of cropping. NFT has extremely minimal buffering against flow interruptions, which is a drawback (e.g., power outages). Overall, though, it's definitely one of the most effective methods.

V.ADVANTAGES

With its many benefits, vertical farming is advantageous for the future of agriculture. It requires very little land, uses 80% less water, is pesticide- free, recycled and stored, and in the case of high-techfarms, is not particularly weather dependent. With the aid of a vertical farm, urban farming is now a possibility. As opposed to the refrigerated produce that is typically sold at supermarkets, when the farms are close by, the produce is also rapidly delivered and always fresh.

Reduced transportation lowers the price of fossil fuels and the emissions that follow from that, which also lowers transportation spoilage. Vertical farming, like everything else, has its own disadvantages. The main issue is the initial capital costs for setting up the vertical farming system. Additionally, there are expenditures associated with building the structures and automating them using tools like climate control systems, automated racking and stacking systems, remote control systems, and monitoring systems.

BENEFITS

Benefits of Vertical Farming are:

- Ensures Consistent Crop
- Production.
- Uses Space Optimally.
- Reduces Usage of Water.
- Cuts Down on Transport Cost.
- Less Labour Costs.
- Energy Efficient.
- Doesn't Involve Chemicals or Pesticides.
- Limits Occupational Hazards.

PRODUCTIVITY

Traditional farms obviously require productive arable land. However, regardless of weather or temperature extremes, vertical farms can be planned and constructed everywhere. Additionally, it is feasible to increase productivity on a short land area because of their stacking growth systems, which allow them to expand vertically.

FRESHNESS OF FOOD

Because it is grown close to residential areas, vertical farming is less expensive than regular farming. As a result, there are fewer CO2 emissions. Customers also receive recently harvested, fresh food that is good for them.

ENVIRONMENTAL IMPACT

Water- 70% of the Freshwater goes to agriculture.

Land- 25% of the world's land is highly degraded, with soil erosion, water degradation and biodiversityloss.

Carbon Emissions- Traditional commercial farming requires a lot of energy since it requires drilling for water, pumping from deeper reservoirs than ever before, and running tractors and harvesters. 98 percent less transportation emissions are produced by vertical farming.

IMPLEMENTATION

These are some pictures of the model which we have prepared for our project.

VI. CONCLUSION

Till now in our project we have sown different seeds using Hydroponics method. In which we have seen good growth in them. We have noticedand studied each and every aspect of how the seeds and plants behave in the absence of soil. We have concluded that it is really effective in comparison to conventional method if we take care of it on timely basis. We have also seen the failures in the germination process itself with excessive sunlight orexcessive water. So we are currently working on how to overcome the failures and proceed with our project with better results.

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Understanding the zEPI and the Future of ZNE Building Performance

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***Abstract*— The paper gives valuable information on the world's present problems. The shelter is one of the basics need of humans. There are lots of benefits we get from house but can we live in house when we understand that the electricity that we are using are made from fossil fuel which are limited and causing lots of pollution rise in their process, can we live in house who blocks nature sources or not have good ventilation, can we live in house who's electricity cost is increases day by day. Pollution rise, fossil fuel limitation, increasing distance from the nature, discomfort living, high electricity cost are the current problems and Zero energy building are solution on it. Paper contains brief about ZNE buildings and their features also brief on their advantages and limitation. It describes how ZNE buildings are efficient that common buildings.**

Keywords*— *Net zero, renewable energies, sustainable, passive energy, active energy

I.INTRODUCTION

Net Zero Carbon emission is a Need for the present and Future and Net Zero Emission Building is one of the aspects of it. Dependence on traditional fuel sources is already cost us a lot by creating pollution (in all aspects including water, Air, soil, etc.) that indirectly affect human health. How can we depend on sources which directly or indirectly cost human life? As well as our traditional fuel sources like coal and petrol are now on the way from existence so it's time to shift!, Shift on natural resources!, Shift on Renewable Energy!, Shift on Eco friendly and Green construction!, Shift to Save Every Parameter in a building by giving the better option to it!

India has promised to become Net Zero Carbon Emission by 2070 at COP 26 Glasgow summit and the Building sector has to play Major Role in it.

What is ZNE?

Zero energy buildings (ZEB) are also known as Zero net energy (ZNE) buildings' in which by using current technologies like heat pumps, high-efficiency windows.

The goal of NZEBs is to minimize their dependence on traditional energy sources and become self-sufficient in terms of energy production and consumption

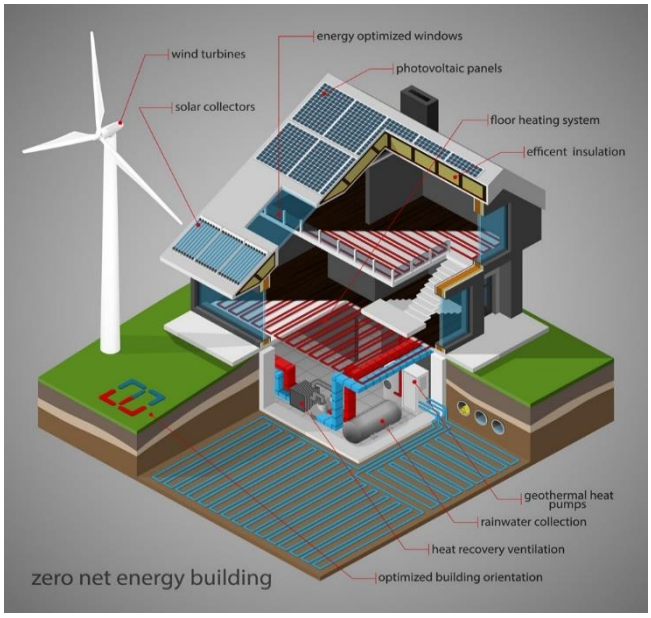


Fig.1. Zero Net Energy Building

Insulation, solar panel, photovoltaic cell etc. we generate renewable electric energy equal to total energy consumed. These types of building contributes very less in greenhouse gas emission during operation than regular buildings. ZNE buildings also cut the costs of operation by selling extra renewable energy produced, and it also very energy efficient by saving 50% and 70% more energy than regular buildings also these buildings are more reliable, comfortable, sustainable than normal buildings.

Definitions of ZNE buildings

- Net zero site energy: - These buildings produces total amount of energy required for building on site only as it uses over the course of year [1].
- Net zero source energy: - These buildings generates the same amount of energy used annually including energy used to transport the energy to the building, these building's must generates more electricity than net zero site energy buildings [1].

- Net zero energy cost: - These building produces at least as much emission for your renewable energy as it uses from on site and off site emission [1].
- Net zero energy emissions: - These building's receive at least as much annual revenue from the utility for an onside energy source that is exported to the grid as the amount paid for energy utility costs consumed annually.

ZERO ENERGY PERFORMANCE INDEX (ZEPI)

The Zero Energy Performance Index (zEPI) is a metric that is used to evaluate the energy performance of buildings, and it is based on the energy consumption of a building and the energy that is produced by on-site renewable energy systems. The zEPI is a ratio of the actual energy consumption of a building to the energy consumption that would be required for a building that produces as much energy as it consumes, also known as a net-zero energy building. A building with a zEPI of 1 or higher is considered to be less energy-efficient than a net-zero energy building, while a building with a zEPI of less than 1 is considered to be more energy-efficient. The zEPI is a useful tool for evaluating the energy performance of buildings and identifying opportunities for energy efficiency improvements.

It also takes into account the building's thermal envelope and heating and cooling systems, lighting and appliances, and renewable energy systems and is calculated annually.

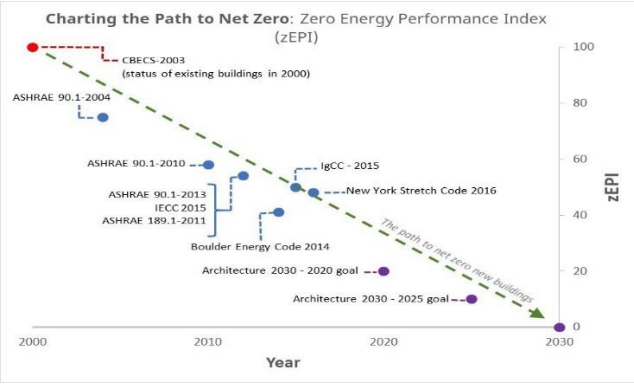


Fig.2. Charting the Path to Net Zero: Zero Energy Performance Index (ZEPI) [4]

II.PROBLEM STATEMENT

Fossil fuel shortage and dependency on a specific country: India is big importer of fuels like oil and natural Gas. [2].

Unhealthiest Coal Power Plant and Limitations: India is 2nd largest coal producer in the world but is popular for its unhealthiest mining.

Limited fuel resources: as coal is a finite resource that is becoming increasingly expensive to extract [3].

Other aspects:

Environmental: Emission of C02 Gas during Construction, Limitation of fossil fuel, Climate Change, Deadly Heat Wave, Global Emission, Acid Rain etc

Financial: Construction cost of Building in long term, More Electricity and maintenance cost, Transportation.

Waste generation: Coal power plants produce large amounts of waste'

Health impacts: Exposure to coal dust and emissions from coal-fired power plants can cause respiratory problems, heart disease, and other health issues.

Water usage: Coal power plants require large amounts of water for cooling, which can strain water resources and impact local communities

III.METHODOLOGY

The most cost effective step towards reduction in building energy consumption usually occurs during the design process that's why efficient design with fulfillment of basic requirement is must.

IV.DESIGN AND CONSTRUCTION

Passive energy efficiency: - It refers to an energy that is naturally obtained from the environment without the need for mechanical systems. In a net-zero energy building, passive energy strategies are utilized to reduce the amount of energy required for heating, cooling, and lighting. These strategies include:

Site selection: - site selection is first and important step to build ZNE buildings, site which have good ventilation phase, exposure to sunrays or nature.

Passive solar heating:- the use of windows and other design elements to maximize the amount of solar radiation entering the building during the winter, reducing the need for heating

Building orientation: - ridge line need to face east to west so that we have a south facing roof slope, it's important to give you enough room for solar panels to power the house also the south facing wall is best place for windows that can gather the sun in winter time and their overhang's can stop excessive heat in summer time.

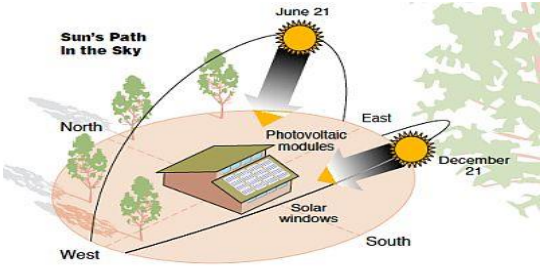


Fig.3. Sun's Path Diagram [5]

Window orientation: - In ZNE buildings most of the windows are south facing and almost no windows facing north. Because most of the sunlight is coming from Southside.

Thermal mass: - Its most essential part of ZNE buildings to having correct thermal mass, using thermal mass in the wall, in the main level slab also concrete tops in kitchen gives enough amount of heat storage and in the summer it radiate that excessive heat

Building enveloped: - To build successful ZNE home limiting air leakage in necessary, for this we can use sips panel construction which is a foam core with OSB on both side these panel are made up to 8 feet by 24 feet in single panel so we can have entire wall with windows precut out with we might lose only 1 or 2 percent.

Daylighting: - the use of skylights, windows and light wells to bring natural light into the building, reducing the need for artificial lighting.

Balanced insulation: - having great insulation in the roof but not so much in the walls is not cost effective. Using R5 windows which is u value of 0.2 W/m2K can give more ventilation, we can save more energy if we just added more insulation to the lid.

Heating and cooling equipment's: - consider ground source heat pump this piece of equipment is about four hundred and fifty percent efficient on year around average, this pumps draws hot water from the ground and heat that water also we can use solar energy for it.

Efficient lighting: - having at least fluorescent and compact fluorescent bulbs but the lights that are mostly on in this case we can use LED lights they are worth spending no need to replace for the next 20 years and also they are most efficient.

Active energy efficiency: - It means electricity production from renewable energies or from high efficiency energy sources. Active energy in a net-zero energy building refers to the use of energy-consuming systems such as heating, cooling, lighting and appliances. Unlike passive energy strategies, which rely on natural elements to reduce energy consumption, active energy systems require energy inputs to operate. The goal of a net-zero energy building is to reduce its overall energy demand through the use of passive strategies, and then generate enough renewable energy on-site to meet its remaining energy needs.

Some example of renewable energy:

1. Photovoltaics
2. Solar systems
3. Wind turbine systems
4. Biomass systems
5. Geothermal systems
6. Nuclear power
7. Adding solar panels, production meter, putting energy back into the grid when you produced excess energy

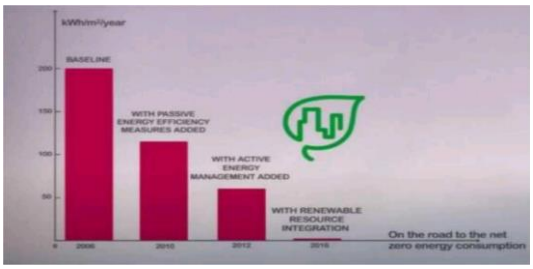


Fig.4. Comparative Efficiency Graph

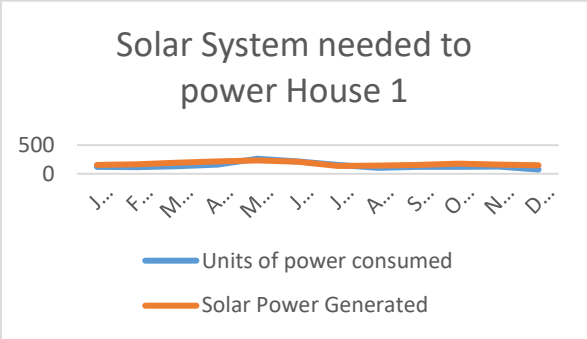
Technologies for Smart Green Building

Fig.5. Technology for smart Green Building

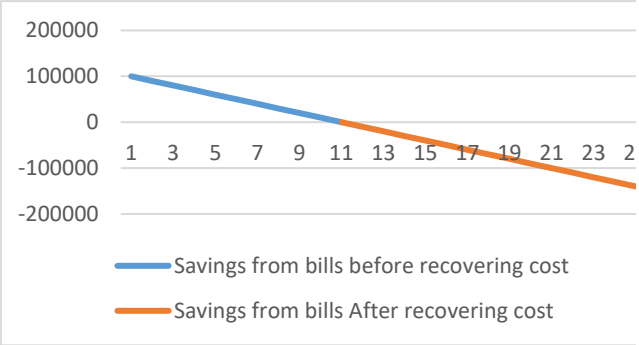
Efficiency With Solar

SUBSIDY ON SOLAR PANELS		
By Central Government		
Capacity	Subsidy	
Up to 3 KW	40%	(Installation cost or tendered rate whichever is less)
4 – 10 KW	20%	
Group Housing Up to 500 KW	20%	(Installation cost or tendered rate whichever is less)
		(Installation cost or tendered rate whichever is less)
By State Government		
State	Subsidy	
Uttar Pradesh	15000 rs. per KW	Only for residential rooftops
Maharashtra	30% of the standard cost	Up to 10 KW
Haryana	30% of the standard cost	Up to 10 KW
Bihar	25% on the installation cost ***30% on solar panel price***	Minimum of 1 KW ***Only State***
Gujarat	10000 rs. additional to central government ***20000 rs. per KW for residential rooftop solar project scheme***	Additional to Central Government 40% or 20% ***Cost Borne by customer will be solar panel cost less than 20000 rs.***
Odisha	Same as central government	Installation cost or rendered cost whichever is less
Madhya Pradesh	40% on installation cost	Up to 3 KW
Andhra Pradesh	40% on installation cost	Up to 3 KW
Jharkhand	40% on installation cost	Up to 3 KW
Rajasthan	40% on installation cost	Up to 3 KW

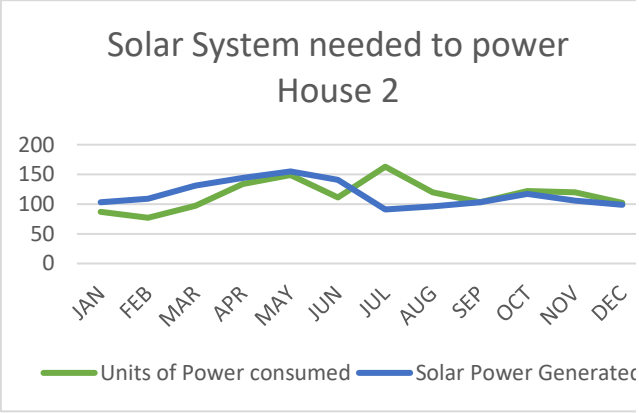
CASE STUDIES



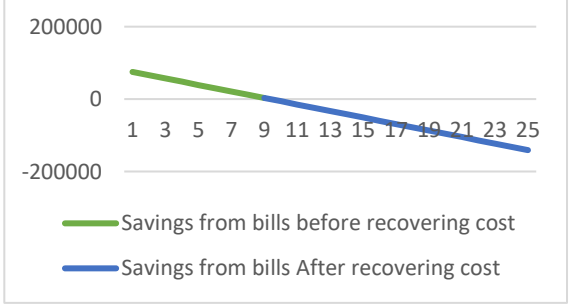
House 1 :- Apartment Block with terrace, Area 830 sq. ft., 3 windows, 3 fans, 8 LED, 1 washing machine, 1 AC, 1 Fridge is provided with 1.5 KW Solar System on Grid



House 1 Rough estimation of time required to recover installation cost of 1,08,000 Rs. after subsidy for 1.5 KW Solar system (Cost of maintenance & Profit from surplus Electricity is not calculated) Saving 1,40,000 Approx. in 25 years life of Solar System.



House 2 :- Independent House, Area 460 sq.ft., 3 windows, 3 fans, 3 LED, 4 Light bulbs, 1 exhaust fan, 1 Fridge is provided with 1 KW Solar System on Grid



House 2 Rough estimation of time required to recover installation cost of 75,000 Rs. after subsidy for 1 KW Solar system (Cost of maintenance & Profit from surplus Electricity is not calculated) saving 1,41,000 Rs. approx. in 25 years life of Solar System.

Tariff Category 2(B)			
Units of Power Consumed	Fixed Charges	Electricity Terrife	Wheeling Charge
0 - 100	80	3.05	1.47
101 - 300	120	5	1.47
301 - 500	120	6.7	1.47
>500	145	7.8	1.47

V.CERTIFICATION

Passive house & LEED are the two most common certification for green building. Passive house's goal is to be energy efficient and reduce the use of heating/cooling. LEED certification is more ambient in regards of energy use. In the range of categories if buildings demonstrate sustainable practices than it is awarded credits. Also, International Living Future Institutes (ILFI) provides a certification called the Net Zero Energy Building (NZEB) certification that designates a building as a net zero energy building exists within the requirement of the Living Building Challenge (LBC), it was developed in November 2011 as the NZEB certification but in 2017 it was simplified as Zero Energy Building Certification. Included in the list of green building certifications, the BCA Green Mark rating system allows for the evaluation of buildings for their performance and impact on the environment.

VI.DEVELOPMENT EFFORTS

There have been significant efforts to develop net-zero energy buildings in recent years, as the demand for sustainable and energy-efficient buildings has increased. These efforts include

- Government incentives and regulations
- Industry partnerships and initiatives
- Technological advancements
- Education and awareness
- Market demand

Acceptance and wide construction of ZNE buildings will require government efforts and construction regulation. As of now the world business council for sustainable development has taken many major initiatives to support the development of construction of ZNE buildings. The organizations have the support of both large global companies and the expertise to mobilize the corporate world and Governmental support to make ZNE buildings a reality. In their first report, the key players in real estate and construction had done a survey on expenses on building a green building, and the results indicate that cost of green building is overestimated 300%.

In India, 'The India PARYAVARNA BHAVAN' located in New Delhi, is the first net zero energy building that was constructed with adoption of solar

passive design and energy efficient building material. It was inaugurated in 2014. Features of the building are passive solar building design and other green technologies, High-efficiency solar panel was proposed. It cools air from toilet exhaust using a thermal wheel in order to reduce load on its AC system. It has many water conservation features too.

Fig.6. India paryavarna bhavan

VII.WORLD INITIATIVE

Countries around the world have been gradually implementing different policies of ZEB to tackle Climate change. Between 2008 and 2013, researchers from Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, the Republic of Korea, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the United Kingdom and the US worked together in the joint research program "Towards Net Zero Energy Solar Buildings". This program was created under the umbrella of the International Energy Agency (IEA) Solar Heating and Cooling Program (SHC) Task 40 / Energy in Buildings and Communities (EBC, formerly ECBCS) Annex 52 with the intent of harmonizing international definition frameworks regarding net-zero and very low energy buildings by diving them into subtasks.

The World Initiative on Net Zero Energy Building (WINEB) is a global effort to promote the design, construction, and operation of buildings that consume zero energy from the grid. The goal of WINEB is to increase the number of net-zero energy buildings and to promote the widespread adoption of net-zero energy building practices. The initiative aims to achieve this through education, research, and the sharing of best practices and technologies. WINEB is a collaborative effort between governments, industry, and academia, and is supported by a network of organizations and individuals committed to promoting net-zero energy buildings

ADVANTAGES

- Isolation for building owners from future energy price increases.
- NZEBs can generate their own energy, reducing dependence on the electrical grid and increasing energy independence.
    - By reducing energy consumption and promoting the use of renewable energy, NZEBs reduce their impact on the environment and help to conserve resources.
- Increased comfort due to more-uniform interior temperatures (this can be demonstrated with comparative isotherm maps).
- Reduced total cost of ownership due to improved energy efficiency.
- Although the initial cost of building a NZEB may be higher, the long-term cost savings from reduced energy consumption and maintenance costs can make it a cost-effective choice.
- Reduced total net monthly cost of living.
- Reduced risk of loss from grid blackouts.
- Minimal to no future energy price increases for owners.
- Higher resale value as potential owners demand more ZEBs than available supply.
- The value of a ZEB building relative to similar conventional building should increase every time energy costs increase.
- Contribute to the greater benefits of the society,

e.g. providing sustainable renewable energy to the grid, reducing the need of grid expansion.

Fig.7. Sustainability Green Buildings

VIII.LIMITATIONS

Net zero energy buildings (NZEB) have several limitations that need to be taken into consideration when designing, constructing and operating them:

- High cost: NZEBs tend to have higher initial costs due to the integration of advanced technologies, energy-efficient systems, and renewable energy sources.
- Weather dependency: The energy performance of NZEBs heavily depends on the weather conditions, which may limit their performance in certain climates.

- Complex design: NZEBs require a thorough understanding of energy efficiency, building science, and the integration of various technologies, which can be complex and challenging for architects, engineers, and building owners.
- Limited availability of renewable energy: Access to renewable energy sources such as solar or wind power may be limited in certain locations.
- Limited Energy storage capacity: With the increasing use of renewable energy sources, energy storage capacity will become increasingly important, however, the current energy storage technology is not capable of storing sufficient energy to meet the energy needs of a building.
- Financing and funding: Accessing to financing and funding for the construction and operation of NZEBs can be difficult.

Net zero energy buildings are a promising solution to reducing energy consumption, however, they face several limitations that need to be taken into consideration when designing, constructing, and operating them

IX.RESULT AND DISCUSSION

1. ZNE building is more eco-friendly and it has very less dependence on governing bodies for resources and energy & also helping society by creating renewable energy and providing it to governing bodies also.
2. Net zero energy building produces it's on electricity, from this we can save huge amount of electricity bill. It will be reduces uses of fossil fuel in future. From this we can reduce the emission of harmful gases which will affect our environment.
3. Renewable Energy Generation: NZEBs utilize renewable energy sources such as solar, wind, or geothermal to produce energy on-site, reducing their carbon footprint and helping to mitigate climate change.
4. Financial Benefits: Although the initial cost of building an NZEB can be higher, the long-term cost savings in energy bills, reduced maintenance costs, and increased property value make it a financially attractive option.

X.CONCLUSION

Net-zero energy buildings are an important step towards a more sustainable and energy-efficient future. By utilizing a combination of passive energy strategies and renewable energy sources, these buildings can significantly reduce energy consumption, while also providing a comfortable and healthy living or working environment. With the advancement in renewable technology, ZEB are the future. Many governments have framed ZEB laws. Few governments are also providing subsidies to individuals and organizations for creating Zero Energy Buildings. But the goal of zero energy buildings would not be fulfilled till the time all the people don't understand their responsibility and contribute towards reducing energy consumption.

XI.FUTURE SCOPE

1. Increased use of renewable energy sources: As technology improves and costs decrease, it is likely that more buildings will be able to rely on renewable energy sources such as solar and wind power to meet their energy needs.
2. Advancements in building materials and construction techniques: Research and development in sustainable building materials and construction techniques will likely lead to more energy-efficient and durable buildings.
3. Future buildings will focus more on renewable and sustainable energy resources by implementing an efficient building envelope and utilizing energy- efficient and high-performing utilities promotingreduced energy consumption levels.
4. World population & government is focusing on less emission and preventing global warming and ZNE building will going to be in a big demand.

Overall, the future of net zero energy building is one continued innovation and progress, as new technologies and design approaches are developed to make buildings more energy-efficient and sustainable.

XII.ACKNOWLEDGEMENT

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An effective way for mitigating the problem of conserving and re- using the rainwater and reduce water demand at source

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Abstract— An effective way to mitigate the problem of conserving and reusing rain water and reduce water demand at source is to implement rainwater harvesting systems. This can include the use of rooftop catchment systems, storage tanks, and filtration systems to collect, store, and reuse rainwater for various non-potable pur- poses such as irrigation, toilet flushing, and laundry. Additionally, water-saving measures such as efficient irrigation systems, drought-resistant plants, and low-flow fixtures can also help to reduce demand for fresh water. By incorporating these solutions, it is possible to conserve and reuse rainwater, reduce demand on traditional water sources, and promote sustainable water use.

Keywords—Catchment, drain pipe, filter, storage tank

I.INTRODUCTION

Water is a vital resource that is essential for life, yet it isbecoming increasingly scarce in many regions of the world due to factors such as population growth, urbanization, and climate change. The need to conserve and reuse water is becoming increasingly urgent, as the demand for fresh water continues to rise. One effective way to address this challenge is by implementing measures to conserve and reuse rainwater, and to reduce demand for fresh water at its source. Additionally, water-saving measures such as efficient irrigation systems, drought-resistant plants, and low-flow fixtures can help to reduce the demand for fresh water, thereby promoting sustaina-ble water use. The aim of this introduction is to highlightthe importance of conserving and reusing rainwater, and to outline some of the strategies that can be employed to achieve this goal.

II.PROPOSED FRAMEWORK

Work has been ongoing for several years in the EU on legislation on responsible water reuse. The proposal to this end that was approved by the European Council in 2020, following its successful passage through the Euro-pean Parliament the previous year, is titled: 'EU regula- tion on minimum requirements for water reuse for irriga- tion'. Together with a number of her colleagues, KWR toxicologist Milou Dingemans already examined the document at an earlier stage. 'The EU wants to use the proposed guidelines to support and stimulate the responsible and safe reuse of wastewater for irrigation', says Dingemans. 'This is being done through the harmonisation of minimum quality requirements, risk management, licensing and the sharing of relevant information'. Domestic rainwater harvesting (DRWH) is widely recognized as an alternative source of water in Taiwan becauseof water shortages. This suggests that rainwater potential should be maximized and quantified. In this article, we assess the potential of DRWH at a national level. To consider the climatic, building characteristic, economic, and ecological aspects of DRWH, we propose three categories: (1) theoretical; (2) available; and (3) environmental bearable rainwater potential. Four main steps were followed to develop the proposed framework: (1) Fifteen rainfall zones across Taiwan were generated through cluster analysis based on the average annual 10-day rainfall distributions of rainfall stations and administrative districts; (2) The roof area in each rainfall zone was estimated using a geographic information system (GIS) and land use classification database; (3) The weighted percentage of rainwater use in each rainfall zone was determined by the optimal point on the storage capacity and rainwater supply reliability curve for an equivalent building from each building type; (4) The percentage of the total

roof area used to harvest rainwater in each region depends on the downstream impact of the streamflow. The methodology developed in this study provides an effective tool for preliminary assessment of national DRWH capacities

III.PROPOSED METHODOLOGY

The methodology for mitigating the problem of conserving and reusing rainwater and reducing water demand at source may involve the following steps:

Assessing current water use patterns: A comprehensive assessment of current water use patterns should be conducted, including an analysis of the sources of water andthe demand for water in different sectors. Designing rainwater harvesting systems: Based on the assessment, suitable rainwater harvesting systems shouldbe designed to meet the specific needs of each commu- nity or organization. The design should consider factors such as climate, rainfall patterns, the size of the catch- ment area, and the water demand of each sector.

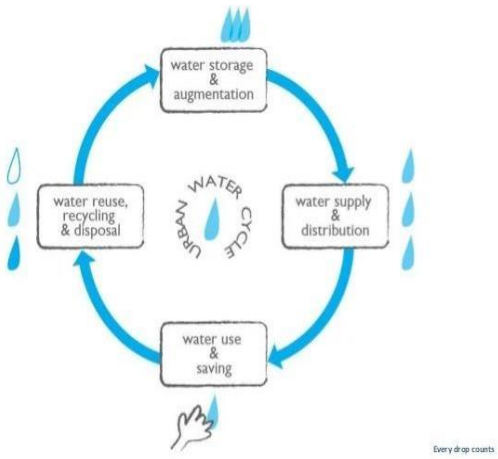
Implementing rainwater harvesting systems: Once the design has been finalized, the rainwater harvesting systems should be installed. This may involve the construc-tion of storage tanks, the installation of filtration systems,and the connection of the harvested water to the various water systems within the community or organization.

Monitoring and maintenance: It is important to monitor the performance of the rainwater harvesting systems andcarry out regular maintenance to ensure their continued functioning.

This may include regular cleaning of storage tanks and filters, monitoring water quality, and checking the condition of pipes and other components

Impact Assessment: The impact of rainwater harvesting systems must be assessed regularly to evaluate their effectiveness in retaining and reusing rainwater and reduc-ing water demandat the source.Thismay include meas- uring the amount of water collected and changes in water demand over time.

I. Flowchart



IV.FIELD SURVEY

The main reason for a rapid decline in the water table canbe attributed to our ever-increasing exploitation of ground water resources for meeting the growing water demands of agriculture, domestic and industrial pur-poses. Increasing urbanization and industrialization have also resulted in ground water pollution causing adverse effects on the health, environment and imbalance in the ecosystem.

The basic purpose of artificial recharge of groundwater is to replenish water into aquifers that have been depleted due to excessive ground water extraction. Artificial groundwater replenishment systems involve techniques that modify the natural movement of surface water and utilize suitable civil construction techniques inorder to address issues such as:

- Enhancement of the sustainable yield in areas where over-development has depleted the underground aquifers. Storage and conservation of excess surface water for evolving future requirements
- Improvement in the quality of existing ground water through dilution.
- Avoiding flooding of roads during storm showers by capturing the rainfall run-off which would otherwise overwhelm sewer or storm drains.
- Help reduce soil erosion and flood hazard.
- Provide an eco-friendly method of water resource conservation.

In this post we discuss the importance of performing a Geophysical Survey of an area targeted for ground water recharge or extraction. We have presented sample data from our records showing variations in soil formation with changes in location and how a Geophysical Survey can help in planning & designing structures for groundwater extraction and artificial ground water recharge

V.RESULT

Rainwater harvesting and harvesting are appropriatestrategies that can be used to address water crises world- wide. All communities benefit greatly from the use of rainwater harvesting systems. This simple way to save water can be the impetus for amazing solutions in areas with high rainfall but not enough groundwa- ter. This will not only provide the most sustainable and efficient means of managing water re-sources, but will also open the door to a range of economic activities leading to grassroots empowerment**.**

VI.FUTURE SCOPE

Widespread adoption: With increasing awareness of the need to conserve water resources and reduce water de- mand, it is likely that the adoption of rainwater harvest- ing systems will increase, providing benefits for commu- nities and the environment Integration with other tech- nologies: It is possible that rainwater harvesting systemswill be integrated with other water management technol-ogies, such as greywater reuse systems, to provide a morecomprehensive approach to sustainable water use.Development of new technologies: With ongoing re- search and development, it is likely that new technolo- gies will be developed to improve the efficiency and ef- fectiveness of rainwater harvesting systems, providing.

even greater benefits for communities and the environment even greater benefits for communities and the environ- ment

Expansion to other regions: As water scarcity becomes an increasingly pressing issue in many regions, it is likelythat the implementation of rainwater harvesting systemswill expand to other areas, providing benefits for com- munities and the environment.

VII.CONCLUSION

Conserving and reusing rainwater and reducing water demand at source is a critical issue in many regions, as wa-ter scarcity becomes an increasingly pressing concern. Implementing effective strategies for capturing and reusing rainwater can have numerous benefits, including reduced demand for fresh water, increased water security, improved water quality, lower water bills, increased environmental awareness, and better water management.

The future scope for mitigating this issue is promising, with the potential for widespread adoption of rainwater harvesting systems, integration with other water manage- ment technologies, the development of new technologies,expansion to other regions, and increased funding for re- search and development in this area. These efforts will help ensure the availability of this precious resource for future generations..

ACKNOWLEDGMENT:

The following work ‘ An effective way to mitigate the problem of conserving and reusing water and reduce water and demand at source is to implement rainwater harvesting systems can’t be created by a single person. The timely completion of the work has been possible due to the guidance of our mentor MR Vinod Salunke who im-parted his knowledge regarding the topic on us and with his continual motivation, this work was completed. We are also thankful to the Department HOD Seema Jagtap Save for allowing us to use the lab equipment’s which were required for our project, and to our parents for providing us with all possible resources. We also thank our college ‘Thakur College of Engineering and Technol-ogy’ for providing us with a platform and the necessary facilities to make this project possible.

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Study on Slum Rehabilitation System

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***Abstract*— The work demonstrates attempts to study and make report on the slum rehabilitation system in Mumbai. India is on an accelerated path of urbanization but several Indian cities face the challenge of housing their growing population, especially the urban poor. Much of the population is forced to living in slum settlements, especially in large cities like Mumbai. Undertaking slum rehabilitation/redevelopment schemes (SRS) becomes essential for cities to improve housing conditions of the urban poor.**

Keywords— SRS, Yojana, SRA, etc.

I. INTRODUCTION

population of about 15 million. It has a population density of 30,000 persons/ sq km, which is relatively very high. Housing such a large population is a major challenge for a city which is constrained by topography due to the peninsular shape of city and large coastal marshland. Also, Mumbai's property is known to be one of the highest in the country as well as the world (DNA, 2016). Besides high population, the cost of housing unit/ property is very high in Mumbai due to the restrictive development control regulations that limit the development density to low levels. Further, there are multiple regulations imposed on the development of land and housing in Mumbai, which restrict the housing options for citizens.

As a result, the cost of housing developed tends to be very high so much that it is not even within the reach of middle income groups (MIG), leaving aside low income groups (LIG) and economically weaker sections (EWS). There is a lack of affordable housing option for the urban poor in most Indian cities like Mumbai, which is one of the major challenges that they face when India is on an accelerated urbanization path. The slum population in Mumbai city is as high as 55% due to the housing problem, especially for the urban poor who are forced tolive in slum settlements. Slum settlements in Mumbai are not a new phenomenon but they have been present historically for a very long time ever since industrializations that peaked during 1960s. However, these slums are characterized by unhygienic and poor sanitation conditions; they are also vulnerable natural and manmade calamities.

II. OBJECTIVE

The objective of this report is to trace the efforts taken by the government of India since the last few decades. We follow the change in the school of thought of the policy makers as the socio-economic structure of the country changes with new economic policies being implemented. This is done through an extensive literature review of the successive schemes implemented in the metropolitan city of Mumbai, capital of the state of Maharashtra and considered as the financial and commercial capital of the nation; where the problem of slums appears to be the most urgent.

III. LITERATURE REVIEW

As study conducted by J. Godwin Premsingh and SheenaPhilip (2014)on “Improving living conditions in Slums Dwellers” researcher found that over 65 million people live in slum, increased from 52 million in 2001. It is found that slum population had increased at lesser rate ascompare to urban population rate over the last decade.

The proportion of SCs living in slum increased over the last decade. Sex ratio of schedule cast in slum has betterthan any other urban communities. It is found that the literacy rate is now reached to 77.7% but still far from urban average.

As study conducted by Rekha Mehta (2013), on "Trends and Patterns of Households Saving in India (Pre and Post Economics Reforms" it is found that household sector has been the main contributor to the total saving. as per MPS methods it shown improvement in the post economic reforms periods over pre-economic reforms period. Long run MPS is found higher than short run.

A study was conducted by Ramesh Jangili,(2011) Research Officer in the Department of Statistics and Information Management, Reserve Bank of India,Mumbai on "Causal Relationship between Saving, Investment and Economic Growth for India – What does the Relation Imply?" , and was published in Reserve Bank of India Occasional Papers in summer 2011.The author addressed and investigated the relationship between saving, investment and economic growth of India based on the period of 1950-51 to 2007-08.

As study conducted by Sufaira.C (2013) on "Socio Economic Conditions of Urban Slum Dwellers in Kannur Municipality" Authors in his study found that the socio-economic conditions of the slum dwellers in the notified areas where the Integrated household Slum Development Program's implemented are better than slums in non-notified area. The author has examined various aspects of slums and found that developmental activities in urban centers provide employment to the rural migrants as wellas the local urban population. These low income groups,in the absence of proper shelter were settled in the slum areas characterized by overcrowding, dilapidated dwellings, lack of sanitation and civic amenities.[6]

IV. CAUSES OF SLUMS AND SQUATTER SETTLEMENTS :

• The chief reason for squatter settlements occurs due to economic reasons. The homeless are naturally inclined to search for shelter and they do so in abandoned properties, even if the property is in a dire state, unsuitable for occupation.

1. RAPID INDUSTRIALIZATION: •The Industrial growth and employment opportunities in towns and cities have acted as powerful magnets to attract the rural population to cites. • the workers employed in the in these factories & industrial areas generally make their habitation as near as possible to the place of work. • Theyare low waged persons and cannot afford daily travelingfrom the distant places in the city.

2. POPULATION GROWTH:

• There is a great demand/supply gap between the tremendous growth of population and the construction of houses.

• These shortages manifest themselves in creating slums.

3. PHYSICAL & SOCIAL DECENTRALIZATION:

• One of the major reasons for slum development is the physical and social decentralization in which the rich and middle-class people move out to the extension areas of city by leaving the poor in the overcrowded part of the town to make it more unsanitary.

• As a result, the slum colonies start mushrooming at a fast rate within City.[1]

V. SLUM REHABILITATION ACT 2022

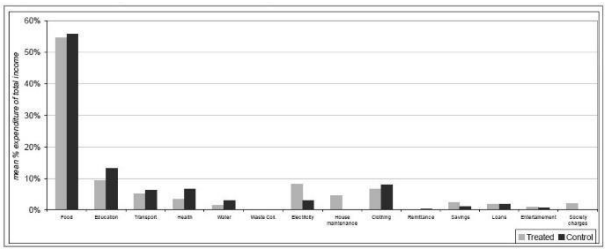
The Slum Rehabilitation Authority (SRA) CEO Satish Lokhande in the notification issued on May 23 said slumis defined under Regulation 33 (10) of DCPR 2034 as ''slum'' shall mean those censused or declared and notified in the past under the Slum Act. At present, the slum dwellers occupying the structures existing on January 1, 2000, and prior thereto are entitled to rehabilitation free of cost and the slum dwellers occupying the structures existing after January 1, 2000, to January 1, 2011, are entitled to rehabilitation subject to payment of premium decided by the government. TheSlum Rehabilitation Authority has taken a policy decision to declare all public as well as private land on which the slum was existing as of January 1, 2011, or prior thereto and which has been declared as slum undersection 4 of the Slum Act or censused slum as slum rehabilitation asea. 'Hereafter all such slum occupied lands on January 1, 2011, or prior thereto excluding the lands falling under section 3Z-6 of the Slum act shall be deemed to be slum rehabilitation area under section 3C of the Slum Act for the purpose of implementation of slum rehabilitation schemes Pradhan Mantri Awas[2]

Yojana (Government initiative):

• Deciding the eligibility criteria for beneficiaries to avail the scheme such as, the cut-off date from when the beneficiaries were residing in that housing. • Deciding ifthe beneficiaries are liable to contribute a certain amountto avail housing under the scheme.[8]

• State governments are allowed to subsidies the cost of each house up to Rs. 1 lakh by utilizing their own fund or by utilizing funds from the central government rehabilitation fund. • State governments decide whether the houses constructed will be allotted on ownership rights or on renewable, mortgageable and inheritable leasehold rights.[8]

V. FLOWCHART



In the case of electricity, author's estimations suggest that control households have a higher per capita consumption (57,02 kWh/month.person) than treated households (48,09 kWh/month.person). This could be a consequenceof the formalization of the electricity supply. Sharma results for the case of MUTP resettlement indicate that 77% of the families say to be paying more electricity thanbefore. One of the highest increases in expenditure is the amount paid for maintenance and society charges, according to Bhide et al. 67.3% of the respondents found this increase to be sharp and unaffordable. Sharp increases in electricity and household maintenance are partly compensated by lower expenditure in health, education, food and transport. While transport and education expenditures may reveal specific of the households employment and the slum pocket location, health expenditure might actually reveal a positive indirect outcome of rehabilitation. A comparison between control and treated households from our survey shows that on average rehabilitated households work more days a week than control households and lose less days of work due to

illness.[3]

VI. FIELD SURVEY

Group	*Slum/rehab site name*	*Sell (Rs.)*		*Rent (Rs. Month*	
		Slum	Rehabilitation	Slum	Rehabilitation
Treated	Sai Wadi	625 000	1 532 268	2 185	7 769
Treated	Sundar Nagar	635 000	930 000	1 279	3 313
Treated	Ganesh Nagar	581 539	1 509 700	1 327	4 250
Treated	Ashram Chawl	570 833	1 253 036	2 325	4 622
Control	Korba Mithagar	903 380	1 773 295	2 219	5 964
Control	Sundar Nagar II	788 842	1 766 667	3 698	5 079
Control	Betwala Chawl	603 000	1 800 000	3 100	17 250
Control	Godiwala compound	663 333	1 600 000	4 143	7 000
Control	Waterfield Road	1 474 429	3 000 000	6 000	7 750

Literature refers to slum policies generated mobility, mostly as a consequence of the cost of opportunity. When a slum dweller gets a formal ownership right, property value raises and so does the cost of opportunity. Payne (2001) arguments that the provisionof land titles may increase property values and displace most vulnerable groups in favour of higher incomes.

Gilbert and Varley (1991) explain how informal settlement that were once in peripheral or marginal location can now be found to be in strategic location given urban growth.[4]

VII. RESULT

Rapid urbanization is direct result of rocketing population. One of the most chronic and intense problem of urban life is slums. Slums exist in almost every metropolitan city of the globe.

Slum population makes positive contribution to the city economy by active participation in productive activities.Efforts must be mobilized to control the future growth of unhygienic slums and improve living condition of the people.

This gives the result of benefitting the urban poor toimprove their quality of life.

Slum Rehabilitation activities have increased the density of construction in Mumbai. The state government should be careful of not overloading the

VIII. FUTURE SCOPE

As per survey, by 2050, 70% of the world population will be in urban areas. The goal of the United Nations is to improve urban landscapes and make them accessible and sustainable. There is a lot of scope for technologicalsolutions in the area.[4]

IX. CONCLUSION

Slum rehabilitation projects have increased the density of construction in Mumbai. The state government should be careful of not overloading the already strained infrastructure and environment of the city. Some still argue that the kind of scheme implemented in Mumbai, steers away from its intention of rehousing and focuses more on the profits for the developers. This makes the success of the schemes entirely dependent on the price differential between the sale price of the additional apartments built and the construction cost of the rehabilitated apartments.

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Resource Management of Infrastructural Project for Future Cities: A Re Modified Minimum Moment method

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***Abstract*— Infrastructural industry is facing a global challenge in optimisation from the past few decades in the field of resource management namely man, machine, material, money (4Ms). A well-designed sound scheduling technique for future cities other than normal traditional methods needs to be carried out to keep the country's economic growth well within its boundaries. Various past research experts have shown that the inter dependency of 4Ms and its varying consequences with the increase in duration directly affects the project cost. To overcome this issue, the objective of this research emphasizes in identifying a unique approach by real time monitoring of 4Ms and hence providing a optimize solution by a methodology termed as Re-Modified Minimum Moment Method (RMMM) with considering a case study from Mumbai region, stating post project analysis. Results signifies that RMMM gives better results in terms of optimization than traditional method.**

Keywords*— *Resource improvement coefficient, Re-modified minimum moment method, Resource levelling

I. Introduction

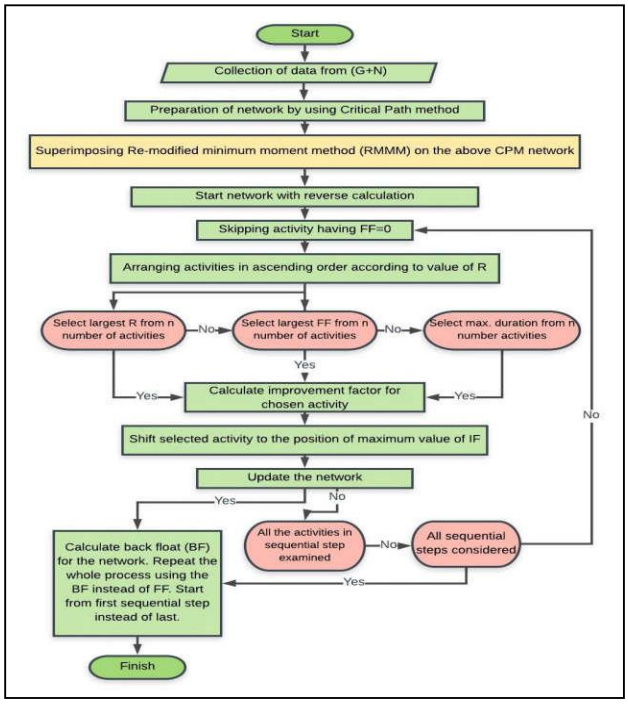
Many project-based industries are recognizing the importance of project planning, but the Infrastructural industry depend on scheduling skills. As they are working under changing environmental conditions and being involved in some complex and a unique project, which requires multi-disciplinary collaboration for which they have to develop accurate planning and frequently modernizing in it. Nowadays there is increase in the competition within the industry which ultimately forces the construction companies to provide the products of good quality within limited durations, for lower costs and under the safe working conditions. In infrastructure project preparation, its schedule requires immediate changes in various uncertainties. Scheduling is not a simple concept of determining these quinces and the timings of activities within a project. A planner has to cope with a number of considerations and various constraints. Therefore, while planning a project site availability, lag durations, output rate, working schedule and atmospheric conditions are the measure issues which has to be analyzed.

II. Literature Review

Edem O.P. Akpan et al. (2000) [10] He stated that, to remove the changes in peak and valley of project resources there is a need of levelling practices. Generally, the activity having high peak region floats started at lower date are moved and to smooth the resource profile of course to time constraint to fill up the valleys. The process is done till all the floats are getting exhausted. Mohammed A. Salem Hiyassat et al. (2001) [9] this paper gives the modification of minimum moment method and to simplified steps to arrange multiple resources by using MMM method. MMM method gives better results than traditional method. Gomer J. E., et al. (2002) [8] a very good workforce strategy, known as multi skilling which shows that how to reduce the cost of labour indirectly as well as improve output and reduction in overall project cost. On the basis of capabilities, knowledge and experience on former projects workers are getting tasks by the foreman. This study discovers the method of allocating a multi-skilled work force in construction project and to optimize the multi-skilled workforce assignment and allocation process in a construction project the study developed a linear programming model to help.

III. Methodology

Applying the RMMM method on data which is collected from site. In backward cycle to calculate the improvement factor, skip the activity having free float (FF) zero from CPM network. Select the activity having largest value of resource rate. There is possibility of having same value of R, at that time choose the activity having largest number of FF. If again there is tie, then activity which having largest duration is to be selected. If again there is tie, then choose the first activity in the queue. After calculating Improvement factor, the activity will be shifted to the new position if the calculated improvement factor of that activity will be larger than zero or



equal to zero. Still the tie is observed in the value of IF, then the largest value of time unit is selected.

Fig. 1. *Flowchart on Re modified Minimum Moment Method*

No shifting of activity takes place if the value of Improvement factor is negative. activities which can be shifted and hence the backward cycle completes. Again, the process is staring with forward cycle. If shifting occurs, the resource rate of activity is subtracted from daily resource sum hence the FF, lags, EFD and ESD are updated in the network. Repeating the process for all the At the end, when the process gets finished, we will get final outcome. The above methodology is descripted into figure. 1

A. Re Modified Minimum Moment Method

In the sequential step of network to select the criteria of activity, Re-modification of minimum moment method is considered. The assumptions are made in the RMMM are same like MM and MMM.

Improvement Factor (activity J, S) = R (Σx - Σw -mR)

Where,

IF = Improvement factor,

S = Count of shifting days,

Σx = Daily resources sum of x1, x2, . . , xm, to which deduction of m daily resource rates (R) is to be apply.

Σw = Daily resources sum of w1, w2, . . ,wm, to which addition of m daily resource rates (R) is to be apply;

m = Least of either activity duration (t) or the activity is to be shifted (S) in days; R = Resources rate.

To get resource improvement factor, minimum moment of the element exists when the histogram is shaped as a rectangle over this interval. This moment is the minimum possible for any resource histogram regardless of the total amount of the resource. [9]

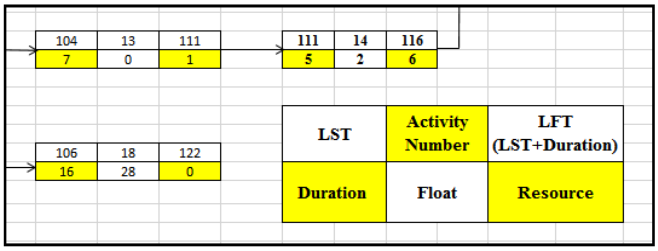
$$RIC = n*\Sigma Yi2/(\Sigma Yi)2$$

Where ΣYi= Sum of daily resource sum at i^{th} day

Ideally, the value of this coefficient would be one; hence, the nearer the value of the RIC is to one, the more closely the resource histogram is to a rectangle

B. Study area of the project

Study area located in Fig 2 is having coordinates of proposed site are 19.2813° N, 73.0483°



Activity No.	Task Name	Duration
1	Excavation	14
2	Foundation For PCC	6
3	RCC Footing	37
4	Columns Up To Plinth	3
5	Plinth And Ground Beams	4
6	Murum Filling	11
7	Soiling	1
8	PCC Below Flooring	11
9	Columns Up To First Floor Slab	7
10	First Floor Slab	10
11	Ground Floor Brickwork	14
12	Ground Floor Neeru Plaster	16
13	Columns up To Second Slab	7
14	Second Floor Slab	5
15	First Floor Brickwork	14
16	First Floor Neeru Plaster	16
17	Ground Floor Flooring	7
18	Doors & Windows	16
19	First Floor Flooring	7
20	External Sand Faced Plaster	9
21	Painting	12
22	Site Cleaning	14

Fig. 2. *Satellite view of site*

C. Data collection and Analysis

The data is collected from Residential Construction project at Bhivandi. The activities are arranged according to

their inter relationship which are shown in table 1. The proposed Construction project involves the following activities. Table No. 1 contains the activity No., task name and duration. By using these three inputs, a well-arranged CPM network is prepared. According to CPM network, free floats are calculated and critical path is decided. Activity No. 14 is selected to show sample calculation of improvement factor, in which fig. 3 shows the schematic representation of activity no. 14 and fig. 4 shows the bar chart of activity no. 14, in which the FF is 2 therefore activity can be shifted by 2 days.

D. Network and Bar chart

AON network is drawn for the activities arranged according to their EST, re-modified minimum moment method in figure 3 and 4.

Fig. 3. *Network of activity No. 14*

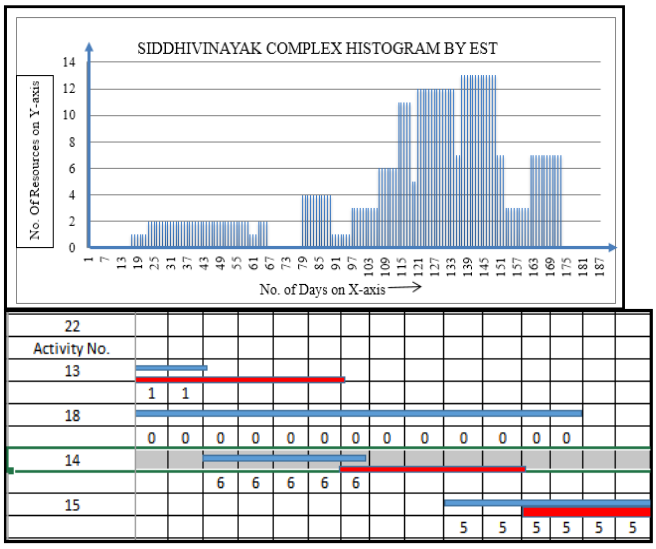


Fig. 4. *Bar chart of activity No. 14*

E. Calculation

To obtain the minimum moment, improvement factor is needed and for that calculation of each activity is done. Activity no. 14 is explained from all the activities of construction project.

Consider activityno.14

Improvement Factor (activity J, S) = R ($\sum$x - $\sum$w –mR)

R14=6; F.F.14=4; D14=5

I.F (14, 1) = 11 – 5 – (6*1) =0

I.F (14, 2) = (11*2) – (5*2) – (6*2) =0

I.F (14, 3) = (11*3) – (5*2) – 7 – (6*3) = –2

I.F (14, 4) = (11*4) – (5*2) – (7*2) – (6*4) = –4

Shifting activity 14th by 2 days.

Where, R = resources used for that activity d = Duration,

f.f. = free float,

i.f. = improvement factor

IV. Result And Discussion

Re-modified minimum moment method is helpful to complete the work without any interruption. This can be achieved through proper scheduling of construction activities. Re-modified minimum moment method is helpful to minimize calculation and maximize output in terms of accuracy.

1) The RIC of the project by EST is 2.07 and by Re-modified minimum moment method is 1.93.

2) By using above methodology, the duration of each activity remains constant.

3) By using above concept, the network logic is fixed.

4) By using above concept less calculation is expected with maximum accuracy.

5) According to histograms, Re-modified Minimum Moment Method gives the uniform resource management than EST which is shown in figure 5 and figure 6.

Fig. 5. *Histogram of activities by EST*

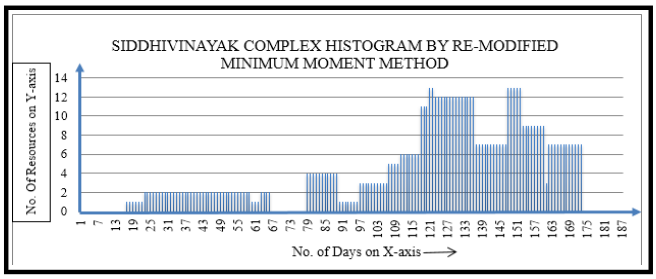


Fig. 6. *Histogram of activities by re-modified minimum moment method*

Acknowledgment

The preferred spelling of the word “acknowledgment” in America is without an “e” after the “g”. Avoid the stilted expression “one of us (R. B. G.) thanks ...”. Instead, try “R. B. G. thanks...”. Put sponsor acknowledgments in the unnumbered footnote on the first page.

References

The template will number citations consecutively within brackets [1]. The sentence punctuation follows the bracket [2]. Refer simply to the reference number, as in [3]—do not use “Ref. [3]” or “reference [3]” except at the beginning of a sentence: “Reference [3] was the first ...”

Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it was cited. Do not put footnotes in the abstract or reference list. Use letters for table footnotes.

Unless there are six authors or more give all authors’ names; do not use “et al.”. Papers that have not been published, even if they have been submitted for publication, should be cited as “unpublished” [4]. Papers that have been accepted for publication should be cited as “in press” [5].

Capitalize only the first word in a paper title, except for proper nouns and element symbols.

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The Green Retrofit

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***Abstract*— Retrofitting of structures has become increasingly important as infrastructure ages and deteriorates. The problem has been exacerbated by optimized and greener construction technologies. Many expansive methods are available for retrofitting structures and choosing the appropriate method or material is a challenge for a civil engineer. Green retrofitting is the science and technology of improving existing structures or structural elements to enhance their performance through new technologies, features and components. It is one of the most environmentally friendly and effective solutions to improve energy efficiency and could also help to extend the life of the existing building or historic buildings while ensuring optimal thermal comfort for the occupants, leading to higher efficiency.**

Keywords—Retrofitting, infrastructure.

I. INTRODUCTION

a) General

In the present scenario, deterioration of structure is a worldwide problem. The reasons behind this are many, like - occurrence of natural hazards like earthquakes, lack of awareness of several important codal provisions in construction, poor quality of supervision etc. These factors lead to strength deficient structures. Sometimes, overloading of structures leads to excessive deformations and corrosion which need significant attention today. To overcome all these effects on reinforced structures: repair, retrofitting or strengthening are regularly required activities inconstruction field today. The damages caused by all of these possible ways will require variety of possible repair techniques, from which most effective one will be chosen in each particular case. In some cases, even newly built structures require, repair and strengtheningso as to eliminate defects due to mistakes in design or construction. Specialized techniques of strengthening,stiffing and repair are needed to deal with damaged structural elements due to unusual event such as fire, earthquake, foundation movement, impact and overload. Many existing bridges, industrial structures, urban transport structures, marine structures and earth retaining structures are in need of repair or upgrade. Replacing the whole structures causes disadvantages like high costs for labor and material. So, without replacing the whole structure, if is desirable to repair itor upgrade it by retrofitting if possible and feasible.

b) Necessity of Strengthening

Masonry structures were built on ancient times when no appropriate theory and good knowledge were available. People usually built their houses according to the available knowledge and skill. So many buildings which still exist do not satisfy the existing guidelines. Also, the recent worldwide earthquakes make people more conscious about the safety of life and property. Some of the renowned building which becomes valuable in terms of culture and history demand longer service life.

GREEN RETROFITTING

Green Retrofitting is all about improvising existing structures or structural elements to enhance their performance in one of the most environmental friendly way.

A. Purpose

The world around us is evolving and becoming more sensitive to climate and the planet we all call home. About 8 out of 10 people in the world live in cities. Although cities cover only 8% of the Earth's land mass, they are responsible for 80% of the world's total energy consumption and carbon emissions. Existing building structures account for 40% of all emissions from a city, and scientific projections indicate that this will soon rise to 50%. These problems are ever-growing and pervasive, and require serious and important human intervention if there is to be any chance of saving the planet.

B. Aim

The aim of our project is to bring about a shift in thinking and understanding of what a green structure is and how we can achieve a "net 0" status of energy production and consumption so that we are fully sustainable. Our team believes in the ideology that everyone deserves an earth that is free from pollution, emissions and dependency, and this is where our role comes in. We want to propose energy-efficient retrofits for existing structures that benefit both the environment and your wallet.

C. Applications

(1) Reduce dependencies towards external agents.

(2) Improve structural stability.

(3) Reduce cost of living and maintenance.

(4) Reduce carbon emission.

D. Methodology

Survey the structure: Visit the site of retrofit and investigate the structure.

Identify pain points: Look for issues that have a high dependance and/or are heavy power users/emitters.

Understand the scenario: Look at the geographical and geological details of the region of the structure.

Look for green substitutes: Provide retrofit options forthe existing structure.

Efficiency comparison: Compare improvements between conventional and retrofitted technologies.

Cost Estimation and Certification: Prepare cost sheet for implemented improvements and apply for a LEED certification.

E. The benefits and challenges

Benefits: Green Retrofitted buildings are more adaptable and suitable to existing activities or future activities if required, more comfort; Green Retrofitted buildings are more energy efficient, lower carbon emissions from the building operations;

Challenges: Expensive initial capital; Internal spaces may reduce upon installation of internal wall-insulation; Might cause negative impact to heritage and archaeological assets caused by usage of unproven methods, technologies or instruments; Further researchis needed especially on insulation mechanism on wallsand the effect of green retrofit on buildings fabrics; More education, training and activities on maintaining and preserving the buildings need to be taught to address issues and to create awareness.

II.CONCLUSION

Green Retrofitting the existing buildings is one of the most environmentally friendly, economically competent and proven as an efficient solutions to optimize the energy performance and could also help to prolong the life of the existing building especially to the historical buildings. Thus, the application of green retrofit should be promoted across the construction and conservation industries. More research needs to be done in order to have complete sets of detail data on the directand indirect impacts of green retrofit to the environment, cost differences between green retrofit with the normal construction of a building, cost of maintenances as well as, the impacts to the end users and to the surround area of retrofitted buildings.

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The use of Sustainable Green Technology varies in construction work

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Abstract— With the increasing application of a sustainable development concept in the construction industry, green construction technology has been widely used in the construction stage of architectural projects which promoted the development of construction engineering in China. Green construction has been an irresistible trend of the constructional industry development all over the world. This paper studies the fundamental connotation of green building construction, illustrates the significance and meaning of green construction and analyzes the green construction principles. Then, the useful green construction technical measures will be put forward in order to provide reference for researchers and engineers. Finally, the actual projectis introduced as an example to demonstrate the application and management measures to minimize pollution, reduce natural resource consumption, and create environmentally friendly, energy-saving green buildings. The main elements of green construction, work art and requirements of green construction application and management, occupational health and safety management measures are illustrated as well.

Keywords:Construction Projects, Green Technology, Sustainable Design,Sustainable Principle, Technological Life-cycle.

I. INTRODUCTION

The realm of green technology is fast improving and trendy solution in the construction industry today. Since early 1990's a lot of importance is being placed on green technology, and in modern day construction; there is a serious shift to an efficient construction design implementation driven by eco-friendly activities that make sustainable technology possible. Green technology, otherwise known as sustainable technology, is one that has a "green" driven-insight geared towards sustainability strongly applicable to construction in our modern era. Of a truth, when we talk of "Green" it's referring to nature. But green technology, in general, is one that takes into account the temporary or lasting impact of innovation on the environment (Arslan, 2016). Green technology in construction encompasses the construction of innovative buildings that integrate one with extra aspects of eco-friendly solutions in construction projects. According to US daily newsletter on green technology (2016 edition), green products are eco- friendly discoveries that often consist of efficient energy, recycling, health safety concerns, and resources which are renewable, etc. In the construction of environmentally friendly buildings, the highest goals are; firstly: safeguarding natural resources conservation, eliminating the negative impact of construction activities on environmental safety by producing materials that are reusable or recyclable, and also causing an alteration in production pattern to reduce waste and pollutants. Secondly, finding an alternative to undesirable practices which affects the environment and is challenging to humans' existence. When an appropriate design is used and a good setting for the construction is obtained, then an improvement in the energy efficiency of the building is inevitably achievable.

II. SUSTAINABLE MATERIALS

A green structure requires exceptional materials and frameworks to adapt supportability contrasted and an ordinary structure. The business of green structure materials and administrations alongside the mounting pattern of green structure advancement is additionally creating in India. Figure 1 shows the rules for green building construction. The practical development fuses various techniques during plan development and activity of building venture. Utilizing green material is one among the manageable plan activity and development systems. The green materials are ecologically capable materials as they help with falling natural effects (Green-ecnomics). asset effectiveness, indoor air quality, energy proficiency and reasonableness should be the critical highlights of the practicalstructure materials. Green structure rating for coordinated environment appraisal. Green building material that has little orno impact or a positive impact on the surroundings. Most greenmaterials are composed of recycled materials that assist the environment and use of waste energy in a better way, the energy needed in manufacturing them is also reduced.

III. METHODS

When the building materials are made from renewable sources that are sustainably harvested are also considered green. Sustainably grown and chopped wood or bamboo flooring is an example of this. Another advantage of a sustainable product is Durability. The building material

which are very durable are also considered to be green . A common example of this that out lasts less durableproductsare durable siding, which results in significant savings in materials and energy over the life span of the property. Figure 2 shows the various sustainabble building materils used in green building construction. Further profit can be attained when sustainable product is generated fromrecycled waste which is environmentally friendly. A material's "greenness" is generally founded on specific models; its strength and furthermore whether the material is asset productive in its assembling, inexhaustible, establishment, use, and disposal . An efficient way to deal with total and look at the sources of info and yields of materials and energy and to straightforwardly depict the ecological effects of an item or administration framework forthe duration of its life cycle is its Life-cycle evaluation (LCA)

. An eco-brick and bio-brick will be the upcoming concept in green building construction as they will replace the traditional bricks. Through recycling plastic waste, it can be used in road paving as well as in certain attractive decorative items. Green framework products and materials can have similar properties. Recyclability of building materials or reusability when no longer needed, sustainably derived from rapidly depleting resources, such as asserted tile flooring, bamboo flooring, wool mats, strawboard, and cotton ball safety (created utilising denim scrap). Using renewables reduces the use and fatigue of limited rough materials, increases durability, and reduces the amount of radioactive radiation emitted by the product. The Forest Stewardship Council's (FSC) Principles and Criteria for Wood Building Pieces, such as post-consumer reclaimed products, may be rescued for reuse, restored, remanufactured, or reused for timber or wood-based items.

III.PLANS

An eco-brick and bio-brick will be the upcoming concept in green building construction as they will replace the traditional bricks. Through recycling plastic waste, it can be used in road paving as well as in certain attractive decorative items. Green framework products and materials can have similar properties. Recyclability of building materials or reusability when no longer needed, sustainably derived from rapidly depleting resources, such as asserted tile flooring, bamboo flooring, wool mats, strawboard, and cotton ball safety (created utilising denim scrap).

IV.FUTURE SCOPE

Green construction projects are made from longer-lasting, more sustainable materials like metal, stone, and brick. Examples ofthese types of materials include:

Wood: Cork floors or bamboo floors

Brick: Facades or flooring

Stone: Landscaping, flooring, or facades

Concrete: Build on a slab, concrete walls, or floors

Metal: Metal roofs, metal framing, or rebar in concreteBy choosing materials that last longer than their counterparts, you extend the life of the building, reduce maintenance needs,and lower costs in the long run. In addition, by looking at sustainably harvested wood and other biodegradable material option, you reduce the carbon footprint of the building.

V.RESULT AND DISCUSSIONS

Green technology is premium and of great necessity in order to stimulate the sustainable principles outlined in this study. More so,

the value obtained from “green technology” application in construct work can be significant and broad, offering noteworthy advantages when used in new facilities as well as current structures. Engineers and structure owners take various phases to make a building"green". These appropriate approaches as stated by Elizabeth (2019), include correctly locating the structure to take gain of normal conditions together with solar alignment, making use of recycled or eco-friendly building materials, and reducing housing sprawl with considerations to other sustainable principles appropriate in solving design problems. Apparently, any kind of construction is naturally harmful to the environment. Nevertheless, with sustainable design; it is likely to lessen or eliminate any damaging effect. There are numerous values derived from applying green technology in the construction industry which some studies has revealed. Elizabeth(2019) also stated that although the purchase and costs of installing green building materials might be somewhat costlier initially, long- standing profits are much realistic. These technologies are intended precisely to efficiently maximize resources, which in return, causes a reduction in overall costs. According to Elizabeth (2019), workable sustainable features in designing procedures and construction of a building can moderate environment influence, conserve expenses andcreate value that lasts.

Possibly the particular most significant value of buildings applying green solutions is the environmental influence of waste it minimizes. Orthodox technologies, for instance, petrol generators, can result in a wide devastating effect on the environment, makingit indispensable for companies to decide on using green technologies. Particularly, green technology aid in reducing industrial carbon footprint production minimizes waste generation, preserves water consumption, decrease energy usage as related to oldtechnologies (Zhiwei Yi, 2014). Since the stir of the 21st century construction industry is towards sustainable development which is obviously towards the reduction of negative impact, utilization ofgreen solutions will be paramount and appropriate. More so, the ‘green’ energy sector in an economy is accountable for numerous job prospects in today’s market sphere. There is a need for sufficientproficiency in workable solution in the business of building structures. “Green energy” sector is perhaps an emerging market niche which now remains more than a few generations to come. Consequently, various employment choices are available for the public, some of which include; health engineers, solar utility specialists, and proficient illumination professionals in addition, etc.

VII.. CONCLUSION

Sustainable materials are identified and it can be replaced with the existing conventional building materials. There are various advantages of using these sustainable green materials for building constriction. This paper will helpful to the people, communities and general public and they will be aware about the benefits of using green building materials for sustainable environmental development and management. Nowadays energy sources are decreasing fast and also the use of natural resource is more. This paper conclude that theuse of sustainable building materials will lead to optimize energy efficiency. In addition to this, the rate increment in total expense is 12-15% in green building construction instead of conventional building.

After the compensation time of LED installations is finished saving in money is around Rs. 10,000 every year. Payback period considering savings only is approximately 35 years.

VIII. ACKNOWLEDGMENT

At the outset of our project, we take this opportunity to express our sincere heartfelt gratitude to our project guide andmentor, Mr. Ghanshyam Pal who with his guidance and valuable advice helped us in the project. We are also thankful to Dr B. K. Mishra, Principal TCET, Mumbai, Dr Seema Jagtap, Head CED, TCET, Mumbai, for giving a lot of freedom and encouragement and the faculty members of Thakur College of Engineering and Technology, Mumbai, for providing all kind of possible help throughout for the completion of research work

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Development of Geopolymer aggregate Added with quarry waste

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***Abstract*—This study was conducted to compare the mechanical properties of fly ash-engineered geopolymer aggregates and natural aggregates (rock) in terms of impact strength, specific gravity, and water absorption. Environmentally hazardous waste such as fly ash should also be used. The raw materials used are fly ash, sodium hydroxide, sodium silicate and natural aggregates. After the artificial geopolymer aggregate is manufactured, its water absorption, specific gravity and aggregate impact tests are conducted. All results obtained are compared with natural aggregates. Numerous studies have shown that fly ash geopolymer aggregates have lower specific gravity than natural aggregates. Fly ash geopolymer artificial aggregate has a slightly higher impact value than natural aggregate but has a higher water absorption rate than natural aggregate. In summary, fly ashhis geopolymer artificial aggregate can be used as one of the building materials for concrete as an alternative to coarse aggregate, in addition to natural aggregate with lighterproperties.**

Geopolymer composites are a new material and appear to have the potential to replace traditional aggregates. This paper summarizes research on the use of geopolymer aggregates as partial or complete replacements for conventional aggregates. The impact of geopolymer aggregates on civil engineering and the environment has been extensively studied in this work. Thisstudy shows that the addition of geopolymer aggregates significantly improves workability.

Keywords—Geopolymer, Aggregate, fly ash, alkaline solution, NaOH

I. INTRODUCTION

Finely ground coal is burned in boilers to generate steam for power generation in general power plants and industry. This results in the formation of a by-product called fly ash. Fly ash is removed from plant flue gases primarily by electrostatic precipitators or baghouses and then by scrubbersystems. Also, in the manufacture of concrete, one of the most important raw materials is used as coarse aggregate. Common coarse aggregates are gravel, crushed stone, etc. The intensive use of this coarse aggregate is now an environmental issue. The demand for concrete, especially in construction work, is increasing day by day, and the use of coarse aggregate is also increasing. Coarse aggregates produced from natural resources such as crushed stone can be depleted if they are consumed in large quantities without plans or methods to produce alternative substitutes. Geopolymer materials or products are There are many uses in life. The most common use of geopolymers is construction, especially geopolymer concrete. Geopolymers have now proven to be safe and reliable materials in toxic and radioactive waste disposal systems. Geopolymer concrete is used as one of the main building materials in radioactive waste disposal systems because it contains toxins such as uranium and rad with high reaction rates. This paper presents a comparison of artificial fly ash produced by a geopolymerization process, geopolymer aggregates, and natural aggregates for use in concrete for building purposes. Aggregate is one of the most widely used resources in the building industry yet it is criticized for being environmentally unfriendly due to its destructive resource- consuming nature and severe environmental impact. The emission of huge amounts of CO2 during its process, the significant reduction in the naturally occurring amounts of aggregates and the disposal of construction and demolition waste are a few examples to count. The development of geopolymer aggregate added with quarry waste is thought to offer a solution leading to sustainable construction. Attempts in the use of different substituent or recycled materials gave good indications for the production of geopolymer aggregate worldwide. This study will test the potential usefulness of geopolymer aggregates.

II. MATERIALS AND EXPERIMENTAL PROCEDURES

Materials will be obtained from nearby power plant, where it will be collected by mechanical or electrostatic separators from the flue gases of the thermal power plant. The spherical shape of fly ash particle will improve the flow ability and reduces the water demand.

Sodium silicate (Na2SiO3) or known as water glass will be obtained from nearby Chemical Industires. It contained 30.1% SiO2, 9.4% Na2O and 60.5%H2O (modulus, SiO2/Na2O = 3.2), specific gravity at 20ºC = 1.4G/cm3 and viscosity at 20ºC = 0.4Pa s. The sodium silicate in liquid form will be used because powdered water glass leads to lower performance compared to the liquid form. Sodium hydroxide (NaOH) in pellets form with 99% purity and distilled water will be used to produce NaOH solution. Sodium cations are smaller compared to potassium cations and can migrate throughout the geopolymer paste chain withmuch less effort promoting better zeolitization. *Experimental Procedure*

The process start with producing geopolymer artificial aggregate by geopolymerization process where the raw

Chemical Composition	Weight percentage (%)
SiO_2	35.7
Al_2O_3	15.4
CaO	20.8
Fe_2O_3	19.91
K_2O	1.85
TiO_2	1.13
SrO	0.30
SO_3	3.55

Table 1: Chemical composition of fly ash powder

material which is fly ash is activated with alkaline activator (sodium hydroxide + sodium silicate). The mixture was then shaped into a rounded shape and size similar to normalcoarse aggregate. After that, the artificial aggregates were then cured in an oven with plastic covering the container to avoid moisture loss and cracking. After the curing session ended, the aggregates were subjected to density and aggregate impact tests. Results were compared to the result obtained by using natural aggregates.

III. METHODS

After doing the researches, two methods will be used. And they are listed below.

1. Method one

For method one the raw materials will be: fly ash (class F), micro silica. The ratio of two materials will be 10:1. The chemicals will be used are Sodium Hydroxide (NaOH), of 16 M and Sodium Silicate (Na2SiO3). The ratio of these chemicals will be in the ratio of 1.414:1.

2. Method two

The materials of second method are fly ash (class F) and Metakaolin. The ratio of fly ash and metakaolin is 7:3. The chemicals are sodium hydroxide (NaOH), of 8 M and potassium hydroxide (KOH)

IV. PLANS

To execute the plan, firstly we need to find the maximum strength between the fly ash and the activator. We will be using compressive strength test. Daily testing will be needed.

The things we need to find are:

- at which molarity of the activator, gives the maximum strength.
- how many days it will take to give the maximum strength
- the behavior of the mixing after reaching the maximum strength.
-

Activated with NaOH, KOH or Ca(OH)2 solutions, and also depends on other parameters such as temperature, pH, composition and the solid-to-liquid(s/L) ratio.

- Micro silica:

  Used material in the cement and concrete to improve the performance because of its pozzolanic reactivity besides the pore-filling effect.

- Aluminum Oxide
- Polypropylene Fiber:

  Helps to increase the tensile strength

VI. EXPECTED OUTCOME

- Better properties than Convention Aggregates
- Environment Friendly
- Easy Availability
- Cost Effective

VII. FUTURE SCOPE

Geopolymer products are innovative & eco-friendly construction products & are alternative to any conventional materials. By the use of geopolymer products we can decrease global warming. Reduces the demand of any conventional materials which is responsible for high carbon dioxide emission. Geopolymer products are made from utilization of waste materials such as fly ash etc.

VIII. RESULT AND DISCUSSIONS

Characterization of fly ash geopolymer aggregates X-ray fluorescence (XRF) X-ray fluorescence (XRF) tests were performed on fly ash powders to determine their elemental composition before proceeding to the manufacture of fly ash geopolymer aggregates. [7]. The chemical composition of the obtained fly ash powder helps determine the class of fly ash powder used in this study. Table 1 shows the chemical composition in % of the fly ash powder used.

From Table 1, fly ash powder from the Manjung power plantin Perak contains 35.7% silicon dioxide (SiO2), 15.4% aluminum oxide (Al2O3), and 19.91% iron trioxide (Fe2O3). increase. SiO2 + Al2O3 + Fe2O3 gives a value of

71.01. This means that this fly ash falls under ASTM C618 Class F fly ash. Additionally, the 20.8% calcium content is classified as a low calcium percentage and this fly ash is also classified as Class F fly ash. Si and Al Applied Mechanics and Materials Vols. , dissolves in alkaline solutions or alkaline activators by the action of hydroxide ions [8]. Therefore, the high concentration of Si and Al in the starting material reacts quickly, and when mixed with the high concentration of sodium hydroxide, the Si and Al dissolve, forming a geopolymer paste with short curing time and high workability.

IX. CONCLUSION

Fly ash geopolymer aggregates can be used as an alternative to natural aggregates in the development of industrial waste-based concrete. Fly ash geopolymer aggregates are comparable to natural aggregates in terms of specific gravity and impact value. This artificial aggregate can be one of the alternative coarse aggregates for concrete. Furthermore, the quick and easy implementation of the geopolymerization process saves overall time and labour costs at the construction site, while preventing the depletionof natural soil sources and allowing the use of industrial waste will be transformed into useful products.

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At the outset of our project, we take this opportunity to express our sincere heartfelt gratitude to our project guide and mentor, Mr. Arpit Vyas who with his guidance and valuable advice helped us in the project. We are also thankful to Dr B. K. Mishra, Principal TCET, Mumbai, Dr Seema Jagtap, Head CED, TCET, Mumbai, for giving a lot of freedom and encouragement and the faculty members of Thakur College of Engineering and Technology, Mumbai, for providing all kind of possible help throughout for the completion of research work.

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Net-Zero Energy Building

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***Abstract* —** *The project designated to us is "Designing a Net-Zero Energy Building." Our team discusses the design concept of being a curator of systems and lifestyles, placing a heavy emphasis on the end-user experience, with the assistance of our mentor. To achieve a thorough design plan, each member has been given a specific task. Tools like Kanban proved to be really beneficial for our team in this entire process, helping us to carry out things properly, track our progress, and efficiently organise task allocation and discussions. To address issues with lightning, ventilation, and satiation as well as preventative fire safety measures, a proposal is being made to construct a building with net-zero energy and net-zero water use. We are researching the viability of implementing various energy-saving technologies, including solar power, piezoelectricity, biomass, etc. We utilised weekly PBL sessions throughout the process to carry out our work efficiently and with a sense of teamwork. We also kept ourselves inspired and hungry to learn more about our project.*

I. INTRODUCTION

Preserving an outstanding legacy of five years. Yog Life Spaces Llp seeks to provide dignified living situations where people would feel a feeling of belonging for the urban fabric. It is a residential structure with a ground-floor business area. The proposed solution must be net-zero energy and net-zero water to address issues with lighting, ventilation, and saitation while taking preventative fire safety measures. Jhulelaal Chowk in Ghatkopar East is where your project is located. Its total square metres are 5469.10. the project's stage It is suggested that construction work has not yet started and is still in the pipeline. Engineering and architecture students who make up the team all share the design approach of being curators of systems and lifestyles with a strong focus on the end user experience. Each team member has been given a specific aim to achieve after teaming with students from diverse sustainable design and engineering professions to create a thorough design strategy.

II. TEAM APPROACH

Engineering and architecture students who make up the team all share the design approach of being curators of systems and lifestyles with a strong focus on the end user experience. Each team member has been given a specific aim to achieve after teaming with students from diverse sustainable design and engineering professions to create a thorough design strategy. The team's participants were students from the colleges listed below.

THAKUR COLLEGE OF ENGINEERING & TECHNOLOGY

Established in AY 2001-02 with a clear objective of providing Quality Technical Education in tune with International standards and contemporary global requirements.

A. THAKUR COLLEGE OF ARCHITECTURE & PLANNING

Established in 2014, TSAP is oriented towards meeting both the local and global requirements of Architecture by providing 'State of Art, Architecture Education' to young budding aspirant architects that will be coherent with the overall sustainable developments of the state and country.

I. OUR AIM

The purpose of this innovative and unique project is to analyse the localities' or, more precisely, the citizens', energy use before looking for creative ways to minimise it. Building must be planned so that the project achieves net zero energy design. To create such an ideological structure, the following ideas must be modified: -

Solar energy: 180 kW of electricity must be produced in order for the project to have net zero energy design. In Mumbai, the average sun irradiation is 5500 W/sqm. Over the course of a year, a 1 kWp solar rooftop plant will produce 5 kW of electricity each day on average (considering 5.5 sunshine hours)

Biomass: Utilizing manure and compost for energy generation and as a source of cooking gas. This will promote waste control and efficient use.

Transparent Concrete: Laying solar panels beneath the surface of the road to produce electricity.

In addition to this approach, piezoelectricity can also be used to achieve the objective. In addition, eco-friendly materials and decorations will be utilised in the construction process, allowing the building to register itself under the category of green structures. Along with this, a unique waste management system will be implemented to create an even cleaner atmosphere inside the building and turn it into a producer of many useful resources for both outsiders and its own occupants.

II. LITERATURE STUDY

In the context of a worldwide response to climate change and sustainable development, the idea of a "net zero energy building (NZEB)" was originally advanced during the 21st United Nations Climate Change Conference (COP21). The history of the "energy-saving building," which was proposed during the oil crisis in the 1970s, is fundamentally different from that of the net zero energy building. As we shift our focus from rising energy use to climate change, the need for net zero energy buildings becomes increasingly pressing and comprehensive. Since then, pertinent ideas have been advanced, such as passive buildings, low-energy buildings, ultra-low-energy buildings, practically zero-energy structures, and so forth. Around the world, projects with high ambitions have been developed to promote continued growth. The "Net Zero Energy Commercial Building Initiative" was given permission by the Energy Independence and Safety Act of 2007 to establish the objective of achieving NZEB for all new commercial buildings in 2030, for 50% of commercial structures in 2040, and for all commercial buildings in 2050. NZEB is the energy consumption goal for all public and government buildings starting in 2018 and for all new construction starting in 2020, according to the European Building Energy Performance Directive (EPBD). The NZEB is now recognised as an essential practical tool to reduce CO2 emissions rather than a futuristic concept. The definition of the NZEB as it is currently presented in China is as follows: "the building can actively adapt to local climate characteristics and natural conditions, and can reduce building heating and cooling demand to the greatest extent so that the building energy consumption is less than the renewable energy supply." It is clear from the aforementioned definitions that NZEB is understood differently in various nations.

III. FEASIBILITY OF NET ZERO ENERGY BUILDING

Most people agree that NZEB is only practical for low-floor, low-density residential constructions. For moderate and high-rise commercial buildings, it is still challenging to balance the energy consumption and the on-site renewable energy production, despite the fact that the energy demand of buildings can be decreased by comprehensive passive and active technology. The goal of this research is to investigate the technological viability of net zero energy commercial buildings using case studies created in climates with hot summers and warm winters. Based on the findings of case studies, the technological approaches of NZEB for high-density and high-volume buildings in China are examined. Solar shading is another crucial measure, in addition to natural ventilation, to lower the need for building cooling in hot summer and warm winter regions.The demonstration project uses a double curtain wall construction and a variety of moveable exterior sunshade forms on the facade to create shading by adapting to the lighting and ventilation requirements inside. The same outcomes are also demonstrated by the monitoring data of another NZEB demonstration project in the same climate zone. Additionally, it is a tall office building. Having a maximum floor area of 23,546 m2. The structure uses energy-saving techniques like solar BIPV generation, LED intelligent lighting, high-efficiency HVAC technology, and high-performance envelope (such as wall and roof insulation, natural lighting, and ventilation).

The project used 738,000 kWh of power overall in 2017, while the 228 kWp photovoltaic system produced 150,000 kWh of electricity, representing 16% of the project's total electricity use for the entire year. The annual energy consumption level was only

33.4 kWh/ after subtracting photovoltaic power generation (m2 a). Results indicate that neither of the two demo projects were successful in reducing building energy consumption to energy production from a "net" or "almost" zero standpoint. With photovoltaic panels covering even the building envelope, the energy requirement has significantly decreased.

IV. TECHNICAL FEASIBILITY OF NET ZERO ENERGY BUILDING

We need to re-evaluate how each structure functions within the context of the entire urban energy system and investigate the technological

NZEB's viability on a larger scale. According to statistical findings, China's air conditioning electricity usage peaked over the summer at 30–40% and is continuing increasing. The capacity, security, transmission, and distribution effectiveness of the power system will all be significantly impacted by the volatility in building power demand. The building typically consumes energy passively, and there isn't much contact between the building and the power system. The supply side of the electricity grid should

be designed to have primarily passive response in order to address any issues that may result from fluctuations in the demand for air conditioning in buildings. These response strategies include anticipating air conditioning demand using historical data and weather predictions, expanding the power grid's reserve capacity during the summer's peak load period, and turning off industrial load to ensure residential power supply. Building energy demand is actually very flexible. The thermal inertia of the building and people's tolerance to temperature variations are potential responses to the active power grid peak shaving even in the absence of energy storage. Virtual energy storage (VES), which was proposed by certain academics, is used to assess a building's capacity to actively control or shift the demand for electricity for a specific amount of time. Although a building's influence and contribution to the power grid are quite limited, under the "high-density and high-volume ratio" urban design, significant environmental benefits can be anticipated by actively regulating the building's power consumption for building clusters. The normal coal consumption per unit power generation at the supply side can be efficiently lowered by 10-15% by implementing demand response with 10% peak shaving, according to research on the demand response mechanism of the power grid. It will have significant economic benefits for the electrical market in addition to outstanding environmental benefits.

The NZEB's energy balance should be determined using primary energy, which is employed in both the energy generation and transmission processes. Technology-wise, improved building "flexible" energy storage, microgrid technology, and flexible access to renewable and distributed energy sources are the key directions for the development of NZEB technology.

CONCLUSION

This paper examines the technical viability of the commercial net zero energy building in the hot summer and warm winter climate zone starting with the concept of NZEB. It is evident from the study of the energy data from the two demonstration projects that NZEB cannot be accomplished in a single commercial structure in this area. It is preferable to accomplish the NZEB at the scale of building clusters rather than a single building when taking into account the link between buildings and the urban energy infrastructure. The NZEB will become viable and significant in the high-density, high-volume metropolitan area as a result, and this will also present an opportunity for the building industry to utilise information technology going forward.

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Rainwater Harvesting

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Abstract*—At the rate which India populace is expanding, it is said that India will definitely supplant China from its number 1 position of most thickly populated nation of the world after 20-30. There will prompt high rate of Utilization of most profitable regular asset; water's subsequent in enlargement of weights on the allowed freshwater assets. Rain water reaping is outstanding amongst other techniques satisfying those necessities. The specialized parts of this paper are water gathering from housetop which is thought to be catchment territories from all lodgings and institutes Departmental working at Thakur college of engineering and technology Kandivali east Mumbai. As a matter of first importance, required information are gathered i.e. catchment zones and hydrological precipitation information.

Keywords*—Rainwater harvesting, catchment, Rainwater, Population.

I.INTRODUCTION

Rain is a definitive wellspring of new water. With the ground zone around houses and structures being solidified, especially in urban communities and towns, water, which keeps running off from patios and rooftops, was depleting into low-lying territories and not permeating into the dirt. Consequently, valuable water is wasted, as it is depleted into the Ocean in the end. Consequently, valuable water is wasted, as it is depleted into the ocean in the end. Rain water gathering is a framework by which, the water that gathers on the rooftops and the region around the structures is coordinated into open wells through a channel tank or into a permeation load, constructed particularly for this reason. Water is gathered straightforwardly or revived into the ground to enhance ground water stockpiling. Water that isn't removed from ground amid blustery days is the water spared.

II.WATER SCENERIO

About 75% of total demand of water in Nashik is supplied by DWASA, and the rest comes from privately owned tube wells. At present DWASA can yields about 2092.69 million liters (ML) [1] per day in which about 1840.04 MLD is collected from 586 deep tube wells (DTW), and the remaining 252.65 MLD is supplied by two surface water treatment plants [1]. Godawari Krishna and Tapti are the main four water bodies surrounding the city and could be an ideal sources of water supply [19, 20]. But these water bodies already lost their potentiality as sources of supply due to the huge pollutions Untreated municipal and industrial wastes make the river water so contaminated that most of the water quality parameters surpassed their allowable level. However, he water supply authority mainly relies on groundwater sources and needs to install more tube wells to fulfill demand [21, 22]. Installation of more tube wells must lower the groundwater level.

III.WATER SUPPLY AND DEMAND

In order to understand the variation between demand and supply, the total demand needs to be known. That could be calculated through population data and per capita demand. According to Bro [23], per capita demand for 2006 was about 200 liters, including 10% provisions for commercial use and 40% due to system loss during supply. As per capita demand will be assumed to be decreased in the future by proper inspection and management, for 2015 the total per capita demand will stand at 180 liters per day and for 2025 and 2030 at 160 liters per day. According to DWASA, 2011 [24], the water supply is about 1356.67 MLD (considering service flow with 40% leakages), and the total demand is 2200 MLD (assuming 85% service area). So the deficit is about 843.33 MLD. As demand is more than just supplied water, deficit prevails, which is increasing every day.

IV.RAINWATER HARVESTING

Rainwater harvesting is a Multipurpose way of supplying usable water to consumers during a crisis period, recharging the groundwater and finally reducing the runoff and water logging during the season of heavy rainfall. Traditional knowledge, skills, and materials can be used for this system. During the rainy season, an individual can collect Water on his rooftop and manage it on his own. Reserved rainwater on rooftops can be used for self-purposes or domestic use. Water from different rooftops of a lane can also be collected through a piped network and stored for some time. This water can be then channeled to deep wells to recharge groundwater directly, to ponds to replenish groundwater slowly, and to reservoirs to dilute reclaimed water for no potable use. Unless it comes into contact with a surface or collection system, the quality of rainwater meets Environmental Protection Agency

standards [27], and the independent characteristic of its harvesting system has made it suitable for scattered settlement and individual operation. If needed, a chemical treatment such as chlorination can be used to purify the water. The acceptanceof rainwater harvesting will expand rapidly if methods are treated such as building services and if designed into the structure instead of being retrofitted.

V. History of rainwater harvesting

Water collecting and use frameworks have been utilized since antiquated circumstances and confirmation of rooftop catchment frameworks go back to early Roman circumstances. Roman estates and even entire urban communities were intended to exploit water as the chief water hotspot for drinking and residential purposes since no less than 2000 B.C. In the Negev leave in Israel, tanks for putting away overflow from slopes for both local and farming purposes have permitted home and development in zones with as meager as 100mm of rain for each year. The most punctual known proof of the utilization of the innovation in Africa originates from northern Egypt, where tanks running from 200-2000m3 have been utilized for no less than 2000 years – numerous are as yet operational today. The innovation likewise has a long history in Asia, where water gathering hones have been followed back right around 2000 years in Thailand. The little scale gathering of water from the overhang of rooftops or by means of straightforward drains into conventional jugs and pots has been polished in Africa and Asia for a huge number of yars. In numerous remote provincial regions, this is as yet the technique utilized today. The world's biggest water tank is most likely the Yerebatan Sarayi in Istanbul, Turkey. This was built amid the lead of Caesar Justinian (A.D. 527-565). It quantifies 140m by 70m and has a limit of 80,000 cubic meters

VI. Benefits of rainwater harvesting

Rainwater harvesting is a simple and primary technique of collecting water from natural rainfall. At the time of a water crisis, it would be the most easily adaptable method of mitigating water scarcity. The system is applicable for both critical and normal situations. It is an environmentally friendly technique that includes efficient collection and storage that greatly helps local people. The associated advantages of rainwater harvesting are that:

- It can curtail the burden on the public water supply, which is the main source of city water;
- It can be used in case of an emergency (i.e., Fire);
- It is solely cost effective as installation cost is low, and it can reduce expense that one has to pay for water bills; (iv) it extends soil moisture levels for development of vegetation;
- Groundwater level is highly recharged during rainfall

VII. Need for rainwater harvesting

Most of the rain falling on the surface tends to flow away rapidly,leaving very little for the recharge of groundwater . As a result, most parts of India experience lack of water even for domestic uses.

Hence, the need for implementation of measures to ensure that rain falling over a region is tapped as fully as possible through rainwater harvesting, either by recharging it into the groundwater aquifers or storing it for direct use.

VIII. Advantages of rainwater HARVESTING

- Augments groundwater table.
- Reduces runoff which chokes drains and avoid flooding of roads.
- Provides self-sufficiency to water supply and to supplement
- Domestic water requirement during summer and drought conditions.
- It reduces the rate of power consumption for pumping of groundwater. For every 1 m rise in water level, there is a saving of 0.4 KWH of electricity.
- In desert, where rainfall is low, rainwater harvesting has been providing relief to people.

IX. Disadvantages of rainwater harvesting

- Supplies can be contaminated by bird/animal droppings on catchment surfaces and guttering structures unless they are cleaned/flushed before use.
- Poorly constructed water jars/containers can suffer from algal growth and invasion by insects, lizards and rodents. They can act as a breeding ground for disease vectors if they are not properly maintained.

X. Ways of rainwater harvesting

- SURFACE RUNOFF HARVESTING: It is a method in which rainwater flowing as surface runoff is caught and used for recharging aquifers by adopting appropriate methods.
- ROOF TOP RAINWATER HARVESTING (RTRWH): In rooftop harvesting, the roof becomes the catchment, and the rainwater is collected from the roof of the house/building. It can either be stored in a tank or diverted to artificial recharge system.

XI. Techniques of rainwater harvesting

- Storage of rainwater on surface for future use: The storage of rain water on surface is a traditional techniques and structures used were underground tanks, ponds, check dams, weirs etc.
- Recharge to ground water: the collected rainwater is transferred to the ground through suitable means for recharging the depleting aquifers.

XII. STRUCTURES GENERALLY USED

a) ***Pits:-*** Recharge pits are constructed for recharging the shallow aquifer. These are constructed 1 to 2 m, wide and to 3 m. deep which are back filled with boulders, gravels, coarse sand.

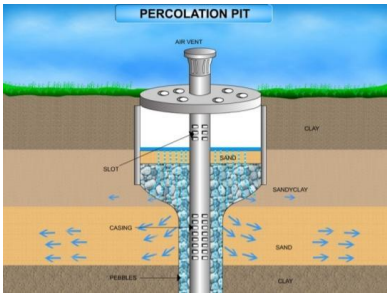


Fig. 1: pits

b) ***Trenches:-*** These are constructed when the permeable strata is available at shallow depth. Trench may be 0.5 to 1 m. wide, 1 to 1.5m deep and 10 to 20 m. long depending up availability of water. These are back filled with filter materials.

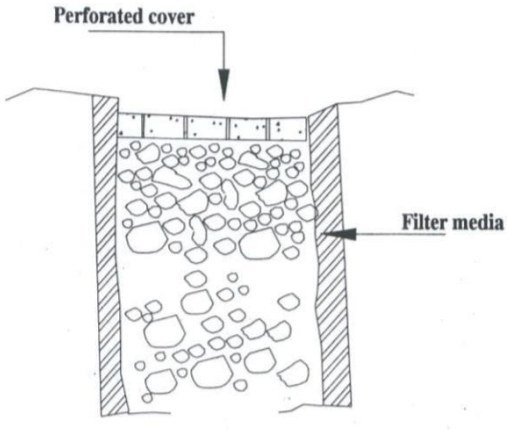


Fig.2: Trenches

c) ***Dug wells:-*** Existing dug wells may be utilized as recharge structure and water should pass through filter media before putting into dug well.

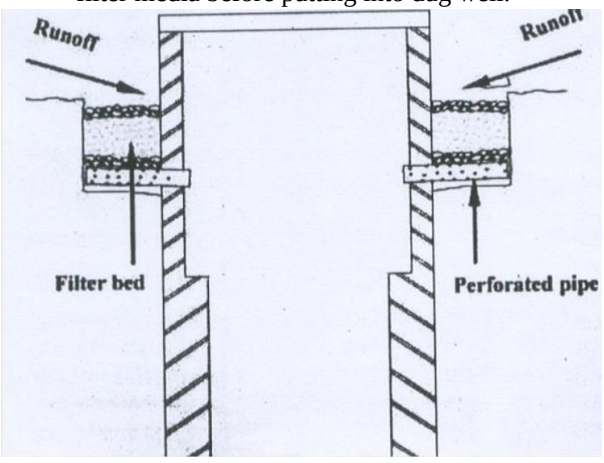


Fig. 3: Dug wells

d) *Hand pumps: - The existing hand pumps may be used for recharging the shallow/deep aquifers, if the availability of water is limited. Water should pass through filter media before diverting it into hand pumps.*

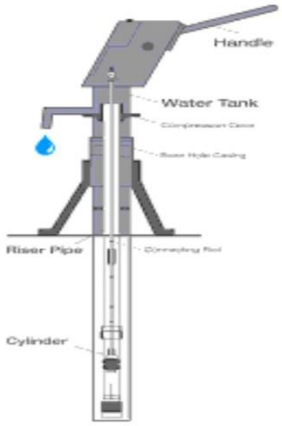


Fig. 4: Hand pump

XIII. BASIC COMPONENTS OF RAINWATER HARVESTING

- Catchment area/roof.
- Gutters and downspouts.
- Leaf screens and roof washers.
- Storage tanks
- Delivery pipelines.
- Filters
- Conveying

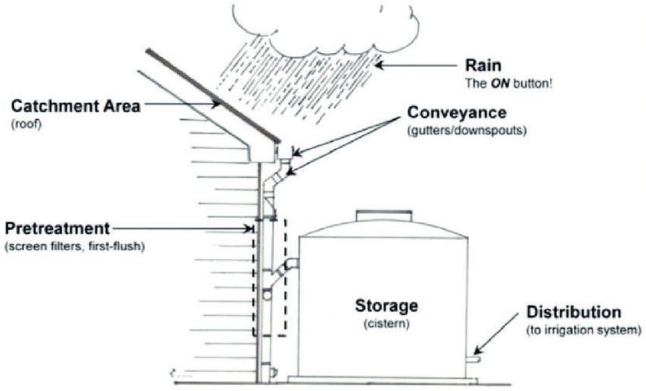


Fig. 5: Basic components of rainwater harvesting

XIV. LITERATURE REVIEW

RWH system is a method that can be used to prevent flooding and reduce the use of groundwater. The system has been widely applied in several countries in the world. Many studies were conducted related to the implementation and development of RWH systems in commercial buildings and households in urban areas (Appan et al., 1997, Terry Thomas, 1998, Marcel Marcelo et al. 2011, B. alawneh et al 2011, A. Jabelamar and G. Ravikumar, 2011, Enedir Ghisi et al., 2012 Aftab Bin Tallal et al. 2012, Otti VI et al 2013). Research on hydrological analysis model to calculate the RWH system also

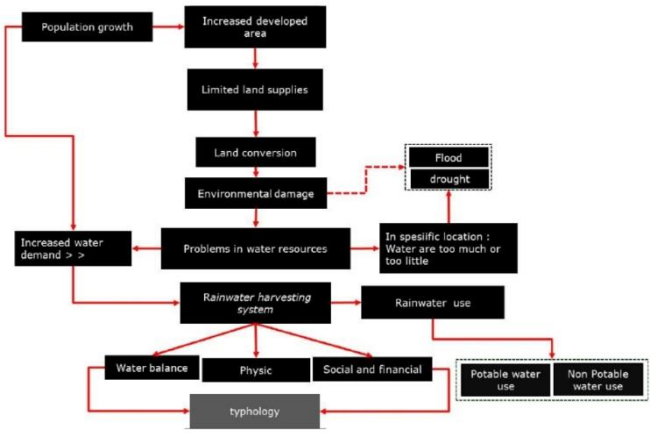
performed well for many computer programs and formulations (Fewkes and Butler, 1999, RM Roebuck and Ashley 2006, S. Ward et al., 2008, A. Gerolin et al., 2010, Monzur Alam Imteaz et al. 2011, TD Fletcher et al. 2012.

There are several obstacles that must be faced in RWH application. The frequency and rain water potential sometimes does not meet the required minimum amount of water needs. Rain water quality also has not met the prevailing standard of clean water. Rain water can be contaminated by impurities that exist in the catchment area. In addition, insects can also breed in stagnant water. This requires several treatments to maintain the quality of rain water in order to meet clean water standards before use. One way is to create a filter on a scale wastewater treatment plant or a house on a residential scale. There are some issues emerged RWH system. The slow progress in implementation and widely use of RWH caused by the uncertainties of economic benefits, the lack of experience and the lack of evidences that such a system can be implemented. Although in some countries have issued regulations or guidelines on the implementation of RWH systems, but the developers and development practitioners are still who manage water more interested in programs that are general rather than domestic. Calculation of the economic feasibility of RWH systems needed at the system design stage. In addition to the economic aspects, social aspects of the users also need to be evaluated so that the application of the system in accordance with the needs of the user. An socio-economic feasibility study of the RWH systems have been carried out and has been applied to several sectors of water resources. The approach includes the cost benefit analysis, cost effectiveness, net present value, internal rate of return, payback period and life cycle cost analysis.

Previous studies focused more on RWH system reliability whether hydrologic and economic for certain conditions. In those studies, few studies look at a RWH system that integrated with the region. An application of large-scale rainwater harvesting is considered as an adaptive strategy in the face of climate change-related water shortages.

In addition, previous studies have not been focus on standard model of RWH implementation for certain social conditions of the region and especially to areas in Indonesia. Therefore, for purposes planning in the future, it is need to made a typological model of RWH implementation for domestic purposes in urban areas in accordance with the socio-economic conditions of the region and its inhabitants. The development of the model based on water and soil conservation, rain water harvesting, and a good drainage system planning in a residential area. From the studies, a standardization for the application of RWH can be made.

Typology model of RWH implementation



models could be distinguished by the condition of hydrology and topography of the residential area or the social and economic condition of the occupants or users of RWH systems.

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Traffic Analysis and Modelling of Urban Expressway

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***Abstract*— We propose a software system, which will be able to mitigate traffic congestion by diverting the light vehicular traffic to street roads from the expressways. Here its main function is to reroute the travel route ofthe users based on a model developed upon past traffic flow behavior pattern, peak hourly time, and volume as its input. This permits continuous flow in the heterogenous traffic, utilizing the existing infrastructure at its fullest, without constructing huge new infrastructure. Here, we present recent research on this problem statement with discussing its effectiveness in thedeployed locations**.

*I.*INTRODUCTION

Urban Expressway is a staple for high mobility by providing a through movement of vehicles from one destination to another, with the least emphasis on accessibility. But with the cyclic nature of transportation infrastructure, the connecting routes have become popular which has led to increased demand for the expressway facility which it couldn't keep up leading to increased congestion and delay in travel time.

For a little perspective on the supply and demand status of road usage in India, India's road networks have grown by about 30% in the tenure of 10 years, also at the same time vehicle registrations have risen by almost three times. Mumbai a metropolitan city, shares second place withBogota and Manila, with all-seeing congestion levels of 53% -- By TomTom Index 2022. This diminishes the whole purpose of the expressway.

Now, this is where traffic analysis and modeling of urban expressway comes into the picture. The analysis helps with modeling the traffic behavior of the road segment and whichin turn helps in predicting the site's possible trafficcongestion and helps to analyze the best solution for solving the congestion problem. Many papers have been published on this topic, its detailed summary is mentioned in the literature review.

II.PROBLEM STATEMENT

The current situation of Indian road network focuses heavilyon new infrastructure design but with increasing road users and decreasing available land for construction this solutionis not feasible and will become more uneconomical andsustainable.

The goal of this study is to gather data on current congestionproblems in terms of traffic parameters by which the traffic pattern of the expressway can be modelled to predict the traffic.

Analysis & modelling of traffic behavior by conducting traffic volume studies. Using the data. To predict congestion & quantifying traffic Volume and peak sub-hourly time.With its help diverting 2-wheeler traffic to street roads from main lanes/major districts roads. To decrease congestion and increase flow.

III.OBJECTIVES

The objective of the study is the determine the current traffic parameters at highly congested zones of urban expressway and use a sustainable approach to improve transportation network. This research is focused on identifying important parameters which could define the traffic characteristics of asection and use these as input data to predict real-time trafficparameters effectively and accurately. All with the goal of reducing congestion at site which will ultimately result in reduced environmental harm and users discomfort implying lower accidents.

Main objectives could be highlighted as:

1. To determine vehicle composition in traffic stream
2. To predict traffic parameters and possibility of congestion using mathematical modelling approach
3. To determine main factors affecting congestion

IV.LITERATURE REVIEW

The author discusses the use of a similar software VANET which provides vehicle to vehicle communication through routing protocols. GPSR and A-STAR are the most

efficient routing algorithms to forward packet in a best manner, but still faces a lot of problems like delivery rateand delays. In this we will be discussing Vector based geographic routing protocol, Connectivity oriented, routing protocol, Beamforming technique, and the use of Greedycurvemetric based routing algorithm and Intersection based algorithm.

[4] (Leung, K. K.) proposed the concept of node connectivity in vehicular ad-hoc networks. He pays attentionon studying transport system with planned mobility. He provides a logical framework including the design requirements of the mobility model for the vehicular networks. In this research paper the author has used VANET software for traffic-management.

[7] [Zeyang Cheng] The paper deals with the classification of road vehicles using machine learning algorithm. FCM clustering method, has been in use for this purpose. The paper proposes ample degree of road network method whichwill make up a comprehensive classification indicator system with other parameters such as traffic flow, speed and occupancy. Over testing, the results show the ample degree takes less time to reach objective function which is in comparison has reduced by 31.11%, and cluster center error also show a descending trend

[6] The paper discusses the proposed solution on the topic, (STMS) Smart Traffic management system is at its the core module and it has the sub-modules such as video control system, Traffic Control System, Supervisory computer control system and peripheral devices. The Traffic Control System manages and guides heavy traffic during pre-hour. With the help of video monitoring system, it identify excess traffic through video camera and when the amount of vehicles in particular path increases a pre-calculated limit, it informs the traffic control in charge of STMS alerts “traffic limit reached” and prevents any further vehicle to enter in that path.

[1] Here the ML algorithm predictions possible alternative routes, by calculating the percentage increase in travel time after 90 min of an accident taking place, which would be useful for diverting the traffic after the incident takes placein the main route. The data suggested are of high quality, which may be able to solve the missing data. But has to be applied in a real scenario for the feasibility of the idea and the available data processing required.

This can be utilized in the scope of keeping the traffic minimum in the urban expressway.

[2] The paper utilizes the OWENN model for the forecasting of traffic, and this data is then fed into traffic control systems for taking action. The accuracy rate of the prediction model compared to older models is high up to 98.23%

Which when fed into the OWENN gives the area with the highest congestion.

[3] Genetic algorithm is used for finding an optimum O-D path. The main characteristic of the Genetic algorithm is it finds the best solution from a given no of solutions/populations by using a matching technique.

The accuracy of forecasting models is not discussed in every possible situation of traffic flow. The Prediction paper mentions the inability of the model to correct estimation in the transient conditions of traffic and even on applying sometechniques, the accuracy is shifted.

In [3] it is addressed that Short-term prediction models are most viable/ tested for free-flow traffic conditions. C. N. Bowman and J. A. Miller, “Modeling traffic flow usingsimulation and big data analytics,” this paper address the issue according to [3] by integrating different ML methods for accuracy in abnormal situations.

By [7] US model is optimum while SO systems are efficient but can’t be considered until all systems are automated rather than depending on automated vehicles making the way, such that it decreases no. of variables. Dueto the large amount of noise in traffic data (Yu et al. 2021), the transportation system must be considered a nonlinear and nonstationary system, which poses substantial challenges to the linear assumption models.

(Yu, Y., et al. "A low-rank dynamic mode decomposition model for short-term traffic flow prediction.")

Many papers so far haven’t taken into consideration the spatial data of the adjoining routes/segments while reroutingand the effect of load distribution in the entire network.

[5] discusses the introduction of HDVs affects the lane- changing behavior of other vehicles, hence traffic characteristics and parameters are taken into consideration while calculating prediction data may vary.

V. PROPOSED SOLUTION

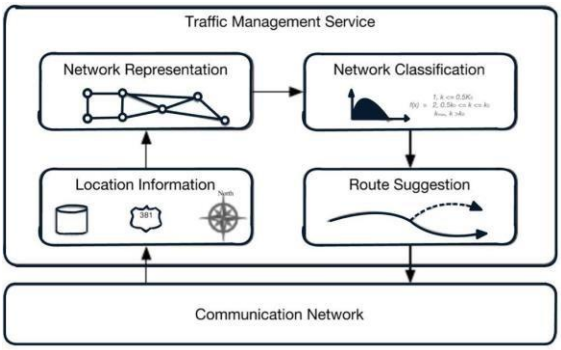

Figure- 1 Data cycle

The road network data is in the form of traffic parameters viz. peak hourly volume, peak sub hourly traffic, road user behavior pattern, congestion characteristics. These parameters helps to devise a model, which is suitable and correct representative of the present going traffic condition.

Next stage in the process is classification of heavy and light vehicles using machine learning algorithm and segregating at an intensity depending on the amount of congestion predicted in the upcoming hour.

Rerouting of the upcoming traffic takes place, by segmenting the traffic into street roads by taking modeling output data to analyze future congestion and its intensity, which will indicate how much segregation must be performed.The researches we have encountered use internet as its communication link, which has an major disadvantage

of service lost, low transmission on traffic heavy zones due to limited network service in practice.

We propose the incorporating the idea with existing infrastructure design, which will accommodate modifying the traffic signs to indicate rerouting data.

VI. METHODLOGY

Research papers are gathered based on relevance to the project, to identify previous work done in the field. Qualitative data is preferred over quantitative to evaluate thefinding, of the alternate possible proposed solutions.

A. Collection of data

- Magneto-meters/Passive magnetic systems
- Weigh-In-Motion (WIM) systems
- Video image detection (VID)
- Infrared Sensors
- Microwave - Doppler and Radar
- Pulsed and Active Ultrasonic

B. Testing

- VISSIM for traffic simulation – For validating thefindings

VII. CONCLUSION

Over the past decade of huge infrastructure projects there hasnot been a decrease in congestion over the years. To counter the disadvantage of total new construction approach, wepropose an software system which would reduce the congestion and would incorporate in already used infrastructure. It starts from collecting data of the section to make an mathematical model and acting as an input parameter for segmentation of traffic. Development of this kind can help understand the behavior of traffic and congestion practically using easily accessible inputs, limitedto nodes only, and help in improving the road network planning and management.

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Impact of Climate on Water Resources

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Abstract-Water resources planning and management in the 21st century is becoming an increasingly difficult task due to the increasing population, rapid urbanization, projected climate change and consequent changes expected in the hydrologic cycle, the increasing incidence of natural disasters. Among these, the impacts of global warming and consequent projected climate change due to the increasing concentrations of Greenhouse Gases in the atmosphere on water resources have emerged as a matter of great concern to water resource managers and government authorities. Human activities and changes in land cover and use are believed to be the primary cause of increase in the atmospheric concentrations of GHGs. This alteration of the energy balance and tends to warm the atmosphere resulting in climate change. Studies in recent years have shown important regional water resourcesvulnerabilities to changes in both temperature and precipitation patterns. It is primarily at the local and regionalscales that policies could be evolved and technical measures could be taken to avoid or reduce the negative impacts of climatic change on the natural environment and society.Understanding the possible impacts of climate change on water resources is of utmost importance for ensuring itsappropriate management and utilization. We will see how climate changes affects varies water resources in different Zones of India.

I.INTRODUCTION

The greenhouse effect is a natural mechanism essential to lifeon earth, but human activity has altered the balance in this mechanism. Radiant energy emitted by the sun comes through the earth's atmosphere and warms its surface. This heat then radiates back into the atmosphere, but some of the sun's heat is absorbed in the atmosphere by gases. With increasing concentration of GHGs in the atmosphere, this effect is amplified, thereby increasing the earth's temperature. These activities include, in particular, the burning of fossil fuels and deforestation both of which cause emissions of carbon dioxide (CO2), the main gas responsiblefor climate change, as well as other GHGs, such as methane (CH4) and nitrous oxide (N2O). As much as 25% of all global GHG emissions can be attributed to land use changes, among which tropical deforestation is the most prominent. Even if emissions stop today, the impacts of what has already occurred will continue for many decades. Water is a very vital natural resource on which the survival of all living species is the main gas responsiblefor climate change, as well as other GHGs, such as methane (CH4) and nitrous oxide (N2O). As much as 25% of all global GHG emissions can be attributed to land use changes, among which tropical deforestation is the most prominent. Even if emissions stop today, the impacts of what has already occurred will continue for many decades. Water is a very vital natural resource on which the survival of all living species is dependent. Since it is not spatially distributed in a way as to be able to meet the requirements of the population at a local level, proper management of water resources becomes extremely important so as to enable meeting the current and future demands as well as to ensure sustainability. Climate change is recognized as one of the most serious challenges facing the world today and is expected to impact hydrological processes such as precipitation, and evapotranspiration. This,in turn, may have direct impact on stream flow and groundwater recharge. Likely impacts of projected climate change on water resources, consequent to global warming due to increasing concentrations of greenhouse gases in the atmosphere, has emerged as a matter of grave concern to decision makers all over the globe.

II. CLIMATE CHANGE

Climate change is a change in the usual weather found in a place. This could be a change in how much rain a place usually gets in a year. Or it could be a change in a place's usual temperature for a month or season. Climate change is also a change in Earth's climate. This could be a change in Earth's usual temperature. Or it could be a change in where rain and snow usually fall on Earth. Weather can change in just a few hours. Climate takes hundreds or even millions of years to change. The rapid climate change we are now seeing is caused by humans using oil, gas and coal for their homes, factories and transport. When these fossil fuels burn, they release greenhouse gases - mostly carbon dioxide (CO2). These gases trap the Sun's heat and cause the planet's temperature to rise. Earth's climate is always changing. There have been times when Earth's climate has been warmer than it is now. There have been times when it has been cooler These times can last thousands or millions of years People who study Earth see that Earth's climate is

getting warmer. Earth's temperature has gone up about one degree Fahrenheitin the last 100 years. This may not seem like much. But smallchanges in Earth's temperature can have big effects. Some effects are already happening. Warming of Earth's climate has caused some snow and ice to melt. The warming also hascaused oceans to rise. And it has changed the timing of whencertain plants grow.

III.ZONES OF INDIA AND THEIR MAIN WATER SOURCES

India is divided into many zones namely North, South, East, West Zones. Each area has its own water source origin. NorthZone can be considered special case with a lot of types of areas like J&K and Himachal Pradesh depend on snowfall, spring water and Ice which are few of the origins of water resource for that state. Punjab &Uttar Pradesh are dependent on Rainfall and Rivers from Himalayas, and there is dry stateof India Rajasthan too in north Zone which has very less water and depends on other states, reservoirs and groundwater. East Zone has the most rainfall in India so its one of the top water sources is rainfall which is harvested foremergency use too. West Zone has Maharashtra, Madhya Pradesh, Gujarat and other states which is like a balanced zone which depends on rainfall, groundwater, rivers. Dams are built on rivers for use in dry season of summer. South states are also similar to west zone. India is covered from 3 sides which helps the country get water by rainfall.

IV.CAUSES OF CLIMATE CHANGE

Generating electricity and heat by burning fossil fuels causes a large chunk of global emissions. Most electricity is stillgenerated by burning coal, oil, or gas, which produces carbondioxide and nitrous oxide that emit powerful greenhousegases that blanket the Earth and trap the sun's heat. Manufacturing and industry produce emissions, mostly from burning fossil fuels to produce energy for making things likecement, iron, steel, electronics, plastics, clothes, and othergoods. Mining and other industrial processes also releasegases, as does the construction industry. The manufacturingindustry is one of the largest contributors to greenhouse gas emissions worldwide. Since forests absorb carbon dioxide,destroying them also limits nature's ability to keep emissionsout of the atmosphere. Deforestation, together with agriculture and other land use changes, is responsible forroughly a quarter of global greenhouse gas emissions. Most cars, trucks, ships, and planes run on fossil fuels. That makestransportation a major contributor of greenhouse gases,especially carbon-dioxide emissions. But emissions fromships and planes continue to grow. Transport accounts for nearly one quarter of global energy-related carbon-dioxideemissions. Producing food causes emissions of carbondioxide, methane, and other greenhouse gases in various ways, including through deforestation and clearing of land for agriculture and grazing, digestion by cows and sheep, theproduction and use of fertilizers and manure for growingcrops.

V.EFFECTS

As greenhouse gas concentrations rise, so does the global surface temperature. The last decade, 2011-2020, is the warmest on record. Since the 1980s, each decade has been warmer than theprevious one. Wildfires start more easily and spread more rapidly when conditions are hotter. Temperatures in the Arctic have warmed at least twice as fast as the global average. Destructivestorms have become more intense and more frequent in many regions. The frequency and extent of tropical storms is also affected by the warming ocean. Cyclones, hurricanes, and typhoons feed on warm waters at the ocean surface. Such stormsoften destroy homes and communities, causing deaths and huge economic losses. Global warming exacerbates water shortages inalready water-stressed regions and is leading to an increased risk of agricultural droughts affecting crops, and ecological droughts increasing the vulnerability of ecosystems. Droughts can also stirdestructive sand and dust storms that can move billions of tons of sand across continents. The ocean soaks up most of the heat fromglobal warming. The rate at which the ocean is warming stronglyincreased over the past two decades, across all depths of the ocean. As the ocean warms, its volume increases since waterexpands as it gets warmer. Melting ice sheets also cause sea levelsto rise, threatening coastal and island communities. In addition,the ocean absorbs carbon dioxide, keeping it from the atmosphere. But more carbon dioxide makes the ocean moreacidic, which endangers marine life and coral reefs.

VI. MEASURES TO REDUCE IMPACT OF CLIMATE CHANGE

Cutting emissions starts with clear policy signals. Carbon pricing systems – such as emissions trading systems that capemissions or carbon taxes that charge per ton – send a long- term signal to companies by creating an incentive to reduce polluting behaviors and to invest in cleaner energy choices and low-carbon innovation. Close to 40 countries and more than 20 cities, states and provinces now have or are preparingto implement carbon pricing through emissions trading systems or carbon taxes, and their numbers are growing. Korea launched the newest carbon market in January. China,with seven pilot carbon markets in cities and provinces, saw its emissions drop last year and plans to launch a national emissions trading system as early as 2016. Fossil fuel subsidies send a different signal, one that can encourage waste and discourage low-carbon growth. By phasing out harmful fossil fuel subsidies, countries can reallocate their spending to where it is most needed and most effective, including proving targeted support for the poor. Nearly $550 billion went into direct fossil fuel subsidies worldwide in 2013, taking up large percentages of some countries' GDP toartificially lower energy prices. With careful planning of transportation and land use, and the establishment of energy efficiency standards, cities can build in ways that avoidlocking in unsustainable patterns.

They can open up access tojobs and opportunity for the poor and reduce damaging air pollution. Financing that growth to be sustainable can be a challenge, though. Data show that only about 4 percent of the 500 largest developing countries cities are deemed creditworthy in international markets. Energy efficiency improvements are crucial. Every gigawatt saved is a gigawattthat didn't have to be produced. Globally, energy use is about one-third lower today than it would have been without the past 20 years of energy efficiency improvements. Renewable energy, meanwhile, is becoming increasingly affordable as prices fall. In many countries, developing utility-scale renewable energy is now cheaper than or on par with fossil fuel plants.

CONCLUSION

Climate change is expected to exacerbate current stresses on water resources resulting from population growth, economicfactors and land use changes, including urbanization. On a regional scale, mountain snow packs, glaciers and small ice caps play a crucial role in freshwater availability. Widespread mass losses from glaciers and reduction in snow cover, reported in recent times, are projected to accelerate throughout the 21st century, reducing water availability, hydropower potential, and changing seasonality of flows in regions supplied by melt water from major mountain ranges,where more than one-sixth of the world population currently lives. Runoff is projected with high confidence to increase by10 to 40% There is also high confidence in the projection thatmany semi-arid areas will suffer a reduction in water resources due to climate change. Drought-affected areas are projected to increase in extent, with the potential for adverseimpacts on multiple sectors, including agriculture, water supply, energy production and health. Regionally, large increase in irrigation water demand is projected as a result of climate change. This rise in surface air temperatures is expected to significantly affect terrestrial hydrology, an integral part of climate system. One of the most severeconsequences of climate change will be the alteration of the hydrological cycle, and this in turn, will affect the quantity and quality of regional water resources. Since hydrologic conditions vary from region to region, the influence of climatic change on local hydrological processes will likely differ between localities, even under the same climatic scenarios. Studies in recent years have shown importantregional water resources vulnerabilities to changes in bothtemperature and precipitation patterns. It is primarily at the local and regional scales that policies could be evolved and technical measures could be taken to avoid or reduce the negative impacts of climatic change on the natural environment and society. Understanding the possible impactsof climate change on water resources is of utmost importance for ensuring its appropriate management and utilization

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Use of Bio-enzyme in Concrete

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***Abstract* – Local Materials which are left unused & which just encompasses the landfill is a cause of concern to think about. Theimportant point of view to think about such local waste is to get itin use again in Construction sector. By taking a step towards thisProceedings can help change a lot. Every material delivers something special in the creative process. Employing local materials has an advantage of reducing the major environmental consequences of long-distance transport of materials.**

Keywords- Local waste, long-distance transport, sustainable, Contaminating, habitats, cost effective, eco-friendly etc

I.INTRODUCTION

The construction industry is looking for ways to mitigate its environmental impact now that governments and businesses are giving more importance to sustainability. Construction waste causes significant damage, since it accounts for about one-third of all refuse nationwide. Recycling construction materials can significantly reduce the environmental impact of the industry. Traditionally, construction and demolition waste has been disposed of in landfills. However, this has a negative environmental impact, contaminating underground water and surrounding habitats. Construction companies and developers are learning that recycling is beneficial for the entire industry Rising industrialization generates greater demand of materials for various construction activities wherein, exploiting the non-renewable (virgin) materials poses a great risk of depleting theavailable natural resources. Use of sustainable materials such as concrete with fly ash as a substitute of cement, fly ash bricks,recycled glass, ceramic tiles, steel, gypsum ceiling are preferred eco-friendly options. Majority of materials specified in the construction are preferred from local sources thus reducing theenergy incurred in mining of raw materials and transportation.

The major Problem Statement identified during research study:

1. Manufacturing of Construction material create pollution on large scale.

2. Processing of procured material increases the emissionof sulphur dioxide, and nitrogen oxide which result in acid rain.

3. Overtime, excessive use of non-recyclable material leads to ecological degradation.

4. Reduction in construction site due to increase in landfill sites with the advancement of technologies and rapid improvement in building materials to keep up with the pace of urbanisation, the construction methods and technologies has been facing challenges due to unsustainable aspects of some building materials. this has put stress on the environment and has also increased consumption of energy and other degradableresources. On the hindsight, this has also created opportunities for innovative and unconventional resources to emerge by reinventing the traditional building materials and using it in anintelligent way

OBJECTIVE OF STUDY

- To prevent the pollution which is created from manufacturing of construction material
- To reduce the emission of sulphur dioxide and nitrogen oxide which results in acid rain occurred dueto processing of proqured material
- To avoid reduction of land due to increase in landfill sites
- To minimize ecological degradation

II. BENEFITS EXPECTED

Energy Savings: Recycling saves large amounts of energy, and in general it decreases the consumption of natural resources toproduce new materials. For example, if all the concrete and asphalt waste generated annually in the US were recycled, it would save the energy equivalent of 1 billion gallons of gasoline.

Landfill waste reduction: Landfills are filling up, which means that alternative ways to manage waste must be developed. Recycled construction waste can be reused as it is,or turned into something new.

- Recycling eliminates the need to send waste to landfill sites.

-
- Processing hazardous waste properly minimizes toxic build-up in the environment.

III. LITERATURE REVIEW

Banana peel fiber (BPF) and orange peel fiber (OPF) are common agro-wastes with a long history of use in concrete as an additive or a cement substitute. Based on recent findings, the characteristics, fresh and hardened state structural performance of BPF and OPF as composite materials in sustainable concrete manufacturing are reviewed in this study. For quality concrete reinforcing, it was discovered that OPF and BPF have good surface areas and low specific gravity. For quality concrete reinforcing, it was discovered that OPF and BPF have good surface areas and low specific gravity. BPF and OPF, on the other hand, have significant pozzolonic binding properties of up to 97.3%. This allows them to act as binders and supplement the high strength yielding in concrete. Furthermore, using BPF in concrete enhanced workability, consistency, compressive and tensile strengths, and setting times by 21.1%, 48.64%, 46%, 52.5%, and 47.37%, respectively, whereas the use of OPF raised concrete density by 5.34%. This indicated that both BPFand OPF had much potential for producing high-quality concrete. [8

Bio-enzymes can be produced by fermenting vegetable and fruit peels along with jaggery and water in the ratio 1(Jaggery): 3(peel waste): 10(water) in an airtight plastic container. In whichjaggery acts as a carbon source or energy for the micro-organisms to grow. The enzymatic and antimicrobial efficacy ofbio-enzyme acquired from vegetable and fruit peel wastes of Carica, papaya (Papaya), Ananas comosus (Pineapple), Lagenaria siceraria (Bottle gourd) and Luffa acutangular (Ridge gourd) were analyzed. Analysis on enzymatic activity for Amylaseby Starch Hydrolysis, Cellulose by Carboxymethylcellulose (CMC) Hydrolysis, Protease by Gelatin and Lipase by Tween 20 were performed. Antimicrobial activityfor the bio-enzyme was analyzed with Escherichia coli by incorporating well diffusion method and a good antimicrobialpotential was exhibited by the crude extracts of Pineapple andRidge gourd. This method is a concept of zero- waste economyin which bio-enzymes and biomass are produced. [9

To make concrete with high compressive strength and has acertain concrete specification other than the main concrete materials are also needed concrete mix quality control and otheradded material is also in line with the current technology ofconcrete mix that produces concrete with specific characteristics. Addition of bio enzyme on five concrete mixturethat will be compared with normal concrete in order to know the optimum level bio-enzyme in concrete to increase the strengthof the concrete. Concrete with bio-enzyme 200 ml/m3, 400ml/m3, 600 ml/m3, 800 ml/m3, 1000 ml/m3 and normalconcrete. Refer to the crushing test result, its tends to themathematical model using 4th degree polynomial regression(least quartic), as represent on the attached data series, which isfor the design mix fc' = 25 MPa generate optimum value for33,98 MPa, on the bio-additive dosage of 509 ml bio enzymes. Mix design of concrete based on DoE (Department of Environment) from British Standard Code's. Adopted toIndonesian's Code [17] to mix design. The method of mix designshows in Figure 1. Mix design with initial concrete (normalcondition) fc' is 25 MPa, Portland Cement = 409 kg, water = 225 kg, fine aggregate = 733 kg, coarse aggregate = 1013 kg.Cylinder testing with 6 types of experiments (type A to F). Findthe optimum value of the 5 additional variations with

different types of polynomial equations to R2 = 1. [10]

In the construction industry, maintaining a balance betweenperformance and cost, while at the same time satisfying environmental regulations, has become a challenge for building material manufacturers, design engineers, and contractors. This challenge has led to identification and use of new constructionmaterials and techniques. The mixed concrete is currently alsodeveloping rapidly, to get desired characteristics many otheradded material application technologies is useful One way to get desired characteristics of the concrete mix is to use the added material, either a chemical such as entraining admixture,reducing water in the form of synthetic or organic. Concretequality also improves using with green technology using bioenzyme (Terrazyme), which is not covered yet in current ofconcrete chemical admixtures used. For Improving the strength of the concrete mix, the quality of concrete mix is good. [11

Additional material in the concrete mixture has several objectives such as Reducing Cement Content, Hydrating Heat, Reducing Shrinkage cracks, and Increasing Compressive Strength, etc. While natural waste such as bamboo, coconut fiber, and coconut shell as substitutes for concrete mixtures withthe aim of reducing waste and green concrete. This paper aims to obtain an economic model for utilizing waste materials and reducing the amount of cement so that the concrete meets the elements of waste reduction and green. The methodology for making concrete mixture test specimens is the design of concretemixtures modified with concrete mixtures with bioenzymes and coarse aggregate substitution with natural bamboo waste, coconut fiber, and coconut shell at 15% volume of coarse

aggregate. Test for 15x15x15 cm3 concrete cube at 28 days witha plan to reduce cement usage. The optimal percentage of cement reduction in the standard, bamboo, coconut fiber, and coconut shell design mixes was 30%, 24%, 18%, and 15%respectively. While the value of the cost savings for 1 m3 of normal / bio-enzyme concrete mixture is IDR 79,409, while forsubstitution of blends with natural ingredients is IDR 53,527; IDR 27,645; and IDR 14,704. The conclusion obtained is that economically using bio-enzymes in standard concrete mixes has a high value, while substitution with natural ingredients is intended to increase permeability and porosity.[12]

The investigated that on addition of terazyme to soil and the liquid limit reduced with time, while plastic limit increases withtime. There a proportional increase in strength for the soil and can be treated with optimum dosage of terrazyme along with cement and lime with ageing in comparison with untreated soil. Using materials as specified that is fine aggregate, coarse aggregate and prepared Bio Enzyme also

called as Garbage Enzyme Produced by referring procedure as given. Results: It is found that there is increase in workability (Slump test) by36.90% for the M20 grade of concrete treated with 700 Ml/**m3** dosage of Bio-Enzyme when compared to untreated M20 gradeof concrete. It is found that there is increase in strength by 24.58% for the M20 grade of concrete treated with optimum dosage of Bio-Enzyme at 28 days when compared to untreated M20 grade of concrete. It is found that there is increase in strength in early stage but later rate of increase in strength decreases with ageing. It is found that Optimum dosage of Bio-Enzyme is 550 ml/**m3**. [13]

Strength developed in stabilized clay by progressive addition of urease bio-enzymes was evaluated in this paper. The soils were stabilized with 5, 10, 15 and 20% urease bio-enzymes. From the compaction tests, the OMC decreases from 13.1% to 9.20% with an increase in enzyme percentage from 0% to 20% for A-7-6. The same decrease was observed for sample A-7-5 from 17.1% to 13.0%. A-7-6 and A-7-5 samples recorded increase in MDD from 1.90g/cm3 to 1.99g/cm3 and from 1.69 to 1.75g/cm3 respectively. The work further revealed improvement in California Bearing Ratio (115% increment) anda significant increment of 312% in Unconfined Compressive Strength of stabilized clay after 28days curing with 0-20%urease bio-enzymes addition. Comparatively, the use of liquid concentrate bio-enzyme fermented from vegetable extracts for stabilization and other construction purposes, not only reduced the cost of construction (economy), but enhances improvedhandling,local content and sustainability.[14]

ECONOMIC BENEFITS

Cost Savings: Recycling and reusing construction materials reduces the cost of disposal and transportation. Some recycling organizations even charge less compared with conventional disposal methods. Recycling also reduces the demand for new resources, which also cuts transportation and production costs.

Green Certifications: Construction companies that recycle materials have a competitive edge, due to the increasing importance of green building and environmental conservation.Recycling can help building owners earn points for LEED certification, which is the most popular green building rating system.

IV.FUTURE SCOPE

The most immediate is the reutilization within the production process of waste material generated by the production process.Wastes of metal, glass and limestone may be returned to the process, thus reducing the energy requirement associated with these inputs.

Opting in for construction waste recycling saves on disposal and landfill fees as well as the purchasing of new materials in some instances. In fact, in some cases, using recycled materialsor repurposed building elements (old wooden beams from the building that was previously on-site as an example) can not only reduce construction costs in purchasing new materials, butalso reduce transport costs, and therefore, transportation pollution. As building rectification specialists, we have found time and time again, that it is more effective to recondition and repurpose elements on a building (say treating corroded steel as opposed to replacing it) than installing new ones.

A. Environmental Benefits

Many reuse programs have evolved from local solid waste reduction goals because reuse requires fewer resources, less energy, and less labour, compared to recycling, disposal, or the manufacture of new products from virgin materials. Reuse provides an excellent, environmentally-preferred alternative toother waste management methods, because it reduces air, waterand land pollution, limits the need for new natural resources, such as timber, petroleum, fibres and other materials.

B. Community Benefits

For many years, reuse has been used as a critical way of getting needed materials to the many disadvantaged populations that exist. Reuse continues to provide an excellent way in which to get people the food, clothing, building materials, business equipment, medical supplies and other items that they desperately need. There are other ways, however, that reuse benefits the community. Many reuse centres are engaged in job-training programs, programs for the handicapped or at-risk youth programs.

C. Economic Benefits

When reusing materials, instead of creating new products from virgin materials, there are fewer burdens on the economy. Reuse is an economical way for people of all socioeconomic circles to acquire the items they need. Different Approaches for Reuse and Recycle of Building Materials. Green Building sustainable design

And construction, or “green building,” is a holistic approach that minimizes environmental impact, reduces maintenance, and creates a more desirable workspace for the building occupants. Green building focuses on siting issues, energy and water efficiency, recycled content building materials, minimizing local and global environmental effects caused by buildings, and indoor environmental quality. The goal is to transform the market of public funded construction, so that allprojects will be designed and constructed reflecting green building principles.

V.CONCLUSION

By using the unused waste for betterment of construction and development of new strength in concrete and to contribute for green construction upto possible extent in an

efficient and efficient manner. This will also help to reduce the waste to some extent.

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A Literature Review on Utilization of Plastic Fiber in Subgrade Construction

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Abstract - This review is a detailed study related to the different types of plastic which are used daily such as Polyethylene terephthalate (PET), Low-density polyethylene (LDPE), High density polyethylene (HDPE), Polypropylene (PP); we can utilize these in the process of reinforcing soil subgrade for road construction. The principle of using plastic in the form of strips is based on the difference in densities of soil, water & plastic. Soil is denser than plastic hence the fibers mixed in the soil contribute to vary the mechanical properties of soil such as maximum dry density (MDD), optimum moisture content (OMC), California bearing ratio (CBR). After studying the material available it has been found that the introduction of plastic in weak soil enhances the properties like MDD, OMC, UCS, resilient modulus (Mr), cohesion, friction angle, CBR, Unconfined compression stress. And at the same time, it helps in decreasing the permeability and free swell of the weak or untreated soil. This variation in the mechanical

properties mainly depends upon the type of soil, types of plastic fiber, size of plastic fiber & percentage of plastic. Hence this paper focuses on the above-mentioned types of plastic.

Keywords - Polyethylene terephthalate (PET), Low-density polyethylene (LDPE), High density polyethylene (HDPE), Polypropylene (PP), MDD, OMC, CBR, Soil subgrade.

I. INTRODUCTION

Plastic waste is one of the major concerns for humanity. Plastics boast a unique and useful set of properties. They are polymers, long chains of molecules made from repeating links called monomers, often produced from chemicals like petroleum. Because of this, it is nearly impossible to decompose the plastic we use every day. On the other hand, pavement is the most important component of the roadway transportation. The prosperity of the country is directly derived from its road network & their condition as they provide connectivity. It is important to construct the road with long service life and economic maintenance. Road projects are made economical by reducing the cost of construction in the first place. We can reduce the construction cost by spending less on the road material or the material which goes in to stabilisation of the soil subgrade, as the soil subgrade has the huge mass. This stabilization of soil can be done in three ways such as biological, chemical, or mechanical depending upon the requirement. Among this, Mechanical soil stabilization can be made more economically by using the plastic waste as the soil reinforcing material. This study would help in reducing the plastic waste from the environment & would help in increasing the service life of the pavement at the same time.

1.1 Subgrade reinforcement with High density polyethylene (HDPE)

When HDPE fibres of different sizes & lengths are used as a subgrade reinforcement it is been seen that the performance of the soil subgrade is directly proportional to the percentage &length of HDPE fibres [2]. Also, when it is mixed with local sandy silt soil it has found that, compression index (Cc) and coefficient of volume change (mv) values decreases with the increase of fibers in soil from up to 0.50%, but values decrease with further increase of plastic fibres upto 1.00% in soil. 90% of total compression takes place within 96 seconds for 800 kN/m2 load with the inclusion of the plastic fibers in soil with size 10mm X 1.25mm and fiber content of 1.00% [3].

When it is mixed with the black cotton soil it has been seen that, 12% of HDPE fiber is optimum to increase the friction angle by three times & cohesion by almost five times to that of the unreinforced soil. At 10% of HDPE content free swell of the black cotton soil decreases by fifty times than unreinforced soil. Coefficient of permeability decreases for minimum percentage of HDPE at 12%. Optimum CBR values can be obtained at 12% of HDPE fiber [6].

1.2 Subgrade reinforcement is reinforced with Polypropylene (PP)

Percentage of PP plastic content in soil subgrade is directly proportional to the CBR values till a certain percentage of the PP plastic& beyond that percentage if it still added, the CBR values starts decreasing. When 4% of PP by its weight is mixed with clayey soil it has been seen that the improvement in UCS values with 57.4% for 10mm long & 73% for 20mm long PP fibre. When same percentage of

these fibres are added, it increases the CBR values by 150% &resilient modulus improved by 120% [7].

1.3 Subgrade reinforcement with Polyethylene terephthalate (PET)

When the soil subgrade is reinforced with PETfibres is has been seen that the CBR values increases with the increase in percentage of PET fibres till a certain percentage of PET plastic & when it is further added it starts decreasing.

When 4% of PET by its weight is mixed with clayey soil it has been seen that the improvement in UCS values with 76.4% for 10mm long & 96.6% for 20mm long PET fibre. When same percentage of these fibres are added, it increases the CBR values by 185% &resilient modulus improved by 120% [7].

When it is used to reinforced red mud plus fly ash, the 2% of PET fibres increases the dry density value significantly [13].

1.4 Subgrade reinforcement with Low- density polyethylene (LDPE)

LDPE reinforced soil subgrade shows increase in CBR values till a certain percentage of the LDPE plastic & after that percentage it shows decrease in CBR values.

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Table 1: Variation in the prop. Of soil

PLASTIC TYPE	TYPE OF SOIL	PERCENTAGE OF PLASTIC %	PROPERTIES OF SOIL	VARIATION
PET	CLAYEY	4	CBR	INCREASES 185%
			MR	INCREASES 120%
			UCS	INCREASES 76.4 TO 96.6%
	RED MUD + FLY ASH	2	MDD	INCREASES
LDPE	EXPANSIVE CLAY	0.5 TO 2	OMC	DECREASES
			MDD	SLIGHTLY INCREASES
	WEAK SOIL	0.2	CBR	INCREASES 138%
HDPE	SANDY SILT	0.5	CBR	INCREASES UP TO CERTAIN % OF PLASTIC THEN DECREASES
			MDD	DECREASES
			MR	INCREASES
			PERMEABILITY	DECREASES
	BLACK COTTON SOIL	10	FREE SWELL	DECREASES 50 TIMES
		12	CBR	INCREASES
			PERMEABILITY	DECREASES
			COHESION	INCREASES 5 TIMES
			FRICTION ANGLE	INCREASES 3 TIMES
	CLAYEY	2.5	CBR	SIGNIFICANTLY INCREASES
PP	CLAYEY	4	CBR	INCREASES 150%
			MR	INCREASES 120%
			UCS	INCREASES 57.4 TO 73%

When LDPE plastic fibres are used in expansive clay soil, it has been seen that the significant improvement in shear strength parameters. The swelling and desiccation cracking behavior of the soil were also expressively reduced. There was a substantial reduction in the optimum moisture content and slight increment in maximum dry density. The optimum plastic size (aspect ratio) and plastic content that results in optimum result can be selected based on the importance of theselection parameter for a specified engineeringwork

When it is used with weak soil, it is been seen that there is an increment in strength of the soilby 138% when 0.2% of 20mm plastic strips areused [16].

II.CONCLUSION

Various experiments & investigations have utilized plastic waste to change properties of soils. following are the significant conclusions derived out of this literature review.

1. CBR values are seen to be increasesignificantly by addition of plastic fibrein the soil. PET plastic fibres have shown significant amount of change inCBR percentage & it is directly proportional to the percentage of plastic added.
2. MDD values increases with the increase in percentage of plastic fibre irrespective of the type of plastic &type of soil. Corresponding OMCvalues decreases with the increase in plastic content.
3. It has been seen that the plastic fibre reduces the permeability of sandy silt & black cotton soil remarkably. This may enhance the life of road subgrade & save considerable cost of repair & maintenance.
4. Increase in MR values shows that the plastic fibres are beneficial for the subgrade strength.
5. After analyzing the variations in thesoil properties, we can conclude that the plastic waste is favourable &economical material which we could use in soil stabilization.

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Development of Integrated Transportation System for Metro Cities

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Abstract-India is experiencing rapid urban growth, which is causing a number of transport-related issues such as congestion, low service levels and pollution. The lack of efficient public transportation is compelling commuters to shift their travel modes to private and intermediate transport, resulting in unbalanced modal splits. The growing urban population of India lives in themajor metro cities. In the upcoming years, these cities will play a critical role in sustaining high rates of economical growth, since they contribute a major sharein the GDP of India. But, it can be sustained if and only ifcities function efficiently – that it depends largely upon the effectiveness of its transportation and infrastructure.

Keywords— Urban, Transportation, Traffic, Accidents,etc.

I.INTRODUCTION

Transport problems in India are becoming more complex with the growth in population and urban areas. As cities grow, they tend to have varied and complex travel functions, resulting in traffic bottlenecks. In the modern context, transport demands in metro cities has increased substantially, due to increase in population. These cities account for a larger share of total urban population- a trend that has been observed since independence. The present form of transportation system includes private and public transport has emerged as a result of intense development in the urban areas and offers both merits and demerits. The existing transportation system in these cities experiences numerous traffic and environmental problems such as several traffic congestion and road accidents

This article provides an overview of metro cities transportation and its infrastructure in India. Rather than covering aspect of metro cities transportation, it primarily focuses on those area that are important for a policy point of view. This article reviews the availability of transport infrastructure in these cities.This is followed by a discussion on the infrastructure and magnitude of transport problems such ascongestion, and road accidents. Cities like Mumbai havebeen considered for the study.

II.OBJECTIVE

The objective of such integrated system is to provide travelers with seamless transport opportunities with multiple destination choice through a convenient, accessible, safe and affordable public transport system.

III.STUDY AREA

Public transport in Mumbai involves the transport of millions of its citizens by train, road, and water. Mumbai has the largest organized bus transport network among major Indian cities.

Mumbai's public transport consists primarily of rapid transit on exclusive suburban railway lines augmented by commuter rail on main lines serving outlying suburbs,the bus services of the three municipalities making up the metropolitan area, public taxis and auto rickshaws, as wellas ferry services.

IV. DATA COLLECTION:

1. MUMBAI SUBURBAN RAILWAYS:

Mumbai railways offer first class commuter transport. First class fares are approximately 10 times the second-class fare and tend to be less crowded in the non-rush hour period. First class compartments also have slightly better seats than second class. While less crowded during non-peak hours, the first-class compartments are rather more crowded during the peak hour time, as there is a large supply and demand gap. It is notoriously hard to get into the first-class compartment as the coach is overcrowded with people hanging out of the doors.

Since 2017, Mumbai Suburban Rail became the first in India to operate Air-Conditioned rakes in its Western andCentral line. These rakes are equipped with automatic doors and are vestibuled in a 12-coach configuration with coaches 1 to 6 vestibuled, motor connection between coaches 6 and 7 and coaches 7 to 12 again vestibuled There are also women-only cars (termed 'ladies'), and since 1992, 'Ladies Special' trains with all coaches reserved for women passengers.

- Western between Church gate and Dahanu Road
- Central between Chhatrapati Shivaji Terminus (CST) and Kasara/Khopoli
- Harbour, running between CSTand Panvel/Goregaon
- Trans-Harbour, running between Thane and Vashi/Panvel

2. METRO:

In January 2004, a master transit plan was unveiled by the Mumbai Metropolitan Region Development Authority (MMRDA). The plan integrated a 146 kilometer-long metro system, of which 32 km would be underground.In June 2004, government approval was given for a 12- station elevated line between Ghatkopar and Versova. InJune 2006, the first phase of the Mumbai Metro project was inaugurated. Construction work began in February 2008.A successful trial run was conducted in May 2013, and the system's first line entered operation in June 2014, although some aspects of the project were afflicted by delays and cost issues. The Mumbai Metro opened on 8 June 2014. On 2 April 2022, Metro line 2A and 7 were inaugurated, these two lines have a combined length of 19,25 km and will reduce the traffic congestion in North Mumbai. Many more lines are under-construction or plannedhaving a total length of 345 km (215 mi).

3. MONORAILS:

The Mumbai Monorail is a monorail system for the city of Mumbai. Construction began in January 2009 and the first operational line was inaugurated on 1 February 2014. It is being contracted by the Mumbai Metropolitan Region Development Authority and is the first monorail in India.

Four lines were proposed. The first two are 25 kilometers (16 mi) long. Out of the two, Line 1 was opened to the public in 2014.

- Initial plans were to build a line runningfrom Malabar Hill to the Bandra-Kurla complex via the Haji Ali Dargah, Jacob Circle, Wadala Road, Sion Hospital and Dharavi. This was planned to have beenopened by 2011.
- A line from Thane to Bhiwandi via Kalyan. A consultant's report to government has recommended that this corridor be served instead by a road-based system for the next 10–15 years using buses and bus rapid transit.

Two lines 10 kilometers (6.2 mi) long were to be constructed after the first two have opened.

- Chembur to Jacob Circle via Mahul. Thisroute is planned to have been opened by December 2010. (May get extended to Vashi, Navi Mumbai.)
- Lokhandwala Complex to Kanjurmarg via Oshiwara.

Additionally, previously planned Mumbai Metro corridorsare also being examined to be made as monorail corridors instead of the metro by MMRDA due to the dense and congested areas these corridors pass through. The corridorsare:

- Hutatma Chowk – Ghatkopar – 21.8 km
- Ghatkopar – Mulund – 12.4 km

4. AIR

The Chhatrapati Shivaji Maharaj International

Airport (formerly Sahar International Airport) is the main aviation hub in the city and the second busiest airport in India in terms of passenger traffic. It handled 30.74 millionpassengers and 656,369 tons of cargo during FY 2011–12.

The new integrated terminal T2 was inaugurated on 10 January 2014 and opened for international operations on 12February 2014, increasing the capacity of the airport to 40 million passengers annually. A dedicated six lane, elevatedroad connecting the new terminal with the main arterial Western Express Highway was also opened to the public the same day.

The proposed Navi Mumbai International Airport to be built in the Kopra-Panvel area has been sanctioned by the Indian Government and will help relieve the increasing traffic burden on the existing airport.

The Juhu Aerodrome was India's first airport, and now hosts a flying club and a heliport.

V. MUMBAI URBAN PROJECTS

The Mumbai Urban Transport Project (MUTP), is a projectformulated by the Mumbai Metropolitan Region Development Authority (MMRDA) to bring about improvement in the traffic and transport situation in the Mumbai metropolitan region

Phase I

Phase I began in 2002 and was completed in 2011.[1] The total estimated cost of the MUTP Phase I was ₹4,526 crore Most of the money was spent on railway projects, while less than a fourth was spent on road projects.

The following projects were proposed to be implemented under MUTP:

Road transport

- Widening and improvement of the Jogeshwari -Vikhroli Link Road
- Santa Cruz – Chembur Link Road (including aROB at Kurla
- ROB at Jogeshwari (South)
- ROB at Jogeshwari (North)
- ROB at Vikhroli
- Purchase of 644 ecofriendly buses
- Pedestrian Grade Separation Schemes
- Area Traffic Control System in the Island City
- Station Area Traffic Improvement Schemes(SATIS) at 6 stations
- Other traffic management and safety schemesincluding footpaths
- Environment - Air quality monitoring
- Different studies and technical assistance

The road projects included in MUTP were the Santa Cruz-Chembur Link Road (SCLR) and the Jogeshwari - Vikhroli Link Road (JVLR).

Railway Minister Dinesh Trivedi announced in 2012 thatPhase I was completed.

Phase II

The projects proposed under MUTP–II

Phase III

Phase III of the Mumbai Urban Transport Project was approved on 8 December 2011. It will cost ₹52,000 crore The feasibility study for the project cost ₹100 million.

The project includes a fast corridor from Chhatrapati Shivaji Terminus to Panvel with a connection to the proposed new Navi Mumbai International Airport, extending the Harbour Line to Borivali, and multiple additional tracks being laid on existing routes. The projectis scheduled for completion in 2031.

Phase 3A

The Union Cabinet approved Phase 3A of the MUTP on 7 March 2019. It will cost ₹33,690 crore shared equally by the Union and State Governments, and is scheduled to be completed within 5 years. Projects approved under Phase 3A include:

- Procurement of 191 air-conditioned rakes
- Extension of the Harbour Line fromGoregaon up to Borivali
- Segregation of suburban and long-distancetraffic at Kalyan Yard
- Implementing a Communications BasedTrain Control System
- Revamping 19 railway stations
- Additional capacity of existing lines
- 5th and 6th lines between Borivali and Virar
- 4th line between Kalyan and Asangaon
- 3 rd and 4 th lines between Kalyan and Badlapur.

(Including Virar car shed and Virar - Dahanu road track center work)

- Optimization on Western Railway
- Optimisation on Central Railway
- Optimisation on Harbour line
- DC/AC conversion
- Procurement of new EMUs (trains)
- EMU maintenance facilities
- Stabling lines
- Track machines
- Technical assistance and studies - setting up ofMRVC
- PPF reimbursement

VI.METROPOLITAN TRNASPORTATIONAND INFRASTRUCTURE

Mumbai, the financial capital of India is renowned as commercial and industrial hub. Recognizing the increasingpressure on the over burdened infrastructure, the state government has aggressively taken up the implementation of Mumbai Transportation Project. Mumbai area traffic control system is a system of centrally traffic signals using real time data collected through detectors which help to maximize the flow of traffic, reduce congestion and in junction stops and delays to suit traffic conditions of different times of the day.

VII.RESULT

It covers institutional responsibility of road safety action plan, raising safety action plans raising awareness and understanding of road safety problems,road crash data systems, and enforcement of traffic laws. We have to develop a road safety plan

which should be prerequisite for achieving measurable long term and midterm road safety targets.

A simple but effective monitoring and evaluation system is required to track the progress of road safetyactivities and to estimate the safety impact. The introduction of self-enforcing techniques in road designs is likely to have better short-term result than improving vehicle standards.

Policy measures to improve urban transportation in India: to resolve the transportation problems is the highest priority of Indian authorities. Transportation plans should emphasize on public transport system. Very few urban buses transport systems in India have been able to keep pace with the very rapid andsubstantial increases in travel 630 Dr. Awari MaheshBabu demand of the last few years. Furthermore, transport policy should encourage the pedestrian paths and cycle tracks especially in newdevelopment areas of larger cities and small and medium towns which should be integrated with thetransport network.

The application of Transport System Management (TSM) strategy such as one-way systems, improvement of signals, traffic engineering improvement measures for road network, intersections, bus priority lanes, and suitable policies and development of intermediate passenger transportas a short-term measure should be introduced in all cities especially in metropolitan cities so that the existing road capacity and road user safety is increased. Road infrastructure improvement measures like new road alignments, a hierarchy of roads, a provision of service roads, by-passes, ring roads, bus bays, wide medians, intersection improvements, construction and repair of footpaths and roads, removal of encroachments, good surface drainage etc.should also be introduced at least in metropolitan cities. These can be considered as short-and medium-term measures

VIII.CONCLUSION

The transportation system is the lifeline of the metropolitan cities. As a result of urbanization problems like pollution, congestion, road accidentsare increasing day by day. The public transportationsystem should be given more attention as if it wouldbe developed in a concise and cogent manner so many of the problems can be abandoned.

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Behaviour of Green Concrete (Blended Concrete) using Agro-Industrial Waste AS Partial Replacement of Cement

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***Abstract*— Rapid urbanization has increased demand for natural resources, and industrialized nations' agricultural waste disposal problems have created opportunities for agrowaste to be used in construction. All throughout the world, research is being done on how to use industrial or agricultural wastes as a source of building materials to boost the construction industry. In addition to being feasible, using these wastes would also produce an environment free from contamination. The utilization of agricultural and mechanical waste delivered by modern techniques has been the focus of waste reduction research for financial, environmental, and specialized reasons. There is an urgent need for waste management solutions since agricultural and industrial wastes like sawdust and rice husk ash are seriously impacting the environment. The research's first stage will be to make blended cement from agro-industrial waste and analyze its qualities using a variety of mix proportions. Then, green concrete for M30 grade will be created using mixed cement.**

***Keywords*—Agro-Industrial Waste, Blended Cement, Concrete, Sawdust and Rice Husk Ash.**

I.INTRODUCTION

The act of dumping or possibly insufficient garbage management from many assembling segments has had a considerable impact on the environment in recent decades, despite the waste management systems that have been widely and universally embraced. These strategies also entail a monetary expense. In any case, correctly managed trash can be made into a resource that contributes to raw material investments, safeguards the environment, and fosters economic growth. By reducing the amount of concrete needed and so reducing CO2 emissions, the development of novel solid additive chemicals could produce a more grounded, more functional material. Because it makes a great building material for both straightforward street development and more alluring projects, cement is employed in such enormous quantities. In order to produce mixed concrete using agro-mechanical waste and identify the characteristics of the best mixed bond from various blend extents, the exploration work will be done initially. After that, utilizing Agro Waste and a few modifications, the green solid will be created for M30 testing. This study analyses the effects of rice husk ash and saw dust ash on cement by partially substituting concrete at a few weight proportions. In order to identify the ideal mixes, the exploratory study examines the compressive quality, split stiffness, and flexural quality of mixed cement. Most of the fixings consist of blended concrete, waterway sand, coarse total, and water.

II.MATERIALS AND ITS PROPERTIES

2.1 RICE HUSK ASH

About 20 million tonnes of rice husk ash are delivered each year. When released, this Rice Husk Ash creates a serious threat to the surrounding environment and the land. They are being organised in a number of ways using this Rice Husk Ash. The specific gravity of rice husk ash is 2.14 g/cc. Burning rice husk (RH) produces rice husk ash, which is highly reactive and pozzolanic. Despite encouraging its use, IS 456-2000 [8] does not specify how much rice husk ash should be added to concrete. The method and temperature of burning have an effect on the chemical makeup of rice husk ash. As the burning temperature rises, there is a rise in the amount of silica in the ash.

Table 2.1: Physical Properties of Rice Husk Ash

SR NO.	TEST CONDUCTED	TEST OUTCOMES
1.	Specific Gravity	2.14 g/cc
2.	Consistency	40%
3.	Initial Setting Time	11760 secs
4.	Final Setting Time	15600 secs

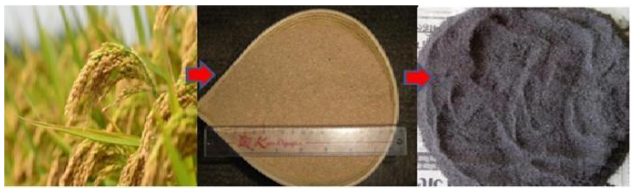

Fig.2.1 Rice Husk Ash

III.EXPERIMENTAL WORK

This chapter presents the ideas behind experimental work. The procedures for testing the workability of fresh concrete, hardened concrete, and normal Portland cement, as well as sawdust and rice husk ash, are all described, as are the testing objectives. There were several ratios of rice husk ash, saw dust ash, and combinations ranging from 0% to 20% used. The amount of waste materials in each blend was the same.

IV..TEST OUTCOMES

4.1 COMPRESSIVE STRENGTHS

i. **Rice Husk Ash:** The compressive strength was quite low when rice husk ash was replaced 100%. The compressive strength value decreased as the replacement level was raised. They connected increased porosity to a reduction in compressive strength, which was supported by the higher water requirement of rice husk ash. On the other hand, the rice husk ash was better able to fill the tiny gaps between the cement particles.

ii. **Sawdust Ash:** Concrete containing Sawdust ash as a partial replacement has a greater compressive strength when compared to control concrete at 10% replacement, but the strength decreased as the quantity of replacement rose. The compressive strength of the concrete is observed to fail when the replacement ratio of sawdust increases, such as by 20% and 30%.

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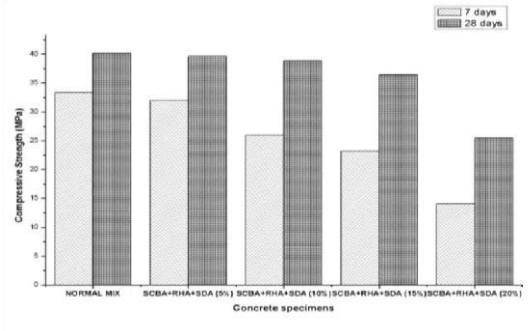

Fig.4.1 Compressive Strengths of Concrete specimens

4.2 Flexural Strength

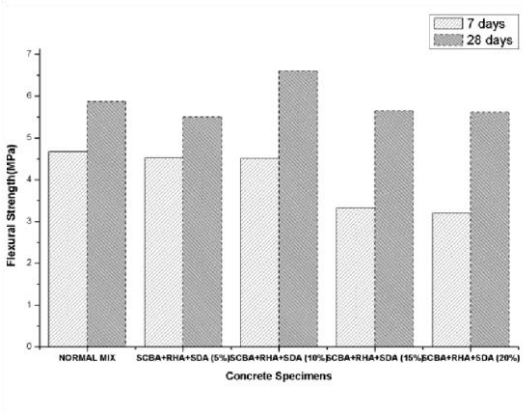

Fig.4.2 Flexural Strengths of Concrete s

Figure 4.2 depicts the flexural strength of concrete sample after 7 and 28 days of curing.

4.3 Split Tensile Strength

The addition of sugarcane bagasse ash to concrete reduced tensile strength, whereas other agro-waste materials boosted tensile strength at first, then declined as the amount of replacement grew.

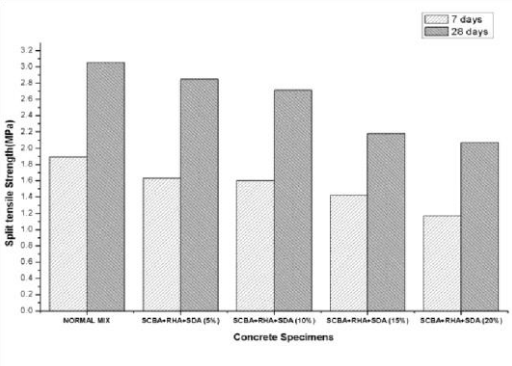

Fig.4.3 Split Tensile Strengths of Concrete specimens

Figure 4.3 displays the data for Split Tensile Strength for Concrete Specimens Curing for 7 Days and 28 Days.

V.METHODOLOGY

A comparison between the RHA/SDA concrete made by replacing cement with raw RHA/SDA in varying percentages and a control concrete of a certain grade. The primary goal of this research is to investigate the properties of RHA and SDA.

1. Its effect on workability when replacing cement with RHA/SDA in different quantities with cement in a mix design
2. Impact on concrete's compressive strength
3. Determine the RHA/SDA dosage that should be used in the concrete mix.

A single batch of standard Portland cement in 53 grades was used to accomplish the entire job, although it had to

be maintained in airtight containers to prevent exposure to ambient moisture and monsoon humidity. Chemical

and physical criteria were tested in compliance with IS: 4032-1977 and IS: 12269-1987, respectively.

5.1 Properties of Cement

SR.NO	PROPERTY	VALUE
1.	Normal consistency	33mm
2.	Fineness of cement	7 %
3.	Setting times	
	Initial (Minutes)	85
	Final (Minutes)	240
4.	Compressive Strength	
	7 Days	40.34 Mpa
	28 Days	54.62 Mpa

5.2 Preparation of Testing Specimen

5.2.1 Mixing

Ingredients are mixed in a pan mixer with a capacity of 40 liters. The aggregate is added and blended following complete mixing of the cementitious components, and then water is slowly added and mixed. The mixture is acceptable for casting once the wet mixing process has produced a homogeneous colour and consistency. Before casting the specimens, a compaction factor test was used to assess the mixtures' workability.

5.2.2 Preparation of Specimens

Mineral oil is used to clean the cast iron moulds of dust particles before concrete is poured into them. On a flat surface, the moulds are placed and used. The moulds are put on a vibration table after being filled with properly mixed concrete. Extra concrete was removed and disposed of, and the top surface was polished to a level and smooth finish in compliance with IS 516-1969. Curing the specimens The specimens are kept undisturbed at room temperature for around 24 hours after casting. The specimens are then removed from the moulds and quickly moved to the different curing environment tubs, where cubes are cured in fresh water.

5.2.3 Casting

Apply oil to the moulds after cleaning. Layers of concrete around 5 cm thick should be placed inside the moulds. With the tampering rod (a steel bar with a 16 mm diameter and a 60 cm log), compact each layer with at least 35 strokes each layer. (bullet aimed towards bottom)

Fig.5.2.3 Casting of cubes

5.2.4 Curing

The first batch of 12 test samples is maintained in the damp air for 24 hours, after which the samples are marked, taken out of the moulds, and kept submerged in clear, fresh water until they are removed for the test.

Fig.5.2.4. i Curing of cubes

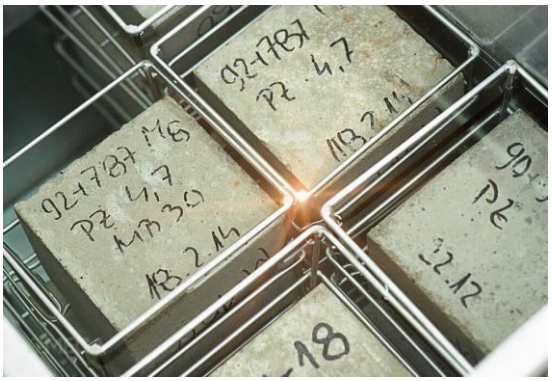

Fig.5.2.4. ii Marking of cubes

5.2.5 Testing of Specimens

To guarantee that specimens are properly tested on the due day and time, a time schedule for specimen testing is maintained. According to IS 516-1959, the cast specimens must be examined right away after being taken out of the curing tubs and wiped dry of surface water. Compressive strength and workability durability of the specimens are tested. With CTM, it is possible to determine a cube's compressive strength (Compression Testing Machine)

Fig.5.2.5 Compression Testing Machine

The flexural test provides an indirect indication of the tensile strength of concrete. It assesses how vulnerable a concrete slab or beam is to bending-related failure. As soon as the specimen is taken out of the curing environment, it is tested. The test is completed according to IS 456:2000. The Modulus of Rupture (MR), which is expressed as the value in psi (MPa), is a measure of the flexural strength and is determined by standard test methods ASTM C 78 (third-point loading) or ASTM C 293. (center-point loading).

Fig.5.2.6 Flexural Strength Testing Machine

Tensile strength is one of the fundamental and important properties of concrete that has a considerable impact on the extent and severity of cracks in structures. The procedure is based on IS 5816 1999 and other codes that are equivalent to ASTM C496 (Standard Test Procedure of Cylindrical Concrete Specimen). The cylindrical specimen cannot be built without first preparing the concrete mix. Tensile strength can be determined after 7, 28, and taking the wet specimen out of the water. On both ends of the specimen, diametrical lines are painted to ensure that the ends are in the same axial position.

Fig.5.2.7 Split tensile Testing Machine

VI.RESULTS

Comparing the compressive strength values of the 5%, 10%, RHA, and SDA combinations to the normal concrete mix, there is no appreciable drop. In comparison to all other concrete mixes, the compressive strength values of the 15% and 20% replacement combinations revealed very low strength values. The split tensile strength of concrete mixes with 5% and 10% replacement demonstrates greater tensile strength than concrete samples with 15% and 20% replacement. The flexural strength of concrete samples with 10% replacement demonstrated the highest strength values of any mix. Concrete samples with 20% replacement had the lowest strength values.

At 5%, 10%, 15%, 20%, and 25% by weight of cement, SDA was employed to replace regular Portland cement. The findings of the compacting factor which reflect workability, show that the value drops as the SDA content rises. As the SDA content rises, so does the compacting factor. Compressive strength typically rises with curing time and falls with increasing SDA content. After three days, the strength dropped from 14.22 N/mm2 for the control to 5.41 N/mm2 for 25% SDA replacement. Similar trends were seen at seven days. As the SDA % rises, concrete becomes less workable, requiring more water to make the mixtures more workable. This indicates that SDA concrete requires more water to produce

VII.CONCLUSION

The study's findings led to the following conclusions. The 20 percent value of RHA and SDA combo showed minimal workability in compared to other values. Compressive strength values of 5%, 10% RHA, and SDA combinations do not significantly differ from standard concrete mix. The 15% and 20% replacement concrete mixes had compressive strengths that were much lower than those of all other concrete mixes. In comparison to 15% and 20% replaced concrete samples, the split tensile strength of 5% and 10 Samples of concrete were replaced with 10% flexural strength. The strength of the other mixes was inferior to this one. The 20% of the rebuilt concrete samples with the lowest strength. Above a 15% replacement level, concrete's mechanical properties significantly deteriorated.

This study found that a 10% substitute can be utilised to partially replace cement with advantageous technical and environmental effects. For instance, cement businesses and significant governmental organisations should be informed about and urged to institutionalize the manufacture and use of this potential concrete substitute material.

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Modified Self-Compacting Concrete with Recycled Concrete Aggregate

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***Abstract*—This paper presents the results of research of self-compacting concrete produced with recycled concrete aggregates and activated filler. The physical and mechanical characteristics of coarse aggregate, grain distribution of aggregates and sand proportion in aggregate mix, design of self-compacting concrete mixture and it's structure properties with use mathematical experiment planning method were carried out. The results indicated that optimal content of filler is 22% with 150 min of activation and 0.5% content of organic admixture. Standard consistency of composite binder has decreased from 26.5% to 22.4%. The mathematical models can be used in the design of the self-compacting concrete mixture.**

Keywords— Self-compacting concrete; Concrete waste; Recycled concrete aggregate; Filler; Water-to-binder ratio; Standard consistency.

I.INTRODUCTION

Recently, there has been an increasing trend toward the use of sustainable materials. Sustainability helps the environment by reducing the consumption of non-renewable natural resources. Concrete the second most consumed material in the world after water uses a significant amount of non- renewable resources. As a result, numerous researchers have investigated the use of recycled materials in the production of concrete such as fly ash and recycled aggregate [3-7]. In the recent time due to significant increase in population and urbanization large amount of waste from construction and demolition are generated. Therefore, majority of the developed/ developing countries are facing the problem of handling and disposal of such construction and demolition wastes. Considering this aspect, there has been a growing emphasis on the utilization of waste materials and by-products in construction activities. Use of waste materials not only helps in getting the mutilized but also has numerous indirect benefits such as savings in energy and protection of environment. Over the last decades, large amount of experimental works have been carried out to investigate the material properties and durability of recycled aggregate concrete (RAC). Accordingly, significant progress has been gained by applying recycled aggregates into construction materials in the form of RAC members. Compared with natural aggregates, recycled aggregates usually have greater porosity and water absorption, lower density, and lower strength than normal aggregate. As a result, RAC structural components in variably experience inferior physical and mechanical properties compared to normal aggregate concrete (NAC), such as low mechanical performance and poor durability behaviour.

For concrete made with100% recycled aggregates, the compressive strength of RAC was reportedly decreased by 940%. It is generally accepted that the lower elastic modulus of RAC is attributed to a lower modulus of elasticity of recycled aggregate, and the lower strength of RAC is mainly due to the weaker mortar as well as the weaker interfacial transition zone (ITZ) between the old mortar and newmortal.

Irrespective of all the inferior properties of recycled aggregate, any researchers are of the opinion that recycled aggregate are a good alternative to natural coarse aggregate in concrete considering its environmental and economic benefit apart from reducing load on natural resources in construction industry.

This paper presents a complete and updated literature review on the properties of self-compacting concrete with fine and coarse recycled aggregates. The subject of self-compacting concrete with recycled aggregates (RASCC) is greatly relevant to Society, since there is an increasing demand from the construction industry to adopt new processes to minimize its negative impacts on the environment. The use of recycled aggregates in concrete production presents a great environmental benefit through savings from the extraction of natural aggregates and the reduction of dumped material. The advantages associated to the use of both concrete with recycled aggregates and self-compacting concrete have boosted an increase in research and a consequent publication of literature in the last few years. Combining these two themes has allowed allying the environmental and economic advantages of each of the materials, leading to an innovative material of great interest to the construction industry in general. Even though RASCC is a relatively recent scientific area, studies on this material have demonstrated its viability, to produce both traditional and non-complex structural elements and highly complex and densely reinforced elements, which

hinder the vibration procedures and may influence the final quality.

The article presents an experimental study on self-compacting concrete prepared by using different percentages of recycled aggregates, in order to obtain a sustainable and environmentally friendly self-compacting concrete. For this purpose, ten different compositions of self-compacting concrete were made. The main recipe used for comparing results has been discovered from trial and error using the recommendations from the Eurocode. After the recipe was obtained the replacement of cement, limestone and fine aggregates had been made with the following recycled materials: fly ash, blast furnace slag, crumbrubber and brick dust in different percent and replacing different materials as presented in Table 1. The influence of the type and dosage of recycled aggregates is discussed. The main objective of the article was to analyze the properties of self-compacting concrete prepared with these recycled materials. In order to have the possibility to certify the difference between the ten recipes no changes had been made from one recipe to another except variations of water and super plasticizer quantity for obtaining SCC due to the different absorption by the recycled material. The w/c ratio varies from 0.38 to 0.63 and the Super plasticizer varied from 0.8 to 1.3 % of the cement

II. LITERATURE REVIEW

The utilization of construction and demolition waste is useful for sustainable infrastructure development and protecting the environment. In this research, the properties of self-compacting concrete produced by replacing the natural coarse aggregates (NCA) with inferior recycled coarse aggregates (RCA) were investigated. The properties of self-compacting concrete (SCC) and self-compacting mortar (SCM) with varying replacements of RCA (0, 25, 50, and 100%) in NCA were determined. The flow, strength, early shrinkage tests, and microstructure using X-ray diffraction (XRD) and a scanning electron microscope (SEM) were investigated. The fresh property results indicated that the viscosity of freshly mixed SCC increased with higher replacement levels of RCA, thus reducing flow. The compressive strength of RCA SCC was reduced up to 30% for a 100% replacement level, while the flexural strength was reduced by about 15%. The compressive strength and flexural strength of SCMs, however, increased up to 12% and 28% for 100% replacement with RCA. The mechanical strength of SCM increases with RCA because of high fine content which reduces the porosity and makes the system denser. The early age linear shrinkage increases with RCA due to its greater water absorption. The results indicate that recycled coarse aggregate can be effectively used as the replacement of NCA in SCC to produce sustainable and eco-friendly structural concrete.

A large amount of aggregate waste is generated in the construction industry. The waste aggregate can be recycled for new construction to help in the conservation of natural resources. The energy requirements, emissions, and carbon footprint associated with the production and processing of natural aggregate can also be reduced. The utilization of waste aggregate will not only improve sustainability but also decrease construction costs and reduce disposal and landfill issues. The utilization of self-compacting concrete in the construction industry is gaining wide acceptance. Self-compacting concrete (SCC) consolidates under its own weight without the need for compaction. SCC has favour able flow ability, filling, and passing abilities. It is a non segregating concrete which can flow easily and covers the reinforcement in formwork without the need for mechanical consolidation. Moreover, it shortens the duration of concreting and provides a healthier working environment by reducing unpleasant noise and vibrations during casting. The use of self-compacting concrete was proposed during 1986 by Professor Okamura as an alternative to conventional concrete. Ozawa and Maekawa developed the prototype of SCC

in Japan in 1988, encompassing the workability of concrete as a major parameter.

Making concrete structures without vibration, have been done in the past. For examples, placement of concrete under water is done by the use of tremie without vibration. Mass concrete, and shaft concrete can be successfully placed without vibration, but the above examples of concrete are generally of lower strength and difficult to obtain consistent quality. Modern application of self compacting concrete is focussed on high performance, better and more reliable and uniform quality. Selfcompacting concrete is an innovative concrete that does not require vibration for placing and compaction. It is able to flow under its own weight, completely filling formwork and achieving full compaction, even in the presence of congested reinforcement .The hardened concrete is dense, homogenous and has the same engineering properties and durability as traditional vibrated concrete. SCC offers a rapid rate of concrete placement with faster construction times and ease of flow around congested reinforcement. The fluidity and segregation resistance of SCC ensures a high level of homogeneity, minimal concrete voids and uniform concrete strength, providing the potential for a superior level of finish and durability to the structure. The elimination of vibrating equipment improves the environment on and near construction and precast sites where concrete is being placed, reducing the exposure of workers to noise and vibration.

Recycled aggregates have the added benefit of reducing landfill disposal, while conserving primary natural resources and reducing transportation costs, help to promote sustainable development in the protection of natural resources.

Large volume of waste concrete from construction and demolition (C&D) waste is generated globally every year. To have a sustainable future, a solution must be provided for the utilization of C&D wastes. The most innovative approach till date to deal with it is to make recycled aggregates (RA) from C&D waste incorporate in self-compacting concrete (SCC). However, various uncertainties limit the widespread use of RA in SCC. The fluctuation in the properties of industrial-grade recycled aggregate and their influence on the properties of fresh and hardened properties is of specific concern. SCC can

compensate for the degraded properties of RA because of its ability to have higher strength compared with fellow concrete of the same grade. Because of the SCC's ability to compensate some of the loss in the properties, RA in SCC is emphasized on the last decade. Lack of confidence and specification, incorporation of SCC with RA, has a limited outcome. This paper presents an up-to-date literature review of incorporating RA derived from C&D wastes in SCC. The main goal of this study is the study the influence of RA from C&D waste on self-compacting concrete. The first part introduces the discussion on the main properties of RA, such as the composition, components, and presence of the attached mortar are the principal parameters affecting the final quality of SCC. The second part presents the feasibility of RA in SCC along with in-depth review of the fresh, hardened, and mechanical properties of SCC with recycled coarse aggregate (RCA), recycled fine aggregates (RFA), and recycled powders (RP) derived only from C&D waste. It also presents a brief insight into the rheological properties of concrete made with RA. In comparison, the negative effect of the fine fraction on the properties of SCC is more evident that coarse fractions. Improvement in properties of concrete can be seen by the use of supplementary cementitious materials or chemical activators. This paper tries to explain the approaches for better performances, identifying the knowledge gaps and reasons why this promising technology still not a mainline choice as a construction material.

The use of construction and demolition wastes (C&DW) is a trending future option for the sustainability of construction. In this context, a number of works deal with the use of recycled concrete aggregates to produce concrete for structural and non-structural purposes. Nowadays, an important number of C&DW management plants in the European Union (EU) and other countries have developed robust protocols to obtain high-quality coarse recycled aggregates that comply with different European standards in order to be used to produce new concrete. The development of self-compacting concrete (SCC) is another way to boost the sustainability of construction, due to the important reduction of energy employed. Using recycled aggregates is a relatively recent scientific area, however, studies on this material in the manufacture of self-compacting concrete have proven the feasibility thereof for conventional structural elements as well as high-performance and complex structural elements, densely reinforced structures, difficult-to-access formwork and difficult-to-vibrate elements. This paper presents an original study on the use of coarse recycled concrete aggregate (CRA) to obtain self-compacting concrete. Concrete with substitution ratios of 20%, 50% and 100% are compared with a control concrete. The purpose of this comparison is to check the influence of CRA on fresh SCC as well as its physical and mechanical properties. The parameters studied are material characterization, self-compactability, compressive strength, and tensile and flexural strength of the resulting concrete. The results conclude that it is feasible to use CRA for SCC production with minimal losses in the characteristics.

Japan has used self-compacting concrete (SCC) in bridge, building and tunnel construction since the early 1990.s. In the last five years, a number of SCC bridges have been constructed in Europe. In the United States, the application of SCC in highway bridge construction is very limited at this time.However, the U.S. precast concrete industry is beginning to apply the technology to architectural concrete. SCC has high potential for wider structural applications in highway bridge construction.

The application of concrete without vibration in highway bridge construction is not new. For examples, placement of seal concrete underwater is done by the use of a tremie without vibration, mass concrete has been placed without vibration, and shaft concrete can be successfully placed without vibration. These seal, mass and shaft concretes are generally of lower strength, less than 34.5 MPa and difficult to attain consistent quality. Modern application of selfcompacting concrete (SCC) is focused on high performance. Better and more reliable quality, dense and uniform surface texture, improved durability, high strength, and faster construction.

Recognizing the lack of uniformity and complete compaction of concrete by vibration, researchers at the University of Tokyo, Japan, started out in late 1980.s to develop SCC. By the early 1990.s, Japan has developed and used SCC that does not require vibration to achieve full compaction. More and more applications of SCC in construction have been reported in

Japan. As of the year 2000, the amount of SCC used for prefabricated products (precast members) and ready-mixed concrete (cast-in-place) in Japan was about 400,000 m3.

With the tremendous development of construction of mega structures the world over, the demand for self compacting concrete (SCC) application is increasing. Many sites have the problems of congestion of reinforcement in principal structural members. The design issues are compounded due to the high risk of seismic zone, vulnerability to cyclonic storms and huge capacity addition of the plants to a very large scale. SCC has become the only choice in such difficult site environments. Ideally the development of concrete mix where placing and compaction has minimal dependence on the Standard of workmanship available on a particular site should improve the true quality of the concrete in the final structure, and hence its durability. This was an important driving force behind the development of self-compacting concrete (SCC).

Self-compacting concrete is considered as a breakthrough in concrete technology due to its improved performance and working environment. It has wide application from thin elements to bulk robust structures. SCC can be taken as greatest technical advancement and most revolutionary development in concrete technology over the years. SCC is a concrete of future, as it will be replacing normal concrete due to its distinct advantages.Self-compacting concrete (SCC) also called as Self Consolidating Concrete or Rheodynamic concrete is an innovative concrete that does not require vibration for placing and compaction. It is able to flow under its own weight, completely filling formwork and achieving full compaction, even in the presence of congested reinforcement. The hardened concrete is dense, homogeneous and has at least engineering properties at par with and durability as traditional vibrated concrete. The

principle behind Self Compacting Concrete (SCC) is that the settlement of aggregates is related to the viscosity of the fresh concrete. SCC can be produced using the same ingredients as that of normal concrete.

However, a closer tolerance is required to ensure strict control of workability characteristics. The proportioning of SCC mix is much more scientific than that of conventional concrete mixes. SCC mix requires high powder content, lesser quantity of coarse aggregate, high range superplasticizer and VMA (Viscosity Modifying Agent) to give stability and fluidity to concrete mix. The workability of SCC is equilibrium of fluidity, deformability, filling ability and resistance to segregation. This equilibrium has to be maintained for a sufficient time period to allow for its transportation, placing and finishing. Combinations of tests are required to characterize the workability properties. Concrete that requires little vibration or compaction has been used in Europe since the early 1970s but Self-Compacting Concrete was not developed until late 1980s in Japan.

In Europe it was probably first used in civil works for transportation networks in Sweden in the mid 1990s. The EC funded a multinational, industry lead project "SCC" 1997-2000 and since then SCC has found increasing use in all European countries and the use is increasing all over the world, and in India also. In India, the SCC has been used (about 5000 Cum.) in Kaiga Nuclear Power Project (Karnataka) and also in Kota Atomic Power project (Rajasthan).

Some of the projects where SCC has been used are

• Delhi Metro Project – 10000 Cum.

• Tarapore Atomic Power Project – 6000 Cum.

• Gosikhurd Project – 5000 Cum.

• Purna Dam Project – 500 Cum.

• Lower Wardha Project – 2000 Cum.

The use of SCC is increasing day by day in India and many infrastructure projects are going in for SCC, the example being 'The Signature Bridge' on river Yamuna near New Delhi and the Bandra-Worli sea linkproject, Mumbai.

Self-Compacting Concrete offers a rapid rate of concrete placement, with faster construction times and ease of flow around congested reinforcement. The fluidity and segregation resistance of SCC ensures high level of homogeneity, minimal concrete voids and uniform concrete strength, providing the potential for a superior level of finish and durability to the structure. SCC is often produced with low water-cement ratio providing the potential for high early strength, earlier de-molding and faster use of elements and structures.

The elimination of vibrating equipment improves the environment on and near construction sites where concrete is being placed, reducing the exposure of workers to noise and vibration.

The improved construction practice and performance, combined with the health and safety benefits, make SCC a very attractive solution for both precast concrete and on-site civil engineering construction.Self-compacted concrete have high workability, which makes it flow through dense and complex reinforcement under the effect of its own weight to fill the pores by reducing voids without vibrators (khayat,1999). The author also reported that for SCC to be successful it must have high fluidity, high segregation resistance.

The capacity of the concrete to deform and spread freely is known as High deformability. This property helps in filling all the space in the formwork. Further, the ease with which the concrete flows around the obstacles, such as reinforcement is known as restrained flowability characteristic. This characteristic usually is the ability to decrease its tendency to segregation. According to Bonen and Shah 2005, the key factor for a successful development of SCC is to clearly understand the role of the different constituent material in the mix and their effects on the fresh and hardened properties of SCC.

With the development in the field of superplasticizers technology this concrete type has become wide spread in all over the world. The advent of superplasticizers technology has contributed significantly to the progression and formation of SCC. In

SCC mixes the use of superplasticizers (HRWR) maintains the fluidity while VMA provides stability of the mix, resulting in high resistance against bleeding and segregation. The filling ability and stability of self-compacting concrete in the fresh state depends upon type and amount of additive like chemical admixture which is used.

Further, the Indian standard IS: 456-2000[4] documents the use of industrial waste products, fly ash and silica fume, as mineral admixtures, which have both pozzolanic and cementitious properties for amending the properties of concrete which will lead to cost and energy saving.

Yazici H., 2008[5] in his study concluded that the use of fly ash could increase the slump flow of the SCCs mixes. Moreover, the need for viscosity-enhancing chemical admixtures is minimized. "Siddique [6]" reported that the use of mineral admixture increase the flow of the concrete mix subsequently and reduces the dosage of superplasticizers. Dinakar et al. 2008[7] concluded that in case of Portland pozzolana cement, 30 to 50% replacement of cement with fly ash is ideal for SCC mixes.

Further, Miura et al. 1993[8] reported that the replacement of cement by 30% fly ash resulted in excellent workability and flowability. It can be concluded from the literature [9-14] that, there is reduction in material cost of SCC with the use of mineral admixtures like fly ash and slag cement or viscosity-modifying agents and further, improves flowability and strength characteristics of the SCCs mixes. Khayat

1999[1] and Ozawa et al 1995[15] concluded that VMA can enhance the viscosity and cohesiveness of SCC mixes through the addition of filler material like limestone powder. They further concluded that the viscosity of concrete mixes can also be improved by decreasing the

water/ cementitious material ratio (w/cm). Earlier, efforts have been made to quantify the effect of fly ash in concrete by determining the cementing efficiency factor (k- value) for fly ash [16]. The k- value is defined as the part of the pozzolanic material which can be considered as equivalentto Portland cement having the same properties as concrete without the pozzolanic material. Babu and Rao 1993[17] observed that the k-value of fly ash with respect to 28 days compressive strength varies over a wide range depending upon amount of fly ash added in the mix, water cement ratio, age of concrete and type of cement. The German and the British code adopted k- value of 0.3 for fly ash up to 50% with cement. Cementing efficiency factor of 0.5 for water to cement ratio in the range of 0.5 to 0.65 was reported by Schies 1991[16]. The Danish standards further stipulated an efficiency value of 0.5 for fly ash. Babu & Rao 1995[17] in their paper dealt with the Cementing Efficiency Factor and proposed that the values should be 0.3, 0.5 and 0.6 for varying percentage of replacement. Schiess 1991[16] also reported that for w/c ratio between 0.5 and 0.65 a k-value of 0.5 is more appropriate for the Cementing Efficiency Factor.

Very recently the use of recycled concrete aggregate (RCA) from construction and demolition wastes is showing potential relevance in construction industry as substitute to natural coarse aggregate (NCA). Since aggregate makes up most of the concrete by volume, it makes sense to investigate the use of concrete waste as aggregate in new concrete. Lower environmental pollution with saving in natural aggregate resources may be considered as the potential advantages of recycling coarse aggregate from rejected old concrete.

Tavakoli and Soroushian 1996 reported that the original concrete strength along with percentage of the coarse aggregate in the original concrete affects the strength of recycled aggregate concrete. It has also been reported by the authors that water absorption and Los Angeles Abrasion loss of the recycled aggregate play important role in determining the strength of recycled aggregate concrete. The authors further reported that the conventional relationships between splitting tensile strength, flexure and compressive strength are different for recycled aggregate concrete as compared to natural coarse aggregate concrete.

Ajdukiewicz and Kliszczewicz,2002[19] in their work concluded that to achieve the same workability as natural coarse aggregate concrete, the water content should be modified for recycled aggregate concrete, which may further lead to loss in compressive strength.

Tuyan et al. 2014[20], commented that the cost of SCC is higher than traditional vibrated concretes due to the need for higher powder contents and chemical admixtures in SCC. Thus in order to allow SCC to reach its full potential in terms of industry uptake it is necessary to develop ways of making SCC more cost effective. The use of coarse RCA as substitutes for coarse natural aggregates in SCC offers a means of reducing the cost of SCC, while reducing the carbon footprint of concrete production. Consequently, there are both business case and an environmental obligation to explore the use of RCA in SCCs. Kou, S.C., Poon, C.S, 2009[21], Studied the fresh and hardened properties of SCC with recycled concrete aggregates as both coarse and fine aggregates states. Three sets of SCC mixes with partial replacement of recycled fine aggregate with river sand.

III.RESULT AND DISCUSSION

Fresh and hardened properties of concrete were studied for NVC and SCC with different percentages of RCA. , T-500, V-funnel and L-box tests were carried out in the laboratory as per EFNRC guidelines to determine the fresh properties of SCC. Fresh properties of concrete obtained in the lab tabulated in. The values obtained are within the range specified in EFNRC guidelines. The slump-flow is the mean diameter of slump flow test by using a slump cone, expressed to the nearest 10 mm. The T500 time is the time in seconds the concrete has flowed to a diameter of 500 mm in the slump flow test. The time taken for the concrete to flow out of the V-funnel is measured and recorded in second is the V-funnel flow time.

Compacting concrete (SCC) is defined as concrete that can be placed normally and will flow under its own weight while maintaining its homogeneity. Full compaction and strength may therefore be achieved without theBassistance of mechanical vibration. Its development was based on the desire to improve the quality of concrete work and automate construction. It was developed in 1988. Since then, various investigations have been carried out and mainly large construction companies have used the concrete in practical structures in Japan. Here in this report an attempt has been made to study self-compacting concrete and the specialties in the mix design, given it the self-compacting capacity.

Self-compacting concrete refers to a special type of concrete that can be compacted to every corner of the formwork, purely by means of its own self-weight and without the need for vibrating or compaction. Scc is self-compacting itself alone due to its own self weight and it is characterized by high segregation resistance. The need for self-compacting concrete is particularly because conventional concrete tends to present a problem with regard to inadequate consolidation in thin sections or areas of congested reinforcements, which leads to a larger volume of entrapped air and compromises the strength and durability of concrete. SCC was developed initially in Japan in the 1980s when contractors were experiencing as ever shortage of skilled manpower. it is now becoming a revolution in concrete technology.

IV.CONCLUSION

It is desirable to use SCC because of its advantages like faster rate of construction and superior level of finish and also it can be used in congested reinforcement very well. Since the strength is not much reduced with recycled aggregates and flow properties were good recycled aggregate can be effectively used in SCC. Early was less in SCC compared to traditional concrete. While comparing the Split tensile strength SCC gave highest result. But with coarse aggregate replacement gives a less value. Flexural strength was studied all concrete mixes gave similar to that of traditional concrete. The water absorption increased in SCC with recycled aggregate was due to the higher water absorption in RCA. But it is within satisfactory

limits. So RCA is a good alternative of CA in SCC. SCC with more percentage of RCA is to be studied.

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Integrating Waste into Cement Mortar and Concrete

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***Abstract*— In the last decades, because of the modern lifestyle mode, the progress in trade and technology had light-emitting diode to a very important increase within the quantity and sort of wastes. The matter of waste accumulation each year is everywhere on the planet. These industrial and agricultural wastes square measure by-products, slag,rice husk ash, bagasse, fly ash, cement dirt, brick dust,sludge, glass, tires, etc. The wastes represent a significant drawback for the setting as a result of the pollution (the dirt and really fine particles that unfold within the atmosphere). The building material business may be a domain of interest for victimization of the wastes and researchers have tried to provide new construction materials incorporating wastes. The new generation of building materials is developing alternative theories in concordance with the property of setting. Concrete is obtained from natural aggregates, cement and water, compounds that build it an inexpensive material and simple to provide a place. Concrete is made from natural aggregates, cement, and water, which makes it a low-cost material that can be produced anywhere. Ordinary concrete typically contains about 12% cement, 8% water, and 80% aggregates by mass. Only cement must be produced in fabrics, which pollute the environment, because aggregates and water are derived from natural resources (for producing 1 m3 of concrete a quantity of 480 kg of CO2 is liberated in the atmosphere). The use of waste-derived replacement materials was investigated in order to reduce aggregate and cement consumption.**

Keywords— Cement, Aggregates, Glass, Concrete fgf

I. INTRODUCTION

The initiative for promoting the assorted aspects related to waste materials reuses is conquest worldwide. As these materials ar having the properties that encouraging the researchers to create up such mechanism nullifying overburden of the Brobdingnagian volume of waste disposal. except for that alternative issue like Carbon emission, ecological development and economical parameter are influencing to rethink regarding the rational creation of recent materials. At the instance, Cement production is to blame for five-hitter of worldwide evolution dioxide emissions and seven of business fuel use. The waste glass powder during this situation is taking part in the key role to find as substitution of cement in creating the combination of mortar and alternative helpful product

Glass powder originally derived from glass, verdant on a chic scale over the layer. The glass business is victimizing this in making all the wants of society in numerous forms. Non-biodegradable nature of glass makes it implicit to utilize once more and once more. The analysis adds this direction goes up; and also the existing work of the varied scientist manifolds that tumbler powder has the latent property to make new dimensions for creating cement and housing industry greener. In context to Indian perspective because the country is growing exponentially within the region of Asia Pacific with all around infrastructural development, there's a big growth for Indian cement business that has to be capable of seeking the above-stipulated state of affairs in their framework

II. OBJECTIVES

A. Careful characterization of waste is necessary before it is used in construction.
B. Treatment of some waste materials is necessary to improve their quality before being incorporated into concrete.
C. Environmental assessment of waste and concrete containing waste is also necessary for proper evaluation of waste materials as a constituent in concrete.
D. Slump, bulk density, unit weight, and air content; mechanical properties such as strength and elasticity modulus, and durability properties such as water absorption, shrinkage, carbonation and chloride resistance of fresh and hardened concrete containing waste materials, are normally evaluated
E. Some waste materials can improve certain concrete properties such as fire behaviour, thermal insulation and cracking. As different waste materials can change the microstructure of mortar and concrete and the hydration chemistry of cement

III. TYPES OF TEST

A. *Crushing Test on Aggregates - The combination crushing worth check indicates the strength of combination that is that the most essential property of coarse aggregate. the mixture crushing worth provides a relative live of resistance to crushing below a step by step applied compressive load. For achieving a prime quality of pavement, combination of upper crushing strength i.e. low crushing worth ought to be most well-liked. Lower crushing worth suggests that higher strength because it indicates a lower crushed fraction below load. this offers a extended service life and a a lot of economical performance.*

B. *Abrasion Test on Aggregates- The aggregate hardness is determined by an abrasion test. It demonstrates aggregate's resistance to wear and tear.*

C. Impact Test on Aggregates- Aggregate could also be subjected to a explosive shock or impact throughout in addition as when the development. These masses ar completely different from the bit by bit applied compressive masses. because of such quite masses, combination breaks down into smaller items. so as to guage the resistance to impact of combination, the combination impact take a look at is conducted. combination impact worth provides the thought regarding what proportion impact load may be resisted by combination. Actually, combination ought to be sufficiently powerful to resist their disintegration because of impact. This distinctive property is measured by impact worth take a look at.

D. Soundness Test on Aggregates-Soundness check on combination is conducted to grasp the resistance of aggregates to weathering action. Aggregates area unit subjected to the physical and activity of rain-water, groundwater and therefore the different impurities of the atmosphere. this could cause a modification within the volume that isn't smart and substandard for the sturdiness of construction. The property of combinations to resist the adverse action of weather is understood as soundness of aggregate.

E. Shape Test on Aggregates - Aggregates ar obtainable in numerous sizes and shapes, i.e. rounded, cubical, and angular flaky or elongated. it's proven that the flaky and elongated particles have less strength, less bonding, less interlocking and sturdiness as compared with three-dimensional, angular or rounded particles of identical size aggregates. It will be same that aggregates ar flaky once aggregates ar too skinny compared to their average size (mean dimension). Elongated combination suggests that aggregates they're too long compared to their average size (mean dimension). Flakiness index check and elongation index check ar performed to seek out flaky and elongated aggregates

IV. MATERIALS REQUIRED FOR TESTS

A. *Crushing Test on Aggregates -*
- *Compressive Testing Machine*
- *Crushing Mould: A 15 cm diameter steel cylinder with a plunger and a base plate.*
- *Sieve, weighing machine: 12.5 mm, 10 mm, and 2.36 mm in size*

B. *Abrasion Test on Aggregates-*
- *Los Angles Abrasion Machine*
- *Steel balls: 11no.*
- *Weighing balance*
- *Sieves: 20, 12.5, 10, 1.7mm*

C. Impact Test on Aggregates
- Aggregate impact apparatus,
- IS sieves (12.5 mm, 10.0 mm and 2.36 mm),
- Cylindrical measure and cylindrical cup,
- Weighing balance,
- Tamping rod.

D. Soundness Test on Aggregates
- Sodium Sulphate or Magnesium Sulphate Solution,
- Oven,
- Weighing Balance,
- IS Sieves

E. Shape Test on Aggregates
- Thickness gauge
- Length gauge
- Weighing balance
- IS Sieves

CONCLUSION

Significant progress has been created within the use of waste materials as mixture, fibre or filler in concrete. the utilization of waste materials as mixture in concrete consumes a colossal quantity of waste materials and saves natural resources. If waste materials square measure employed in concrete as aggregate, fibre or filler this considerably changes its properties. The incorporation of some waste materials like ground plastics, sliced rubber and coal bottom ash will enhance some specific properties of concrete and thus special styles of concrete may be developed by victimization these waste materials. the assembly of cheaper and additional sturdy concrete by combing completely different mineral additions into cement and waste mixture can go how to helping to unravel ecological and environmental issues. Lack of widespread reliable information on mixture substitutes will hinder the utilization of most waste materials as mixture in concrete. additional analysis is needed to style consistent and durable concrete containing such waste mixture. there's AN increasing demand for a higher understanding of concrete properties in addition as for higher management of the microstructure that develops within the concrete which contains numerous waste materials.

ACKNOWLEDGMENT

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Study On Effect of Geogrid on Concrete Cubes

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***Abstract*—This paper presents the detailed study on effect of geogrid on concrete cubes. Use of geogrids as strengthening material are extend used, especially for enhancement of concrete elements as inter layers concrete applications, eight cubes are to be tested to explain the effect of geogrid on the behavior of concrete cubes. Cubes tested had equal cross-sectional dimension (150 mm x 150 mm) & equal compressive strength. . The tested cubes are to be divided into two groups according to the presence of geogrid layer, with and without geogrid. Each group consists of four specimens, which should be sub-divided according to the flexural reinforcement ratio. During the tests, the load deflection curve for cubes with geogrid layer as well as without geogrid layer is to be noted, the maximum applied load as well as well as deflection values are also to be tested & noted.**

Keywords— Agro-Industrial Waste, Blended Cement, Concrete, Sawdust and Rice Husk Ash.

I. INTRODUCTION

Geogrids are geo-synthetic material constructed from polymers, such as, polyester, poly-propylene, and poly-ethylene. They are used generally in applications of civil engineering to offer tensile reinforcement of soil. Geogrids are used in erection of steep slopes, roadway bases, retaining walls, and foundations. It is a flexible mesh which be used to create a reinforced coherent mass behind the retaining wall by stabilizing the soil. They consist of two sets of ribs, intersecting each other in two directions. The first set is parallel to the machine direction, and the second set of ribs is perpendicular to the direction of machine and called cross-machine direction. The openings between the ribs are called the apertures; they vary from 150 to 250 mm depending on the arrangement of the longitudinal and diagonal ribs[1]. There are three types of geogrid, uniaxial geogrid which it is extended on the longitudinal direction only and the stress can be transferred on the longitudinal direction only and biaxial geogrid, it is extended on the two directions (longitudinal and transverse) which it lead to distribute the stress in both directions. Since the strength is equal along both axes these geogrids are mostly favored in construction, finally a triaxle geogrids are also used and it's had a multi-directional properties leverage triangular geometry and the construction of geogrid has most stable shapes, which lead to provide a greater stability and stiffness than other two types [2] as shown in figure 1.

Fig.1 types of geogrids

There are many advantage of geogrid which lead to use in this research its very light in weight in comparison with the other method used to resist shear strength like shear head, stirrups and using of flexural reinforcement or using concrete sections like column capital and drop panels, high resistance to corrosion due to its raw material made from it, so it is more efficient more than steel reinforcement as well as to getting rid of crushing in concrete cover due to the swelling of steel bar, high resistance to sulphates or chlorides attack and this due to the nature of the raw material, easy to transport it from place to another without the need for cranes, due to it is lightweight, ease of cutting and use, where it can be cut by using scissors and spread by hand so it needs fewer workers to place it that lead to reduce the time [3]. The purpose of this current work is to investigate the effect of geogrid layer on the structural behavior of reinforced concrete beams.

OBJECTIVES

The objective of this study is to test the properties of concrete when shredded or crumbed rubber used as aggregate by partial replacement of natural aggregates

II. LITERATURE REVIEW

In the present experimental investigation, the work investigated the effects of calcium chloride as an admixture in Geosynthetic fibre (geogrid) concrete. Also studied the compressive strength and tensile strength of plain concrete and geogrid reinforced concrete by adding calcium chloride in

various ratios (0.2, 0.5, and 0.8) and to determine the optimum value of calcium. The objective of this paper is to investigate the effect of geogrid on concrete cubes. Compressive strength, of concrete is measured and comparative analysis is made. The parameters of this investigation include the compressive strength of concrete specimens' cubes of (150mm X150mm X150mm) size. M25 grade concrete is used for testing.

This study explores the effects of geogrid on some mechanical properties of concrete. The aim of this work is to highlight the use of geogrid for tensile reinforcement of soil. Two types of concrete cubes sets were prepared and tested in terms of compression, stress-strain manners and workability evaluation through weight and permeability tests. During the tests, it was noted that, the load deflection curve for beams with geogrid layer were stiffer and the percentage of stiffening was increased with increase of the flexural reinforcement ratio. The maximum applied load for beams with geogrid layer were higher than conventional beams without geogrid layer under the same conditions, while, the deflection values for beams with geogrid layer was lower than conventional beams without geogrid layer. The first crack load of beams with geogrid was greater than conventional beams without geogrid layer. So, the geogrids layer offer great enhancements to concrete properties and performance from the first cracking load, load-deflection response, reduce the cracks width and number and ultimate strength of tested in comparison to the conventional beams.

This paper presents the mechanical properties of effect of geogrid on concrete for stability, erection of steep slopes, roadway bases, retaining walls, and foundations.. The test programme involved the preparation of normal strength concretes with and without geogrid. The test results indicated considerable increase in compressive and flexural strengths. It was found that the maximum applied load for cubes with geogrid layer were higher than conventional cubes without geogrid layer under the same conditions, while, the deflection values for cubes with geogrid layer was lower than conventional beams without geogrid layer. That the shear strength is critical compared to the combined moment and axial thrust and the maximum rubber content was 17% max for rubberized concrete.

From experiments we can see that when geogrid is applied to the concrete, it reduces the movement in the concrete particles and increases the stability and provides a better grip to the concrete.

III. METHODOLOGY

1. COLLECTON OF RAW MATERIALS

CEMENT – CONFIRMING TO IS 8112-1989 OPC OF GRADE 43 WAS USED IN THIS EXPERIMENT. CEMENT IS A BINDING MATERIAL USE IN CONSTRUCTION TO BIND OTHER MATERIALS LIKE COARSE AND FINE AGGREGATE.

a. Cement – Confirming to IS 8112-1989 OPC of grade 43 was used in this experiment. Cement is a binding material use in construction to bind other materials like coarse and fine aggregate.
b. Geogrid- geogrid material is to be accumulated for the tests
c. Cube moulds- cube moulds are required for formation of concrete cubes

2. LABORATORY TESTING

Following tests will conduct in lab viz.

i. Compressive strength test-

Compressive Strength of the concrete is a measure of the concrete's ability to resist the load which tend to compress it. Compressive Strength can be calculated by the failure load divided by the cross sectional area resisting the load.

ii. Flexural test-

Flexural test evaluates the tensile strength of concrete indirectly. It tests the ability of unreinforced concrete beam or slab to withstand failure in bending. The results of flexural test on concrete expressed as a modulus of rupture which denotes as (MR) in MPa or psi.

iii. Permeability test-

Water permeability test determines the resistance of concrete against water under hydrostatic pressure. Therefore, the water permeability test determines the true resistance of concrete against the penetration of water under hydrostatic pressure.

iv. Workability of concrete-

Slump test measures the consistency of fresh concrete before it harden. To find out the workability of fresh concrete, slump test is conducted.

EXPECTED OUTCOME

The expected outcome was noted that, the load deflection curve for geogrid layer were stiffer and the percentage of stiffening was increased with increase of the flexural reinforcement ratio. The maximum applied load with geogrid layer were higher than conventional without geogrid layer under the same conditions, while, the deflection values for cubes with geogrid layer was lower than conventional cubes without geogrid layer. The first crack load of cube with geogrid was greater than conventional cube without geogrid layer. So, the geogrids layer offer great enhancements to concrete properties and performance from the first cracking load, load-deflection response, reduce the cracks width and number and ultimate strength of tested in comparison to the conventional beams.

From the load deflection curves for tested specimens with geogrid layer were stiffer and the percentage of stiffing was increased when the flexural reinforcement ratio had been increased.

The maximum applied load for concrete cubes with geogrid layer was increased to 60%, and 80% when the flexural ratio were increased from (0.0124 to 0.0263) respectively, in comparison to the reference, on the other hand the ultimate load capacity for concrete cubes without reinforcement were increased to 75%,when the geogrid layer had been added. So, it was noted that the maximum applied load for cubes with geogrid layer was higher than other conventional cubes without geogrid layer at same.

FUTURE SCOPE

This research indicates that there is a great potential for utilization of geogrid at different types of soil for better stability.

Geogrid can be used to provide grip to steep slopes for better compressive strength of concrete.

The effect of different sizes should be study in future.

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Application Of Geo-Composite Material For Ground Improvement

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***Abstract*— Geotechnical engineering is one of the vast and important domains for the structural stability point of view. So, in that for dealing with the weak soil enormous approaches are available with us. One of them is the soil reinforcement in which provision of geosynthetic material is made by considering different engineering and strength parameters like bearing capacity, shear strength, etc. of weak soil. Further to get deeper into it, currently there are various methods available to achieve the required parameters for the soil based on the geosynthetic material. One of Geosynthetic material is geocell which is having a honeycomb like pattern, which is beneficial such that it will provide a confinement for the soil mass and thus enhance the properties of the soil. Based on the resources and type of structure and soil, the entire system can be analyzed using FEA approach which is possible by means of various software. Further to our project we have decided to proceed with Ansys software. Analysis of the model will be carried out by considering the phenomenon of soil prestressing. In continuation with the project, we have initiated by preparing a model of an isolated footing which is embedded in the soil. Furthermore, we will be examining the structure by performing various iterations and establishing a relationship between soil and geosynthetic material to achieve the expected outcome.**

Keywords*— *Soil Reinforcement, Geotechnical, Geosynthetic, FEA, ANSYS

I. INTRODUCTION

Historically, major developments in structural engineering have only been possible because of parallel developments in the technology of construction materials. Larger and more elaborate structures became possible as we went from using wood to building stone to concrete to reinforced concrete and most recently to pre - stressed reinforced concrete. The materials of geotechnical engineering are soil and rock, it is difficult to think of similar parallel developments in geotechnical construction and earthen materials in this field. Probably the best example of a parallel development between material and the construction application is soil reinforcement. In a direct analogy with reinforced concrete, steel and polymeric materials provide tensile resistance and stability to soils that have low to no tensile strength. Polymeric reinforcement materials are a subset of a much larger recent development in civil engineering materials such as geosynthetics. Geosynthetics are planar products manufactured from polymeric materials (the synthetic) used with soil, rock, or other geotechnical - related material (the geo) as part of a civil engineering project or system. Since the total cost of the construction is at least four or five times the cost of the geosynthetic itself, the impact of these materials on civil engineering construction is very large indeed. In many cases, the use of a geosynthetic can significantly increase the safety factor, improve performance and reduce costs in comparison with conventional design and construction alternates.

1.1 DEFINATION AND TYPES

A geotextile is a permeable geosynthetic made of textile materials. Figure 1 indicates a geo- textile material laid on soil.

Fig 1. Geotextile

Geo- grids are primarily used for reinforcement; they are formed by a regular network of tensile Elements with apertures of sufficient size to interlock with surrounding fill material.

Fig 2. Geogrid

Geo- membranes are low permeability geosynthetics used as fluid barriers

Fig 3. Geomembrane

Geocell is a three dimensional, polymeric, honeycomb like structure of cells interconnected at the joints that provide effective confinement of the encapsulated soil against being pushed away from the region under loading. The filled cells being interconnected, the panel acts like a large mat that spreads the applied load over an extended area leading to an improvement in the overall performance.

Fig 4. Geocell

Geotextiles and related products such as nets and grids can be combined with geomembranes and other synthetics to take advantage of the best attributes of each component. These products are called geo composites, and they may be composites of geotextile - geonets, geotextile - geogrids, geotextile - geomembranes, geomembrane - geonets, geotextile - polymeric cores, and even three dimensional polymeric cell structures. There is almost no limit to the variety of geo- composites that are possible and useful. Figure 5 depicts a geo- composite material made up of geo- cell and geo- membrane.

Fig 5. Geo composite

1.2 INTRODUCTION TO ANALYSIS

Ansys develops and markets engineering simulation software for use across the product life cycle. Ansys Mechanical finite element analysis software is used to simulate computer models of structures, electronics, or machine components for analyzing the strength, toughness, elasticity, temperature distribution, electromagnetism, fluid flow, and other attributes. Ansys is used to determine how a product will function with different specifications, without building test products or conducting crash tests. For example, Ansys software may simulate how a bridge will hold up after years of traffic, how to best process salmon in a cannery to reduce waste, or how to design a slide that uses less material without sacrificing safety.

Most Ansys simulations are performed using the Ansys Workbench system, which is one of the company's main products. Typically, Ansys users break down larger structures into small components that are each modeled and tested individually. A user may start by defining the dimensions of an object, and then adding weight, pressure, temperature and other physical properties. Finally, the Ansys software simulates and analyzes movement, fatigue, fractures, fluid flow, temperature distribution, electromagnetic efficiency and other effects over time. Ansys also develops software for data management and backup, academic research and teaching.

Further are the snap - shots of Ansys software interphase.

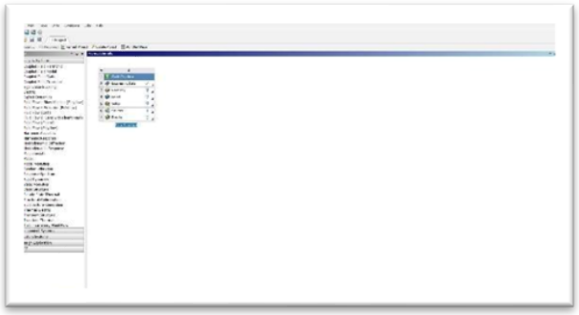

Fig 6. Interphase of Ansys Workbench

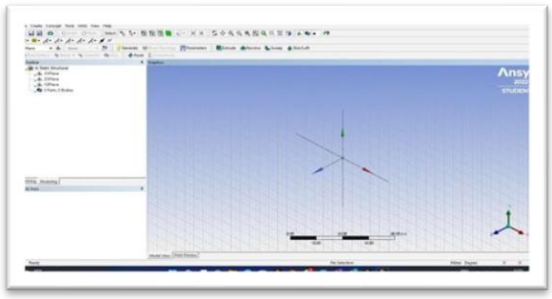

Fig 7. Interphase of Ansys Design Modeler

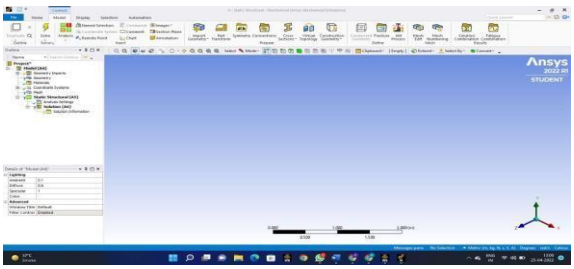

Fig 8. Interphase of Ansys Mechanical

II. LITERATURE REVIEW

Abu Farasakh et.al (2006). Various reinforcements have been used to improve the tensile capacity of soils in many soil structures, especially in the construction of reinforced earth walls, reinforced slopes, embankments on soft soils, and foundation soils. The design of these structures requires the evaluation of interface friction between the soil and reinforcements. The use of reinforcements provides additional shear stress in the soil mass through the tensile force in the reinforcement, which increases the strength of the soil - reinforcement mass, reduces the horizontal deformations, and thereby increases the overall stability of the structure. The increasing interest in the use of geosynthetics in reinforced soil structures has led to the development of different testing procedures to evaluate their interaction parameters. The soil–geosynthetic interface parameters can be evaluated by using either large direct shear tests or pullout tests.[1] Michael T. Adams. Et. al. (1997). The Paper describes about large model spread footing load test on Geosynthetic Reinforced Soil foundation. In this Paper, 34 different model test was performed on strip footing of large scale comparatively. Load test was carried out on three categories of soil - Unreinforced soil, Reinforced Soil by geogrid and Reinforced Soil by Geocell. At last the result were discussed on various strength parameters. [2]

Anoop Bhardwaj. Et. al. (2019), The current study is an attempt to find out the behavior of geogrids when placed at the interface of the ballast and thegranular soil when the formation is subjected to extreme stresses because of the high speed or heavy axle trains.[3]

Kuo - Hsin Yang et.al (2019) had described about the geosynthetic reinforced foundation across a normal fault by modern digital image techniques. A series of model tests on GRS foundations acrossa normal fault were performed to evaluate the performance of the reinforced foundations as a mitigation measure for surface faulting hazards. [4]

S.K. Das et.al (2015). The present paper aims to examine the effect of prestressing geosynthetics and the effect of adjacency of footing on Unreinforced (UR), Geogrid Reinforced (GR) and Prestressed Geogrid Reinforced (PGR) soil on the load bearing pressure and settlement characteristics of soil using software PLAXIS 3D. Ina nutshell, it can be said that prestressing the geotextile possess a great potential to be used in the field of geotech - nical engineering especially ground improvement techniques. Though thereis certainly a need for an extensive study to be done before using the concept in the field, but this simple method can put forth a cost effective yet robust method of ground improvement in the near future. Prestressing the geogrid layer enhances the load bearing capacity to a great extent. The bearing ca - pacity improved by about 300 to 500 % with re - spect to UR soil whereas it improved by about 200 % with respect to conventional geogrid reinforced soil.[5] Dhatrak A. I. et.al (2014). This paper mainly investigates a series of laboratory scale bearing capacity tests carried out on multiple prestrssed reinforcement layer on model square footing. The investigation parameters are the bearing capacity improvement, magnitude and direction of prestressing force. The addition of prestress to geogrid reinforcement results in significant improvement in the load carrying capacity and settlement response of the prestressed reinforced geogrid sand. Improvement in load bearing capacity is found to be more with biaxial prestressing than uniaxial prestressing. A series of load tests were conducted on the model footing, the primary purpose of which was to evaluate the effect of prestressing the geogrid on the settlement behavior of footing resting on the geogrid - reinforced sand bed. The parameters investigated include the settlement of the model footing, the bearing capacity ratios. The improvements in settlement behaviour and loadbearing capacity of a geotextile - reinforced sand foundation were investigated using experimental methods. The physical model test with single and double layer of prestressed geotextile as reinforcement was developed.[6] Ahmed M. Eltohamy et.al (). In this paper, an experimental and numerical study was adopted to investigate the effect geogrid soil reinforcement prestressing on the pressure settlement relation of sand bed supporting a strip foundation. The studied parameters include foundation depth and pre - stress ratio for the cases of one and two pre - stressed reinforcement layers. The study reflected that pre - stressing of soil reinforcement resulted in a marked enhancement in reinforced bed soil stiffness compared to the reinforced soil without pre - stress. The best benefit of pre - stressing reinforcement was obtained as the overburden pressure and pre - straining ratio increase. Pre - stressing of double reinforcement topmost layers results in further enhancement of stress strain relation of bed soil. The effect of pre - stressing of soil reinforcement on the pressure settlement relation of strip footing was investigated by an experimental and numerical analysis. Soil geogrid reinforcement without pre - stressing was insignificant in improving stiffness of bed soil for relatively shallow foundation depth of down to one time footing depth. Pre - stressing of geogrid reinforcement significantly improved bed soil stiffness. Pre - stressing of reinforcement results in increasing interaction between reinforcement and surrounding soil resulting in higher axial force carried by reinforcement.[7]

S.M. Haeri et.al. (2000) carried out laboratory triaxial compression tests in order to determine the stress - strain and dilation characteristics of geotextile reinforced dry beach sand. The mechanical behavior of the composite material was investigated through varying the number of geotextile layers, type of geotextile, confining pressure, and geotextile arrangement. In order to study the effect of sample - size on the results, tests were performed on samples with two different diameters. The results demonstrated that geotextile inclusion increases the peak strength, axial strain at failure, and ductility. Failure envelopes for reinforced sand were observed as bilinear or curved and bulging between layers was detected in reinforced samples which failed. [8]

Hana Jie et.al (2015). Concrete, asphalt pavements, and ballast are removed during the re construction of existing roads and have been increasingly recycled as aggregates for the construction of roadways. Due to existence of asphalt, cement, and fines, mechanical properties of recycled aggregates may not be sufficient for load support. They may also have long - term durability problems. Geosynthetics have been used to improve mechanical properties and long -

term durability of recycled aggregates. This paper reviews recent research work on the use of geosynthetics to stabilize recycled aggregates in roadway construction and summarizes the main findings on permanent deformation, creep deformation, degradation, stress distribution, and/or crack propagation.[9].

Regarding to the different types of geosynthetics and practical applications, all of this are well mentioned by R.D. Holtz (2001). [10]

J.Jayamohan et.al (2015). This paper presents an analytical model to predict the improvement in bearing capacity of a reinforced granular bed (RGB) overlying weak soil due to prestressing the geosynthetic reinforcement. The values of bearing capacity ratio predicted by the analytical model are compared with results from a series of laboratory scale bearing capacity tests carried out on model square footings. Finite element analyses are also carried out, using the program PLAXIS, to study the effect of prestressing the reinforcement. The laboratory scale tests are carried out for two thicknesses of granular bed, i.e. equal to the widthof the footing and equal to twice the width of footing. The magnitude of prestressing force applied to the reinforcement is equal to 1%, 2% and 3% of the tensile strength of geosynthetics reinforcement. Prestress is applied both uniaxially and biaxially and the results are compared. The addition of prestress to geosynthetic reinforcement resulted in significant improvement in the load carrying capacity and settlement response of the improved ground. The results obtained from the proposed analytical model are in reasonably good agreement with results obtained from experimental studies and finite element analyses. [11]

G. Madhavi Latha et.al. (2006) had showcased the effects of reinforcement form on strength improvement of geosynthetic ‐ reinforced sand through triaxial compression tests. In this experiment, three types of geosynthetics ‐ geotextile, geogrid, and polyester film are used for reinforcing sand in layer form. Two types of geosynthetics ‐ geotextile and polyester film are used in tests on geocells. Among the three forms of reinforcement, cellular form of reinforcement is found to be more effective in improving the strength than discrete fiber form. All reinforced samples exhibited improved stress ‐ strain response compared to unreinforced sand. Among the planar and cellular forms of reinforcement, cellular reinforcement is found to be more effective in improving the strength considering the low tensile strengths of the seams. The stress ‐ strain curves for geocells at all confining pressures are found to be almost flat after the peak is reached unlike in case of other forms, where post peak strength loss is observed.[12]

G. Madhavi Latha et.al (2007) had showcased a numerical model on the embankment encased by geocell at the base in horizonal position and generated a valuable outcome regarding the aspect ratio of more than 1.0, positive effects of granular soil for filling onto the geocells and increase in the depth of the foundation for the parametric finite element analysis.[13]

A Laboratory evaluation of the behavior of a geotextile reinforced clay was carried out by R. Noorzad et.al. (2010) to evaluate the behaviour of cohesive soil reinforced with a geotextile, 144 unconfined and 72 unconsolidated ‐ undrained (UU) triaxial compression tests were conducted. The results provide evidence that as the moisture content increases, the peak strength of both the reinforced and unreinforced samples decreases and the axial strain at failure increases. For soils with low plasticity indices the main cause of the increase in the strength is the increase in the cohesion of the reinforced sample. However, in soils of higher plasticity index, as the number of geotextile layers increases, the internal friction angle of the reinforced samples increases. By conducting unconfined and triaxial compression tests on unreinforced and reinforced clays the results obtained were quite eminent and satisfactory.[14]

As experimented by Taesoon Park et.al. (2005) for enhanced performance of reinforced soil walls by the inclusion of short fiber, the paper presents the effects of the inclusion of short fiber in sandy silt (SM) soil on the performance of reinforced walls. The inclusion of short fiber in soil is expected to increase soil strength and improve stability when it is used as the backfill material. Short fiber of 60mm length was used and the mixing ratio of the fiber was 0.2% by weight of the soil. The FEM was used to analyze the influence of the reinforced short fiber on reinforced walls. The vertical and horizontal earth pressure, displacement and settlement of the wall face were examined. These results were compared to the measured results from two full ‐ scale tests. It is shown that use of short fiber reinforced soil increases the stability of the wall and decreases the earth pressures and displacements of the wall.[15]

M.N.A. Raja et.al (2021), in their paper had predicted settlement of GRSF (Geosynthetic ‐ reinforces soil Foundation) based on the combination of evolutionary algorithms i.e., GWO (Grey wolf Optimization) & ANN (Artificial Neural Network) together abbreviated as ANN ‐ GWO model. For inputting the data, numerical model was prepared in the PLAXIS ‐ 3D Tunnel for the footing underlaid with geogrid. Further, the comparison was made in between the forecasted AI model and actual model settlement.[16]

K. S. Sherin. Et. al. (2017). A series of the experimental testing program was carried out to determine the influence of cell geometry and multi ‐ layer system on the behaviour of a square footing resting on geocell reinforced sand. Geocell fabricated from PVC polymer sheet was used for the experimental investigations. Geocells made of three different PVC polymers of varying thickness and strength were used for testing purpose. Laboratory plate load tests were conducted to determine the pressure– settlement response of reinforced soil for different geometric parameters like diameter, height, depth of placement, and shape of the geocell. [17]

S.N. Moghaddas Tafreshi. Et. al. (2010). The Paper highlights a brief comparison between the Geocell on the sand and the coplanar form of geotextile reinforcement in term of bearing for the strip footing. The series of Laboratory test were performed. Reinforcement Parameters such as width, height, Number of reinforcement layers, etc were discussed. On the whole, the Results indicate that, for the same quantity of geotextile material, the geocell reinforcement system behaves much stiffer and carries greater loading and settles less than does the equivalent planar reinforcement system. [18

As experimented and implicated by Fumio Tatsuoka et.al (1997) for the GRS bridge abutment, they have identified that the preloading along with the prestressing of the soil by geosynthetic will have a significant improvement over a structure. This mechanisms of preloading of tie road and prestressing of geosynthetic will reduces the plastic

deformation and thus eventually increases the stiffness of the soil.[19]

Temel Yetimoglu. Et. al. (1994). The paper presents a brief on the bearing capacity of rectangular footing on geogrid reinforced soil. The entire research is conducted in two parts viz., Laboratory test and analysis. In laboratory test, more than 100 load test were carried out on rectangular footing model different geogrid reinforcement parameters. Further for analysis part, they have used finite element analysis by computational program - DACSAR (deformation analysis considering stress anistrophy and reorientation). And discussed various parameters and outputs that are inferred from the both laboratory test and FEA. [20]

Geosynthetics have been successfully used to fulfill a number of functions that contribute significantly to the good performance of roadways. They include the functions of separation, filtration, reinforcement, stiffening, drainage, barrier, and protection. One or more of these multiple functions have been used in at least six important roadway applications. The applications include the migration of reflective cracking in asphalt overlays, separation, stabilization of road bases, stabilization of road soft subgrades, and lateral drainage. This paper illustrates the mechanisms as well as key advances in each one of these multiple applications. [21]

OBJECTIVES

- Ground improvement techniques to improvethe load carrying capacity.
- Reduce the settlement of the soft foundation bed.
- Improve the bearing capacity and settlement performance of shallow foundation.
- Research on various geosynthetic materialsfor soil reinforcements.
- Learning and implementation of model usingANSYS software (FEA Approach).
- Approach of soil prestressing.
- Fulfilling the need of various complex structure in the domain of geotechnical engineering.
- Avoiding mishaps due to failure of soil by land sliding or settlement of soil.
- Investigation of various soil properties with the combined effect of geosynthetic materials and foundation soil.
- Achievement of economic and durable structure.

METHODOLOGY

4.1 Study on Soil Reinforcement

Every location has different properties or type of soil. Thedesign of the structure to be built depends on the composition of soil. Hence, where soil is not stable to withstand heavy structures, soil reinforcement is necessary. Referring to our project we will be using geosynthetic material as a ground improvement technique for weak / loose soil.

4.2 Selection of Material and Type of Geosynthetic

As mentioned in Introduction, the various kinds of geosynthetic applications are available for ground improvement technique. With respect to this, we will be using the part of geo - composite by means of various combinations. Furthermore, we will also perform research for the selection criteria regarding geosynthetic material i.e. conventional or naturally polymeric material.

Currently we are experimenting on geo-grid material and following are the properties:

Raw Material	Polypropylene
Aperture Type	Triaxial
Thickness	1.1 mm
Tensile strength at 5% strain	300kN/m

4.3 Test on Geosynthetic Material as well as Soil:

For determining various physical and chemical properties of a selected geosynthetic material, accordingly we performed various tests to find out the correctness of material. Parallelly, we also conducted required tests on soil on which the soil reinforcement will be applied to check the SBC of the soil.

1. Tests Conducted on Soil

   i. Standard Proctor Test Results:

Before Soil Reinforcement: -

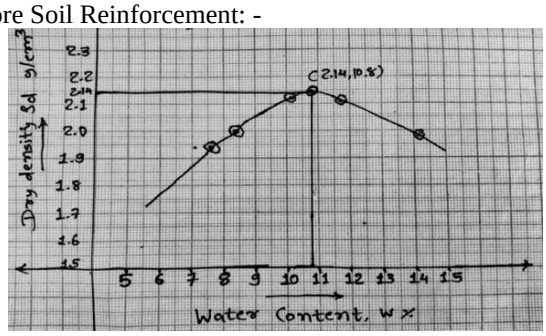

Fig 9. Dry density versus moisture content

The optimum moisture content of given soil sample from the compaction curve was 10.8 %. The maximum dry density of given soil sample from the compaction curve was 2.14 gm/cc.

2. Liquid Limit Test

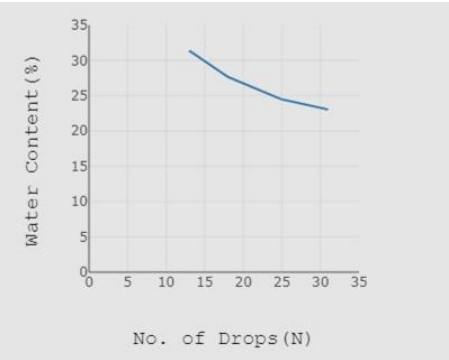

Fig 10. Water content versus No. of drops

Figure no. 10 shows the graphical representation of the plastic limit test results conducted by our group. After conducting the test, the Liquid Limit, which we obtained, was 28.

4.4 Application of Soil Reinforcements

After conducting all the required tests on geosynthetic material as well as soil, we will further proceed to the application of soil reinforcement to a sub‐structure and comparison between soil w/o geosynthetic reinforcement and soil with geosynthetic reinforcement. This way we would achieve the results of better soil bearing capacity.

4.5 Analysis with Software

In concern to our project, we have initiated the analysis using Ansys software for an isolated footing. Figure no. 11 represents the model prepared by us on ANSYS. Initially, we have assumed engineering (material) properties, which are required while preparing the model.

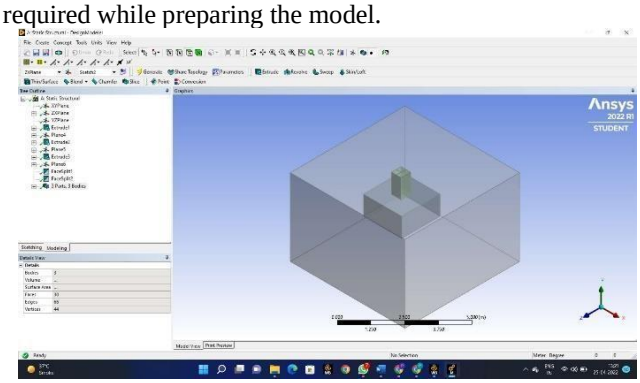

Fig 11 Model of an Isolated Footing

4.6 Costing

The cost of the sub structure retained on a loose soil is comparatively high because of its complex foundation design and the output that we have achieved from our project has low cost for the same sub structure, then we can achieve economic structure.

The costing of the soil improvement also varies on the geosynthetic material which is to be used i.e. whether it is natural or conventional.

CONCLUSION

Further with reference to the summary of the literature reviews or current requirements considering the ground situation and meeting the future requirements, the application of soil reinforcement is practically possible.

As mentioned in the methodology, we have prepared a model and will perform its analysis by applying the suitable loads and boundary conditions in our further tasks. The engineering data which we have assumed till date will be defined by performing the appropriate tests.

In the future scope we will apply the pre- stressing system along with the soil reinforcement for the entire structure.

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Light Weight Concrete Using Building Debris

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***Abstract*— One of the most vastly used material for construction in this world is concrete. At present, population growth is at its peak which is resulting in the remarkable increase in the demand for various construction mechanisms like domestic buildings, bridges, dams, roads etc. Due to this it is getting very difficult to manage the resources required for the construction process. Hence researchers are finding out various ways to deal with the shortage of resources by discovering alternative sources to meet the requirements of the present. The key motive of this project work is to analyze the strength of concrete incorporating the recycled aggregate and industrial waste. The objective of this research is to discover up to what proportion the natural coarse aggregate can be substituted by recycled coarse aggregate and industrial waste (plastic waste) in the concrete mix. Also, the objective of this project is to check whether it is feasible to reduce the weight of the concrete block by using the above materials. This project work is focused mainly on the usage of recycled coarse aggregate and plastic waste. Several tests were carried out to determine the compressive strength with and without recycled aggregates. Natural coarse aggregates in concrete were substituted with various proportions of crushed concrete coarse aggregates and plastic waste.**

Keywords*— *Natural coarse aggregate, Recycled coarse aggregate, Plastic waste, Compressive strength

I. INTRODUCTION

Advancements are on it's top around the world in the field of construction. There are sundry bridges, deep dihydrogen monoxide structures, roads, empyrean- scrapers, and underground tunnels everywhere throughout the world. To suit incipient structures, numerous structures worked in the precedent hundreds of years are being demolished and crushed because of theirbreaking point of life expectancy, unacceptable position in a conventionally developing city, and harmed condition established by natural events. The devastation of structures is engendering concrete rubbles and triggering ecological issues because of impromptu disposal and shortage of landfill sites. Aggregates are culminating up progressively infrequent in metropolitan areas. That implicatively insinuates that aggregates mustbe conveyed from longer disseverments into the urban regions, which is the place most buildings are built. Reutilizing demolition waste was initially carried out after the Second World War in Germany. Ever since then, numerous research work is carried out in different countries which provided felicitous evidence thatconstruction waste can be incorporated in engendermentof incipient concrete. Construction and Demolition (C&D) waste include damaged concrete, broken pavement, or bricks from buildings. In this way, Recycled Aggregate (RA) could be extracted from the eradication of buildings, concrete roadbeds, airport runways, and bridge fortifies. Concrete composed of such aggregates is kenned as Recycled Aggregate Concrete (RAC). [1]

II. LITERATURE SURVEY

Limbachiya et al. (2004) In this research work, the researchers carried out an experiment in which they replaced the natural aggregates with 100% coarse recycled aggregates. They observed the effect of this replacement on a range of engineering and durability properties. They also checked whether it can be used for future purposes in various applications in the construction industry. They used cubes of concrete of dimension 100 mm for the test of compressive strength.These casted cubes were left for curing for 28 days in water with a temperature of 20°C. The outcomes demonstrated that the use of 30% coarse RCA doesn'taffect compressive strength, however from there on a gradual reduction with increasing RCA content takesplace. [2]

Song Gu et al. (2009) carried out a research that showed the old mortar particles attached with the aggregates increases the water absorption rate to a great extent as compared to that of natural aggregates. As the replacement rate of RCA increases, the slump and strength decreases. Fly ash can help to enhance the workability of recycled concrete. The strength of concrete does not decrease up to 30% replace of fly ash.[3]

Yong et al. (2009) carried out research on "Utilisation of recycled aggregate as coarse aggregatein concrete". For the experiment, recycled concrete aggregate was used which was derived from specimens that were site-tested. The primary motive of this project work was to utilise recycled aggregate in the concrete production as coarse aggregate. The main emphasis was to determine the possibility of replacement of RCA in concrete. Natura coarse aggregate, natural fine aggregate and RCA were used in this experiment. Replacement of 0%, 50%, and 100% of RCA was done to make the concrete. Also a concrete was produced which consisted of Saturated Surface Dry (SSD). RCA using a similar mix proportion. Concrete with 100% replacement of RCAgave the most critical 7 days and 28 days 'compressive strength of 41.25 MPa and 58.95 MPa respectively. The result showed that the concrete with 50% replacement of RCA gave a compressive strength thatwas very close to that of conventional concrete. [3]

Bhavani et al. (2012) carried out an experiment to observe the performance of recycledaggregate concrete (RAC) as compared to that of concrete consisting naturally occurring aggregates.The mix design that was adopted was M20 and thewater cement ratio was taken as 0.4. The compressive strength of the natural aggregate concrete (NAC) and the concrete so obtained by replacing RAC was examined at 7-days and 28-days. The results show the difference between thecompressive strength of RAC and NAC as average87% in which RAC was lower. Also, another thingthat was observed was that the slump formed was low which can be enhanced by using Saturated Surface Dried (SSD) of RCA. In light of the acquired outcomes the researchers proposed thatitis feasible to use RCA which is extracted from demolition waste as replacement of aggregates to produce a new concrete. Although the strength of recycled aggregate concrete is less than that of NAC, it can be used for various other purposes that has certain applications in the construction industry. [4]

Lee et al. (2012) carried out an experiment to analyse the compressive strength of concrete consisting coarse RA extracted from old concretedebris. The results established that the compressive strength of concrete has not declined. However, the experiment could not confirm that using coarse concrete debris affects the strength ofconcrete. [4]

Etxeberria (2004) conducted a research which gives us an ideaabout the structural behaviour anddurability. These two factors are important to account for while using RCA. Structural behaviourdepends on the percentage of RCA used, and durability depends on the heterogeneity of recycled particles. That is why chemical, physical, and mechanical properties of original coarse aggregatesneed to be identified as well as original fine aggregates present in adhered mortar. The results also showed that density and absorption are affectedby the quality of the adhered mortar, and porosity isaffected by the watercement ratio of the recycled concrete. The particle size as well as the procedureof crushing of concrete debris also influences the amount of mortar adhered. On the other hand,the workability is affected by the use of RCA in condition of dryness. The shape and texture also affects workability. Reduction of water- cement ratio also help to keep the same compressive strength increasing the amount of replacement of coarse RCA, but not in the case of coarse and fine aggregate replacement, which requireshigh cement content to sustain the resistance. [5]

Suryawanshi et al. (2015) focused on compressive strength tests carried out on concrete cylinder samples with dimensions- 150mm(dia.) and 200mm(height). Debris of old concrete was crushed manually with the help of a hammer in thelaboratory from which the RA was extracted. The results showed a gradualdecrease in compressive strength as RA 14 was increased. However,even on replacing 100% RA, the decrease in compressive strength of concrete was found out to be 11%. [6]

Nabajyoti and Brito (2012) carried out a research clarifies that even though plastic is effectively combustible, burning it will discharge poisonous chemicals like harmful dioxins into the atmosphere.Another choice is to store it in landfills. [4]

III. METHODOLOGY

- Data collection
- List of quantity of conventional concretes.

1. For M20 the ratio is 1:1.5:3

Material	Quantity
Cement	10 kg
Sand	15 kg
Aggregate (10 mm)	12 kg
Aggregate (20 mm)	18 kg
Water	5 L

2. For M25 the ratio is 1:1:2

Material	Quantity
Cement	10 kg
Sand	10 kg
Aggregate (10 mm)	8 kg
Aggregate (20 mm)	12 kg
Water	5 L

3. For M30 the ratio is 1:1:3

Material	Quantity
Cement	7 kg
Sand	7 kg
Aggregate (10 mm)	9 kg
Aggregate (20 mm)	12 kg
Water	3.5 L

Now for M25, replacing aggregate and sand by debris
Using 20 % debris in place of aggregate

Material	Quantity
Cement	10 kg
Sand	10 kg
Aggregate (10 mm)	8 kg
Aggregate (20 mm)	8 kg
Water	5 L
Debris	4 kg

Using 20 % debris in place of aggregate and10% in sand

Material	Quantity
Cement	10 kg
Sand	8 kg
Aggregate (10 mm)	8 kg
Aggregate (20 mm)	8 kg
Water	5 L
Debris	6 kg

- Data analysis

It is a process of inspecting, cleansing, transforming, and modelling data with the goal of discovering useful information, suggesting conclusions, and supporting decision making. Data analysis has multiple facets and approaches, encompassing diverse techniques under a variety of names, in different business, science and social domains. In this process we have used the approximate method to calculate the amount ofcement, water, sand, aggregates and debris required for our project

- Testing of physical properties of materials

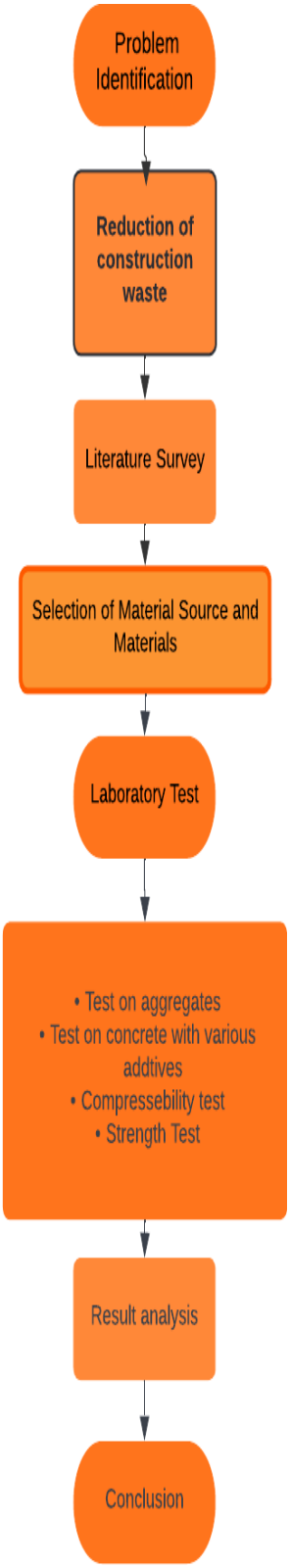
- Crushing of debris using crusher for replacingaggregate and sand.
- Measuring the weight of debris using weighingscale
- Mixing the raw materials in the conventional ratio and prepare the concrete blocks.
- Replacing the debris in place of aggregate andsand.
- Preparation of concrete block and testing thecompressive strength of the block for comparison.
- Test for cement.
  - Consistency test
  - Specific gravity of cement
- Water absorption test for aggregate.
- Mixing of concrete for cube test.
- Cube sampling

- Final Product

Fig.1.Concrete cubes in molds

Fig.2.Recycled Aggregate Concrete Cubes

IV. FLOWCHART



III. RESULT AND DISCUSSION

The compressive strength of M30 design mix concrete comprising Recycled aggregate has a significant decrement for high volume replacement of Recycled coarse aggregate. Hence high-volume replacement is not advisable. 30% replacement of Natural coarse aggregate (NCA) with Recycled coarse aggregate (RCA) is advisable. There was a significant reduction in compressive strength when replacement with plastic waste was done.This was because of the low bonding between plastic waste and cement paste.

10% replacement of aggregates with plastic waste is advisable.

IV. CONCLUSION

There would be a greater chance if we had used admixtures to obtain light weight concrete. But this in turn increases the cost of production of light weight concrete. Therefore, we only managed to make concreteusing building debris. Light weight concrete can be achieved using admixtures such as fly ash, silica fumes, but this we have kept for further scope and study. Light Weight Concrete can be further achieved for M25 and M30 grade by using specific admixtures in proper proportions.

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Evaluation of Plastic Waste Modified Binder for Road Construction

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***Abstract*— The waste plastic and its disposal is a major threat to the environment, which results in pollution and global warming. The utilization of plastic waste in bituminous mixes enhances its properties and also its strength1. In addition it will also be a solution to plastic Disposal & various defects in pavement viz., pot holes, corrugation, ruts, etc. the waste plastic Used are poly- ethylene, poly-styrene, poly-propylene. The waste plastic is shredded & coated over aggregate & mixed with hot bitumen and resulted mix is used for pavement construction. This will not only strengthen the pavement and also increases its durability. The titanium-di-Oxide is used as a smoke absorbent material, which will absorb the smoke from the vehicles. This innovative technology will be boon for Indian hot-humid climate. It's economical and Eco-friendly. In this paper, we have discussed about the soil properties to be considered in Design of pavement, pavement design, process of construction flexible and plastic- smoke Absorbent pavement.**

INTRODUCTION (*HEADING 1*)

Plastic is the most widely used material in the present times. It is light in weight, moisture resistant, flexible and very inexpensive. These qualities increase our propensity towards Plastic and hence making its use very common. Today plastic is used in every vital sector of the economy, ranging from agriculture to automobile, electronics, construction, etc. It has revolutionized all spheres of life. But this plastic ultimately becomes a waste. It is a common site both in urban and rural areas to see plastic wastes littering the roads. It forms the major portion of the total municipal solid wastes (MSW). Tons of plastic wastes which include polyethenes, cups, bags, etc. are discarded every year, polluting land, rivers, seas, oceans, etc. plastic is a non- biodegradable material and it has been found that it can remain on earth for about 4500 years without showing any signs of degradation. Its improper disposal can cause serious health hazards in humans. Based on the present usage scenario of plastics, its complete ban will not be justified; hence we have to find the alternatives to reuse the plastics.

It is estimated that approximately 10 thousand tons per day (TPD) of plastics waste is generated i.e. 9% of 1.20 lacs TPD of MSW in India. The plastic waste constitutes two major categories of plastics; (i) Thermoplastics and (ii) Thermoset plastics. Thermoplastics, constitutes 80% and thermoset constitutes approximately 20% of total postconsumer

plastics waste generated in India. The Thermoplastics are recyclable plastics which include; Polyethylene Terephthalate (PET), Low Density Poly Ethylene (LDPE), Poly Vinyl Chloride(PVC), High Density Poly Ethylene (HDPE), Polypropylene(PP), Polystyrene (PS) etc. However, thermoset plastics contains alkyl, epoxy, ester, melamine formaldehyde, phenolic formaldehyde, silicon, urea formaldehyde, polyurethane, metalized and multilayer plastics etc. The use of plastic materials such as carry bags, cups, etc. is constantly increasing. Nearly 50 to 60% of the total plastics are consumed for packing. Table 1 provides the data on total plastics waste consumption in India during last decade.

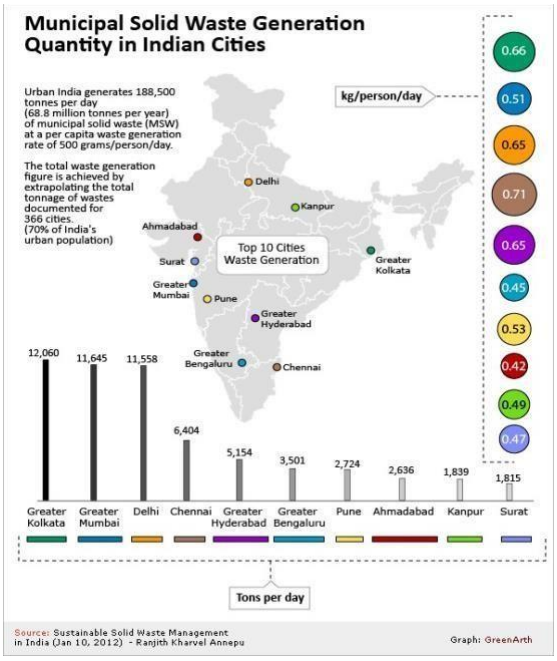


Fig.1: Top 10 cities waste generation in India. [10]

We have to take some practical steps at the ground level in order to control the menace of plastic waste.

Studies have shown that plastic waste after proper process can be used in the construction of bituminous pavements.

Such pavements show enhanced properties and increased life spans, thus making the road construction economical and solving the environmental problem at the same time.

Fig. 2: Waste plastics

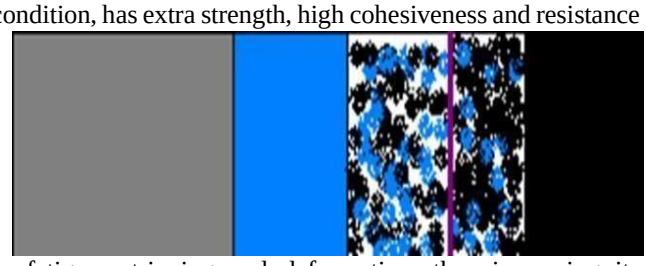
LITERATURE REVIEW

The plastic wastes have been utilized in the construction of pavements in India since a decade now. It is seen that the use of plastics enhances the rheological properties of bitumen and hence that of the pavement. Considerable research has been carried out to determine the suitability of plastic wastes in the construction of bituminous pavements. Dr. R. Vasudevan has stated in his works that the use of plastic in bitumen improves the binding properties of bitumen. Prof. C.E.G Justo states that addition of 8% percent by weight of processed plastic is desirable in saving 0.4% bitumen by weight of mix as it improves the stability, strength, life and other desirable properties of bitumen. Dense bituminous macadam with recycled plastics, mainly low density polyethylene (LDPE) replacing 30% of 2.36 – 5 mm aggregates, reduced the mix density by 16% and showed 250% increase in Marshall Stability. Zoorab and Suparma stated that the use of recycled plastics in plain bituminous concrete mixes increases its durability and fatigue life. D. N little further worked on the effect of plastics on bitumen and found the resistance to deformation of asphaltic concrete modified with low density polyethylene (LDPE) was reasonably improved. Studies have showed that the use of recycled polyethylene in bituminous pavement mixes reduces the permanent deformation in the form of rutting andthe low temperature cracking of pavement surfacing. Bindu et al studied the effects of shredded plastic in stabilizing the stone mastic asphalt (SMA) mixture in flexible pavements.

PLASTIC AGGREGATE BITUMEN

INTERACTION MODEL

The plastic waste in the shredded form is sprayed and spread over hot aggregates in such a way that these aggregates get coated with a thin layer of molten plastic. The coated plastic remains in . softened state for a temperature range of 140oC to 160oC. The hot bitumen (160oC) is added and spread over these aggregates. At this temperature both the coated aggregates and bitumen remains in liquid state and are capable of diffusing easily at the interface. This process is further helped by the increase in the contact area. The observations may be explained as follows. Plastic is basically the polymer having long chain hydrocarbons and bitumen is a complex mixture of ashphaltenes and maltenes which are also long chain hydrocarbon. The plastic layer has already bonded with aggregates. When bitumen was mixed with plastic coated aggregate a portion of bitumen diffuses through the plastic layer and binds with aggregate thus forming the internal three dimensional linked networks between plastic (polymer molecules) and bitumen making the bond strong. [7] Hence, the pavement so constructed can withstand extreme weather condition, has extra strength, high cohesiveness and resistance



to fatigue, stripping and deformation, thus increasing its lifespan.

Fig.3: Plastic aggregate bitumen interaction model for

The Plastics waste coated aggregate bitumen mix. [11]

SCOPE OF PROJECT

To eradicate potholes

To minimize the global warming, greenhouse gases and pollution.

The lifespan of the roads can be increased.

Eco-friendly in nature

RESEARCH METHODOLOGY

A. Materials used.

The materials used for carrying out the present research are:

1. Aggregates
2. Bitumen
3. Plastic waste

1. Aggregates

Aggregates form the major portion of pavement structure and they form the prime materials used in pavement construction. Aggregates have to bear stresses occurring due to the wheel loads on the pavement and on the surface course. They also have to resist wear due to abrasive action of traffic. These are used in pavement construction in cement concrete, bituminous concrete and other bituminous constructions and also as granular base course underlying the superior pavement layers. Therefore the properties of the aggregates are of considerable significance to the highway engineer. Some of the desired properties of these aggregates are strength, durability, toughness, hardness, etc.

- Test on aggregates

1. crushing test
2. Los Angeles abrasion test
3. Impact test

2. BITUMEN

Bituminous materials used in highway construction are broadly classified into bitumen and tar. Bitumen may further be divided into petroleum asphalt or bitumen and native asphalt. There are different forms in which native asphalts

are available. These are those which occur in a pure or nearly pure state in nature. The viscosity of bitumen is sometimes reduced by a volatile diluents; this material is called cutback. When bitumen is suspended in a finely divided condition in an aqueous medium and stabilized with an emulsifier, the material is known as emulsion. Tar is the viscous liquid obtained when natural organic materials such as wood and coal are carbonized or destructively distilled in the absence of air.

Bitumen is available in various grades and types. To judge the suitability of these binders various physical tests have been specified by agencies like ASTM, Asphalt Institute, British Standards Institution and the ISI. These tests include penetration tests, ductility tests, softening test, flash and fire point tests, viscosity tests, etc.

3. PLASTIC WASTE

The plastic waste such as carry bags, cups, disposables, etc. are shredded in the shredding machine and then sprayed in different percentages over the hot aggregates. The details of the process are given below,

FIG 4: Collection of Waste plastic.

a. Waste plastic shredding:

Shredding is the process of cutting the plastic into small sizes between 2.36mm to 4.75mm with the help of the plastic shredding machine viz. Agglomerater and Scrap Grind

b. Details of Shredding Machine:

For shredding of poly-ethylene "Agglomerater" is used. In this process, plastic wastes are cut in small pieces with the help of rotator blades. The process is completed in about half an hour.

FIG 5: Collection of Waste plastic

The shredded waste plastic was sprayed over the hot aggregate which got coated on aggregate when molted. The extent of coating was varied by using different percentage of plastic. Increase in percentage of plastic increases the properties melting point of the bitumen. Hence, the use of waste plastics for pa of aggregates.

Fig 6: Shredded plastic waste being sprayed over hot aggregates.

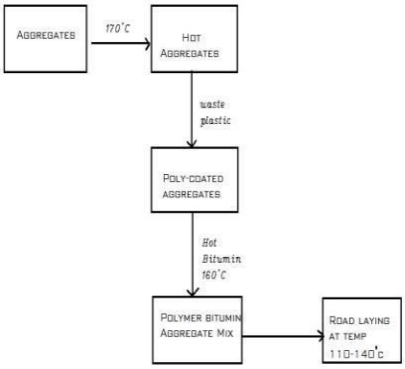


FIG 7: Flow diagram of plastic coated bitumen mix road

ADVANTAGES:

Reduce the need of bitumen by around 10%.

1. Develop a technology which is eco-friendly.
2. Improvements in fatigue life of roads.
3. Increase the strength and better performance of the road.
4. Use higher percentage of plastic waste.
5. The gases released during traffic conditions are absorbed by smoke absorbent.

DISADVANTAGES:

1. Toxic present in the co-mingled plastic wastes would start leaching.
2. But the presence of chlorine will definitely release HCL gas.

III. CONCLUSION

The generation of waste plastics is increasing day by day. The plastics show adhesion property in their molten state. Plastics will increase the cement is one of the best methods for easy disposal of waste plastics. Moreover plastic is not recyclable and using them in road construction will help in the disposal of these plastic wastes in an eco- friendly manner.

The use of the innovative technology will not only strengthen the road construction but also make it economical as well as increase the life span of roads. Plastic roads will be most feasible for a country like India, where temperature is around 50oC and the heavy monsoons too create havoc, leaving the roads with potholes and ruts. It is hoped that in near future we will have strong, durable and eco-friendly roads that will relieve the earth from all type of plastic waste.

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Experimental Studies on Mechanical Properties of Waste Aluminum Fiber Reinforced Concrete

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***Abstract*— Aluminum electrical wires scrap that are accessible after the devastation of buildings is by and large cleared out unused within the market. It could be a lightweight fabric competent of showing quality properties with a potential for reusability in concrete. The aluminum strands utilized in this work were circled atits close to improve its bond quality with the concrete. This paper appears the results gotten from a test considering on the mechanical properties of aluminum fiber-strengthened concrete to accomplish its perfect fiber volume division. A add up to of three grades of concrete and five distinctive fiber volume divisions at (0, 0.5, 1, 1.5,and 2%) were consolidated in this consideration. After 28 days of curing, the compressive quality and part pliable quality of the concrete examples were decided through research facility tests. Moreover, based on the exploratory results a relapse investigation was performed to foresee the quality of fiber-reinforced concrete utilizing factual displaying based on the test outcome.**

Keywords*— Aluminum, Compressive strength; Split tensile strength; Fibre reinforced concrete; Regression analysis; Strength prediction model

I. INTRODUCTION

Aluminum wires were broadly utilized as electrical wires amid the prior days due to its low fetched and anticorrosive properties which back the special utilize of aluminum in wires. Numerous ancient buildings in India of over a period of 50–60 a long time are being annihilated presently. The sum of aluminum electrical wires scrap got from these pulverized buildings run into a few thousand tons. Rather than dissolving and reusing these aluminum wires, a parcel of them can be arranged for utilize as strands in concrete since the dissolving of aluminum wires scrap and creation into other components will include colossal vitality. India accounts for 18% of utilization of aluminum wires all inclusive taking after China. This moreover shows the plausible utilize of aluminum electrical scrap wires in future. Aluminum scrap is a usable material that can be secured exceptionally effortlessly within the showcase. It is broadly accessible within the frame of refreshment cans, nourishment packs, radiators, wires and different semiconductor sheets etc., which are by and large disposed of without advance re-use. It is without a doubt a well-established reality that the calculative consolidation of filaments of diverse materials improves the characteristics of concrete such as ductility, affect resistance, weariness resistance etc. The utilize of filaments not as it were improves the post-cracking conduct of concrete but moreover give the support, in this manner compensating for the brittleness of concrete by sewing the micro-cracks and the macro-cracks and taking up the ensuing malleable strains acting on concrete (Amziane and Loukili, 1999, Brandt, 2008). Different exploratory investigations has been carried out on the consolidation of steel strands in concrete utilizing diverse fiber volume divisions. In a test conducted utilizing steel filaments in concrete by Mohammadi et al. (2008), the comesabout appeared significantly improved values with regard to compressive quality and part malleable quality. It was seen that the comes about were subordinate to the fiber volume concentration and its perspective proportion as well. There have been thinking about on how scrap steel strands of distinctive geometries from tires might be consolidated in a concrete blend as well, for generation of Steel Fiber Strengthened Concrete (Holschemacher et al., 2010, Sengul, 2016). Aluminum is for the most part considered a light weight and less destructive material than steel. Agreeing to Worldwide Aluminum Founded, there's an evaluated 17 million tons of aluminum scrap collected around the world, which is anticipated to extend to around 21 million by 2020. All through Europe, around 95% of aluminum from vehiclesIn this inquire about, an attempt was made to explore the impacts of aluminum scrap filaments in concrete with distinctive fiber volume divisions. The aluminum strands utilized were given with circles at both of its closes to reach at a craved shape for effective bonding with concrete. The most reason of this ponder was to supply information on the mechanical characteristics of aluminum fiber strengthened concrete, taking into consideration significant concrete and fiber parameters. The relationship between the different fiber fortified concrete parameters has been defined and

compared. In expansion, a scientific show was created for foreseeing theconduct of Aluminum Fiber Concrete (AFC)1 beneath compression and part pressure. .

II. Necessity For Waste Aluminium Fibre Reinforced Concrete

Waste material disposal is considered as a difficult issue to adopt in current world. Waste metal, which has been recognised as a major problem in the environment and resource deficiency, could have important implications in the concrete construction industries. Waste metal utilisation in construction of reinforced cement concrete (RCC) works is immerging in recent time. Construction industries are looking for cost effective structural materials and utilisation of renewable materials.

Metal waste such as chips of tin, still and other metal fragments which is abandoned and spread inthe environment could be utilize as a replacement of traditional steel reinforcement bar in the RCC.

Cementing materials combined with aggregate and reinforcement have great engineering property. Concrete that includes imbedded metal (usually steel) is called reinforced concrete or ferroconcrete. Reinforced concrete was invented in 1849 by Joseph Monier, who received a patent in 1867. Joseph Monier was a Parisian gardener who made garden pots and tubs of concrete reinforced with an iron mesh. Reinforced concrete combines the tensile or bendable strength of metal and the compression strength of concrete towithstand heavy loads. From this point forward, reinforced concrete structure becomes most popular and different scalesof structure have been built with it. Typically, it is called reinforced cement concrete (RCC) where different standard grades of steel bars are used as reinforcement. However, reinforcement can be provided in cement concrete in different ways, such as different types of fibres which can provide thefunctionality of reinforcement in cement concrete. This type of fibre reinforced cement concrete (FRCC) is become morepopular in last two decade. As additional benefits, fibres suchas PE and PVA can possess chemical polarity, which significantly increases the self-healing capacity of cracks due to pre-loading. A little number of fibres, such as 1.5 % is sufficient for processing healing action.

The advantages of aluminium fibre-reinforced concrete include the following :

Strength:

Aluminum Fiber-reinforced concrete has more tensile strength when compared to non-reinforced concrete. The aluminum fiber mixture provides the structure a good support.

Durability:

The aluminum fiber reinforced concrete is durable as it has negligible effects of atmosphere or other gases present.

Impact strength:

It reduces crack growth and increases impact strength. It can handle more load compared to the orthodox reinforced concrete.

Resistance:

As the material is can resist temperature to a higher extent, Fiber-reinforced concrete improves resistance against freezing and thawing.

Fatigue strength:

Reinforcing concrete with fiber increases fatigue strength.

III. Research objective

Increasing the fibre dosage or the aspect ratio enhances the fibre-matrix (concrete) confining property that effectively reduces the transversal deformations which are bound to arise. Thus, the compressive strength of concrete is seen to increase up to a threshold limit of fibre dosage.

However, beyond the threshold fibre dosage limit, fibres have an adverse effect on compaction. At higher fibre dosage, the workability of the concrete is drastically reduced to such a greatextent that even admixtures may not help to reduce the damage. Workability also depends on factors like; cement fineness, aggregate properties, water-cement ratio and the fibre reinforcing index (RI) as shown in Eq.(1) and the fibre-reinforcing index (RI) as shown in Eq. (1). Thus, the results of poor compaction and formation of more honeycombs and voids formations have a detrimental effect on compressive strength athigher fibre dosage.

$$RI = V_f \times \frac{L_f}{\Phi_f} \quad (1)$$

where V_f is fibre volume fraction, L_f is thelength of the fibre

and Φ_f is the diameter of the fibre.

3.1 Strength prediction equation

Regression analysis was subsequently done to develop strength prediction equation, based on the experimental outcomes of 30 AFC specimens. The strength prediction equation proposed through the results in the study account for the interaction of NCmatrix strength with aluminium fibre. The general form of the proposed strength prediction equation is given by Eq. (2),

$$f'_{Model} = A\left(f'c\right)^{\alpha} + BV_f + CV_f^2 \quad (2)$$

where f'c is the 28-day compressive strength of the NC matrix, Vf is the volume fraction and A, B, and C are the regression coefficients.

I. MODERN CONSTRUCTION TECHNIQUE

The fibers obtained from waste materials of the environment areutilized in order to protect natural resources and reduce environmental pollution. The idea of reinforcing concrete by theinclusion of fiber was first advised by Portar in 1910.

Moreover, the works of Romualdi, and Batson (1963) on steel fibers in concrete, and of Biryukovich on the glass fiber reinforced concrete paved a new concept in this subject. The concept of utilizing fibers as reinforcement

material is not a modern concept, fibers have been used as reinforcement since traditional and ancient times. A recent advancement has been made in this subject; waste materials have been used in concrete to improve one of the strength behaviors of the concrete by incorporating fibers in concrete. Inclusion of fibers improves the performance of concrete. Mostof the fibers have high value of elastic modulus and other properties which might have a positive influence on concrete

properties. Thus, fibers contribute in improving many of the properties like, flexural strength, tensile strength, compressive strength, and others. At the present time, waste material is abundantly being utilized in concrete as one other fibers to makefiber reinforcement concrete. Many researchers are struggling on the usage of such waste materials for increasing the strengthof concrete structures and ultimately finding the cost-effective and eco-friendly materials. Moreover, research into novel fiber- reinforced concretes continues at present. Thus, in this study soft tin fibers or aluminium waste fibers are used as reinforcing material to enhance mechanical properties of concrete. In order to improve low tensile strength and flexural strength, inclusion of fibers in concrete have been a major concern of the researchers. Moreover, Influence of addition of fibers on concrete have been studied and investigated in detail and use of waste materials and aluminium can fibers are being used abundantly as a reinforcing material and partial construction material in today's construction industries to make concrete robust and cost-effective material. Large amounts of solid waste materials gather every year in every country. Nowadays resource efficiency is being increased as the utmost important concern in construction industries. . Thus, use of waste materials and secondary materials are being emphasised in the production and today's construction industries. With the increasing demand of cementfor concrete, a huge volume of energy is required. It is reportedthat about 7% of CO2 is released to the atmosphere owing to generation of cement in production industries. Detrimental properties of concrete on the environment can be eliminated by making durable concrete by using these secondary and waste materials. In our country Pakistan, there is a huge number of construction practices which are growing at a rapid rate. Such an enormous scale building and construction activities demand a huge amount of capital and other sources. Building and other construction materials contribute near around 75% of the cost out of total cost. Thus, there is dire need of the replacement of expensive, and conventional construction materials by creative, innovative cost-effective substitute construction materials. Hence, in this study use of soft drink can fiber or aluminium waste fiber is used as the waste and secondary materials generated as a result of the environmental waste. This can have a good influence on tensile and flexural strength parameters. Results revealed that there is a positive influence of addition of fibers in improving mechanical performance of the concrete in terms of tensile and flexural strength parameters. Soft drink tin fiber or aluminium can fiber is considered as one of the waste materials or secondary materials, this could have a promising future in the construction sector. It is a waste material obtained after the use of beverage cans in which beverage or liquid is filled, a large number of beverage cans are accumulated at shops of 'scrape' per day by laborers. Moreover, there are a number of studies related to the utilization of these fibers under the capacity of reinforcing material in concrete that have been investigated and reported by the researchers and investigators [20]. In all studies, the researchers have worked on the use of soft drink can fibers or aluminium waste fibers to improve some of the parameters and characteristics of concrete [21], such as workability, fatigue strength, density, post crack behavior, energy absorbing capacity of concrete.

CONCLUSION

The results of the tests conducted on fibre-reinforced concretespecimens over different grades and aluminum fiber volume divisions were compiled. The following conclusions were made based on the over inquire about:

1. The compressive strength of AFC progressed with the expansion of aluminum fibres at changing volume divisions. The quality appeared a most extreme at 0.5% division taken after by a steady declination past 0.5% to 2% independent of the grades of concrete, still remaining 9%, 11.67% and 10% higher than the control example for M20, M30 and M40 gradesof concrete respectively.
2. The expansion of aluminum fibres improved the part tensile strength and moved forward with expanding fiber volume division. The part ductile quality extended from 17.87% to 36.88% higher for the divisions from 0.5% to 2% for M20 review of concrete. Additionally, the part tensile quality extended from 4.58% to 20.92% for M30 and 3.54% to 19.19% for M40 for the divisions from 0.5% to 2%, separately. Subsequently, compared to the control example, circled conclusion aluminum fibres had altogether progressed the parttensile strength of concrete.
3. The strength effectiveness at each fiber volume division appeared most extreme for part tensile strength taken after by the compressive strength.
4. The peak compressive strength from the strength expectation condition was achieved at 0.77% of Vf. This forall intents and purposes can be amplified to as the idea volume concentration of fibres to reach at the most extreme quality properties.
5. The conditions proposed predict the compressive and part tensile strengths precisely to a impressive degree. In any case, in arrange to approve the proposed conditions, advance investigate is required.

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Storm Water Management for Marshy Land

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Abstract:-Urban stormwater runoff increasingly has become an important water management issue in the development of municipalities in Ontario. Conventional approaches to the mitigation of urban runoff have involved the utilization of detention or retention ponds. An innovative strategy to control flooding and assirnilate pollutants is the construction of artificial wetlands. Based uoon the experience with artificial wetlands for stormwater management in the United States, this strategy seems to have great potential. Thus far,however, the use of these facilities in Ontario has notbeen widesoread. This study begins with an examination of the hydrological functions of wetlands. Next, the use of artificial wetlands for stormwater management in three areas of the United States is examined. The paper concludes by suggesting five possible research opportunities to aid in the implementation of this technology for Ontario.

This publication presents recommended guidelines of current concepts for managing storm-water and snowmelt runoff when it is necessary to use wetlandareas. The Urban Storm Water Advisory Group acknowledges that wetlands are often affected by stormwater management; decisions and wetland responses to changes in storm-water flows can behighly complex and can affect other waters, such as lakes and streams. Though this document focuses on avoiding impacts to wetlands from storm water and snow melt, keep in mind that wetlands are part of a larger hydrologic system. Poor storm-water management can readily damage not only wetlands, but lakes, streams and ground-water resources as well. This guidance seeks to balance storm-water and floodflow management with ecological protection. Comprehensive plans for local government units, including cities, counties, and watershed management organizations, should address the management of the effects of urban storm-water and snow-melt runoff on wetlands and associated water courses and basins. These guidelines should be considered whenever there are storm-water discharges to natural water courses andbasins, including wetlands, so as to minimize anyadverse impacts to the diverse biological systems. Theaim of these guidelines is to reduce chemical andphysical degradation to water uses, aquatic habitats, and the level of water quality necessary to sustain such uses. These guidelines are intended to assist managers in designing a process that minimizes wetland impacts. The guidance does not take the place of any criteria administered by local, state, and federal agencies. Theproject must meet any requirements of the state Environmental Policy Act (M.S. 116D) and the state Environmental Rights Act (M.S. 116B), andcomply with all permits issued by any unit of government. The permits include, but are not limited to, those issued by local governments under the stateWetland Conservation Act of 1991 (M.S. 103G), Protected Waters permits (M.S. 103G.245) issued by the Minnesota Department of Natural Resources, permits issued by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act, and certifications by the Minnesota Pollution Control Agency under Section 401 of Clean Water Act. This guidance was developed to summarize the existing knowledge about impacts of runoff to wetlands.

Recommendations are included that attempt to standardize how various units of government can implement the guidance in existing planning and regulatory processes. New regulatory programs based on the guidelines may need to be developed, but thisshould be done if current programs cannot effectivelyincorporate the guidance concepts, and only after significant public and governmental input. The advisory group that developed the guidance intends that it become a source of common understanding sothat current required programs can be made more effective in controlling environmental impacts at the same time they can be made less burdensome through procedural simplification and clear statements of regulatory expectations.

I. INTRODUCTION

Urbanization results in a significant in- ers, and lakes. This degrading influence on crease in the amount of impervious aquatic ecosystems is caused by many surfaces which decreases much of the contaminants including suspended solids, land's natural recharge capacity. For a organic and inorganic nitrogen and phosgiven storm event a developed watershed phorus, petroleum hydrocarbons, heavy wili in general produce a runoff event with a metals, pathogenic bacteria and viruses, greater volume and earlier peak flows than and toxic refractory organics. Priority conan undeveloped or less developed state. In taminants in stormwater include toxic addition to flooding, stormwater runoff in refractory organic susbstances, such as urban areas is recognized as an important PCB's, aldrin, dieldrin, mirex, DDT, non-point pollution solnr:e to streams, riv- hexachlorobenzene, and heavy metals in cluding lead, mercury, zinc, copper (Marsalek and Schroeter, 1988). The construction of wetlands to manage stormwater runoff from urban areas has been attempted in various parts of the United States since the early 1980's. The creation of wetlands, in addition to ameliorating floods and improving stormwater quality, provides new wildlife habitat. Artificial wetlands also orovide recreational and aesthetic benefits, educational opportunities, as well as benefits to bird watchers and nature study groups (Athanas, 1988). In Ontario, approvals are being given for the use of natural wetlands to manage stormwater such as in the case of the Laurentian West Subdivision in Kitchener, Ontario. However, the use of artificial wetlands to control stormwater has had limited use in Ontario and in other regions of Canada. We believe this to be an opportune time to bring this innovative strategy to the attention of Canadians through a review of oertinent American experiences

This paper begins with a brief account of the hydrological basis for using artificial wetlands for stormwater quality improvementand f lood control. The oaoer then examines three casestudies to demonstrate the use of artificial wetlands for stormwater management in urban and urbanizing areasas a viable alternative to retention/detention ponds. The paper concludes by offering some suggestions on this innovative Eco technology as a suitable management technique for Ontario and presents some possible research opportunities

1. Artificial Wetlands and Storm water Management

The Hydrological Basis

The rationale for constructing wetlands for the purpose of urban stormwater control is based uoon the flood control and the water quality improvement functions of natural wetlands.

Flood Storage and Desynchronization

Kittelson (1988) and Ogawa and Male (1990) both have stated that wetlands are generally considered to provide temporary storage of flood waters and desynchronize peak flood flows. Flow reductions varying from 50% to 80% in drainage basins with lakesor wetlands have been reported (Novitzki, 1978). Similarly, working in the Devil's Lake Basin in North Dakota, Ludden et a/. (1983) found that wetland depressions store approximately 72"/" of the total runoff volume from a 2 year Irequency runoff event and approximately 41"k ot the total runoff from a 100 year frequency runoff event. Wetlands provide this retention function by spreading water over a wide flat area. Flood desynchronization is the process by which simultaneous storage of peak flows in numerous basins within a watershed and their subsequent release in a staggered manner. The result is containment of flow by desynchronizing the tributary and main-channel peak flows thus acheiving more persistent flows downstream of the wetland (Carter, 1986).

2. Water Quality improvement

The ability of natural wetlands to improve water quality is well documented and in this context are referred to as "natural treatment plants" (Hammer and Bastian, 1989). In a more specific sense, natural wetlands have been used extensively to assimilate municipal and industrial wastewater for water quality enhancement (Landers and Knuth, 1991;United States

Environmental Protection Agency, 1985). Natural wetlands also have been studied in the context of controlling urban stormwater (Lakatos and McNemar, 1988; Stockdale and Horner, 1987). As a case in Point, Brown (1984) found that a 6.4 ha urban wetland in Metropolitan Minneapolis-St. Paul retained 97% ofnon-volatile suspended solids, 76% of volatile suspended solids, 48% of total phosphorus, 4% dissolved phosphorus, 3% of dissolved nitrite plus nitrate nitrogen, 1% of total ammonia nitrogen, and 47"h of total organic nitrogen. Natural wetlands improve water quality through several physical, chemical, and biological removal mechanisms which include sedimentation, filtration, adsorption, precipitation, decomposition, bacterial and olant metabolism and natural die-off (Kadlec, 1989). The f low through a wetland facilitates retention of sediment. nutrients. and heavy metals by emergent vegetation which also slows flow, thus allowing suspended particles to fall out. Wetlands also improvewater quality by functioning as nutrient traps, at least seasonally. Nutrients may be temporarily stored in the vegetation or sediment of wetlands and may be removed by physical and biochemical transformations (Kadlec and Alford, 1989). Annual efficiency of nitrogen and phosphorus rernoval, however, is a function of the hydrological regime, litter fall pattern,and the rate of litter decay. In addition, high plant productivity, large adsorptive areas of sediments, and low oxygen content of sediments affect the ability of wetlands to remove nitrogen and phosphorus (Bastianand Benforado, 1988). Nutrient retention in wetlands fluctuates seasonally with the retention capacity greatest during the growing season. Furthermore, during some time periods there may be a net export orrelease of nutrients. The transformation and export of phosphorous may occur from certain wetlands (Geherls and Mulamoottil, 1989). Other dissolved constituents such as chloride often pass through wetlands unaltered. Heavy metals such as aluminum, iron, and caicium tend to become immobilized in soilsby adsorption in many instances as are pesticides andother refractory chemicals (Kadlec and Kadlec, 1978).

3. Artificial Wetlands and Stormwater Control Case Studies

A few case studies have been selected to illustrate the United States exoerience in using artificial wetlands for stormwater management. The rationale for the choice of these soecific case studies is the availability of adequate documentation, geographical spread of the site locations, and the apparent success of the facility. In addition, each example highlights a special feature such as the orovision of a ore-detention structure to increase removal rates of pollution, detailed design guidelines, and establishment of habitats for waterfowl and other bird species.

4. Case Study 1: Coyote HillsRegional Park, Fremont, California

During the early 1980's, it was realized that urban runoff had a significant impact on the water quality of San Francisco Bay and the idea of a wetland treatmentsystem was conceived. A decision was made to convert a 20 ha fallow agricultural field into a freshwater wetland near Fremont, California (Silverman, 1989). The Demonstration of Urban Stormwater Treatment (DUST) Marsh was constructed in 1983 and covers approximately 16 hectares with three contiguous wetland systems (Figure 1). The cost of creating the DUST Marsh was $260 000 in 1982 dollars (Silverman and Meiorin, 1990). The system and control structures receive runoff from approximately 1200 ha with landuses as follows low-density residential, 66%; agricultural/open space, 28%; high-density residential, 5%; and urban road and commercial, 1"/" (Meiorin, 1989). The DUST complex consists of a combination of ponds in different configurations, an overland flowarea, and restricted and unrestricted channels. The main supply of freshwater to the DUST system is from Crandall Creek. The incoming water is diverted into parallel marsh systems A and B, and these two marshes discharge into a connecting marsh System C. Marsh Covedlows into 4.9 hectares of North Marsh (Duffield,1986). System A consists of a large pond with side slopes of 4:1 and a water depth range of 0.6-1.8 metres.This marsh has surface area of approximately 4.8 hectares, containing 49/" open water and 7" emergentvegetation. The marsh was vegetated with marsh olants such as cattails. System B consists of an initial 0.2 hectare oond which distributes water to a gently sloping overland flow area of approximately 1 .2 hectares. The water is shallow during storms (0-15 cm) and becomes moist mudflats between storms. The water then f lows into a pond system of 0.8 hectares with a maximum deoth of 1.2 metres and side slooes of 4:1 before entering into System C. System B contains 80- 92h oI open water and 8% of emergent vegetation. The shoreline has little vegetation. However, cattails and alkal bulrush (Scirpus robustus)were planted along with a thicket of willows (Sa/x spp.) along a narrow channel.

System C consists of a long, narrow, steeped-sloped channel which was wellvegetated with cattails, alkali bulrush and pickleweed (Salicornia virginica). The channel contains two smallislands which are also well vegetated. The maximumwater depth is approximately 2 metres and has 19% open water and 81% marsh vegetation (Duffield, 1986). Between November 1984 and March 1986, eleven storms were monitored to study the pollutant removal effeciencies of the DUST Marsh.

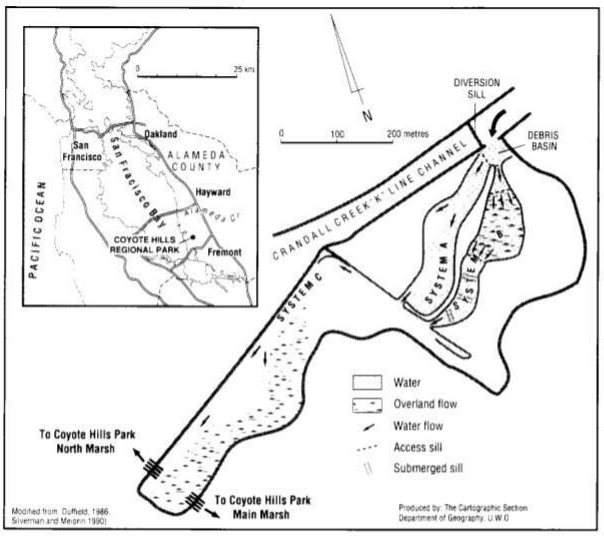

Figure 1: Artificial Wetland at Coyote Hills Regional Park, California

The results indicated a positive treatment performance (Table 1). System C performed most consistently of the three systems. Both System A and B were constructed from uoland areas, and hence. olant colonization and marsh development were incomplete after three years. System C, which has heavy vegetation cover and inundated areas during high water, significantly reduced

Table 1: DUST Marsh Trap Efficiencies (Meiorin, 1989)

Constituents	System A	System B	System C[a]	Overall[b]
TDS	-9%	-20%	-50%	-49%
TSS	42%	24%	45%	64%
BOD_5	-26%	-22%	-8%	-35%
NH_3-N	-22%	27%	12%	10%
NO_3-N	9%	5%	8%	15%
TKN	7%	-32%	-17%	-28%
Orthophosphate	53%	19%	28%	56%
Total Phosphate	17%	-44%	51%	48%
Chromium (Cr)	40%	20%	53%	68%
Copper (Cu)	5%	-10%	32%	31%
Lead (Pb)	30%	27%	83%	88%
Manganese (Mn)	-22%	-1%	-86%	-111%
Nickel (Ni)	34%	-30%	12%	20%
Zinc (Zn)	6%	-22%	51%	33%

[a]System C inflow = composite of System A and B outflows.
[b]Overall trap efficiencies may be greater than cumulative reductions by individual systems because System C provides secondary treatment for System A and B discharges.

incremental BODs, organic P, and all heavy metals exceot Mn. Overall. the DUST Marsh was effective in reducing suspended solids and inorganic N, P, and Pb (Meiorin, 1989). As the DUST Marsh matures, Meiorin (1989) believes that the differences in treatment levels between the three systems will become more noticable as a result of design variations. Furthermore, as the marsh matures the following conditions are anticipated 1) development of a more complete and dense vegetative cover on the overland flow area of System B and the perimeter of System A; 2) stabilization of marsh sediments; 3) establishment of an equilibrium for dissolved/suspended material between the soil-water interface; and 4) improved stormwater treatment performance from a combination of the f irst three conditions (Meiorin, 1989). Working at the same study slte, Duffield (1986) found extensive waterbird use of the wetland system. The data collected by Duffield indicated widespread waterbird utilization of the artificial wetland complex and led her to the conclusion that, Urban stormwater treatment wetlands may be one solution for alleviating pollution and habitat loss oroblems. Furthermore, the public has shown an increasing interest in the wildlife potential of these areas. Further investigation is needed in this dual manaoement area. so that this multipurpose value can be addressed at the beginning stages of marsh development (Duffield, 1986, 234).

5. ADVANTAGES

- Low capital costs
- Low maintenance costs
- Provide stormwater treatment
- Can utilize existing stormwater ponds Concealed from view
- Do not consume above-ground space
- Can be freeze protected Moderate capital costs
- Moderate maintenance costs
- Can be gravity fed

6. DISADVANTAGES

- Public safety concerns if not fenced
- Habitat for mosquito breeding
- Loss to evaporation Greater capital costs
- Higher maintenance costs
- Require stronger structure in traffic areas
- Require pumping
- Access can be difficult Aesthetic concerns
- More susceptible to weather conditions than below-ground systems (UV, freezin

CONCLUSION

The case studies have demonstrated that artificial wetland creation for stormwater management in urban and urbanizing areas is possible from a technological and engineering perspective. This concept is considered a proven technology in the United States having been successfully implemented in varying degrees in Florida' Maryland, and California. Although natural wetlands have been used for stormwater control, it has been argued that stormwater discharges have significant ecological and environmental impacts on natural wetlands including:

1) sedimentation build-up,
2) Bioaccumulation of pollutants in food chains,
3) Negative effects of detention time and water levels on vegetation succession pattern. And
4) Detrimental effects of toxicants on groundwater.

Thus, the use of wetlands to treat storm water runoff should be limited to artificial wetlands where conditions can be better-controlled and periodic maintenance such as dredging and/or harvesting of vegetation can be undertaken. These factors must be considered during the design phase of the project. Failure to do so may result in the abandonment of the system if it is difficult to maintain (Esry and Cairns, 1 989). In Ontario, theintegration of artificial wetlands and stormwater management has not been thought of as a viable option. It is asserted that this is due in oart to the lack of information, education and experience with this type of strategy in the province (Carlisleet al., 1991). However, because the urban stormwater runoff interim water quality guidelinesfor the province recommend that an increasing amount of stormwater be impounded by means ofretention for varying time periods (Ontario Ministry of the Environment and Ontario Ministry of Natural Resources, 1989a; b), there is the possibility that municipalities may explore new techniques in stormwater management measures. We believe that this could lead to the implementation of artificial wetlands to serve as impounclment facilities with the secondary benefit of wildlife/waterfowl habitat creation. The relevant provincial agencies should examine howwell artificial wetlands for stormwater impoundment and waterfowl./wildlife habitat would function in the Ontario climate. In addition, it must be determined which considerations have to be incorporated into the design of the facility tooptimize the establishment of wetland habitat andimprovement of the quality of stormwater.

Specific attention may be directed to:

1) Desirable depths for waterfowl,
2) Desirable velocities of runoff through thefacility,
3) Appropriate detention time of stormwater in thewetland,
4) Angle of slope of the facility,
5) Shoreline configuration, and
6) amount of pre{reatment of runoff.

The institutional arrangements which will affect the planning, management, and maintenance of artificial wetlands for stormwater control and waterfowl habitat will be complex with several agencies and ministries having vested interest in and responsibility for the facility. Research opportunities exist to explore mechanisms to facilitate coordination and cooperation among those responsible for the artificial wetland complex. In addition, the role of non-government organizations needs attention in the context of their role in the planning and management of theseresources. A final research opportunity, and perhaps the most important in terms of acceptanceof artificial wetlands in urban areas for runoff management, is the need for cost-benefit studies comparing the use of this type of stormwater management measure and currently employed strategies such as retention and detention ponds. lf the benefits and costs of utilizing constructed wetlands is found to be comoarable to those of traditional stormwater impoundments, acceptance of the concept will be strengthened, and hopefully implemented within the orovince of Ontario andother regions of Canada

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Review On Evaluation of Plastic Waste Modified Binder for Road Construction

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***Abstract*— The main objective of this paper is to evaluate the use of plastic waste as a low cost asphalt binder modifier. For this purpose Marshall mix design procedure was used. Marshall mix design procedure seeks to select the Optimum Binder Content (OBC) to be added to a specific aggregate blend resulting in a mixture that satisfies the desired properties of strength and durability. In order to evaluate the plastic waste modified (PWM) asphalt mixtures, the OBC for the conventional asphalt mix was first identified, and then different percentages of crushed plastic waste by weight of the identified OBC were tested. Marshall test results for the modified asphalt mixtures were analyzed to find the optimum PWM content. Finally, the static indirect tensile strength (IDT) was determined for all mixtures using the splitting tensile test. It was found that PWM content of 7.43% by weight of OBC is recommended as the optimum PWM content needed for enhancing the performance of asphalt mixtures. It enhanced stability by 42.56%, flow by 89.91% and strength by 13.54%. This would lead to a more durable pavement by improving the pavement resistance to fatigue cracking and rutting.**

Keywords—Binder content modifier, Marshall test, plastic waste, polyethylene terephthalate

I. INTRODUCTION

Good road infrastructure is a vital requirement for the social and economic development of any country. The goal of roads is to provide durable and long lasting pavements to improve riding comfort and safety, as well as to reduce maintenance costs. This can be achieved by providing good structural pavement design as well as good asphalt mixture design. Throughout the years, numerous studies have been conducted to improve asphalt mixture design for better performing pavements . Significant improvement on asphalt mixture quality has been made by the addition of modifiers. These modifiers can enhance asphalt binder's stiffness at normal service temperatures which will reduce rutting and shoving, while decreasing its stiffness at low temperatures to improve its resistance to fatigue cracking. Also, modifiers can increase adhesion between asphalt binder and aggregates in the presence of moisture, this will reduce the probability of aggregate stripping . The most common asphalt mixture modifiers are filer, extender, fiber, oxidant, antioxidant, hydrocarbon, crumb rubber and polymers . Crumb rubber can be obtained from tiers while polymers can be obtained from waste disposal plastic such as plastic bags and bottles. Disposal of plastic waste materials has become a serious environmental problem . The steady increase in the use of plastic products has resulted in proportionate rise in plastic waste. It is produced in a massive scale worldwide with an estimated production of 12 billion metric tons of plastics in 2050, representing 90% increase over 2017, and confirming an increasing trend over the past years. This can have serious downsides on the environment and health. Therefore, the utilization of plastic waste in asphalt mixtures would not only enhance pavement performance, but would also manage plastic waste and solve disposal problems. The main objective of this paper is to study the ability of using recycled plastic waste as a low cost asphalt binder modifier to improve performance of asphalt roads as well as to extend their service life. For the purpose of this study Organic Polyethylene Terephthalate (PET) materials in the form of plastic cups and plastic bottles were used as an asphalt binder modifier. The PWM asphalt mixture was tested and compared to a conventional asphalt mixture using Marshall mix design procedure. Also, the IDT was determined for all mixtures using the splitting tensile test. It was found that the PWM asphalt mixture outperformed the conventional asphalt mixture.According to the Environmental Protection Agency (2018), approximately 33 million tons of plastics were generated in 2014, with only less than 10 percent being recycled. Among

the plastics generated, linear low-density polyethylene (LLDPE), low-density polyethylene (LDPE), and high-density polyethylene (HDPE) combined account for the largest proportion of over 35 percent. These plastics fall within the category of commodity thermoplastics. Commodity thermoplastics can be re-softened to their original condition by heat, allowing them to be recycled. Additional thermoplastics include acrylonitrile-butadiene-styrene (ABS), polyethylene terephthalate (PET), polypropylene (PP), polystyrene (PS), and polyvinyl chloride (PVC) (ACC,
2019).

II. LITERATURE SURVEY

The study focuses on Surface water flooding which arises due to rainwater which is not sufficiently drained naturally or by artificial infrastructure, and therefore, it accumulates in surface depressions. It researches on a simple method that can be applied by decision makers to analyze effects and opportunities of development on surface water flood risks. The model uses a water balance approach and is prepared and run by using ESRI ArcGIS software along with Surface sinks and their catchment areas which are recognized by using a Lidar DEM (Digital Elevation Models). The Excess surface water is calculated by using a runoff coefficient which is then applied to rainfall volumes gathered from sources, and no other losses are considered. The model is then applied to the town of Keighley in West Yorkshire which had suffered from frequent surface flooding. Sensitivity analyses were performed to test the main assumptions adopted in the model. It was demonstrated that the main catchment processes remained unchanged under the various tests and the assumptions produce acceptable model results. Again, un-official confirmation against informal information on surface water flooding locations in Keighley indicated that the model works well for its intended screening purposes. This simple methodology gives a quick assessment of sinks that are potential areas of flooding or that are critical storage areas within in the catchment, which could be used to alleviate flooding.[3]

The flooding problem in the Navi Mumbai city area is examined by considering a catchment area of Kalamboli. An urban flood simulation model is developed which can predict flooding stretches of channels within a catchment-based on given rainfall hyetograph and tidal variation for the study area. The model is established on a kinematic wave for overland flow and diffusion wave for channel flow, modelled by FEM integrated with GIS and remote sensing database. The model was used for the simulation of four rainfall events, and the results were compared with observed data for three events. The comparison of simulated and observed stages for the three events (July 14–15, 2009; July 21–22,2009; and July 22–23, 2009) was found to be satisfactory. The simulation of the extreme event on July 26–27, 2005, showed flooding of the Kalamboli channel, which was also reported by local authorities. Results through the simulation provide the overtopping extent of the channel. A Sensitivity study showed that peak discharge is more sensitive to the variation of Manning's roughness factor for overland flow and channel flow. The depth of flooding in the channel and the maximum water level in the detention pond had shown signs of decrease with an increase in the area of detention and has extended the start of flooding. And hence the provision of a detention pond at an appropriate location can reduce the intensity of flood problems. Thus, an integrated model can be effectively used in developing rapid flood management tools for coastal areas.[4]

In another study, a web GIS based distributed hydrological model of a coastal urban watershed is created for flood simulation. The model is such that all the various GIS datasets regarding the area to be studied can be accessed and visualize through the web, thus the need for any GIS software is eliminated. The IFAM (Integrated Flood Assessment Model) toolisaquasi-2D urban flood model, which is established on the web GIS server which allows for visualization of flood extent easy on the browser. The study uses the integration of different applications developed on various platforms viz: WGS on Java and IFAM tool in MATLAB. The implementation of the model has been demonstrated for two watersheds of Navi Mumbai, India. The results of the studies that were performed showed that IFAM is a very efficient and effective coastal urban flood simulation tool.[5]

Another study of the flood mapping and effective methodology to accurately represent the flooded region by using remote sensing and GIS in Naogoan which is the northern district of Bangladesh. Data gathering is done by obtaining the remote sensing and Geographic information system (GIS) for which Satellite images which have been collected from Landsat 4-5 Thematic Mapper for the year 2004, 2007, and 2012 and Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) images for the year 2017. It is estimated that the LANDSAT image helps to map the flooded area with an accuracy of 73-81% depending on various indices used. From the study and analysis its seen that the area of flood damage from the year 2004-2017 most damage happened is to agricultural and vegetation area and in every five years interval its keep raising from 3.95.62 sq.km (11.47%) to 16.47% area. It also helps in decision making for residential planning, urban and land use planning, it also gives the idea for relocation, mitigation and modernization. It showed that high a risk of Naogoan district to flooding since its surrounded by many rivers and here it needs proper flood management by accurate flood mapping which is fully achieved by remote sensing and GIS.[2]

Mongalkote block in West Bengal is in very severe flood state and flood is most common natural disaster that block has to face every year with varying intensity and thus due to short period massive rainfall, narrow river channel, low runoff, sedimentation of channel, and very low elevation the flood intensity is high in this area. With the help of remote sensing and GIS has emerged as an indispensable tool in the study of floods, particularly with its capacity to provide near real-time data, enabling the preparation of maps of inundated areas and assessment of damages. Geographical Information Systems (GIS) is also now being used in several studies to represent the flood-hazard areas. Remote sensing technologies are excellent tools in the mapping within a short period of time

and it's also a very cost-effective way for flood management plans. Disaster management includes 4 elements such as mitigation, preparedness, response, and recovery and it can be achieved by satellite data since it can be used before during, or after the flooding. And since having the accuracy of the key information and past records flooding the adverse effect of flooding can be minimized.[1]

Another study focused on flood-affected villages in Bongoan Sadar sub-division, West Bengal, India, during the period between 1996 and 2016 by reviewing on its geographical pattern and variation in flood-affected villages. For studying the statistics of flood-affected/non-affected villages, GIS-based Voronoi statistics were used and to incorporate and predict the pattern of flood-affected/non-affected zones Inverse distance weighting (IDW) was used. It determined the importance of the use of GIS-base mapping to reveal the extent and frequency of areas most affected and are at potential risk from floods. It recommended that spatial statistics can be effective for identifying flood risk from historical data, it indicated if the method wisely applied can play a big part in recognition and analysis of floods.[6]

A good approach to flood managing strategy in a river basin based on the European Floods Directive, with a goal of determining a proper flood management strategy and the determination of the flood-hazard areas with the help of GIS which was studied on the Koiliaris river basin which is located 15 km east of the city of Chania, Crete, Greece. In order to determine the areas and settlements in danger of flooding. It gives a model to know the benefits of a flood warning system as well as the method to estimate the hazardous area and this flood management strategy includes: (i) pre-flood measures, (ii) flood forecasting, and (iii) post-flood measures.Six factors such as elevation, land use, geology, slope, rainfall intensity, flow accumulation werestudied with the help of the GIS and satellite images and past records of the river basin in order to estimate the spatial distribution of the hazardous area. The studying ofthese factors and obtaining a methodology was presented which could beuseful for the prediction of flooding areas and for better organization of flood managing plan.[7]

CONCLISION

The main objective of this paper is to evaluate the use of plastic waste as a low cost asphalt binder modifier. PET materials such as plastic bottles and plastic cups were used. Plastic waste was collected from houses and schools. The collected PET materials were chosen with a maximum thickness of 60 micron. This would facilitate mixing them with asphalt at the laboratory under its softening point. Also, in order to provide appropriate plastic particles, the bottles and cups were cleaned then slashed into small pieces then crushed and sieved such that it passes through 3-5 mm sieve using shredding machine. Marshall mix design method was used to compare the modified asphalt mix with the conventional asphalt mix. Marshall mix design procedure seeks to select the OBC to be added to a specific aggregate blend resulting in a mixture that satisfies the desired properties of strength and durability, so in order to evaluate the modified asphalt mixtures, the OBC for the conventional asphalt mix was identified, then different percentages of crushed plastic waste by weight of OBC were tested on the PWM asphalt mixtures. Marshall test results for the modified asphalt mixtures were analyzed to find the optimum PWM content. Finally, the static IDT was determined for all mixtures using the splitting test. It was found that PWM content of 7.43% by weight of OBC is recommended as the optimum PWM content needed for enhancing the performance of asphalt mixtures. Asphalt mix modified with 7.43% PWM by OBC % would significantly enhance stability by 42.56%, flow by 89.91% and strength by 13.54%. This improvement can be explained by the enhanced adhesion developed between asphalt and plastic waste coated aggregates caused by the intermolecular bonding which improves asphalt mix strength. This would be reflected in the enhanced durability and stability of the asphalt mix which would lead to enhancing pavement resistance to fatigue cracking and rutting or permanent deformation.

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Development of Waste Cloth Modified Road Construction

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***Abstract*— Bitumen is a complicated viscoelastic material that has a significant role in the asphalt pavement behaviors. It contributes in around 95% of pavement construction all over the world. These asphalt based pavements are exposed to different types of distresses over time due to the increase of the heavy traffic and change in weather condition during the last few decades. Among those distresses, the permanent deformation, fatigue and low temperature cracking failures are the most common, which are considered one of the main parameters that govern the durability of the asphalt pavement. Millions of dollars have been spent every year to maintain and repair these pavement failures. The researchers and engineers are also continuously seeking for enhancing the properties and performance of asphalt mixtures and pavements. As a sense of responsibility to reduce such cost and develop a sustainable product the research has identified two new modified bituminous mix prepared using waste cloth. This paper intends to review various technical paper on different fibre modified bituminous mix in order to use it as a guide to develop the new modified bituminous mixes using waste denim fibre and synthetic cloth fibre (obtained from waste cloth).**

***Keywords*— Bituminous mix, Synthetic cloth fibre, WDF (Waste Denim Fibre), OBC (Optimum Binder Content), OFC (Optimum Fibre Content), wet process, dry process**

I. INTRODUCTION

India has a road network of over 4,689,842 kilometers (as in 2013), the second-largest road network in the world. More than 98% of the total road network comprises of flexible pavement. Bitumen has been widely used in the construction of flexible pavements for a long time. This is the most simple and convenient type of construction but due to increased traffic factors such as heavier loads, higher traffic volume and higher tyre pressure, it resides in the number of failures represented by low-temperature cracking, fatigue cracking, and surface rutting causing its quality and performance to decrease. Therefore, there is a huge demand for higher performance pavements that improve its service life. In order to do so, conventional bitumen mix need to be improved or modified using various modifiers. Numerous research have been conducted and various technical paper have been published related to modification of bituminous mix using various fibres such as asbestos, rock, wood, glass and cellulose fibres. But government and researchers are looking for new fibre materials from industries and urban solid waste to be used in flexible pavement construction. Today, solid waste generated comprises majorly of textile cloth waste out of which 80-90% is produced using synthetic fibre making it non-degradable and a serious hazard to the environment. Nearly, 17 million tonnes of textile waste is produced in the world and most of this waste is either dumped in landfills or incinerated which is toxic for the environment owing to its contribution towards increasing the global carbon footprint. This waste cloth can be developed as a sustainable, alternative modifier to be used in the bituminous mix as the fibres present in them have the ability to improve the rut resistance, fatigue life properties, aggregate-binder bond and low temperature cracking.

II. OBJECTIVES

The major objectives of this study are to develop a new modified bituminous mix using waste cloth fibres. However, on a wider note the exact objectives of this study shall be dealing with following points:

1. To suggest alternatives to overcome challenges faced by conventional asphalt- bituminous mixes to solve the most crucial problem of repair and maintenance and fatigue cracking

2. To study the use of waste denim fibreand synthetic cloth fibre as a new modifier for asphalt mixes to used in flexible road construction.
3. To design and experimentally determine the effect of Waste Denim Fibre and synthetic cloth fibre on the properties of bituminous mix and hence compare it with the conventional bituminous mix.
4. To experimentally analyse the optimum amount of Waste Denim Fibre and synthetic cloth fibre to be used as modifier for the bituminous mix.

I. LITERATURE SURVEY

Abdulnaser Al-Sabaeei, Madzlan Napiah, Muslich Sutanto and Wesam Alaloulhave introduced the waste denim fiber as a modifier for bitumen used in the flexible road construction. The sources, chemical components, and properties of denim fiber were discussed. Methods of adding different types of fibers into bitumen and asphalt mixtures were also presented. In addition to that, a review of the effects of cellulose fiber as the main component part of denim fiber in bitumen and asphalt mixture was summarized. The motivations of using denim fiber as a modifier for base bitumen was also highlighted, such as the mechanical properties, lower water content compared to other natural fibers and the sustainability in terms of low cost and mitigate the environmental problem in the same time. Furthermore, Challenges of using denim fiber for bitumen modification were reported. [1]

In this research, waste denim fibre modified binders were prepared at 0.5%, 1%, 1.5% and 2% concentration of waste denim fibre by weight of bitumen using the wet process for addition of WDF (Waste Denim Fibre) in bitumen. Effects of waste denim fibre on physical and rheological properties of bitumen were investigated by conducting various test the results showed that penetration value of WDF modified binder decreases as the content of WDF increases. Also, the softening point temperature of the modified bitumen increased on addition of WDF. The rutting parameters showed that WDF modified binders were more resistant to permanent deformation. 2% WDF was concluded as the optimum content for the modification of base bitumen. [2]

Abdulnaser Al-Sabaeei, Madzlan Napiah, Muslich Sutanto, Wesam Alaloul, Nur Izzi Md Yusoff, Noor Zainab Habib and Waqas Rafiq used waste denim fiber (WDF) as a new modifier to mitigate the inconsistency problem of bio-asphalt that incorporated waste cooking oil (WCO). Response surface methodology (RSM) was applied to design and analyze the experimental data.16 blends of base and bio-asphalt binders were prepared with high shear mixer and evaluated by conducting penetration, ring and ball temperature and temperature susceptibility tests. Results showed that the addition of waste denim fiber reduced the penetration values and increased the ring and ball temperature and the penetration index of base and WDF-modified bio-asphalt binders [3]

This paper investigates the effect of mixing process on polypropylene (PP) modified bitumen mixed with well graded aggregate to form modified bituminous concrete mix. Two mode of mixing, namely dry and wet with different concentration of polymer polypropylene was used with 80/100 pen bitumen, to evaluate the bituminous concrete mix properties. Three percentages of polymer varying from 1-3% by the weight of bitumen was used in this studyThe results showed that 3% PP modified wet bituminous mixture exhibited good performance in terms density, stability, and stiffness compared to 1% and 2%wet bituminous mixture. Meanwhile, the dry bituminous mixture containing 1% of PP displayed better than 2% and 3% PP dry bituminous mixture in term of stability, flow, density, and stiffness. [4]

This paper is an experimental study on the use of jute fibre in 2 types of mixes i.e. SMA (stone matrix asphalt) and BC (Bituminous Concrete) where 60/70 penetration grade bitumen was used as binder Jute fibre was used with varying concentration (0, 0.3% and 0.6%). Optimum binder content and optimum fibre content were found as 5.5% and 0.3% respectively using the Marshall Method of mix design. [5]

In this Paper, an attempt was made to study the effect of glass fibre as an additive in Dense Bituminous Macadam (DBM) by conducting experiments on conventional bitumen and fibre modified binder. Using the Marshall procedure, optimum binder content was fixed at 4.5% and optimum fibre content was fixed at 1.5%. Also rheological properties of the modified binder were obtained using the dynamic shear rheometer. It was found out that the modified binder had higher complex modulus, increased binder elasticity and flexibility at high temperature thereby, improving resistance both in rutting and fatigue cracking. [6]

CONCLUSION AND FUTURE SCOPE

The method of mix design, experimental approach and processes of introduction of any fibre in a fibre modified bituminous mix were discussed in the literature review of different technical paper. These review paper will serve as a reference and a source of valuable information for further research and development of the two new modified bituminous mixes, that are, Waste Denim Fibre Modified Bituminous Mix and Synthetic Cloth Fibre Modified Bituminous Mix.

It can be thus concluded that the above two mentioned bituminous mixes are an unexplored area of research in the field of modification of conventional bituminous mix. However, further research on these modified bituminous mixes regarding the process of introduction of cloth fibre, its properties, its compatibility, its benefits together with experimental testing and analysis of result needs to be worked upon in the near future.

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Utilisation of Waste Fibers in Road Construction – A Review

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***Abstract*—Road transportation is undoubtedly the lifeline of the nation and its development is a crucial concern. The traditional bituminous pavements and their needs for continuous maintenance and rehabilitation coupled with frequent repairs, points towards the scope for cement concrete pavements.Concrete is weak in tension and has a brittle character. The concept of using fibers to improve the characteristics of construction materials is very old.Concrete is presently the most widely used manufactured construction material in the world. This superiority of concrete over other construction materials is due to its high compressive strength along with other advantages such as water resistance, low maintenance cost, ease in mouldability to required size and shape, low cost, less energy input in manufacture, and so on. However, lower tensile strength and brittle behaviour are considered as the major disadvantage of this material. Reinforcement concrete is the best way to prevent the cracking of concrete subjected to tensile stress. Reinforcement concrete using discrete fibres, randomly arranged, is an acceptable solution to improve the ductility of concrete. Addition of fibres in concrete affects most of the properties both in wet and set stages. By reviewing many of the recent literature on fibre reinforcement concrete, it is very clear that its structural performance is superior to non-fibrous reinforcement concrete structures. These enhancements in material properties have paved the way for more research in this area to explore its advancement into unused areas. Experimental results quantitatively reveal its improvement in various parameters like tensile strength, flexural strength, toughness, ductility, resistance to corrosion, resistance to cyclic and dynamic loads, cracking resistance, etc which highlight its better material behaviour. . Addition of fibers to concrete makes it a homogeneous and isotropic material. When concrete cracks, the randomly oriented fibers start functioning, arrest crack formation and propagation, and thus improve strength and ductility. The failure modes of fiber reinforced concrete (FRC) are either bond failure between fiber and matrix or material failure. There are several advantages of cement concrete pavements over bituminous pavements. Potential benefits from fibres in concrete are improved crack control and the possibility of more slender structures.**

***Keywords*— Fiber Reinforced Concrete (FRC), composite, strength, durability, toughness, structural performance, transportation, development, material.**

I. INTRODUCTION

During the past decades the concrete construction field has experienced a growing interest in the ad-vantages fibre reinforcement has to offer. Between the different fibres available, e.g. steel, synthetic, glass, and natural fibres, the steel fibre is probably the most investigated and most commonly used. Fibre reinforcement today is mainly usedin applications such as industrial floors, overlays, and sprayed con-crete, although other application areas exist.Some of the potential benefits of fibres in concrete are im- proved crack control and the possibility of designing more slender structures. However, the extent of the crack control depends to a large extent on the type and amount of fibres added. From a durability point of view it is essential to con-trol the cracking process and, moreover, being able to predict crack widths and crack pattern as well as to design a structure that exhibits the desired behaviour. This behaviour, of course, depends on a number of different factors such as structural type and size, type of concrete and amount and type of reinforcement, and, not at least, the casting procedure. In general, to achieve crack control, large amounts of conventional reinforcement are needed, especially in structures where only very small crack widths ($w \leq 0.1$ mm) are allowed. Negative effects from large amounts of re-inforcement are that: structural dimensions often need to be larger than what is needed for load bear-ing capacity inorder to make space for all the steel; the heavy labour placing it; and also difficulties with pouring the concrete past the tightly placed rein-forcement bars of the steel cage. By using fibres in combination with or instead of the conventional rein-forcement, these drawbacks may be reduced or even completely avoided.

Fibre reinforced concrete (FRC) is a cement based composite material reinforced with discrete, usually randomly distributed, fibres. The objective with add-ing fibres to a concrete mix is to bridge discrete cracks and thereby providing for increased control of the fracture process and also to increase the fracture energy (i.e. yields a more ductile behaviour). The ma-terial behaviour of concrete showed a tremendous improvement in the various parameters like tensile strength, flexural strength, toughness,

ductility, resistance to corrosion, resistance to cyclic and dy-namic loads, cracking resistance, etc due to the ad-dition of steel fibres.cracking resistance, etc due to the addition of steel fibres.

From a structural point of view, concrete is assumed to be a no-tension material with some softening post-peak behaviour in compression due essentially to the limited transverse strain capability of the ma-terial. This characteristic influences the structural performances of reinforcement concrete structures because the mechanical behaviour of concrete is essentially brittle. The negative effects of the brittle behaviour of the material can be reduced by improv-ing the post-peak behaviour of the concrete with the addition of fibres. Moreover, good structural design demands high quality experimental data and reliable modeling of the mechanical properties of the con-stituent materials and hence all the factors that af-fect and enhance the material properties have to be clearly analyzed and noted. Thus it is very essential that the steel fibres should be added only in optimum quantity based on the area of application in order to improve the structural strength of concrete. The failure modes of fiber rein-forced concrete (FRC) are either bond failure between fiber and matrix or material failure.

II. LITERATURE SURVEY

A literature survey revealing the current state of re-search for fiber reinforced concrete (FRC) has been carried out as a part of this licentiate work.It was found that Plastic fiber reinforced concrete (PFRC) can be used advantageously over normal concrete pavement. Polymeric fibres such as polyester or poly-propylene are being used due to their cost effective as well as corrosion resistance. Plastic fiber rein- forced concrete (PFRC) requires specific design con- siderations and construction procedures to obtain optimum performance. The higher initial cost by 15-20% is counterbalanced by the reduction in mainte-nance and rehabilitation operations, making Plastic fiber reinforced concrete (PFRC) cheaper than flexible pavement by 30- 35%. In a fast developing and vast country like India, roadnet works ensure mobility of resources, communication and in turn contribute to growth and development. Resistance to change, though however small, disturbs our society; hence we are always reluctant to accept even the best. It's high time that we overcome the resistance and reach for the peaks. Plastic fiber reinforced concrete (PFRC)opens a new hope to developing and globalizing the quality and reshaping the face of the "True Indian Roads.[1].

The existence of post-cracking strength and pseudo-ductilityof reinforced cement concrete (RCC) result-ing from the inclusion of steel fiber reinforcement is shown. All fibers tested indicated that postcracking performance is directly proportional to fiber content. This study was iimited to one length of steel fiber; longer and 68 thicker fibers should be included for a more complete coverage of the cost-performance ratio. The performance of field cores was better than that of equivalent laboratory-fabricated samples be-cause fiber presence does not disturb the consolida-tion efforts of both paver and roller. Based on im-proved fatigue life, inclusion of fibers in reinforced cement concrete (RCC) results in pavement thickness reduction. Savings in material and construction costs compensate for the additional cost of fibers. In the given examples, improvement in first crack strength due to the presence of fibers was not considered. Fiber content may be lowered depending on the type of fiber.[2]. Fibre reinforced concrete (FRC) can be used advantageously over normal concrete pave-ment. Polymeric fibers such as polyester or polypro-pylene are being used due to their cost effective as well as corrosion resistance. Plastic fiber reinforced concrete (PFRC) requires specific design considera-tions and construction procedures to obtain optimum performance. The higher initial cost by 15-20% is counterbalanced by the reduction in maintenance and rehabilitation operations, making Plastic fiber rein-forced concrete (PFRC) cheaper than flexible pave-ment by 30- 35%. In a fast developing and vast coun-try like India, road networks ensure mobility of re-sources, communication and in turn contribute to growth and development. Resistance to change though however small disturbs our society, hence we are always reluctant to accept even the best. Its high time that we overcome the resistance and reach for the peaks. PFRC opens a new hope to developing and globalizing the quality and reshaping the face of the "True Indian Roads".[3]

The studies emphasize that fiber reinforcement in a cement bound road base has the potential to improve performance by improving fatigue life of the base and improved resistance to reflective cracking of the as-phalt. The studies also establish that the properties of hardened Steel fibrereinforced concrete (SFRCC), such as flexural strength, are remarkably better than those of conventional reinforced cement concrete (RCC). Thus, the use of steel fiber foreffective pave-ment construction can be suggested positively.[4]

Steel fibre reinforced concrete (SFRC) has been stud-ied and used as an alternative material to take ad-vantages of their workability and economic benefits over traditional reinforced concrete (RC). In this pa-per, a design study was conducted to replace original-ly designed reinforced concrete (RC) shaft lining using Steel fibre reinforced concrete (SFRC) in terms of ge-otechnical engineering. Several geological and struc-tural design reports used inoriginal lining designs were utilised, and theoretical and experimental ap-proaches were used to determine Steel fibre rein-forced concrete (SFRC) designs corresponding to the original reinforced concrete (RC). The axial load and bending moment of the shaft lining were derived us-ingCanadian concrete design codes CSA A23.3 com-bined with RILEM TC-162 TDF, and several analytical solutions with uniform and nonuniform loading cases were adopted for the evaluation of Steel fibre rein-forced concrete (SFRC) shaft lining performance. In addition, a numerical analysis model developed for Georgian Bay shale with swelling behaviour was used to determine if the proposed installation timing of the shaft lining is appropriate, and to evaluate the long-term stability of the shaft lining. According to the structural analysis, reinforced concrete (RC) with 20 M@300-radial and 15 M@300-vertical steel bars are characterised by an extremely high axial load and bending moment capacity of approximately 6100 kN/m and 880 kNm/m, respectively.

The SFRC showed a relatively low bending moment with 370 kNm/m, while showing a high axial force correspond- ing to the RC with 5800 kN/m. The calculated hoop thrust and bending moment under both uniform and non-uniform loading cases were within the capacity of the Steel fibre reinforced concrete (SFRC) lining, and thus it is estimated that an alternative design of a circular shaft, using Steelfibre reinforced concrete (SFRC), possesses sufficient load- bearing resistance. Therefore, it has been demonstrated that the Steel fibre reinforced concrete (SFRC) lining poses an excel-lent alternative to steel bars in conventional rein- forced concrete (RC) for use as circular shaft struc-tures, with both improved construction efficiency and structural capacity. Numerical analysis using the "swello" constitutive model, coded in FLAC 2D finite difference program, was performed to evaluate whether the proposed timing of the shaft lining is ap-propriate, and estimate the long-term stability. Ac-cording to the results of the numerical analysis, the shaft lining installed at the proposed timing is ex-pected to be structurally stable in the long-term, and furthermore, it could be considered that the installa-tion time can be reduced by up to 20 days. Therefore, it can be concludedthat the SFRC lining, installed 70 days after excavation, can sufficiently withstand the long-term ground swelling behaviour and can reduce the construction schedule by reducing the delays due to TDD. The construction cost could also decrease by reducing the waiting time for theshaft lining installa-tion.[5]

III. TYPE OF FIBER-REINFORCED CONCRETE

Steel Fiber Reinforced Concrete:-

Steel fiber is a metal reinforcement. A certain amount of steel fiber in concrete can cause qualitative changes in concrete's physical property. It can greatly increase resistance to cracking, impact, fatigue, and bending, te- nacity, durability, and others. For improving long-term behavior, enhancing strength, toughness, and stressresistance, SFRC is be-ing used in structures such as flooring, hous-ing, precast, bridges, tunneling, heavy-duty pavement, and mining. The types of steel fi-bers are defined by ASTM A820 are, Type I: cold-drawn wire, Type II; cut sheet, Type III: melt-extracted, Type IV: mill cut and Type V: modified cold-drawn wire.

Fig No.1:-Steel Fiber Reinforced Concrete

Polypropylene Fiber Reinforced Concrete:-

Polypropylene fiber reinforced concrete is al-so known as polypropene or PP. It is a syn-thetic fiber, transformed from propylene, and used in a variety of applications. These fibers are usually used in concrete to control crack-ing dueto plastic shrinkage and drying shrink-age. They also reduce the permeability of concrete and thus reduce the bleeding of wa-ter. Polypropylene fiber belongs to the group of polyolefins and is partially crystalline and non-polar. It has similar properties as poly-ethylene, but it is harder and moreheat re-sistant. It is a white rugged material with high chemical resistance. Polypropylene is manu-factured from propylene gas in the presence of a catalyst such as titanium chloride. Poly-propylene fiber displays good heat-insulating properties and is highly resistant to acids, al-kalies, andorganic solvents.

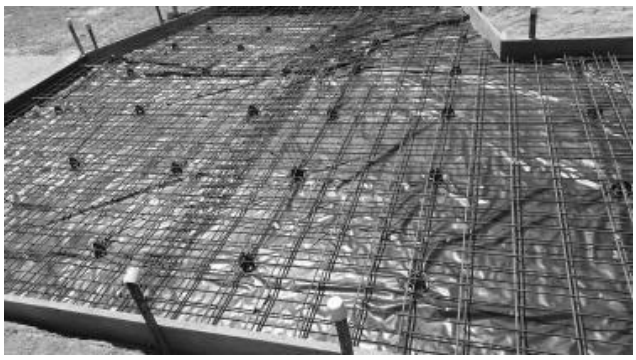

Fig No.2:- Polypropylene Fiber ReinforcedConcrete

Glass Fiber Reinforced Concrete:-

Glass fiber reinforced concrete is a material consisting of numerous extremely fine fibers of glass. Glass fiber has roughly comparable mechanical properties to other fibers such as polymers and carbon fiber. Although not as rigid as carbon fiber, it is much cheaper and significantly less brittle when used in compo-sites. Glass fibers are therefore used as a re-inforcing agent for many polymer products; to form a very strong and relatively light-weight fiber-reinforced polymer (FRP) com-posite material called glass-reinforced plastic (GRP), also popularly known as "fiberglass". This material contains little or no air or gas, is denser, and is a much poorer thermal insula-tor than is glass wool.

Fig No.3:- Glass Fiber Reinforced Concrete

Polyester Fiber:-

Polyester fibers are used in fiber-reinforced concrete for industrial and warehouse floors, pavements and overlaysand precast products. Polyester micro- and macro-fibers are used in concrete to provide superior resistance to the formation of plastic shrinkage cracks versus welded wire fabric and to enhance toughness and the ability to deliver structural capacity when properly designed, respectively. Polyester mi-cro- and macro-fibers are used in concrete to provide superior resistance to the formation of plastic shrink-age cracks versus welded wire fabric and to enhance toughness and the ability to deliver structural capacity when properly designed, respectively.

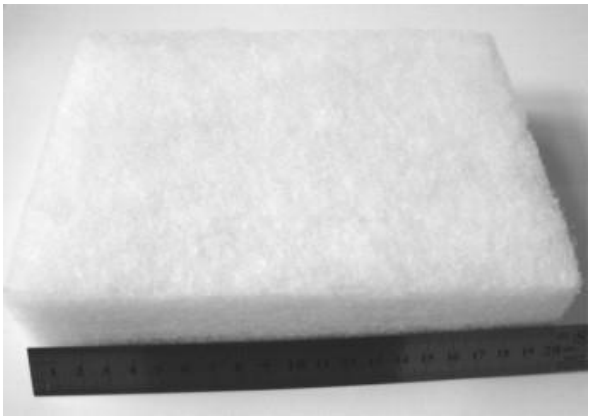

Fig No.4:- Polyesters Fiber

Carbon Fiber:-

Carbon fibers are fibers about 5–10 micrometers in diameter and composed mostly of carbon at-oms. Carbon fibers have several advantages in-cluding high stiffness, high tensile strength, low weight, high chemical resistance, high-temperature tolerance and low thermal expan-sion. Carbon fibers are usually combined with other materials to form a composite. When im-pregnated with a plastic resin and baked it forms carbon-fiber-reinforced polymer (oftenreferred to as carbon fiber) which has a very high strength- to-weight ratio, and is extremely rigid although somewhat brittle. Carbon fibers are also compo-sited with other materials, such as graphite, to form reinforced carbon composites, which have a very high heat tolerance. Carbon fibers are also composited with other materials, such as graph-ite, to form reinforced carbon composites, which havea very high heat tolerance.

Carbon fibers are industrially produced fibers which arerefined in such a way that they consist almost exclusively ofcarbon. They are microscopically small and about eight times thinner than a human hair. In order to make them usable for various applications, 1000 to 60000 filaments are combined into a multifilament yarn (roving), which is wound onto a spool.

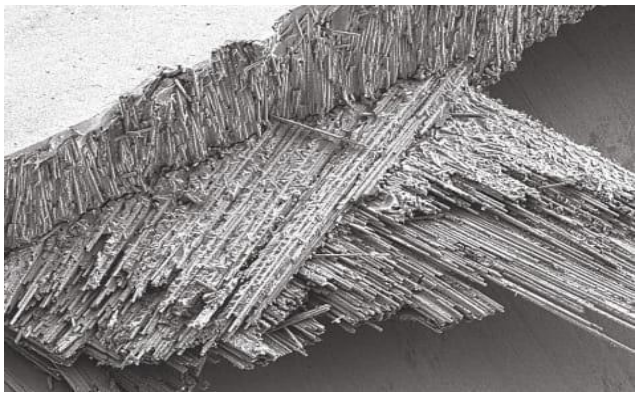

Fig No.5:- Carbon Fiber

Macro Synthetic Fiber:-

Macro synthetic fibers are made from a blend of pol-ymers and were originally developed to provide an alternative to steel fibers in some applications. Initial-ly, they were identified as a potential alternative to steel fibers in sprayed concrete, but increasing re-search and development showed that they had a role to play in the design and construction of ground-supported slabs and a wide range of other applica-tions. They are particularly suitable for providing nominal reinforcement in aggressive environments, such as marine and coastal structures, as they do not suffer the problems of staining and spalling that can result from the corrosion of steel. Besides, because they are non-conducting, they have been used in tram and light railway developments.

Fig No.6:- Macro Synthetic Fiber

Micro Synthetic Fiber:-

Micro-synthetic fibers provide superior resistance to the formation of plastic shrinkage cracks ver-sus welded wire reinforcement, they are unable to provide any resistance to further crack width openings caused by drying shrinkage, structural load or other forms of stress. However, these products should be regularly specified in any type of concrete to improve cracking resistance, spall protection, freeze-thaw durability and improve the homogeneity of concrete during placement.

Fig No.7:- Micro Synthetic Fiber

Natural Fiber:-

The natural fiber is directly obtainable from an animal, vegetable, or mineral source and convert-ible into nonwoven fabrics such as felt or paper or, after spinning into yarns, into woven cloth. A natural fiber may be further defined as an ag-glomeration of cells in which the diameter is neg-ligible in comparison with the length. Although nature abounds in fibrous materials, especially cellulosic types such as cotton, wood, grains, and straw. The use of natural fibers in making con-crete is recommended since several types of these fibers are available locally and are plentiful. The idea of using such fibers to improve the strength and durability of brittle materials is not new; for example, straw and horsehair are used to make bricks and plaster. Natural fibers are suitable for reinforcing concrete and are easily available in developing countries. The natural fi-ber is directly obtainablefrom an animal, vegeta-ble, or mineral source and convertible into nonwoven fabrics such as felt or paper or, after spinning into yarns, into woven cloth.

Fig No.8:- Natural Fiber

Cellulose Fiber:-

Cellulose fibers are made with ethers or esters of cellulose, which can be obtained from the bark, wood or leaves of plants, or other plant-based material. In addition to cellulose,the fibers may also contain hemicellulose and lignin, with differ-ent percentages of these components altering the mechanical properties of the fibers. The main applications of cellulose fibers are in the textile industry, as chemical filters,and as fiber-reinforcement composites, due to their similar properties to engineered fibers, being another option forbiocomposites and polymer compo-sites.

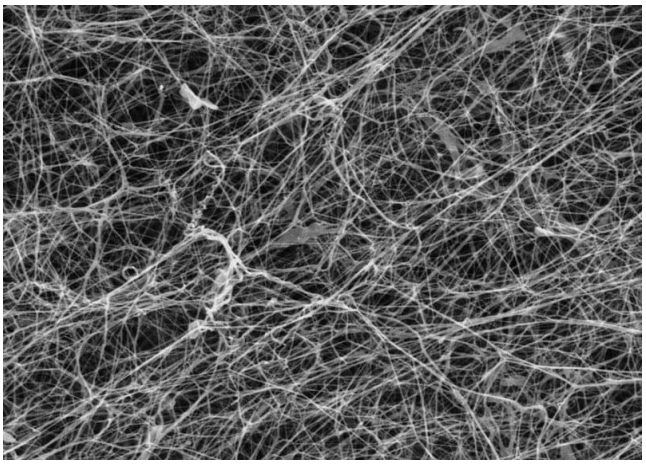

Fig No.9:- Cellulose Fiber

IV. ADVANTAGES

1. Fibers reinforced concrete may be useful wherehigh tensile strength and reduced cracking are desirable or when conventional reinforcement cannot be placed.
2. It improves the impact strength of concrete, limits the crack growth and leads to a greater strain capacity of the composite material.
3. For industrial projects, macro-synthetic fibers are used to improve concrete's durability. Made from synthetic materials, these fibers arelong and thick in size and may be used as a replacement for bar or fabric reinforcement.
4. Adding fibers to the concrete will improve its freeze-thaw resistance and help keep the concrete strong and attractive for extended periods.
5. Improve mix cohesion, improving pumpability over long distances.
6. Increase resistance to plastic shrinkage during curing.
7. Minimizes steel reinforcement requirements.
8. Controls the crack widths tightly, thus improving durability.
9. Reduces segregation and bleed-water.
10. FRC, toughness is about 10 to 40 times that of plain concrete.

11. The addition of fibers increases fatigue strength.
12. Fibers increase the shear capacity of reinforced concrete beams.
13. Fibre-reinforced concrete has more tensile strength when compared to non-reinforced concrete.
14. It increases the concrete's durability.
15. It reduces crack growth and increases impact strength.
16. Fibre-reinforced concrete improves resistance against freezing and thawing.
17. Reinforcing concrete with fibre increases fatigue strength.
18. Rain might expose the fibres.
19. Fibres randomly orient in the concrete and could result in poor quality concrete, if not uniform.
20. Reinforced concrete is about 10% to 15% costlier than non-reinforced concrete.

V. DISADVANTAGES

1. Steel fibres will not float on the surface of a properly finished slab, however, rain damaged slabs allow both aggregate and fibres to be exposed and will present as aesthetically poor whilst maintaining structural soundness.
2. Fibres are capable of substituting reinforcement in all structural elements (including primary reinforcement), however, within each element there will be a point where the fibre alternative's cost saving and design economies are diminished.
3. Strict control of concrete wastage must be monitored in order to keep it at a minimum. Wasted concrete means wasted fibres.
4. Fiber may sometime stick up out of the surface, rains allows fiber to be exposed.
5. Fiber randomly orient in concrete and maybe concentrated at few places which cause poor quality of concrete.
6. Fiber increase the cost of concrete by 10% to 15%.
7. The addition of fibers increases the specific gravity of concrete which may result in heavier concrete in some fibers.
8. Fiber in concrete reduce the workability.

VI. CONCLUSION

Durability to aesthetics fiber-reinforced concrete can addbenefits to your project. Fiber-reinforced concrete has been rapidly growing throughout the building industry since contractors and homeowners started to recognize its many benefits. Fibre Reinforced Concrete is gaining an increasing interest among the concrete community for the reducedconstruction time and labor costs. Besides cost issues, quality matters are of paramount importance for construction and fiber-reinforced concrete also ful-fills these requirements.

At present, FRC is specified especially when repair andincreased durability is required for many non-conventional structures or concrete subjected to special conditions. The main role of fibers is to control crack-ing due to plastic shrinkage and drying shrinkage, providing additional energyab-sorption capability. It has also been reported that fibers may improve the static flexural strength of concrete as well as its impact strength, tensile strength, ductility and flexural toughness. Many modern reinforced concrete structure contain a wide range of reinforcing materials, made of eithersteel, polymers or alternative composite materials; they may or may not be combined with traditional steel reinforcement.The final composite will have a particular failure mechanism,which depends on the combination of the employed materials. Needless to say, these new design techniques are required to ensure the long-term durability of these special concretes. The successful ex-perimental and theoretical methods will certainly be used in future concrete R&Dactivitie.

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[9] COMPARATIVE STUDY OF POLYMER FIBRE REINFORCED CONCRETE WITH CONVENTIONAL CONCRETE PAVEMENT

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[11] AIJREAS VOLUME 4, ISSUE 1 (2019, JAN) (ISSN-2455-6300)ONLINE Anveshana's International Journal of Research in Engineering and Applied Sciences Anveshana's International Journal of Research in Engineering and Applied Sciences EMAILID:anveshanaindia@gmail.com,WEBSITE:www.anveshanaindia.com 5 STEEL FIBRE REINFORCED CONCRETE PAVEMENTS FOR ROADS.

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A Critical Study on Modern Formwork system in Construction

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***ABSTRACT*— By definition, formwork is "the mold," or the container into which the casting material, typically concrete,is poured to create the required structural shape. Formworkis used in the construction industry to cast concrete membersin a variety of shapes and sizes using a variety of materials, including wood, steel, aluminum, plastic, etc. Form-work hasa synonym called shuttering. Formwork must be strongenough to support both dead and live loads during casting operations as well as afterward until the concrete hardens and reaches a certain percentage of design strength.**

This paper presents a comprehensive review of various formwork systems in concrete construction, including their raw materials, flexibility, fabrication methods, applications in concrete structures and environmental impacts. The advantages and current limitations of different formwork systems are compared and discussed, and finally recommendations are given.

Keywords— formwork, mold, casting, material, structural, dead load and live load.

I. INTRODUCTION

Formwork systems can be categorized as classic formwork systems, flexible formwork systems, and recyclable formwork systems based on the material stiffness, recyclability, and fabrication procedures, as illustrated in Fig. 1. Since ancient times, concrete has been constructed using traditional formworks, which are built of stiff materials and typically employed for constructionswith regular geometry. The two most popular traditional formwork kinds are made of wood and metal. In recent decades, flexible formwork systems have been created and used in the construction of geometrically complicated concrete components and structures due to the rising demand for structural efficiency and aesthetics. This studywill provide a thorough analysis of numerous formwork kinds, covering their components, traits, manufacturing techniques, and applications. The benefits and existing limits of each formwork system will be assessed, and conclusions will be reached as well as suggestions for formwork system development in the future.

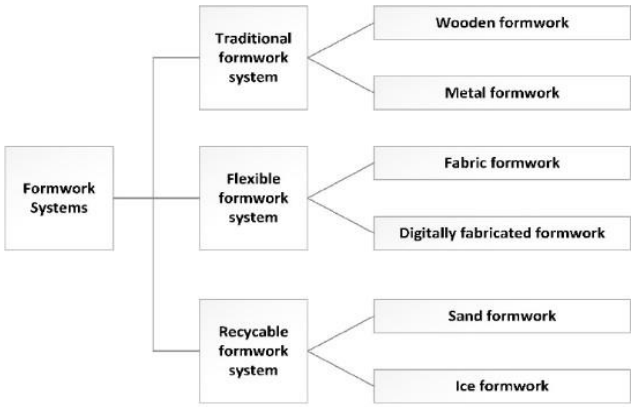


Fig. 1 Classification of formwork systems.

II. LITREATURE REVIEW

D. M. Wijesekara (2012) Formwork makes up around 40% of the entire project cost for the structure, makingit one of the most crucial variables in deciding the success of a construction project in terms of speed, quality, cost, and worker safety. The client wants to usethe facility as soon as possible for the intended purposeand the contractor needs to finish the project as quickly as possible to reduce costs. Achieving a very quick floor cycle is the most effective approach to accelerate work while developing high rise buildings. That isdirectly related to the type of formwork that was used for the building.

Harris M. Mal at el. (2016) in India generally monolithic construction system carried out only for lower rise buildings; if we contemplate this structural system medium height to sky scrapper building then it may more practicable, acceptable and economic comparing conventional structural system. In this structural system all elements of cast at site together. For analysis and design, ETabs software is used for both structural systems.

James (1992), studied that, concrete formwork labour costs constitute over 1/3 of total cost of concrete construction. The factors which majorly influence formwork productivity must be identified and their impacts quantified to improve productivity and to get accurate prediction. The scope was limited to wall and column formwork. From the literature survey factors which significantly impact productivity are repetition, sequencing, weather events and material management

.His study identified the factors which can reduce the number of labour hours required to erect, align and strip concrete formwork will help to improve the cost effectiveness of construction operations. Formwork labour expenses constitute nearly 35% of the total cost of vertical concrete work. Proper system selection,repetitive design dimensions, efficient scheduling, and careful activity coordination can yield significant productivity savings. Productivity depends on formtype, panel size, formed surface shape, form height, method of assembly and placement.

The formwork is a key time-controlling aspect in high-rise building projects since it directly influences the floor cycle, which in turn will speed up the construction of the main structure and significantly reduce the overall project length. In this study, total project costs have been compared for a number of projects when both types of formworks are used in the same undertaking.

Factors effecting the selection of formwork system Cost Quality, Safety, Cycle-time, Building design, Siteconstrains, Available resources, Contractors experience and The abilities of labour, No. of reputations, Capital availability, Method of hoisting.

The single most expensive part of the structural frame of a concrete building is the formwork. The price of theformwork is more than the price of the concrete or steel, and in some cases, the formwork is more expensive than both of those materials taken together.

Many concrete finishing issues, such as discolouration, staining, and dusting, are caused by using subpar formwork materials and craftsmanship during casting. Additionally, some warped concrete surfaces resultfrom flawed formwork systems brought on by repeated formwork reuse and insufficient formwork support.

The building industry is crucial to boosting the economy of a rising nation like India. Urbanization is becoming more and more necessary as the population grows. A successful construction project must priorities time and cost savings without compromising work quality. Formwork is one of the factors that affects theproject's timeline and cost. It is vital to choose a formwork that is appropriate for a certain project because there are numerous types of formworks accessible in terms of material and function. Aluminum formwork (MIVAN technology) is utilized most frequently in construction in India, where it is thought to save time and money for large-scale projects for mass housing, while conventional formworks arebelieved to be more affordable.

III. TYPE OF FORMWORK BASED ON MATERIAL

a. Timber Formwork:

One of the most common forms of construction equipment is the on-site-made timber formwork. Although simple to create, larger structures takemore time. The lifespan of plywood facing is short. Timber is lightweight, portable, and simple to fix. The most adaptable sort of shuttering is timber; it may be used for structures of any size and design. The following prerequisites for wood shuttering should be met:

i. Lightweight
ii. Well-Seasoned
iii. Free from termite attacks
iv. Easily Workable

Advantages of using timber formwork:

v. Timber formwork is easy to construct for anyshape, size and height.
vi. It is economical for small projects.
vii. It can easily be made into any shape or size.
viii. It can be constructed using locally availabletimber.
ix. It is light weight as compared to steel oraluminum formwork.

Figure 2: Timber Formwork

b.*Plywood Formwork (in combination with timber):* Plywood is a synthetically produced timber material that comes in a variety of thicknesses and sizes and is used to make concrete member formwork. It is lightweight, robust, and long-lasting. One of the materials that is frequently used for sheathing, decking, and form lining in shuttering is plywood.

Figure 3: Plywood in combination with timber formwork

a. Steel Formwork:

Steel formwork is growing in popularity as a result of its extended lifespan and versatility. Although expensive, steel formwork can be utilized in a wide range of tasks. Concrete surfaces are finished with exceedingly smooth steel shuttering. It is appropriate for curving or circular constructions such retaining walls, columns, chimneys, sewers, and tanks.

Advantages of steel form-work over timber form

- Steel shuttering is strong, durable & has longer life.
- It gives very smooth finish to surface of member.
- It is waterproof and minimizes the honeycombing effect.
- It can be used more than 100 times.
- Steel formwork can be installed & dismantled with greater ease.

Figure 4: Steel Formwork

c. Aluminum Formwork:

In many ways, aluminum formwork is similar to steel formwork. Due to their low density, aluminum forms are lighter than steel forms, which is their main benefit over steel. If there are several instances of repeated usage during construction, shuttering is cost-effective. Thedrawback is that once the formwork is built, no alterations can be made.

Figure 5: Aluminum Formwork

d. Plastic Formwork:

Plastic form work is a modular, interconnecting system that is lightweight and may be reused more than one hundred times. It can be applied tostraightforward concrete constructions. Due to its similar shape and extensive housing plan, this type of shuttering is growing in popularity. Plastic form work has the following benefits:

- It is lightweight, requiring less handling expense;
- It may be used for big sections;
- If carried and utilized carefully, numerous reuses are conceivable, making it highly affordable.

Figure 6: Plastic Formwork

e. Fabric Formwork:

Fabric formwork is emerging technology in shuttering industry for construction of irregular shape and complex member. The flexibility of thismaterial makes it possible to produce concrete at any shape.

Figure 7: Fabric Formwork

IV. Type of Formwork Based on Structural Member

a. Wall Formwork

Wall formwork is used to pour concrete into shear or RCC walls, such as those in dams, wings, basements,etc. The inner side of plywood sheeting boards are attached to vertical upright timbers (bearers) that formthe wall shuttering. Boards on either side are used to diagonally reinforce the upright timbers.

b. Beam Formwork

The most crucial component of an RCC-framed structure is the beam. Prefabricated formwork forbeams includes bottom and side sheeting panels. The size of the beam is used to determine how the form- component work's sections are made. A fabrication table needs to be made on site in order to prefabricate the sheeting sections.

a. Foundation Formwork

Formwork for foundations is created based on the type of foundation. Depending on the type of foundation, such as footing, combined footing, or raft, the shuttering design will vary. Basically, there are differences in how various foundations are designed, and for strip foundations, shuttering The size, particularly the height of the base, determines the shuttering's design.

b. Column Formwork

Depending on the shape of the column, such as rectangular, circular, hexagonal, or any other shape, the formwork arrangement for the column may vary. According to the column dimensions, the sheeting for the shuttering is built. With the use of bolts, the panels are set in a foot rim and secured to the ground.

V. FORMWORK STRIKING PROCEDURE

- For each prop, ease all supports by 1-2 turns.
- Remove the props toward columns or walls beginning at mid-span.
- If the final few supports were left at the mid-span as intended in the original design, this will ensure that no negative hogging bending moment is created in the concrete slab.
- Bending will occur otherwise.

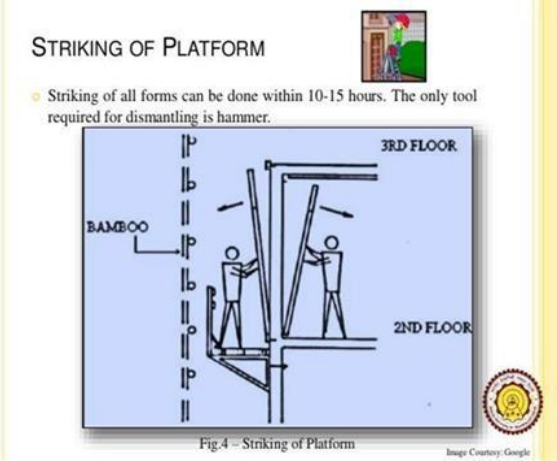
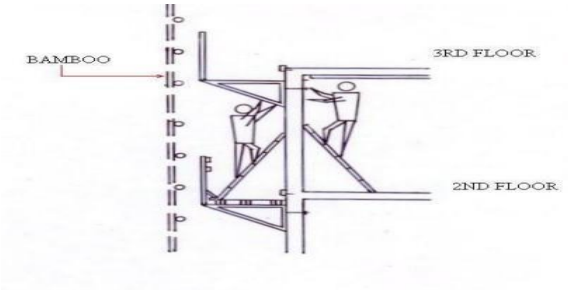


Fig.4 – Striking of Platform



POSITONING OF WORKING PLATFORM BRACKET ON 3RD FLOOR LEVEL AND SECURING NUTS ON TIE ROD ON INSIDE THE BUILDING.

After thoroughly researching formwork, we have learned that there are many different forms that, whilefunctionally identical, have a significant impact on theeconomics, or the project's cost. Aluminium formworkhas the advantage of being reusable multiple times at alower cost each time. The following provides a preliminary estimate of cost deduction for many uses.

Though the initial cost is very high but aluminium formwork is more economical than others.

Table 1 No. of Uses and cost

Number of Uses	Cost Per Square Foot of Contact Area
1	1.00
2	0.62
3	0.50
4	0.44
5	0.40
6	0.37
7	0.36
8	0.34
9	0.32

Table 2- Comparison of cost per square foot of contact areafor different number of uses

THE COMPARISON OF DIFFERENT FORMWORK						
Items	Plywood formwork	small steel formwork	big steel formwork	Heavy steel frame plywood formwork	Light steel frame plywood formwork	Aluminum formwork
Material	12-18mm thickness plywood	2.3-2.5mm thickness steel plate	5-6mm thickness steel plate	18mm thicknes plywood	15mm thickness plywood	4mm thickness aluminum profile
Thickness	12-18	55	86	120	120	65
Weight	10.5	35-40	80-85	56-68	40-42	18-22
Loading (KN/m^2)	30	30	60	60	50	60
Cycle times	5	100	250	200	150	300
Execution	easier	easy	difficult	difficult	easier	easier
Mending fee	lower	low	high	high	high	low
Effectiveness	low	low	high	low	high	higher
Application	Wall, column, beam, bridge	Base, wall, column,beam, slab	Wall	Wall, column, beam, bridge		
Quality of concrete surface	Rough surface	Rough surface, low accuracy	Smooth surface, fair-faced	Smooth surface, can reach facing and ornament fair-faced		
Recycle value	low	middle	middle	low	low	high
must using liftingtower or not		no	yes	yes	yes	no

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We would like to express gratitude to the reader for reading our article and appreciation to our mentor Mr. Swapnil Raut sir for his valuable suggestions andguidance. As without his support it would be impossible for us to write this paper.

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Solid Waste Management in Rural Areas

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I. INTRODUCTION

Solid Waste Management (SWM) is a universal problem that the World is facing today and being no exception, over the years it will grow significantly both in population andin density, which may result a great pressure force on the resources of the city. The municipal solid waste of residential area and waste products of commercial area are the two major solid waste produced in the rural areas. The utmost challenge for rural areas is the disposal of enlarging quantities of solid waste. The present methods of solid waste disposals in the State are not been satisfactory . The wastes that are being disposed are most unscientific (land) thereby posing a great threat to environment and public health Waste reduction and Operational efficiency are the two advanced methods of smart solid waste management. India has 250,000 Gram Panchayats consisting of over 700,000 villages and 8000 cities and towns. Over 65% of the population lives in rural areas and are governed by the Gram Panchayats under the respective state governments and the Ministry of Panchayati Raj.Lack of awareness, growing population, and ignorance towards conscious development has led to waste becominga serious challenge in rural India. Today, with increased accessibility to villages, advertising, and overflowing tourism, there are only a few places where X With increasing litter and growing dumps, it has become necessary to address the problem of rural waste. Rural wasteis a result of increased consumerism and lack of knowledgeat all levels in managing the resultant waste. Solid waste generated in rural areas is predominantly organic and biodegradable, it is becoming a major problem as the waste generated is not segregated in-situ and is of theorder of 0.3 to 0.4 million metric tons per day, as reported the Ministry of Drinking Water and Sanitation (MDWS), Government of India.

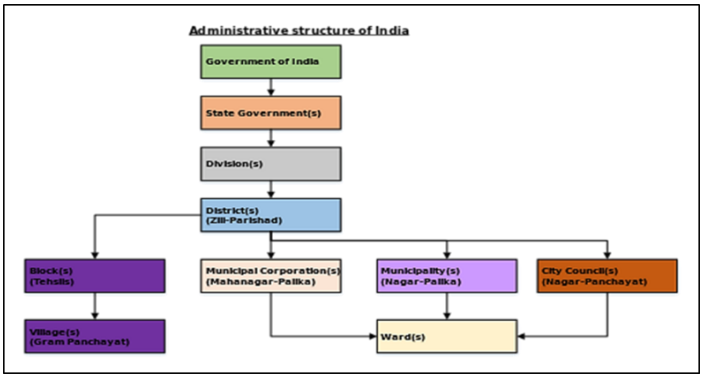


Fig. 1. Administrative structure of rural areas ofIndia

II. LITERATURE REVIEW

Solid waste management in small village a case study. [1]: Management of wastes is a significant problem faced by local governments like panchayats, municipalities, and corporations .each. Every day, large quantities of wastes are being generated by the different economic sectors.

These wastes could be effectively managed and, in some cases, effectively conserved. Effective managing and preservation of wastes usually conserve the natural as well as environmental incomes. Further, conservation the natural resources and effective management of wastes canreduce the problems of pollution and thus save man and nature. The natural environment can be protected by adopting appropriate wastes management policies, which should be effectively implemented by the authorities. The success of waste management schemes and programs depends upon the co-ordination of the different government pieces of machinery with the support of influential people`s participation.

A Case Study on solid waste management in Gujarat: GIFT City [2]: As far as sustainability is concerned, GIFTreflects a sophisticated planning approach to ensure integration of Environmental concerns and Green Buildings, optimum usage of energy, water and construction materials. The project regenerates the area as high-quality, mixed use district of commercial, residential and open space facilities that optimize land and real estate values.

Solid Waste Management In Rural Area (A Case Study for Shahapur Village) [3]:
The rural India has tremendous wealth in terms of underutilized crop residues, animalexcretion and domestic refuge normally known as waste. A systematic management and utilization approach applyingthe recent innovation will only help in maintaining rural areas clean but will also provide sufficient energy, manureand raw material for many industries. The sustainable waste management technologies have brought about a positive change in the rural people. But, we can attain a level of maturity in the areas of waste management in the rural areas

Solid Waste Management Strategy & Improvement of Existing Scenario Based on Market Waste [4]:
Environmental policy issues for market solid wastes management in Khulna are criticized in this paper and focus on weak points in the criteria used by pertinent studies for the storage of solid wastes. To ensure better human health and safety of workers involving in the process of waste disposal, effective solid management system is needed and it must be economically sustainable. By recycling in this management process, materials can be reused which is economical. In BOD pending process naturally oxidation takes place which is also economic and able to minimize environmental hazard. This study tried only to unfold a theoretical model for better solid waste management in Khulna city markets. To investigate the possibility of this model, a complete empirical study is necessity. This study will also prepare the platform for additional study andexploration of the market solid waste management

Rural Solid Waste Management: Issues and Action[5]:
The rural India has tremendous wealth in terms of underutilized crop residues, animal excretion and domesticrefuge normally known as waste. A systematic managementand utilization approach applying the recent innovations will only provide sufficient energy, manure and raw materials for many industries. The sustainable waste management technologies have brought about a positive change in the sanitation and hygiene behavioural changes inthe rural people. But, we have a long way to go before we can attain a level of maturity in the areas of waste management in the rural areas.

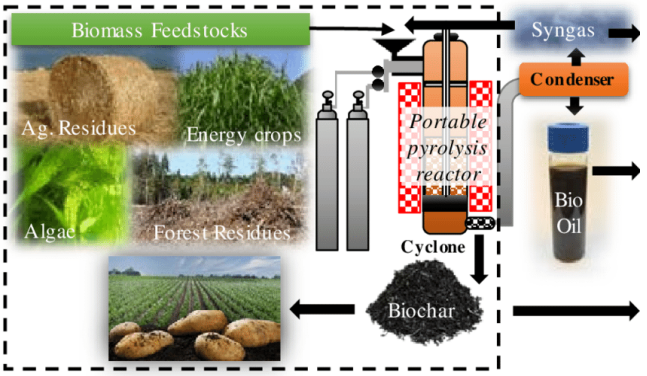
III. OBJECTIVES

1. To protect human health and improve quality of life among people living in rural areas
2. To reduce environment pollution and make rural areas clean
3. To promote recycling and reuse of solid waste.
4. To convert bio-waste into organic manure which is nutrient source of agricultural and horticultural crop.
5. To generate employment for rural poor by offering new opportunities in solid waste management by adopting cost effective and environmentally sound solid waste treatment technologies

IV. METHODOLOGY

Pyrolysis: Pyrolysis involves an irreversible chemical change brought atmosphere devoid of oxygen about bythe Pyrolysis, unlike incineration is an endothermic reaction.
Produces three component streams: i) Gas A mixture of combustible gases such as H.CO, CH, CO, and some

i) liquid: Consisting of tar, pitch, light oil etc.
ii) Char along with the inert materials in the waste feed.



iii) Fig. 1.Pyrolsis method

Vermi-composting: Vermicomposting is the process of composting the biodegradable fraction of municipal solidwaste with the help of earthworms Works in the moisture range of 20-80% and thetemperature range of 20-40°C Pre-processed waste should be laid in vermibeds in layers of 6 inches each, along with uniform spraying cow dung slurry in the ratio of 1:1 Around 150 earthworms may be introduced into thecompost pit of about 2m x 1m x 0.75m.

Fig. 3. Vermicompositing method

Incineration : Incineration involves combustion of wasteat very high temperatures, in the presence.
Results in the production of ash, flue gas and heat Incineration is feasible for unprocessed or minimum processed refuse besides for the segregated fraction ofthe high calorific waste.

Fig. 4. Incineration method

V. CONCLUSION

Conclusion of our project is under process, but the conclusion we derived till now through the literature reviews is that how we can reduce waste from different methods.
Conservation the natural resources and effective management of wastes can reduce the problems of pollution and thus save man and nature.
The success of waste management schemes and programs depends upon the co-ordination of the different government pieces of machinery with the support of influential people`s participation.

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AAC Blocks Using Recycled Concrete

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***Abstract*— This paper is intended to classify the literatures on the innovations that have been done on replacement in AAC materials to enhance its physical and mechanical properties and thermal performance. Apparently, recycling the concrete waste powder to a wall concrete, particularly an autoclaved aerated concrete (AAC) was not frequently practiced in construction and moreover no study has been carried out yet. To improve its physical and mechanical properties and to reduce its production cost, tremendous innovation which used waste materials as partial replacement of AAC materials have been done.**

I. INTRODUCTION

Autoclaved Aerated Concrete (AAC) is a quite popular concrete that has been used in construction building due to its environmentally friendly characteristics and has an excellent thermal insulation.

Most researched innovations that have been carried out proved that the replacement of either fine sands or cement may improve its strength, lower the density as well as thermal conductivity and other properties.

Apart of that, AAC is relatively lightweight, having lower thermal conductivity, higher heat resistance, lower shrinkage, and faster in construction process when compared to normal concrete.

AAC can be considered as a green or environmentally friendly due to its ability to reduce building energy consumption for about 50% without adding thermal insulation layers on the building wall. replacement using waste materials that contribute to lower production cost, thus reduce the cost in AAC construction. In such innovation, none of researcher use recycled AAC as a material to improve its physical and mechanical properties.

II. LITERATURE REVIEW

Utilization of waste material for aerated autoclaved concrete production: Summarizing the research pertaining innovations of replacement in AAC materials to enhance its properties and lower its production cost, the observations show the properties are influenced by the density and thus, they should be qualified with the density, strength of AAC is significantly higher due to its tobermorite which is more stable form of tobermorite on autoclaving and the drying shrinkage of AAC is lower. In such innovations, recycled AAC hasn't taken part yet thus it is an opportunity to use recycled AAC as materials in order to enhance its properties and reduce its production cost.

Preparation of a New AAC-Concrete Sandwich Block and its Compressive Behaviour at Quasi-Static Loading: This study was conducted to meet three main objectives: (1) to produce a lightweight load-bearing building block using AAC made of recycled materials to optimize bonding at the AAC-concrete interface in the composite sand- wich using different sandwiching techniques and (3) to investigate the behaviour of the proposed composite sandwich under quasi-static loading.

MANUFACTURING PROCESS OF AAC BLOCK :

AAC blocks are light weight Aerated Autoclave Concrete Block. It is manufactured through a reaction of aluminium powder and a proportionate blend of lime, cement, and fly ash or sand. Autoclaved aerated concrete (AAC) is a lightweight cellular concrete that has been used for more than 80 years. Currently, however, no good recycling options for AAC from construction and waste exist. During this process, the hydrogen gas escapes create lots(billions) of tiny air cells, applying AAC with a strong cellular structure. The hydrogen gas or bubbles cause the concrete to expand to roughly thrice times its original volume, further strengthened by high pressure steam curing. The product thus formed is not only light weight concrete but also has higher compressive strength. AAC is a masonry material that is lightweight, easy to construct, and economical to transport. AAC is one of the materials which can cope up with the shortage of building raw materials and can produce a light weight, energy efficient and environmentally friendly concrete. This study deals with the manufacturing process of the autoclaved aerated concrete blocks.

A. Study Of Autoclaved Aerated Concrete Block As A Alternetive Building Construction Material

Economy of structure is one of the basic aspects upon which any design is based. Stability plays an important role but best designer is one who comes out with a design which gives the stable and economic structure. The development of construction technology is closely related to the development of adequate mechanization and handling technology. Autoclaved aerated concrete block is an important addition

to the types of masonry units available to the builder and its use for masonry is a constantly increases. An investigation on construction of Autoclaved aerated concrete block masonry emphasizing in the present to study the crack patterns developed in the structural elements such as wall. Though the strength of wall constructed with Autoclaved aerated concrete block give the less strength as compared to brick masonry but cost of construction is very less.

III. OBJECTIVES

1. To improve the strength of AAC blocks
2. To make use of concrete from used structure

IV. METHODOLOGY

Collecting the sample from demolished site

Crushing the concrete into required size

Forming the mould with use of required materials

Testing the specimen by performing various tests

Results and conclusion

Collecting the sample: As of now we first collected the concrete cubes of size 150 X 150 X 150 mm. then we kept the cube in water for curing to get ready for crushing in required size of particles.

Crushing the concrete cube: In this stage we prefer crushing the concrete cube by mechanical means.
Some advanced machinery can perform this type of task. Crushers or grinders are required which can make this work easy.

Forming of mould: Mould formation is one of the important steps because this mould can be used in building construction as an AAC Blocks. In this step the block is casted as the same size for which the mould is built.

Testing of specimen: On this specimen number of test are to be carried out and on thew basis of the test results we can derive its various properties.

V. CONCLUSION

Summarizing the research pertaining innovations of replacement in AAC materials to enhance its properties and lower its production cost, the observations show the properties are influenced by the density and thus, they should be qualified with the density, strength of AAC is significantly higher due to its tobermorite which is more stable form of tobermorite on autoclaving and the drying shrinkage of AAC is lower. In such innovations, recycled AAC hasn't taken part yet thus it is an opportunity to use recycled AAC as materials in order to enhance its properties and reduce its production cost.

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Study on Effect of Bacterial Concrete on Crack Repair in Concrete

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***Abstract* — The use of concrete has widened and drastically increased in the last few years, owing to its strength and durability. However, with time, the strength of the concrete decreases and it also tends to develop cracks due to distress. To deal with these distresses, repair and maintenance is necessary. This repair and maintenance turn out to be the most neglected part, due to lack of co- operation, neglected approach, cost of repairs etc. Moreover, additional repairs consume un- necessary resources and manpower which directly increases the cost and causes environmental problems like resource depletion and solid waste generation. As a sense of responsibility to reduce such costs and develop a consumer- friendly product, the research has identified an innovative technique i.e. Self- Healing Concrete. The paper describes the methodology adopted to test the technical and economic viability of this concrete.**

Keywords — Self- Healing, B. Subtilis, B. Pseudofirmus, Precursor Compounds, Light Weight Aggregates.

I. INTRODUCTION

Concrete is a widely used and preferred material for any construction activity. The basic process of using concrete starts with the mixing of the basic constituents: Cement, Sand and Aggregates with water and suitable admixtures. The concrete is then poured at the place of casting. After complete hardening, this concrete is cured to completely hydrate the cement and increase the strength of concrete to its maximum. This process of curing has to be carried out fora minimum period of 14 days. Once the concrete is set, the major task is completed but after a certain time, various properties of concrete may be affected due to various environmental and other reasons. This may lead to development of defects in the concrete. To ensure that such defects do not occur, proper maintenance has to be carried out on regular basis and if in case any such defect is developed, necessary repair methodology needs to be adopted after consulting suitable engineers at the earliest. If not the structure will deteriorate and eventually its working life will decrease, causing an economic burden.

In this entire process, today Curing of Concrete andRepair and Maintenance have evolved as crucial parts causing economic and environmental burdens and forming an ignorant part in the industry. The labourers or site engineers tend to forget the importance of curing or take it very lightly citing various reasons like lack of labour, insufficient water etc. Moreover curing of vertical members like columns becomes difficult as water slides down the column. This ignorant approach towards curing leads to development of micro cracks in the concrete, which may widen further, causing other minor or major defects

The Repair and Maintenance process is widely neglecteddue to lack of funds, ignorant approach, etc. and is continuously delayed. In return, when repair and maintenance is carried out, the final cost increases and causes unnecessary use of extra materials and exploitation ofvarious resources which could be avoided, had the repairs been carried out earlier

These problems can be resolved by doing necessary changes at the grass root level of manufacturing concrete. The use of Self- Healing Concrete is the most relevant solutions.

Self- Healing Concrete

As the term suggests, Self- Healing means ability of concrete to repair its cracks autogenously or autonomously without the application of any external agents. The concrete, hence ensures that the micro- cracks that are developed are repaired at the micro level itself and do not intensify further.

II. OBJECTIVES

The major objectives of this study are to deal with the problems faced by the final consumers of concrete. However, on a wider note the exact objectives of this study shall be dealing with following points:

1. To suggest an innovative technique to avoid to resolve the problem discussed above.
2. To study the features and characteristics of self- healing concrete as a measure to neglected maintenance and repairs to concrete structures and its economic viability.
3. To experimentally determine various physical properties of the concrete and hence compare it with respect to ordinary in various aspects.
4. To experimentally analyze the optimum dosage of ad-mixtures to be added to the concret

III. LITERATURE REVIEW

E. Schlangen, H. Jonkers, S. Qian & A. Garcia have carried out a detailed study on self- healing techniques in 3 different materials and provided the methods of self- healing.The first technique was induction of bacteria into concrete mix to promote the formation of calcium precipitates to seal the cracks. They have identified its larger scope in underground structures where it is difficult or nearly impossible to carry out repairs. The second method was using Strain Hardening Cementitious Composites (SHCC) and its combination with micro- fibers and SAP's (Super Absorbent Polymer's). Third suggested method is for Asphalt Concrete which self- heals using encapsulated oils and micro- steel fibers. [1]

H. Jonkers and E. Schlangen in another paper have studied in detail Bacterial based Self- Healing Concrete.They used *B. Pseudofirmus* as the self- healing agent and have concluded from their study that there was a loss of 10% compressive strength in the concrete, which could not be justified due to any other cause except the addition of bacteria. The two component bacterial concrete included addition of the bacteria and nutrients which developed 100 micron size calcite particles on the surface. The control setupconsisted only nutrients added in the mix and showed negligible calcite formation. This clearly justifies theaddition of bacteria as a self- healing agent. They have concluded the method to be sustainable and useful. They however have not identified the quantification of a self- healing which needs to be studied. The study also explains indetail the growth of bacterial culture. The study has also pointed out the un- clarity about the availability of organic compounds mixed with concrete to the bacteria. [2]

H. M. Jonkers has further studied in detail the Bacterial Self-Healing process. The author has here attempted to identify a long living bacteria for effective crack sealing. He has suggested to add precursor compounds, which can be converted to hard precipitates by the bacteria. The author has identified that 100% self- healing can be obtained with the use of proper precursor materials. The experiments were conducted on 6 cubes and they were later tested for permeability and all the 6 cubes ended up with negligible permeability in spite of being cracked before testing. It was also observed that the bacteria with precursorshave an ensured life of more than 6 months. The paper however doesn't quantify the bacteria and precursor material and still is incomplete in the aspect of economic viability of this concrete. [3]

Salmabanu Luhar and Suthar Gourav have presented astudy on Self- Healing Concrete. They have added bacteria in the concrete mix with a combination of Light Weight Aggregates (LWA). They have observed an increase in compressive strength by 15- 18% and a considerable decrease in permeability parameters of the self- healing concrete. Bacterial Concrete also has lower value of relative capillary index and also decreased gas permeability. This clearly explains and justifies the self- healing mechanism. This study has presented different type of bacteria most suitable for different types of repairs like for crack repair, *B. Pasteurii* and for surface treatment *B. Sphaaericus* would bemost suitable etc. The paper also concludes that the concretethus obtained has decreased gas permeability and lower rate of infiltration. [4]

Meera C. M. and Dr. Subha V. have carried out a study on Strength and Durability of Self- Healing Concrete. The study explains various self- healing mechanism andfocuses mainly on bacteria based self- healing. The experimental analysis was carried out on M20 Grade. Fir compressive strength and split tensile strength analysis cubes and cylinders were used respectively. For durability assessment the specimens were immersed in 5% H_2SO_4 Soln., 5% NaCl Soln. and Distilled Water. The final results concluded an increase in strength, both compressive and splittensile and also observed that bacterial concrete is more resistant to acid attack and less water absorption. The concrete is hence also less susceptible to internal and reinforcement corrosion. [5]

IV. METHODOLOGY

The basic idea of this project is to deal with the shortcomings of using ordinary concrete. So the work on thisproject started with understanding concrete and identifying problems. After identifying the problems, literature review on the problems and their possible solution was carried. The next step of this project is to design the material and experimentally test it and compare its properties with ordinary concrete. The final step is to analyze the obtained results and check the economic viability of the idea to conclude if the idea is sustainable or not.

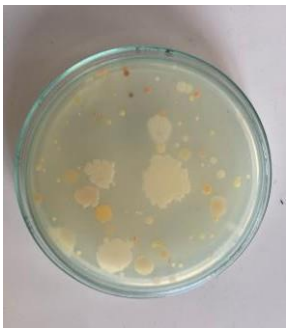

Fig. 1: Bacterial Cultures (Alive)

The basic admixture required for Self- Healing Concrete is Bacteria in its dormant state. Alive bacteria cannot sustainthe mechanical forces developed while mixing the concrete and the dry state developed by mixing of the bacteria with the dry mix. The bacteria added in dormant stage can sustainsuch harsh conditions and hence is suitable to be added. These cells of dormant bacteria get active as they get favorable conditions like moisture, oxygen, etc.

When cracks are developed in the concrete, these conditions are automatically made available to the bacteria. The cells then carry out the metabolic activities and generatecalcium carbonate ($CaCO_3$). This calcium carbonate fills the crack and the concrete (defects/ cracks) is healed autogenously.

Fig. 2: Dormant Bacterial Culture of B. subtilis mixed withNutrients

The development of bacterial culture is one of the most crucial parts for developing this concrete. The very first experiment of the study involved checking the sustainability of the bacteria in cement conditions

To check this a dummysample of cement paste with bacterial mixed was developed.The isolated, dormant culture of *B. subtilis* was obtained from the laboratory. This culture was mixed with nutrients and heated to a suitable temperature. The bacteria with nutrients was then mixed with cement paste. The developed cement block was then cured as per the specifications of the relevant IS code. To check the viability of the bacteria, artificial cracks were induced and the sample was broken to check the homogeneity of the mix. The sample is to be observed under microscope to obtain relevant conclusions.

V. CONCLUSION AND FUTURE SCOPE

The main objective of this study is to find a solution to the problems as discussed above and to check if it is relevant in today's consumer centered market. This technical paper has discussed the one of the most suitable and innovative concrete that can help in the development of concrete industry viz. Self- Healing Concrete.

However the research does not stop here. The objective of experimental testing and analysis of result and comparison of these concretes with ordinary concrete in various aspects has to be worked upon.

Once the relevant results and outcomes are obtained from the dummy sample, the mechanical properties of the concrete are to be identified. The crack healing mechanism is to be studied with respect to time and the economic viability has to be explored.

This aspect of the study is yet to be examined but the ongoing experiments will definitely give a positive outcome.

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Microbial Fuel Cell

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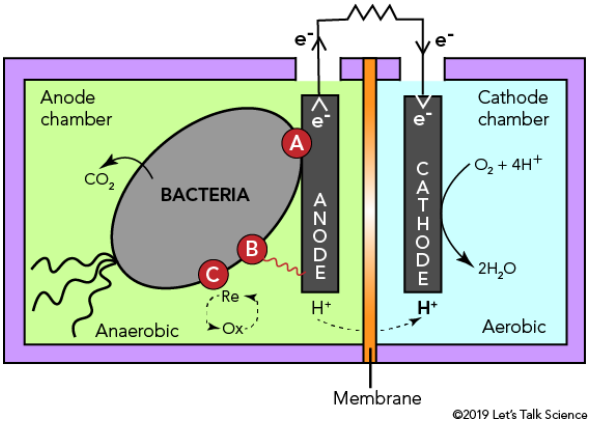
Abstract **:-The focus, in this work, is on the electricity generating function of an MFC. In todays time, there is a great need to reduce the use of fossil fuel energy on our planet, to reduce the harmful effects of these fossil fuels. For these purpose we needto research on the exploitation of renewable sources of energies. One of the renewable source of energy can be microbial fuel cell. It is a potential alternative that can function in two ways : To produce energy or whileintensifying wastewater treatment by degradation of organic waste matter. Our main aim of this experimentis to generate electricity by using synthetic water which contains sources of carbon (saccharose:C12H22O11), sources of amino acid (Viandox) , sources of sodium chloride(NH4Cl) and source of phosphate (H3PO4).Our main target is to generate electricity by using MFCs. There are different types of MFCs and are built and categorized on the basis of their performance. The most important parameters like maximum power density, internal resistance and coulombic efficiency are calculated and measured using different electrodes and substrates in order to compare five different types of MFCs. Our result were quite accurate, as we obtained around 1.2V of Potential Energy. For our experiment firstly we took a cylindrical pot made up kaolinite soil. The pot is baked at temperature of 800 degree C. The earthern pot is firstly filled with synthetic water . Thenwe will place a graphite cathode and a steel scrap of 316 anode and form a circuit using titanium wire. The graphite sheets are also wrapped to the outer side of the pot using titanium wire. And our circuit of the microbial fuel cell is roughly completed here. We used synthetic waste water and soil as a substrate and found that soil sample will deliver higher power supply under same situations. It is traditional MFCs which consists of anode and cathode put in a single chamber MFCs. Microorganisms used in the process plays the role of catabolizing the substrates and generating the electricity. MFCs can also be used in biosensors like small devices as a power generators.**
Besides lots of advantages of MFCs it has some important disadvantages also. One of the disadvantageis that it has low power and current density. In this project we reviewed the research, demonstrated the practical and worked on the possible improvements in our MFCs. Also we discussed
about the other key factors and parameters that can generate bioelectricity

Keyword:- ***Microbial Fuel Cells; Sustainable Energy Source; Renewable Electricity Production Capacity; Power Source of Environmental Sensors***

I. NTRODUCTION



Let us start of with what is MFCs .They are basically microbial fuel cells which are used to produce electricity by using the electrons derived from biochemical reactions catalyzed by bacteria .Today weare witnessing a global energy crisis due to huge energy demands and limited resources. Non-renewableenergy sources are depleting and renewable energy sources are not properly utilized. Renewable resources are energy sources that cannot be depleted and supply a continuous source of energy which makes it economical and sustainable. There is an immediate need for search of alternate routes for energy generation. Microbial fuel cell (MFC) technology, which uses microorganisms to transform chemical energy of organic compounds into electricity is considered a promising alternative. Extensive studies have corroborated new insights into MFC, which showthat a wide array of carbon sources including wastes can be employed using a variety of microbes.Microbial fuel cell (MFC) is a novel technology for wastewater treatment along with energy recovery.

Many countries around the world have made remarkable efforts to find solution for energy crisis byturning the eyes into renewable energy sources such as solar energy, energy produced from wind and water. Among thses efforts, one of

the latterly proposed alternative energy sources is fuel cell (FC) which generates energy using high value metal catalysts (in the traditional version) .In contrast, high cost and high mass generation are the only disadvantages of this newenergy sources

One type of FCs is microbial fuel cell (MFC) that usesan active microorganism as a biocatalyst in an anaerobic anode compartment for production of bioelectricity . Although electrical current produced bybacteria was observed by Potter in 1911 , limited feasible results were acquired in this area by the next 50 years . However, in the early 1990s, FCs became far more appealing devices; consequently, MFCs were considered as promising technology . Furthermore,research domain of MFCs turned much vaster in 1999once it was discovered that mediator was not a compulsory component within MFCs.

Renewable energy production and waste water treatment are two long term goals of developing the MFC technology. Efforts are being made to improve the performance and reduce the construction and operating costs of MFCs. Meanwhile, finding niche applications in which the technology can be used immediately in practice will certainly help technologyadvances and eventually achieve these long term goals.

In future, MFCs may set an optimistic baseline as an alternative energy source and for waste treatment. In India, rural areas in particular should benefit by replacing methogenesis with MFC. In urban areas,MFC technology may help industrial wastewater treatment plants reduce their operating costs with parallel treatment of generated waste.

The scope of this project in future is that , MFCs mayset an optimistic baseline as an alternative energysource and for waste treatment. In India, rural areas inparticular should benefit by replacing methogenesis with MFC. In urban areas, MFC technology may helpindustrial wastewater treatment plants reduce their operating costs with parallel treatment of generated waste. Our research matters because using something which will not lead to any pollution or other side effects to get various advantages on the other hand is something remarkable and will be known and play a dominant role in the future.

II. COMPONENTS OF MFC

Anode

The anode structure of MFC should provide adequate support for development of electrochemically active biofilm which will enable efficient electron transfer

Anode materials should have high conductivity,chemically stable in the wastewater streams, have good biocompatibility with no toxicity towards microorganism, high surface area for microorganism to easily anchor and material should be economical

Cathode

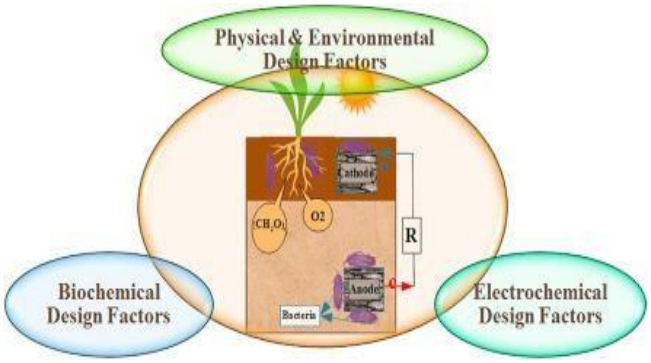
Cathode is responsible for electron transfer to terminalelectron acceptor and its poor reduction kinetic is themajor bottleneck restricting power output from MFC. The nature of electrode material, available surfacearea, cathode catalyst, cathodic electron acceptor &operating condition at cathode such as oxidantconcentration, temperature and catholyte pH are parameters significantly influencing the performance of cathode.

Separator

A separator is an essential component required todecrease electrode spacing, oxygen intrusion intoanodic chamber and insulate the electrodes in MFCs. To enhance power output from MFC, it is necessary touse the separators possessing high cation transferproperty.

Varieties of separators have been used such as ion exchange membrane, bipolar membrane, size exclusive separator, ceramic separator etc.

III. LITERATURE REVIEW



We choose Microbial Fuel Cell as our project topic forour area of research since it is one of the most efficient renewable source which provides us electricity and treats water with nothing in return Though the ongoingresearch that concern MFCs was condensed throughout the last decade, in 1911, Dr. M. C. Potter aprofessor at the University of Durham in the UK- observed in his series of experiments that the bacteria

E.coli can produce electricity if put in an organic environment using platinum electrodes. His experiments led to the implementation of a primary microbial fuel cell. Dr. M. C. Potter could also prove that parameters such as temperature, concentration, nutrient medium can influence the amount of “electricity generated”. A maximum voltage of 0.5V was recorded as a result of his exhaustive experimentsthat has never been achieved before, making him the first scientist to concretely prove that actual bacteria can result in a current . Two decades later, and exactly in 1931, Professor Barnet Cohen was able to produce approximately 35V, and two milliamps of current. Mr. Cohen aligned and connected a number of microbial fuel cells in series to be able to create such a high potential and relatively good current . Later on and in 1962, an MFC was designed by Rohrback et al. that generates glucose. Since then, research efforts were put in studying the ability of bacteria to generate an electriccurrent while implementing and testing different designs that at the end took the shape of what we call now a microbial fuel cell in the 1970’s. In 1993, a group of professor from King’s College in London succeeded in developing microbial fuel cells usingdifferent bacteria and microorganisms present in organic waste. They also used mediator systems to improve the efficiency of the cell and its reaction rate .In 2006 and at the Korean Institute of Science and Technology in South Korea, another group of professors joined their efforts together while working on microbial fuel cells. They discovered that some microorganisms have the ability to transport electrons to the anode without referring to any mediator, making the rise of a new type of cells called

"mediator-less microbial fuel cells". The use of wastewater as a sourceof substrate has a dual advantage; first, the electricity produced is cheap, and second, it leads treatment of wastewater. Extensive research has shown that these complex substrates such as agro wastes are oxidized bydifferent group of microorganisms and causegeneration of electricity. In this We have discussed some uncommon wastes and pollutants, which are utilized in MFC for electricity generation

Problem Statement :

Our problem statement is to generate electricity from the synthetic waste water using the microbial fuel cell and microorganisms. MFCs have been invented in 2007 as " bioreactors which converts chemicalenergy bonds of organic materials into potential energy with the help of certain catalytic activities of microorganisms under certain anaerobic conditions. "

Objectives :

The main aim of our project is to generate cost efficient electricity using waste-water such assewage water to uplift small scale industries and rural areas. It is one of the new method forgeneration of electricity and the sludge or residue formed after the process is minimal.

It also targets toward sustainable development and as eco-friendly fuel, saving us from heavypollution caused by use of fossil fuel. It provides us an alternative for producing electricity and lowers our dependency on the already available costly methods.

In this project we need to increase the rate of power generation and production of electricity simultaneously minimising the operation and maintenance cost.

IV. METHODOLOGY

Experimental Set up

The microbial fuel cell (MFC) comprises of one earthen cylindrical pot of 10cm diameter, thickness of0.7cm and of depth 16.5cm with internal volume of about 1296cm^3. It has a cover at the top, of Acrylic sheet of diameter same as that of earthen pot and withthickness, 3mm. A titanium wire of length 30-40cm tosuspend steel scrap of grade 316/304 as Anode, insidethe pot surrounded with synthetic waste water. Carbon felt sheet is used as Cathode of height same as of earthen pot to cover outer area. Connecting wire with 100ohm resistor is used to create the whole circuit and a multi-meter used to measure the voltage obtained.

Synthetic Waste-water composition

It is prepared by using mixing chemicals which are mainly:-

i. 1 liter tap water
ii. Sodium Acetate (CH3COONa)
iii. Sucrose (C12H22O11): 0.445 grams
iv. Sodium hydrogen carbonate (NaHCO3): 0.750grams
v. Ammonium chloride (NH4CI): 0.159 grams
vi. Di-potassium hydrogen phosphate (KHPO): 0.0135grams
vii. Potassium dehydrogenate phosphate (KH2PO4): 0.0045 grams
viii. Calcium chloride hydrate (CaCl2.2H2O): 0.125 grams
ix. Magnesium sulphate heptely (MgSO4.7H2O): 0.032 grams
x. Ferrous sulphate (FeSO4.5H2O): 0.01 grams

Economy of cylindrical mould

a. It is a tera coated soil having iron oxide hence is redin colour.
b. Shrinkage is 10% -12%.
c. Baking Temperature is 750-800 degree Celsius for about 6-8 hour mould.
d. Porosity is 10% to 15% and cost is Rs 280 per
e. Water required is 30%-40% of total volume of soil.
f. Terra coated soil is used for the ceramic cylindrical moulds and acts as a proton exchange membrane.
g. This soil was used by ancient colonies such as Harappa and Valley.
h. It is eco-friendly material as made up of earthy claymaterial, strong and are resistant to electricity!
i. When surface is burned before firing it reducesporosity of the mould and has good cation exchange property

Experimental Procedure

In the experiment the synthetic waste water is poured inside the pot. Then the acrylic sheet is fixed using M-Seal over the lid of pot and two small hole is made overit, one for and another for inserting titanium wire inside. The titanium is suspended inside the pot such that it should not touch either bottom of the pot or anyside of the pot holding steel scrap which should completely submerge inside the waste water completing our Anodic connection. The ratio of volume of steel scrap to the volume of pot should be as the volume of pot is 1296cm^3 hence volume ofscarp should be cm^3. Now the carbon felt sheet is usedto cover outer surface area of earthen pot and is winded using titanium wire completing our Cathodic connection. Then both the connection are elongated using connecting wire and is connected with 100ohm resistor to the complete the circuit and to start the flow of electricity generation, using multi-meter the magnitude of generation is noted.

V. RESULTS

Hence we conclude that are mfcs have generated electricity of 1.2 V.

CONCLUSION

It is genuine that in forthcoming years with the expected improvement in this technology and lower costs, more variety of substrates will be used leading us to a sustainable and economical bioenergy. The varioussubstrates that have been used in MFCs for current production and waste treatment are numerous but thereis also scope of production or utilization of newersubstrates along with improved outputs both in terms of power generation as well as waste treatment. Other potential ways to use MFC are in areas like desalination, pollution remediation, remote sensing andhydrogen production .Another development in the fieldof utilizing microbial fuel cells is that we can think of power our house with sewage or can charge our pacemaker with household sewage rather than using conventional source of energy as it is not only eco- friendly but also can increase GDP or gross domestic production of a nation. As the whole world is depended on conventional source of energy this field is emergingto be a reusable, nonconventional and renewable and bio friendly source of energy By combining

MFC wi th electro dialysis one can overcome the drawbacks of MFCs.

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Seismic Response of Irregular building

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***Abstract*—Earthquake-resistant or aseismic structures are designed to protect buildings to some or greater extent from earthquakes. While no structure can be entirely immune to damage from earthquakes, the goal of earthquake-resistant construction is to erect structuresthat fare better during Seismic activity than their conventional counterparts. According to building codes, earthquake-resistant structures are intended to withstand the largest earthquake of a certain probability that is likely to occur at their location. Currently, there are several design philosophies in earthquake engineering, making use of experimental results, computer simulations and observations from past earthquakes to offer the required performance for the seismic threat at the site of interest. This paper consists of literature review of those past earthquake occurring, their observation and results based on which a new Earthquake resistance structure will be designed.**

Keywords—seismic design, calamity, earthquake, reinforced concrete, superstructure, substructure, strength.

I. INTRODUCTION

Earthquake-resistant or aseismic structures are designed to protect buildings to some or greater extent from earthquakes. While no structure can be entirely immune to damage from earthquakes, the goal of earthquake-resistant construction is to erect structures that fare better during Seismic activity thantheir conventional counterparts. According to building codes, earthquake-resistant structures are intended to withstand the largest earthquake of a certain probability that is likely to occur at their location. This means the loss of life should be minimized by preventing collapse of the buildings for rare earthquakes while the loss of the functionality should be limited for more frequent ones. Currently, there are several design philosophies in earthquake engineering, making use of experimental results, computer simulations and observations from past earthquakes to offer the required performance for the seismic threat at the site of interest. These range from appropriately sizing the structure to be strong and ductile enough to survive the shaking with an acceptable damage, to equipping it with base isolation or using structural vibration control technologies to minimize any forces and deformations.

II. OBJECTIVE

Following are the objectives:

a. The objectives of our project are to create a structure thatis resistant to earthquake, like calamities.
b. Earthquake-resistant structure, building designed to prevent total collapse, preserve life, and minimize damage in case of an earthquake or tremor.
c. Earthquakes exert lateral as well as vertical forces.
d. Earthquake-resistant structures absorb and dissipate seismically induced motion through a combination of means: damping decreases the amplitude of oscillations of a vibrating structure, while ductile materials (e.g., steel) can withstand considerable inelastic deformation

The aim of the design is therefore to provide life safety (or no collapse) under the design earthquake. Life safety practically means that heavy irreparable damage may occur in the structure but collapse and loss of life are avoided.

If a skyscraper has too flexible a structure, then tremendous swaying in its upper floors can develop during an earthquake. Care must be taken to provide built-in tolerance for some structural damage, resist lateral loading through stiffeners (diagonal sway bracing), and allow areas of the building to move somewhat independently.

III. LITRATURE REVIEW

Construction of earthquake resistant building and infra structure implementing seismic design and building code in northern Pakistan 2005

This research showed that the many areas of Pakistan are vulnerable to natural disasters like earthquake. Earthquakes are more common in the northern part of Pakistan (Khyber-Pakhtunkhwa and AJK) and western part of Pakistan (particularly Quetta and nearby areas). The earthquake occurred due to collision of north western side of Indian platewith the Eurasian plate in the northern part of Pakistan in theareas of AJK and northern Khyber-Pakhtunkhwa. The destruction was more than expected because

- construction techniques used were not good without taking into account the seismic design and provisions.
- The wall construction was non-engineered and not durable, and there were no good ties of walls with floor and roof.
- The foundation was not deep and thick to give sufficient support to the structure. The quality of building materials Most multistorey buildings were found resting on non-structural infill walls and collapsed easily by ground

- The mortar used in walls was mostly mud or low-quality cement, making the walls easy to collapse.

Some buildings were constructed on mountain slopes without proper balance. Pakistan's seismic zoning ranges from zone 1 to zone 4; the earthquake affected area was in zone 2 which should be in zone 4. Around 70% cost of earthquake was related to reconstruction. So, in reconstruction, the implementation of building and seismic design is very important and it is also needed to update the code and seismic design according to international standards and the practices in Japan [1].

Comparative Study of Static and Dynamic seismic Analysis of Multistoried Building

Anirudh Gottala, shaik Yajdhani et al [2] studied static and dynamic analysis of G+9 multistoried building. Linear seismic analysis was done by static method (Seismic Coefficient Method) and dynamic method (Response Spectrum Method) using STAAD-Pro as per the IS-1893- 2002-Part-1. Parameters such as Bending moment, Axial force, Torsion, Displacement, Nodal displacement, beam and column end forces etc. were calculated. The authorsconcluded that,

- The values for Moments are 35 to 45 % higher for Dynamic analysis than the values obtained for Static analysis.
- The values of Torsion of columns are negative for Static analysis and for Dynamic analysis the valuesof torsion are positive.
- The values of Nodal Displacements are 50% higher for Dynamic analysis than the values obtained for Static analysis.
- Nodal Displacements and Bending moments in beams and columns due to seismic excitation showed much larger values compared to that due tostatic loads. [2].

Study of Behaviour of Seismic Evaluation of Multi-storeyed Building with Floating Column

In this dissertation work, the behaviour of the buildings withand without floating columns are analysed for seismic and gravity condition. The seismic parameters such as lateral displacement, base shear, fundamental time period and inter storey drift are studied and the comparison between these parameters are given between the regular building and building with floating column. Observations are below:

- The natural time periods obtained from the empirical expressions do not agree with the analytical natural periods. Hence, the dynamic analysis is to be carried out before analysing these types of structures. And also, it can be concluded from the analysis that the natural time period depends on the building configuration.
- Lateral displacement increases along the height of the building. There is more increase in the displacement for the floating column buildings compared with the regular building.
- The inter storey drift also increases as the increase in the number of storeys.
- The storey drift is more for the floating column buildings because as the columns are removed the mass gets increased hence the drift.

As the mass and stiffness increases the base shear also increases. Therefore, the base shear is more for the floating column buildings compared to the conventionalbuildings. Hence, from the study it can be concluded that as far as possible, the floating columns are to be avoided especially, in the seismic prone areas [3].

Seismic Analysis of Regular & Vertical Geometric Irregular RCC Framed Building

The comparison of results has been done storey wise for each bay and then bay wise for same building height. It is concluded that as the amount of setback increases the shear force also increases. The fluctuation of critical shear force from regular to vertical geometric irregular is very highBased on the work presented in this thesis following point- wise conclusions can be drawn:

- It is concluded that as the amount of setback increases, the critical shear force also increases. The regular building frames possess very low shear force compared to setback irregular frames.
- The critical bending moment of irregular frames is more than the regular frame for all building heights. This is due to decrease in stiffness of building frames due to setbacks. Thus, there is need for providing more reinforcement for irregular frames.
- It is seen that the critical seismic parameter of 4 bay building frames up to eight storey building height is less than corresponding 8 bay building frames. Therefore 4 bay building is appropriate for lower building heights.
- For higher storey building (twelve & sixteen storey) 8 bay configurations should be preferred because theyhave generally lesser values of critical seismic parametersthan 4 bay. Thus, this study demonstrated that with the increase in number of bays the seismic performance of both regular and setback building improves.
- The seismic performance of regular frame R is found to be better than corresponding irregular frames in nearly all the cases. Therefore, it should be constructed to minimize the seismic effects. Among setback frames, Type V1 building configuration is found superior than others [4].

Comparison of analysis and design of regular and irregular configuration of multi-Story building in various seismic zones and various types of soils using ETABS and STAAD

S. Mahesh, B. Panduranga Rao [5] studied residential building of (G+11) regular and irregular configuration for earthquake and wind load using ETABS and STAAD PRO V8i. Assuming the material property to be linear, static and dynamic analysis was performed. This analysis was carried out by considering different seismic zones and for each zone; the behavior was assessed by taking three different types of soils namely Hard, Medium and Soft. Authors compared both the regular and irregular configurations. Following conclusions were drawn,

- The base shear values and story drift values were morein regular configuration than irregular configuration.
- Base shear value was more in the zone 5 and that in thesoft soil in regular configuration.

Story drift value was more in the story 13 in the regular configuration.

IV. METHODOLOGY

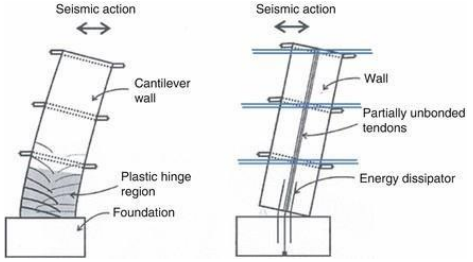
A non-engineered house is an unsystematically designed, built, and supervised house structure. These houses are usually constructed by traditional builders and/or building owners, using common traditional approaches withoutintervention by qualified architects and engineers in their design and construction, but which may follow a set ofrecommendations derived from the observed behavior ofsuch buildings during past earthquakes and trained engineering judgement.

Talking about the Burj Khalifa is built to act like a stiffened rod, reinforced with cross-bracing beams and braced panels that can withstand earthquakes up to magnitude 7. The building's outer structure is ringed with perimeter columns that attach to the building's interior walls like floats to an outrigger boat.

The designers note that these features help to keep the floors and walls from breaking from twisting stress or from the stress of moving laterally. The designers also note that seismic and geotechnical reports attest to the strength of the building.

These are few insights so as to how was Burj Khalifa was designed, on basis of these insights only we can create a mini replica of a structure on a smaller scale.

- The superstructure is supported by a large reinforced concrete mat, which is in turn supported by bored reinforced concrete.
- The podium provides a base, anchoring the tower to the ground, allowing on grade access from three different sides to three different levels of the building. Fully glazed entry pavilions constructed with a suspended cable-net structure provide separate entries for the Corporate Suites at B1 and Concourse Levels, the Burj Khalifa residences at Ground Level.
- And addition to its aesthetic and functional advantages, the spiraling “Y” shaped plan was utilized to shape the structural core of Burj Khalifa. This design helps to reduce the wind forces on the tower, as well as to keep the structure simple and foster constructability.
- The crowning touch of Burj Khalifa is its telescopic spire comprised of more than 4,000 tons of structural steel. The spire was constructed from inside the building and jacked to its full height of over 200 meters (700 feet) using a hydraulic pump



The structure which we are planning to build would be calculated somehow on the basis of the objectives and methods followed in the structures give above, like Burj Khalifa and Antilia.

Major role in countering the earthquake is played by the steel used in the RCC, and the design of the structure.

Any structure to be resistant to the waves of earthquake, needs to have a good foundation.

The core strength of the structure depends on the substructure and the design of the structure.

The structures are planned and calculated, keeping in mind a magnitude of earthquake that has to be resisted. Earthquake is measured in the instrument known is Rictor’s scale.

The definition of a method for design and evaluation of the seismic resistance of R/C building structures is a wide and complex problem. One hand, it is necessary to carry out the most possible realistic definition of the structural system capacity, in terms of strength and deformability capacity of the system, and on the other hand, after having selected the expected earthquake effect on a given site, in terms of intensity, frequency content and time duration, to predict as realistically as possible the nonlinear behavior of the structure, and on the basis of these results to define the earthquake, i.e., the seismic force or the acceleration that would cause damage to structural elements and the integral structural system.

The idea of using displacement in the design process is not a new one. In 1974, Gulkan and Sozen discussed that the design of the structure could be modelled as a single degree of freedom system. That work formed the basis of the so-called "substitute structure approach". The substitute structure is an elastic structure that has the same peak force and peak displacement characteristics as the inelastic structure. This modelling is required because Displacement -based design (DBD) procedure used an elastic response spectrum for the design of a structure that is expected to have inelastic deformation in the design level earthquake. DBD procedure is alternative seismic design procedure that designs the structure for the requirements based on the displacements rather than forces. The only initial design input parameter is the maximum allowable displacement. Design forces, stiffness and reinforcement details all become dependent on the target displacement.

CONCLUSION

Seismic risk reduction through the implementation of seismic codes in construction is not simply physical and technical intervention. Implementation of seismic codes should conform with a new paradigm shift that a combination of technical and non-technical intervention is an important factor as a fundamental element in the wider context of disaster reduction. Here, the combination of the two has emerged clearly, even though technical intervention is still in the majority.

Finally, the implementation of proper seismic codes in real non-engineered construction is the principal solution to make a substantial difference in seismic risk reduction. A balance should be struck between communicating local seismic risk and the importance of seismic codes to the people, and enforcing them to implement the codes.

Hence, the structure will be proceeded to made with, keeping in mind some of the minor calculation and design of the structure we have referred with, Burj Khalifa and Antilia. The project made would be on minor basis, which can portray, the absorption of seismic waves up to a certain limit.

Methodology for design of seismic resistance buildings (RESIST-INELA) is based on the modern principles and trends for design of seismic resistance buildings.

In the both methodologies the parameter for evaluation of seismic resistance of the building is displacement so the advantages of these methodologies over the traditional design practice is obvious: displacement are the better indicators of damage than forces behaviour of non-structural elements are control by structural displacement control of the plastic deformation

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Soil Stabalization Using Eco-Enzymes

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***Abstract*-If the construction site is not able to provide good soil, then it is important that thecontractor uses soil stabilization. This process is carried out to maintain the soil's characteristics and improve its performance as a construction material. It can also strengthen the embankments of roads.**

This paper aims to review the various types of soilstabilization agents that are commonly used for improving the performance of the soil. They are identified as fly ash, lime, cement, waste paper sludge, and expanded polystyrene geofoam. Besides their technical properties, the cost andenvironmental impact of these agents are also taken into account to determine their optimal use.

I. INTRODUCTION

The soil which contains the ground andcomplexion patches show considerable sign oftorture accompanied by loss of strength of the soilduring stormy seasons and loss during summer. Black cotton soil is one similar type of soil which loses its strength during stormy season due to their extensive geste . The problems of extensive geste of soil are as follows(N.B.O. 1962).a. extensive soils have high malleability and compressible when they're impregnated. b. Thesetypes of soil have high strength in dry state, becomes soft after achromatism. Filling up water into crevices and cracks, accentuates the process of softening causing reduction of shear strength and leading to low bearing capacity.c. Structure erected in a dry season show discriminational heaving as a result of lump of soils during posterior wet season. Structure erected at the end of wet season when the natural water contentis high show loss crack and agreement, during dry season. Shrinking cause a downcast thrust on the foundation through skin disunion therefore adding the foundation cargo. Due to these reasons extensive soils need treatment previous to use as an engineering material. These treatments are generally classified into two process, viz.(1) soil revision and(2) soil stabilization. Soil stabilization is the process ofblending and mixing accoutrements with a soil to ameliorate certain parcels of the soil. The processmay include the blending of soils to commercially available cocktails that may alter the gradation, texture or malleability, or act as a binder for cementation of the soil (IRCSP89- 2010). Soil revision is the stabilization process in which enhancement in some property of the soil but doesn't affect in a significant increase in soil strength and durability for uncertain logic, classifiers and literacy styles, Artificial Neural Networks (ANN), inheritable Algorithms and cold- blooded ways are extensively used in the field of Construction Management(CM). Soil parcels like strength, compressibility, plasticity, swelling implicit and volume change tendencies may be altered by colorful soil stabilization and revision styles. Stabilization is deduced by thermal, mechanical, chemical or electrical means. Thermal and electrical is infrequently used and lower data is available about these two. Mechanical stabilization or contraction is the densification of soil by the use of mechanical energy. By the densification air is expelled from the soil voids without important change in humidity content. This system is used to stabilize factious soils where contraction energy can beget rearrangement and interlocking of patches.But, the ways aren't effective if the soil is subordinated to significant humidity change. The effectiveness of contraction may also dwindle with an increase of fine content, bit lower than 75micron, of the soil. This is because inter flyspeck relating and rearrangement during contraction. Changing the physio-chemical parcels of fine granulated soil by chemical stabilization is a more effective form of durable stabilization also densification. Chemical stabilization of non cohesive, coarse granulated soil with lesser than 50 by weight coarser than 75micron is also profitable if a substantial stabilization response achieved.

Quality improvement

By the stabilization better soil gradation, increase in continuity, increase in strength, reduction of malleability indicator and reduction in swelling eventuality is achieved. Stabilization improves the parcels of construction accoutrements and gives the following attributes (IRCSP89- 2010). a) After achromatism with water substantial proportion of their strength is retained. b) Resistance to corrosion.

c) face deviation is reduced. d) The elastic moduli of layers constructed above stabilized subcaste are increased. e) The stiffness and strength of a soil subcaste can be increased through the use of amalgamation to reduce the consistence of the road pavement.

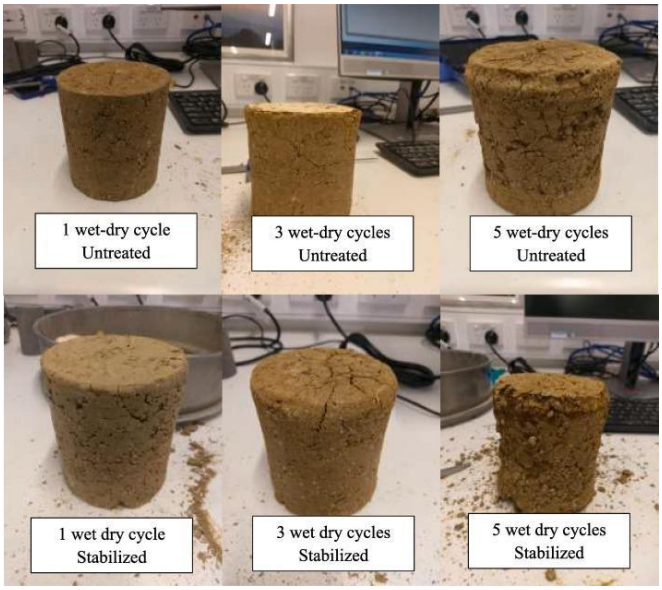
Materials

Fly ash itself has lower cementitious value but it reacts chemically and form cementitious emulsion in presence of humidity. Cementitious emulsion formed improves the strength andcompressibility of soil(Karthik etal., 2014). Karthik etal.,(2014) estimated the effect of cover ash deduced from combustion ofsub-bituminous coal at electric power shops, for stabilization of soft fine grained red soil

The Liquid Limit, Plastic Limit and Specific graveness of soil was 32,23.37 and2.7 independently. Test was conducted on soil and soil- cover ash fusions prepared at optimum water content of 9. At 6 of cover ashthe bearing capacity of soil changes from 10kg/ mm2 to 35kg/ mm2 and CBR value changes from3.1 to4.82. Due to increase in CBR values the consistence of pavement decreases from 12elevation to8.5 elevation. Ahmed(2014) stabilized the muddy soil for the construction of civic roads using cover ash. Author set up that the optimum rate of cover ash with muddy soil is15 by weight of soil. A dramatic reduction in the parcels of soil is seen for 0 to 15 of cover ash content but no conspicuous decline appear in the range 15 to 20 of cover ash content. For contraction, the dry viscosity andO.M.C were measured for colorful cover ash rates. The dry viscosity rise as the cover ash increases up to 15, also reduced to1.53 at 20 of cover ash. The liquid limit dropped from 55 to 48 for increase of coverash from 0 to 15 by weight. Malleability indicator changes from 30 to 13 for addition of 0to 15 of cover ash.C.B.R value of soil changes from 3 to 56. Gyanen etal.,(2013) evaluates the contraction of stabilized black cotton soil using two type of cover ash,viz.(1) fine and(2) coarse. The natural black cotton soil was taken from Gadag quarter of Karnataka. The Liquid Limit,Plastic Limit, Natural water content and Specific graveness of soil were 66,37.12,8.95 and2.68. Fine cover ash soil has M.D.D1.35 g/ cc for 95 of soil and 5 of cover ash. TheM.D.D becomes1.35g/ cc for 95 soil and 5 cover ash admixture and smallest viscosity was0.6 g/ cc for 70 soil and 30 cover ash. The coarse cover ash has M.D.D1.35 g/ cc for 95 soil and 5 cover ash admixture and smallest viscosity about1.0 g/ cc for 70 soil and 30 cover ash. Ashish etal.(2013) stabilize the Black cotton soil set up in Maharashtra usingcover ash. The cover ash content was increased from 0 to 50. Soil under study hasO.M.C.20.4,M.D.D14.7 N/m3C.B.R(Soaked)3.1, CBR(Unsoaked)6.89. Stabilization of soil was done at 0, 10, 20, 30, 40 and 50 of cover ash content. O.M.C is maximum at 10 of cover ash, has29.17.M.D.D. is maximum at 20 cover ash, has14.97 N/ m3. Soaked CBR is2.52 for 10 cover ash and unsoaked C.B.R. is22.90 for 20 cover ash. Bhuvaneshwari etal.,(2005) studiedthe effect of cover ash on soil. Authors increase the cover ash content from 0 to 50. The soil has Liquid Limit 30, Plastic Limit 18, Malleability indicator 12, Dry Density18.04 KN/ m3 andunrestrained compressive strength 2697KN/ m2. The Sot viscosity was continuously decreases and15.13 KN/ m3 at 50 of cover ash. unrestrainedcompressive strength is also decreases and becomes 1176KN/ m2 for 50 of cover ash. Brooks (2009) stabilized extensive soil of CH type. Author uses Fly ash and Rice Husk ash (RHA) to stabilize the soil.O.M.C andM.D.D of undressed soil is 20 and15.5 kN/ m3 independently. In stress strain graph of unrestrained compressive strength it's easily shown that failure stress and strain increased by 106 and 50 independently when the cover ash content was increased from 0 to 25. When the RHA content was increased from 0 to 12, unrestrained compressive stress increased by 97 while CBA bettered by 47. Author concluded that 12 of RHA and 25 of cover ash is used for strengthening the extensive sub grade soil. Grounded on laboratory test 15 of cover ash was mixed with RHA to form a swell reduction subcaste. Anil Kumar and Sudhanshu(2014)stabilize the extensive soil using cover ash and Rice Husk ash. Soil was collected from vill Sukkha, District Jabalpur Madhya Pradesh. Soil has 8 beach and 92 ground complexion. The Liquid limits, Plastic limit,C.B.R,O.M.C, MDD(kN/ m3) and free swell indicator of soil is 53, 30,1.5-2, 26,1.52 and 35 independently. In his study author comes to the conclusion that Liquid Limitis decreases to 55 for 20 FA 25 RHA, malleability indicator is decreases to 86 for 20 FA 25 RHA, Differential free swell is decreases to 75 for 15 FA 20 RHA and specific graveness changes from2.61 to2.20. Dilip Shrivastava etal.,(2014) used the soil of Bilhari area of Jabalpur(M.P.). Soil has specific graveness2.56, Liquid limit48.5, Plastic limit22.7, Malleability indicator25.8, loss limit8.61. Authors made a series of laboratory trials on 5 lime mixed with 5, 10, 15 and 20 ofRHA by weight of dry soil. The CBR value is increased by287.62 and unrestrainedcompressive strength is bettered by 30. The Differential free swell indicator is dropped by86.92 with increase of RHA form 10 to 20. Yaduand Tripathi(2013) stabilized the soft soil, collected from Tatibandh- Atari, pastoral road of Raipur Chhattisgarh, by the use of Granulated blast furnace sediment and fly ash. The soil was classified as CI- MI as per Indian standard bracket system. Different quantum of GBS, i.e. 3, 6 and 9 with different quantum of cover ash i.e. 3, 6, 9 and 12 were used to stabilize the soil. Grounded on contraction andC.B.R test, authors concluded that the optimum quantum of GBS Raut etal.,(2014) stabilized the muddy soil collected from hard of Yeshwantro College of engineering, Wanadongri Nagpur. In his study murrum of Kalmeshwar chase and fly ash of Koradi power factory near Nagpur is used. The muddy soil has Clay 1, beach 20, ground 28, and complexion 51. Grounded on these parcels soil is classified as CH. Specific graveness, Liquid limit, plastic limit, malleability indicator,M.D.D andO.M.C of soil is2.55, 52,20.80,30.50,16.88 and19.0 independently. Authors stabilized the soilby cover ash and murrum. With increase in content of cover ash and murrum UCS andM.D.D. increases up to certain proportion and also decreases. Maximum value of UCS andM.D.D, set up at7.5 of murrum and 5 of cover ash, was4.95 gm/ cm3 and0.328 gm/ cm2. Singh and Pani(2014) used Lime and fly ash as a stabilization material for trace. Author estimated theC.B.R values for both soaked andun-soaked condition,O.M.C,M.D.D of compacted cover ash mixed with 1, 2, 5 and 10 lime. After the work they come to the result that dry unit weight changes from1.142 to1.255 KJ/ m3, andO.M.C decreases from30.2 to24.2. With addition of limeM.D.D increases and OMC diminishments. Addition of lime results in filling the voids of compacted cover ash therefore increased the viscosity. The maximumun soaked and soaked CBR valuess25.39 and1.546 independently. b) Lime Stabilization response of lime with soil is grouped into two corridor, viz(i) original and(ii) Long term. The original response involved flocculation and ion exchange. Longer term responses involve response between the soil flyspeck and free lime. These responses are pozzolanic because they involved pozzolans.These pozzolanic response do when free lime reacts with water as a result cementing effect isdo between soil and lime. The increase instrength of soil is depending on the degree of pozzolonic response between lime and soil(Dallas and Syam, 2009). Author uses three typesof soil relatively plastic silty complexion, relatively plastic tan complexion and Heavy complexion with 5 of doused Lime. Author designated them

as N- 11, N- 12 and N- 13 independently. Malleability indicator decreases form 25 to 4 for N- 11, 29 to 6 for N- 12 and 36to9 for N- 13. unrestrained compressive strength changes from 145 to 2770KPa for N- 11, 280 to 3000KPa for N- 12 and 163 to 2200KPa for N- 13. Flexible modulus changes from 79MPa to 275MPa for N- 11, 53MPA to 63MPA for N- 12 and35.8 MPA to 209MPA for N- 13\ Lateritic soil form a group comprising a wide variety of Yellow, brown, red, fine granulated residual soil of light texture. They're characterized by the presence of iron and aluminum oxide or hydroxide which gives the colour to the soil. In this paper author studied the felicity and lime stabilization demand of lateritic soil samples. Soil samples A, B, C collected from a levee point and stabilized with 0, 2, 4, 6, 8 and 10 of lime. Optimum lime content for the samples A, B, C were 8, 6, 6 independently. Malleability indicators is reduced as the lime increases. TheC.B.R of sample „ A ‟ increased from10.6 at 0to29.0 at 8 lime, while that of „ C ‟ bettered from2.5 to8.6 at 6. The compressive and shear strength were also bettered. The uncured compressive strength of „ B ‟ bettered from119.13KN/ m2 at 0 to462.81 KN/ m2 at 6 lime. Author concluded that sample A and B will be suitable asbase material while sample „ C ‟ will be suitableas sub grade material. Malhotra and John, describes the use of mechanical outfit in the construction of four stretches of lime stabilized roads extending over a length of twenty kilometer.He named four roads of Amraoti circle in Maharastra,viz.(1) Amraoti Asra road,(2) Asra Mana road,(3) Daryapur Amla road,(4) Achaopur Kakda road. All the four roads wereB.C soil of CH group. In his study authors stabilized theB.C soil by 2 of lime and their service geste was observed. For a period of four time, stabilized sections conducted veritably satisfactorily but later, the lime treated stretches started deterioration. Ankur etal.,(2014) stabilize the Black cotton soil using Lime and gravestone dust. For his study, Black cotton soil sample were collected from Gwalior-Jhansi road(M.P) and gravestone dust was collected from Aman Vihar Industrial area, New Delhi. The Black cotton soil had specific graveness2.61, chance end Is sieve 75 micron is58.0, liquid limit 57, plastic limit31.4, malleability indicator26.5, discriminational free swell 41.0,M.D.D16.1 KN/ m3, CBR(soaked)1.50 and unrestrained compressive strength166.2 KN/ m2. Author classified soil as CH according to the unified soil bracket system. In their study, authors determine optimum chance of lime was 9 and gravestone dust was mixed by 5, 10, 15, 20 and 25 by weight of lime black cotton soil. The MDD of lime stabilized B.C. soil increases up to theaddition of 20 gravestone dust and farther increase of the gravestone dust decreases thevalue. also for CBR and UCS the strengthincreases up to 20 addition of gravestone dust in lime stabilized soil. c) Cement Stabilization Cement can be used to stabilize any soil except largely organic soils(IRCSP89- 2010). figures of responses do when cement is added to the muddy soil. These responses are flocculation, ion exchange, carbonation and pozzolanic responses(Rawas etal., 2005). Due to these responses property of soil like strength and continuity bettered. Oyediran and Kalejaiye(2011) studied the effect of adding of cement by weight on the strength and contraction parameter of lateritic soil of south west Nigeria. Three soil samples were collected from hole at depths of0.5 m,1.0 m and2.0 m The soil was stabilized with 2, 4, 8, 10, and 20 by weight of cement. There are multitudinous experimenters that have used the ANN in the discipline of civil engineering. Experimenters have used the ANNs in prognosticating the parcels of the following types of concretes normal, high performance and tone- compacting. ANNs have been used also indetecting the damage of the structure, relating thestructure system, modelling the geste of accoutrements , covering the ground water, optimizing the structure, and making a model for the fusions of flowable concrete in the constructions erected aquatic. ANNs are extended to other operations in the civil engineering similar as prognosticating the concrete compressive strength due to long- term sulphate attack, assessing the chloride diffusivity in high performance concrete, and detecting the permeability of the asphalt concrete. lately, the SCC is extensively used in the construction request. But there's no accurate or standard design system for detecting its constituents. So,to the stylish of the authors' knowledge and grounded on the former studies, there are sufficient workshop that cover the vaticination of SCC parcels using ANNs. But the vaticination of SCC constituents as an affair grounded on its toughened and fresh parcels has not been covered well. So, this study aimed to use the ANN for prognosticating the constituents of the SCC using the 28- day compressive strength and depression inflow values. Especially in engineering design, construction operation and decision- making program were told by numerous misgivings which could be answered not only in need of mathematics, drugs and automatic computations but also depend on the experience of interpreters. Civil engineering scholars need to learn how to deliver practical sustainable results for the engineering systems. Thomson (2010) established that applied assessment and award ways can be usefully used as tutoring tools. Obonyo(2011) describe the deployment of ane- learning terrain for construction courses groundedon enhancing virtual computing technologies using agent- grounded IJTSRD22985 International Journal of Trend in Scientific Research and Development. The proposed agent-acquainted methodology and performingoperation organizes construction knowledge into a structure that enables the scholars to take over further tone- directed, methodical and scientific disquisition. Flood(2008) applied artificial neural network to stimulate interest within the civil engineering exploration community for developingthe coming generation results show that this approach requires the design of some veritably sophisticated inheritable coding medium in order to develop the needed high order network structures and use development medium observed in the nature similar as growth, tone- association andmulti-stage objective function. Neural networks exploration is artificial intelligence has lately handed important system that works as a supplement or a complement to similar conventional expert system. It poses a number of seductive parcels for modelling a complex mechanical geste or a system universal function approximation capability, resistance to noisy or missing data, accommodation of multiple nonlinear variables for unknown commerce and good conception capabilities. In order to achieve a financial engineered estimating methodology, it is imperative that different techniques should be evaluated.Hegazi and Moselhi (1995), conducted severalsurveys studies in Canada and the United States to determine the elements of costs estimation.The survey was carried out with the participation of 78 Canadian and U.S.A building construction contractors in order to elicit current practices.

The rest of the paper is organized as follow, section 2 explains historic background, section 3 gives a detailed explanation of artificial neural network.Section 4 discusses literature review. Area of Applications are explained in section 5, section 6 explains methodology of work on ANN in construction

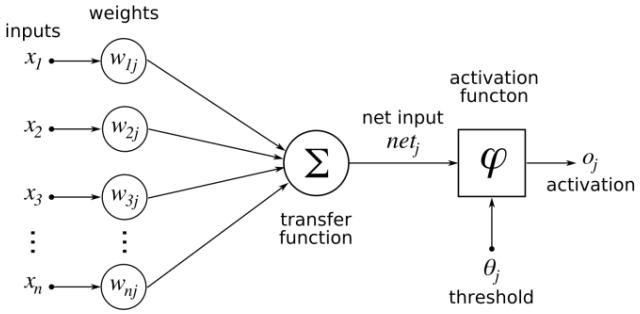


Historic background

The history of neural networks can be divided intoseveral ages from when developed models of neural networks grounded on their understanding of neurology, to when neuroscience came influential in the development of neural networks. Psychologists and masterminds also contributed to the progress of neural network simulations. Neurally grounded chips are arising and operations to complex problem developing. easily, moment is a period of transition for neural network technologies.

Artificial neural network

Artificial neural network based on simplified models. Neural networks are kinds of data information used to give out the method, whose architecture is enthused by the construction of human nervous structure (Caudill and Butler, 1990). Actually, the fundamental purposes of biological neurons are simulated by artificial neurons (Hawley et al., 1990). A network is performed by lot of nodes that are connected together by function. The nodes inside the input and output layers are named sensory and responding nodes, respectively. The nodes in the interior layer between input and output layers are named hidden nodes. The information data are entered into the network named input nodes, afterwhich they are connected to hidden nodes by function, and finally the network output is concluded from the output layer nodes. The selection of the network type is the first and important part of modelling by artificial neural network, after which the input parameters will be selected adequately to the output data. Then, the network architecture means of the number of layers, the neurons in each layer and their connection together, the kind of transfer function for neurons, and the network training and learning function will be determined. After determining the network type and net architecture, there is need for some gathered data to generate network. The gathered data, which must be for the network generation, are divided into three phases (Ripley, 1996): 1. Training phase: Using all training data set for network learning to fit the weight of the classifier. 2. Validation phase: A set of data used to adjust the parameters of a classifier, such as the number of hidden layers and neurons in each hidden layer. Actually, in this phase, the necessary training iteration is determined to avoid overtraining. 3. Test phase: A set of data is used for full assessment of the network performance.



II.LITERATURE REVIEW

Thepost-contract phase of a construction design has been supposed pivotal in suiting the outgrowth of any construction design(,2). At this stage, operative cost control is vital to precluding cost overruns climaxing from compass changes as well as other exogenous and endogenous variables(5), especially with the objectification of contractors(,6). thus,post-contract cost control is carried out to insure that the budgeted account isn't surpassed(3), thereby contributing to prosperous design quittance and scoring value for plutocrat for construction guests(7). savants allow that the ways exercised forpost-contract construction bring control are veritably important for arbitrating whether the design will be completed on time and, within account(8). Although the actuality of several PCCTs has beenreported in the literature(), penurious opinions relating to the applicable timing and sequencingof their relinquishment and posterior deployment in thepost-contract construction phase has led to the underwhelming cost control interpretationbeing endured. Making the right opinions pertaining topost-contract cost control, timeously, is essential during construction systems quittanceto insure that calculated cost isn't surpassed(,9). To support this profession, Omotayo andKulatunga(8) and Sanni and Durodola(6) conserve that the deployment of cost control Also, the IDEF0- grounded model directly being employed by CPM working out in the Nigerian construction assiduity during their engagement with operativepost- contract cost control procedures is a grounded on a combination of the process- centric and methodical resolution- making approaches(3). An IDEF0 has been described as a active company modelling device which evolved from structured dissection and project(SADT) principles(,11). tallying to these savants, it's exercised for the project and specification of active/ functional methodologies across colorful surrounds. also, the frame developed by Oladapo(12) for guiding cost operation professionals to control the cost of low- profit casing systems from commencement to completion espoused a combination of both approaches to resolution-making as it

pertains to the liberty of cost control ways. Also, due to retired layers of marketable opinions current in the force chain, design cost information which has been made accessible for the purposes ofpost-contract cost control is frequently an shy representation of the true cost of construction. For case, despite being primary guardians of construction cost information, Quantity Surveyors are frequently short of pragmatic cost information of construction systems in Nigeria(13), while the use of BCIS cost information in the UK frequently leads to inaccurate cost guidance(14). thus, irrespective of the ways and resolution- making process,post-contract-cost control seems not to be climaxing in advancements within the forcechain(15). This confirms the want for ingenious advancements in thepost-contract control processes within construction systems hence this study. It's anticipated that similar advancements should involve an estimate of the resolution- making process, as preliminarily stressed.

Artificial Neural Netwrok in Civil Engineering Construction projects

Construction assiduity is largely competitive and faces expostulations in the areas of charges of systems, detainments in constructionconditioning, labor productivity, controversies, tenders, bidding prices, security aspects, rate of accoutrements , conservation charges, threat dissectionetc. which are largely convoluted in nature. To deal with these expostulations, Artificial Intelligence(AI) ways like shaggy sense, case-grounded logic, probabilistic styles for uncertain logic, classifiers and literacy styles, Artificial Neural Networks(ANN), inheritable Algorithms and cold-blooded ways are extensively exercised in the field of Construction Management(CM). In the last two decades of twentieth century, there was a swell in publications dealing with Artificial Intelligent ways and especially ANN in colorful aspects of CM. In 2001, Adele and Yen handed a complete review of similar operations made before the turn of the century. The current work presents a review of around 7 papers published in the area of CM. Theideal of the paper is to punctuate the operationsof ANN in the following fields of CM Cost, Productivity, Risk Analysis, Safety, Duration, disagreement, Unit rate and mongrel Models. farther overcritical review of the rulings will support the compendiums to concentrate onimportant areas for implicit use and evolution of ANN in the spoke areas of CM. The unborn compass will grease uninterrupted exploration sweats. The paper is farther synthesized as follows originally a pithy preface on ANN is offered and is followed by the valuation of their recent operations in the areas of Cost, Productivity, Risk Analysis, Safety, Duration, disagreement, Unit rate and mongrel Models. deliberation and overcritical review are done in the antedating section followed by author's commentary on the rulings and unborn compass. ANN is a soft computing device, mocking the capability of mortal mind to effectively pay modes of logic and/ or pattern recognition. ANN as aconception was being for a long time; still, its operation in civil engineering started in late 1980's primarily in construction conditioning. ANN's were set up to get from the connections between input and affair handed through training data and could generalize the affair, making itable fornon-linear cases where judgment, experience and girding conditions are the crucial features.

ANNs generally muster of 3 layersviz. input subcaste with input neurons, hidden subcaste(s) with hidden neurons and affair layers with affair neurons. Each neuron in the input subcaste is connected to each neuron in the retired subcaste and each neuron in retired subcaste is connected to each neuron in the affairsubcaste. The number of retired layers and number of neurons in each retired subcaste can be one or further than one. The number of input neurons, hidden neurons and affair neuronsconstitute the network armature. Before its operation the network is trained, i.e., the connection weights and bias valuations are fixed, with the help of a fine optimization algorithm and utilizing portion of the data set until a veritably lowvalue of inaccuracy is attained. The network is also tried with an unseen data set to judge the delicacy of the developed model. The network is trained utilizing colorful training algorithms which cast at minimizing the inaccuracy between the observed and network prognosticated valuations. The networks are codified tallying passage of inflow of information either in the forward instruction(feed forward) or in rear or side directions(intermittent network). usually, three- subcaste feed-forward or intermittent networks are set up to be sufficient in civil engineering practices. Other manners of networks carry thecounter-propagation ANN, Hamming's network and the radial base function network. threat dissection and security are important aspects in CM in for identification of implicit threat in thesystems and security indicators are carried out. ANN grounded procedures had been developedto prognosticate the liability of contractor dereliction in Saudi Arabia(4), and to estimate the threat indicator for an thruway constructionstage utilizing the principles of system proposition, operability, independence and community. ANNs were developed to estimate chance variation between the read and factualcharges of docks at 30, 50, 70 and 100 completion stages grounded on 11 significant threat procurators. In 2014, Mehdi assessed the threat value for 10 threat procurators as mechanical failure, electrical failure, wrong seller electionetc. in cement diligence in Bangladesh. In2007, Ella and Wang assimilated ways of ANN and retrogression dissection to estimate the threat grievance and threat order for ground conservation systems. Liu and Gao in 2014 proffered a threat valuation system utilizing rough sets to reduce misgivings and ANNs. An ANN system was developed consequently as to identify the cost diversions that do, due to the political threat involved in a construction design. The design director can integrate the threat consequences into a bidding resolution, andinduce refashioned and streamlined threat evaluations totally and fluently during the process of the design. A standing in the shape of a chance revise in cost from the birth cost forms theaffair vector for the neural network model. An ANN model was developed to prognosticate security climate of a construction design and evaluation of construction workers ' safe work geste . ANN-grounded model was developed for prognosticating employees ' fatigue in hot andsticky terrain. In a study ANN and Logistic Regression were employed to model the occupational security and health of construction employees and interpretation of the models were assessed by calculating the log- liability(LL) rate. In 2015, Chen and Liu developed model grounded on Bayesian network for interpretation valuation of the shelter construction security inChina. Mohammad amet.al. in 2015, exercisedchain

logical path which comprehended rough set proposition and ANN modelling, and modelled theprocurators affecting health of pool and prognosticating inflexibility of occupational injuries. In 2013, Goh and Chua exercised neural network to study relationship between rudiments of security operation and accident inflexibility and bandied on visionary operation of accidents.

APPLICATION OF ARTIFICIAL NEURAL NETWORK IN CONSTRUCTION

Traditional logical system for determination of daedal case is getting delicate since expression becomes tedious. For illustration, vaticination of rainfall changes isn't an ready task as it includes voluminous number of unknown procurators which is delicate to understand and it only support us to give a probabilistic result. On the other phase, evolution in Information technology is at a rapid-fire rate when assimilated to the former conceptions. Artificial intelligence issluggishly landing every region since it provides results for daedal cases in important simple manner.

A. Road Safety

Creating a network which can identify the end of row of buses in a particular business traffic and display a communication to the upstream thruwaywill help us to reduce input of vehicles on that path, also saves a lot of time for the motorists. These networks formerly completely functional, can identify road accidents to ameliorate transport system; can analyses entire road network and structure grounded onnon- destructive measures using Deflectometer. It also helps to prognosticate the crack propagation on concrete pavement which helps to prognosticate the service life of the path. New generation vehicles are in- figure with bus- airman mode which when coupled with ANN system will significantly reduce road accidents and ameliorate the effectiveness of transportation system.

B. Construction technology and Management

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Major effects faced in construction assiduity are lack of model for chancing labour productivity; a system for cast profit of controversies while construction; lack of proper cost optimization ways etc. Connecting Neural networks these colorful procurators of a construction design along with usual design scheduling styles similar as CPM and PERT can resolve these effects and helps to achieve balance between time, cost & other resources.

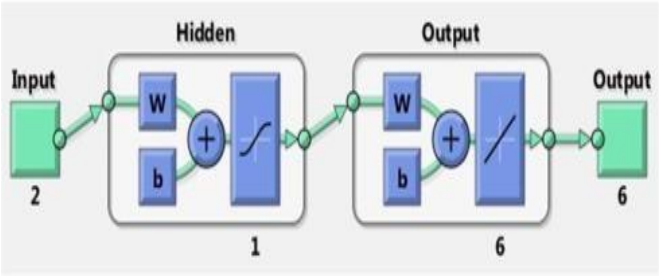
C. Water resources engineering

Mathematical expression and modelling for assaying water division system, relating water loss through checks on secret tube system, study on retrofitting and recuperation of water networks are certain operation of Neural networks in the field of Hydraulics. further inquiries are yet to done on this field involving water quality confidence, expansion of sewage network system, styles to boost the effectiveness of sewage treatments etc with the help of ANN system. From inquiries conducted inonce two decades, it shows encouraging effects in utilizing Artificial Neural Networks in Civil Engineering field and their utility in daedal casesin construction workshop. still, mastering this network system requires longer training moments and proper training sets. Handling voluminous measure data is delicate task since itcovers all the satisfactory results. Indeed however, this system can efficiently replace usual approaches in case working.

II. METHODOLOGY

The training process of a neural network consistsof applying the needed ordinate way for tuningthe synaptic weights and verges of its neurons, in order to generalize the results produced by itslabors(da silva etal., 2017). The primary thing oftraining is to minimize the inaccuracy function by searching for a set of connection puissance and threshold valuations that beget the ANN toproduce labors that are equal are close to targets.The manner in which the knot of ANN is structured is nearly related to the algorithmexercised to train it. Some of the algorithm exercised ANN training carry backpropagation algorithm, conjugate grade algorithms, radialbase function, waterfall correlation algorithm (Nagesh Kumar etal.,2004).All of these algorithms are compactly described in ASCE(2000a) with an total list of sources.

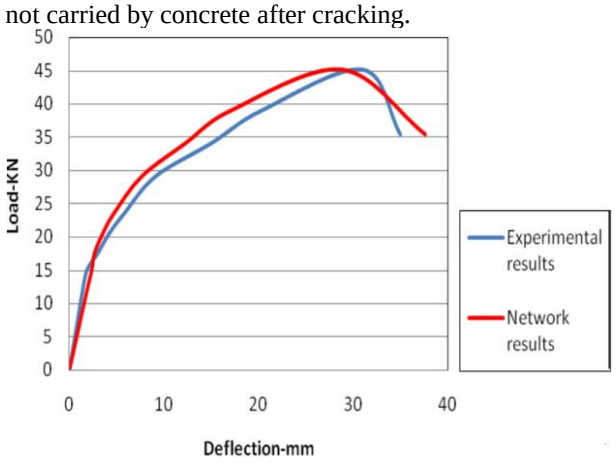
A. Predicting the ingredients of self- compacting concrete using artificial neural network



The parameters exercised in this study were the 28- day compressive energy and depression valueas inputs. There were two methodologies have been espoused for the labors. The first methodology exercised a multi input – multi affair neural network labeled as ANN I to prognosticate- at the same time and from thesame network- the six constituents labors cement, fly ash, water/ binder(W/ B), fine total(FA), coarse aggregation(CA) and superplasticizer(SP). The armature of the ANN I network is shown off in Fig. The alternate methodology exercised a multi input – single affair neural network labeled as ANN- II to prognosticate one affair of the six constituents at a time. therefore, ANN- II network uses six moments with nonidentical weights and impulses to prognosticate the six component labors. The armature of the ANN I network is shown off in Fig. All data sets are exercised in the training and testing processes forANN I and ANN- II network. The training process is done utilizing the Levenberg – Marquardt backpropagation algorithm from MATLAB toolboxwith its dereliction settings. The run- time terrain is MATLAB R2013a.

Nonlinear analysis of load-deflection testing ofreinforced one-way slab strengthened by carbon fiber reinforced polymer (CFRP) and using artificial neural network (ANN) for prediction

The LUSAS is a finite element analysis (FEA) software that can evaluate all kinds of complex models using linear or nonlinear analysis. In LUSAS software, the model geometry is definedas features which are then sub-divided into finite elements in order to do the analysis. By increasing the number of elements in the meshed member, the accuracy of the analysis is usually increased, and the time required for analysis is also increased. The elements are modeled in LUSAS software as the following statements: In considering the linear strain distribution over the depth, no slip was found between the concrete and steel bar and external CFRP, thereby the adhesive tensile strength was ignored and tensile stress was not carried by concrete after cracking.



A. Predicting the ANN Based Construction Site Resource Allocation and Prediction Using AI

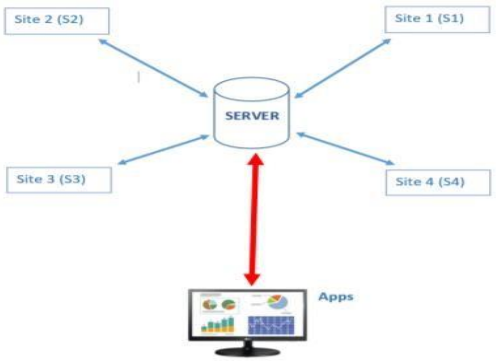


Figure 6: System Architecture

As shown in above system architecture S1, S2,S3, S4 are the construction sites where all users will store the data centrally at server and then at user end our program will generate the results like charts, reports, and predictions of allocation of resources. Also, user interface to each and stack holder at construction site. Using this UIevery stack holder will update the informationabout site like material and resources on cloud. Using this data, we will create data set and will apply our smart algorithms and programs on this dataset to prediction and allocation system. Each and every registered user will have access to own profile to CRUD the dataset on cloud. This system is accessible from different devices like desktop, mobile and wearables.

CONCLUSION

From the effects of case inquiries which areconsidered in this review, it's clear that ANNs have been successfully worked out in theconstruction operation field veritablyeffectively. ANNs is helpful in vaticination, resolution timber, threat dissection, bracketresource optimization and election etc. Case inquiries demonstrated that ANNs grounded fine model gives stylish effects than any usual system does. ANNs resolves the civil engineering dilemmas which are convoluted and not veritably ready to understand. ANNs exclusively makes use of accessible literal data, feed it as input and affair and sets the relation between them by conforming their weights. Hence ANNs has proven veritably operative as it uses separate and inadequate information to arrive at best practicable result. ANNs can fluently streamlined by introducing new training data. With this all rates, ANNs has surfaced out as a dynamic and factual device in the area of construction operation and also awaiting new enhancement in case working of this assiduity in future. therefore, ANNs have a number of significant effects that make them a important and ultrapractical device for working numerous cases in the field of civil engineering and are anticipated to be workable in future.

The Authors are grateful to Thakur Collage of Engineering and Technology for giving us opportunity to work on this project.

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Review Article on Analysis and Design ofCalamity Resistant Structures

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Abstract: This study's major goal is to evaluate disaster-resistant buildings as the cornerstone of sustainability. Each year, various regions of the world experience natural disasters like earthquake, cyclone, flood, and drought that affect buildings. These catastrophes result in significant losses, devastation, human and animal deaths, and injuries. Most of the damage to non-engineered homes built by people results from a lack of expert direction and affordability. It is crucial to establish an adequate housing model that resists the forces of disasters, given the rise in non-engineered housing and the extent of damage caused by disasters to housing. The subsequent article covers further topics related to earthquake damage as well aspossible solutions.

I.INTRODUCTION:

Unexpected occurrences like disasters haveharmed mankind from the beginning of time. In reaction to such occurrences, efforts have been made to lessen the catastrophic effects of these catastrophes. The outcomes of such efforts are luckily and sadly poor in underdeveloped nations, including our own, but quite encouraging in developed nations. Large-scale disasters seriously interrupt daily life and cost billions of dollars in property damages because they severely harm the built environment. One of the most frequent and devastating disasters is an earthquake, which reveals flaws in infrastructure design and construction and puts engineers' capacity for planning, designing, and building to the absolute test. The only choice available to us given that earthquakes are now unpredictable and unpreventable is to design and construct structures that are earthquake resistant.As a result, efforts in this regard have been made all over the world.

II.METHODOLOY:

The main aim of the article is to study different papers and analyze the adverse effects natural calamities (mostly earthquake) on structures and provide technical solutions for such effects. To provide the technical solutions we may design calamity resistant structures using efficient and reliable software such asMidas Gen, E tabs or Staad pro.
The **objectives** of the article are:

- To study different techniques for Construction of calamity resistantstructures.
- To understand different guidelines for calamity resistant buildings
- The objective of this paper is to evaluate the response of braced and unbraced structure subjected to seismic loads and
- To identify the suitable bracing system for resisting the seismic load efficiently with proper reference to the guidelines and safety

III.EFFECT OF EARTHUAKES ON STRUCTURES:

Buildings lying on the ground will move at their bases as a result of an earthquake's shaking ofthe ground in both directions. Because ofNewton's First Law of Motion, the roof of the building tends to remain in place even when the building's base moves with the ground.However, because the columns and walls areattached to it, they pull the roof along with them as well. Based on ground movement, resistance forms in the members from the drag of the roof, and if the resistance exceeds the allowable limit of the buildings, it damages the structures. The building's roof typically stays put even though the building's base moves with the ground because to Newton's First Law of Motion. But because the walls and columns are fastened to it,they also drag the roof along with them. When the drag of the roof creates resistance in the members due to ground movement, thestructures are damaged if the resistance is greater than what is safe for the buildings.

IV.GUIDELINES TO BE FOLLOWED FOR DISASTER RESISTANTCONSTRUCTION

Governments at the federal and state levels are steadily modifying their tactics, policies, and programs formitigating the effects of natural catastrophes and preparing for them. Avoid hilly slopes and locations with delicate and clayey soil if you want your building to withstand earthquakes. Multiple terraced blocks should be preferred over a single huge block with footings in various clusters. The structure ought to be

maintained nearly symmetrically. Forms with fewer projections perform better during anearthquake than simple rectangular shapes. A massive building must be divided into multiple blocks in order to ensure the symmetry and rectangularity of each block. Good disaster-resistant building practices include limiting the width of apertures, utilizing bond bearings, and turning to steel or wooden dowels as well as RCC band at plinth, lintel, and roof levels.

V.ROLE OF CIVIL ENGINEERS IN REFERENCE TO NATURAL CALAMATIES:

Even though there may be very little chance that an earthquake would strike aparticular area, it is nevertheless important to consider this possibility while creating a structure because even asingle
earthquake-related tremor throughout a building's lifetime could be dangerous for its occupants. If anyone could conceivably reduce or eliminate the problem, it would be us, the civil engineers. Therefore, the goal of engineering in this context is to create earthquake-resistant buildings that can withstand the effects of ground shaking.

VI.CONCLUSION:

The deadliest type of natural disaster thatcauses significant structural damage is anearthquake. It is said that neglecting how an earthquake impacts buildings and using subpar construction techniques are two types of errors that might substantially jeopardize structures.

The employment of novel designs, non-traditional building materials, and construction procedures are required when homes and buildings built using standard methods and materials do not possess the requisite disaster resistance qualities. As a result, the national programs and initiatives on disaster mitigation and prevention should consider the use of disaster-resistant technology for construction.
Because of this, it is crucial to have a thorough grasp of how earthquakes affect structures. Designers and builders should take this into account when creating earthquake-resistant buildings.

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Eco-Friendly Waste Management for Organic Waste Generated In Society

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Abstract*— Nowadays managing waste is a very difficult task. Depending upon the constituents waste is classified into different forms like solid waste, organic waste, bio-medical waste, etc. In this paper, we will be dealing with organic waste only. Organic waste has some physical and chemical properties. By considering these properties we have to manage this organic waste. Organic waste can be converted to compost for sustaining soil health by microbial activities to improve its physiochemical properties or we can eliminate this waste by feeding it to the animals. Compost is called Gardener's Gold and is a vital partner in enhancing crop productivity on a sustainable basis. Composting is helpful to reduce the volume of waste and in managing landfills through recycling and reusing organic waste. Vermicompost is also a type of compost utilizing worms for organic waste disintegration. Composting can be categorized as an aerobic and anaerobic process either carried out in the existence of air or done in controlled air conditions. The materials added to the compost pile during the composting process are consumed by microorganisms. They consume oxygen to breathe, carbon and nitrogen to grow and reproduce, and water to break down food. By lowering the amount of pollution, organic farming contributes to the preservation of the environment. Minimizing the number of residues in the product lowers the risks to human and animal health. It aids in maintaining agricultural production at a level that is sustainable. Both the soil's health and the cost of agricultural production are improved. Overuse of chemical fertilizers can cause soil acidification and soil crust, which lowers the amount of organic matter, humus, and beneficial organisms in the soil, stunts plant development, change the soil's pH, feeds pests, and even triggers the release of greenhouse gases. A little compost bucket called the Magic Bucket can be used to dispose of moist waste at home. This bucket transforms wet or kitchen waste into compost that may be used as natural plant fertilizer. A basic bucket with a cover serves as the Magic Bucket. Any bucket may be quickly transformed into a magic bucket right in your own home. Similarly, we had set up a magic bucket at our home in which we laid the mixture of organic waste and sawdust along with soil layer by layer. Proper airflow was provided to it using a perforated tub and perforated PVC pipe. The moisture content was monitored and maintained by us between 50% to 60%. The compost was ready after maturation after a period of 15 days. The results after testing the sample of our compost at a certified testing facility showed that the pH value was 6.94, NPK percentage was 0.487, 0.028, 0.135 respectively, and the C:N ratio was 1:15.2. The technical person further stated that the compost produced would be more effective if used for the growth or increasing the yield of salt-loving plants.

Keywords — Moisture content, Nutrients, Organic waste, Environment.

I. INTRODUCTION

Organic wastes are materials originating from living sources like plants, animals, and microorganisms that are biodegradable and can be broken down into simpler organic molecules. Organic wastes produced in nature by various means can exist either in a solid-state or liquid state. Solid organic waste is primarily understood as organic-biodegradable waste, and it contains about 80-85% moisture content. The most common sources of organic wastes include agriculture, household activities, and industrial product. Even though most of the organic wastes in the soil add up nutrients and minerals for soil fertility and plant growth, inappropriate disposal practices might cause severe damage to the environment. Recently, however, the concept of organic waste management and recycling has been introduced and implemented.

In this project, we circulated one survey form regarding organic waste management. We got almost 128 responses from different areas like rural, metropolitan a,nd urban. So, our main focus is on the metropolitan and urban regions. In these areas waste is collected and managed by centralized approach. In these approaches management of waste is quite difficult. So, if we go with decentralized approach, then management and collection of organic waste become easier. So, we can manage the organic waste and decompose it in different forms easily. We get 27 responses from metropolitan and urban region. We are considering every family have 4-5 members. In

metropolitan region people order cooked and uncooked food on online mode. By doing this they collect packaging waste more than that of organic waste. Packaging waste includes paper, plastic and rubber like things. Almost 15% people from metropolitan region order cooked and uncooked food from online mode. If we segregate the waste in dry and wet form then collection and management of organic waste gets much more easier. By survey we get to know that 71% of people segregate waste in dry and wet form by their own. It is very helpful and efficient for us. 15% of housing societies have their own composting and waste disposal plant which is quite less. If we increase this number to some extent then it is helpful for community and society as well. Composting plant converts organic waste into compost. If we sell this compost to neighboring farmers and shopkeepers then society will get income from it or else we can do is we use this compost in our society garden so that expenses for compost that we bring outside becomes less.

II. Problem Statement

1. Organic waste can be stored for limited time.
2. Its decomposition in anaerobic stage generates methane gas, which can contribute to increase global warming.
3. Scattering of organic waste create nuisance in society.
4. Scattered organic waste attracts rodents, roaches and animal.
5. Conventional method of composting is very slow, which takes around min 45 days to max 90 days.

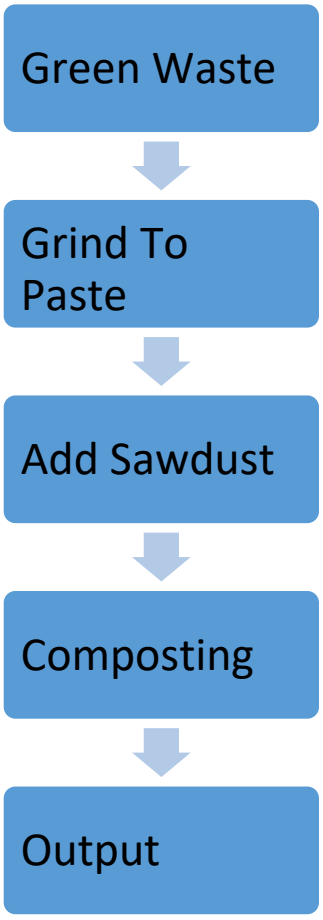
III. Objectives

1. To adapt the decentralized approach for management of organic waste.
2. To do advancements on conventional technologies of organic waste management.
3. To develop a zero organic waste management system.
4. To apply own methodology on small housing projector individual house of 5 members.

IV. Literature Review

In recent decades, large amounts of garbage from numerous sectors have been produced due to human activity and rapid population expansion. According to studies, the production of solid waste worldwide is predicted to increase to 3.4 billion metric tonnes by 2050, or 70%. In order to treat trash disposal, the authorities must immediately provide a low-cost, effective technology. But it's clear that only 20% of waste is recycled, with the rest still being thought about for landfilling. A serious threat to people, animals, and the environment results when waste is simply dumped in the open in poor nations. Fourteenth-generation biomass and organic waste have both been studied so far for various intended products. As a result, the current review paper emphasises the new issues in the production, management, and transformation of organic waste into various bioproducts with added value. The conversion of various biofuels, including liquid, solid, gaseous, and bioelectricity from organic waste resources is also included in this review. In addition, the most recent methods for processing organic waste are thoroughly discussed for the creation of bioproducts with added value such bioplastic, bio-compost, and organic acids. Also investigated are the techno-economic analysis (TEA) and life cycle assessment (LCA) of organic waste By decreasing trash, improving energy generation, and producing other healthcare products, the conversion of organic waste into value-added bioproducts improves the circular bioeconomy strategy. The use of organic waste to produce high-value bioproducts and biofuels will assist achieve high energy security, environmental protection, and enhancement of the bioeconomy perspectives, it is concluded.

V. Flowchart and Methodology



- Green Waste : The uncooked green waste should be collected. The waste collected should not be kept for more than twenty four hours. Green waste contains moisture and nitrogen in it. It is primary consttuent of our composting process.

Fig. 2. Green organic waste from market

- Grind To Paste : The green waste needs to be grinded into a fine paste with the help of a

grinder. The finer the paste the faster will be the process of decomposition and simultaneously formation of compost.

Fig. 3. Finely ground waste

- Add Sawdust : Sawdust needs to be added to the paste of green waste. The moisture content of the mixture needs to be maintained between 50 – 60 (%).

- Composting : The process of composting is executed in the following manner :-

➢ A perforated tub covered wth a plastic net is required. It will provide proper air flow from all sides.

Fig. 4. Netted basket for composting

➢ Perforated PVC pipes are requied for air circulation in the central part.

Fig. 5.Pipes for internal ventilation

➢ The final setup should be in the following manner :-

Fig. 6. Final arrangement of compost magic basket

➢ The mixture and soil needs to be added to the setup layer by layer simultaneously. Water needs to be sprayed after every layer to maintain the moisture content. The moisture content of the compost pile can be monitored using a moisture meter.

Fig. 7. Routine checkup for pH, Moisture and

- Output : After continuously maintaining and monitoring the moisture content for a period of 15 to 20 days, the compost pile will be totally decomposed and turned into ready to use compost.

VI. Result and Discussion

The compost prepared was sent to a research station for testing. Test results highlighted the following points :-

- The pH of the compost turned out to be 6.94.
- The NPK (Nitrogen Phosphorous Potassium) value in percentage were 0.487, 0.028 and 0.135 respectively.
- The C:N ratio was 1:15.2.
- The technician further stated in a verbal discussion that this type of compost will be more beneficial if used for the growth of salt loving plants.
- Normal compost is having standard values of NPK 2:1:2. Our manufactured compost was green compost which is made-up of only green waste.

VII. Conclusion

Organic waste is a valuable resource because it contains a high content of oxygen, high moisture content, and alkaline earth metals. Processing of organic waste would reduce the quantity of organic waste reaching dumpsites or burned. Developing sustainable technologies to utilize organic waste. This

method of composting takes only 7 days as it contains only finely ground green waste. The results achieved from this methods are also good enough to serve the purpose. Segregation of household waste at the source would reduce the burden of solid waste significantly while at the same time improve the supply of compost.

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Design of Efficient and Smart Solid Waste Collection System by Smart Bin for Thakur Village

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Abstract- **This study was conducted as project under the subject solid waste management. The aim of the study is to provide an overview ofthe elements of the Municipal Solid Waste Management (MSWM) system in the city of Mumbai and its ward, India. The main current challenges were identified with focus on social aspects such as waste management planning, strategies and legislations. The data for this research were gathered from literature studies and in-depth from official website of municipal corporation our focus of project was of ward; R\S ward no 25 Borivali, Mumbai. The results show that the MSWM in Mumbai is facing many challenges and that there is a lack of coordination and a system approach on all levels. Further, a deeply rooted negative attitude towards the field of MSW could be observed. The main problems were shown to be related to lack of awareness. The overall conclusion is that it is not enough that a small fraction of the society, with partially contradictory interests, is taking initiatives to improve the MSWM in Mumbai. In order to achieve a sustainable long-term solution, coordination and a more holistic system approach is necessary.**

***Keywords: urban planning, Smart wastemanagement system, smaet dustbin*.**

I. INTRODUCTION

The rate of increasing population in our country has increasing rapidly and also we have increase in garbage which have increased environmental issue. Dustbin is a container which collects garbage's or stores items which recyclable or non-recyclable, decompose and non-decompose. They are usually used in homes, office etc., but in case they are full no one is there to clean it and the garbage are spilled out. The surrounding of a dustbin is also conducive for increasing the pollution level. Air pollution due to a dustbin can produce bacteria and virus which can produce life harmful diseases for human. Therefore, we have designed a smart dustbin using ARDUINO UNO, ultrasonic sensor which will sense the item to be thrown in the dustbin and open the lid with the help of the motor. It is an IOT based project that will bring a new and smart way ofcleanliness. It is a decent gadget to make your home clean, due to practically all offspring of home consistently make it grimy and spread litter to a great extent by electronics, rappers and variousother things. Since the smart dustbin is additionally intriguing and children make fun with so itwill help to maintain cleanliness in home. It will be applied for various type of waste. Dustbin will open its lid when someone/object is near at some range then it will wait for given time period than itwill close automatically. Here lid will close when youdon't want to use and it will only open whenit is required. Smart bins are an intelligent waste management system. They have wireless ultrasonic fill-level sensors embedded inside which detect how full the bin is and then, throughthe Iot this data is sent to a cloud-based monitoring and analytics platform.

OBJECTIVES:

1. To design smart waste management system
2. To optimize waste collection with the help of smart system
3. To develop efficient solution for wastecollection in Thakur village.
4. To make our adopted Thakur village Kandivali east clean and healthy using 'Smart Dustbin'

Problem statement

It becomes very tedious for the respective authority to visit and collect the garbage from the place where the dustbins have been placed, because the dustbin may be not at all filled, or half- filled or may be overflowing. Also, collecting the Information and status of each dustbin in not feasible. Thus, we need a system which displays and even send all such details to the authority sothat they can send the person who can visit and perform the required action.

Need of the Project

- At present condition the community bin are located on roadside above ground which creates lot of nuisancesuch as Bin overflowing with garbage lying in open
- Poor quality garbage bins

- Stray animals feeding on the waste
- Unhygienic, unclean city and surroundings leadto citizens rejection

PROPOSED FRAMEWORK

The following set of Sensors/Actuators which are used in the system design arelisted as follows:

1. Arduino Uno
2. E18-Dro Ir Sensor
3. Jumper Wire
4. Gsm 900 Module

ARDUINO UNO: arduino is an open-source platform used for building electronics projects. arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) of software, or ide (integrated development environment) that runs on your computer, used to write and upload computer code to the physical board.

Fig.1.ARDUINO UNO

E18-Dro Ir Sensor: the e18-d80nk digital proximity sensor uses an infrared ledand receiver to determine the presence of an object within a specific distance. these make great obstacle detectors and can also be used as a optical gate or in positioning applications where stopping at certain distance is needed.mounting this sensor is quite easy – it has a long threaded body allowing for a considerable adjustment

Fig.2.E18- DRO SENSOR

JUMPER WIRE : a jump wire (also known as jumper, jumper wire, dupont wire) is an electrical wire, or group of them in a cable, with and a piece a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

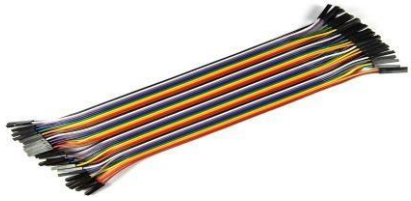


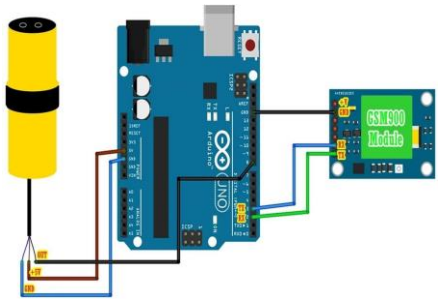
Fig.3 jumper wire

5. GSM 900 MODULE

GSM/GPRS module is used to establish communication between a computer and a GSMGPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) isan extension of GSM that enables higher data transmission rate. GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc.) for computer. GSM/GPRS MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM and GPRS network. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification.

Servo Motor

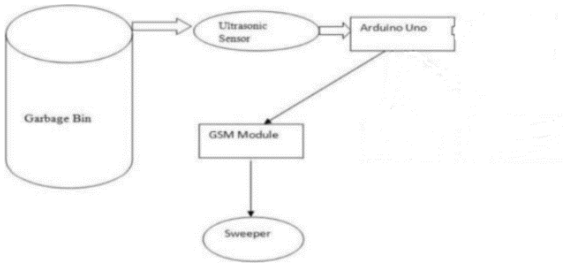
Servo implies an error sensing feedback control whichis utilized to correct the performance of a system. It also requires a generally sophisticated controller, often a dedicated module designed particularly for use with servomotors. Servo motors are DC motors that allows for precise control of angular position. They are actually DC motors whose speed is slowly lowered by the gears. Theservo motors usually have a revolution cutoff from 90° to180°. A few servo motors also have revolution cutoff of 360° or more. But servo motors do not rotate constantly. Their rotation is limited in between the fixed angles.



Connection diagram

Working methodology of smartdustbin

smart dustbin which will help in keeping our environment clean and also ecofriendly Nowadays technologies are getting smarter day-by-day so, as to clean the environment we are designing a smart dustbin by using arduino At the core of smart bin technology is a series of wireless ultrasonic sensors that detect fill levels. The IoT devices communicate waste data to sanitation department workers in real-time.

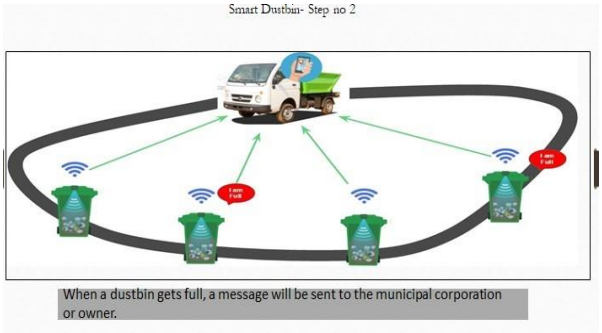


Working process

After wiring and attaching all the devices and setting up to the Smart Dustbin, now observe all the important setup whether they are well connected or something missed.

After connection set up now next step is to submit/upload code in Arduino and supply power to the circuit.

When system is powered ON, Arduino keeps monitoring for any things that come near the sensor at give range. • When Ultrasonic sensor detect any object for example like hand or others, here Arduino calculates its distance and if it less than a certain predefined value than servo motor get activate first and with the support ofthe extended arm of the lid.Lid will open for a given time than it will automatically close As soon as the thrash in the bin reaches a threshold value GSM will send a message to the concerned for immediate action.



The aim of this project to study mswm in thakur village (R\S ward no 25). The focus is on social and political challenges such as waste management planning, strategies and legislation. Also potential solution will be identified and discussed.

1. **R/S 25 WARD**

Sr No.	Address	R/CENTR ALWARD, 16, MAHAVI R NAGAR, BORIVALI
1.	Area	17.78 Sq.km
2.	Population	570954 Approx
3.	Roads	Major Roads: 38 Minor Roads: 125
4.	Garbage Generation per day	225 M.T

Results

Arduino-based smart din system and Android can work in accordance with the design that has been made, both the circuit design and the program and its visualization. The input can be detected the type of material between plastic or iron using an inductive sensor and capacitive sensor well. The Android program on this device can run well, where when the input is a type of plastic waste The dustbin is able to open the lid with the help of servo motor whenever it detects motion. The ultrasonic sensor is giving the details about the waste present in the dustbin. The status of the waste is transferred to the municipal authority whenever it is exceeding the threshold value.

Conclusion

Here we are going to make an evolution change toward cleanliness. The combination of intelligent waste monitoring and trash compaction technologies, smart dustbins are better and shoulders above traditional garbage dustbin. It is equipped with smart devices like sensor Arduino etc. Lid of the dustbinwill automatically open when an object comes near to the dustbin andafter certain time period it will close the lid. For society, it will help towards health and hygiene so that normalpeople to rich people can take benefit from it.

SCOPE FOR FUTURE

Following are the issues to be addressed after the project implementation:

- ✓ The additional location of bin scan be strategicallydefined factors based on following
- ✓ The waste collection data from the proposed waste collection system
- ✓ Waste generation pattern
- ✓ Traffic Density
- ✓ Route optimization for easy waste collection truck's movement.
- ✓ User manual for dumping the waste in smart Bins by public awareness campaign or poster advertisements to make the general public aware about the usage of proposed system.

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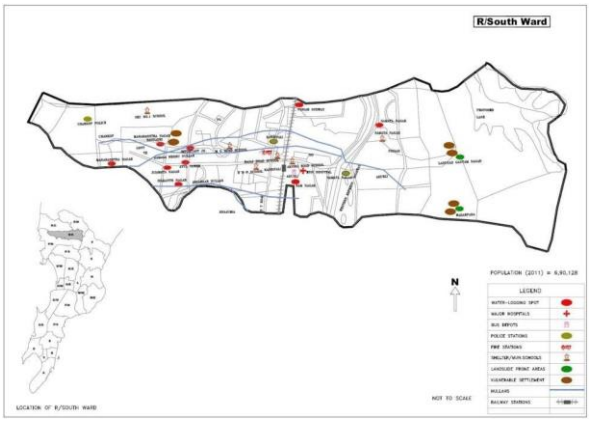

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Replacement of Recycled Aggregate with Silica Fume In Cement Concrete

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***Abstract*— The amount of recycled aggregates produced was increased day by day leading to environmental affects. The disposal of the recycled aggregate is uneconomical and can be utilized in the construction activities. In this paper an attempt has been done to find the efficiency of replacing coarse aggregate with recycled aggregates. The influence of combination of silica fume with recycled aggregates on concrete for M45 grade with 0.4 W/C ratio and 0.75% superplasticizer by weight of the cement.**

Percentage of silica fume is varied as 25%, 30%, 35% and 40% by weight of natural aggregate and the silica fume by 10% and 20% by weight of cement to determine the fresh and hardened properties of the concrete. Compression, flexural, split tensile strength and modulus of elasticity tests are conducted to determine the influence of silica fume with recycled aggregates after 7,28 and 56 days curing. Compressive strength of the concrete increases with increase in the number of recycled aggregates up to

35% and then decreases with further increase in the amount of recycled aggregate. Optimum compressive strength of 72.64 Mpa

and optimum flexural strength of 5.32 Mpa was obtained at 10% of silica fume and 35% of recycled aggregate. Modulus of elasticity of 34611 Mpa was achieved at 10% silica fume and 35% recycled aggregate.

Index Terms: Silica fume (SF), Recycled coarse aggregate (RCA), natural aggregate, Replacing, Compressive, Flexural, split

tensile strength, modulus of elasticity (E).

I. INTRODUCTION

Concrete is far most used as a construction material, commonly from combination of broken stone, sand, binding material and water which can be poured into moulds which forms a stone like mass on hardening. It is the most important building material which used in various forms of construction such as reinforced concrete that is used to make building columns and decks for high rise building due to its longer life, low maintenance cost, strength and better performance. It is often used for residential driveways, house foundations, walls, pavements and other building infrastructures. Due to the industrialization, urbanization growth. Commonly, structural deterioration, development of city, extension of traffic directions and day by day rising traffic weight, environmental calamities (seismic activity, fire and overflow) leads to the construction and demolition wastes. Around 850 million tons of building and crushed derbies produced in the EU annually, which represents 31% of overall waste production (Parkesh and Modhera, 2011). In that, construction wastes are 20 to 30 times less than demolition wastes. Aggregate producing from the processing of inorganic material earlier used in construction and mainly comprising of crushed concrete is washed and recycled as aggregate in the production of additional concrete. Now days, a general technique is applied to enhance the properties of concrete by alteration of the interfacial transition zone between the aggregate and bulk density of concrete by silica fume. It is extremely fine pozolonic material comprised of amorphous silica formed by electric arc furnaces as a by-product of elemental silicon or alloy of Ferro silicon.It Silica fume is also known as micro silica, condensed and volatilized SF or silica dust. It is used to enhance the mechanical properties to excessive level by lime consuming action, pore size distribution lesser, heat of hydration lower , minor porosity, permeability and bleeding. Fig 3 shows the flow chart of basic effect of micro silica in concrete.

II. MATERIALS USED

(2.1)CEMENT

Ordinary Portland cement of 43 grade with cement content 410 kg/m3 was used in this work. The cement was stored in bags and kept under minimum exposure from humidity. Light grey colour cement free from any hard lumps was used shown in fig1

Fig 1. Cement

Table 2.1 Physical Properties of Cement

(2.2) SILICA

silica fume is the by-product of silicon or Ferro silicon which is produced in the electric arc furnace. Densified dark grey colour silica fume collected from Manjeshwar Traders, Mangalore was usedshown in fig2. Physical properties of silica fumes given:

Table , Physical Properties of Silica Fume

Sl. No	Properties	Results
1	Colour	Grey colour
2	Specific Gravity	2.13

Fig. Silica fume

(2.3) FINE AGGREGATE

Locally available river sand which is passing from 4.75 mm sieve size is used in this study. Fine aggregates physical properties are given below,

Table 2.3 Properties of fine aggregate

Sl. No	**Tests**	**Result**	**Test conforming to**
1	Specific gravity	2.65	IS 2386 (part-III)-1963
2	Water absorption, %	1.0	

(2.4)COARSE AGGREGATE

Natural coarse aggregate (NCA), locally available, crushed stone having 20mm down size and RCA from tested concrete specimen waste crushed in to 20mm down size with the help of jaw crusher were used in this study. Physical properties of NCA and RCA are the results obtained from coarse aggregate

(2.5)WATER

Water plays an important role in concrete during mixing, placing, compacting and curing of the concrete specimen to achieve the strength of the concrete. Increasing the quality of water can enhance the strength of the concrete. Hence potable water was used in this study.

(2.6)SUPER PLASTICIZER

Super plasticizer is used to increase the workability of the concrete. Conplast SP 430 conforming IS 9103-1999 was used in this study

3.METHODOLOGY

Concrete mix was designed for 1:1.68:2.79 ratio with M45grade for the experimental study as per the code IS 10262-2009 with water cement ratio as 0.4. Super plasticizer is added to increase the workability of the concrete and is added by 0.75% by the weight of cement with 100mm slump. Recycled aggregate is replaced by 25%, 30%, 35% and 40% with natural aggregate and silica fume is partially replaced by 10% and 20% by weight of cement.To check the mechanical properties of the concrete such that density test, compression, flexural, split tensile, modulus of elasticity, various specimens are casted by Cement, silica fume, fine and coarse aggregates, water and super plasticizer are weighed according to the mix proportion 1:168:2.79:0.4 corresponding to M45grade concrete.these are shown in fig 3.1 and fig3.2. Natural aggregate and recycled aggregate are added to the wet drum and 25% of water and super plasticizer are also added. Then fine aggregate, cement and silica fume are added with remaining water and super plasticizer is poured in to the wet drum and homogenously mixed. For every mix slump cone test was carried out to measure the workability. This wet mix is poured in to the moulds and compacted with the help of mechanical vibrator. Demoulding done after 24 hours and kept curing for 7, 28, 56 days and specimens are tested. Water immersion type of curing was adopted in this study.To check workability of concrete slump cone test was used.

4.RESULTS

4.1 Effects of Silica Fume (SF) on Workability of Concrete:

The slump cone test is conducted to ascertain the workability of concrete. fig explains the graphical representation of effect of silica fume on workability of concrete. It shows that higher the percentage of silica fume decreases the workability of concrete. Silica fume having higher surface area which absorbs more water. The slump value of the control mix higher than the other mixes.

4.2 Effect of RCA on Workability of Concrete:

From the Fig it is seen that workability of recycled aggregate decreases with increase in percentage of RCA with constant water cement ratio 0.4, due to presence of adhered mortar on the surface of recycled aggregate and micro cracks in RCA. Slump value of control mix was 100mm that was higher than the varying percentage of recycled aggregate.

4.3 Effect of Silica Fume on Density of Concrete

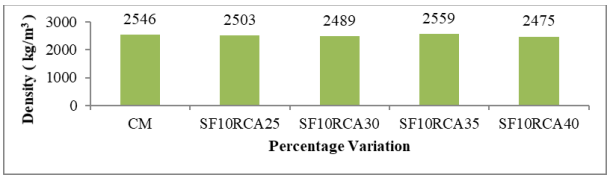
Normal concrete density is about 2400 kg/m3. Density influences the strength of concrete and also gives the information about compaction and particle packing. Fig shows that influence of silica fume on density of concrete. Addition of 10% of silica fume increases density to 0.6%, 20% increment of silica fume density reduced to 4.4% this is mainly due to silica fume act as a filler material which fills the pores.

4.4 Effect of RCA on Density of Concrete

From Fig it is observed that when percentage of recycled aggregate increases density decreases up to 4.24% with 35% of RCA compared to control mix. Due adhered mortar on the RCA there will be decrease in density.

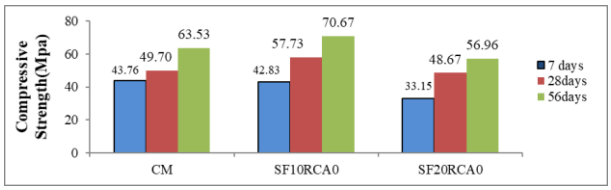
4.5 Effect of Addition of Silica Fume on RCA Concrete

From the Fig and it was clearly observed that density of concrete is increased at 35 % recycled aggregate with 10% silica fume in the range of 0.5% compared to control mix. This is due to action of filler materials which fills the pores space of the concrete. Fig 4.8 shows density of concrete decreases at 35% RCA with 20% silica fume.



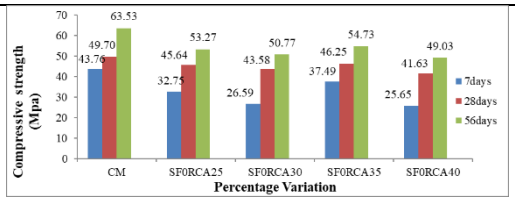
4.6 Effect of Silica Fume on Compressive Strength of Concrete

Fig shows the effect of silica fume on compressive strength of concrete. 10% silica fume gives maximum strength than control mix on 28 days, such as 10 % more strength gives than control mix. Further increase in the silica fume decreases the strength than control mix. Because once the silica fume reaches its saturation state further reaction does not take place. Maximum strength obtained on 56 days was 70.67Mpa, which14.33% more than the control mix.



4.7 Compressive Strength of RCA on Concrete

Fig represents the effect of recycled aggregate on compressive strength of concrete in 7, 28, 56 days. RCA strength was decreased up to 30% and suddenly increased at 35% further strength was decreased. But 13.85% strength was reduced compared to control mix for 56 days. Due to size, shape and adhered mortar in aggregate impart the strength of aggregate



CONCLUSION

The preliminary tests conducted for natural aggregate and recycled aggregate satisfied the standard specifications. The recycled aggregates have higher water absorption capacity (1.97%) compared to the natural aggregate. The workability of the concrete decreases with increase in the amount of recycled aggregates which have higher water absorption due to the presence of mortar in if. The workability of silica fume decreases with increases in the percentage of SF. The compressive strength of recycled aggregate with SF increases up to a certain percentage and then the strength decreases slightly. The compressive strength of the concrete with 35% recycled aggregate and 10% silica fume is 72.64 Mpa which is found to be more than the normal concrete. The flexural and the split tensile strength of concrete decreases with increase in the amount of silica fume and recycled aggregate. Optimum flexural strength of 5 Mpa and split tensile strength of 5.32 Mpa was achieved when 10% of silica fume is added to the concrete with 35% of recycled aggregate. The modulus of elasticity of the concrete decreased with increase in the amount of silica fumes and varying percentage of recycled aggregate. The optimum value was found to be 34611Mpa, when 10% silica fume and 35% recycled aggregates are added.

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The following work ‘Replacement of recycled aggregate with silica fume in cement concrete’ can’t be created by a single person. The timely completion of the work has been possible due to the guidance of our mentor Mr. Ghanshyam Pal who imparted her knowledge regarding the topic on us and with his continual motivation, this work was completed. We are also thankful to the Department HOD Dr. Seema Jagtap for allowing us to use the lab equipment’s which were required for our project, and to our parents for providing us with all possible resources. We would once again like to thanks ‘Mr. Ghanshyam Pal’ for providing us opportunities and giving his valuable time out of his busy schedule and allowing us to understand the importance of this paper for our research purpose. We also thank our college ‘Thakur College of Engineering and Technology’ for providing us with a platform and the necessary facilities to make this project possible.

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Study on Weak Subgrades using Geo Synthetic Materials for Construction of Roads

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***Abstract*—Soil reinforcement is an effective methodology to impart strength and resist the subsidence which is been practiced since ancient ages. Many researchers have investigated the essence of reinforcement in soils by utilizing natural fibers of coir, jute, bamboo, sisal fibers etc. Also then was the era of geotextiles and geosynthetics for the gain of strength and stability. Fine grained cohesive soils also have been tried to be stabilized with various cementitious materials like cement, lime, stone dust and also with wastes generated as by products in the form of fly ash, sewage sludge ash, rice husk ash etc. Also, soil has been tried to be stabilized by chemical admixtures and additives which alter the soil properties all together in new dimensions. Today in the era of Science and advanced technologies, plastic waste and jute geotextiles materials are one such materials, which have gained utmost importance in almost all fields of science and engineering. The researchers are attracted towards the unique properties of these materials which are really astonishing and which tend to alter the properties of soils when used in optimum proportions. In this regards an experimental investigation on soft marine clay stabilization has been undertaken using geosynthetic reinforcement and assess the performance of stabilization in terms of improvement in CBR values. Maybe the geotechnical community should take use of this potential and encourage such applications that lead to enhanced highway efficiency at an optimum cost because the experience obtained from their practical implementation as well as from ongoing effort undoubtedly proves to be worthwhile.**

***Keywords*—Geotextile, reinforcement, geosynthetics, pavement, subgrades, waste plastic bottles, jute geotextiles**

I. INTRODUCTION

Construction of any structure over a weak or soft soil is a challenging task for engineers considering the probabilities of failure due to differential settlements, surface unevenness/upheaval contributed due to changes in the shrinkage, swelling and cracking characteristics of fine grained soils subjected to the environmental conditions. Under such circumstances the site feasibility study plays an important role in deciding the future benefits of the project. The geotechnical design criteria such as design load and service period of the structure, type of foundation to be used and the load carrying capacity of the underlying soil needs to be properly known before the commencement of any project. The construction and road infrastructure is not much different from other structures where the geotechnical aspects play a vital role in deciding the further serviceability of the roads to be constructed over weak cohesive subgrades. Due to the rapid urbanization and growing demands of traffic, in developing countries like India, the biggest challenge is to provide a complete and a durable network of road systems with the limited finances available by making the best use of the conventional available methods.

The problem peculiarly lies especially when the roads are to be constructed over the soft cohesive soils. Weak subgrades result in insufficient pavement support and may hamper the durability of the pavement structure. Fine grained soils especially clays, exhibit low shear strength and tend to lose its further strength upon wetting and other surcharge loadings. They tend to expand on wetting and shrink on drying. These types of soils have a tendency to creep over time under constant load especially when the shear stress is approaching its shear strength making them prone to sliding. Also they tend to have low resilient modulus, as a result which need for its improvement (12).

In most of the developing countries the common types of road failures include the failure due to shallow and deep pot hole formations, small and wide cracks, base and asphalt failures, wash outs etc. The failures may also result due to the poor quality of construction, improper

selection of materials, lack of skilled labour and technical expertise and improper selection of the construction techniques.

Following factors affect the failures due to cracks because of the surface runoff and percolation of water in to the layers underlying the wearing surface such as subgrade, subbase and base course).

- Inadequate CBR values which often lead to design decisions and adopt expensive aggregate based constructions.
- Adopting poor construction methodologies arising due to lack of technical competence.

If proper materials are not found in the areas of vicinity to the site, then very high costs may be involved in the transportation & construction process which may further lead to delay of work and enhance the project cost. Hence improving the quality of available materials is of utmost importance in order to ensure to meet the project budget cost and its timely completion. However, the need for stabilizing the soils arises when available materials do not meet the specifications. Geosynthetics have been widely used to serve a variety of roles that greatly lead to roadways performing well. These provide isolation, filtration, stabilization, stiffing, drainage, barrier, and safety functions.

A. Stabilization- an ancient practice

Stabilization of soils is a proven technology even before the Christian era began, wherein it was found that certain regions across the globe were plagued with certain materials and environmental conditions that made the movement of men and material difficult over the paths connecting the different villages and towns. The Mesopotamians and the Romans later discovered that the pathways for traffic could be improved by stabilizing the soft soils with pozzolanous materials like limestone or calcium. This was the first attempt to stabilize the weak soils for its improvement in strength. Later it was discovered through trial and error, that the soil could be capable of handling large loads in the form of carts and wagons as long as the surface conditions proved to be stable considering the availability of the moisture content within the soil mass. The use of stone slabs was then adopted by Romans which proved to be durable enough to establish their serviceability even after many years subsequent to their constructions.

Thereafter there have been number of improvements in the process of technology and equipment and the scope of stabilization of soils gained a large momentum since the middle of the twentieth century where lot of research has been carried out to stabilize the poor/ weak soils thus making them compatible during the process of construction.

B. Concept of Stabilization

Stabilization is a process of mixing the soils with strength gaining materials/compounds which when added in suitable proportions to the soil help to modify and improve the physical, mechanical, chemical, mineralogical and morphological properties. As a result, various engineering parameters like the compressive and tensile strength, density, hydraulic conductivity, bearing capacity, swelling and shrinkage, compressibility and compaction, shear strength etc., get affected on account of stabilization.

C. Need for stabilization

Stabilization of soils is given utmost priority based under the following conditions.

- When the locally available materials do not confine to the desired standards.
- When there are financial constraints on the project completion and the project cost without hampering the quality of construction.
- When there is an encouragement and a special emphasis laid for utilizing the industrial wastes/ resources to be adopted as low cost construction materials.

D. Basic Principles of stabilization

The soil stabilization works on the following principles.

- Complete characterization of the soil to be stabilized.
- Evaluation of deficiencies in soil based on the characterization data.
- Selection of appropriate method and technique of soil stabilization considering the prevailing ambient environmental conditions.
- Designing an adequate stabilized mix considering the requirements and serviceability of the structure.

E. Stabilization by Random reinforcement

Apart from stabilizing with conventional materials, soils also have been tried to be reinforced with various fibers such as natural (coir)fibers, jute fibers, sisal, bamboo wood, palm leaf, coconut leaf, metal, nylon etc. to improve the CBR values and bearing capacities. (Ayyar et al 1989., Mandal and Vishwamohan,1989) Also the use of timber crib frames, natural fabric strips were introduced in the soils as natural materials to study the strength and deformation modulus. (K.R. Datye,1988). Random inclusions of discrete fibers, geotextiles (Krishnaswamy et al.1988) geosynthetics and geogrids have been tried to be included as a source of reinforcement to impart necessary strength to the weak soils.

F. Stabilization with Wastes

With the rapid increase in the amount of sewage sludge produced from wastewater treatment plants it becomes urgent to both reduce and reuse sludge. In the past, pozzolanic properties have been found in both sludge ash and fly ash by many studies. More recently, efforts to replace fly ash with incinerated sludge ash in the improvement of soft subgrade soil look promising. Sludge ash being rich in siliceous compounds tends to modify and improve the engineering properties of soils when supplemented by additives. (Tay and Goh 1991., Lin et al. 2005). Furthermore, people have been more receptive toward the application of recycled resources in road engineering than in building construction. Hence,

the application of incinerated sewage sludge ash also holds a promising future applied to soil sciences in the field of geotechnical engineering.

Rice husk which is also one of the important agricultural wastes finds a potential in stabilization processes. Plenty of rice is produced in India and the disposal problem of rice husks is as similar to the disposal of sludge ash /fly ash. Rice husks also being rich in silica tend to improve the strength properties of soils when combined with additives (Basha et al 2005).

Use of plastic products such as polythene bags, plastic bottles also has grown to its peak and the disposal of such wastes without any ecological hazards is a big challenge. Many researchers are trying to make the best use of these materials in soil from the strengthening point of view (Arvind Kumar et al. 2009; Choudhary and Jha 2010, Ramrathanlal and Mandal 2013)

G. Critical Appraisal of Literature Reviewed

Reinforcement and stabilization of soils has been in practice quite a few decades before. Various tests to explore the physical properties like specific surface area, specific gravity and density, Atterberg limits, UCS, triaxial tests, direct shear tests, CBR, resilient modulus, compaction, have been conducted by several researchers to throw a light on the effect of reinforcement and stabilization on different types of soils. A summary of the extensive literature survey has been presented in this section and an attempt to critically evaluate the earlier researches has been made in brief.

Aluminium foil strips were initially used as reinforcement in soil layers to study the effect on bearing capacities (Binquet and Lee, 1975), Coir fibers and jute fibers of small diameters were reinforced with clay to offer a greater resistance to swelling (Ayyar et al, 1989; Sivakumarbabu et al 2008) and to study the effect on CBR values (Mandal and Murti MVR,1989), Timber crib frames, natural fabric strips were introduced in soils as natural materials to study strength and deformation modulus (K.R.Datye,1988). Natural and synthetic fibres with copper wires were also used as reinforcing elements to study the effect of shear strength (Ola.S. A,1989). Geotextiles were introduced to increase the soil strength ratio with respect to the reinforcement aspect (Krishnaswamy.N.R and Raghavendra.H.B, 1988). Pull out tests, centrifuge tests, triaxial tests and direct shear tests have been performed on planar reinforcements indicating the presence of reinforcement increased the shear resistance and the ductility of the soil (Broms, 1977, Mandal 1980). High density polyethylene geogrid (HDPE) to study the development of higher shear resistance (Bergado et al. 1993; Yetimoglu and Salbas 2002). Random sisal fibres and waste polymer fibres were adopted as reinforcement on soft soil and study the triaxial behaviour of specimens on soft soils (Prabakar and Sridhar 2002; Naeini and Sajdadi 2008). Palm leaf as natural fibre was introduced to study the triaxial behaviour of cohesive soils (Estabragh et al. 2010), Nylon thread fibres in varying concentrations were also analysed to assess the benefits of subgrade soil improvement (Tallapragada 2009).

All the above studies basically include the use of natural fibres and synthetics as reinforcements in soft soils by conducting triaxial, direct shear and UCS tests. However, very few studies have been undertaken to combine these materials with readily available wastes such as fly ash/ mine wastes/ sludge ash etc. and to assess the stabilizing effect of partially doped soils with these wastes and analyse their strength, CBR and resilient properties, to be effectively implemented as subgrades in the pavement infrastructures.

Many studies on soil stabilization with fly ash and other cementitious products have been carried out to focus on the effective utilization of fly ash as a suitable material for stabilization of soft soils and subgrades. Pulp mill fly ash and lime has been utilised for improvement in bearing capacity(Zhou et al. 1999; Kalra et al.2000; Arora and Aydilek,2005) burnt sludge ash for improvement in strength and reducing the swelling and plasticity (Munjed and Attom, 2000) saturated drained triaxial tests were also conducted to assess the behaviour of soils with addition of fly ash and calcium chloride considering the curing conditions (Consoli et al. 2001).Randomly oriented polyester fibre inclusions with fly ash and cement additive combinations were also studied to bring more ductility to the soil mixes (Kaniraj and Havanagi,2001; Arvind kumar et al. 2007). Recycled asphalt product (RAP) was also used along with fly ash to achieve the gain in stiffness of soft soils (Rupnow,2002). Compaction, CBR and swelling characteristics have been studied by replacing fly ash in varying proportions (Prabhakar et al.2004). Fibres of Cir and polypropylene have also been utilised with fly ash to measure the effect of reinforcement under different confining pressures (Chauhan et al. 2008). Polyvinyl alcohol fibres were also used in combination with sand and cement as an additive to check the effect on strength and ductility (Sung-Sik Park, 2011).

In-situ case studies on fly ash stabilized soils also have been undertaken to measure the increase in strength and stiffness of fine subgrades by measuring the CBR and resilient modulus properties (Shafique et al. 2004; Edil et al. 2006). Field studies on combinations of reclaimed asphalt pavement (RAP), Foamed asphalt (FA), Blast furnace slag (BFS), lime, crushed stone and cement were conducted by accelerated pavement testing by blending it with different combinations and analysing the rutting depth and verifying the same by FEM model (Wu et al, 2004; Mohammed and Saadeh 2008). Waste plastic strips have been used in combination with stone dust and fly ash to observe the effect on CBR and secant modulus values (Dutta and Sarda, 2006). Sewage sludge ash has been effectively established as a stabilizing material in improving strength, CBR and plasticity (Lin et al. 2007 a; Lin et al. 2007b).

All the above studies have been put forth to establish the effective implementation of fly ash with other conventional cementitious additives like lime and cement. However, very few studies have come up with the suitability of fly ash in combination with novel materials like nano materials and assessing the CBR, strength and resilient properties to establish it as a good subgrade/sub-base material. Moreover, very few model

studies have been taken up to assess the behaviour of fly ash in combination with soft to medium soils as subgrades under the repetitive loading. CBR and resilient modulus properties of such materials also need to be established further to employ the usage of these readily available wastes, so as to create a sense of awareness in the society.

Recent trend of stabilising the soils by nano materials also has also gained momentum since the past decade. Research has been carried out almost in all the fields of science and engineering to convey the versatility of the nano products.

New chemicals comprising of sulphuric acid and lignosulphonates, petroleum emulsions, polymers and tree resins were adopted for stabilizing the soft soils with cement and lime pre-treated soils by conducting UCS and Triaxial (UU) tests (Puppala and Hanchanloet,1999; Santoni et al. 2002). Nano-silica was found to be effective in increasing the pozzolanic activities of the high volume fly ash concrete (Li, 2003). Strength properties of sewage sludge ash were improved by adding nano silica and nano alumina additives to soft soils in small varying proportions (Luo et al. 2004; Luo et al. 2009; Luo et al. 2012). Flexural fatigue performance of PCC and nano added concrete, titanium dioxide) and nano-SiO2(silicon dioxide) particles was studied (Li et al. 2007), iron nano particles have been used to remediate polychlorinated biphenyls (PCB) contaminated soils (Varanasi et al. 2007). Recent advances in the field of medicinal sciences have cited the use of quantum dots and iron oxide nano crystals in the treatment of cancers and identifying single cells, individual DNA molecules and biological structures in soils (Wang et al. 2007; Wilson et al. 2008). Nano aluminium has been used to study the transport through the porous media with the introduction in column studies to measure the leachate concentrations (Doshi et al 2008). Improvement in flexural strength of self-compacted concrete by improving the pore structure was achieved by adding nano zinc oxide (Nazari and Riahi 2011). Also, the physical, mechanical and thermal properties of concrete were improved by addition of nano zinc. (Riahi and Nazari 2011; Kawashima et al. 2012). Compaction, Shrinkage and swelling potential and crack initiation in soils was found to be improved by adding nano-clay, nano-copper nad nano-alumina (Taha et al. 2012). Terasoil and nano zinc partcles have found to be very effective in improving the physical properties, strength and CBR of soft soils (Patel and Dalwadi 2011; Ugwu et al. 2013).

Studies on waste plactic bottles and jute geotextiles materials reveal the diversity of applications in almost all the fields. However, the research relating to the construction industry still provides a sufficient space for the complete development and understanding of these materials. There is enough evidence of success rates in the field of concrete technology. However, more research in the field of geotechnical engineering needs to be done so as to establish the significance of these materials to assess their interaction with different types of soils. Also, more emphasis is to be given to the usage of these novel materials in combination with readily available wastes, such as fly ash where the question of their disposal and utilisation shall automatically stand to be resolved to a certain extent. Also model studies need to be conducted wherein the importance of these materials can be brought to the notice of mankind by helping them to choose appropriate methodologies which can make revolutionary changes in the field of road and building infrastructure.

II. FRAMEWORK

Separation: By putting a geosynthetic between two different materials, the two components' integrity and usefulness are preserved. Additionally, it could entail offering long-term stress reduction. Key design elements for carrying out this role include those that describe the geosynthetic's capacity to survive during installation.
Filtration: The geosynthetic permits liquid to pass through it while holding back tiny particles on the side facing upstream. The geosynthetic permittivity (cross-plane hydraulic conductivity per unit thickness) and measurements of the geosynthetic pore-size distribution are important design elements to achieve this function (e.g., apparent opening size).

Reinforcement - In order to maintain or enhance the stability of the soil-geosynthetic composite, the geosynthetic creates tensile forces. The geosynthetic tensile strength is a crucial design characteristic to perform this purpose.

Use of geosynthetics in mitigation of reflective cracking in asphalt overlays –
Roadway that was built either (a) without geosynthetics or (b) with them.

Stiffening: To manage deformations in the soil-geosynthetic composite, the geosynthetic creates tensile stresses. The ability to quantify the increased stiffness brought on by the interaction between the soil and the geosynthetics is one of the key design characteristics to achieve this function.
Drainage: The geosynthetic material permits the movement of liquid (or gas) along the axis of its structure. The geosynthetic transmissivity is a crucial design characteristic to quantify this function (in-plane hydraulic conductivity integrated over thickness).
Additional geosynthetic functions, albeit less prevalent in paving applications, include:
Geosynthetic hydraulic/gas barriers reduce cross-plane flow and provide liquid or gas confinement. The geosynthetic material's long-term durability and other key design characteristics are required to carry out this purpose.
Protection - The geosynthetic acts as a cushion on top of or below another material (such as a geomembrane) to reduce damage when the overlaying materials are positioned. The design parameters that describe the geosynthetic's puncture resistance are important for quantifying this function.

III. METHODOLOGY

The methodology used for this thesis work. It includes:

1. Selection of Site
2. Collection of materials

A. Selection of Site

As we want to use geo-textile in road construction in this thesis work, we have selected palghar-virar NH160A, as construction of widening of this road is in progress, the available soil is taken for testing. The soil is cohesive in nature.

B. Collection of materials

Black cotton soil- The black cotton soil collecting from nearby Virar-palghar road Palghar. This soil was collected from an open excavation, at a depth of 1m to 1.5m below the natural ground surface. The Soil used in this study is a blackish Gray inorganic clayey soil of medium plasticity. Sufficient quality of soil was brought to the Geotechnical Engineering Laboratory of TCET Mumbai. This black cotton soil has very low bearing capacity due to that existing road getting damaged. To improve the bearing capacity, we will be going to use plastic and jute geotextile in the road.

Fig.1. Black cotton soil

The plastic bottles should be collected from plastic scrap shops and for cutting of this plastic in round shape. manual method is adopted. Plastic disc having mean diameter 10cm. For large scale project mechanical cutting should adopted

Fig 2. Waste plastic bottles

IV. TESTING OF MATERIALS

After collection of materials, we have done testing of all materials both individually and after mixing, Kashmir. The various tests done are:

1. CBR Test
2. Specific Gravity
3. Moisture content
4. Compaction Test

A. CBR Test

The CBR is the difference between a load that penetrates a material to a certain depth and a load that penetrates crushed stone to the same depth. The test provides a composite assessment of both stiffness modulus and shear strength rather of measuring either one directly. [2]

A conventional plunger with a diameter of 50 mm is used to apply the bearing load to the sample at a rate of 1.25 mm/min in order to assess penetration. The CBR is given as a percentage of the actual load that caused the standard loads on crushed stone to penetrate by 2.5 mm or 5.0 mm. It is sketched a load penetration curve. At 2.5 mm and 5.0 mm, the load values for normal crushed stones are 1,370 kgf (13.44 kN) and 2,055 kgf (20.15 kN).

B. Specific Gravity

The natural gravity of a soil is the measure of the weight of an equivalent amount of water to a given volume of matter. This is not appropriate for soil comprising more than 10 per cent of stones that are held in the 37.5 mm BS check sieve so these can be broken down to less than that.

C. Moisture Content

It is nothing but moisture content present in untreated soil sample or it is defined as weight of water present in soil to the weight of soil solids in percentage. It should be determined with reference of relevant IS code IS 2720 PART II by oven drying method.

TABLE 1. Properties of Soil

Sl.No	Name of Test	Results
1	Water Content	28.51%
2 3	Specific Gravity by Pycnometer	2.48
4	Plastic limit test	0.25%
5	Liquid limit of soil	57%
6	Standard proctor test	OMC 17.5% MDD-1.7gm/cc

V. RESULTS AND DISCUSSION

The laboratory experiments were conducted on the three samples obtained for the purpose of defining, classifying, and evaluating technical characteristics of the materials used. After that the samples in the pavement model were used as test subgrades.

VI. CONCLUSION

Introducing the use of geotextiles in road building, since it eliminates the act of "borrowing to fill" because the in-situ soil can be conveniently improved by utilizing geosynthetics, is of economic gain from the above research taken on both soil sample and content. The geotextiles perform a key function in the design of highways. They're used e effectively in almost all new building details. This significantly increases surface asset life, which effectively reduces repair costs. It significantly separate sub-base from sub-soil and have structural support due to its strong deformation resistance. It also decreases the thickness of the granular subbase path. This would be advantageous if geotextiles were used in the development of highways as their use would minimize initial construction costs and reduce regularly.

VII. FUTURE WORK

To investigate Black cotton soil as fill material to construct the sub bases in pavements by addition of waste plastic fibers/ jute fibers.

To investigate the UCS, Shear strength and CBR values of subbases using combination of black cotton soil and waste plastic fibers/ jute fibers depending on different aspect ratios.

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Design of Restoration of Pond And Water Tank

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***Abstracts*- This paper presents the design of a restoration project for a pond and water tank. The goal of the project is to improve the water quality and increase the overall health of the pond and water tank ecosystem. The design process involved analyzing the current state of the pond and water tank, identifying sources of pollutants and degradation, and developing. The restoration plan includes installing a filtration system, adding plants and other vegetation to the shoreline to absorb excess nutrients and pollutants, and introducing beneficial organisms to the ecosystem. The filtration system will improve water quality by removing excess nutrients, pollutants, and sediments that contribute to eutrophication and degradation of the pond. The introduction of vegetation will provide habitat and food for aquatic organisms, while also improving water quality by absorbing excess nutrients and pollutant.**

Keywords- Pond, Restoration, Seepage, Resisting moment, Capacity, sustainability.

I. INTRODUCTION

Adequate availability of water of required quality is pre-requisite for survival and quality of human life. Surface water bodies like lakes, ponds, reservoirs, tanks and riverswere treated as community resource or assetover the centuries. In city areas additionally such water bodies performed an critical position as a source of consuming water, absorption of flood water and a conduit for floor water recharge.[1] They have been being nurtured, included, conserved and controlled by way of the lively participationof the area people without any code of conduct or rule.[2] In turn, those water bodies have been catering the neighborhood human and livestock populations. The introduction of public water supply and floorwater development thru tube wells and handpumps inside the contemporary instances, coupled with urbanization and industrialization induced pollutants, a tectonic shift in the attitude of the human beings towards these water bodies has been witnessed. Both locals in addition to the authorities have commenced neglecting this asset and feature stopped worrying, nurturing and retaining those network resources. [3] Mushrooming city, business and infrastructure improvement has similarly changed the reputation of thesewater our bodies from network assets to a trifling dumping ground or sink for stable wastes, creation debris, domestic sewage,industrial effluents, non secular offering andmany others. [4] Resulting in severe degradation in the quality of such resources.India has had abundant supply of water resources. However, from being a water

abundant country India is gradually progressing towards water scarcity due to increasing population pressure, urbanization and uncontrolled growth. At present it issustaining 18 per cent of world population with 4 per cent of global water 2 resources. Therefore, management of water resources has assumed great importance. Today availability of water resources is a major issue and is a big challenge facing our country.

OBJECTIVES

- Improvement and restoration of pond
- Increasing tank storage capacity
- Ground water recharge
- Used for fire fighting

***II*- RESTORATION METHODOLOGY**

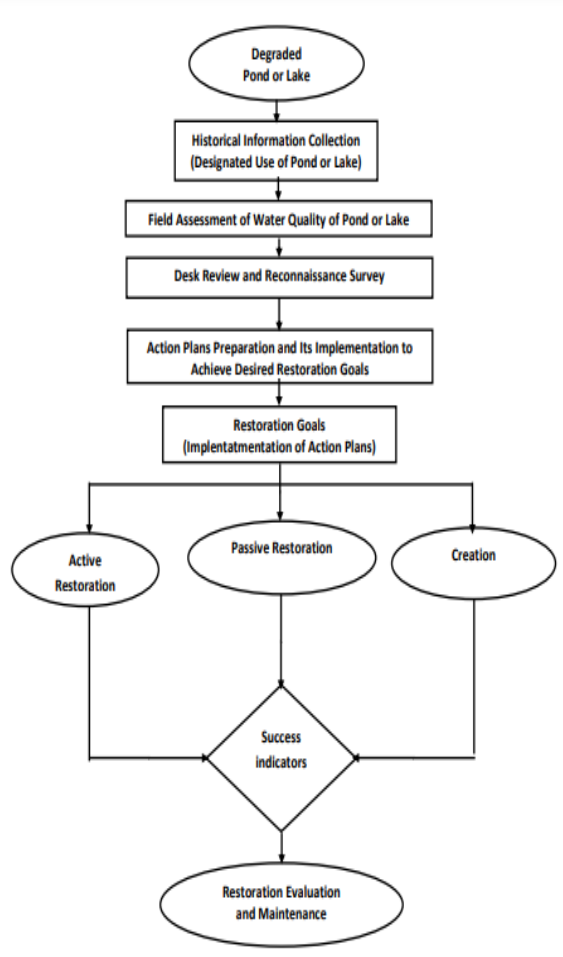
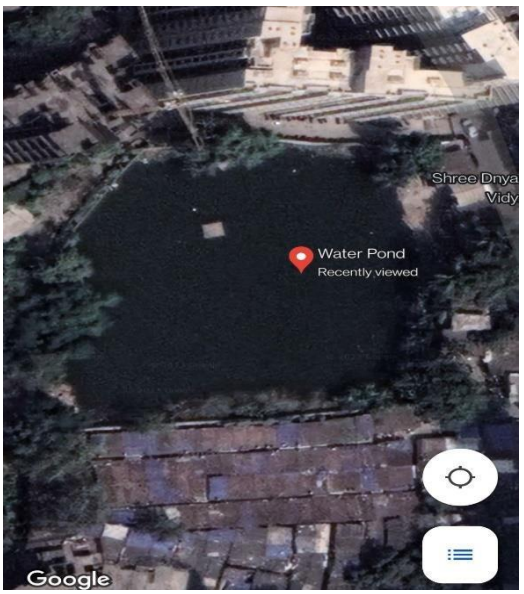


Figure 2. Model Flow Chart for Restoration of Pond or Lake

III-FIELD SURVEY

The field survey is carried out of a pond near Borivali west in which we have found that the soil cover is largely alluvial and loamy. The pond in octagonal shape having dimension 9m,7m,3m,5m,12m.

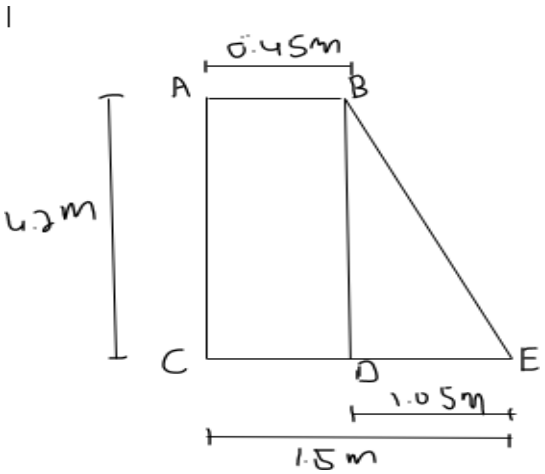


Soil inside the ponded place—Suitability of a pond web site relies upon on the ability of the soils inside the reservoir place to hold water. The soil have to contain a layer of material that is impervious and thick sufficient to prevent immoderate seepage.Clays and silty clays are exquisite for this cause; sandy and gravelly clays are typically excellent. Generally, soils with at least 20 percent passing the No. 2 hundred sieve, a Plasticity Index of greater than 10 percentage, and an undisturbed thickness of at least 3 ft do now not have excessive seepage whilst the water intensity is less than 10 ft. Coarse-textured sands and sand-gravelcombinations are rather pervious and therefore commonly improper. The absence of a layer of impervious fabric over part of the ponded area does no longer necessarily imply that you must abandon the proposed site. You can deal with these components of the region with the aid of one in all numerous techniques described later in this handbook. Any of these strategies can be costly. Some limestone regions are especially risky as pond web sites. Crevices, sinks, or channels

that are not seen from the surface may be in the limestone underneath the soil mantle. They may empty the pond in a quick time. Inaddition, many soils in these regions are granular. Because the granules do now not damage down quite simply in water, the soils continue to be particularly permeable. All the factors that could make a limestone website unwanted are not without problems identified without considerable investigations and laboratory checks. Thepleasant clue to the suitability of a website inthis sort of areas is the diploma of fulfillmentothers have had with farm ponds inside the immediate location. Unless you realize that the soils are sufficiently impervious and thatleakage will not be a problem, you must make soil borings at periods over thelocation to be blanketed with water. Three orfour borings in line with acre may be sufficient if the soils are uniform. More maybe required if there are large differences.

Foundation situations—The basis under a dam must make certain stable guide for the shape and provide the necessary resistance to the passage of water.

IV-DESIGN



Cross-section of pond concrete wall
Parameter of the pond = 37m
Slope (s) = 1:2
Concrete quantity = volume of ABCD + volume of BDE

=(0.45mx4.2m)37m + ½ (1.05mx4.2m)37m
=69.93m^3+81.58m^3
=151.51 m^3

Grade of concrete used in the wall is M25 (1:1.5:3)

Pond Capacity- Estimate pond capacity to besure that enough water is stored in the pond to satisfy the intended use requirements. A simple method follows:

- Establish the normal pond-full water elevation and stake the waterline at this elevation.
- Measure the width of the valley at this elevation at regular intervals and use these measurements to compute the pond-full surface area in acres.
- Multiply the surface area by 0.4times the maximum water depth in feet measured at the dam.
- A pond with a surface area of 37m and a depth of 4.2m feet at the dam has an approximate

capacity (0.4 x 4.2 x 80.57) =135.35 cubic meter[1 cubic meter = 1000 liter] Total capacity= 135350 liters = 35755.68 gallon

V-CALCULATION

The concrete pond of trapezoidal cross section as shown with T=0.45m B=1.5m H=4.2m and h= 4m. The weight of concreteis 24KN/m*3.

1. The total Hydrostatics force on the pond in KN per meter length.

$$\rho = \gamma h$$

$$\rho = \frac{9.8kN}{m3(4m)}(4.2\text{m})$$

$$\rho = 39.2kN/m\text{^}3$$

$$\rho = Sum\ of\ the\ hydrostatic\ pressure$$

$$\rho = \frac{\rho(h)}{2}(0.45)$$

$$\rho = [39.2\ \text{kN/m^3}\ (4\text{m})]/2(0.45\text{m})$$

$$\rho = 35.28\text{kN}$$

2. The Resisting moment of the pond to Overturning, in kN-m per meter length of Pond.

$$W1 = v_C x w_C$$

$$W_1 = (4.2mx0.45mx0.45m)\left(\frac{24kN}{m3}\right)$$

$$W_1 = 20.41kN$$

$$W_2 = v_C x w_C$$

W_2 =0.5(4.2mx1.05mx0.45m)(24kN/ m^3)

$$W_2 = 25.52kN$$

$$RM = w_1 d_1 + w_2 d_2$$

RM =20.41kN(1.05m+0.5m)+25.52kN[2/3 (1.05m)]

RM =49.58 kN-m

VI-RESULT AND DISCUSSION

The consequences for the varying evaluation undertaken via the research were mentioned below every section to recognize the unique characteristics of the conventional water tanks. As a metropolitan town there may be a plenty of water shortage in every components, So the recuperation of pond ought to be done on precedence foundation and accumulate the water of monsoon but with converting weather situations, the herbal healing of those traditional water our bodies were in jeopardy. The identified problems aside from the water best together with overgrown vegetation, unregulated get admission to to the water bodies, waste dumping and many others. Desires to be saved in check on occasion to make certain the sanctity of these traditional water bodies

VII - CONCULSION

Thus the design of pond depends on many factors such as ability of soil to hold water, water capacity, type of limestone etc. As a meteropolitan city restoration of ponds and tanks must be done on regular basis, due to water shortage. We should harvest as much rain water we can There ought to be ordinary water first-class assessments to assess the circumstance of those water our bodies. The protection of these traditional water bodies must be in harmony with the socio-cultural elements regarding the nearby public to deliver inside the experience of belongingness towards those historical past water bodies. The complete look at has more advantageous know-how of the spatio-temporal behaviour of conventional water frame as a result it's going to additionally be beneficial within the destiny for policymakers and different applicable authorities in designing or improving those conventional water bodies anywhere in the India. The conservation of traditional water our bodies isn't always confined to certain motion plans however desires to be done in a regulated manner which includes to restore the ability of those traditional water our bodies to triumph over the bigger problem of water shortage in India. The conservation of traditional water bodies is not limited to certain action plans but needs to be done in a regulated manner such as to revive the potential of these traditional water bodies to overcome the bigger issue of water
scarcity in the country.

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Sustainable Energy Using Cool Roof Technology-Development of Terracotta Tilewith chambers

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***Abstract*--- This technical paper describes a sustainable energy solution for rooftop construction utilizing terracotta cool roof tiles integrated with water circulation and green roofs. It focuses on its applicationto promote sustainable energy practices. The paper presents an overview of the benefits of cool roof technology, including reduced energy consumption andlower greenhouse gas emissions, and reviews the terracotta tile that can be used to implement cool roof technology. The study focuses on these tiles' potential to reduce the energy required for cooling buildings inwarm climates, thus reducing their carbon footprint. The research details the thermal performance of terracotta cool roof tiles, including their solar reflectance and thermal emittance, and compares themto conventional roofing materials. The results show thatthe use of terracotta tiles can significantly reduce energy consumption and improve indoor thermal comfort, making it an attractive and sustainable energy solution for the building industry.**

Keywords*--- *Sustainable energy, Cool roof technology, Terracotta, Cost efficiency

I. INTRODUCTION

The urban heat island phenomenon has compelled architects, engineers, and building contractors to apply passive design principles in building design, construction, and specification. These passive design solutions entail taking advantage of the environment in which the building is to decrease or, in some cases, eliminate the need for mechanical heating or cooling. These tactics include building orientation, shape, envelope (material selection), and landscape concerns. The increase in demand for shelter caused by population growth (which is still ongoing) has compelled architects, builders, and contractors to be more cautious in the specification of material choice of elements utilized for the building envelope. This isa passive design method for lowering building surface temperatures in hot areas. Higher surface temperatures increase the energy demands on cooling equipment within the building envelope and raise the ambient temperatures around them. Roofs and pavements account for approximately 60% of urban land cover inIndia (20-25% roofs, 30-45% pavements) and have high surface temperatures.

A variety of elements influence a material's thermal performance, but the two most important ones are solar reflectance (albedo) and thermal emissivity. Other surface qualities include the type of coating utilized on the material's surface, the thickness and texture of the coating, and the coating's longevity when exposed to weather elements. Reflectance and emissivity are fractions ranging from 0 to 1. The higher the value, the colder the material's surface temperature when exposed to sunlight. Solar reflectance, also known as albedo, is the fraction of solar radiation reflected by the roof, whereas thermalemissivity is the material's relative ability to emit absorbed heat energy. In hot-dry and hot-humid climates, approximately fifty percent (50%) of peak energy demand is used to fulfill space conditioning; cooling consumes less energy than heating.The growing demand for sustainable energy solutions has led to innovative technologies that promote energy efficiency and reduce the overallcarbon footprint of buildings. This technology effectively lowers the temperature ofthe roof and the interior of the building, reducing theneed for energy-consuming air conditioning systems and promoting environmental sustainability. In this technical paper, we will explore the scientificprinciples and design considerations of the cool roof technology using terracotta roof tiles and a water system, including the installation process and thebenefits of using this technology in hot and humid climates. We will also analyze the performance and energy efficiency of this technology to provide a comprehensive understanding of its potential for use in sustainable building design.

II. LITERATURE REVIEW

A study by the Department of Energy in the United States found that cool roofs can reduce the energy required for air conditioning by up to 15% in hot regions. Moreover, cool roof technology has the potential to reduce urban heat islands, lower greenhouse gas emissions, and improve air quality.

In a study conducted by the Lawrence Berkeley National Laboratory, researchers found that the use of cool roofs can reduce peak electricity demand and air pollution levels. The study also found that cool roofs can help to reduce the urban heat island effect, whichis a significant contributor to global warming.

A study published in the Journal of Building Engineering found that cool roofs can reduce the cooling energy consumption of a building by up to 10%, which can lead to significant energy savings. The study also highlighted that the installation of coolroofs can improve thermal comfort, reduce the need for air conditioning systems, and enhance the overallenergy efficiency of buildings.

In another study published in the International Journal of Sustainable Energy, researchers found thatcool roofs can provide up to 25% energy savings compared to conventional roofs. The study also highlighted that cool roof can help to reduce theenvironmental impact of buildings by lowering greenhouse gas emissions and reducing the urban heatisland effect.

A review of the literature published in the International Journal of Sustainable Energy and Environmental Research found that cool roof technology can significantly reduce the heat absorption of buildings, thereby reducing energy consumption and promoting environmental sustainability. The review also highlighted the need for further research on the economic and social benefits of cool roof technology.

III. PROPOSED METHODOLOGY

***Clay selection*:** The first step in the process is selecting the right type of clay. The clay used for roof tiles should be of high quality, with the right balance of plasticity and strength. The clay is usually sourced from specific regions known for their clay deposits and is then cleaned, sifted, and tested to ensure its suitability for roof tiles.

***Mixing the clay*:** The cleaned and sifted clay is then mixed with water to form a homogeneous mixture. This mixture is known as "slip." The slip is then left to settle, allowing any impurities to rise to the surface, which is then skimmed off.

***Press molding*:** The slip is then placed into a mold, which gives the tile its shape. The mold is then compressed using a hydraulic press, removing air pockets, and forming a dense, solid tile. The press molding process typically takes a few seconds.

Drying: The molded tiles are then left to air dry for several days. Thisallows any excess moisture toevaporate, which is important for ensuring the tiles are strong anddurable. The drying process iscarefully controlled to avoid cracking or warping of the tiles.

Biscuit firing: The dried tiles are then placed in a kiln and fired at a low temperature (around 1000°C) for several hours. This process, known as biscuit firing, removesany remaining moisture and hardens the tiles. It also gives the tiles theirinitial color and texture.

Cooling and packing: The finished tiles are then removed from the kilnand allowed to cool. They are then packaged and ready for shipping. The tiles are often stacked in layers, with a protective layer of paper or foam between each layer to prevent damage during transit.

Fig.01 The Manufacturing Process

IV. RESULTS

NAME OF THE TEST	RECORDED VALUE	PERMISSIBLE VALUE	COMPLIANCE
1. Water Absorption Test	8%	/> 10%	**PASSED**
2. Compressive Strength	73 N/mm^2	</ 25 N/mm^2 (IS 3316)	**PASSED**
3. Abrasion Test			
4. Solar Reflectance		>30 (IGBC)	**PASSED**
5. Thermal Emissivity		0.90 to 0.95	**PASSED**

Table 01. Tests performed on the specimen.

V. APPLICATION

1. **Prepare the roof surface:** Make sure the roof deck is clean, dry, and free of any debris. Install a layer of underlayment, such as roofing felt, over the deck to provide a moisture barrier.
2. **Install the eave flashing:** Install the eave flashing along the bottom edge of the roof, overlapping the underlayment. This will prevent water from seeping under the tiles.
3. **Install the starter course:** Begin at the eaves and install the first row of tiles, called the starter course, using mortar to hold them in place. Make sure the tiles are level and properly aligned.
4. **Install the field tiles:** Install the terracotta tiles in rows, starting from the bottom and working your way up to the ridge. Use mortar to secure the tiles in place and make sure they are properly aligned and level.
5. **Install the water pipes:** Install the water pipes according to the plumbing code and regulations. Make sure that the pipes are securely fastened and sealed.
6. **Install the ridge tiles:** Once you have installed all the terracotta tiles, install the ridge tiles along the top of the roof, again using mortar to secure them in place.
7. **Finish with hip and rake tiles:** If your roof has hips or rakes, install the appropriate tiles to finish these areas.

CONCLUSION

Cool roof technology is a revolutionary and environmentally sustainable approach to reducing the heat buildup on the roofs of modern buildings. By integrating the use of terracotta roof tiles and water in this technology, it is possible to significantly lower the amount of heat that is absorbed and transmitted through the roof into the interior of the building. This cutting-edge technology is particularly beneficial in regions with high-temperature climates, as it can helpto reduce the overall carbon footprint of the buildingby minimizing the use of air conditioning systems and energy consumption. The integration of terracotta roof tiles is key to the effectiveness of cool rooftechnology. These tiles are specifically designed to reflect sunlight and prevent heat absorption, which can significantly reduce the overall temperature of the roof. Moreover, the use of water in the technology further enhances the cooling effect of the roof. Wateris used in the form of a shallow pool or a series of channels on the roof to create a continuous flow of water. This flow of water can absorb the heat that enters the building and evaporate it through the process of natural cooling, thereby keeping the temperature of the building at a comfortable level. The benefits of cool roof technology using terracotta rooftiles and water are numerous. It helps to significantlyreduce the heat buildup in buildings, thereby reducingthe need for air conditioning and related energy consumption. This technology is also a cost-effectiveand environmentally sustainable solution for buildings in high-temperature regions. Moreover, the installation of terracotta roof tiles and water channelsis a simple and effective process, which can be easilycarried out by skilled professionals. In conclusion, cool roof technology using terracotta roof tiles and water is a sophisticated and innovative approach to reducing heat buildup in buildings. The integration ofthese elements into the roof can greatly enhance the overall energy efficiency of a building and promote environmental sustainability. As global temperaturescontinue to rise, the importance of sustainable solutions like cool roof technology cannot beoverstated.

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Determination of water requirement for crops based on climate

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***Abstract*- Water, the precious resource with which a life can be prolong on Earth. The term crop water requirement is defined as "amount of water required to the crop fromits planting date to harvesting date". It also refers to the amount of water required to compensate the evapo-transpiration loss from cropped field. It depends on crop type, stage of growth and evaporation demand. This study focuses on one of the most important basins i.e., Brahmani River Basin, Odisha, India which has been a primary agricultural center and now transforming in to industrial hub at various locations. It is a water surplus basin, but has water scarcity as well as water logging/flooding at different reaches. The crop water requirement is muchbelow the available rainfall and even available groundwater at various locations of Brahmani River basin.**

Key words: Brahmani River Basin, Crop water requirement, Crop coefficient, Evapotranspiration.

I. INTRODUCTION

Indian agriculture is diverse, ranging from impoverished farm villages to developed farms utilising modern agricultural technologies. Irrigation in India refers to the supply of water from Indian rivers, tanks, wells, canals and other artificial projects for the purpose of cultivation and agricultural activities. In developing country such as India, 64% of cultivated land is dependent on monsoons. Agriculture is an important part of Indian economy. billion People live in areas experiencing economic water scarcity, where the lack of investment in water or insufficient human capacity makes it impossible for authorities to satisfy the demand for water. However, milk production generates more value than the outputs of rice and sugarcane combined. Sustainable water use and agricultural growth in major milk-producing areas require a drastic reduction in groundwater Consumptive water use, which, at present, exceeds natural recharge. It is suggested that diversifying to a mix of milk and high- value (but low water consuming) crops can reduce groundwater CWU whileensuring higher total output. The loss of benefits when irrigation water reallocate for requirement of environmental flow is only 1.2–1.6 % of the grossvalue of crop production, which can be overcome with an increase in irrigation efficiency or marginal productivity. Crop water requirement depends on crop type, stage of growth and evaporation demand.

Thisstudy focuses on one of the most important basins i.e Brahmani River Basin, Odisha, India which has been a primary agricultural center and now transforming in to industrial hub at various locations. It is a water surplus basin, but has water scarcity as well as water logging/flooding at different reaches. River Brahmaniis the second largest river in the State of Odisha. River Sankh originating in Chattishgarh and river Koel originating in Jharkhand are the two major tributaries of River Brahmani. After their confluence at Vedvyas, Panposh in Odisha, the river is known as Brahmani. The total drainage area of the river basin is 39116 Km2. Of this, basin area inside Orissa is 22516.08 Km2. which constitutes 57.36-% of the total basin area. The basin area inside Jharkhand andChattishgarh are 15700 Km^2. and 900Km^2. respectively. This basin is located within the geographical coordinates of north latitude$20^0$28' to $23^0$35' and east longitude $83^0$52' to$87^0$03'. Brahmani river basin is an inter-state river basin .

Monthly precipitation data for each district (15 districts in all covering Brahmani river basin) for a time period of 1901 to 2012 wascollected from Indian water portal and IMD,Pune. Data related to ground water usages and water level (quarterly) were collected from water resource department (Odisha, Chattissgarh and Jharkhand) and CGWB,respectively. Daily discharge data collected from central water commissionforall five gauge sites like Tilga, Jaraekela, Panposh, Gumlai, and Jenapur.

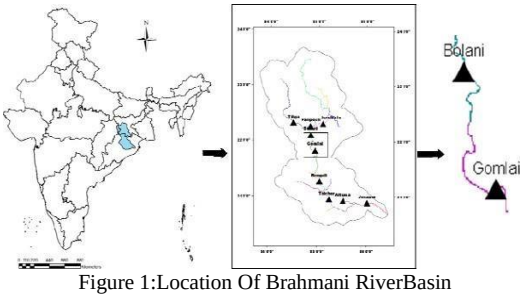

Figure 1:Location Of Brahmani RiverBasin

II. METHODOLOGY

Crop water requirement depends onseveral factors, including cropping pattern crop – growth periods, crop coefficient
(Kc), potential evapotranspiration (Etp), effective rainfall and percolation in paddy areas. Crop water requirement (Cwr) of the

$$WR_{paddy} = A_p * [\sum_{i=1}^{m}\{\sum_{j=1}^{n}(K_{p(i,j)} * E_{tp(i,j)} - R_{e(i,j)}) - \sum_{j}^{n} P_{p(i,j)}\}]$$

:

WR PADDY = Crop water requirement for paddy in m^3 for i^{th} cell (plot area) and j^{th} time period (days)

$$WR_{other} = A_p * [\sum_{i=1}^{m}\{\sum_{j=1}^{n}(K_{o(i,j)} * E_{to(i,j)}) - \sum_{j}^{n} P_{o(i,j)}\}]$$

paddy crop is estimated as. And the crop water requirement of othercrops is estimated as
KP (I,J)= Crop coefficient for paddy for i^{th} cell(plot area) and j^{th} time period (days)
$K_{o(i,j)}$Crop coefficient for other crops

KTP(I, J)= Evapo-transpiration for paddy area in m^3 for i^{th} cell (plot area) and j^{th} time period(days)

ETO (I ,J) = Evapo-transpiration for othercropped area in m^3 for i^{th} cell (plot area) and j^{th} time period (days)
forith cell (plot area) and j^{th} time period (days)
$R_e(i,j)$= Rainfall excess in m3 for ith cell (plotarea) and jth time period (days)
$P_{p(i,j)}$ = Percolation during paddy crop in m3for ith cell (plot area) and jth time period (days)
$P_{o(i,j)}$ = Percolation during other crops in m3for ith cell (plot area) and jth time period (days)

Result and discussion

Finally for the analysis of whole Brahmani river basin various maps (figure 2) developed using satellite data in Arc-GIS environment. From these maps it has been observed that 78 percent of the basin area (39268 Km2) is suitable for agricultural purposes with multiple crops. Some of the area is prone to water logging too. Less area has been utilized for agricultural purposes inspite of having canal system. The agriculture production depends on the rainfall, river flowand the groundwater. Most of the area is cultivating kharif and rabi crops, which covers 65% and less than 35 % crop production, respectively. The mean rainfall over the entire Brahmani river basin was estimated using Thiessen polygon method. The basin receives more than 35000 MCM of rainfall per year (Figure 3) .The available ground water is 1920 MCM and utilizable groundwater is 921.60 MCM by considering efficiency and correction coefficient values are 0.8 and 0.6, respectively. The crop water requirement has been obtained using the equations (1) and (2) as suggested by Amarsinghe et al. (2005). The crop coefficient has been observed to vary between 1.0 - 1.2 for different stages of the crop. Figure 4 illustrates the estimated total evapotranspiration and crop waterrequirement in Brahmani River basin. In this, the ET lossess due to reservoir area has not been con sidered, which comes out to be 600 MCM. The evapotranspiration has been obtained using the Penman-Montieth equation

CONCLUSION

It has been observed that a large amount of water is available and ground use is less than 30% in most of the regions of the Brahmani River basin. The crop water requirement is much below the available rainfall and even available groundwater at various locations of Brahmani River basin. If the agricultural area is utilized fully, irrigation is done bystoring the water and consumptive use is utilized, the crop production can bemaximized and cost of production can be reduced. Moreover, the crop water requirement is required to be increased by increasing the crop production with multiple crops and by using more agricultural land for crop production. Therainwater in the monsoon months (June to September) is sufficient to sustain crops and vegetation in the basin. During the months of November to February, thewater deficit is moderate and may be generally met from the residual soil moisture from the monsoon months. However, if water is conserved then all the deficits can be fulfilled during themonths of March to May, as the soil moisture deficit becomes rather large andshallow-rooted crops and vegetation cannot survive without irrigation.

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SMART WINDOWS

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Abstract*— *Windows are vital elements in the built environment that have a large impact. on the energy consumption in indoor spaces,affecting heating and cooling and artificial lighting requirements. Moreover, they play an important role in sustaining human health and well-being. In this review, we discuss the next generation of smart windows based on organic materials which can change their properties by reflecting or transmitting excess solar energy (infrared radiation) in such a way that comfortable indoor temperatures can be maintained throughout the year. Moreover, we place emphasis on windows that maintain transparency in the visible region so that additional energy is not required to retain natural illumination. We discuss a number of ways to fabricate windows which remain as permanent infrared control elements throughout the year as well as windows which can alter transmission properties in presence of external stimuli like electric fields, temperature and incident light intensity. We also show the potential impact of these windows on energy saving in different climate conditio

I. Introduction

The objective of meeting the growing demand of thermohydrometric and environmental comfort, associated with an urgent need to improve the energy efficiency of buildings to achieve "carbon neutral" or "zero energy buildings" (ZEB), is determining a thorough review of the building envelope characteristics and requirements, directing toward technological solutions that can provide a continuous adjustment of the set of environmental flows in relation to climatic conditions and different exposures (dynamicanisotropy).

In fact, the building envelope plays a pivotal role in the energy performance of a building, significantly affecting the wellbeing levels of the indoor environment. It constitutes a complex system of barriers and environmental filters, not onlypotentially able to regulate the heat, solar radiation, air and steam flows, but also to convert radiations into energy (heat and electricity) essential for the building metabolism.

In this context, the transparent part of the building envelope can play the important role of climate filter between the internal and external environments, able to balance visual comfort with hygrometric wellbeing control needs and reduction requirements for air conditioning and lighting energy consumption. Transparent solutions, however, requirea much more accurate design, focused on the characteristics of the environmental context, the integration with mechanical equipment and performance targets (distribution of radiant temperatures, air stratification, etc.); otherwise, the transparentshell can turn into the major source of environmental discomfort and energy dissipation of the building. According to the Department of Energy of the United States, from 25%to 35% of energy in buildings is wasted due to inefficient windows.

The California Energy Commission estimates that about 40% of the cooling demand of a typical building is due to the solar heat gain through windows. Although the market is now offering high-performance glazing systems with regard to the characteristics of thermal insulation, with U thermal transmittance values less than 0,9 W/m2K for double glazing and 0,4 W/m2K for triple glazing, comparable to those of opaque components, the control of incident solar radiation, in order to optimize incoming thermal and lighting flows, is instead still particularly delicate.

The traditional static systems for solar radiation control are proving insufficient in meeting the objectives of energy efficiency and environmental wellbeing required by regulations while restraining freedom of expression in the use of transparent components. Dynamic shading systems, widely used in Europe especially in double-skin glass facades, as wellas having higher installation, operation and maintenance costs, hinder external vision and are often not suitable for energy retrofits. The solution for both new constructions and existing buildings renovation is now represented by dynamic or smart windows, able to continuously

.

I. Solar radiation control inbuildings

The control of the incident solar radiation is a key element for the achievement of indoor wellbeing and more generally of greater energy efficiency in buildings.

In winter, solar heat harvesting through windows can help reduce energy consumption for space heating. During summer,especially in warmer countries and in countries with a Mediterranean climate, excessive solar radiation passingthrough the glass can instead cause overheating of the indoor environment resulting in high consumption for air conditioning. In these countries, in order to limit energy consumption for air conditioning during summer, national regulations require, in the case of new buildings, mandatory installation of sun shading systems or, alternatively, windows with solar heat gain coefficient (SGHC) less than or equal to 0.5, capable of substantially reducing the incoming energyflow.

Penetration of direct solar radiation within the indoor environment can also be a hindrance for visual activities, especially for facades exposed to the east and west, affected by low and deep reaching sunrays, with the consequent need for simultaneous use of screening systems and artificial lighting systems despite exterior light levels being very high. Direct solar radiation, especially in its UV component, is finally cause of deterioration of furniture and interior materials.

Incident solar radiation control can be implementedthrough the use of traditional static systems, consisting of solarprotection glazing and/or fixed or mobile shading devices, or through dynamical systems, possibly integrated and coordinated with building automation systems, consisting of automated mobile shading devices or dynamic windows able to change their optical properties according to solar radiation.

A. Static solar protection glazing

Unlike simple high thermal insulation double glazing for heat loss reduction, solar protection glazing's task is to preventthe majority of the incident radiant flux on the window to penetrate inside the environment to protect.

Available on the market are "body tinted glazing","pyrolytic" coated glazing and "selective" high-performance glazing with "magnetron" type coatings which, compared to the first, allow a better control of energy transmission without overly penalizing visible light transmittance. This property is measured using the Light to Solar Gain Ratio (LSG) index, also called spectral selectivity index, which defines the ratio between the light transmittance (VLT), and the solar heat gain coefficient (SHGC): glass with a high LSG (selective glass) transmits a high percentage of incident visible light radiation and a small fraction of the total radiation. Selective glasses on the market today have a visible transmittance between 34% and 69% and a solar heat gain coefficient between 24% and 56%, with a selectivity index LSG between 1.28 and 2.29.

Among solar protective glasses also falls thin film semitransparent photovoltaic glazing, organic or inorganic, available in several transparency ratios (10% - 20% - 30%) and colors and able to reduce incoming heat (SGHC between 0.29 and 0.41) and produce electricity at the same time.

The use of static solar protection glazing allows reducing heat load in summer while maintaining the vision through and limiting glare phenomena. However, such systems do not allow to follow daily solar path and weather conditions or seasons alternation, with the result of reducing energyharvesting during winter (especially in the south facing facades) and reducing natural light levels in the absence of direct solar radiation (in particular for the east or west facing facades, irradiated for only half of the day).

TABLE I. MAIN SELECTIVE GLAZING ON THE MARKET WITH HIGHER LSG

	GUARDIAN SUNGUARD SNX	**SGG COOL-LITE EXTREME**	**AGC STOPRAY ULTRA**	**PILKINGTON SUNCOOL**
VLT [%]	62	60	60	60
SHGC	0.27	0.28	0.28	0.32
LSG	2.29	2.14	2.14	1.87
Ug [W/m²K]	1.36 (Argon fill)	1.00 (unspecified)	1.00 (unspecified)	1.00 (Argon fill)

TABLE II. TYPICAL THIN FILM SEMITRANSPARENT A-SI PHOTOVOLTAIC GLAZING CHARACTERISTICS

Properties	**Transparency**		
	10%	**20%**	**30%**
VLT [%]	10.80	17.30	28.40
SHGC	0.29	0.34	0.41
LSG	0.37	0.50	0.70
Power Yeld [Wp/m²]	45	39	32
Ug [W/m²K]	1,1 (Argon fill + Low-e coating)		

C. Static and dynamic shading systems

Among the various shading systems, external shadin elements, such as horizontal or vertical projecting louvers (Brise soleil), shutters, blinds, or awnings, are preferable to internal ones because they block the solar radiation before it penetrates the building. Furthermore, brise soleil have architectural value and can therefore strongly

characterize the external image of a building. It is however important to evaluate the behavior of such devices as their presence can significantly change the performance of the openings and therefore the ventilation coefficient of rooms.

Internal elements, however, such as curtains, blinds, orshutters, work primarily by reflecting and diffusing the radiation outward, often absorbing a significant share resultingin the release of heat inside the indoor environment. These elements have anyway good efficacy in preventing glare.

If carefully designed, outer shading systems can provide a differentiated behavior over the year, excluding solar radiation in the summer while allowing, instead, the access during winter. The effectiveness of such systems must be verified using shading masks: the ideal screen blocks the sun path in the hours in which solar radiation is not desired. The presence of the screen, however, interferes with the visual enjoyment, natural lighting, natural ventilation, and thepossibility of leaning out or passage offered by the window. In order to choose the most suitable type of screen is also necessary to know the behavior in relation of noise and vibration generation due to wind, façade encumbrance, ease of operation, and compatibility with the different types of opening of doors and windows.

With the development of building automation systems, ever more widespread especially in new constructions, dynamic screening systems are today able to change their geometric shape and optimize the amount of incoming solar radiation according to the climatic conditions (adaptive facades or kinetic facades). Especially in Europe these systems are normally made using adjustable louvers or blinds integrated into a double-skin curtain wall. There are examples of even more innovative solutions as in the case of Bahar Towers in Abu Dhabi (2013), designed by the engineering firm Aedas, where a special software allows the screeningelements to open and close depending on the angle and power of solar rays, shaping a "thinking facade" completely self-sufficient thanks to photovoltaic panels placed on the roof and along the south façade.

However the use of screening systems, including dynamic ones, although effective in the maintenance of solar gains in winter, in the reduction of heat load in summer and in the elimination of glare in relation to external environmental conditions and users' needs, may cause an excessive reduction of inside natural lighting, while not allowing external vision and not being suitable for energy retrofits of existingbuildings. Such systems have also higher costs of installation, management and maintenance.

D. Dynamic Glazing

The need to balance diverse needs from the energy and lighting points of view is leading to the use of next-generation products, such as chromogenic transparent materials that allowselective and dynamic control of thermal energy and incident light with the ability to change their optical properties in response to a light, electrical, thermal or chemical stimulus.

The chromogenic materials belong to the category of smart materials, a new class of highly innovative materials able to perceive stimuli from the external environment (such as mechanical stress or temperature variations, humidity, pH, electromagnetic fields, and solar radiation) and reacting immediately modifying independently and reversibly their mechanical, physical-chemical or electrical properties, or their geometrical characteristics, adapting to changing environmental conditions (self-cleaning materials, shape memory materials, phase change materials, piezoelectric, photovoltaic, electrochromic, photochromic, thermochromic materials, etc.).

The use of transparent chromogenic materials inarchitecture allows to realize transparent envelopes with variable performance, defined smart windows, dynamic glazing or switchable glazing, able to optimize the energy behavior of buildings and at the same time meet the comfort needs required by users. Intelligent glazing can be used in a wide range of daily use products such as windows, doors,skylights, partitions, and is easily integrated inside high performance IGUs. Expectations for demand growth for dynamic glass are very high. In 2013, the market for smart windows was worth over 1.5 billion dollars and is expected to reach more than 5.8 billion dollars by 2020 with an estimated CAGR of 20% (2014-2020) [13].

II.Smart windows

Based on their mode of operation, intelligent glass is distinguished in two main categories: with passive control, or self-regulating, and with active control, adjustable to user's needs.

A. Passive dynamical systems

Passive dynamic systems do not require an electrical stimulus for their operation. These systems respondindependently to the presence of natural stimuli such as light (photochromic glass) or heat (thermochromic and termotropic glazing). Compared with active systems they are therefore easier to install and more reliable in the face of theimpossibility of being controlled by the user on request.

B. **Photochromic glazing**

Photochromic glass is able to modify their transparency properties autonomously in relation to incident light intensity. This ability is due to the presence in the glass paste of organic or inorganic compounds which act as "optical sensitizers",such as metal halides (chloride and silver bromide) reactive to ultraviolet light, or plastics, which absorb the sun's energy according to the output color spectrum variation. When photochromic glass is directly exposed to solar radiation, the difference in spectral absorption between the energy layers of glass and additional substances leads to the formation of a reversible process of intense colouring. The speed of response to environmental changes is of the order of a few minutes and, generally, the passage from the tinted state to the clear one takes twice as long. These differences in response time can lead to problems in case of sudden and frequent changes in external brightness or in the case of cast shadows on the building that can cause uneven and unsightly areas of light and shadow. Furthermore, following the chromatic transitionphotochromic glasses become absorbent rather than reflective,

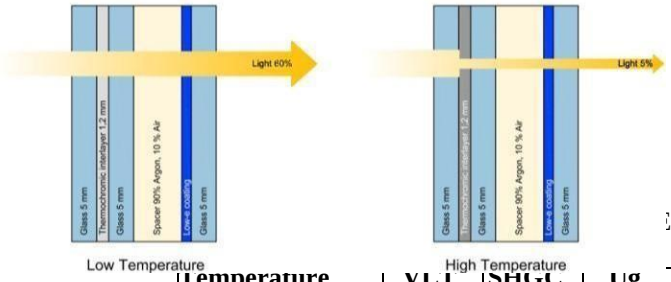
with possible slab overheating phenomena, which may lead to rupture by thermal shock in the event of intense solar radiation.

Currently the main use of these products relates to the areas of glass for the optical and car industry. The diffusion of photochromic glasses in architecture is instead hampered bythe still high cost, the complexity of the technological system, the inability for the user to directly control the performance,the difficulty in obtaining a uniform distribution of photochromic substances inside the slab and the gradual loss of the reversibility of the process over time. Still, the technological problems have significantly attenuated in recent years, allowing to extend slab sizes and to improve the stability over time.

C. Thermochromic Glazing

Thermochromic glazing (Pleotint, Ravenbrick, Solarsmart etc.) is capable of autonomously modifying its optical properties according to the external surface temperature, which determines a chemical reaction or a phase transition between two different states. The material therefore remains transparent when temperature is lower than the transition one, while becomes opaque for higher temperatures

Figure 1. Thermochromic glazing



The interval of the transition temperature is generally between 10° C (maximum transparency) and 65° C (minimum transparency). The properties of thermochromism can be observed in a wide range of organic and inorganic compounds (such as cloud gel) and in films of metal oxides, such asvanadium oxide, that by switching from semiconductor to metallic state acquires a reflective behavior highly sensitive in the infrared zone.

At this time the most promising technological solution for the deployment of thermochromic glazing concerns the use of thermochromic materials directly into plastic film of polyvinyl butyral (PVB) with a thickness of 1,2 mm, introduced for the first time on the market in late 2010. Since PVB is one of the most used products for the production of laminated safety or acoustic glass, this solution in fact allows the best integration in the manufacturing processes and the possibility to provide at a reduced cost a higher quality product. The typical ranges of light transmission and solar heat gain in correspondence of transparent and opaque states when coupled with a clear glass are respectively VLT = 60-13% or 55-5% and SHGC 0,37 to0.17 or 0,36 to 0.12 with switching times in the order of a few minutes. Among the disadvantages, in addition to the impossibility of user control, thermochromic glazing may not reach the temperature required for switching to the dark state even in the presence of solar radiation with the drawback of not eliminating glare for users. Duration is guaranteed for an operating time of at least 20 years and they are cheaper than active control dynamical systems (ROI < 4 years).

ERMOCHROMIC GLAZING ON THE MARKET

Temperature	VLT	SHGC	Ug	VLT	SHGC	Ug	VLT	SHGC	Ug
	PLEOTINT SUNTUITIVE CLEAR			INNOVATIVE GLASS SOLARSMART			RAVENBRICK RAVENWINDOW		
Low	60%	0.37	1.36	55%	0.36	1.36	33%	0.28	1.36
High	13%	0.17	Argon	5%	0.12	Argon	5%	0.18	Argon

VIII. Active dynamical systems

Active dynamic systems can be controlled directly or connected to a computerized building management system in order to respond to changes in external (temperature, solar radiation) or internal climatic conditions (temperature, artificial and natural lighting levels, heat intakes, presence of people) or the needs of users, allowing to adjust the intensity of penetrating visible and infrared radiation without the use of screening systems, significantly reducing energy consumption for air conditioning and lighting (savings are estimated at more than 20%). The most advanced systems on the market provide integration with photovoltaic systems for total electrical self-sufficiency, in addition to the possibility of remote control via smartphones, and allow independentadjustment of different panels of the same window (light- zoning), up to the possibility of becoming real imaging displays with touchscreen technology (Advanced Tech Windows).

Part of electrically controllable active systems are electrochromic glass (EC), suspended particle devices (SPD), liquid crystal devices (LC / PDLC) and the most recent, still experimental glazing devices, based on micro-blinds (MEMS) or with a special, nanotechnological coating. Each of these technologies has different characteristics, performances andcosts, making it more suitable for determined applications or requirements (privacy, switching speed, solar gain reduction etc.).

f) Electrochromic devices (EC)

Electrochromic glazing (Sage, View, Infraselect etc.)exploits the properties of some materials to vary the parameters of transmission, reflection, and absorption of solar radiation according to an electrical stimulus adjustable by an external user. Change of the properties of these elements is attributable to the addition or extraction of mobile ions from the electrochromic layer: when the electric field is activated,

the introduced ions react generating compounds which alterthe coloring of the material.The central part of an electrochromic device is constituted by an ion conductor (or electrolyte) sandwiched between two layers, respectively constituted by an electrochromic film (alsocalled electrode) and an accumulation layer (counter- electrode). The two outer layers are made of transparent conductive materials, but the electrons accumulation layer and the transparent conductor may be incorporated in a single layer. When electric potential difference is applied between the two transparent conductors, ions extracted from the accumulation layer pass through the conductor layer and are lead into the electrochromic layer, thereby changing its optical properties. Conversely, when the electrical stimulus is turned off, the ions are extracted from the electrochromic layer and, through the conductive layer, are deposited into the accumulation layer making the device transparent again.

Obtainable glazing has typically green or blue colors in relation to the electrochromic materials most widely used (for example, the tungsten oxide which varies its color from transparent to blue) and the degree of transparency can be modulated in intermediate states from clear (off device) to completely tinted. Light transmission varies from 60% in the transparent state to 1% when opaque. SHGC is instead comprised between 0.46 and 0.06.

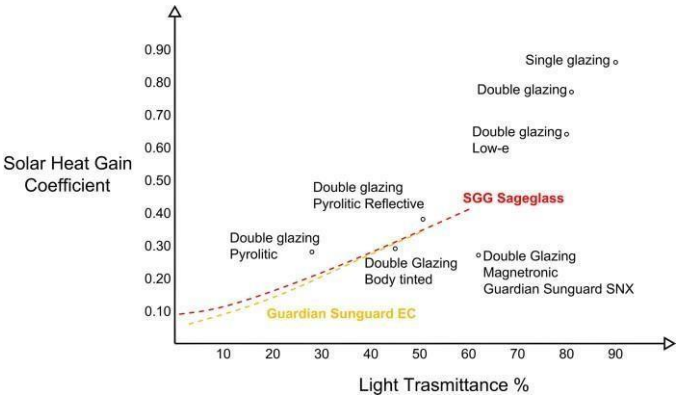


Figure 2. Electrochromic glazing dynamic range

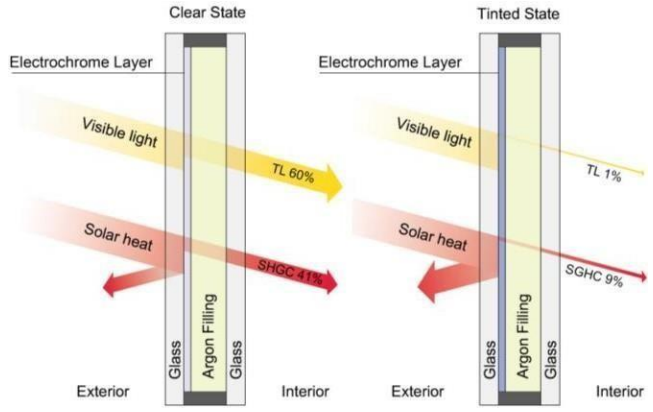


Figure 3. Electrochromic glazing

The amount of energy required by the system to switch between the different coloration states is minimal (1-2.5 Wp/m^2) and, thanks to the property of electrochromic materials to possess a bistable configuration, even less is the amount of energy required to maintain the desired tinted state (less than 0.4 W/m^2).

If the device is working properly, the change of properties of the glass is almost perfectly uniform over the entire surface.Darkening occurs from the edges, moving inward, and is a slow process, ranging from several seconds to some minutes depending on panel size. Switching speed is also linked to the glass temperature. The coloring process typically takes little longer than the clearing process. In conditions of moderate or warm climate, a 90 x 150 cm window usually takes between 5 to 10 minutes to accomplish at least 90% of its colouring cycle. The time increases in conditions of low temperature when, any how, the need to control the coloring of the glass is less likely. The gradual change of light transmission, however, is advantageous because it allows the occupants to adapt naturally to changes in light levels without ailment or distraction. The electrochromic glass provides visibility even in the darkened state and thus preserves visible contact with the outside environment.

Technological room for improvement for electrochromic glass concerns the possibility to increase the number of controlstates (currently four) and the switching speed, to raise opacityin tinted state to improve privacy and to further reduce the already limited energy consumption.

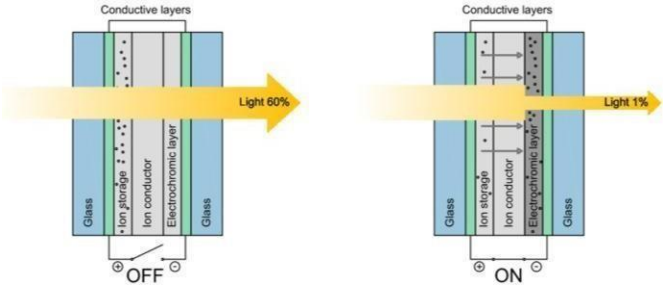


Figure 4. Electrochromic glazing operation

TABLE IV. MAIN ELECTROCHROMIC GLAZING ON THE MARKET

Tinted state	VLT	SHGC	Ug	VLT	SHGC	Ug	VLT	SHGC	Ug	VLT	SHGC	Ug
	GUARDIAN SUNGUARD EC (Low-e)			VIEW DYNAMIC GLASS			INFRASELECT (Low-e)			SGG SAGEGLASS		
0	50%	0.34	1.10 Argon fill	58%	0.46	1.64 Argon fill	55%	0.40	1.10 Argon fill	60%	0.41	1.64 Argon fill
1/3	35%	0.24		40%	0.29		-	-		18%	0.15	
2/3	18%	0.13		20%	0.16		-	-		6%	0.10	
3/3	3%	0.06		3%	0.09		15%	0.12		1%	0.09	

1) Suspended particles devices (SPD)

Suspended particles devices (Isoclima, Vision Systems, Innovative Glass, Hitachi Chemicals, etc.) consist in a double sheet of glass within which is located a layer of thin laminate of suspended particles similar to rods immersed in a fluid, placed between two electrical conductors of transparent thin plastic film. When the power is turned on, the suspended rod particles align, light passes through and the SPD smart glass panel clears. When the power is switched off the suspended rod particles are randomly oriented blocking the light and the glass appears dark (or opaque), blue or, in the more recent developments, gray or black. In this way, SPD glass can lighten or darken, allowing instantaneous control of the amount of light and heat passing through. SPD smart glass, when dark, can block up to 99.4% of the visible radiation. SPD glass finally protects from harmful UV rays both when switched on or off.

The typical ranges of light transmission and solar heat gain in correspondence of transparent and opaque states are respectively VLT 65-0.5% and SHGC 0.57-0.06 with switching times of some seconds. The very high switching speed, along with the total controllability by the user and the fact that the obscured state coincides with the device powered off, make SPD glass particularly suitable for the automotive (side and rear windows, transparent sunroofs), marine (windows, skylights, portholes, partitions and doors) and aviation sectors (more than 30 different models of aircraft have SPD windows installed).

The device requires about 100 volts AC to operate from the off (tinted) state to the transparent one and can be modulated to any intermediate state. The power requirements are 5 W/m^2 for switching and 0,55 W/m^2 to maintain a state of constant transmission. With further research, operating voltages may drop to about 35 volts AC. New suspensions are also being developed to obtain different colors than blue (green, red and purple) and to obtain a greater variation in the solar factor. At the moment slab sizes can be up to 1524 x 3048 mm (length any size) and are available in several shapes, both planar and curved. Durability and optical-solar properties have not been verified in the long term as the products are nowentering the market, but the high cost remains a problem (to date they are the most expensive dynamic glass on the market).

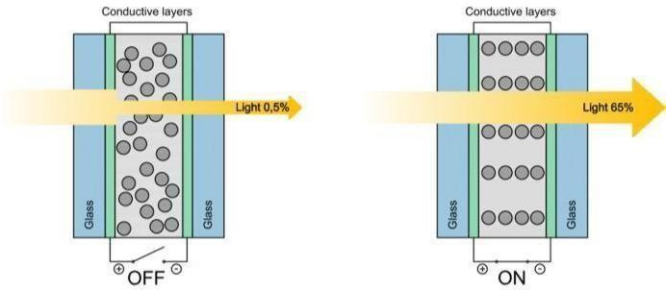


Figure 5. Suspended particle devices operation

2) PDLC devices

Liquid crystal devices (Scienstry, Polytronix, Essex Safety Glass, Switchglass, Smartglass International, Magic Glass, Dream Glass, etc.) consist in a double sheet of glass within which is located a package (called Polymer Dispersed Liquid Crystal Device, PDLC) comprising of a polymer matrix film sandwiched between two electrical conductors of transparent thin plastic film. Within the film are dispersed tiny liquidcrystal spheres with a diameter of the same order of magnitudeas the wavelength of visible radiation.
In the absence of electrical stimulus the liquid crystals have a disordered arrangement and the light rays undergo random diffractions so glazed elements appear white and translucent; on the other hand, when an electric field is applied, the liquid crystals align in the same direction ensuringthe transparency of the panels. The degree of transparency can be controlled by the voltage applied. The light transmittance ofliquid crystal glazing in the active state does not normally exceed 70%, while in the off state is about 50%, although appropriate dyes may be added to darken the device in the off state. The liquid crystal systems, while able to optimally spread direct incident solar radiation, do not to block enough to obtain a significant reduction of the solar factor, usually between 0.69 and 0.55. Furthermore, compared to electrochromic systems, liquid crystals systems are not bistable and require a constantly applied electric field for correct operation, resulting in a continuous consumption of electrical energy (about 5-10 W/m^2 of surface operating between 65 and 110 volts AC). PDLC systems are mainly used for the construction of interior or exterior partitions in applications that usually require privacy such as shop windows, meeting rooms, intensive care areas, bathrooms and showers doors or transparent walls to use temporary as projection screens. PDLC devices are also available in rolls as an adhesive, bespoke intelligent film to apply to existing glazing.

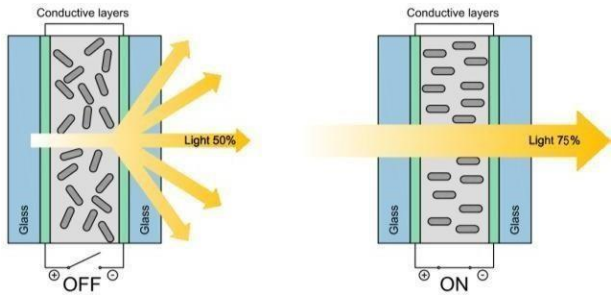


Figure 6. Polymer dispersed liquid crystals devices operation

3) Emerging Technologies

Among the emerging dynamic technologies, intelligent glass with integrated micro-blinds and nanocrystals based electrochromic materials are of particular interest for possible future applications in architecture.

Micro-Blinds shielding glass is composed of inorganic pre-stressed curling electrodes, invisible to the naked eye (size of 100 micrometers) and able to unwind following a weak

electrostatic stimulus. These MEMS (Micro Electrical Mechanical Systems) are manufactured by depositing on the glass slab a magnetron layer not dissimilar to a low-emissivity coating and subsequently patterning it by laser. At the current experimental stage their performance is comparable to conventional dynamic electric control glass; however, they do not require expensive indium-tin oxide conductive layers, and have activation and deactivation times in the order ofmilliseconds. MEMS can be realized with materials of different properties, allowing for example to favor UV rays resistance, or, on the contrary, permeability for healthier indoor environments, or by using highly reflective materials in order to further improve performance in the shielding

(unwound) configuration. Development is now focusing on laser etching modes and the possibility to create market sized products.

As regards instead nanotechnological electrochromic materials, researchers at the University of Berkeley have recently developed a novel material consisting of indium tin- oxide nanocrystals embedded in a glassy matrix of niobium oxide. With an electrical pulse, the resulting compound allows to independently control visible light radiation and infrared radiation (NIR, Near Infrared Radiations), allowing to block unwanted energy intakes while maintaining, at the same time, the possibility of best exploiting natural light.

TABLE V. COMPARISON BETWEEN MAIN ACTIVE AND PASSIVE CHROMOGENIC GLAZING ON THE MARKET

Properties	**Dynamic glazing**			
	Passive systems	**Active systems**		
	TC	**EC**	**SPD**	**PDLC**
Optical and Thermal performances				
Clear state	Low temperature	Off	On	On
Dark state	High temperature	On	Off	Off
Visible Light Trasmission (Clear)	60%	60%	65%	Up to 75%
Visible Light Trasmission (Dark)	5%	1%	0.5%	50%
SGHC (Clear)	0.37	0.46	0.57	0,69
SGHC (Dark)	0.12	0.06	0.06	0,55
UV Trasmission (Clear)	0%	0.4%	0.1%	0.5%
UV Trasmission (Dark)	0%	0%	0.1%	0.5%
Privacy in dark state	No	No	Limited	Yes
Number of light control levels fromclear to dark	No	Typically 4 states	Unlimited	2 (Transparent and frosted)
Continuos states between dark and clear	Yes	Yes	Yes	No
Light Zoning	n/a	Yes	Yes	Yes
Operating temperature	from -20 to 160 °C	from -20 to 70 °C	from -40 to 120 °C	from -20 to 70 °C
Configuration options				
Maximum size	1651 mm x any lenght	1524 x 3048 mm	1524 mm x any lenght	1828 x 3567 mm
Shapes	Any shape, includingcurved	Rectangle, square, trapezoid, trangle	Any shape, including holes anywhere andcurved	Any shape, including holes anywhere andcurved
Colours	Blue, Green, Bronze,Gray	Blue, Green	Tipically Blue	Clear, Bronze, Gray,Green tint
Electrical Properties				
Operating voltage	n/a	12 V DC	65-110 V AC	65-110 V AC
Power for state requirem enttransition	n/a	2,5 W/m^2	5 W/m^2	5-10 W/m^2
Power for state requirem entmaintenance	n/a	0,4 W/m^2	0,55 W/m^2	5-10 W/m^2
Switching speed	Several minutes	Tipically 3 to 5 minutesto reach 90% of its range	Tipically 1 to 3 seconds	Instantaneus (0.1 sec)
Control	No	Wall switch, Remotecontrol, Movement sensor, Light and temperature sensor, Timer	Wall switch, Remotecontrol, Movement sensor, Light and temperature sensor, Timer	Wall switch, Remotecontrol, Movement sensor, Light and temperature sensor, Timer
Integration with BMS	n/a	Yes	Yes	Yes
Costs and durability				
Cost	Lowest	Medium	Highest	High
Durability	>20 years	>30 years	>20 years	>10 years

I. Energy and environmentbenefits in the use of electrochromic glass

Among the different dynamical active control systems, electrochromic devices (EC) are particularly interesting, and are currently considered the most suitable and promising chromogenic technology for the control of radiant energy through the transparent components of the building envelope (to switch from clear to completely tinted, a 200 m^2 EC glass façade needs about the same energy used to power a single 60 W light bulb). Compared to SPD and PDLC glass, electrochromic glazing has lower power consumption for both the switching and the maintenance of the desired tint state. It also allows excellent protection from solar radiation, with SGHC values variable from 0.46 to 0.06, and ultraviolet radiation while always allowing vision through (unlike PDLC)and, to date, has a higher and proven durability, guaranteed up to over 30 years (one of the first installations of electrochromic glass in the Desert Regional Medical Center in Palm Springs, California, dates from the year 2003 and the glass is still operative today) along with inferior costs compared to SPD and PDLC devices.

Compared with the first installations, registered in the early 2000s, new electrochromic products allow for greaterslab sizes (up to 1524x3048 mm); are available in different shapes (circular, triangular, trapezoidal, etc.) and colors; offer the possibility of adjustment between four different tinted stages; allow independent modulation of individual panels (light zoning); can be self-powered by window-integrated photovoltaic systems; are controllable via Wi-Fi by smartphones; have considerably higher durability, guaranteed for more than 30 years.

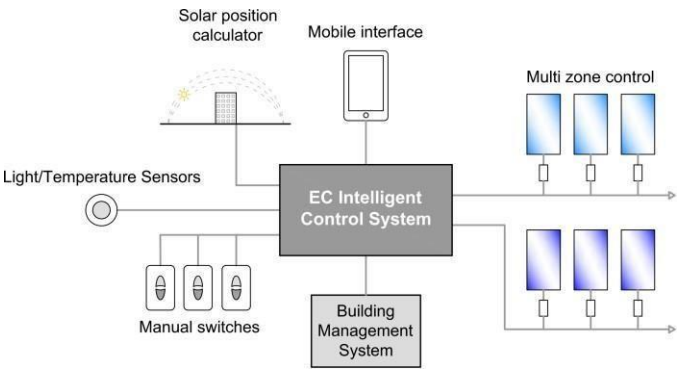


Figure 7. Dynamic active glazing intelligent control

There are now several hundred examples of buildings that have electrochromic glazing installed around the world and in different climatic zones, from education buildings, commercial offices and public buildings up to hotels, hospitals and worship facilities. According to the US Department of Energy (DOE), the goal of achieving zero energy or positive energy buildings is not feasible without the use of dynamic glazing.

The main advantages of using electrochromic glass (EC) concern, in particular:

- reduction to up to 60% of the needs of artificial lighting by increasing the light transmission through the windows resulting in increased visual comfort for the occupants and reduced energy costs;
- the ability to adjust the lighting levels in indoor environments while maintaining transparency and the exterior vision resulting in greater satisfaction for the occupants, who have the opportunity to enjoy the outdoor views both during the day and at night (even in its most dark state, with less than 2% of visible lighttransmission (VLT), the glass is still transparent); the reduction of summer and winter air-conditioning (HVAC) requirements thanks to the ability to control heat gains from solar radiation with consequent reduction of energy costs for management and installation, the latter thanks to the possibility of resorting to plants of smaller size (up to 25% lesspower needed);
- the elimination of both internal and external solar control screens, with consequent reduction of installation, maintenance and, in the case of powered mobile systems, management costs;
- the protection of materials and furnishings from direct solar radiation reducing discoloration and degradation due in particular to solar ultraviolet radiation UV entirely blocked by the electrochromic glazing;
- greater freedom in architectural design, allowing toincrease the glazed surface to opaque surface ratio of the envelope (window-to-wall ratio or WWR) without affecting the building's energy performance, or to use glass components in situations where it would not normally be indicated in order to not compromise the environmental comfort;
- the possibility of use in all cases of upgrading theenergy efficiency of existing buildings;
- the ability to achieve high scores on environmental certification systems such as LEED buildings and BREAAM (see table VI).
    - TABLE VI.DYNAMIC GLASS AND LEED
    -

LEED Certification Criteria	Points (up to 28 pts)
Energy and atmosphere	18
Indoor environment quality	8
Thermal comfort	1
Daylight	3
Quality views	1
Interior lighting	2
Sustainable sights	1
Material and Resources	2

- In view of these indisputable advantages, the costs for installing electrochromic glass, and dynamics glazing in general, still remain high for their mass application both in the residential that for the commercial one.
- The extra cost of dynamic windows compared to traditional insulating glass units is around 215 €/m^2 with a payback period of between 26 and 33 years for residential buildings and between 57 and 61 years for commercial buildings.

- **Conclusions**

This study shows how the use of dynamic windows can bring numerous benefits in terms of energy efficiency, environmental comfort and architectural quality of buildings. Static solutions with selective glass and fixed or mobile screens do not allow to optimize solar gains and light conditions during the year thus limiting, in the design phase, the size of glazed components. Solutions with automated dynamic sun screens coupled with building automation systems offer excellent energy performance, but have high

installation, maintenance and management costs, and hinderthe view from the inside to the outside.

Dynamic glazing, and electrochromic in particular, instead enable to adjust the amount of incoming light and heat according to the effective need, allowing to realize a building envelope able to fully adapt to the weather conditions (climate adaptive building shells), improving building overall performance for every kind of climate, and in hot climates and Mediterranean countries in particular.

Electrochromic systems also prove more convenient both with respect to static systems, thanks to the significant reduction in energy consumption for artificial lighting and air conditioning during summer and winter, and with respect to automated screens systems due to lower installation costs (absence of internal and external screening systems and the relative motion devices, possibility to use lower power airconditioning systems) and management.

The critical aspects still reside in the high cost of the products, anyhow destined to drop following increasing market penetration and improvement of production processes, and the still limited information between professionals andconsumers, also due to a lack of standardization in the technology.

Rather than improving the already good performance, it therefore appears more important to drastically reduce the costof dynamic glass, focusing on materials, production processes improvement and easier installation.

To ensure wide market penetration of the dynamic glass, the 2025 target should be to achieve less than 65 €/m^2 extra cost, allowing a payback time of 10-12 years for residential buildings and 21-22 years for commercial ones [17].

Regarding existing buildings, in addition to high costs,spread is still hindered by the necessity of having to replace the entire window and the need for extensive wiring. It is therefore essential to promote research in the field of dynamic high-performance films to be used to retrofit existing windowsand in the development of internal self-powering systems and built-in remote control via Wi-Fi for windows (Internet ofThings).

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Analysis and Design of Calamity Resistant Structure by Respect to Tsunami

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Abstract: -

Designing structures that are capable of withstanding the impact of tsunamis is a critical aspect of disaster risk reduction in coastal areas. This paper provides a comprehensive overview of the steps involved in the analysis and design of a calamity-resistant structure with respect to tsunamis.

The paper begins with an examination of site selection, where the importance of choosing a location that is at a higher elevation and far from the coastline is emphasized. This is followed by a discussion of hydrodynamic analysis, which includes the determination of expected tsunami wave height, velocity, and run-up height at the site. This information is then used to inform the structural analysis, which utilizes computer simulations and mathematical models to analyse the structural response of the building under the expected tsunami loads.

The paper also provides insight into the design of structural elements, including columns, beams, walls, and foundations, which must be able to resist the tsunami loads. The use of materials that are corrosion-resistant and have a high strength-to-weight ratio is recommended. The elevation of the building above the expected run-up height of the tsunami wave is also discussed as a means of reducing the risk of flooding and damage to the structure.

In addition, the paper highlights the importance of developing a tsunami evacuation plan for the occupants of the building. This plan should include access routes, safe zones, and procedures for evacuating the building in the event of a tsunami. Finally, the importance of regular maintenance of the building and its systems is emphasized as a means of ensuring that the structure remains in good condition and can withstand the effects of a tsunami.

The comprehensive nature of the information provided in this paper will assist students in gaining a deeper understanding of the complex and multi-disciplinary approach required to design structures that are capable of resisting the impact of tsunamis.

Keywords: - Tsunami, Earthquake Structures, Hydrodynamic analysis, Tsunami wave Tsunami loads.

I. INTRODUCTION

Tsunamis are catastrophic natural disasters that can cause significant damage and loss of life in coastal communities. In the aftermath of a tsunami, it is essential to have structures in place that can withstand the impact of these events and reduce the risk of damage and loss of life. This is where the design and analysis of calamity-resistant structures comes into play.

The design of structures capable of withstanding tsunamis requires a multi-disciplinary approach that considers factors such as site selection, hydrodynamic analysis, structural analysis, design of structural elements, elevation of structures, evacuation planning, and regular maintenance. For example, in the 2004 Indian Ocean tsunami, many buildings and infrastructure were destroyed due to the lack of adequate tsunami-resistant design. On the other hand, some structures, such as the Kamaishi fishing port in Japan, were designed to withstand the impact of tsunamis and suffered minimal damage during the 2011 Tohoku earthquake and tsunami.

This paper provides a comprehensive overview of the steps involved in the analysis and design of a calamity-resistant structure with respect to tsunamis. The aim of this paper is to provide students in civil engineering with a better understanding of the complex and multi-disciplinary approach required to design structures that are capable of resisting the impact of tsunamis. By the end of this paper, students will have a better appreciation of the importance of designing structures that can withstand the effects of tsunamis and the role that engineers play in reducing the risk of damage and loss of life in coastal communities.

II. TSUNAMI

A tsunami is a series of ocean waves with very long wavelengths (typically 100-600 km) caused by large-scale disturbances of the ocean, such as:

1. Underwater earthquakes
2. Volcano eruptions
3. Landslides
4. Meteorite impacts

Tsunamis can travel across the open ocean at speeds of up to 700 km/hr and can grow to become very tall waves when they approach the coast. This makes tsunamis highly dangerous, as they can cause widespread damage to coastal communities, including flooding, erosion, and loss of life.

Tsunamis can also have significant economic impacts, as they can cause damage to infrastructure and disrupt commerce and tourism. As a result, many countries have developed early warning systems and disaster management plans to help reduce the risk of damage and loss of life in the event of a tsunami.

It is important to note that tsunamis are not the same as tidal waves or storm surges, which are caused by astronomical tides or strong winds, respectively. Tsunamis are a unique and powerful natural hazard that require special consideration in coastal planning and disaster management.

2.1 History: -

Tsunamis, also known as seismic sea waves, have been documented throughout history. The term "tsunami" comes from the Japanese language and refers to a large ocean wave caused by a disturbance, such as an earthquake or volcanic eruption.

One of the earliest recorded tsunamis was in 426 AD, when a large wave hit the coast of the Aegean Sea, resulting in widespread destruction and loss of life. In 1707, a tsunami struck the coast of Japan, causing significant damage to the city of Honshu.

In the 20th century, several major tsunamis occurred, including the 1946 Aleutian Island earthquake, which generated a tsunami that caused widespread damage in Hawaii, and the 1964 Alaskan earthquake, which generated a tsunami that caused significant damage in Alaska and California.

The most recent and well-known tsunami was the 2004 Indian Ocean tsunami, which was caused by a massive earthquake off the coast of Sumatra, Indonesia. This tsunami caused widespread destruction and loss of life in several countries along the Indian Ocean, including Indonesia, Thailand, Sri Lanka, and India.

These events have led to increased awareness and research on tsunamis, and the development of early warning systems and disaster management plans to help reduce the risk of damage and loss of life in the event of a tsunami.

2.2 Characteristics and Physics of Tsunami: -

The characteristics and physics of tsunamis are determined by several factors, including:

Wavelength: Tsunamis have very long wavelengths, typically 100-600 km, which makes them different from wind-generated ocean waves that have much shorter wavelengths.

Speed: Tsunamis can travel across the open ocean at speeds of up to 700 km/hr, allowing them to cover large distances in a short amount of time.

Height: The height of a tsunami wave can vary greatly, depending on the location and the depth of the ocean. In deep ocean waters, tsunamis may only be a few centimeters tall, while they can grow to be several meters tall when they approach the coast.

Energy: Tsunamis are a manifestation of the large amount of energy released by the underwater disturbance that generated the wave. This energy is transported across the ocean as kinetic energy, which can cause significant damage when the wave reaches the shore.

The physics of tsunamis are complex and involve the interaction of water, gravity, and the ocean floor. When a large underwater disturbance, such as an earthquake or a volcanic eruption, occurs, it can displace a large volume of water, generating a series of ocean waves that travel across the ocean. As the waves approach the coast, the shallow ocean floor slows them down and causes them to grow in height, creating a tsunami.

It is important to note that tsunamis are not simple waves, but rather complex hydrodynamic phenomena that can cause significant damage and loss of life in coastal communities. As a result, it is important to have a good understanding of the physics of tsunamis in order to develop effective early warning systems and disaster management plans.

2.3 Generation Process of Tsunami: -

The generation of a tsunami involves several steps, including:

Underwater disturbance: The first step in the generation of a tsunami is an underwater disturbance, such as an earthquake, a volcanic eruption, a landslide, or a meteorite impact. This disturbance can displace a large volume of water and generate a series of ocean waves.

Propagation: The waves generated by the underwater disturbance propagate across the ocean, traveling at speeds of up to 700 km/hr. As the waves travel across the ocean, they can grow or shrink in size, depending on the energy of the disturbance and the depth of the ocean.

Amplification: As the waves approach the coast, the shallow ocean floor slows them down and causes them to grow in height, creating a tsunami. This process is known as wave amplification, and it is one of the key factors that determine the destructive power of a tsunami.

Run-up: The height of a tsunami wave can continue to grow as it approaches the shore, creating a massive wall of water that can cause significant damage to coastal communities. The maximum height of a tsunami wave is known as the

run-up, and it is determined by several factors, including the

slope of the shoreline, the presence of natural barriers such as cliffs or reefs, and the strength of the wave.

Inundation: After the wave has reached the shore, it can cause widespread flooding and inundation, as the water is pushed inland by the momentum of the wave. This can cause significant damage to buildings, infrastructure, and natural ecosystems, as well as loss of life.

The generation of a tsunami is a complex process that involves the interaction of water, gravity, and the ocean floor. As a result, it is important to have a good understanding of the generation process in order to develop effective early warning systems and disaster management plans.

III. OBJECTIVE

To determine an appropriate site for the construction of the structure, taking into consideration factors such as elevation and proximity to the coastline.

To conduct hydrodynamic analysis to determine the expected tsunami wave height, velocity, and run-up height at the site.

To perform a structural analysis using computer simulations and mathematical models to analyze the structural response of the building under the expected tsunami loads.

To design structural elements such as columns, beams, walls, and foundations that is capable of resisting the tsunami loads.

To specify materials that are corrosion-resistant and have a high strength-to-weight ratio for use in the construction of the structure.

To design the elevation of the building to be above the expected run-up height of the tsunami wave to reduce the risk of flooding and damage to the structure.

To develop an evacuation plan for the occupants of the building, including access routes, safe zones, and procedures for evacuating the building in the event of a tsunami.

To emphasize the importance of regular maintenance of the building and its systems to ensure that the structure remains in good condition and can withstand the effects of a tsunami.

IV. LITERATURE REVIEW

Tsunamis are a major natural hazard that can cause significant damage and loss of life in coastal communities. In recent years, there has been a growing body of research on the design and analysis of calamity-resistant structures with respect to tsunamis.

Several studies have focused on the site selection criteria for the construction of tsunami-resistant structures. Factors such as elevation, proximity to the coastline, and the expected tsunami wave height and run-up height have been identified as key considerations in site selection.

In terms of structural analysis, researchers have developed computer simulations and mathematical models to analyse the response of structures to the loads imposed by tsunamis. These models have been used to evaluate the strength andstability of different structural systems and to design structures that are capable of resisting the impact of tsunamis.

Materials selection and the design of structural elements are also critical considerations in the design of tsunami-resistant structures. Researchers have studied the use of materials such as concrete, steel, and composites, and have recommended the use of materials that are corrosion-resistant and have a high strength-to-weight ratio.

Evacuation planning is another important aspect of the design of tsunami-resistant structures. Researchers have developed evacuation plans that take into account the size and complexity of the structure, the location and accessibility of safe zones, and the availability of emergency services.

In conclusion, the literature review shows that there is a growing body of research on the analysis and design of calamity-resistant structures with respect to tsunamis. Researchers have focused on a range of interrelated topics, including site selection, hydrodynamic analysis, structural analysis, materials selection, and evacuation planning. This research has contributed to a better understanding of the multi-disciplinary approach required to design structures that are capable of resisting the impact of tsunamis.

V. METHODOLOGY

The methodology for the analysis and design of a calamity-resistant structure with respect to tsunamis involves several interrelated steps:

Site selection: A suitable site for the construction of the structure is chosen, taking into account factors such as elevation and proximity to the coastline.

Hydrodynamic analysis: The expected tsunami wave height, velocity, and run-up height at the site are determined through hydrodynamic analysis.

Structural analysis: A structural analysis of the building is performed using computer simulations and mathematical models to analyse the structural response of the building under the expected tsunami loads.

Design of structural elements: The structural elements, including columns, beams, walls, and foundations, are designed to be capable of resisting the tsunami loads.

Specification of materials: Materials that are corrosion-resistant and have a high strength-to-weight ratio are specified for use in the construction of the structure.

Elevation of the building: The elevation of the building is designed to be above the expected run-up height of the tsunami wave to reduce the risk of flooding and damage to the structure.

Evacuation planning: An evacuation plan is developed for the occupants of the building, including access routes, safe zones, and procedures for evacuating the building in the event of a tsunami.

Regular maintenance: The importance of regular maintenance of the building and its systems is emphasized

to ensure that the structure remains in good condition and can withstand the effects of a tsunami.

These steps are iteratively repeated until an optimal design for the calamity-resistant structure is obtained. This methodology provides a comprehensive and systematic approach for the analysis and design of structures that are capable of resisting the impact of tsunamis.

VI. CONCLUSION

In conclusion, tsunamis pose a significant threat to coastal communities and the design and analysis of calamity-resistant structures with respect to tsunamis is a crucial aspect of disaster management. A comprehensive and systematic methodology, which includes site selection, hydrodynamic analysis, structural analysis, design of structural elements, materials selection, evacuation planning, and regular maintenance, is required for the design of structures that are capable of resisting the impact of tsunamis.

The literature review highlights the progress that has been made in this field, with researchers focusing on a range of interrelated topics including site selection, hydrodynamic analysis, structural analysis, materials selection, and evacuation planning. The integration of these different aspects is essential for the design of structures that are both safe and resilient to the effects of tsunamis.

The continued development of this research is essential to enhance the ability of coastal communities to prepare for and respond to tsunamis. By applying the methodology and lessons learned from previous studies, future structures can be designed to better resist the impact of tsunamis, reducing the risk of damage and loss of life.

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Urban Farming Construction Model on Vertical Building

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***Abstract*— the application of Vertical Farming into cities has increased. Vertical farming is a cultivating vegetable vertically by new agricultural methods, which combines the design of building and farms all together in a high-rise building inside the cities. This technology needs to be manifest both in the agricultural technique and architectural technology together, however, little has been published on the technology of Vertical Farming. In this study, technology as one of the important factors of Vertical farming is discussed and reviewed by qualitative approach. In the first, identifying existing and future VF projects in Europe, Asia, and America from 2009 to 2016. The integration of food production into the urban areas have been seen as a connection to the city and its residents. It simultaneously helps to reduce poverty, adds to food safety, and increases contextual sustainability and human well-being.**

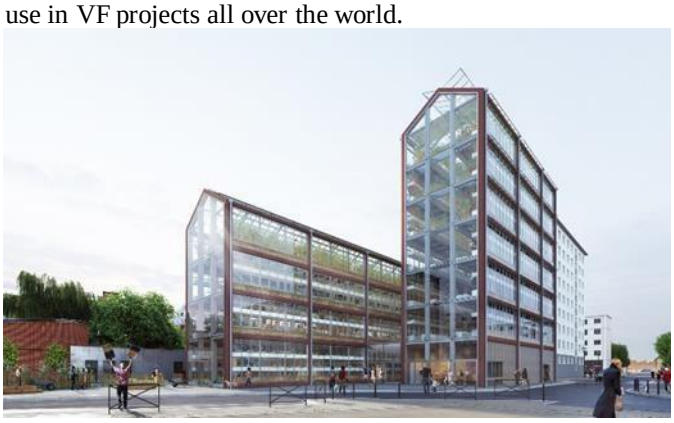
Keywords— Vertical Farming, Technology, farming methods, food production.

I. INTRODUCTION

"We live vertically, so why can't we farm vertically?" Due to the limited access to land for farming, there is a need for sustaining farming tasks so as to pave the way for adding to food needs. Many aspects press on food industry and processing such as: growth of population and its growing needs accordingly, reduction of natural sources due to growing cities, earth erosion, different forms of contamination, advent of biofuels, restrictions imposed on food production techniques affected by customers and rule providers which requires better quality, less use of chemicals and many useful environmental attempts 'from farm to fork'. Recently, environmental obsessions have been mixed with rising obsession with health as architecture design is concerned. Therefore, it
has led to more interest in providing healthy food and incorporating it in the sustainable development project.

The answer to these issues is Vertical Farming (VF). VF has grown as a project which combines the design of building and farms all together in a high-rise building. VF is a system of growing crops in skyscrapers, to maximize the use of land by having a vertical design whereby plants, animals, fungi and other life forms are cultivated for food, fuel, fiber… by artificially stacking them vertically above each other. Vertical farms are now used in a lot of countries. At present, these farms are largely grown and produce different types of crops inside cities.

There have been a great many publications on farming in cities and VF. However, little has been published on the technology of VF. So far, there has been no systematic analyses the design of the VF. This research tries to review techniques and technologies that use in VF projects all over the world.



II. NEED OF VERTICAL FARMING

Increasing food demand due to growing population along with ever decreasing arable lands poses as one of the greatest challenges.The high yield farming

methods that support our immense population are characterized by their instable consumption of our limited reserves of fresh water, fossil fuel and soil.

Vertical farming is the urban farming of crops inside a building in a city or urban centre, wherein the floors are designed to accommodate certain crops.

These heights will act as future farm lands and that they can built by nations with little or no arable land, transforming nations which are currently unable to farm into top food producers. Vertical farming creates an alternate source of sustainable food production units for today's urban needs and future generation.

The food production is just the start. These vertical farms will recycle grey water and black water, generate power from the incineration of plant waste (think plasma arc gasification) which will reduce waste to its constituent molecules, and harvest water from dehumidification. Every urban center gets one or several thus cutting way down on food miles.

III. Brief History of Modern Farming

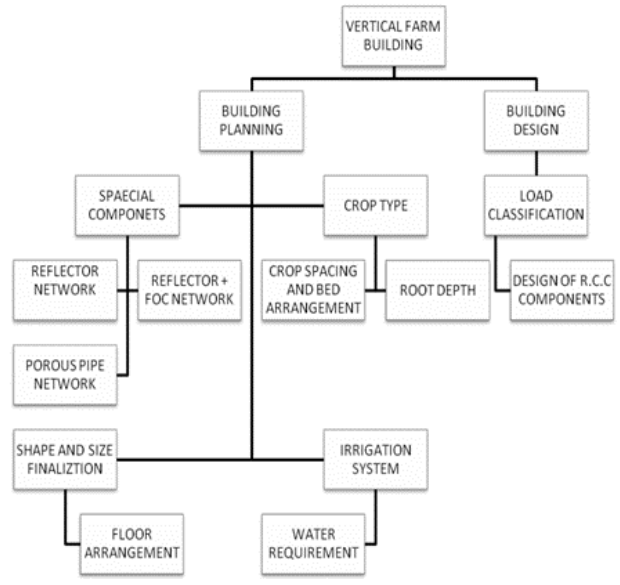
The hanging garden of Babylon poses as the earliest method to grow plants vertically. In 1915, the American geologist Gilbert Ellis Bailey used the concept of the tall multi-story buildings for indoor cultivation Vertical farming as a concept was developed in the recent years (1999)through the advances in technology by Dickson Despommier, an Emeritus Professor of Microbiology at the Columbia University;
He explains that hydroponic crops could be grown on upper floor and the lower floors would be suited for chickens and fish that eat plants waste.

IV. Objective:-

The main objectives of Vertical Farming are: -

- To plan and design a building suitable for vertical farming.
- To get higher productivity in smaller place.

V. Methodology



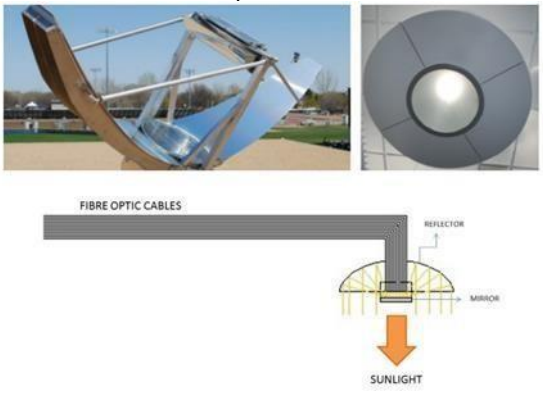
DESIGN OF VERTICAL FARM BUILDING:

To design a new building specifically for a self-sufficient vertical farm following parameters have to be incorporated:

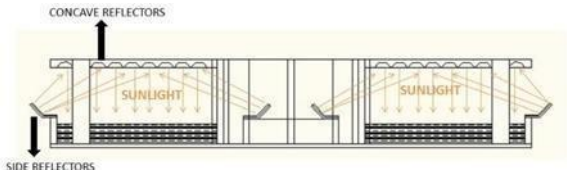
- Multi-storey construction
- Shape of the building can be narrow to rectangular
- Windows can be large or small depending on the usage of sunlight
- Ventilation should be controlled
- Floors should water proofed and resistant to conducting heat and vibration, not slippery under any condition
- High rise structure with a core
- Effective warehouse and storage layout
- Shipping and receiving areas at a convenient location
- Wind turbine can be accommodated for electrical resources (EUROWIND wind turbine)
- Solar photo-voltaic cells for energy renewal xi. Light system-network of reflectors and fibre optics cable.

Special Components:

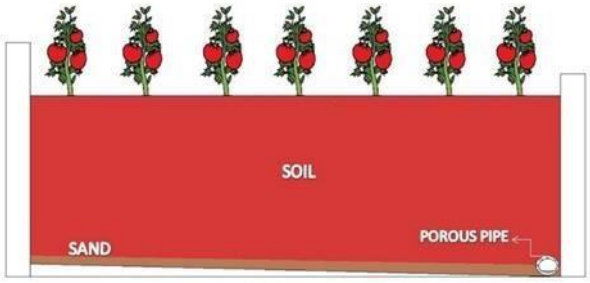
Natural Lighting:- The design of the building is such that absorbs as much light as possible. Especially the roof can be designed so as to get the highest amount of energy from the sun in all seasons in places where the weather is moderate.Other parts of the building can receive sunlight too which is a viable option.



Network of reflectors + FOC:- Here a network of fiber optic cables is arranged as show in figures below. A bunch of fiber optic cables is inserted in the concave reflectors at the ceiling of each floor which will transmit the sunlight down to any floor required.

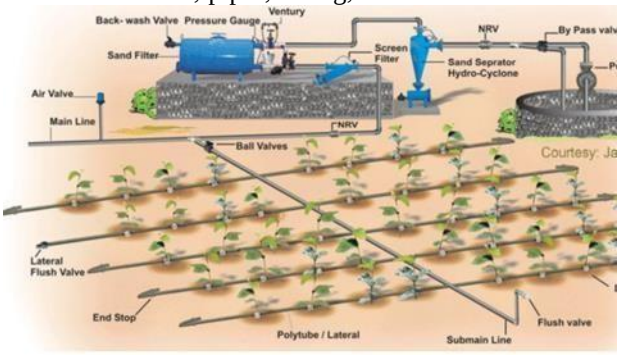


Porous pipe network:- To provide an efficient drainage system underneath the soil bed an extra arrangement of porous pipe network is provided.



Crop Selection :-Almost any crop can be produced in a vertical farm as far as all the required conditions are provided .The first thing to think about when choosing the crops to grow is considering which plants can be better bred indoors. Because of limitations imposed by height, plants that grow on trees such as bananas, olives, avocados, and nuts are hard to grow inside.

Irrigation System:- Drip irrigation, also known as trickle irrigation or micro irrigation, is an irrigation method which saves water and fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone, through a network of valves, pipes, tubing, and emitters.



Waste Management Sub system: - The yearly bio-waste from the plant cultivation rooms is calculated to be approximately 2443 metric tons. In aqua cultural systems, the same figure is estimated to be approximately 517 tons. Assume that each ton of the plant-produced waste is fed to tilapia every day, and then the rest is about 7.11 tons a day as an average. In growing eatable biomass, vertical farms produce bio-waste in their by-product (for example leaves, stems, fibrous roots, fruits or vegetables that are damaged) as well as those from an aquaculture system.

VI. Advantages of Vertical Farming

- ***Preparation for Future:*** By 2050, around 80 % of world population is expected to live in urban areas, and the growing population will lead to an increasing demand for food. The efficient use of vertical farming may perhaps play a significant role in preparing for such a challenge.
- ***Increased and Year-Round Crop Production:*** Vertical farming allows us to produce more crops from the same square footage of growing area. In fact, 1 acre of an indoor area offers equivalent production to at least 4-6 acres of outdoor capacity.
- ***Less Use of Water in Cultivation:*** Vertical farming allows us to produce crops with 70-95 less water than required for normal cultivation.
- ***Not Affected by Unfavorable Weather Conditions:*** Crops in a field can be adversely affected by natural calamities such as torrential rains, cyclones, flooding or severe drought. Indoor vertical farms are less likely to feel the brunt of the unfavorable weather, providing a greater certainty of harvest output throughout the year.
- ***Increased Production of Organic Crops:*** As crops are produced in a well-controlled indoor environment without the use of chemical pesticides, vertical farming allows us to grow pesticide-free and organic crops.
- ***Human and environment Friendly:*** Indoor vertical farming can significantly lessen the occupational hazards associated with traditional farming vii. Farmers are not exposed to hazards related to heavy farming equipment, diseases like malaria, poisonous chemicals and so on.

VII. Limitation of Vertical Farming

- ***No Established Economics:*** The financial feasibility of this new farming method remains uncertain. The cost of building skyscrapers for farming, combined with other costs such as lighting, heating, and labor, can be more than the benefits we can get from the output of vertical farming. For a 60 hectare vertical farm, the building cost can be we000ll over $100 million.
- ***Difficulties with Pollination:*** Vertical farming takes place in a controlled environment without the presence of insects. As such, the pollination process needs to be done manually, which will be labor intensive and costly.
- ***Labor Costs:*** In vertical farming, the labor cost can be very high due to the need for highly skilled workers. So, the hourly cost of workers may be significantly higher than for agriculture in general. And vertical farming technologies will require significant training,which will add to labor costs.
- ***Fewer Jobs***: Automation in vertical farms may lead to the need for fewer workers. Manual pollination may become one of the more labor-intensive functions in vertical

farms.

- ***Lower Worker Efficiency:*** The layout of a vertical farm may pose a challenge for the workers to reach each layer. Climbing to upper layers takes time and energy, decreasing the overall employee efficiency.
- ***Too Much Dependency on Technology:*** the entire vertical farming is extremely dependent on various technologies for lighting, maintaining temperature, and humidity. Losing power for just a single day can prove very costly for a vertical farm.

VIII. Expected Outcome

- Reduction in vehicular transport, there will be less demand for delivery trucks, garbage trucks and other utilities.
- Fewer bacteria can find its way out in theenvironment & the atmosphere.
- Water can be used more efficiently.
- Spoilage will be less.
- End reliance on pesticides, herbicides & petro based fertilizers.
- Sustainable organic farming techniques.
- Appropriate unused and abandoned urban spaces.
- Year round food production.
- Create sustainable urban space.

IX Conclusion

Human being of entire world is depending on the agriculture to survive. Already many countries are facing the scarcity of the drinking water but agriculture uses most of the freshwater which is available now. For the transportation for food products in traditional farming on an average 40% fossil fuel is using. Population increases day by day and available arable land is using as buildings and flats. One and only solution is vertical farming to fulfil the food to the increasing population and solve these upcoming problems

Benefits of vertical farming are endless. Vertical farming is practically costlier through financial point of view but considering the importance of restoration of ecosystems and reclamation of environment around the world with solution of food scarcity it is the best possible solution.

Acknowledgement

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Analytical Study of Drinking Water Supply System in Maharashtra

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Abstract :- India has made good progress toward meeting basic standards of access to safe drinking water, but improved planning methods are needed to prioritize different levels and types of water service needs for public investment. This paper presents a planning approach for collecting, analyzing, and mapping drinking water service data at the village, block, and district levels in Pune district, Maharashtra, India. The planning approach created a mobile application for data collection by *gram speaks* at the village level. It employed ranking methods developed with district officers to prioritize villages with the greatest needs, cluster analysis to distinguish different types of needs, and geographic information system (GIS) mapping to visualize the spatial distribution of those needs. This analysis shows that there are high levels of spatial heterogeneity in water services within, as well as between, blocks but also that there are broad patterns of priorities for planning and policy purposes. These priorities include water service needs in the Western Ghats, a combination of water source and service needs in dissected plateau lands, source strengthening in the eastern plains, and local hot spots in peri-urban areas. Based on this Pune district case study, the Government of Maharashtra is testing the approach in five additional districts.

Keywords: - Planning approach, Analyzing, Mapping.

I. INTRODUCTION

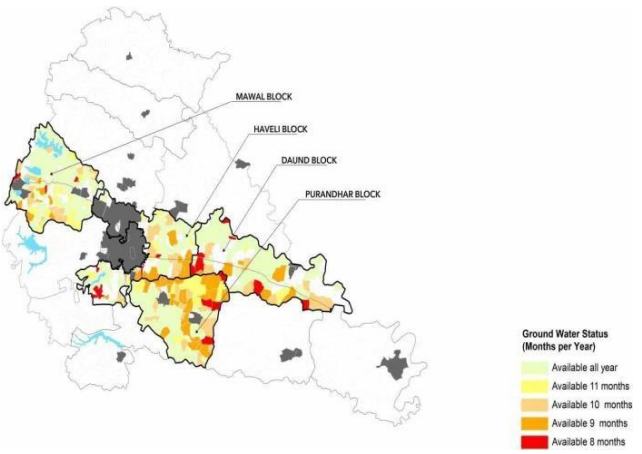
Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70 % of water. But due to increased human population, industrialization, the use of fertilizers in the agriculture and man-made activity, it is highly polluted with different harmful contaminants. Water should be free from the various contaminations while supply is done as well as all its parameter like pH, alkalinity, Total Hardness, Chloride, residual chlorine, Total Solid, turbidity, color, odor, taste etc. should be within a permissible limit by taking tab water samples from different areas. Safe drinking water is essential for human existence. Hence, the right to adequate drinking water is considered as fundamental human right (Ramachandraiah C. (2001), Kanmany J.C. (2003)). The proportion of urban population of India is projected to increase from 28 per cent of the total population to about 38 per cent in 2026.The current state of supply of core services in the urban areas, viz, water supply, sewerage, solid waste management and street lighting, is inadequate by any standards. The higher growth of urban population will add further pressure on provision of these services (MoF 2009). The growth of urbanization is higher in Maharashtra. The government has promoted industrialization due to such policy automobile, engineering, electronic, information technology (IT) and biotechnology industries have grown fast. Such industries have created huge employment opportunities in the state. Therefore immigration of the indigent rural labor and qualified professionals from other states took place. Along with the production and manufacturing, the growth of services sector also occurred in the state. The BPO, call centers‟, banking, and insurance companies have opened their corporate offices and grown significantly in terms of numbers. The abandoned industrial sights are getting converted into residential locations. Township planning and low cost vii affordable housing is developed for growing population. Urbanization is putting more pressure on the existing civic amenities in all the municipal corporations.

II. OBJECTIVES

The objective of this study is to assess the current status ofthe drinking water supply system in Maharashtra and to identify potential areas of improvement. The study will also identify the challenges and opportunities associated with providing safe and reliable drinking water to the residents of Maharashtra.

III. LITERATURE REVIEW

In this research work, Physico-Chemical characteristics of Khadakwasla reservoir near Pune were monitored by Nagamani.c (2015), Kumar nitin (2013) for PhysicoChemical parameters like temperature, pH, electric conductivity, Sodium, Potassium, Calcium, Magnesium, Silica, Iron, Bicarbonate, Chloride, Sulphate, Nitrate, Phosphate, dissolved Oxygen, biological Oxygen demand & chemical Oxygen demand. These parameters were analyzed by collecting water samples at 4 different locations of reservoir from July-2005to Jan-2006. From this study, it is observed that there is a seasonal variation in concentration of Physico-Chemical parameters & some of parameters are beyond permissible limit, which shows degradation of water quality due to pollution. According to the research topic of Omran .A.(2011) pollution analysis of water in lime industry area by Shaskikant R, Reveals the In this research work, Physico-Chemical characteristics of Khadakwasla reservoir near Pune were monitored by Nagamani.c (2015), Kumar nitin (2013) for Physico-Chemical parameterslike temperature, pH, electric conductivity, Sodium,Potassium, Calcium, Magnesium, Silica, Iron, Bicarbonate, Chloride, Sulphate, Nitrate, Phosphate,



dissolved Oxygen, biological Oxygen demand & chemical Oxygen demand. Methods

This study employs three main analytical methods relevant for rural drinking water planning: (1) water service data collection, analysis, and mapping of individual variables,

(2) aggregate ranking to prioritize water service planning needs, and (3) cluster analysis to identify different types ofwater service needs. We briefly describe each of these

Methods and then of Maharashtra, GSDA report, 2018). The case study Purandhar block (a name associated with the deity Indra) lies south of the Pune metropolitan area, separated from it by a steep slope (ghat) and higher elevation, which made it an important defensive area during the Maratha period. However, its combination of upland mesas and low rainfall limit surface water supplies and storage today. Peri-urban areas and corridors–Haveli case study block: Villages near urbanizing areas of the district face water service challenges associated with increasing population and water demand. Like the plateaus, they have mesic rainfall conditions (700 mm/yr), but less dissected river valley terrain that facilitates infrastructure development and settlement. These patterns are most evident in the Pune and Pimpri–Chinchwad urban- industrial centers and secondarily along highways leading to major towns in surrounding blocks. In addition to water stress, these towns face water quality issues associated with inadequate urban and industrial wastewater treatment. The casestudy block named Haveli (which aptly refers to large, prosperous homes) surrounds Pune city.

Irrigated plains–Daund case study block: The eastern part of the district has a semi-arid climate (500 mm/yr), relatively flat terrain, and arable soils. Villages are relatively large in size but low in population density. Canal and tubewell withdrawals have supported extensive irrigation agricul- ture from the late- 19th century to the present, with large areas of sugarcane and citrus in the kharif season. While irrigation has mitigated agricultural drought hazards, it has increased drinking water scarcity during the pre-monsoon summer months in

IV. FIELD SURVEY

Mumbai has been deprived of appropriate water resource man-agreement largely due to a perception among decision makers that there is adequate water in spite of rapid population growth. The city, which was originally formed as a cluster of seven uninhabited islands about four centuries ago, emerged as the trade and commerce capital of the country with the largest concentration of human beings. The city grew steadily to become a peninsular city by joining mainland India and today it is 432 km2 (MCGM2003a) within the jurisdiction of MCGM. MMA (Mumbai Metropolitan Area), which comprises 16 small and medium municipal corporations (including Mumbai city), is spread over 4500km2Along with the city's growth, the nature and availability of water resources has been changing, from an initial dependence on wells and tanks within the city to water impoundments made100 km away from the city, on the mainland. This latest systemnvolves using the existinggradient and gravity to bring water down into the city using water pipelines. However, by and large, the water supply infrastructure was laid down during colonialrule, when large land reclamations took place to create the Bom-bay island city.

V. RESULTS

Single variable analysis and mapping .Analysis and mapping of individual variables yielded interesting results. We provide one example in Figure 4. The good news is that most villages (64%) reported having groundwater available all 12 months of the 2017– 2018 year. The greatest concerns arose in villages that had only eight to nine months of groundwater that year (10%). Spatially, every block has some villages with unreliable groundwater supplies. Those risks are concentrated in the Purandhar block, the plateau case study, and more specifically in villages on the northern side of that block. These groundwater supply problems are associated with moderately to highly dissected terrain in a low rainfall area of the district. The eight variables were individually mapped to identify specific village water service needs and discussed with district officials. Future scope: As per survey, by 2050, 70% of the world population will be in urban areas. The goal of the United Nations is to improve drinking water supply system and make them accessible and sustainable. There is a lot of scope for technological solutions in the area

CONCLUSION

According to pressure and water flow rate, the test rig in the Hydraulic Laboratory of the

Faculty of Civil Engineering Subotica presented a case of a single household water pipeline.

The water meters are produced by Potiski vodovodi Ltd. from Horgos with rated diameter of 20 mm, class B, and the following flow rate

Characteristics: the flow at starting the water meter propeller (Qa) is between 0.0052 and 0.0067 m^3

/h, Qmin=0.03 m3 /h, Qt =0.12 m^3 /h and

Qn=1.5 m^3/h. Upstream from water meter no. 3 an UFR was installed, manufactured by A.R.I. from Jerusalem, with rated diameter of 20 mm, product type T30.

During accuracy measurements, water meter readings were 2.5 centiliters. Measurement accuracy of water quantity in the vessel was 0.005 kg. According to the measurement results, the most significant contribution of the UFR in measuring water volume by a water meter of a single household takes place at water losses by flow rate Qa, prior to starting the water meter propeller: a) 70.57% at flow rates Q2=0 and Q3=0.005-0.0052 m3/h, and b) 15.7% at flow rates Q2=0.03-0.0385 m3 /h and Q3=0.0049-0.0053 m3 /h.

The effects of UFR types T10 and T20 manufactured by ARI from Jerusalem on water measuring accuracy are less than that of type T30. For calibration discharges, foreseen by the Protocol, through the testing of class B flow meter with 20 mm rated diameter and discharge of Qn=1,5 m3 /h, it has been established, that: in the case, when consumption time was shorter than the time the meter was calibrated for, at discharges of , the range of the meter measuring error exceeded the range of per mitted errors, the biggest errors occur at Q min - for example, atdischarge lasting for 0.5 minute, the error may be even 32.1% (for water meter reading accuracy of 2.5 centilitres), or even 50.9% (for water meter reading accuracy of 1 decilitre), or even 277.4% (for water meter reading ac to provide that measuring errors of calibrated flows be lower than the permitted ones, the minimum time for measuring these flows is 5 minutes (for water meterreading accuracy of 2.5 centiliters), 9 minutes (for water meter reading accuracy of 1 deciliter), or 60 minutes (for water meter reading accuracy of 1 litre).Since it concerns 95% of water consumption measurement, such testing's are necessary for all types of water meters used in the supply networks of this country

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Use of Ceramic Lime Waste in Concrete

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Abstract - This study's aim is to investigate the utilization of ceramic lime waste in concrete. The paper begins by outlining the growing issue of waste management and the demand for environmentally friendly building techniques. The features of ceramic lime waste are then discussed, along with several possible uses for it in concrete. An overview of recent research on the use of ceramic lime waste in concrete is included in the paper, as well as information on theimpacts of various ceramic lime waste proportions onthe durability, workability, and compressive strength of concrete. The report finishes with a review of the possible advantages of utilizing ceramic lime waste in concrete, including its potential to lessen waste, lessen greenhouse gas emissions, and raise the general sustainability of building practices.

Keywords:- environmentally friendly, durability, workability, and compressive strength

I. INTRODUCTION

The construction industry has been the backbone of economic growth, creating employment opportunities and generating income. However, the construction industry also creates a large amount of waste materials, including ceramics, which pose significant, environmental and health hazards if not properly disposed of. The traditional methods of waste disposal, such as landfilling and incineration, are not sustainable solutions and can lead to environmental degradation. Therefore, it is important to find sustainable solutions for the disposal of waste materials, such as the use of waste materials in the construction industry.

One of the waste materials generated by the ceramics industry is ceramic lime waste, which can be used as a partial replacement for cement in concrete. Ceramic lime waste is a by-product of the ceramics industry and is composed of lime, clay, and other minerals. The use of ceramic lime waste in concrete can have several benefits, including reducing the demand for cement, reducing the amount of waste generated and improving the properties of concrete. Concrete is the most widely used construction material in the world, with over 5 billion tons produced annually. The cement industry is a significant contributor to greenhouse gas emissions, with cement production accounting for 7% of global CO2 emissions. With the increasing demand for sustainable construction materials, the use of waste materials in concrete production is becoming increasingly popular. One such waste material is ceramic lime waste, which is a byproduct of the ceramic industry.

Cement is a crucial binder material in concrete, and its production is a significant contributor to greenhouse gas emissions. The demand for concrete continues to increase, resulting in a corresponding increase in the demand for cement. As a result, finding alternative materials to reduce the carbon footprint of concrete production is of great importance.

Ceramic lime waste is generated as a by-product of the production of ceramics and is usually disposed of in landfills. Utilizing this waste material in concrete production can not only reduce environmental pollution but also improve the properties of concrete.

II. METHOD

Several techniques can be used to make use of ceramic wastes. Here "partial replacement of aggregates" is used. The feasibility of ceramic waste as a potential substitute for traditional coarse aggregates in the manufacture of nonstructural concrete artefacts was examined by Brito et al. in 2005. They found that ceramic waste aggregates have the potential to substitute natural coarse aggregates, but only in components where compressive strength is not as important a need as tensile strength and resistance to abrasion. Similar to Senthamarai and Manharan, who investigated whether ceramic waste could replace crushed stone aggregate, they came to the same conclusion that concrete made with ceramic waste coarse aggregate has acceptable workability and favorable strength characteristics.

In the second part here, ceramic wastes are considered as a replacement of cement in concrete. In 2010, Torgal and Jalali examined the feasibility of using ceramic wastes in concrete and their results show that concrete with 20% cement replacement although has a minor strength loss but possess increased durability performance, while when concrete mixes with ceramic aggregates show better results than the control concrete mixtures concerning compressive strength, capillary water absorption, oxygen permeability and chlorine diffusion thus leading to more durable concrete structures, however in 2013 Raval et al. also performed the almost the same investigation and their results show that the use of ceramic masonry rubble as active addition endows cement with positive characteristics as major mechanical strength and the economic advantages. Reuse of this kind of waste has advantages economic and environmental, reduction in the number of natural spaces employed as refuse dumps. Indirectly, all the above contributes to a better quality of life for citizens and to introduce the concept of sustainability in the construction sector.

III. Materials and Methods

The specimen can be made by using a mix design of 1:2:4 (cement: sand: gravel) with a water-cement ratio of 0.5. Portland cement was partially replaced with ceramic lime waste at levels of 0, 5, 10, 15, and 20%. The setting time, compressive strength, and flexural strength were determined at 7 and 28 days. The carbon footprint can be calculated using the IPCC guidelines for the assessment of greenhouse gas emission

IV. Discussion

The results have shown that the use of ceramic lime waste improved the workability of concrete, as measured by the slump test. The density of the concrete specimens was found to decrease with increasing levels of ceramic lime waste replacement, which is beneficial for the overall strength-to-weight ratio of the concrete.

The compressive strength of concrete specimens increased with the addition of ceramic lime waste, with the highest strength observed at a replacement level of 20%. Beyond 20%, the compressive strength decreased with increasing levels of ceramic lime waste replacement.

The use of ceramic lime waste in concrete involves incorporating waste material generated from ceramics industries into concrete mixes as a partial replacement for traditional materials such as cement, sand, and aggregate. The primary benefits of using ceramic lime waste in concrete include:
Sustainability: Incorporating ceramic waste into concrete helps to reduce the amount of waste sent to landfills and reduces the demand for traditional construction materials.

- Performance: Ceramic lime waste has been found to improve the mechanical properties of concrete, including increased strength, durability, and reduced permeability.
- Cost-effectiveness: The use of ceramic waste as a partial replacement for traditional materials can help to reduce the cost of concrete production.
- Availability: Ceramic waste is widely available and can be easily sourced from local ceramics industries. However, the use of ceramic lime waste in concrete also presents some challenges, including the potential for variability in the properties of the waste material and the need for proper processing and quality control measures to ensure consistent performance
- Methods for processing and quality control of ceramic waste for use in concrete Sizing and sorting: The ceramic waste is screened to remove any large or irregular pieces, and the material is sorted into different sizes.
- Crushing and grinding: The sorted ceramic waste is crushed and ground to a consistent particle size to ensure uniform performance in the concrete mix.
- Chemical treatment: Depending on the chemical composition of the ceramic waste, it may be necessary to treat it with chemicals to neutralize any potentially harmful substances and improve its reactivity in the concrete mix.
- Testing and characterization: The processed ceramic waste is tested to determine its properties, such as chemical composition, particle size distribution, and reactivity. This information is used to evaluate its suitability for use in concrete.
- Mix design: Based on the results of the testing and characterization, the appropriate mix design is developed to ensure optimal performance of the concrete containing the ceramic waste. Quality control measures include regular testing of the processed ceramic waste and the concrete containing it to ensure consistent performance and compliance with industry standards.
- Laboratory testing to evaluate the mechanical properties of concrete containing ceramic waste
- Compressive strength: The compressive strength of concrete is an important indicator of its ability to resist crushing loads. Concrete specimens are cast and cured, then subjected to compressive load in a testing machine to determine their compressive strength.
- Flexural strength: Flexural strength measures the ability of concrete to resist bending forces. This is

tested by applying a bending load to concrete beams and measuring the load at which the beams fail.

- Tensile strength: Tensile strength measures the ability of concrete to resist stretching forces. This is typically tested using the indirect tensile strength test, where the concrete specimen is loaded in compression until it fails.

- Durability: Durability of concrete is an important factor in determining its long-term performance. This can be evaluated through tests such as abrasion resistance, resistance to freeze-thaw cycles, and resistance to chemical attack.

- Permeability: Permeability is a measure of the ability of water and other liquids to penetrate concrete. This is tested using methods such as the rapid chloride permeability test and the water absorption test.

These tests are conducted on concrete specimens containing different proportions of ceramic waste to evaluate its effect on the mechanical properties of the concrete. The results of these tests can be used to optimize the mix design and ensure that the concrete containing ceramic waste meets the required performance specifications. (These are observed from a research paper as our experiments has not done as we are in research phase)

- Field trials to assess the performance of concrete containing ceramic waste in real-world conditions

1. Structural applications: Field trials can be conducted on actual construction projects using concrete containing ceramic waste as a partial replacement for traditional materials. The performance of the concrete can be evaluated over time through regular monitoring and testing, such as compressive strength tests, to assess its durability and resistance to weathering and other environmental factors.
2. Durability testing: Field trials can also be conducted to assess the durability of concrete containing ceramic waste. This can involve exposing the concrete to simulated weathering conditions, such as freeze-thaw cycles, and evaluating its performance over time.
3. Performance monitoring: Field trials can include the installation of sensors and other monitoring equipment to track the performance of the concrete in real-time. This can help to identify any potential issues early on and allow for corrective action to be taken.

Field trials provide valuable information on the performance of concrete containing ceramic waste in real-world conditions and help to determine its suitability for use in actual construction projects.
It is important to note that field trials should be conducted in accordance with industry standards and best practices to ensure reliable and accurate results. This may include using standardized test methods, properly trained personnel, and proper quality control procedures.

Cost-benefit analysis of using ceramic waste in concrete compared to traditional materials

Raw materials costs: Ceramic waste can often be obtained at a lower cost compared to traditional materials, such as cement or aggregate. This can result in significant cost savings for concrete production.
Processing costs: The cost of processing ceramic waste, including crushing, grinding, and chemical treatment, must be taken into account.
Transport costs: The transportation costs of ceramic waste must be considered, as it may need to be transported to the processing facility or construction site.
Concrete performance: The use of ceramic waste may result in reduced concrete performance, such as reduced compressive strength or increased permeability. This must be taken into account when comparing to traditional materials.
Environmental benefits: The use of ceramic waste in concrete can help to reduce waste generation and conserve natural resources, which can result in significant environmental benefits.
Market demand: The demand for concrete containing ceramic waste must be considered, as it may be limited in some markets.
A cost-benefit analysis should consider all of these factors and weigh the costs and benefits of using ceramic waste in concrete compared to traditional materials. This can help to determine the economic viability of using ceramic waste in concrete and provide valuable information for decision-makers.

- Environmental impact of using ceramic waste in concrete and its potential for reducing waste in the construction industry

1. Waste reduction: The use of ceramic waste in concrete helps to reduce waste generation, as it is being put to a productive use instead of being sent to landfills. This can help to conserve natural resources and reduce greenhouse gas emissions associated with waste disposal.
2. Conservation of natural resources: The use of ceramic waste can help to conserve natural resources, such as cement and aggregate, which are typically extracted from the earth. This can help to reduce the environmental impact of extractive industries and minimize the impact of mining on local ecosystems.
3. Energy savings: The production of ceramic waste typically requires less energy compared to traditional building materials, such as cement and aggregate. This can result in energy savings and reduce greenhouse gas emissions associated with concrete production.
4. Increased sustainability: The use of ceramic waste in concrete can help to increase the sustainability of the construction industry, as it reduces waste generation, conserves natural resources, and reduces energy consumption.

However, it is important to note that the use of ceramic waste in concrete must be properly managed to ensure its environmental impact is positive. This may include measures such as sourcing ceramic waste from reputable sources, conducting appropriate

testing to ensure its quality, and properly disposing of any wastegenerated during processing.
Overall, the use of ceramic waste in concrete has the potential to reduce waste in the construction industry and promote environmental sustainability. It is an important area of study and can help to drive innovation in the construction industry and reduce its environmental impact.

V. RESULT

After studying various research papers, the results showed that the use of ceramic lime waste improved the workability of concrete, as measured by the slump test. The density of the concrete specimens was found to decrease with increasing levels of ceramic lime waste replacement, which is beneficial for the overall strength-to-weight ratio of the concrete.

The compressive strength of concrete specimens increased with the addition of ceramic lime waste, with the highest strength observed at a replacement level of 20%. Beyond 20%, the compressive strength decreased with increasing levels of ceramic lime waste replacement.

VI. FUTURE SCOPE

Ceramic lime waste has potential to be utilized as a supplementary cementitious material (SCM) in concrete. The use of ceramic lime waste can help reduce the carbon footprint of concrete production, improve the sustainability of the construction industry, and decrease the need for disposal of waste materials. Additionally, the use of ceramic lime waste can also enhance the properties of concrete such as workability, durability, and mechanical strength. However, further research and development is needed to optimize the use of ceramic lime waste in concrete and ensure its long-term performance.
Ceramic waste can be used as an alternative material in the production of concrete. The use of ceramic waste in concrete can improve the mechanical and physical properties of concrete, making it more durable and resistant to abrasion, wear, and tear. The presence of ceramic waste in concrete enhances the concrete's strength and workability, which can lead to increased efficiency in construction. The use of ceramic waste also results in a reduction of the amount of concrete that is used in construction, which reduces the amountof waste produced.

The use of ceramic waste in concrete also has environmental benefits. Ceramic waste is a non-renewable resource, and its disposal in landfills can lead to environmental problems, including soil and water contamination.

By using ceramic waste in concrete, the amount of waste generated is reduced, which reduces the impact on the environment. Additionally, the use of ceramic waste in concrete can reduce the demand for natural resources, such as sand, gravel, and cement, which are used in the production of concrete.

Ceramic lime waste is particularly beneficial in the production of concrete because of its high lime content. Lime is an important component of concrete because it reacts with the other components of concrete to produce a strong, durable, and resistant material. The high lime content in ceramic lime waste makes it an excellent alternative to traditional lime. Furthermore, ceramic lime waste can also be used to reduce the amount of cement used in the production of concrete, which can result in lower costs and a reduced carbon footprint.

VII. CONCLUSION

In conclusion, using ceramic lime waste in place of some Portland cement in concrete has the potential to lower CO2 emissions while also enhancing the material's mechanical and durability attributes. To completely comprehend the impacts of using ceramic lime waste in concrete and to establish the ideal Portland cement replacement ratio, additional research is necessary. The findings of this study could aid in the creation of more environmentally friendly building techniques and the reduction of waste produced by the ceramic sector. the use of ceramic waste in concrete is a promising area of research that has the potential to provide many benefits to the construction industry and the environment. The use of ceramic waste as a partial replacement for traditional materials, such as cement and aggregate, can help to reduce waste generation, conserve natural resources, and reduce the environmental impact of concrete production.

Laboratory and field trials have demonstrated that concrete containing ceramic waste can have acceptable mechanical properties and durability, making it a suitable alternative to traditional materials. A cost- benefit analysis can help to determine the economic viability of using ceramic waste in concrete, and can provide valuable information for decision-makers.

However, it is important to manage the use of ceramic waste in concrete properly to ensure its positive impact on the environment. This may include measures such as sourcing ceramic waste from reputable sources, conducting appropriate testing to ensure its quality, and properly disposing of any waste generated during processing.

In conclusion, the use of ceramic waste in concrete is a promising area of research with many potential benefits, and further study is needed to fully understand its impact on the construction industry and the environment.

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Use of Ecofriendly Construction Material for Sustaining Strength in Structure

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***Abstract*—The development of the family of inorganic polymers, of which geopolymers are a particular family member, provides an opportunity to add a valuable new member to the spectrum of engineering materials. In doing so, this development has the potential to reduce the impact that the manufacture of building materials, products, and structures has on our environment. As a castable resin, mortar or concrete, these materials set on the application of low heat. The hardened ceramic or concrete-like material has high strength, acid resistance, UV resistance and is fireproof and heat resistant.**

They require a precursor or feedstock that contains significant quantities of silicon and aluminium held in an amorphous phase. Many industrial "waste" materials such as flyash, slag, red mud and silica fume, as well as naturally occurring materials like pumice, scoria and granite can be used solely, or in combination, as feedstocks. A greater environmental impact resides in the opportunity to replace conventional portland cement concrete, in a range of both general and nicheapplications. The manufacture of portland cement typically produces one tonne of carbon dioxide for every tonne of cement. The net result is that world cement production generates some 8% to 10% of world carbon dioxide industrial emissions. By comparison, the manufacture of geopolymer concrete produces low carbon dioxide emissions, and provides the opportunity to reduce such emissions by more than 80%. To be able to use these "novel" materials in the building and construction, and infrastructure markets, manufacturers and engineers need to be assured of consistent and durable material properties. To gain this assurance, research needs to provide a full understanding of reaction processes and reaction kinetics, when using various feedstocks, and to be able to predict any possible degradation mechanisms that may arise when such products are installed in typical environments.

Development engineers are running ahead of scientific research in this field, and if the advances promised by inorganic polymer technology are to be realized in an optimum rate and manner, they must slow to allow the construction of a solid scientific platform of knowledge. Geopolymer products which are currently under development in Australia and which in many cases are currently undergoing extensive field trials, include sewer pipeline products, railway sleepers, masonry units, internal tiling and bench-tops, fire-resistant wall panels, protective coatings, repair materials, shotcreting systems, and high performance fibre reinforced laminates. Most are niche applications, taking advantage of one or more unique properties provided by these materials and their relatively simple manufacturing processes. In its initial projects, the CRC for Sustainable Resource Processing is looking more towards those applications that consume large volumes of "waste"or by-product materials. The obvious end- product is geopolymer ready-mixed concrete. Normal to high performance concretes can be made by using anything from 15 to 95% of such "wastes" and can be economically used in the geographic regions near the waste generation sites

(coal-fired power stations, mineral processingcentres,glass product manufacturing sites, etc.)

***Keywords:*-Environment, fiber reinforced laminates, protective coatings, repair materials, shotcreting**

I. INTRODUCTION

Members of the current spectrum of materials in the building and construction industry, from timber, to the metals, to organic polymers or "plastics", to ceramics and portland cement concrete, each have their own performance benefits and deficiencies, and as a group have evolved without lot of concern for their impact on our environment. They continue to be used for four basic reasons; over the decades or even centuries, manufacturing process have been refined, and sale volumes increased so that cost to manufacture is low by comparison with any new contenders, because their beneficial properties outweigh their deficiencies, their deficiencies are often overlooked, or at best, "put up with" by designing around the known problems in known environments, there are often no perfect, commercially viable solutions to the problems that designers and constructors are faced with, the status quo, in both the supply and usage chain is so entrenched, and so protective of their patch, that reassessing the existing participants in the light of their "cradle to grave" impact on the environment will require a generational change in perspective. Over the past decades, the reinvention of the inorganic polymerization process, more commonly know as geopolymerization through the ground breaking work of Joseph Davidovits and his colleagues [1], provides a bookmark in time for usto review this spectrum of materials and decide whether we do in fact have better or more environmentally friendly alternatives.

II. THE GEOPOLYMERIZATION PROCESS.

Geopolymers are a member of the family of inorganic polymers. The most basic, and most well-established member is the field of sol-gel silica technology [2]. Here silicon ions are dissolved from an amorphous precursor or feedstock by the actionof alkali metal hydroxides to form a sol ofsilicon hydroxide molecules. Under the correct concentration and thermal conditions, these sols undergo condensation polymerization to form gels,then rigid networks or chains of theSi-O-Si-O-Si-O- inorganic polymer Sol-gel alumino silicates and geopolymers are the next most complex member, as now both silicon and aluminum ions dissolve and polymerize to form -Si-O-Si-O-Si-O-AlNa-O- inorganic polymers(the Na or K alkali metal ion providing charge balance for the aluminium ion).

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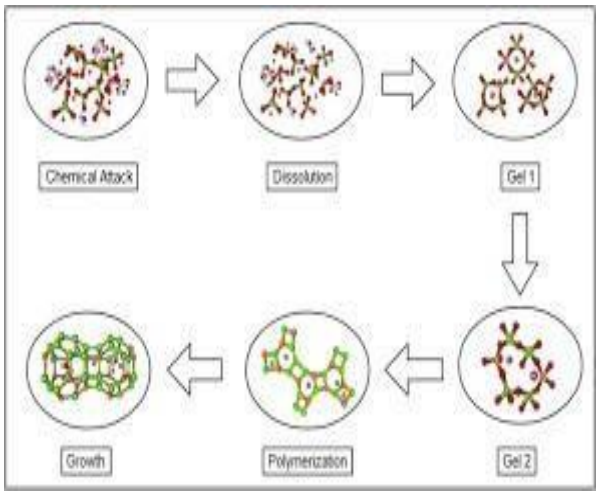


The most complex member is the mixed phase system of geopolymers and ordinary portland cement (OPC) hydrates (often blended with ground granulated blast-furnace slag), developedpredominantly in the Ukraine by Krivenko et al [3] and known commonly as alkali activated or alkaline cements [4].

III. POTENTIAL FEEDSTOCKS AND REACTIVE FILLERS

Almost any material that contains significant amounts of silicon and aluminium, which are held in an amorphous phase, can act as a feedstock or reactive filler. Thus, many waste materials or by- products from the burning of organic matter (coal, rice hulls, etc), or metals refining, can be used to make geopolymer resins, filled resins, mortars or concretes. In an industrial sense the star performers are the ashes (fly and bottom ash) generated in coal fired power stations, and in particular the low calcium class F ashes common in Australia (calcium in significant quantities interferes in some way with the polymerization "setting" rate, and alters the microstructure). Contrary to the current situation where only a selected fraction (typically about 10% of all ash generated) is used in OPC concrete production, geopolymer (GP) concrete production can use the full range of ashes, including bottom ash as a reactive filler. Figure 1 illustrates the relative volumes of flyash that can be used in OPC concrete and GP concrete. OPC concrete would normally consist of 3% flyash, whereas GP concrete can use typically 25% ash, and up to 75% ash if the GP binder is pelletized to produce an artificial coarse aggregate. Thus converting all OPC concrete to GP concrete, without pelletizing, would convert this 10% ashusage

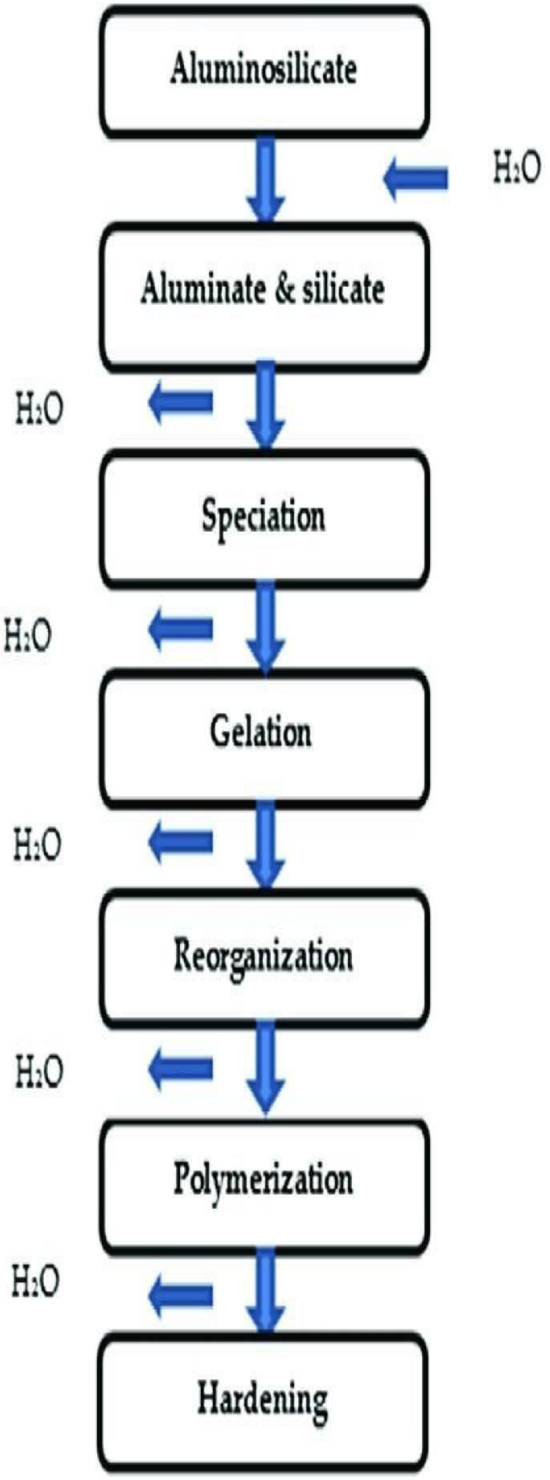
to more than 80% ash usage in concrete production alone. Significantly, the valuable ash now stored in the ever-growing ash dams around Australia, can be recovered, dried, beneficiated if necessary, and used as a GP precursor. Pelletizing to produce artificial aggregate for the concrete industry, although currently relatively costly to produce, has the environmental benefit of reducing the need for stone quarrying. Like the milling of natural timber reserves, quarrying has an undefined environmental cost which is rarely factored into the end product selling price, so engineered alternatives never get to compete on a level playing field

DRY MATERIAL	OPC CONCRETE	GP CONCRETE - FA BINDER	GP CONCRETE -FA BINDER & AGG.
Coarse Aggregate (kg)	500	500	***500***
Sand (kg)	350	250	250
Bottom Ash (kg)	0	***100***	***100***
Cement (kg)	120	0	0
Flyash (kg)	***30***	***150***	***150***
Ash Usage (kg/t of concrete)	***30***	***250***	***750***

Figure 1. Potential Ash Usage Rates for OPC and GP concrete.

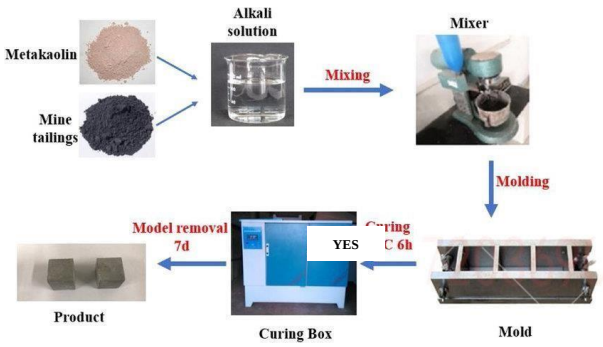
The niche product developers prefer to use metakaolin as the precursor because it is almost totally dissolvable in the reactant solution, produces a controlled Si/Al ratio in the geopolymer, and is white. However, it is expensive to produce, requiring the parent kaolin clay to be dehydroxylated at 500 to 700 deg C for several hours, and is not an economical option for mass concrete production. Other waste materials that can be used as feedstocks include ground slags, silica fume (particularly if used as an alternative to the sodium silicate which normally forms part of the reactant solution), and the naturally occurring alumino-silicates such as scoria and granit fines, and microsilicas.Reactive fillers (which act as binder components, or fine and coarse aggregate particles) include bottom ash, recycled glass, “red mud”, granulated butunground slags, and the quarried alumino- silicate aggregates like granite and scoria. The ability to use reactive fillers is one major advantage GP concrete has over OPC concrete. The GP reaction with reactive aggregate (aggregate containing amorphous silica) produces a chemical bond to the aggregate, which then produces a hardened material with significant tensile strength. OPC concretehas negligible tensile strength and hence must almost universally be reinforced with steel rods orwire to give the product adequate tensile (and hence flexural and shear) strength. One reason for this low strength is that often OPC binder- aggregate bonding is low because of its almost solely physical nature. Indeed, OPC concrete technology must go to extreme lengths to prevent this alkali-silica reaction, because it inevitably must happen after the concrete has hydrated and set. Only during hydration are the alkalis released into the pore water. ASR invokes a volume increase,which can cause bursting stresses to develop many years after manufacture, within the hardened concrete. In some extreme cases ASR can lead to ASR cracking in OPC concrete. GP concrete binder- aggregate reaction occurs prior to setting and hence cannot lead to later age cracking.

4. FLOWCHART



IV. PROPERTIES OF GEOPOLYMERS

Geopolymers with different Si/Al ratios have marginally different properties [5,6], but in general, all are;High strength (compressive strengths from tens of MPa's to typically 350+ MPa [7], with relatively high tensile strengths).Chemically resistant (almost totally resistant to concentrated acids), unlike OPC concrete. fire resistant; Cill not burn or release toxic fumes during a fire, asplastics do. Does not spall with the explosive forces, like OPCconcretes are prone to do in an intense fire.



at temperatures in excess of 1000 deg C, they ultimately melt.Compatible with steel reinforcing, as interstitial pore water has a pH of 11 to 12 (sufficient to keep steel in its "passive" corrosion state).

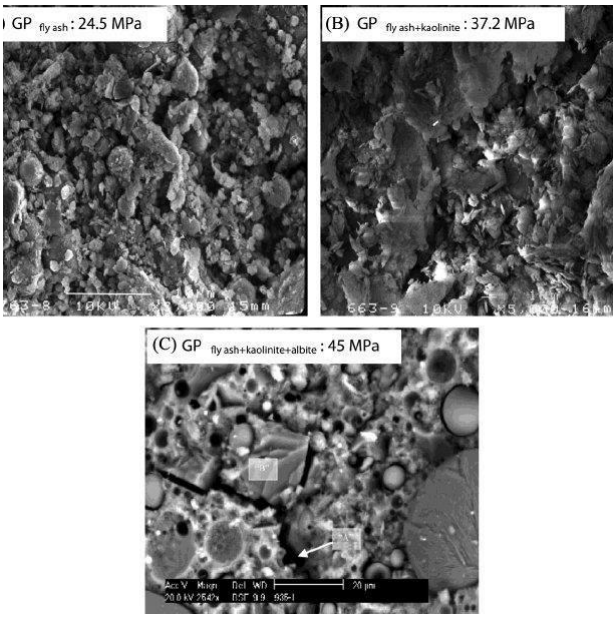
- Low electrical, thermal and acoustic conductivity.
- UV resistant.
- Density typically about 2000 to 2500 kg per cubic metre but can be foamed to obtain densities below 500 kg per cubic metre.
- High Si/Al ratio geopolymers form resins with low viscosity, sufficient to wet out reinforcing

fibres, strands or mats, producing laminates with flexural strengths in excess of 650 MPa [10,11].

Taking advantage of one or more of these unique properties, geopolymer products under development in Australia include;

- Sewer pipeline products where processing ease, strength, acid resistance, and fire resistance put them in a performance class of their own.
- Railway sleepers where processing ease, strength, fire resistance and durability will supplant existing materials.
- Building products including fire and chemically resistant wall panels and doors, tiles, benchtops, ducting etc, which at last provide an alternative to organic polymer materials.
- Masonry units.
- Protective coatings and repair materials.
- Shotcrete.
- High performance fibre reinforced laminates.

Many are showing outstanding performance in on-going laboratory and field trials.



We have obtained the following set of results when the device was kept online for a period of 24HRS.

V. ENVIRONMENTAL FACTORS.

The development of a geopolymer based construction material offers a wide range of significant environmental advantages over those materials currently in use in the building and construction industry.

As a concrete or mortar replacement for OPC concrete, it offers the potential for a dramatic reduction in greenhouse gas emissions. Overall, takinginto account CO2 emissions from calcining limestone in clinker production and energy requirements for grinding and processing, it is estimated that one tonne of CO2 is generated per tonne of cement produced [8]. On the basis of a life cycle analysis [9], the replacement of OPC with a GP binder reduces this figure by approximately 84% (0.164 t of CO2 per tonne of GP binder). Given that OPC production in Australia runs at about 7 million tonnes per annum, the potential for a 6 million tonne reduction in CO2 emissions from this primary source is something that should not be ignored. This is clearly a long-term opportunity, but a several million tonnes reduction is an achievabletarget over 10 to 20 years. This calculation does not take into account the superior properties of GP concrete which will produce longer product life times, lower binder contents, and hence reducedannual binder demand.

In the global context, this opportunity is Earth-saving. The global manufacture of OPC accounts for about 8 to 10 % of worldwide CO2 emissions to theatmosphere [8].Since GP binder feedstocks can be by-products from the processing of other resources, currently dumped as wastes, there is a second stage environmentalbenefit with an environmental impact a

resounding as the primary Greenhouse gas savings.

Thecurrent ponding "solution" to the problems of liquid and fine particle waste containment is not anacceptable permanent long-term option, and is tolerated only because there is no other commerciallyviable alternative. Even if only to convert toxic liquid waste to safe solid wastes, the opportunities offered by the geopolymer process cannot be ignored. In small quantities, metal cations can be incorporated into the polymer network, potentially producing leach rates far superior to those of OPC concrete based systems where the ions are usually relatively loosely bound, and the matrix is susceptible to decomposition when exposed to acidic rain or groundwater. The third environmental opportunity resides in the abilityto substitute GP building products for current products based on organic polymers. In general, organic polymers are not fire-safe, emitting toxic fumes when they burn. Such fumes, in enclosed structures such as buildings or transport vehicles, can kill well before the fire itself threatens life. It is assumed that this issue, and the related "sick building" syndrome, have to date been ignored by regulatory authorities, because they believed there was no alternative. There is now.

VII. INDUSTRY NEEDS

The D's in R&D tend to be running ahead of the R's inthis field. To optimize material, process and product designs, developers need to fully understand thegeopolymer reaction process and reaction kinetics, for alarge variety of potential feedstocks. Otherwise, R&Ddegenerates into alchemy, advancing by trial and error. The research needs to be public domain research,advancing in a co-operative manner, and notquarantined or locked up within industrial researchgroups. GP introduction will be more rapid if the field of opportunity is first surveyed fully, with the infrastructure in place ready for the influx of prospectors. Government in particular should stand above the temptation to get rich quick, or to back individual prospectors, and accept the role of general facilitator and promoter, because only a mass uptake of this technology will provide the promised environmental returns. Once developers can produce uniform materials, a data bank of physical properties will allow the formation of Standards and Codes of Practice, so that structural design engineers can design with, and specify these materials.

Durability studies, modeling material and structural behaviour in a range of known natural and artificial environments, will then allow design lives and service lives to be predicted. Theory and limited experimental data suggest that relative to the performance of current materials, geopolymer products and structures should have exceptionally long lives in natural environments, far exceedin the 50-100 years designs lives currently accepted asnormal in the industry.

The recently formed CRC for Sustainable Resource Processing contains a small research program to investigate the use of processing by-products in geopolymer production. In its initial programs, the CRC is looking towards those applications thatconsume large volumes of waste materials. The obvious end product is geopolymer ready-mixedconcrete. Normal grade to high performance grade concretes can be made which contain anything from 15% to 75% by mass of such processed wastes, and can be economically competitive in geographic regions immediately surrounding the waste generation or collection sites

The form of application of agro-wastes in concrete is roughly divided into two parts: (1) Without chemical process, usually after physical treatment, such as chopping, cutting, and levigation. These materials are added into concrete in order to partially replace the cement, without variation or deceasing the performance of concrete, through applying agro-wastes. (2) Through chemical combustion, where the burned agro-wastes constitute some of the conglutinant substances that could be exploited and partially displace the function of cement. So far, agro-waste admixtures have successfully been applied in Portland cement either with concretes, mortars, or pastes as the supplementary cementitious materials.

Environmentally friendly policies encourage increasing the utilization of agro-wastes materials based on their unique performance. Using waste powder, such as bag house fines, municipal solid waste incineration ash, or waste ceramic materials, as a mineral filler in mixed asphalt concrete has been studied by several researchers. The development and consumption of waste as supplementary cementitious materials were studied at-large, as the generation of agro-wastes is extremely prevalent in many parts of world. Biomass ashes are suggested as a sustainable replacement to low-cost construction materials, which can also be used as a mineral filler in asphalt mixtures [65]. Rice husk ash (RHA) has been evaluated as a filler in hot mix asphalt (HMA) concrete [66]. The results showed that RHA can replace conventional mineral filler, in turn minimizing the numerous wastes from agriculture. Furthermore, two types of biomass ashes, date seed ash (DSA) and RHA, were mixed to replace conventional filler with DSA and RHA fillers. The results suggest that 100% DSA could be regarded as the optimal percentage, and hot mix asphalt (HMA) mixtures with a 75% RHA substitution demonstrated a suitable performance. Overall, the Marshall stability, stiffness, and rutting performance of asphalt mixtures were enhanced under the application of RHA and DSA. Furthermore, compared with the control mixture, HMA incorporated with RHA and DSA exhibited a particularly improved fatigue resistance, which means that the fatigue life of the resulting concrete will be longer with agro-wastes [67]. While comparing 2% cement as a conventional filler when preparing asphalt, the different proportions of RHA (2% to 4%) as an alternative filler were found to be better than a mineral filler by lowering the optimum bitumen amount in an asphalt concrete mix Application of Agricultural Residues on Building Insulation straw, and olive residues mixed with concrete have shown excellent thermal insulation properties. The excellent thermal insulation properties of hemp have been reported in many studies [69–71]. Concrete with a bio-composite of hemp and lime has not only shown good thermal insulation properties and an acceptable mechanical resistance performance, but has also beenfound to be lighter than common concrete [69]. Straw– concrete has also been studied in a mixture of binders of lime with gypsum plaster. The use of olive stone as an additive in

cement lime mortar has also widely been investigated for improving thermal insulation. It was observed that amending 70% olive stone resulted in a decrease in the mortar thermal conductance by 76% [72]. Concrete containing 10% and 20% of cork was found to lower the thermal conductivity of concrete by approximately 16% and 30%, respectively [54]. With increasing the cork dosage (10–80%) in mortars, a decrease in thermal conductivity was presented by other researchers [73]. The addition of barley straw was shownto improve the thermophysical properties of sand concrete by reducing the thermal conductivity and diffusivity by 5.71% and 21.97%, respectively

VIII. CONCLUSION

. Inorganic polymers can be seen as a new member of the spectrum of construction materials. They fit somewhere between the concrete/ceramic materials and the organic polymers (plastics). In certain physical and chemical attributes, they outperform both, but as environmentally friendly alternatives, their future in our "built environment" should be assured. Niche applications suchas in sewer infrastructure, will assure the material has a place in the future (it is genuinely theanswer to a sewer design engineer's prayers). On current scientific knowledge it appears that only "market forces" or infertile ground will prevent the seeds of thisnew material from re-establishing its rightful place as a building material ofchoice in future constructions.

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Kinetic Paving

[SWITCHING EFFECTIVELY FROM FOSSIL FUELS TO RENEWABLE ENERGY SOURCES]

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***Abstract*— The Continuous increase in energy demand has resulted in more consumption of fossil fuels, which leads to higher CO2 emissions every year. To overcome this problem, shifting from fossil fuel based energy resources to renewable and sustainable ones is essential. In terms of reducing fossil fuels and carbon emissions, Kinetic paving can be used as an alternative source of energy. Instead of relying on fossil fuels, Kinetic paving can tap into the renewable energy of footsteps, thereby reducing the amount of fossil fuels used to generate electricity. By providing an alternative source of energy that is both renewable and sustainable, Kinetic paving can help to reduce the amount of carbon emissions released into the atmosphere.**

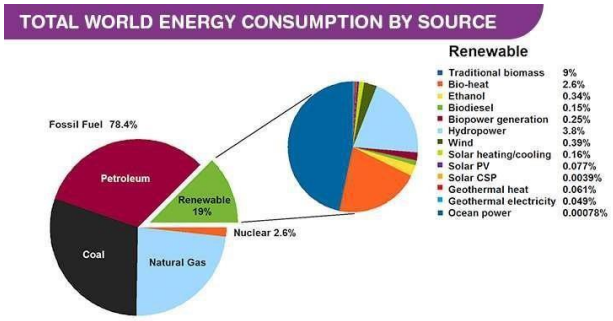
Keywords*— *Kinetic Paving, pavegen, electricity, Sustainable.

I. INTRODUCTION

Energy harvesting from human footsteps is an interesting and applicable issue, thanks to the Ultra-low power consumption of electronic devices lately. Focused on walking, the energy produced by the heel strike of a person's walk is 1–5 J or 2–20 W per step. There are various commercial products which harvest energy from people's walks, such as energy storage shoes and the energy Floor Pavegen and Energy Floors have produced a commercial system that generates power from footsteps The Pavegen system, using electromagnetic generators, can produce 2 to 4 joules, or around 5 watts of power of o_-grid electrical energy per step. Dutch Railways built a novel phone charger for Utrecht Central Station using a swing set called Play for Power the system turns kinetic energy from the swings into power dispensed through charging cables. However, few technical details of those products are published thus far.

Kinetic paving is an invention that uses the power of footsteps to generate renewable energy and reduce fossil fuels and carbon emissions. The technology works by converting the force from each step into electricity which is then stored and used for various purposes. Kinetic paving is designed to be both affordable and easy to install, making it accessible for any location. Additionally, the technology has the potential to be used in a variety of applications, ranging from powering street lights to charging mobile phones.

Moreover, Pavegen can also provide an educational opportunity. By demonstrating the power of footsteps to generate energy, Kinetic paving can help to promote an understanding of renewable energy sources and the importance of reducing carbon emissions. Furthermore, Kinetic paving can provide an interactive and engaging way for people to learn about renewable energy sources and the importance of reducing their carbon footprint.



II. LITERATURE REVIEW

1. Design of Kinetic-Energy Harvesting Floors

Thitima Jintanawan 1, Gridsada Phanomchoeng 1,2,*, Surapong Suwankawin 3 , Phatsakorn Kreepoke 1, Pimsalisa Chetchatree 1 and Chanut U-viengchai 3

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2. Footsteps: Renewed Tiles

Al Akhawayn University In Ifrane
School Of Science And Engineering

Fatima Zahra Bouzidy

All sorts of renewable engineering technologies are trying to extract energy from natural sources. In contrast energy is collected from the human locomotion and translated into electricity stored in batteries to later uses.

3. The concept of self generation of electricity by kinetic tile

Anith Athierah Aziz, Asmat Ismail

As the material used for replacement is a coconut she Nowadays, clean, renewable and environmentally friendly energy generation has always been an issue that needs to be solved. Furthermore, with the use of Self-Generation of Electricity is an innovative idea, which is to generate electricity from kinetic energy. These tiles use the kinetic energy of a footstep to strain a piezoelectric material.

III. Proposed Framework

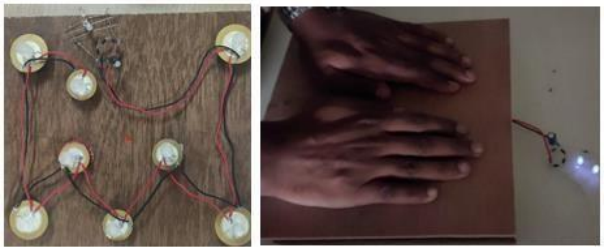
- The top surface of the flooring tile unit is made from recycled rubber and stainless steel.
- The Base of the slab is constructed from over 80% recycled materials with Concrete
- The size of the product is 600 x 450 x 87 (LxBxH) mm.
- The maximum allowable displacement of 15–20 mm.

Types of floor Mechanism

- Piezoelectric effect.
- Magnetic Transducers.
- Micro- generators.
- Static capacitors.

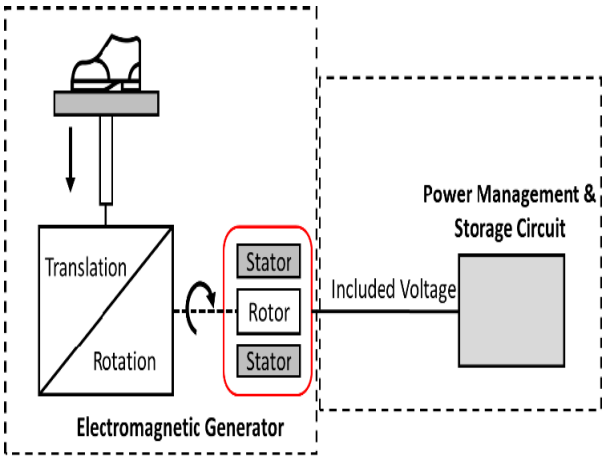
IV. Proposed Architecture

- The force from a footstep is applied on the floor-tile, the mechanism for a movement-converter changes the translation of the floor-tile to the rotation of the EM generator to induce voltage. With the connected PMS circuit, the electrical voltage and power generated by the EM generator is processed. The harvested power is then stored in the rechargeable batteries so it can be supplied to the smart IoT-devices with low energy consumption.



V. Methodology

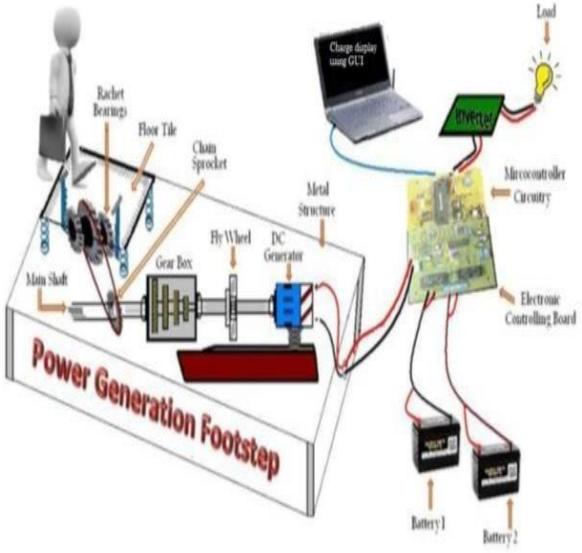
1. Choose a suitable location: Select a public area where the installation of Pavegen tiles would be most suitable and beneficial. Consider factors such as foot traffic and available space.
2. Design the installation: Decide the number of Pavegen tiles needed and the type of energy to be generated. Also, plan the layout of the tiles and the wiring for connecting them.
3. Prepare the area: Clear the chosen area and level the ground. Make sure to follow safety regulations and obtain necessary permits.
4. Install the tiles: Place the tiles in the area and secure them using the appropriate adhesives, grouts, and sealants. Connect the tiles to the wiring and power source.
5. Test the tiles: Test the tiles to ensure that they are working properly and providing the desired result



The working of the Kinetic paving is as follows:

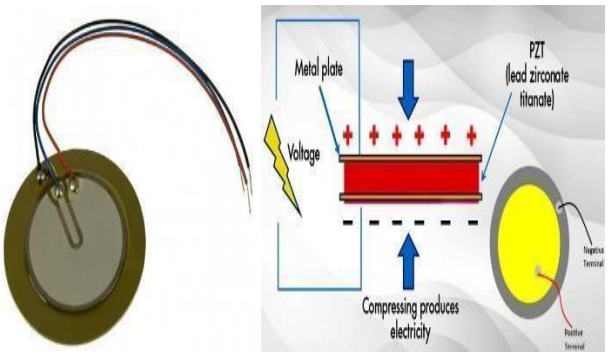
- **Static Mechanism**

- The Electricity is generated through the movement



on the floor tile

- This tile flexes by 5mm once stepped on, resulting in up to eight watts of mechanical energy over the



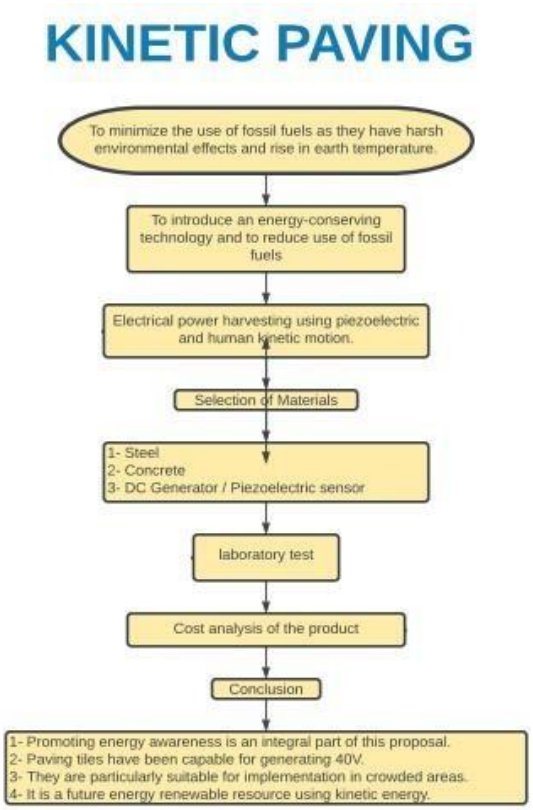
length of the footstep.

- Every step is nice for regarding three joules of energy, which might lightweight a LED streetlight for thirty seconds.

- **Piezoelectric Mechanism**

- The piezoelectric effect is a result of the polarization of the atoms within the piezoelectric material. When a piezoelectric material is subjected to mechanical stress, the polarization of the atom's changes, which leads to a separation of electric charges on opposite faces of the material.
- This creates a voltage difference between the two faces, which can be harnessed and used to generate an electric current.

FLOWCHART



VI. FIELD SURVEY

- It can be used at Railway platform. (According to report 7.5 million passengers travelled every day in local Mumbai.), Taking just rough figure 10,00,000 (1 million) footfall
- According to report from mid-day newspaper, around 3.87lakh approx. foot fall at ghatkopar station.

Table I : Cost Analysis

Particulars	Costing Rs	Unit	Amount RS
Cost of Pavegen Tiles 100 sq.ft	500 / sqft	Sqft	50,000
Labour Cost	8000	L.S.	8,000
Installation Cost	10000	L.S.	10,000
Transportation Cost	5000	L.S.	5,000
Miscellaneous Cost	3000	L.S.	3,000
Total Initial Cost:		100 / sqft	76,000

- One tile generates 5 watts of electricity, if 10,000 footfalls occur then, (10,000 x 5 watts) 50,000 watts (50Kwh) is generated per day.

- Then the energy saving per year (365 days) is approx. 18000kWh
- Electricity charges for 1KWH are 7rs
- So, for 18,000Kwh = 126000Rs
- In Seven months, our costs will be covered and the rest generation will be a profit

VII. Future Scope

- It looks promising as demand for renewable and sustainable energy sources increases.
- Tiles have the potential to reduce reliance on traditional power sources, lower energy costs, and even provide a source of emergency backup power.
- Additionally, the integration of Internet of Things (IoT) technology and data analytics with Pavegen's tiles has opened up new possibilities for smart cities, allowing for real-time monitoring and analysis of foot traffic patterns, energy usage, and more.

VIII. Conclusion

- Paving tiles have been capable for generating 40V. They are suitable for crowded areas.
- It is a future energy renewable resource using kinetic energy.
- The technology offers the first tangible way for people to engage with renewable energy generation.

IX. Acknowledgment

The following work ‘Kinetic Paving’ can’t be created by a single person. The timely completion of the work has been possible due to the guidance of our mentor Mr. Vinayak Bachal who imparted his knowledge regarding the topic on us and with his continual motivation, this work was completed. We are also thankful to the Department HOD Dr. Seema Jagtap for allowing us to use the lab equipment’s which were required for our project, and to our parents for providing us with all possible resources. We also thank our college ‘Thakur College of Engineering and Technology’ for providing us with a platform and the necessary facilities to make this project possible.

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Study on Impact of Climate on Water Resources

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***Abstract*- It has theoretical and realistic meanings to study the climate change's impacts on hydrology and water resources, so as to understand and solve some problems in hydrology and water resources, such as plan management, operation management, environmental protection, ecological balance and so on. And hydrology and water resource system have close relationship with industry, agriculture, city development and economic fields. This paper reviews the relationship between climate change and water resources, water circulating response of climate change. And then summarizes some study methods of analyzing the impacts of climate change on hydrology and water resources, such as generation technology for climate change scenario and hydrologic simulation. At last, it raises problems in study and puts forward the development trend, including perfecting the distributed hydrological model, improving the precision of climate models and hydrologic models and developing the two-way coupling techniques of climate models and hydrological models.**

Keywords- Water Resources, Impact of Climate Change, Water Cycle, Binary Water Cycle.

I. INTRODUCTION

Climate change refers to a period piece, ten years or longer in climate average state and deviation in which both one or two occur significant change together in the sense of the statistics. Its main show is a time state variable and happened vary significantly compared with starting time. The effects of climate change is multi-scale, all-round, multi-level, both positive and negative effects. Climate change not only affects the hydrological, biological and ecological system, but also affects the economy, life, so the future climate change effect the sustainable development of regional, national, and even the world is the most important. This paper on the basis of the predecessors comprehensive research in the relationship between water resources and climate change, exploring water resources, climate change and its related mechanism, in order to provide many response for further research to climate change.

II. THE RELATIONSHIP BETWEEN CLIMATE CHANGE AND WATER RESOURCES

The water resources and the hydrologic cycle is a very important link of climate change. The effect of climate change on water resources is because of the water and water quality changes that caused by climate factors (mainly includes rainfall and temperature changes). And it is achieved by the changes of the various water cycle links. Climate change will change the world of the present situation of the hydrologic cycle, and cause the redistribution of water resources in time and space. It also will have a direct effect on the evaporation, runoff, the soil humidity and so on. The redistribution and changes of water resources in space will cause the human society and ecology change a lot. At the same time, the water resources system changes will affect the local climate, and will exacerbate climate change in a certain extent.

This relationship as shown in fig 1

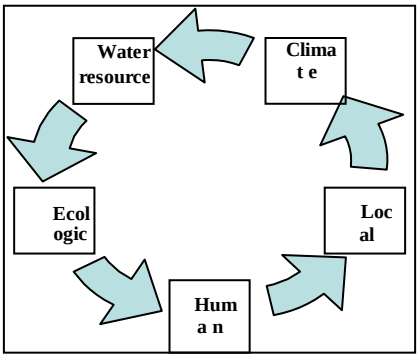

Fig 1 Cycle diagram of climate change affects

The impact of climate change on water resources have developed many research on internal and external. On external, people started to research the impact of climate change on water resources from the 1980s. In 1985, the World Meteorological Organization (WMO) published the review about the impact of climate change on water resources. After that, the WMO put forward some test and evaluation method and published the sensitivity analysis report that impact of climate change on hydrology and water resources [4]. In 1987, the WMO summarized the sensitivity problems in the water resources system for the future and modern climate change. In order to speed up the research, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) jointly set up the Intergovernmental Panel on Climate Change (IPCC) in 1988.The IPCC is specialized in evaluation of climate change, and it have completed four assessment report in 1990,

1995, 2001 and 2007. The report has become the main scientific basis which international society to know and understand the problem of climate change.

We made special research about the impact of climate change on hydrology and water resources since the 1980s in China. In 1988, the national natural science foundation of China approved the "trend and influence of China's climate and sea-level changes" as a major project in the Seventh Five Year Plan. It includes that the impact of climate change on water resources research in the north and northwest of China. In the "Tenth Five-Year Plan", it launched a special subject that is "The impact and comprehensive evaluation of climatic anomaly on China's freshwater resources". It is used to predict the threshold for climate change on the basis of the simulation of future water resources and water demand [7]. In recent years, our country has carried out the research on the evolution of our living environment and the prediction of the drying trend in northern. According to the problem of global warming, it mainly studies arid areas in the north of China future climate situation, the mutual relationship and adaptive countermeasures between water resources and human activities.

III. WATER CYCLE RESPONSE MECHANISM OF CLIMATE CHANGE

Water cycle is theoretical basis of the study of the impact of climate change on water resources. As an important part of the climate system, the hydrologic cycle is restricted by the climate and feedback it too. Climate change will cause water cycle changes, for watershed water cycle, in a great degree, its characteristics are decided by local climate conditions. The effect of Climate factors on the hydrologic cycle is complex, multi-layered. The climate system, directly or indirectly affect the process of water circulation by precipitation, temperature, sunlight, wind, humidity and other factors. The output of the climate system, the effect of precipitation on water cycle is the most direct. Analysis of climate change of water cycle evolution characteristics is influencing foundation of assessing the future climate change to the valley

hydrology and water resources. There are two kinds of driving factors effects on water cycle, natural and artificial, water cycle system is divided into natural water cycle system, "binary" water cycle system.

(1) Natural water cycle system

Affected by the sun radiation and the gravity of the earth, the water on the earth moves and forms natural water cycle. The water on the earth absorbs solar heat energy, evaporation form, steam rose water vapor to high altitude, along with the atmospheric motion and spread to everywhere in the appropriate conditions and environment, condenses into precipitation, and falling to the ground. Water reaches the surface of the earth, except some intercepted by plants and evaporation, part of the flow moves along the ground becoming runoff, and part infiltrate underground aquifer becoming underground runoff, finally flow into the sea. Then evaporating again, continue to condense into rainfall evaporation, operation flow, reciprocating constantly.

"Binary water" cycle system.

Climate change directly led to precipitation and evaporation and runoff process relates to water cycle. Climate change is the most main driver factor of water cycle. The constant change of the human society, human economic activities harder and harder, human activities this disturbance factors gradually strengthened the influence of water cycle in water resources own evolution process. The interference of human on water cycle, broke original natural water cycle system rules and balance, make the original water cycle system singly led by nature to a new system led by natural and manpower. The water cycle system called natural-artificial "binary" water cycle system. The influence of human activities on the hydrologic cycle mainly includes two kinds of situations: human's direct intervention caused the change of the hydrologic cycle, and the other is caused by part change because of human activity.

IV. THE RESEARCH METHODS OF THE IMPACT OF CLIMATE CHANGE ON WATER RESOURCES

The research of the impact of climate change on hydrology and water resources system is mainly through the basin temperature, precipitation and evaporation change caused by climate change such as to predict the trend may increase or decrease the runoff and its watershed water supply influence. Using the "what-if-then" pattern [10], which assume that a change climate scenario as the hydrologic model input to find out each component in the water cycle in the change of scene.

The pattern often includes the following 4 steps:

(1) Define climate change scenarios

(2) Establish, verification of hydrologic model

(3) Make the climate change hydrologic model of the scene as input and simulate the change process of internal water circulation

(4) Using the simulation results of the hydrologic model to evaluate the climate change on the influence of hydrology and water resources.

V. LITERATURE REVIEW

Climate change is expected to have significant implications for the world economy and, more broadly, for many areas of human activity. The purpose of this review is twofold. First, it is to summarise current estimates of the impacts of climate change and to explain how these estimates are built in order to identify the main sources of uncertainty and approximation affecting them. Second, the paper discusses how this uncertainty should influence policymaker"s decisions. A main conclusion of the review is that there are large uncertainties, which are not fully reflected in existing estimates of global impacts of climate change in monetary units. Nonetheless, despite these uncertainties, policy action may be justified, provided that policies are cost-effective, even if the marginal cost of GHG emissions mitigation exceeds the marginal damage of one additional ton of carbon. This is because two features of the impacts of climate change tilt the balance in favour of action: their irreversibility, and the risk that they are extreme.

VI. CONCLUSION

Climate change scene generation technology changed from simple analysis and transplantation historical data to consider the development of greenhouse gas emissions GCM simulation. Also the hydrological simulation technology has changed from simple statistical model development to consider the atmosphere-vegetation-the exchange of soil distributed hydrological model. But because of the people do not have enough understanding to the atmosphere and the mechanism of the hydrologic cycle and the intrinsic link between them, the current study there are the following several insufficient:

A. There is a large uncertainty of climate model prediction. This kind of uncertainty mainly comes from the uncertainty of emissions scene, GSM and scale degradation technique and the physical process parameter, etc.

B. The present study mainly focused on the reflects of the climate change on runoff process average change, while the research of climate change to the extreme events of the hydrological response and to effect of water quality is rarely.

C. In both precipitation and runoff process of land surface hydrology there are strong time uniformity grid, while most of GCM assume that model of mesh vegetation and soil in horizontal plane is uniform which makes the simulation accuracy is not high.

D. GSM and hydrological model coupling mostly are one-way connection response. This kind of one- way connection coupling lacks of whole, physical unanimously description of the hydrologic cycle. Running alone of climate model and hydrological model can hardly feeds back the change of the land surface hydrologic cycle which was caused by human activities and climate change to climate model.

Therefore, the research of climate change on the influence of hydrology and water resources will tend to higher resolution of regional development space and time climate scenarios; perfect distributed hydrologic model and improve the accuracy of hydrological model in climate change conditions of land surface parameters; development models of the climate and surface hydrological model of land between two-way coupling techniques. Strengthen the research of extreme hydrological events, water quality and water environment and water resources system vulnerability under climate change.

ACKNOWLEDGEMENT

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Low-Cost Construction Material for Concrete As Sawdust

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***Abstract*— Nowadays, there is a very high development in infrastructure and redevelopment of building structure, because of which there is a very high demand in cement-concrete, which in turn is increasing the cost of building materials. The purpose of this paper is to present an idea of using sawdust as partial replacement to sand for preparing a sawdust concrete. With the growth of construction industry, it is also necessary to make the projects more economical, as a result, the idea of using wood waste in concrete so as to make construction more environmental friendly is discussed.**

Keywords—Sawdust, Sawdust Concrete, Conventional Concrete, Cement, Sand, Aggregate

I. INTRODUCTION

In today's day, construction industry is growing at a rapid rate. Buildings, bridges, skyscraper, etc are being constructed which are helping growth of the socio-economic state of the country. However with such growth the initial cost of construction is also increasing due to such rapid rate of construction because of which there is increase in cost of the building construction materials. Concrete is one of the most important building material in construction because of which its demand is also more. So as to make such construction material more economical the idea of sawdust concrete is being studied.

Sawdust is a by-product or waste product of woodworking operations such as sawing, sanding, milling, planing, and routing. It is composed of small chippings of wood. These operations can be performed by woodworking machinery, portable power tools or by use of hand tools. Wood dust is also the byproduct of certain animals, birds and insects which live in wood, such as the woodpecker and carpenter ant.[1]

The basic idea of the research is to make use of such woodwaste to prepare the sawdust concrete which would be more economical and environmental friendly than convention concrete. Such concrete can be used for construction of minor activities which are essential in a construction project which would result in overall cost effective project.

Before using the saw dust it should be washed and cleaned because of large amount of barks are present which can affect setting time and heat of hydration of cement. The published literature's indicates that saw dust or wood chippings or wood savings has the potential to be used in production of lightweight concrete.

II. PROPOSED REQUIREMENT

The materials required for preparing sawdust concrete are as follows:

1. Cement
2. Sand
3. Aggregates
4. Sawdust
5. Water

1) **Cement:** Cement is a fine powder which is manufactured by limestone. Cement is the most important element in making concrete.

Fig.1. Cement

2) **Sand:** Sand is a granular material which can be found at a beach, riverbed, and deserts. There are two types of sand which are used in construction industry, they are manufactured sand and natural sand.

Fig.2. M. Sand

Fig.3. River (Natural) Sand

3) **Aggregates:** Aggregates are also used in preparation of concrete to make concrete mixes more compact.

Fig.4. Coarse Aggregate

4) **Sawdust:** As mentioned in the introduction, sawdust is woodwaste which is generated from woodworking operation. It is a crucial element in preparing sawdust concrete.

Fig.5. Sawdust

5) **Water:** Water is one of the most important elements in construction and is required for the preparation of mortar, mixing of cement concrete and for curing work etc.

Fig.6. Water used for mixing of cement

III. PROPOSED METHODOLOGY

First we conducted literature survey of our project by reviewing several technical research paper related to our topic of research and learnt that use of the sawdust makes the concrete light in weight.[2] We also learnt that the bond between woodwaste and cement paste can be increased by soaking the woodwaste in chemical solutions such as sodium silicate.[3][5] While reviewing more such papers we realized that to prepare a sawdust concrete we cannot replace the sand with sawdust completely, instead partial replacement of sand with sawdust is to be done. The paper suggested that the use of sawdust as partial replacement of sand between 0 to 25% will contributes to reduction in sawdust waste generated in the society without adversely affecting concrete strength.[4][6]

After completing the literature review and getting necessary information regarding sawdust concrete, allocation of best suited sawdust from different types of wood was done. We will collect the samples of such wood waste and procure materials like cement, sand, aggregates used to prepare the concrete. And then we shall prepare the sawdust concrete by using proper design mix for desired strength. After preparing the necessary concrete cubes we will place them into curing tank for 7 and 28 days we shall conduct required tests. Similarly we will also prepare conventional concrete block and perform test on it. The acquired results will be analyzed and the report for conclusion will be showcased.

Tests Performed on Materials-

1) Cement- Fineness Test by Sieve Analysis

Fineness of cement represents the particle size of cement. More cement coarse particles affect and reduce the rate of hydration. If the hydration rate decreases, then it impacts the strength development of concrete or mortar. More fineness means high concrete workability and thus increases the setting time. Hence it is necessary to make sure that fineness of cement is less than 10% as per IS recommendation.

Fineness test of cement is performed by sieve analysis method. To conduct this test a IS sieve of 90 micron, sieve lid, weighing balance and cement is used. First 100 gram of cement is taken and noted as W1 and then it is placed in 90 micron IS sieve. The sieve is covered with the sieve lid. After that the sieve is shook with hand for 15 minutes. After that weight of retained cement on 90 micron IS sieve is taken as W2. To calculate fineness of cement (W2/W1)*100 formula is used. Average fineness value came to be 5.47%.

2) Sand- Silt Content in Sand

Sand should be tested for the presence of clay, silt, moisture and other deleterious materials that may affect the strength of a structure and cause avoidable rework. The presence of excess quantity of silt in sand reduces the bonding capacity of raw materials and affects the strength and durability of work.

For silt content test, water with salt is added in a measuring cylinder upto 50ml and then sand is added upto 100ml. Again water with salt is

added upto 150ml. The solution is shook vigorously and allowed to rest for 1 hour. A thin layer of silt is found between the sand and the water. The silt content was found to be 4.47% which is less than 8% hence sand sample is okay.

IV. FLOWCHART

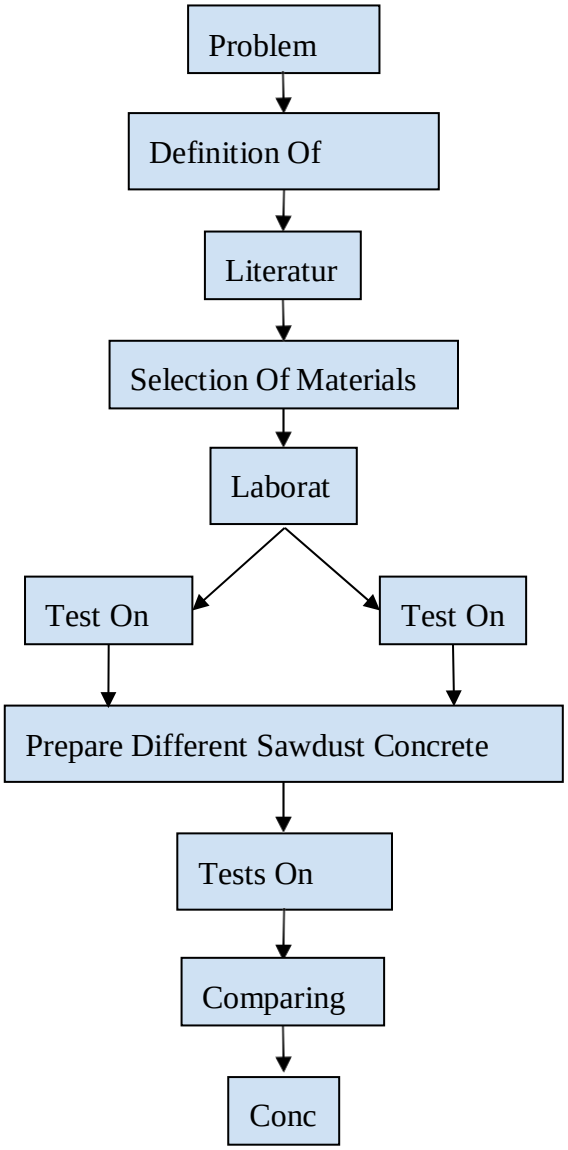

Fig.7. Flowchart

V. RESULT

The final result should lead to the sawdust concrete giving similar strength and durability as conventional concrete without much reduction in strength. The sawdust concrete would prove to be more economical and environmental friendly than conventional concrete.

VI. FUTURE SCOPE

As the construction industry is growing at a faster rate, it would be very helpful and convenient to use sawdust concrete in minor works of construction then traditionally used conventional concrete which would help in keeping the project economical. Also in the future, with new technology and techniques the idea of sawdust concrete can be more developed and ultimately be able to replace use of conventional concrete leading to more eco-friendly construction..

VII. CONCLUSION

The strength of sawdust concrete would not be compromised with the replacement of sand with sawdust and the use of sawdust concrete would be more economical and environmental friendly than conventional concrete and would lead to betterment of construction industry.

ACKNOWLEDGMENT

The following work ‘Low-Cost Construction Material for Concrete as Sawdust’ can’t be created by a single person. The timely completion of the work has been possible due to the guidance of our mentor Mr. Ninad Khandare who imparted his knowledge regarding the topic on us and with her continual motivation, this work was completed. We are also thankful to the Department HOD Dr. Seema Jagtap for allowing us to use the lab equipment’s which were required for our project, and to our parents for providing us with all possible resources. We also thank our college ‘Thakur College of Engineering and Technology’ for providing us with a platform and the necessary facilities to make this project possible.

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Waste Ceramic As A Low Cost And Eco-Friendly Materials In The Production Of Sustainable Mortars

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***Abstract*—**

Reducing the use of natural resources and ensuring proper reuse of industrial wastes are among the most practical potential solutions for sustainable development and a cleaner environment. The generation and disposal of waste materials that cause severe ecological impacts must be inhibited. Based onthese ideas, we propose the utilization of ceramic waste, which is inexpensive, abundant, and environmentally friendly, as a partial replacement for cement and fine aggregates in the preparation of some new types of mortars. This study investigates the long- term performance, mechanical properties, and durability of a mortar comprising ceramic waste as supplementary cementitious material and ceramic particles as fine aggregates.

The use of ceramic products (tiles, electrical insulators, sanitary fitting, etc.) in building and structural construction is increasing day by day. Generation of ceramic waste is increased globally dueto the fragile nature of ceramic it easily breaks during processing, transportation, and installation. Therefore,researchers are growing interest in using ceramic waste as alternative aggregate materials for construction. Thus, the current study focuses on the mechanical (compression, tensile, flexural, and abrasion) and permeability characterization of waste ceramic wall and floor tiles aggregate concrete. Ceramic tiles were used as crushed coarse aggregate in concrete as a replacement for natural aggregates by thereplacement level of 0%, 5%, 10%, 15% 20%, and 25%. The study of these materials to helps the optimum percentage of replacement with cement in concrete and reduce the environmental impact by the utilization of waste and high consumption of cement in mortar as well as in concrete.

I. INTRODUCTION

Concrete has been widely accepted for prominent construction material, mainly of its affordability, performance, and ease of working. Natural aggregate is a major constituent of concrete obtained from the extraction of earth. To fulfill the demand for natural aggregate there are various industrial waste materials like granite, marble, ceramic, glass, plastic waste, sintered fly ash aggregate, demolished waste, etc. Many researchers used different materials as a replacement of natural aggregate at various dosages and examined mechanical and durability properties. Ceramic products are part of the essential construction materials used in most buildings. Some commonly manufactured ceramics include wall tiles, floor tiles, sanitary ware, household ceramics, and technical ceramics. They are mostly produced using natural materials that contain high content of clay minerals. However, despite the ornamental benefits of ceramics, its wastes among others cause a lot of nuisances to the environment.

Ceramic products are one of the main building materials. Common types of ceramics include bricks, blocks, floor tiles, roof tiles, wall tiles, sanitary, household and technical ceramics. Ceramics aremostly produced using natural materials that contain high content of clay minerals. However, despite the ornamental benefits of ceramics, its wastes among others cause a lot of nuisance to the environment. The main sources of the ceramic waste are originated from the wastes of ceramic industry, a leftover of the newly constructed buildings, and demolition of old buildings. In India, for example, specific guidelines and rules have been created to contain the ever-increasing industrial waste. Such progress and headways are always a great step towards integrated sustainabledevelopment, but there

is still much vacuum in this area. In the case of ceramic industries, India is a significant producer of ceramic waste, due to the rapidly growing ceramic industry in the country. The production of ceramics in India has been growingrapidly in recent years, driven by the demand forbuilding materials, consumer goods, and otherproducts made from ceramics.

According to recent estimates, the ceramic industry in India generates hundreds of thousands of tons of waste each year, including broken tiles, sinks, toilets, and other discarded ceramic products. This waste is generated from various stages of the production process, including production, transportation, and disposal of finished products.

The production of ceramic waste in India is a result of various factors, including poor quality control, inefficient production processes, and a lack of proper waste management infrastructure. Additionally, there is a lack of awareness about the dangers of ceramic waste and the importance of proper disposal, which contributes to the growing problem of ceramic waste in the country. The production of ceramic waste in India is a significant issue that needs to be addressed in order to protect the environment and public health. To address this issue, In this study, our aim is to utilize the ceramic waste generated due to the demolition of old buildings and waste left over due to the construction of new buildings.we have been focusing on the replacement of cement and sand by using ceramic waste and studying the various properties of concrete

1. Review of Literature:-

Very few of research is found in the literature review which was related to the environmental use of ceramic waste in the production of concrete.Extract some of the findings from the past research and mentioned in this papers

Akash Agrawal et al [2020] : In this research researcher were performed to determine the density, workability and mechanical strength parameters like compressive and flexure strength of concrete. Mix Proportion of 1:2:4 was prepared and 5%, 10%, 15%, 20%, 30%, 40% and 50% replacements were made simultaneously, keeping W/C as 0.5 and using 2% Plasticizer. The results indicated that the ceramic waste can be utilized as fractional replacement of cement up to 15% and both fine and coarse aggregates up-to a level of 40% with similar strengths and workability.

Salman Siddique et al. (2018) have studied the use of ceramic waste as a partial replacement of fine aggregate. In this research, the researcher utilized fine bone chinaceramic aggregate (FBA) as a replacement of fine aggregate in cement concrete in different proportions (20%, 40%, 60%, 80% and 100%). Researchersinvestigate the strength of wear due to abrasion, voids percentage, the difference in compressive strength andmass as a result of freeze and thaw process, resistanceagainst drying and wetting conditions, chloride penetration and corrosion by conducting suitable tests.Researchers conclude that the concrete mixes with 40% and 60% fine bone china ceramic aggregate (FBA)content were found to have the least comprised energy and emission of carbon dioxide. From the perspective of economy, the concrete mix with 100% fine bone china ceramic aggregate (FBA) content was found to be the most economical in case of low strength concrete. The results of experiment is indicated that fine bone china ceramic waste can be utilized as a replacement of fineaggregate to produce durable and high strength concrete **Dr. K. Ramadevi et al. (2017)** have used of ceramic waste which comes from Construction & Demolition waste in concrete as a replacement of fine aggregate. In this research, M20 grade of concrete were used and deliberate using various percentages (0%, 25%, 50% and 75%) of ceramic waste replaced for fine aggregates. From this results, it is found that 50% replacement by ceramic waste gain more strength and gives better result. Beyond 50% replacement, the strength decreased. The strength loss may be due to an increase in consumptionof water

Prof. Shruthi et al. (2016) have used solid ceramic waste as a replacement for coarse aggregate in M20- grade concrete, In this study , Natural coarse aggregate is replaced by waste ceramic tiles broken pieces with the proportion of 0 to 30 % by weight of natural aggregate required for M20 grade concrete . The cube and beam were casted for 3,7 and 28 days and tested the strength in CTM machine . It is found that the strength has been achieved with the replacement of 30% of natural coarse aggregate with ceramic waste .

Hardik Patel et al. (2015) have utilized Ceramic Waste Powder as a supplementary product in cement concrete. In this research they have taken ceramic waste powder from ceramic wall tiles industry and utilized as replacement to cement in concrete in different proportions such as 10%, 20%, 30%,40%, 50%, and 60% by weight of cement in concrete for M 25 grade and they have compared the obtained results with standard concrete. After the conduct, various tests they conclude that concrete on 30% replacement of cement with ceramic waste powder compressive strength obtained is 33.45N/mm2 (30% ceramic waste powder & 2% Na2SO4) they suggested. By using of ceramic waste powder as supplementary material in concrete cost is minimize up to16.3% in concrete having the grade M25 becomes cheape rwith satisfying the expected mechanical properties of concrete. By following the same proportion of replacementsplit tensile strength of concrete mix is 3.95 and only about1% of loss is detected with compare to standard concrete.

G. Sivaprakash et al. (2016) have performed study to utilize the ceramic waste aggregate as supplementary material of natural fine aggregate in cement concrete. This research includes the investigational study of M25 grade concrete with is having the partial replacement of natural sand with the use of ceramic waste. To analyze the mechanical properties like split strength, flexure tensile, compressive strength by conducting various tests the cubes are molded with replacement of natural fine aggregate using ceramic waste in proportion of 10%, 20%, 30%, 40%, 50% and tested after different curing age like 7 days, 14 days and 28 days. The maximum percentage addition of ceramic waste is experimented with respect to the mechanical properties of concrete as per the requirements. Researchers conclude that replacement of natural fine aggregate with the use of 30% ceramic waste in concrete achieves desired strength and can be measured as optimum percentage. [7]

Objective of Project :-

The objective of this study to replace ceramic wastematerial generated from the demolition of old structures or waste left over in new construction of building with cement and sand .

- To Study the mechanical properties of mortar by adding ceramic powder
- To study the mechanical properties of concrete by replacement of cement with ceramic waste and fine aggregate

2. Materials

In this experimental study, we are decided to prepared the volumetric concrete mix in the ratio 1:1.5:3. In this study of project , we are planning to use OPC or PPC cement ,course garde aggregate of size 20 mm and 12.5 mm size ,Natural River sand of Zone-II whose maximumgrain size was 4.75 mm used.For the mixing of concrete, water-cement ratio (w/c) of 0.5 and superplasticizer if required. For this experimental study damaged tiles of different brands will be using as ceramic waste. Then it will crushed by using jaw crusher and will besegregated through 20mm sieve and retains on 12.5 mm sieve for coarse aggregate and sand passing sieve 4.75 mm and retained on 150 microns for replacement with fine aggregate and finally grinded to powder form for replacement with cement.

Table 1
Physical and chemical characteristics of the GC and OPC.

Materials		GC	OPC
Physical properties			
Specific gravity		2.35	3.15
% Passing through 45 μm wet sieve		95.0	90.0
Medium particle size (μm)		35	40
Chemical contents (% by mass)			
CaO		1.13	68.30
SiO_2		74.10	16.40
Al_2O_3		17.80	4.24
K_2O	0.44	0.22	
Fe_2O_3	3.58	3.53	
SO_3	0.023	4.39	
MgO	1.24	2.39	
LOI	0.10	2.40	

3. Proposed Methodology:-

After reading the literature papers, It was found that various types of ceramic waste are generated from the industries. For this project, we have decided to focus only on waste generated from the demolition of the old structure ,Here we will only consider the different types of tiles waste . In fig 4.1 shows that conversion process of wasteceramic tiles into coarse

Fig. 1. The process to produce ceramic fine aggregates and ground ceramic from ceramic waste.

aggregate,fine aggregateand ceramic powder.

In first phase of project , we will study the materials properties like particle size distribution, the specific gravity of aggregate and water absorption as well as Impact test . Physical and chemical properties of ceramic waste and try to study the pozzolan properties of materials which helps to binding the ceramic waste with cement.

In part A our project the ceramic waste tile powder is partially replace with cement in the percentage of 5%, 10%, 15% & 20% by weight of cement and conduct the test of consistency ,initial and final setting time of cement and observe the behaviour of cement due to additionof ceramic waste powder.

In part B we will replace the cement with ceramic waste powder in the proportion of 10%,20% and 30 % and prepare a concrete cubeof size 150 x 150 mm . also we will prepare a beam of size 150 x 750 mm . workability , Density, Compressive and flexure

In part C, the fine aggregate was partially replaced by crushed ceramic sand and ceramic coarse aggregate respectively in the percentage of 10%, 15%, 20%, 25%, 30%, 40% and 50%
by weight. The workability test of fresh concrete will test according to IS: 1199:1959 [14] using a slump cone of size 100 x 200 x 300 mm. The compressive strength of concrete specimens will test according to IS: 516- 1959 [15]. For this experiment, cube specimens will be cast and cured for 7, 14, and 28 days. Flexural strength
will perform on 7, 14 and 28 day's cured specimens as per standard IS: 516-1959 [15] on the 100 ×100×500 mm beam specimen. However, if we get positive results of the above-mentioned experiments, we would be encouraged to use design mix concrete for moreappropriate testing results.

CONCLUSIONS

The conclusion is based on reviewing the literature above are as follows:

- The optimum level of ceramic waste replacement should be between 5 to 30% in order to obtain maximum strength of the concrete. In first phase we validate our result with the researcher results
- The best possible ceramic waste must be found out which will be suitable to be used as a substitute for conventional coarse aggregate.
- Research should be made with ordinary concrete like M15 and M20 as this type of concrete only is commonly adopted, by considering this as a gap we are going for higher grade of concrete.
- The ceramic waste to be used should be deglazed and a lower cement ratio should be adopted so as to achieve the desired targeted strength.

We are replacing the cement, coarse aggregate and fine aggregate with ceramic waste to provide morestrength to the concrete by adding more or less percentage of ceramic waste.

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Building Redevelopment: The Process and The Socio-Economic Effect

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***Abstract:* - In most cities of developing countries, old buildings always tend to undergo redevelopment. There are one or more than one reasons for this. Such as buildings which are in dilapidated condition or uneconomic to repair ortenants are in a need of more usable floor area. This activity of building redevelopment is much visible in Mumbai city for past decade and half. Because of various constraints and considerations, this process of projects of building redevelopment is quite complex. It takes considerable effort and time to accomplish the projects. If a proper and time bound process is not followed, or if the risks, uncertainties and challenges are not handled properly, even a seemingly simple project can fail, thereby causing great anguish and hardship to the stakeholders. Sometimes this may lead to prolonged litigation. There is a need to identify risks and challenges involved in the process of building redevelopment projects. The aim of researchers is to interact with all the stakeholders of building development projects of housing societies and identify various risks and challenges. The studyhas also revealed various pitfalls and uncertainties related to these projects. This will enable concerned stakeholders to prepare to address these.**

Keywords:- Challenges; Housing Societies; Redevelopment; Risks.

I. INTRODUCTION

If your Society is planning for Redevelopment, then the members of the Society should be familiar with the process for undergoing Redevelopment. The following points will make understanding the Redevelopment process better.

●What is Redevelopment?

Redevelopment means demolishing the Old Structure and replacing the same with New Structure with new Dimensions and Space

●What is the difference between Restoration and Redevelopment?

In restoration, the existing Building is extensively repaired and restored to its original condition. In Redevelopment, the existing building is demolished, and new structure of different dimensions is constructed.

●When should be redevelopment be considered?

As per Bye-law no. 77, a Structural Audit of the Building is to be conducted when the building is more than 30 years old. The Report of such Structural Audit would reveal the condition of the building and indicate whether the Society needs Redevelopment.

●Who is the authorized person to conduct StructuralAudit?

The Structural Audit is to be conducted only by a government an Droved Architect.

●Can a Society go in for Redevelopment withoutconducting a Structural Audit?

Conducting Structural Audit is mandatory since it is the first

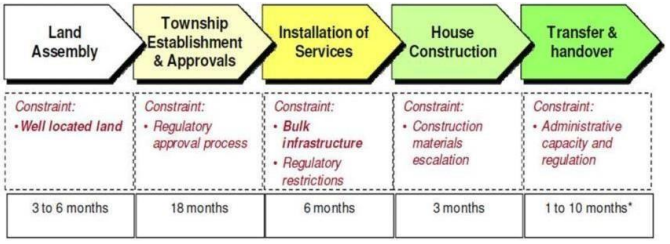

Figure 1: Steps for Redevelopment

and the foremost step to be taken for deciding Redevelopment as Structural Survey is required to be carried out for both the building and the adjacent structures.

●Can a Society opt for Redevelopment if it is below 30 years of age?

It all depends on the Structural Report and its findings.

●Can a Society opt for Redevelopment even if Structural Report does not recommend it?

No, as the Society will be required to get necessary permissions from all the concerned Auto notes.

II. STARTING REDEVELOPMENT PROCESS

For starting Redevelopment process, the following process should be carefully followed.

●When should a Society consider Redeveloping their Building?

The Society should consider Redevelopment of the building only if an adverse Structural Audit Report is received from an approved Structural Auditor appointed by the Society to do Structural Survey /Audit of the Building as per Bye-Law no. 77 and his report should clearly mention the details of defects /remedies / cost of repairs etc.

●What precaution should the Society take at the time of considering Redevelopment of their Buildings?

Society should consider Re-development only if the Society has Conveyance Deed in their favor. Without Conveyance, the Society should not pass any resolution for re-development but should only move towards major repairs.

●What should the Society do in case of a Structural Audit Report?

In case of adverse Structural Audit Report, the Society should circulate the said Report to all the members of the Society within one month of receipt of such report along with their recommendations and check for the consent of all the Members of the Society in writing within 14 days of circulation of Report giving their opinion whether they would like to go for Repairs or Redevelopment.

●Whether individual consent of all the members is required for redeveloping the society's buildings or only a Resolution by the General Body will be sufficient?

A written consent required from each and every member of the Society for carrying out Redevelopment. Unlike the SRA Project, in a Registered Co-operative Housing Society,100% consent of all the members is required before the Society can go ahead with Redevelopment.

●What is the consequence if Consent is not received from all the members for carrying out Redevelopment?

All the members of the Society do not give their Consent for Redevelopment, then permission for Redevelopment will not be granted by the concerned authorities like the Dy. Registrar of Co-operative Societies and the BMC.

●Can a member change his decision after giving his Consent in writing for Redevelopment?

Consent obtained from the members is irrevocable and embossed with Rs. 100/- stamp. Hence, once Consent is given by a member, it cannot be revoked. Only if a member has a strong reason to retract his Consent, then he has to follow the Legal procedure for proving his point of discontent for retracting his consent.

Figure 2: Steps of a Construction Project

●Can a minority member stall the process Redevelopment?

It depends on what proportion of minority is stalling the development and the reasons behind stalling the project. If the reasons for stalling the project are strong. then redevelopment cannot proceed unless the issues with them are settled

●Can one or two members hold the Society to ransom on flimsy grounds?

No member of the Society can hold the Society to ransom on flimsy grounds. Society will have to initiate action against such members.

●What action can the Society initiate against those members who oppose such kind of a move that is supported by a huge Majority?

Then Society can issue show cause notice to the members and take action even to the extent of Expulsion from the society.

●Does a Society require to form a Redevelopment Committee can a Managing Committee carry out the job independently?

The General Body has the powers to decide on this issue. Appointing a Redevelopment Committee is not mandatory but is highly recommended to ensure transparency in the dealings.

●What are the Powers of the Redevelopment Committee?

The General Body must decide on the powers to be allocated to the Redevelopment Committee. Generally, the following powers are to be given to the Redevelopment Committee:

• To approve or reject the proposal placed before them by the Managing Committee of the Society.

• To give suggestions, if any, regarding the Proposal placed before them by the Managing Committee.

●What is the tenure of the Redevelopment Committee?

Generally, the tenure of the Redevelopment Committee should be from the start of the Project to the completion of the Project to ensure the continuity of the control of the Project.

●Whether elections are to be held for selection of members for the redevelopment Committee?

The Election Rules are not binding on the Redevelopment Committee. They should be selected by the General Body from amongst senior members of the society who are educated to read and understand the various Documents and have active interest in redeveloping the Society.

●Can a Redevelopment Committee member of a Redevelopment Committee be terminated?

If the General Body feels that a member of the Redevelopment Committee or the entire Redevelopment Committee acts to the detriment of the interests of the Society and obstructs the working of the Managing Committee in carrying out Redevelopment, then on the recommendation of the General Body, the tenure of a members Redevelopment Committee or the entire Redevelopment Committee can be terminated.

III. REDEVELOPMENT DOCUMENTS

For successful completion of Redevelopment, the Office Bearers of the Society should be aware of the Documents to be kept ready and the Documents to be obtained from the Builder.

●What is the list of important Documents required for starting Redevelopment?

1. Society Registration Certificate.
2. 7/12Extract.
3.Formno.6fromRevenueOffice.
4.ConveyanceDeed/Lease Deed/Sale Deed.
5. Search Report and Title Certificate.
6. Index I
7. N.A. Order.
8. Development Agreement.
9. City Survey Plan.
10. Approved Building Plan.
11.Copy of I.O.D.
12. Commencement Certificate.
13.Occupation Certificate.
14.Completion Certificate.
15. Agreement forSale.
16.Stamp Duty paid proof.
17.Registration Charges paid proof.
18.Appointment Letter.

●What are the Documents needed to be prepared for Redevelopment?

1. Feasibility report.
2. Suggestions from members.
3. Public Notice for inviting the Tender.
4. Minutes of various Meetings.
5.Correspondence with different Authorities.
6. Obtaining required permission from Deputy Registrar, BMC, ULC Department, Na Department etc.
7. Tender Form.
8. Summary of Tenders received.
9. Approval of Tenders in the General Body meetings and preparation of Draft and Final Minutes.
10. Appointment letters to Advocate, Structural Engineers, Architect, Project Management Consultant etc.

●What are the various Documents and Agreements to be prepared in the process of Redevelopment?

1. Redevelopment Agreement.
2. Indemnity Bond by the Developer.
3. Format of Bank Guarantee from the Builder.
4. Power of Authority from Society to the Developer.
5. Agreement for alternate accommodation.
6. Consent letters from the members of the society.
7. Consent Letters from the members of the Society to Builder/Developer/BMC.
8.Memorandum of Understanding (MOU) between the Society and Builder/Developer.
9.Appointment Letter from the society to the Builder/Developer.
10. A session better from the Builder to the Members.
11. Application by new members to the Society for becoming members in Form no. 3.
12. Undertaking from the new members to the society.
13. Format of the Resolution to admit new members.
14. List of Documents required to be collected from the Builder.
15. Revocation / Cancellation of Power of Attorney.

●What are the requirements from the Developer?

1. Partnership Deed of the Developer duly registered OR Memorandum of Association (as the case may be)
2. Copy of Registration Certificate.
3. Name and address of the Partners/Directors along with their PAN.
4. Copy of PAN of the Firm.
5. Income Tax Return filed for the last 3 years of the Partners/Directors of the Company.
6. Service Tax Registration no.
7. Copy of Balance Sheet and PL/ A/c to understand the Financial strength of the Firm /Company.
8. Feasibility Report from the Developer as to how they would develop the Property at the offers given by them.

IV. SUCCESSFUL REDEVELOPMENT

●What are the points to be noted for successful Redevelopment?

1. The offer received from the Developer should be commensurate with the potential of the Plot taken for redevelopment as per Architect's report.
2. The Builder should be strictly chosen based on his Financial Capacity and Track Record and not based on the highest offer received.
3. The Tenders received should be objectively evaluated by an able Architect appointed by the society.
4. All the members of the Society should give their Consents to avoid disputes.
5. Complete details of the offers made by the Developer should be clearly understood by all the members of the Society and there should be transparency in the dealings.
6. Redevelopment Committee should be formed from amongst the other members of the Society by including two or three members from the Managing Committee to oversee the entre Redevelopment process to ensure that complete transparency is maintained by the Managing committee of the society.
7. All Agreements / Documents should be got scrutinized by a competent Advocate appointed by the society to ensure that
8. Bank Guarantee for the total cost of the Redevelopment Project should be obtained from the Developer covering the run period or construction.
9. Penalty Clause should be inserted in the Redevelopment Agreement to ensure proper implementation by the Developer.
10. The Managing Committee and the Redevelopment Committee members should conduct regular inspection when the construction is in process to ensure that there are no deviations from the plans / offers.

V. REDEVELOPMENT IN A NUTSHELL

Complaints received such as.....

- Members are not taken into confidence.
- Transparency not observed in the Tendering process
- Appointment of Contractors in a haphazard manner.
- Breaches of the provisions of the M.C.S. Act, rules and Bye-laws in the working of society.
- Lack of Co-ordination between appointed Engineer and Project Consultants.
- Non preparation of Feasibility Report.
- Proper procedure not followed in the selection of Tender.

- Disparities in the Development Agreement.
- The Commissioner for co-operation and Registrar of Co-op. Societies, Maharashtra State, Pune, held discussions with Concerned experienced professionals.
- Appoints a Study Group under the Chairmanship of the Jt. Registrar of Co-op. Societies, CIDCO.
- In conclusion under Section79 (A) of the M.C.S. Act 1960, the Government has issued Order known as "Order of Redevelopment of the Co-op Hsg Society's Buildings"
- For conducting SGB, Application of requisition signed by Notes than Method of total members to be considered.

- Most important the MC is required to be a properly elected body constituted as per the provisions of the MCS Act 1960 Duties of MC & SGBM.
- Carryout survey of the Land and Building
- Seek information regarding the conveyance
- Seek information about available F.S.l. and T.D.R
- Study Rules of the MHADA / S.R.A. / Municipal Corporations, as applicable from time to time
- To prepare a feasible project & later prepare Project Report within month storm the date of their appointment

AFTER RECEIPT OF THE REDEVELOPMENT PROJECT REPORT

- Copy of the Project Report to be made available to the members for the inspection.
- Members should submit their suggestions, min 8 days before Managing Committee Meeting
- Suggestions received from the members to be sent to the Architect /PMC for their consideration, 7days before the Jt. Meeting
- Hon. Secretary of the society to call a joint meeting of M C and appointed Architect / PMC by issuing notice and obtaining acknowledgement of the same
- Obtain approval from majority towards the submitted Project Report.
- MC to call quotations from minimum five Architects or (PMC) Project Management Consultants who are Empaneled with the government or any focal competent. authority.
- Architect/PM to prepare provisional draft of the Tender
- Special General Body Meeting to select the PMC.
- Tenders to be floated inviting competitive offers.
- To submit the proposed Redevelopment project of the
  i)One of the primary requirements is to be Unchangeable.
  ii)Building Duties of Members.
  iii)Either carpet area or corpus fund - in the case of Developer.
- Submit your inputs, suggestions, recommendations and experienced expert Architects/PMC's in writing along with their approval letter minimum 8 days before date of the meeting
- Min 3/4th Attendance required at SGBM
- Primary resolution required to be passed After the approval of the Resolution for Redevelopment, Meeting will consider following business:
  i) Approve the Terms and Conditions along with the scope of the work to be carried out.
  ii) Minutes of the Meeting to be circulated within 10 days to acknowledgement.
  iii) Copy of the minutes to be sent to the office of the Registrar.
  iv) Issue letter of Appointment to the Architect /PMC selected by the SGM within 15 days of the meeting.
  v) Architect/PM to prepare provisional draft of the Tender.
  vi) Special General Body Meeting to select the PMC.

- Submit your inputs, suggestions, recommendations and experienced expert Architects/PMC's in writing along with their approval letter min 8 days before date of the meeting.
- Min 3/4th Attendance required at SGBM and Primary resolution required to be passed.

After the approval of the Resolution for Redevelopment, Meeting will consider following business:

i) Approve the Terms and Conditions along with the scope of the work to be carried out.
ii) Minutes of the Meeting to be circulated within 10 days to acknowledgement.
iii) Copy of the minutes to be sent to the office of the Registrar.
iv) Issue letter of Appointment to the Architect /PMC selected by the SGM within 15 days of the meeting.
v) Publish list of the Tenders received till the last day on the Notice Board of the society.
vi) Within 15 days of the last date of the receipt of the Tenders, Hon. Secretary to call Special Meetings of the Managing Committee to be attended by the official representatives of the Developers interested members 15 Tender's.

- All the received Tenders will be opened in the presence of all the people participating in the meeting.
- Architect/ PMC will conduct scrutiny of all the Tenders and prepare a compared chart.
- Selection of minimum 5 Tenders to be placed before the SGM
- Concerned other non-present Tenderers to be informed accordingly.
- Within 8 days, Society to apply to the Registrar, C.S. to appoint Authorized Officer for attending Special G.B Meeting
- The Registrar to appoint Authorized Officer.
- Selection of Developer on the basis of experience, caliber, Market status, technical expertise and competitive rates.
- Within month of the appointment of the Authorized Hon. Secretary with prior permission fix day, date, time and venue of the SGM.
- Notice of SGM to be hand delivered as well as sent to every member by Registered A.D. Post acknowledgements be kept in Society s Records.
- Representative of the Registrar's Office will ensure presence of Official Representative of the Tenderers.
- Within 8 days Society to apply to the Registrar, C.S. to appoint Authorized Officer for attending Special GB Meeting
- The Registrar to appoint Authorized Officer.

MOST IMPORTANT

- Video Shooting of the SGM, at the expenses of the society
- Only Bonafede member of the society shall be eligible to attend the SEMI
- Members would require carrying their individual

identification papers to attend the meeting.
- Complete business of selection of Developer (Contractor) and all the matters to be carried out in presence of the Authorized Officer.
- In case of no quorum meeting will be dissolved considering the members interest in the Redevelopment of the society building
- Subject cannot be brought before an SGM for its approval for further.

- Comparative information will be presented regarding the selected Tenders to be considered. (With regards to Redevelopment work).
- Tenders to be presented in serial order.
- Selection of one Developer, with Terms and Conditions, for Redevelopment.
- Finalize Tender with approval from selected Developer
- Present information about the further work.
- Procedure of inviting application for booking the saleable flats.

also.
- Agreement should be registered under Registration Act 1908.
- Agreement shall have specific mention of the agreed Carpet Area.
- Building Plans which are approved by the Municipal Corporation / Competent.

Authority shall be again placed before the General Body Meeting for information. A member wishing to have a copy of the approved Documents can get the same on his written application. The committee is bound to issue the information on charging a reasonable fee.

Selection Process.
- 3/4th majority of the present members shall give in writing their approval selected contractor or their representatives who do not register their presence for the S G M will be considered as having given their consent for the Redevelopment proposal and further process will be carried.
- Managing Committee shall make an Agreement with the Contractor within one month.

Important Points regarding Agreement with Contractor:
- Suggestions from appointed Architect / PM C along with other important issues should be included.
- Completion period of Redevelopment shall not he more than 2 years and in special cases not more than 3years in case of any exigencies
- Contract terms & conditions given to the Contractor will be non-transferable
- Agreement between contractor, Architect and society shall have a condition that disputes, if any, on the Redevelopment work shall be settled under Rule No. 91 of the Rules.
- No member of the Committee or Office bearer shall be a Contractor or his relative

Finally, Prime Points for a Successful Venture:
- Implement Democratic Process to carry out the procedure.
- Project always to be by the People for the People.
- Original Members to have first Say.
- Transparency and coordination to be maintained.
- Maintain control on the process and procedure.

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Local and Recyclable Materials for Construction

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***Abstract*— The building industry has not only become a major consumer of materials; it has salsa become a source of pollution. Environmental integrated production and reusing and recycling is of great importance for the competitive position in EU Member States. EU Member States shall ensure that the technical, environmental and economic feasibility of alternative systems is considered and is taken into account before construction starts. The article focuses on Reuse Building Materials as a way for environment protection and sustainable development. Integrated environmental management integrates the requirements of sustainable development and LCA. There are many methods used to reduce waste and increase profits through salvage, reuse, and the recycling of construction waste. Sustainable development as a tool to continual improvement cycle and with processes innovation the need to save money in the processes via reduced resources and utility costs. This article demonstrates that alternatives to modern building materials are available.**

Keywords: **environment, management, reuse, salvage, sustainable development**

I. INTRODUCTION.

All systems recycle. The biosphere is a network of continually recycling materials and information in alternating cycles of convergence and divergence. As materials converge or become more concentrated, they gain in quality, increasing their potentials to drive useful work in proportion to their concentrations relative to the environment. As their potentials are used, materials diverge, or become more dispersed in the landscape, only to be concentrated again at another time and place. Fitting the patterns of humanity to these material cycling pathways has become paramount in importance as our numbers and influence on the biosphere increases [11]. Directive 2002/91/EC on the energy performance of buildings (the EPBD) requires several different measures to achieve prudent and rational use of energy resources and to reduce the environmental impact of the energy use for buildings. This is to be accomplished by increased energy efficiency in both new and existing buildings. One tool for this will be the application by Member States of minimum requirements on the energy performance of new buildings and for large existing buildings that are subject to major renovation (EPBD Articles 4, 5 and 6). Other tools will be energy certification of buildings (Article 7) and inspection of boilers and air-conditioning systems (Articles 8 and 9). A basic requirement for measures in Articles 4, 5, 6 and 7 is the existence of a general framework for a methodology of calculation of the total energy performance of buildings, as set out in Article 3 and the Annex to the Directive [1]. directive 2002/91/ec of the european parliament and of the council of 16 December 2002 on the energy performance of buildings in article 5 says: Member States shall take the necessary measures to ensure that new buildings meet the minimum energy performance requirements referred to in Article 4. For new buildings with a total useful floor area over 1 000 m2, Member States shall ensure that the technical, environmental and economic feasibility of alternative systems such as:

•Decentralised energy supply systems based on renewable energy, Issue 5, Volume 4, April 2008 CHP, district or block heating or cooling, if available,heat pumps, under certain conditions,is considered and is taken into account before construction starts [2]. In order to stop the global warmth due to the CO2 concentration, the energy use should be decreased. The investment of the building construction industry in Japan is about 20% of GDP. This fraction is much higher than in most developed countries. That results the Japanese building construction industry including residential use consumes about one third of all energy and resources of the entire industrial sectors. To save energy as well as resource, the recycle of building materials should be urgent to be carried out [12].

II. PROPOSED FRAMEWORK

The following framework is proposed to promote the use of local and recyclable materials in construction: Research and Development:

1. Research should be conducted to identify and evaluate local and recyclable materials that can be used in construction. This research should focus on the availability, properties, and potential applications of these materials.
2. Standards and Policies: The development of standards and policies can help promote the use of local and recyclable materials in construction. Governments, regulatory bodies, and industry associations can play a crucial role in creating and enforcing standards and policies that promote the use of eco-friendly materials in construction.
3. Education and Training: Education and training programs should be developed to promote awareness of the benefits of using local and recyclable materials in construction. This can include training for builders, designers, engineers, and other construction professionals on how to source, test, and use these materials effectively.
4. Material Sourcing and Supply Chain: The development of a reliable supply chain for local and recyclable materials is crucial to promoting their use in construction. This can include identifying and engaging with local suppliers, developing partnerships with waste management companies, and creating material recycling programs.
5. Green Building Certification: The integration of green building certification programs can encourage the use of local and recyclable materials in construction. Certification programs can provide incentives for builders and designers to incorporate eco-friendly materials into their projects and can increase the value of properties that have these features. Collaboration and Partnership:
6. Collaboration and partnership among stakeholders, including builders, designers, governments, regulatory bodies, and industry associations, can help promote the use of local and recyclable materials in construction. This can include sharing knowledge, resources, and expertise, and working together to develop innovative solutions for sustainable construction practices.

III. PROPOSED ARCHITECTURE & METHODOLOGY

Architecture:

The proposed architecture for the use of local and recyclable materials in construction involves three main stages:

1. Material selection and sourcing: This stage involves researching and identifying suitable local and recyclable materials, and establishing a reliable supply chain for these materials.
2. Design and construction: This stage involves integrating the selected materials into the building design, and constructing the building using eco-friendly construction practices and techniques.
3. Maintenance and management: This stage involves maintaining the building and managing its operations to ensure optimal performance and efficiency over its lifespan.

Methodology:

The methodology for using local and recyclable materials in construction involves the following steps:

1. Material identification: This step involves identifying suitable local and recyclable materials based on their availability, properties, and potential applications.
2. Material testing and evaluation: This step involves testing the selected materials to evaluate their strength, durability, and other properties that are critical to their use in construction.
3. Material selection: Based on the results of material testing and evaluation, the most suitable materials are selected for use in the building.
4. Design integration: The selected materials are integrated into the building design, taking into account their unique properties and design possibilities.
5. Construction and installation: The building is constructed using eco-friendly construction practices and techniques, with a focus on minimizing waste generation and reducing the building's environmental impact.
6. Maintenance and management: The building is maintained and managed using best practices to ensure optimal performance and efficiency over its lifespan, including regular maintenance and upgrades as needed.

IV. FLOWCHART

1) Start: Construction Project
2) Identify Required Materials
3) Evaluate Local Material Availability:
   -Is the material readily available within a reasonable distance?
   -Is it cost-effective to transport the material to the construction site?
   -Does the material meet quality standards and safety requirements?
4) Determine Recyclable Material Options:
   -Identify materials that can be recycled or repurposed.
   -Assess the feasibility of reusing materials from previous construction projects.
5) Compare Local and Recyclable MaterialOptions:
   -Evaluate the cost and environmental impact of each material option.
   -Determine the availability of each material option.
   -Consider any other relevant factors, such as durability and suitability for the intended use.
6) Select Materials:
   -Choose the most appropriate material options based on the evaluation criteria.
   -Determine the thumber of materials required.
   Source Materials:
   -Obtain the selected materials from local

suppliers or recycling facilities.
-Ensure that the materials meet quality and safety standards.

7) Use Materials:
-Incorporate the materials into the construction project as required.
8) End: Completed Construction Project

V. FIELD SURVEY

The field survey was conducted to gather information on the use of local and recyclable materials in construction. The survey covered various aspects, including the availability of local and recyclable materials, their cost-effectiveness, and their suitability for construction purposes. The survey revealed that many builders and designers are increasingly using local and recyclable materials in construction. This is because these materials are readily available, affordable, and eco-friendly, making them a preferred choice for sustainable construction practices. The survey also showed that local and recyclable materials can be used in various construction applications, such as building walls, flooring, and roofing. These materials have proven to be durable, strong, and energy-efficient, making them an excellent choice for green buildings. Moreover, the survey highlighted that the use of local and recyclable materials can reduce the environmental impact of construction. This is because these materials help to conserve natural resources, reduce greenhouse gas emissions, and minimize waste generation. In conclusion, the field survey has demonstrated that the use of local and recyclable materials in construction is becoming more prevalent, and this trend is expected to continue as more people become aware of the environmental benefits of sustainable construction practices.

VI. RESULT

The use of local and recyclable materials in construction has several positive results that make them an attractive option for builders, designers, and property owners who are concerned about the environment. Some of the key results of using local and recyclable materials in construction are: Reduced environmental impact: Local and recyclable materials can significantly reduce the environmental impact of construction, as they help to conserve natural resources, reduce greenhouse gas emissions, and minimize waste generation. Cost-effectiveness: The use of local and recyclable materials can be cost-effective, as these materials are often readily available and affordable. This can result in lower construction costs and lower operating costs for the building over its lifetime. Energy efficiency: Local and recyclable materials are often excellent choices for insulation and energy-efficient construction, helping to reduce the building's energy consumption and carbon footprint. Durability: Local and recyclable materials are often durable and long-lasting, requiring less maintenance and repair over the building's lifespan. This can result in significant cost savings for the property owner. Aesthetics: Many local and recyclable materials offer unique aesthetics and design options that can enhance the building's visual appeal and create a sense of character and identity. In conclusion, the use of local and recyclable materials in construction has several positive results, including reduced environmental impact, cost-effectiveness, energy efficiency, durability, and unique aesthetics. These results make local and recyclable materials an excellent choice for sustainable construction practices that benefit both the environment and the property owner.

VII. FUTURE SCOPE

The future scope of local and recyclable materials for construction is promising, with an increasing demand for eco-friendly and sustainable practices. Advancements in construction technology, research and development of material properties, and the integration of green building standards and government policies are expected to drive the adoption of local and recyclable materials in the construction industry. This trend is likely to continue as people become more conscious about the environmental impact of construction and the importance of preserving natural resources.

VIII. CONCLUSION

Construction Waste Management is a part of a growing movement toward a sustainable world. Sustainability or “green” management techniques are designed to protect the environment, save resources, and conserve energy. The use of construction waste management techniques which rely on salvage, recycle and reuse of materials have proven to have economic benefits for the construction industry [9]. In our contribution we propose a model of recycling construction materials, made of lightweight concrete, with aggregates containing expanded glass. The scope of the aforementioned model is to plan construction with minimum of waste and to improve energy efficiency in buildings. NSDS follows the general principle of the Renewed EU Sustainable Development Strategy and its key objectives. It covers its key challenges to a satisfactory degree as well and at the same time it integrates the Lisbon goals with the national setting. Slovenia is well aware of the fact that the principle of sustainable development necessitates to be perceived as a continuous process (and not as a one-time document) that has mechanisms set up for monitoring, reporting and adapting of the strategy if necessary. The theory on the basis of the practical experiences envisages sustainable development planning as a process of continuous improvement [20].

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industry, including builders, designers, engineers researchers, government, regulatory bodies, and the construction industry players who have embraced the use of local and recyclable materials. Their contributions have created a positive impact on our planet and have inspired many to join the movement toward sustainable construction practices

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Study on Organic Waste Management-A Case Study

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***Abstract*— A fully matured product from a traditional vermicomposting method takes 45–60 days, which is 25–30 days longer than a rotary drum composting technique. Therefore, the use of rotary drum compost would minimize the vermicomposting period by 15–20 days. Very limited studies were available on combined technologies used for the biodegradation of invasive weeds. In this research, in-vessel composting and vermicomposting technologies are proven to be best in time reduction and produce mature, stable, and nutrient-rich compost that is more superior quality than conventional rotary drum compost. *Esenia fetida, Eudrilus eugeniae,* and *Perionyx Ceylanesis* were used to choose the best earthworm species for surviving with a low death rate and producing high-quality compost. For vermicomposting of pre-degraded waste, four separate reactors were set up: one with *E. fetida* (VrEF), one with *E. euginae* (VrEE), one with *P. ceylanesis* (VrPC), and one sans earthworm species (VrC). Vermicompost made from waste by all earthworm species exhibited a better nutritious value than control. Furthermore, *E. fetida* produced vermicompost with total Kjeldahl nitrogen (TKN) content of 3.24%, 12.87 g/kg total phosphorus (TP), and 22.08 g/kg potassium. The breakdown of complicated chemicals into simpler forms is confirmed by FTIR spectra. To confirm the vermicompost product, a germination assay was conducted on *Vigna radiata*. As a result, vermicomposting is the most effective nutrient recovery method. Weed management and the usage of two-stage compost products in the agro-industry could benefit from the current research.**

I. INTRODUCTION

Due to the increased population and rapid urbanization, solid waste management became a vital environmental threat in the 21st century. There are viable approaches for processing of organic waste locally to convert into valuable products. Composting is the most acceptable and viable option for organic waste management, since it is easier to operate in enclosed areas as long as a good quality product is managed properly. Composting is the process of organic matter degradation in the presence of oxygen under controlled conditions, resulting in a good product that can be used as a soil conditioner for gardening, agriculture, and horticulture, among other applications (Singh et al., 2011). Composting within vessels has demonstrated high efficiency in improving soil characteristics, like soil conductivity, stabilization, tolerance to erosion, soil fertility, and plant nutrition (Celik et al., 2004). In-vessel composting technology is more suitable for organic substrate degradation as it takes less space and time along with better control and high performance (Kim et al., 2008). On the other hand, vermicomposting is also an aerobic degradation of organic compounds involving the use of earthworms to convert the organic compound into a humus-like substance known as vermicompost (Munroe, 2007). Composting and vermicomposting are also commonly recommended as biological waste treatment methods for converting organic waste into usable soil conditioners (Tognetti et al., 2005). In vermicomposting, which does not require a thermophilic process (earthworms may perish if the temperature of the overall reactor or vermicomposting system rises over 35 °C), both earthworms and microbes are closely intertwined to stabilize the organic materials (Riggle and Holmes, 1994). Vermicomposting is a low-cost technology solution that converts agricultural waste into organic fertilizers by allowing earthworms and microorganisms to engage throughout the worm gut (El-Haddad et al., 2014). However, vermicomposting time ranges from 100 days (Garg et al., 2006), 90 days (Bansal and Kapoor, 2000), 75 days (Bharadwaj, 2010) respectively. The main disadvantage of vermicomposting is that it takes longer than in-vessel composting, despite having greater consumer recognition than compost due to its higher nutritional content recovery. Before earthworm inoculation, it is preferred to achieve thermophilic phase (pre-composting), which facilitates pathogen elimination, waste stabilization, poor heat resistance in earthworms, the reduced earthworm mortality rate (Domínguez et al., 1997), and a shorter vermicomposting cycle time. Therefore, composting and vermicomposting can be done in sequence. The thermophilic phase of composting is required for mass reduction, waste stabilization, and pathogen removal before the vermicomposting process (Frederickson et al., 2007). Many researchers have used composting and vermicomposting technologies to solve the issue of terrestrial weeds like *Parthenium hysterophorus* (Rai and Suthar, 2020, Sharma and Chowdhary, 2020, Devi and Khwairakpam, 2021), *Lantana camara* (Devi and Khwairakpam, 2020a, Devi and Khwairakpam, 2020b) and (Rai et al., 2021), *Mikania micrantha* Kunth (Kauser et al., 2020 and Kauser and Khwairakpam, 2021) by converting the biomass into a value-added

resource like compost or vermicompost products. Sharma and Garg (2020) described the 3-week pre-degradation of *Parthenium* and buffalo dung before the vermicomposting process using *E. fetida*, which lasted 90 days. Therefore, most research focused on local/regional specific invasive weeds using traditional composting techniques, but no research has focused on a two-stage composting technique (Rotary drum composting followed by vermicomposting) for weeds like 'mile-a-minute.'

The novelty of the current study lies in reducing the time required for vermicomposting by incorporating an in-vessel compost technique for 10 days, followed by a 20-day vermicomposting process and obtaining nutritional 'vermicast' from it. The overall aim of this study is to monitor various physicochemical and biological parameters during the Rotary followed by vermicomposting (RVC) process to compare its efficiency to that of traditional vermicomposting techniques in terms of nutrient quality. This study employs terrestrial weed biomass 'mile-a-minute', also known as *M. micrantha*, because no extensive research has been conducted on this weed biomass using a two-stage composting technique. It is regarded as one of the most invasive weeds and is readily available in huge quantities in the Northeastern part of India. Earthworms require more time for acclimatization than the actual process to happen. So a pre-degradation process is conducted in a 550 L capacity Rotary drum composter to acquire a significant rise of temperature (thermophilic phase) and then vermicomposting for 20 days using bamboo bins.

II. . MATERIALS AND METHODS

2.1. Rotary drum composter

The total capacity of the drum (R1) is 550 L in which 150 kg of waste is pre-degraded for 10 days. The drum is mounted on a metal stand and rotates mechanically with the help of four rubber wheels. The length and diameter of the drum are 1.022 m, 0.76 m, and 4 mm metal sheets respectively. 40 mm angles are welded inside the drum longitudinally so that the waste is adequately mixed, agitated, and aerated during rotation. Anti-corrosive material in the drum is used to prevent rusting as it might damage the drum due to the production of leachate from waste. Two 10 cm holes adjacent to the drum are designed to drain the surplus water.

2.2. Vermireactor design and earthworm culture

The experimental procedure was carried out in a bamboo reactor of almost 86.12×10^2 mm^3 sizes. Banana leaves that have been degraded for 1–2 weeks have been used as bedding material for vermireactor. 5:4:1 ratio is used for the mixture of waste that has been obtained from previous study on drum composting of MM (Kauser et al., 2020). MM was collected from the vicinity of the IIT Guwahati campus, Amingaon, Assam, India. Cow dung (CD) and sawdust (SD) were collected from a local dairy farm nearby IITG campus and Amingaon market respectively. A total amount of 1.5 kg waste has been used including MM as the first part, CD as the second part, and SD as the third part. For each reactor, a total of 120 earthworms were used. For the process, three separate earthworm species were used for application in the reactor namely: applying *E. fetida* (VrEF), applying *E. euginae* (VrEE), applying *P. ceylanesis* (VrPC), and without earthworm species (VrC). Wet jute bags were used to cover the vermireactor because earthworms can perform more efficiently with less light exposure.

2.3. Rotary drum followed by vermicomposting (RVC)

The waste mixture was first to feed into the Rotary drum reactor (R1) to obtain thermophilic temperature. When the temperature drops to 35–40 °C, the partially decomposed material was used for vermicomposting with three different earthworm species, *E. fetida*, *E. eugeniae*, and *P. Ceylanesis*. *E. fetida* and *E. eugeniae* were obtained from Krishi Vigyan Kendra, Kamrup Rural, Assam. However, *P. ceylanesis*, popularly known as 'Jai Gopal', is a genetically engineered species established by IVRI, Barielly, India

2.4. Analyses (Physico-chemical, biological, total heavy metal content, and FTIR)

The temperature was measured in situ with a portable thermometer (Mextech Digital thermometer, Mextech, India) at various base levels every 4 h during the first 10 days of the composting period. The sample was oven-dried (Hot air oven, ICT, India) at 105 °C for 24 h before grinding and sieved with 0.2 mm US Mesh 70 (Jain and Kalamdhad, 2018, Tiquia and Tam, 1998). The volatile solid was measured first by igniting 5 g of the sample at 550 °C (Muffle furnace, ICT, India) (EPA 196). As described by Maturi et al. (2021), total organic carbon (TOC %) was calculated using Eq. (1)

TOC(%) =V S (%)/1.83 *100

Chemical parameters like pH (μ pH system 361, 132, Systronics, India) and Electrical conductivity (EC) (Digital conductivity meter, VSI-04-Deluxe, India) was measured using aqueous extract of the sample by vortexing the same in the ratio 1:10 (w/v) for 2 h at 120 rpm (Tiquia and Tam, 1998). Nutrient content namely potassium (K), and calcium (Ca) were measured using flame photometry (Flame photometer 128, Systronics, India). Biological parameters: sBOD was estimated using Winkler's method, and sCOD (COD digester, Hech DRB 200, USA) was measured using the Closed Reflux-Dichromate method (Paul et al., 2020). CO_2 evolution and oxygen uptake rate (OUR) were measured as described by Varma and Kalamdhad (2014). Total metal content was estimated using Atomic Absorption Spectroscopy (Varian Spectra 55B, India) by digesting (Kelplus Digestion Unit, KES 42 R, Pelican, India) 0.2 g powdered sample using di-acid (5:1 v/v of sulfuric acid and perchloric acid) for 2 h at 300 °C (Singh and Kalamdhad, 2012). To investigate changes in the functional group, FTIR (PerkinElmer,

UK) spectra were observed using a mixture combination of 300 mg KBr and 1 mg of the sample which is recorded in 400–4100 cm $^{-1}$ wave number scans.

2.5. Germination assay

The Germination Index (GI) test was performed using a compost of reactor R1 and vermicompost (VrEF, VrEE, VrPC, and VrC) extract, as preceded by Matthews and Hastings (1987) modified procedure. Samples were prepared by combining 100 g of a single sample with 300 mL of dH_2O and shaking mechanically in a rotary shaker for 24 h at 120 rpm to achieve a homogenized mixture. After 24 h of continuous shaking, samples were purified, and the filtered sample was used for phytotoxicity evaluation. With different dilutions (0%, 25%, 50%, 75% and 100% v/v), compost and vermicompost extract solutions were formulated using dH_2O. As a test plant for phytotoxicity evaluation, *V. radiata* (Mung bean) was used for analysis. Mung bean was acquired from a certified store in Assam, Guwahati. Mung bean seeds were immersed in $HgCl_2$ solution (0.1 percent w/v) for proper sterilization for 10 min before starting the experiment and washed thoroughly with dH_2O to eliminate traces of $HgCl_2$. For the experiment, glass Petri plates were used to be sufficiently moistened with the respective All the tests were conducted in triplicates, incubated for 4–5 days at 25 ± 1° C. After 5 days of incubation, seedling growth, and biomass were analyzed (8 h duration of light cycle and 16 h duration of dark cycle).

2.6. Statistical analysis

Findings were statistically analyzed in ANOVA using IBM-SPSS (v.25) at $p<0.05$. Every reactor was placed in triplicate, for which mean and standard deviation was calculated. The degree of interaction between measured parameters and their phenomenon is explained by correlation coefficient analysis. As a relationship between parameters, Pearson correlation gives an output of −1 to +1. A positive value indicates that the measured parameters have a positive relationship, while a negative value indicates that they have a negative relationship.

III. . RESULTS AND DISCUSSION

3.1. Evolution in temperature

Microorganisms play an important role in composting, whereas earthworms play a major role in vermicomposting. Vermicomposting takes place at room temperature instead of composting, which has a thermophilic phase that ensures material sanitation and maximum degradation (Fornes et al., 2012). In the present experimental setup, a temperature profile was recorded to evaluate the completion of the thermophilic stage. The maximum temperature reached during this stage was 54.3 °C on day 2 in the reactor R1 as shown in Fig. 2. The thermophilic stage was almost over by day 6. But the rotary drum composting was continued till day 10 to ensure further degradation of the organic compounds and to obtain the optimum temperature required for the earthworms. The temperature begins to drop after the fourth day of composting, and on the tenth day, it was measured at 37–38 °C, which is advisable for the vermicomposting process (Reinecke and Kriel, 1981). The rate of oxidative decomposition of various waste is greatest during composting in the thermophilic phase of temperature range 50–60 °C (Varma and Kalamdhad, 2015) which may reduce the time required for vermicomposting as maximum reduction occurs during this phase and earthworm gets pre-degraded material, which is more useful for making better quality vermicompost. Similar research was conducted on a combination of both the composting technologies for the stabilization of cattle manure (Vicentin et al., 2021).

The current study examined the use of rotary drum composting for pre-degrading waste to achieve a thermophilic temperature, followed by 20 days of vermicomposting to improve the compost quality and shorten the vermicomposting time. Through the two-stage composting process, *E. fetida* achieved 3.24% TKN with considerable decreases in organic carbon and enhanced total phosphorus up to 12.87 g/kg. The reduction in sBOD, sCOD, and CO_2 evolution rate was found to be greater in the earthworm-aided reactor. The earthworm growth and development were higher for the species *E. fetida* and *E. eudrilus.* After exposure to *V. radiata* vermicompost extract, seed germination increased, indicating that the phytotoxic chemicals in the weed biomass may have transformed into less toxic compounds. The FTIR spectra showed a significant transition of the complex organic compound into a simpler form. Heavy metal was significantly immobilized with the degradation of organic compounds during the process of vermicomposting. The two-stage composting technology could be an additional strategy to the conventional composting process in terms of quality improvement and time reduction. The further recommendation would be an application of this weed compost for pot and field study using different plant models in terms of plant growth and fruit quality.

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Modeling, Designing and Optimization Of Net Zero Energy Building

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***Abstract*— With a value of around 40% of overall energy consumption, buildings are a significant main energy user in the global energy sector. Currently, the absence of conventional energy sources encourages the construction of net zero energy buildings (NZEBs). Net or nearly zero energy buildings (NZEB) are exceptionally energy-efficient structures with very little demand for energy, all of which is supplied by renewable resources. Such structures annually balance their energy use and production.It's crucial to understand the broad notion of net zero energy construction.The paper's objective is to present and discuss various strategies and ideas to achieve Net Zero Building through actual Modeling,Designing and Optimization of Building**

Keywords—NZEB, Smart Grid , EPI, OptimizationIOT.

I. Introduction

Are you conscious of the potential environmental impact of your workplace or residential structure? Is it conceivable that you are unaware of dangerous chemicals being released by your building? We are fully aware of the different environmental problems, such as air, water, and global warming pollution, as well as the precautions that must be taken to avoid them. In India, if we adopt sustainable architecture and green construction practices, we may not only protect the environment but also lower our total ownership expenses.The second-largest producer of demolition trash and greenhouse emissions is the building construction sector (35–40%). Building construction and afterwards lighting or air-conditioning systems use the majority of the energy. While different amenities like lighting, air conditioning, and water heating make buildings' occupants more comfortable, they also use a tremendous amount of energy and contribute to pollution. Additionally, tenant activities produce a significant amount of solid and liquid waste.Little more efficiency is not the goal of green construction. It involves designing buildings that make the best use of local resources, and the environment, and most importantly are constructed to consume less energy, water, and other materials.According to TERI estimates, India could save more than 8,400 megawatts of energy, or enough to light 550,000 houses annually, if all structures in Indian urban areas were compelled to adhere to green construction principles.

II. Objective

- To **Design** and **Optimize** the Conventional Single Family Housing to Net Zero Energy Building.

III. LITERATURE REVIEW

According to Reshmi Banerjee, the Net Zero Energy Building (ZEB) does not result in an increase in greenhouse gas emissions. Given current building technologies and design strategies, he observed that a growing number of buildings are meeting this standard, increasing confidence that a ZNE goal is feasible. In the interaction between buildings and grids, the Net ZEBs become an active part of the renewable energy infrastructure.[1]. Masa Noguchi and colleagues created the Eco-Terra house prototype, which was created to be energy-efficient to avoid adverse environmental effects. According to the investigation, the house almost completely eliminates its energy use, and it offers its residents a comfortable and healthful indoor atmosphere.[2].This building sector consists of large, small, commercial, and public structures. The majority of the electrical equipment in these buildings is

standard, including lights, fans, coolers, heaters, and consumer gadgets. The rapid increase in residential building energy use in recent years presents a challenge for zero energy residential building (ZERB) technologies, which seek to significantly lower residential building energy use. Unfortunately, the majority of the buildings are run inefficiently with regard to energy use. Buildings have a 40–50% potential for energy efficiency gains.[3].With a proportion of between 30% and 40%, buildings are one of the biggest consumers of electrical energy worldwide[4].According to data released by the Ministry of Statistics and Programme Implementation, the Government of India, per capita energy consumption increased by about five times between 1980 and 2010 [5]

IV. METHODOLOGY

Our design focuses on minimizing the ecological impact a structure has on the land it is constructed on. The net zero performance is attained by creative planning and fusing of conventional wisdom and current technology. The following are the primary design elements used in our project:

- By using balconies to create buffers, we may achieve comfort with natural ventilation and supported natural ventilation, while also taking into mind the micro - environmental characteristics of the site location and the user experience.
- The humidity is consistently high due to the seaside location. By simulating the microclimate and including dehumidifiers into our system, we are able to validate the extent to which our ventilation tactics contribute to comfort.
- Adopting passive design principles, such as using local materials, minimizing the use of concrete, orienting the plan in accordance with the direction of the wind and sun, collecting rainwater, using energy-efficient appliances, etc.

Site Details:

• Site Area = 1740 m2
• Permissible Built-up Area = 3480 m2 (for 10 row houses)
• Permissible Ground Coverage = 2
• Proposed/Estimated Built-up Area = 240 m2 (for 1 row house)

Figure 1 : **Site Plan**

Energy Performance Index:

EPI Goal = 15 kWh/m2 per year

Preliminary estimate of on-site renewable energy generation potential:

1. Wind Energy Generation Potential = 5000 kWh per year
2. Solar PV Potential = 13200 kWh per year per house
3. An 8.8kW plant is feasible per house. For the domestic wind turbine, a wind speed of 6 m/s for a rotor diameter of 7 m is considered.

Performance Specifications

- **Climate Zone:**

Navi Mumbai is located in a hot, humid region. The location is particularly close to two lakes, a strait, and mangrove woods.
Both the artificial lake Vashi Gaon Chowpatty and the holding lake Vashi are located around 400 meters apart from the site. Less than a kilometer separates the location from a strait. Additionally, a substantial mangrove cover surrounds these water features. The microclimate clearly has effects, as determined by user experiences.

- **Site Analysis :**

Vashi is a node in Navi Mumbai, Maharashtra, across the Thane Creek of the Arabian Sea on the outskirts of Mumbai. The site is plot number 14 of sector 10, Vashi. It has good connectivity to other nodes of Navi Mumbai and Mumbai through local trains, buses, and auto-rickshaws with tar approach roads and cement travel roads. The terrain is flat, with rock formation derived from Deccan Basalt and granites, gneisses, and laterite. The soil is calcareous, neutral to alkaline in reaction (pH 7.5 to 8.5), clayey, with high water holding capacity (200-250 mm/m) The site is in an urban setting. The approach is from the connecting road. The main road is 150 m from the site. The nearest bus stop is also 150 m from the local railway station, 2.5 km from the site. There are hospitals and schools in a 1-kilometer radius. The location of the site is prime in the sense of approachability, hospitals, and schools nearby and bus

and railway stop in close vicinity. The project caters to the redevelopment of the site. However, the new construction is also to cater to the ten families only. No expansion is planned. So, we know the end-users that the project caters to.

Figure 2 : **Ground Floor Plan**

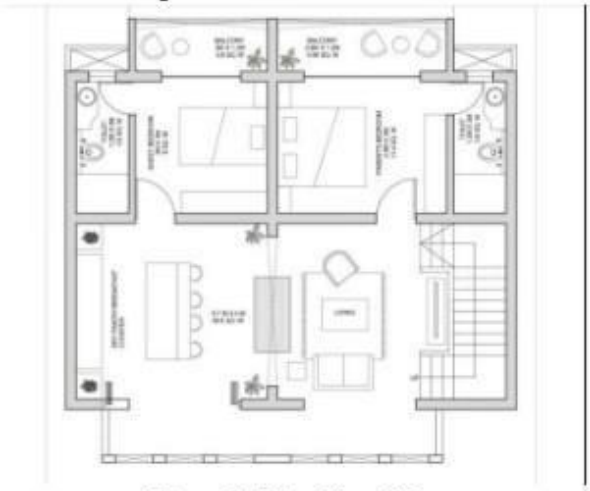

Figure 3 : **First Floor Plan**

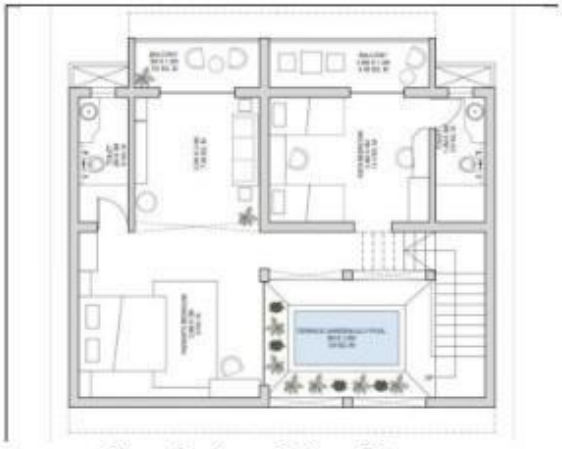

Figure 3 : **Second Floor Plan**

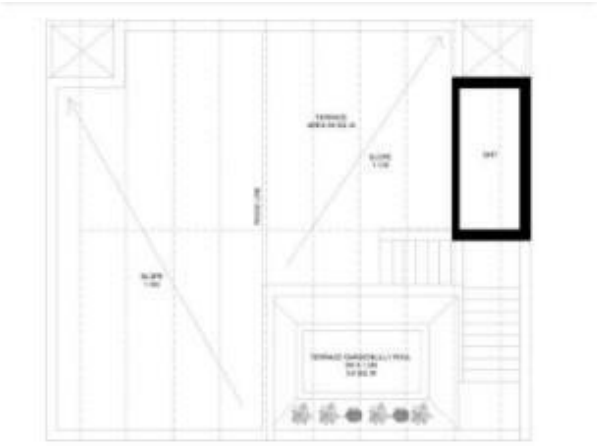

Figure 4 : **Terrance Plan**

- **Performance Specifications**

Table 1

BUILDING ENVELOPE		
WALL-EXTERNAL	(0.6SRI Paint + Agrocrete(200) + Air Cavity(25)+Rockwool(50)+Plaster (10))	U=1.226
ROOF	Insulated Roof (0.3SRI China Mosaic(25)+PCC Screed(50)+PUFF Insulation +Vapour Barrier +WaterProofing Hollow Core (100)+ Plaster(10)	
WINDOW	Double Glazing Dbl Clr 6mm air gap 13mm	Vlt=0.781 U=2.665 Shgc=0.703
HVAC		
TYPE	VRF Dehumidifier and Air Conditioning System	
MODEL	Company -: Daiken VRV VI Model-: VRV RXYTQ8U7YF Tonnage-: 5.4	

	Power -: 380-415V/50 Hz	
RENEWABLE ENERGY		
TYPE	Roof mounted Solar PVs POWER= 8KW Efficiency =18%	

- **Energy Performance**

Navi Mumbai, formerly known as New Bombay, is a planned community located in the Konkan region of the Indian state of Maharashtra. The climate in Navi Mumbai is tropical. The amount of rainfall is substantially lower in the winter than it is in the summer. The average annual temperature in Navi Mumbai is 26.6 °C or 79.9 °F. The average annual rainfall is about 1915 mm (75.4 inches). When it comes to relative humidity, July tops the list (88.90 percent). The month with the lowest relative humidity is December (56.23 percent). The biggest number of rainy days occur in July (29.00 days). The month with the fewest rainy days is March (0.17 days).

- **Reduction of Loads**
-

  - **Building Form:**

In sites with constrained plots in places like Navi Mumbai, it is crucial to analyze the site and the climate early in the design process because the space limitations may result in form restrictions. Our main goal was to improve natural ventilation, thus we tried to design an open zig-zag orientation with more open facades. Even though these architectural forms were appealing, they resulted in a smaller amount of ground coverage and forced us to raise the home higher. After weighing the benefits and drawbacks, we chose design iterations with more ground surface covered, fewer stories, and more effective site usage.

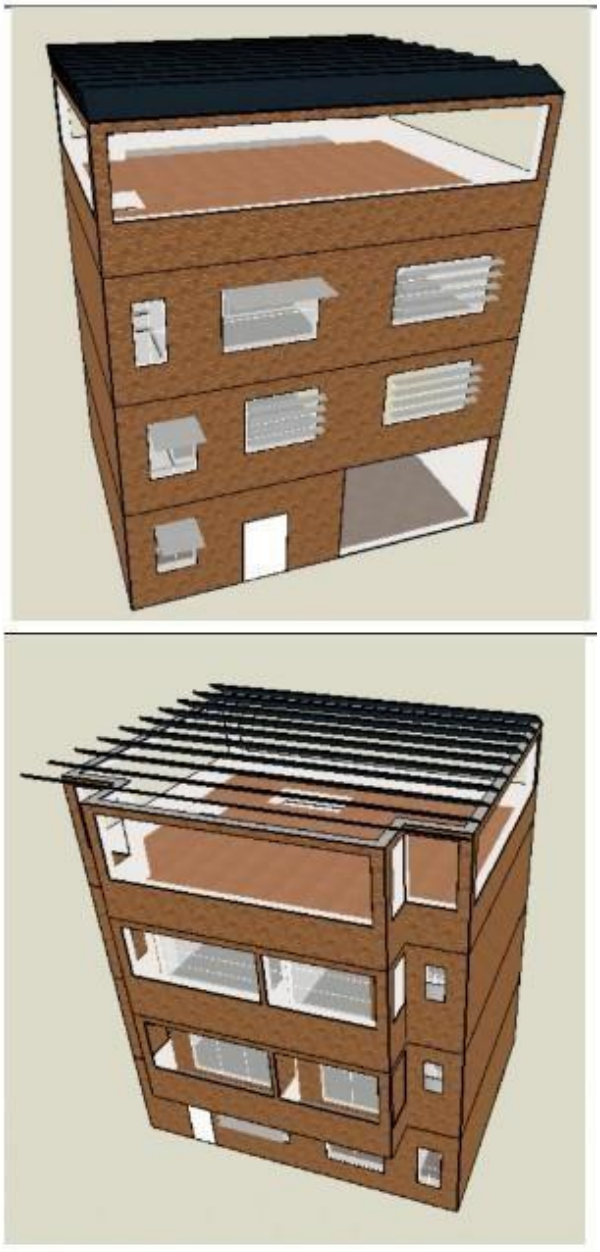

Figure 5 : **Design Builder Model**

  - **Building Envelope:**

Despite being a necessary component of construction, concrete is bad for the environment. To provide the occupants with an organic living environment, we intended to employ materials that adhered to this principle. In order to avoid adding to the concrete jungle, we chose to use carbon-negative building materials.The Agrocrete material we have chosen offers greater thermal performance in addition to being carbon negative. We do away with the necessity for additional insulation by combining Laurie Baker's rat trap bond-building method. All four of the bedrooms have balconies, and the living room has a jail wall with most windows having a single or double glass.

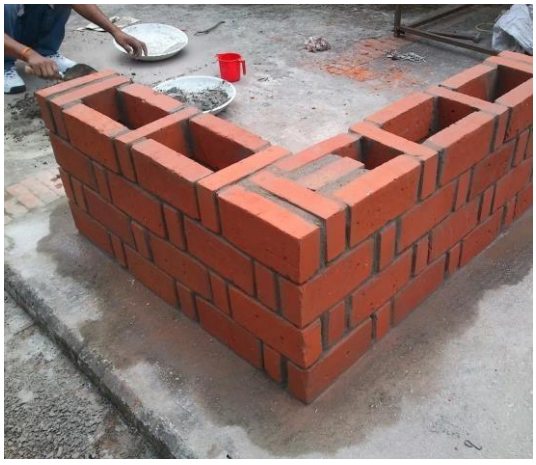

Figure 6 : **Rat Trap Bond**

- **INTEGRATION OF LOW ENERGY COMFORT SYSTEMS**
  A desiccant is a material that collects water molecules from the air and dehumidifies it. It can be solid or liquid. The desiccant is heated to release the moisture it had been holding onto after being initially employed to capture moisture from the air. Desiccant systems are powered by a continuous process called the phase change cycle. In place of the more traditional vapor compression and absorption cooling systems, desiccant cooling systems are heat-driven cooling apparatuses. A desiccant cooling system works by dehumidifying the air inside a rotating dehumidifier, or desiccant wheel.
  The resulting dry air is then further cooled by an evaporative cooler after being partially cooled in a sensible heat exchanger (rotary regenerator). It then blows the generated cool air into space. The system can be run in ventilation or recirculation modes in either an open cycle or, more frequently, a closed cycle.

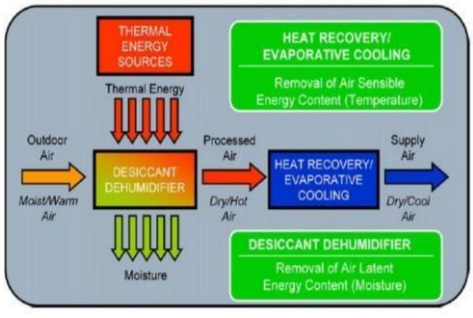

Figure 7 : **Function Of Dehumidifie**r

Advantages : Highest low dew point supply air CMH/kW of regeneration: High Performance Efficiency and Energy Efficient Desiccant cooling systems don't include any harmful materials, unlike traditional vapour compression freezers. As a result, they might be regarded as an eco-friendly air conditioning technology.
Unit Construction: robust, durable, > 20 years life

- SUFFICIENT RENEWABLE ENERGY GENERATION WITH SMART GRID CAPABILITIES

The infrastructure and electrical energy system need to be modernized in order to provide a more intelligent and dependable electricity grid, and this is where a smart grid comes in. When compared to traditional grids, smart grids provide various advantages. Smart grids enhance the grid system's physical and financial operations, boosting dependability and sustainability.

- Lighting Optimization:

We have planned the spaces with daylighting as a fundamental design technique to achieve our goal of giving the users an organic experience. However, because we are using natural ventilation as our main design technique, it is crucial to apply the right shade and strike a balance between daylight and glare in order to prevent people from closing the windows.We designed our apertures using daylighting simulations with an illuminance range of 130 to 1300 lux in order to achieve a balance between natural light and glare. The daylight simulation outcomes for cloudy weather are displayed in the following photos.

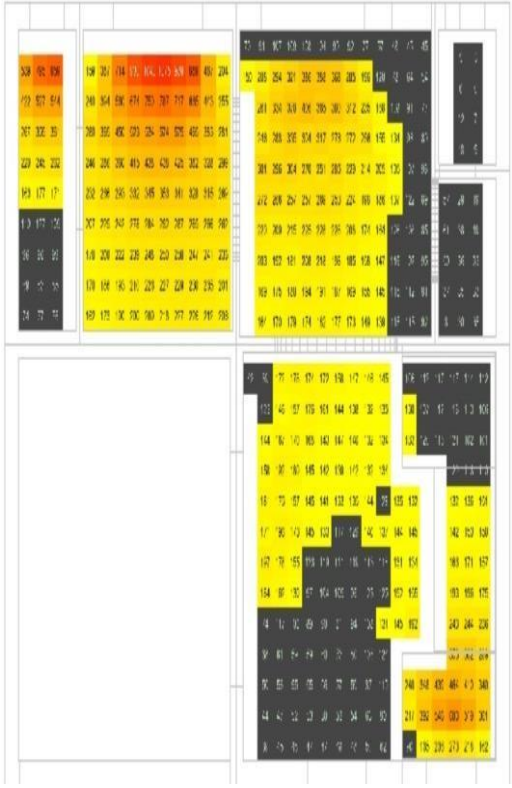

Figure 8 : **Ground Floor Illuminance**

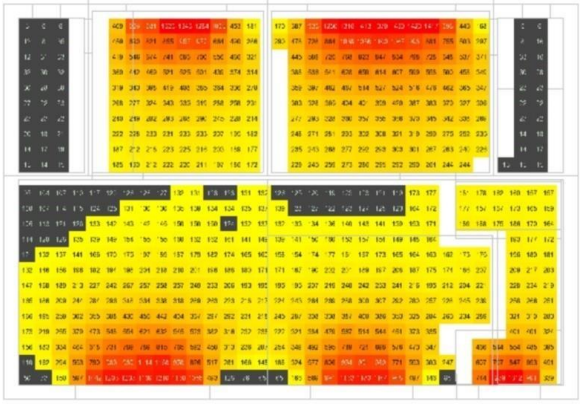

Figure 9 : **First Floor Illuminance**

- **ENERGY ANALYSIS**

In the course of a building's life, the HVAC system uses the most electricity. We intend to use natural ventilation as our main design method while taking the micro-environmental factors, the comfort band, user experience, and our design philosophy into consideration. First, we were able to choose a plan that aided natural ventilation by utilizing the westerly breezes thanks to climatic study. To help with ventilation, we then planned low-energy, high-performance BLDC fans. We may install more assisted ventilation ducts in later iterations to improve comfort, particularly in the hotter months of April and May.

In coastal areas like Mumbai, latent loads make for the majority of the cooling load. Additionally, the microclimate makes the area cooler but also makes it more humid. It is ineffective to achieve comfort by using an air conditioner to reduce latent loads. In order to handle the latent loads, we therefore tried to find more simple alternatives. Temperature and specific humidity changes at critical state points of a solar-assisted solid desiccant cooling system are examined for the ventilation and recirculation modes using TRNSYS simulation software. It looks that the COP in the recirculation mode is a little bit higher than it is in the recirculation mode. Additionally, in the recirculation mode, the regeneration temperature needed for dehumidifier desorption is reduced.Additionally, in the recirculation mode, the regeneration temperature needed for dehumidifier desorption is reduced. The recirculation cycle looks to be superior and more effective than the ventilation mode due to the lower thermal energy needed for reactivation and, as a result, higher COP.

- **Affordability :**

Construction cost optimization and total cost reduction were two of the team's primary goals when planning the project's layout. The team takes a number of simple yet effective steps to achieve these objectives. 1. We intend to use the environmentally friendly Agrocrete® bricks, which are made from crop byproducts and industry byproducts. Similar to Red and Fly Ash Bricks, Agrocrete® can be used in load-bearing and non-load-bearing applications. A Red Brick is almost 5 times the size of an Agrocrete® Solid Block, which lowers construction costs by 30% and enables quicker and simpler masonry. Additionally, Agrocrete® has a lower thermal conductivity, which results in lower running costs for the occupants of the structure.The accompanying image provides a summary of the differences between Agrocrete® bricks and traditional red bricks.

Parameter	Red Bricks	Agrocrete® Solid Block
Strength	7 MPa	5 - 7.5 MPa
Density	1800 - 2000 kg/m^3	1200 - 1500 kg/m^3
Water Absorption	18-20%	10 - 20%
Durability	75+ yrs.	75+ yrs.
Thermal Conductivity*	0.8 W/mK	0.4 W/mK
Embodied Carbon	0.24 kgCO_2/kg	-0.2kgCO_2/kg
Size of Brick (in mm)	215 x 102.5 x 65	400 x 150 x 130
Cost of Walling per sq.m. (incl. masonry, plastering & mortar joints)	₹ 2245	₹ 1255

Figure 10 : **Comparison Between Red Brick and Agrocrete Solid Block**

Using Agrocrete® bricks instead of traditional ones can cut the cost of building per square meter by over 50%. Nothing is more opulent than a floor made of beautiful granite or marble. However, the elegance and beauty of granite come at a high cost to the economy and the environment.Granite stone flooring typically costs between Rs. 90 and 100 per square foot. but the kota flooring costs only Rs. 60 per square foot. Afine-grained, robust, firm, and uniform natural stone isthe ko stone. Shiny kota stones look as good as floors made of marble or granite. Furthermore, shaded kota stone constantly maintains a cool temperature, aiding in the regulation of the temperature within.

The cost of raw materials utilized in construction is significant. Therefore, cutting back on the quantity and price of raw materials utilized can be the best strategy to minimize the entire cost of building. Additionally, if we can accomplish several benefits (such as thermal insulation of the structure while reducing overall cost and raw materials), it will be a double benefit as a sustainable design.

Famous architect Laurie Baker developed the double-wall Rat trap Bond (also known as the Jail Wall design) in Kerala in the 1970s. It is a double-wall technology that significantly reduces construction costs, reduces material and mortar consumption, and helps to increase thermal efficiency without compromising wall strength. In Rat-Trap masonry, rather having the usual horizontal alignment, bricks (standard size 230 X 110 X 75 mm) are positioned vertically so that the 110 mm face is visible from the front elevation. However, because the wall's breadth (230mm) does not change, the 75mm face is replaced by an interior emptiness. This technique saves roughly 30% of the brick and mortar's material, bringing down the cost of the complete construction to about Rs. 300-350/sq.ft.

On average, our operational energy requirements are roughly 40% accounted for by HVAC. One of any building's biggest energy consumers is the air conditioning equipment. Our team focused on natural ventilation and assisted natural ventilation employing fans (to get increased air velocities and ACU) and

dehumidifiers in order to prevent mechanical cooling systems in the buildings in order to reduce energy consumption and ultimately reduce the effective cost (to counter the mainly latent loads). The plan attempts to do away with the requirement for mechanical cooling. This will undoubtedly help lower operational and maintenance expenses significantly over time.

- **Home Automation and Building Management System**:
  As the average resident strength is just 5 persons, with a range of 2–6 people, we have a low population density. Therefore, there is a lot of potential for cost savings with home automation.
  Facility managers now have access to data that was previously out of their reach thanks to an IoT. To improve operational sustainability, these tiny networked sensors can be employed in conjunction with automated building systems. For instance, IoT sensors may dynamically adjust the proper ventilation and lighting levels inside the structure based on temperature, weather, and CO2 data. It is not necessary for the facility manager to manually keep track of these changes or enter data from numerous machines. The following design iterations will focus on the system specs.

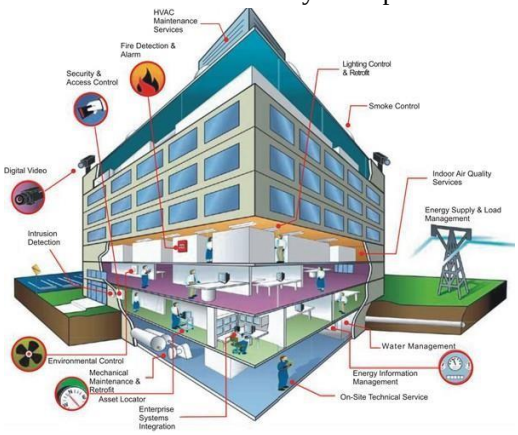

Figure 11 : **IoT Integrated Automated Building Management System**

- **Agrocrete:**
  Our team worked to avoid using concrete in the building in order to make it sustainable and environmentally friendly. We discovered a business called GreenJams, whose mission is to offer clients products and services that help them to lead climate-positive lifestyles. They provide the ideal answer for carbon negative and less expensive building materials. A "First of its type" construction material, Agrocrete by Green Jams is created from crop by-products and industrial waste.In substitution of clay bricks, fly-ash bricks, and concrete masonry units, Agrocrete solid blocks are ideal. They are 25% more energy efficient and roughly 50% less expensive than traditional bricks. Additionally, they are tough and require 20% less plaster than standard clay bricks while providing 50% more thermal insulation

V. Conclusion

The zero energy idea helps to preserve the environment while reducing global warming. The zero energy building, our final year project, stands out for being entirely constructed with sustainability and green building in mind. The building was designed with a "green" philosophy in mind, showing the most advanced HVAC technology combined with recyclable materials. Additionally, it's important to use the right energy conversion tools to maximize the use of water, chilled and hot water, STP, and solar energy conversion. The aforementioned characteristics will be optimized with the aid of the building automation system. The purpose of the prana building is to show that it is possible to design a zero-energy structure and that it is useful for energy conservation.

Acknowledgment

The following work of Modeling,Designing and optimization of Net Zero building can't be created by a single person. The timely completion of the work has been possible due to the guidance of our mentor Dr Sanjeev Vasantrao Chaudary who imparted her knowledge regarding the topic on us and with her continual motivation, this work was completed. We are also thankful to the Department HOD Dr. Seema Jagap for allowing us to use the lab which was required for our project, and to our parents for providing us with all possible resources. We also thank our college 'Thakur College of Engineering and Technology' for providing us with a platform and the necessary facilities to make this project possible.

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Designing Of A Storm Water Drainage System For An Urban Area Near Coastal Region

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Abstract:- **Coastal regions are vulnerable to the impacts of stormwater runoff, which can lead to flooding, environmental harm, and public safety risks. Managing stormwater in these areas requires specialized design and planning approaches that account for the unique challenges and opportunities of coastal regions. This technical paper provides a comprehensive overview of the characteristics of coastal regions and the considerations and design challenges specific to designing stormwater drainage systems in these areas. The paper covers a range of topics, including climate patterns, hydrology, geology and soil types, tidal and wave conditions, and topography. It also covers important design considerations such as regulatory requirements, coastal flood and surge modelling, design storm selection, and runoff estimation methods. The paper highlights key components of stormwater drainage systems in coastal regions, including surface and subsurface conveyance systems, detention and retention basins, infiltration systems, green infrastructure techniques, and water quality treatment systems. Additionally, the paper discusses important design challenges and solutions, such as sea level rise and storm surge, saltwater intrusion, coastal erosion and sediment transport, water quality impacts, and maintenance and operations. Finally, the paper provides case studies to illustrate best practices and lessons learned in designing stormwater drainage systems in coastal regions. This technical paper is intended to provide guidance and best practices for engineers, planners, and policymakers who are involved in designing and managing stormwater drainage systems in coastal regions.**

***Keywords*- Design, Modelling, Coastal, Storm Water, Drainage**

I. INTRODUCTION:

Coastal regions are among the most dynamic and fragile ecosystems in the world, providing valuable ecological, economic, and social benefits to human communities. However, these regions are also vulnerable to the impacts of stormwater runoff, which can lead to flooding, erosion, and other environmental and public safety risks. Managing stormwater in coastal regions is critical for protecting these valuable ecosystems and the communities that depend on them.

Designing stormwater drainage systems in coastal regions is a complex and challenging task, requiring specialized knowledge and skills. Coastal regions face unique challenges such as sea level rise, saltwater intrusion, erosion, and changing climate patterns that require specialized design and planning approaches for effective stormwater management. This technical paper provides a comprehensive overview of the challenges and opportunities for designing stormwater drainage systems in coastal regions, and provides guidance and best practices for engineers, planners, and policymakers.

The paper begins with an introduction to the importance of managing stormwater in coastal regions and the challenges specific to these areas. It then provides an overview of the characteristics of coastal regions, including climate patterns, hydrology, geology and soil types, tidal and wave conditions, and topography. The paper covers important design considerations such as regulatory requirements, coastal flood and surge modelling, design storm selection, and runoff estimation methods.

The paper also highlights key components of stormwater drainage systems in coastal regions, including surface and subsurface conveyance systems, detention and retention basins, infiltration systems, green infrastructure techniques, and water quality treatment systems. Additionally, the paper discusses important design challenges and solutions, such as sea level rise and storm surge, saltwater intrusion, coastal erosion and sediment transport, water quality impacts, and maintenance and operations.

Finally, the paper provides case studies to illustrate best practices and lessons learned in designing stormwater drainage systems in coastal regions. The aim of this technical paper is to provide a comprehensive resource for engineers, planners, and policymakers involved in designing and managing stormwater drainage systems in coastal regions.

1.1. Importance of managing stormwater in coastal regions

Managing stormwater in coastal regions is critically important for several reasons:

Preventing flooding: Coastal regions are at a high risk for flooding due to their proximity to the ocean, as well as the higher intensity of precipitation events. Without proper management of stormwater, the risk of flooding increases significantly, leading to property damage and potential danger to human life.

Protecting public safety: Proper management of stormwater can help reduce the risk of accidents and injuries, such as slip and fall incidents or motor vehicle accidents on wet roads.

Mitigating environmental harm: Storm water runoff can carry pollutants such as oil, grease, heavy metals, and nutrients from urban areas into coastal waters, leading to environmental harm and degradation. Proper management of storm water can help reduce the impact of pollutants and preserve the health of coastal ecosystems.

Meeting regulatory requirements: Many coastal regions are subject to strict environmental regulations governing stormwater management, particularly with regard to protecting water quality and minimizing impacts on sensitive habitats.

Addressing the impacts of climate change: Climate change is expected to increase the intensity and frequency of extreme weather events, such as heavy rainstorms and hurricanes, in coastal regions. Proper management of stormwater can help mitigate the impacts of these events, including flooding and erosion, and adapt to the potential consequences of sea level rise.

Overall, effective stormwater management in coastal regions is critical for protecting public safety, preserving the environment, and ensuring the long-term sustainability of these dynamic and valuable regions.

1.2. Challenges specific to coastal regions

Designing stormwater drainage systems in coastal regions presents several unique challenges, including:

Tidal and wave conditions: Coastal regions are subject to significant tidal fluctuations and wave action, which can affect the design and operation of stormwater infrastructure. High tides and storm surges can cause flooding and increase the risk of damage to infrastructure, while wave action can erode shorelines and impact the performance of stormwater treatment systems.

Saltwater intrusion: In many coastal regions, saltwater can infiltrate into groundwater and surface water, impacting water quality and the performance of stormwater infrastructure. Saltwater intrusion can affect the effectiveness of stormwater treatment systems and increase the corrosion and maintenance requirements of infrastructure.

Coastal erosion and sediment transport: Coastal erosion and sediment transport can impact the stability and performance of stormwater infrastructure, particularly in areas with soft or unstable soils. Erosion can lead to the loss of land and infrastructure, while sediment transport can impact the performance of stormwater treatment systems and increase the need for maintenance.

Water quality impacts: Stormwater runoff in coastal regions can carry pollutants such as heavy metals, nutrients, and pathogens into waterways, impacting water quality and the health of coastal ecosystems. The proximity of stormwater infrastructure to waterways increases the potential for these impacts.

Sea level rise and climate change: Coastal regions are particularly vulnerable to the impacts of sea level rise and climate change, which can increase the frequency and severity of extreme weather events, impact the hydrology of the region, and increase the need for adaptation and resilience measures in stormwater infrastructure.

These challenges require specialized design and planning approaches that account for the unique conditions and risks of coastal regions. Strategies for managing stormwater in these areas must consider factors such as climate patterns, hydrology, geology and soil types, and regulatory requirements, as well as the specific challenges of the coastal environment. Effective stormwater management in coastal regions is critical for preserving the health of coastal ecosystems, protecting public safety, and ensuring the long-term sustainability of these dynamic and valuable regions.

Managing stormwater in coastal regions is critically important for several reasons:

Preventing flooding: Coastal regions are at a high risk for flooding due to their proximity to the ocean, as well as the higher intensity of precipitation events. Without proper management of stormwater, the risk of flooding increases significantly, leading to property damage and potential danger to human life.

Protecting public safety: Proper management of stormwater can help reduce the risk of accidents and injuries, such as slip and fall incidents or motor vehicle accidents on wet roads.

Mitigating environmental harm: Stormwater runoff can carry pollutants such as oil, grease, heavy metals, and nutrients from urban areas into coastal waters, leading to environmental harm and degradation. Proper management of stormwater can help

reduce the impact of pollutants and preserve the health of coastal ecosystems.

Meeting regulatory requirements: Many coastal regions are subject to strict environmental regulations governing stormwater management, particularly about protecting water quality and minimizing impacts on sensitive habitats.

Addressing the impacts of climate change: Climate change is expected to increase the intensity and frequency of extreme weather events, such as heavy rainstorms and hurricanes, in coastal regions. Proper management of stormwater can help mitigate the impacts of these events, including flooding and erosion, and adapt to the potential consequences of sea level rise.

Overall, effective stormwater management in coastal regions is critical for protecting public safety, preserving the environment, and ensuring the long-term sustainability of these dynamic and valuable regions.

1.3. Objectives of the paper

The objectives of a technical paper on designing stormwater drainage systems in coastal regions may include:

Reviewing the unique challenges and opportunities presented by stormwater management in coastal regions, including factors such as climate patterns, hydrology, geology, and soil types.

Providing an overview of the regulatory requirements governing stormwater management in coastal regions, including requirements for water quality protection, habitat preservation, and flood control.

Presenting case studies and examples of successful stormwater management strategies in coastal regions, including best practices for infrastructure design and operation, treatment technologies, and adaptation to climate change.

Outlining the key design considerations for stormwater infrastructure in coastal regions, including factors such as sea level rise, tidal and wave conditions, and saltwater intrusion.

Identifying research needs and knowledge gaps related to stormwater management in coastal regions, including opportunities for innovative design and emerging technologies.

Providing guidance and recommendations for policymakers, engineers, and other stakeholders involved in the design, implementation, and management of stormwater infrastructure in coastal regions.

Overall, the objective of a technical paper on designing stormwater drainage systems in coastal regions is to provide a comprehensive and detailed overview of the challenges and opportunities associated with managing stormwater in these environments, and to provide guidance for developing effective and sustainable stormwater management strategies.

II. COASTAL REGION CHARACTERISTICS

Coastal regions have unique characteristics that must be considered when designing stormwater drainage systems. Some key characteristics of coastal regions include:

1. Tidal fluctuations and wave action: Coastal regions experience significant tidal fluctuations and wave action, which can impact the performance and design of stormwater infrastructure. High tides and storm surges can cause flooding and increase the risk of damage to infrastructure, while wave action can erode shorelines and impact the effectiveness of stormwater treatment systems.
2. Proximity to waterways: Stormwater infrastructure in coastal regions is often located in close proximity to waterways, increasing the risk of water quality impacts from stormwater runoff. This requires careful consideration of treatment strategies and design features to protect the health of coastal ecosystems and the public.
3. Saltwater intrusion: In many coastal regions, saltwater can infiltrate into groundwater and surface water, impacting water quality and the performance of stormwater infrastructure. Saltwater intrusion can affect the effectiveness of stormwater treatment systems and increase the corrosion and maintenance requirements of infrastructure.
4. Coastal erosion and sediment transport: Coastal erosion and sediment transport can impact the stability and performance of stormwater infrastructure, particularly in areas with soft or unstable soils. Erosion can lead to the loss of land and infrastructure, while sediment transport can impact the performance of stormwater treatment systems and increase the need for maintenance.
5. Vulnerability to sea level rise and climate change: Coastal regions are particularly vulnerable to the impacts of sea level rise and climate change, which can increase the frequency and severity of extreme weather events, impact the hydrology of the region, and increase the need for adaptation and resilience measures in stormwater infrastructure.

These characteristics highlight the importance of developing stormwater infrastructure that is designed to address the specific challenges and risks of coastal regions. This may include strategies such as incorporating green infrastructure, designing infrastructure to withstand extreme weather events and sea level rise, and developing adaptive management plans that can be modified as conditions change. By designing stormwater infrastructure that is tailored to the unique

characteristics of coastal regions, we can help ensure the long-term sustainability and effectiveness of stormwater management in these important and valuable area

2.1. Climate patterns

Climate patterns : Climate patterns play an important role in the design of stormwater drainage systems in coastal regions. Changes in climate patterns, such as increased precipitation, sea level rise, and more frequent and severe storms, can significantly impact the performance and design of stormwater infrastructure.

For example, increased precipitation can lead to more frequent and severe flooding events, which can overwhelm stormwater drainage systems and increase the risk of property damage and safety hazards. Additionally, sea level rise can impact the elevation and stability of stormwater infrastructure, increasing the risk of failure and the need for adaptation measures such as raising elevation or installing flood protection systems.

Understanding and accounting for these climate patterns is critical for designing stormwater infrastructure that is resilient and sustainable in the face of a changing climate. This may include incorporating adaptive design features, such as incorporating green infrastructure to absorb stormwater and reduce runoff, or designing infrastructure that can withstand extreme weather events and changes in sea level. By considering the impacts of climate patterns in the design and operation of stormwater infrastructure, we can help ensure the long-term sustainability and effectiveness of stormwater management in coastal regions.

2.2. Hydrology

In the context of stormwater management in coastal regions, hydrology refers to the study of the movement, distribution, and quality of water in the region. Understanding the hydrology of a coastal region is critical for designing effective stormwater infrastructure, as it can impact the quantity and quality of stormwater runoff, and the effectiveness of stormwater treatment systems.

Coastal regions often have unique hydrologic characteristics that must be considered when designing stormwater infrastructure. For example, coastal regions may have high levels of precipitation and runoff due to the influence of storms and hurricanes, and may experience both groundwater recharge and saltwater intrusion due to their proximity to the ocean.

Other hydrologic factors that may be important to consider when designing stormwater infrastructure in coastal regions include:

1. Surface runoff patterns: Coastal regions may have complex surface runoff patterns due to the influence of tidal flows, wave action, and the shape of the coastline. Understanding these patterns can help to design stormwater infrastructure that is effective in capturing and treating runoff.

2. Water quality impacts: Stormwater runoff in coastal regions can have significant impacts on water quality, due to the presence of pollutants such as nutrients, sediments, and chemicals. Understanding the hydrology of the region can help to design treatment systems that are effective in removing these pollutants and protecting the health of coastal ecosystems.

3. Groundwater recharge: Coastal regions may have unique groundwater recharge characteristics due to their proximity to the ocean. Understanding these characteristics can help to design stormwater infrastructure that is effective in recharging groundwater and minimizing the impact of stormwater runoff on local water resources.

4. By considering these and other hydrologic factors in the design and operation of stormwater infrastructure in coastal regions, we can help ensure that our infrastructure is effective, sustainable, and resilient in the face of the unique hydrologic challenges presented by coastal environments.

2.3. Geology and soil types

Geology plays an important role in the design and construction of stormwater drainage systems in coastal regions. The geology of a coastal region can impact the stability and performance of stormwater infrastructure, and understanding the local geology is essential for designing infrastructure that is effective and sustainable.

1. Some key geological factors to consider when designing stormwater infrastructure in coastal regions include:
2. Soil types: Different types of soils have different drainage properties and strengths, which can impact the stability and performance of stormwater infrastructure. For example, sandy soils may be more prone to erosion, while clay soils may be more prone to compaction and clogging.
3. Bedrock: The presence of bedrock can impact the foundation systems required for stormwater infrastructure. In some cases, specialized foundation systems may be required to ensure the stability of infrastructure in areas with unstable or weathered bedrock.

4. Coastal erosion: Coastal erosion can impact the stability of stormwater infrastructure and cause damage to the system over time. Understanding the local erosion patterns and developing strategies to mitigate erosion can help to ensure the longevity of stormwater infrastructure.
5. Land subsidence: Land subsidence can impact the elevation and stability of stormwater infrastructure, especially in areas with high groundwater levels. Understanding the potential for land subsidence and developing strategies to mitigate its impacts can help to ensure the effectiveness and longevity of stormwater infrastructure.
6. By understanding the local geology and incorporating strategies to mitigate its potential impacts on stormwater infrastructure, we can help ensure that our infrastructure is effective, sustainable, and resilient in the face of the unique geological challenges presented by coastal environments.

2.4. Tidal and wave conditions

Tidal and wave conditions are important factors to consider when designing stormwater infrastructure in coastal regions. The tides and waves in a coastal region can impact the performance and effectiveness of stormwater infrastructure, and understanding these conditions is essential for designing infrastructure that can withstand the unique challenges of coastal environments.

Some key tidal and wave conditions to consider when designing stormwater infrastructure in coastal regions include:

1. Storm surges: Storm surges are sudden rises in sea level that can occur during storms and hurricanes. These surges can cause significant flooding and can impact the performance of stormwater infrastructure, especially in low-lying areas.

2. Tidal range: The tidal range in a coastal region can impact the volume and velocity of stormwater runoff, as well as the potential for flooding. Understanding the tidal range is important for designing drainage systems that can effectively manage stormwater runoff and prevent flooding.

3. Wave action: Waves can impact the stability and performance of stormwater infrastructure, especially in areas that are prone to erosion or wave overtopping. Understanding the local wave conditions is important for designing infrastructure that is stable and resilient in the face of wave action.

4. Coastal currents: Coastal currents can impact the movement and distribution of stormwater runoff, as well as the effectiveness of stormwater treatment systems. Understanding these currents is important for designing drainage systems that can effectively manage runoff and protect coastal water quality.

5. By understanding the unique tidal and wave conditions in a coastal region, we can design stormwater infrastructure that is effective, resilient, and sustainable in the face of the unique challenges presented by coastal environments.

2.5. Topography

Topography is an important consideration when designing stormwater drainage systems in coastal regions. The topography of a coastal area can impact the flow of stormwater, the location and elevation of drainage infrastructure, and the potential for flooding and erosion. Understanding the local topography is essential for designing effective and sustainable stormwater drainage systems.

Some key topographic factors to consider when designing stormwater drainage systems in coastal regions include:

1. Slope: The slope of the land can impact the speed and direction of stormwater runoff, as well as the potential for erosion and flooding. Understanding the slope of the land is important for designing drainage systems that can effectively manage runoff and protect against erosion and flooding.
2. Elevation: The elevation of the land can impact the location and design of drainage infrastructure, as well as the potential for flooding and sea level rise. Understanding the elevation of the land is important for designing drainage systems that are effective and sustainable in the face of changing water levels.
3. Drainage basins: The natural drainage basins of a coastal region can impact the flow and volume of stormwater runoff. Understanding the drainage basins is important for designing drainage systems that can effectively manage runoff and prevent flooding and erosion.
4. Vegetation: The presence of vegetation can impact the speed and volume of stormwater runoff, as well as the potential for erosion and flooding. Understanding the type and location of vegetation is important for designing drainage systems that can effectively manage runoff and protect against erosion and flooding.
5. By understanding the local topography and incorporating strategies to mitigate its potential impacts on stormwater infrastructure, we can help ensure that our infrastructure is effective, sustainable, and resilient in the face of the unique topographic challenges presented by coastal environments.

III. Design Consideration

3.1. Regulatory requirements and standards:

When designing stormwater drainage systems in coastal regions, it is important to comply with the regulatory requirements and standards of the local and regional government. This may include permit requirements, building codes, zoning laws, and other regulations that may impact the design and construction of the system.

3.2. Coastal flood and surge modelling:

Coastal flood and surge modelling can help to predict the potential impact of storm surge events on the performance of the stormwater drainage system. This can inform the design of the system, including the location and elevation of infrastructure and the design of flood control structures.

3.3. Design storm selection:

The selection of an appropriate design storm is critical for designing an effective and sustainable stormwater drainage system in coastal regions. The design storm should be selected based on local rainfall patterns, historical storm events, and other factors that may impact the flow of stormwater runoff.

3.4. Runoff estimation methods:

Estimating the volume and flow of stormwater runoff is critical for designing an effective stormwater drainage system. There are several methods for estimating runoff, including the Rational Method, the Soil Conservation Service (SCS) method, and the curve number method.

3.5. Hydrologic and hydraulic modelling tools:

Hydrologic and hydraulic modelling tools can be used to simulate the flow of stormwater runoff and predict the performance of the stormwater drainage system. This may include the use of computer models such as HEC-HMS, SWMM, and MIKE URBAN, which can help to optimize the design of the system and ensure that it is effective and sustainable.

By considering these design considerations, stormwater drainage systems in coastal regions can be designed to effectively manage stormwater runoff, protect the quality of coastal waters, and promote sustainable and resilient development.

IV. Components of a Stormwater Drainage System in Coastal Regions.

4.1. Surface and subsurface conveyance systems:

Surface and subsurface conveyance systems are used to collect and convey stormwater runoff from impervious surfaces and transport it to a discharge point. This may include the use of gutters, curbs, and storm sewers, as well as underground pipes and conduits.

4.2. Detention and retention basins:

Detention and retention basins are used to temporarily store stormwater runoff and release it at a controlled rate to prevent flooding and erosion. Detention basins are designed to temporarily store runoff for a few hours, while retention basins are designed to hold water for longer periods.

4.3. Infiltration systems:

Infiltration systems are designed to allow stormwater runoff to infiltrate into the ground, replenishing groundwater supplies and reducing the volume of runoff. These systems may include infiltration trenches, porous pavement, and bio-retention systems.

4.4. Green infrastructure techniques:

Green infrastructure techniques are designed to mimic natural hydrologic processes and reduce the volume and velocity of stormwater runoff. This may include the use of rain gardens, green roofs, and urban forests, which can also provide other benefits such as improved air quality, reduced urban heat island effects, and habitat creation.

4.5. Water quality treatment systems:

Water quality treatment systems are designed to remove pollutants and contaminants from stormwater runoff before it is discharged into coastal waters. This may include the use of sedimentation basins, bioretention systems, and permeable pavement, as well as the use of filtration systems such as sand filters or media filters.

By incorporating these components into a stormwater drainage system, coastal regions can effectively manage stormwater runoff, protect the quality of coastal waters, and promote sustainable and resilient development.

5. Design Challenges And Solutions:

5.1. Sea level rise and storm surge:

As sea levels rise, storm surge events can cause increased flooding and erosion in coastal regions. Designers must account for these potential impacts by designing stormwater systems with a higher level of protection, such as elevating infrastructure and using flood-proofing techniques.

5.2. Saltwater intrusion:

In coastal regions, saltwater intrusion can occur due to the proximity of saltwater bodies to freshwater sources. Designers can address this issue by selecting appropriate drainage infrastructure and materials that can withstand saltwater exposure, and by implementing techniques such as groundwater management and aquifer recharge to prevent saltwater intrusion.

5.3. Coastal erosion and sediment transport:

Coastal erosion and sediment transport can pose challenges to stormwater drainage system design, as these processes can cause infrastructure damage and sedimentation of drainage infrastructure. Designers can use natural systems such as dunes, wetlands, and beaches to protect infrastructure and manage sediment transport, and can also use structural measures such as seawalls and revetments.

5.4. Water quality impacts:

Storm water runoff in coastal regions can carry pollutants and contaminants that can have significant impacts on water quality. Designers can address this issue by incorporating water quality treatment systems into their design, such as sedimentation basins, bio retention systems, and filtration systems.

5.5. Maintenance and operations:

Stormwater drainage infrastructure in coastal regions can be subject to high levels of wear and tear due to exposure to saltwater, sedimentation, and other factors. Designers must consider maintenance and operations in their design, including routine cleaning, repair, and replacement of infrastructure, and the development of long-term management plans to ensure the continued effectiveness of stormwater drainage systems.

6. METHODOLOGY FOR STORMWATER DRAINAGE SYSTEM NEAR COASTAL REGIONS

The methodology for designing a stormwater drainage system near coastal regions typically includes the following steps:

6.1. Regulatory requirements and standards:
The design of the system should comply with local and national regulations and standards for stormwater management in coastal regions.

***6.2. Site characterization*:**
This includes a detailed survey of the site to identify the topography, soil type, geology, and hydrological characteristics of the area.

6.3. Runoff estimation:
This involves estimating the quantity and quality of runoff that will need to be managed in the coastal region.

6.4. Hydraulic and hydrologic modelling:
This step involves using hydraulic and hydrologic modelling tools to design the stormwater drainage system. This can include identifying the most appropriate design storm, selecting the type and size of conveyance systems, and estimating the capacity and performance of the system.

6.5. Design of components:
This involves the design of the individual components of the stormwater drainage system, including surface and subsurface conveyance systems, detention and retention basins, infiltration systems, and green infrastructure techniques.

6.6. Consideration of design challenges:
The design should take into account the specific challenges associated with coastal regions, such as sea level rise and storm surge, saltwater intrusion, coastal erosion and sediment transport, water quality impacts, and maintenance and operations.

6.7. Cost estimation:
The cost of the design and construction of the system should be estimated to ensure that the project is feasible and cost-effective.

6.8. Construction and implementation:
The stormwater drainage system should be constructed and implemented in accordance with the design specifications and standards, and with proper quality control and monitoring.

6.9. Maintenance and operation:
The system should be regularly maintained and operated to ensure that it remains effective in managing stormwater in the coastal region.

Overall, the methodology for designing a stormwater drainage system near coastal regions requires a comprehensive and integrated approach that considers the specific challenges and characteristics of the coastal environment.

VII. CASE STUDIES

7.1 Case study on "Stormwater Management For Hindemith Flooding"

Hindmata is a low-lying area in Mumbai, India that is prone to flooding, especially during the monsoon season. Stormwater management is critical to prevent flooding in this area.

Several measures can be implemented to manage stormwater effectively in Hindmata. These include constructing stormwater drains, improving the capacity of existing drains, and implementing green infrastructure such as rain gardens and permeable pavement. Additionally, it is essential to regulate construction activities and ensure that buildings are constructed on elevated platforms to prevent waterlogging.

In recent years, the Municipal Corporation of Greater Mumbai (MCGM) has undertaken several initiatives to improve stormwater management in Hindmata, including the construction of new stormwater drains and pumping stations. However, there is still a need for more comprehensive planning and implementation of stormwater management measures in the area.

Overall, effective stormwater management is crucial to prevent flooding in Hindmata, and a comprehensive approach that includes both traditional and green infrastructure solutions is necessary

7.2 Case study on "A Review of Recent Studies on Urban Stormwater Drainage System for Urban Flood Management"

The review on "Recent Studies on Urban Stormwater Drainage System for Urban Flood Management" provides a comprehensive overview of the latest research on urban stormwater management and flood management.

The review highlights the importance of understanding the urban hydrological cycle and the impacts of urbanization on stormwater runoff. It provides an in-depth analysis of different types of urban stormwater management systems, including traditional gray infrastructure and newer green infrastructure solutions such as rain gardens and permeable pavement.

The review also emphasizes the need for integrated approaches to stormwater management that take into account the entire urban landscape, including both public and private areas. It discusses the role of urban planning and zoning regulations in controlling stormwater runoff and highlights the importance of public education and engagement in promoting more sustainable stormwater management practices.
Overall, the review provides valuable insights into the latest research on urban stormwater management and the challenges and opportunities involved in implementing effective stormwater management strategies in urban areas. It is a useful resource for researchers, practitioners, and policymakers working in the field of urban stormwater management and flood management.

7.3 Case study on "Integrated Coastal Management of Mumbai Metropolitan Region"

The article on "Integrated Coastal Management of Mumbai Metropolitan Region" presents a comprehensive overview of the challenges and opportunities involved in managing the coastal zone of the Mumbai metropolitan region.

The article highlights the importance of an integrated approach to coastal management that takes into account the complex social, economic, and environmental factors that shape the region. It discusses the need for effective governance mechanisms, stakeholder engagement, and public participation to ensure the sustainability of coastal development.

The article also provides a detailed analysis of the current state of the coastal zone in the Mumbai metropolitan region, including the impact of climate change, sea level rise, and coastal erosion on the region. It emphasizes the need for proactive measures to mitigate the impacts of these factors, including the implementation of coastal protection measures and the development of green infrastructure solutions.

Overall, the article provides valuable insights into the challenges and opportunities involved in managing the coastal zone of the Mumbai metropolitan region. It highlights the importance of an integrated, collaborative approach to coastal management and the need for proactive measures to ensure the sustainability of coastal development in the region. It is a useful resource for researchers, practitioners, and policymakers working in the field of coastal management and sustainability.

7.4 Case study on "Design of Storm Water Drainage System for Urban Area"

The article on "Design of Storm Water Drainage System for Urban Area" provides an overview of the key considerations involved in designing an effective stormwater drainage system for an urban area.

The article discusses the factors that influence the design of stormwater drainage systems, including the catchment area, rainfall intensity, and soil type. It provides a detailed analysis of different types of stormwater drainage systems, including traditional gravity systems and newer low-impact development solutions such as green roofs and rain gardens.

The article also emphasizes the importance of effective planning and design in ensuring the sustainability and

resilience of stormwater drainage systems. It discusses the need for integrated approaches to stormwater management that take into account the entire urban landscape, including public and private areas, and highlights the importance of stakeholder engagement and public participation in the planning and design process.

Overall, the article provides valuable insights into the key considerations involved in designing an effective stormwater drainage system for an urban area. It is a useful resource for engineers, planners, and policymakers involved in the design and implementation of stormwater management solutions in urban areas.

VIII. Conclusion

8.1. Summary of Key Findings:

Stormwater management in coastal regions is critical due to the increased risks of flooding, erosion, and water quality issues. Designing a stormwater drainage system in coastal regions requires an integrated approach that considers the unique environmental and hydrological conditions of the area. The components of a stormwater drainage system include surface and subsurface conveyance systems, detention and retention basins, infiltration systems, green infrastructure techniques, and water quality treatment systems. The challenges in designing stormwater drainage systems in coastal regions include sea level rise and storm surge, saltwater intrusion, coastal erosion and sediment transport, water quality impacts, and maintenance and operations.

8.2. Future Research Needs:

There is a need for further research on the impacts of climate change on stormwater [1]effects of sea-level rise, increased storm intensity, and other changes in precipitation patterns. There is also a need for research on the effectiveness of different stormwater management techniques in coastal regions and the most effective ways to manage maintenance and operations.

8.3. Implications for Stormwater Management in Coastal Regions:

Effective stormwater management in coastal regions is essential for protecting public health, infrastructure, and the environment. Coastal communities should consider the unique environmental and hydrological conditions of the area when designing stormwater drainage systems. Designers should also consider the potential long-term impacts of climate change when designing these systems. Coastal regions can benefit from an integrated approach to stormwater management that incorporates green infrastructure techniques, water quality treatment systems, and other measures to reduce the impact of stormwater on coastal ecosystems. Finally, effective maintenance and operation of stormwater drainage systems is crucial for their long-term effectiveness.

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Analytical Study of Waste Water System in the City

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***Abstract*— Nowadays many water resources are polluted by anthropogenic sources including household and agricultural waste and industrial processes. Public concern over the environmental impact of wastewater pollution has increased. Several conventional wastewater treatment techniques, i.e. chemical coagulation, adsorption, activated sludge, have been applied to remove the pollution, however there are still some limitations, especially that of high operation costs. The use of aerobic waste water treatment as a reductive medium is receiving increased interest due to its low operation and maintenance costs. In addition, it is easy-to-obtain, with good effectiveness and ability for degrading contaminants. This paper reviews the use of waste water treatment technologies to remove contaminants from wastewater such as halogenated hydrocarbon compounds, heavy metals, dyes, pesticides, and herbicides, which represent the main pollutants in wastewater.**

Keywords: **heavy metals, dyes, pesticides, and herbicides**

I. INTRODUCTION.

Mumbai has the fourth largest population in the world (12.4 million inhabitants, 2011 Census of India) this results in a lot of regular commuter flow from nearby towns, such as Navi Mumbai andThane, resulting in a wide range of services. Mumbai has invested in expanding its basic servicesto meet the population's needs, such as water supply, solid waste disposal, and wastewater collection and treatment in order to meet its growing needs. However, there is a gap between what is offered and what is needed by the general public, creating a gap. The emphasis has been on urban sewerage treatment and disposal in centralized networks traditionally, using water for storage and treatment requires water use as well as well as capital and energy resources. Accordingto recent figures, 50-80% of untreated wastewater flows into oceans until infrastructure is in place,Indian cities are forced to reconsider sanitation concepts should make full use of cost-effective andlong-term solutions. Domestic wastewater collection, treatment, and disposal facilities have been in place since the 1880s, and have been expanded as the city has grown. There are 1,998 km of sewers, 62 sewage pumping stations, 9 provisional treatment facilities, marine outfalls at three locations, three stage lagoons at one site, and single stage lagoons at two locations in the current sewerage infrastructurewith seven areas. The first part of the Mumbai's sewage treatment (stage I) was approved by the Indian government's Ministry of Environment and Forests (MoEF). In 2025, the second stage of MSDP wastewater treatment and discharge facilities are community,organizational, and person levels. Usage oftheland with little to no capital is applied in treatingwastewater in all three of the case studies in this study, and returned to the site where it is madefor re-use. The main aim of the MSDP II is to provide cleaner and healthier air for Mumbai residents while reducing the negative impacts of wastewater disposal on the environment. Milan is currently implementing the Phase II Mumbai Sewage Plan which lays out achievable and quantified goals for the year 2025.It is estimated that the project would cost INR 1,510 million. Approximately 2240 US dollars. Table 1 displays the total expense, operation, and maintenance costs of wastewater treatment plantIn South India, Godfrey et al. conducted a water This case study looks at 2 different projects in Mumbai, all of which are designed to improve the quality of the city's waste water and sewage system.Nature and electric-mechanical technologywere investigated aspart of the initial research for natural and electrical wastewater treatment.Three studies were chosen aftera thorough investigation: on three different scales reclamation study using conventional economics, the advantages were worth $100 each. 3:7 studies looked at the environmental costs of wastewater treatment plants. The authors estimated the economic cost and benefits of water and sanitation improvements. This research aims to decide whether Mumbai's proposed second stage of sewage treatment is advantageous economically, socially, and environmentally. Rapid urbanization combined with growth has resulted in substantial wastewater

production in towns and cities. This case study looks at 2 different projects inMumbai, all of which are designed to improve the quality ofthe city's waste water and sewage system. Nature and electric- mechanical technologywere investigated as part of the initial research for natural andelectrical wastewater treatment.Three studies were chosen aftera thorough investigation: onthree different scalesThe right waste water disposal solutions must be considered and a more integrated approach must be used for diverse situations. The basic principle of devolving implementation standard is the basisfor decentralized wastewater treatment so that wastewater can be managed atlow prices, minimizing the cost of drainage long distances and promoting local reconstruction of treatment wastewater.Treatment and local reuse of wastewater – The twin objectives of equality and sustainability are achieved through the use of locally relevant treatment technology at the Community, administrative and human resources levels.

1.1 What is mean by Sewage?

Sewage is a form of liquid waste that contains a large amount of water as well as various impuritiessuch as waste water from households, offices, factories, and hospitals.

1.2 What exactly is the Sewage Disposal?

The removal of waste from households and factories, such as faeces or polluted water. It is taken away in sewers or drains to be disposed of or converted into a non-toxic form. The process of the removal, destruction or transformation of harmful substances into wastewater, especially via bacterial ammonificationand nitration.

1.3 Need of Sewage Treatment or Disposal

Every day, large industries, factories, and mills produce tonnes of sewage. Any of this waste is so dangerous that allowing it to leave the neighborhood can lead to a variety of diseasesas well as pollution of land and water. Solid waste may be easily eliminated, but removing chemical and biological pollutants from these wastes so that they can be sent to safe areas is more difficult. Sewage treatment plants are usedto do this. We've arrived at this point because of a few main aspects of tertiary sewage treatment.Sewage treatment is also known as wastewater treatment, and it involves the treatment of industrial wastewater. In several cities, the sewer transports a portion of industrial wastewater to a sewage water treatment facility, where it has already been treated to reduce pollution in the factories. If it's a combination sewer, storm water would be carried as well. Using pipes and pumps, waste waters are transported to sewage water treatment plants. The following are the basic processes that sewage goes through in asewage water treatment plant.

1.4 Working of Sewage treatment Plant:

Despite its simplicity, the recycling of treated sewage necessitates meticulous attention to detail and upkeep.The operation of the plant has been defined here

II. REVIEW OF LITERATURE

"Vinayakam Jothiprakash, Marcus Joseph Tobias (2020) Published a Study of theSocioeconomic Spillovers of Sanitation: Sewage Treatment Plants in Navi Mumbai, India". This case study covers various factors such People from rural areas move to cities in search of a decent quality of life as a result of urbanization and industrialization. The massive influx of migrants to major cities in fast-developing countries like India puts a lot of strain on city infrastructure, especiallythe water supply and sanitation systems, as well as sanitation infrastructure like the wastewater collection network, treatment by sewage treatment plants (STPs), sewage disposal system, and reuse delivery system. As a result, about 80% of the existing drinking water intake is converted to wastewater. In a number of cases, the services offered have either been insufficient or have been poorly managed.

According to Kulkarni, Wanjule, and Shinde (2018), only 10% of the sewage released in India is treated before being deposited into water bodies or on the earth. Wastewater is mostly unregulated in most cities, contaminating both land and groundwater supplies. [1] "Ritesh Vijay (2016) published research paperImpact of sewage discharges on coastal water quality of Mumbai, India: present and future scenarios", "this paper explores Using MIKE 21,the simulationthesis evaluates the effect of sewage discharges on the current and expectedwaterquality along the Mumbai coast. Water content parameters such as dissolved oxygen (DO), biochemical oxygen requirement (BOD), and faucal coliform (FC) are compared to defined guidelines. For the current coastal hydrodynamics and observed water quality parameters, the simulation is validated. The validated model is also used to forecast scenarios for pumping station upgrades as well as improvements in wastewater intake, treatment, and disposal systems. The current coastal environment's water quality does not meet the necessary requirements, but it increases significantly in the forecast scenarios. Despite a significant change in FC, it falls short of optimal levels when no medication for bacteria elimination is taken into account. The simulation research stresses the importance of pursuing solutions such as the reuse or recycling

of processed effluent as a means of conserving water." [2] "Indrayani Nimkar (2014) publishedresearch paper on the Status Of Sewage Treatment Plants: A Case Study Of Mumbai City Conference: International Conference On Green Technology For Environmental Pollution Prevention And Control (ICGTEPC) September 2014. In this case study she discussed the key causes of water contamination in India are unmanaged urbanization, population explosion, and insufficient sewage treatment and disposal capability. One of the causes for water contamination in the coastal area is a significant difference

between sewage generation and treatment in Mumbai. This paper provides an overview of Mumbai's sewage treatment plants (STPs), which would be useful in determiningthe extent of water contamination caused byuntreated sewage disposal, pollution control strategies, and treatment technologies for reuse or recycling treated water. The source of generation, treatment capability, technology used, and reuse of treated water at 62 STPs inMumbai is investigated. In Mumbai, institutional wastewater is the primary source of sewage. In Mumbai, sewage is generated at arate of 2700 million litres per day (MLD). A total of 1998 MLD of sewage treatment capacity is available, with 1700 MLD of sewage being collected for treatment. 4 STPs have a treatmentcapacity of more than 200 MLD, and48 STPs have a treatment capacity of less than 1 MLD, out of a total of 62 STPs. various technologies have been used to treat sewage produced, with the Moving Bed Bio Reactor (MBBR) being used in the majority of the STPs(14). STPs also mentioned using filtered waste water for gardening and flushing in around 13% of cases. UsingArcGIS, the location and capability of the treatment plants were mapped against Mumbai's population distribution and drainage system for a more detailed study of STP allocation according to population. [3] "Hamsa Iyer (2016) Published

a Case Study of Mumbai: Decentralized Solid Waste Management", this paper investigates the extent to which various institutions/communities have made effective waste management attempts. Owing to a lack of adequate channels for handlingrejects and sanitary waste, most individuals are unable to reach 100 percent decentralized control. More specifically, since local corporationsare financially dependent on the center and state to survive, it is critical to

III. RESEARCH METHODOLOGY

In this case study, we have collected data from various government agencies. When we look at the waste water management system in Mumbai, where people and organizations are attempting to handle their waste in a more decentralized manner. Methodology for

identifying the critically impacted on Suburban environment, Industry & Society due to residential land use activities and thereby developing an index is discussed in detail below. Any research within the realm of urban planning is interdisciplinary due to the heterogeneous nature of the various sectors it caters and co- opts from. In a developing country like India, availability of structured data is a major concern forsuch a research [Anil Kumar, 2010] [7].

Waste-water Treatment & Sewage Disposal System In Mumbai Suburban region

In 1970, the Maharashtra government was the first in the country to issue rules under the Maharashtra Prevention and Control of Pollution Act, 1969. With the rise in environmental consciousness and the additionof new environmental regulations. Decentralized wastewater treatment and municipal recycling for sustainable urban water management are mainstreamed in Maharashtra. For decades, centralized waste disposal in urban areas has become the traditional method for management. Urban local bodies were also responsible,with some money allocated forriver washing, for wastewater, drains and sewage treatment plants

IV. FINDING ANDRECOMMENDATIONS

Findings of Case Study Mumbai's Sewage and SolidWaste Management Issues

A. Faulty Primary Collection Systemand Old dated Sewage Lines

With nearly 65 lakh people commuting everyday, there is a high number of floaters and dailycyclists, whichcontributes to road littering (Jain 2004). Streets in many parts of the cityare in poor repair owing to a lack of timely street cleaning, and surface water drains are cloggeddue to solid waste pumped into them. Only main roads are washed seven days aweek,and only 77 percent of roads are cleaned six days a week (SWM Cell 2003). Currently, door- to- door waste disposal is limited to just 15% of total waste collected, with the remainder left unsorted. Because of the lack of segregation, a portion of the garbage dumped at landfill sites is recyclable. As a result, the amount of garbagethat needs to be disposed of has increased. The problem is exacerbated in Mumbai by the high density and huge proportion of slum dwellers. Since slum andpavementdwellers lack access to proper facilities, they must disposeof their waste in public areas such as roads, drains,and railway tracks. Hawkers lead to roadlittering.

Disposal of wastes with respect to the Average sewage collection Land accessible for dumping and the construction of landfill sites for waste disposal is becoming scarce as cities grow. In the MCGM field, there are only four landfill sites with a 5-year estimated lifetime. MCGM will have a tough time finding new waste disposal sites in the immediate future to meet current waste generation levels as well as those createdbythe new population

Where did the governmentfail?

1) Lack of planning and management of the administration.

2) The MRDPA, which was established after the 2005 Mumbai floods, has only met six timesin total. The rate at which thisindependent authority has been producing has been slowing recently means that the progress will soon be restored.

3) Short-term option that is not long-term

4) There is no concrete solution in orderto get Mithi out of its sewer-like condition.

5) Pollution, stench

5.1.2 Lack of awareness among the public on the existing facility and proceduresfor obtaining sewerconnections.

1) The private agency's responsibilities werenot well defined, resulting in inadequate collection and transportation.

2) As a result, the water that arrives at the treatment facility is laden with floating materials and coarse solids. This causes clogging during transportation and increases the waste burden on the treatment units, lowering the productivity of the aerobic pond and facultative stabilization pond.

3)The causes of the above issues were discovered to be a lack of institutional cooperation between the private firm, TWAD, and the community.

It was also discovered that these departments blame one another fortheir failures.

4) The productivity of the STP in many sites is extremely low, with just 40% BODelimination.This is mostly attributable to poor influent content, lagoon silting, and the creation of anaerobic conditions, all of which contribute to the plant's decreasedproductivity. The dilemma could be effectively addressed by making authorities aware of their obligations and attempting to form public-private alliances.

5)Poor land use policies and pollution disposal into rivers have culminated in a public protestand appeal calling for proper land use and wastewater reuse for irrigation and Pisciculture.

6)Due to the low quality of treated wastewater, crop selection, and land use trend, wastewaterreuse for agriculture has not been effective.

V. CONCLUSION

We cannot afford to lose our freshwater supplies to contamination as our population andneeds expand. Not only have we shown that we are inefficient when it comes to using our capital sustainably, but we have also neglected to save our magnificent estuarine environment. Nonetheless, the rising demand and declining condition of Mithi and other freshwater bodies can serve as a wake-up call to all of us. The fact that a vibrant river representing a vast, majesticenvironment has been converted to a sewer is a sad circumstance.The environment and the glory of Mithi has long been destroyed by waste, stench, and encroachment. The threats it poses to people's lives andlivelihoods are a red flag that requires immediate attention.

In order to protect the river and the inhabitants, the administration's help is needed. The administration is expected to move quickly to build STPs that will div wastewater away fromthe river while also providing a suitable waste collection system for residents and businesses along the Mithi.

Even after all that has been accomplished by men, it is nevertheless insufficient. Every single day, more garbage is dumped into the river. To combat this problem, further preparation and initiative are needed, but many people are reluctant to volunteer for Mithi clean-up because of the noxious condition in which the river currently finds itself, while the administration focuses on short-term solutions

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Local and recyclable Materials for Construction (Ceramic, Glass, Plant-based Polyurethane Rigid Foam, Reclaimed or Recycled Steel)

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***Abstract*—Building material is any material used for construction purpose such as materials for house building. Wood, cement, aggregates, metals, bricks, concrete, clay are the most common type of building material used in construction. The choice of these is based on their cost effectiveness for building projects. Many naturally occurring substances, such as clay, sand, wood and rocks, even twigs and leaves have been used to construct buildings. Apart from naturally occurring materials, many man-made products are in use, some more and some less synthetic. The manufacture of building materials is an established industry in many countries and the use of these materials is typically segmented into specific specialty trades, such as carpentry, plumbing, roofing and insulation work. This reference deals with habitats and structures including homes.**

I. Introduction

The construction industry is looking for ways to mitigate its environmental impact, now that governments and businesses are giving more importance to sustainability. Construction waste causes significant damage, since it accounts for about one-third of all refuse nationwide. Recycling construction materials can significantly reduce the environmental impact of the industry.

Traditionally, construction and demolition waste has been disposed of in landfills. However, this has a negative environmental impact, contaminating underground water and surrounding habitats. Construction companies and developers are learning that recycling is beneficial for the entire industry.

Since ancient times ceramics and glass have been used to manufacture structural components for construction projects. During the early Neolithic period, the people of Jericho (a town in today's Israel) made bricks from sun-dried mud for building purposes, while later the Romans used concrete to erect the Pantheon temple in Rome. Today, with estimated revenues of over $500 billion in 2018, the construction sector represents a 63% share of the total ceramic and glass industry.

Ceramic products for the construction sector include cements and cement-based materials, interior and exterior tiles, sanitary ware, non-refractory bricks, and other more complex shapes such as drainage, sewer, and chimney pipes and linings.

Cements are used to make mortar and concrete. Mortar is obtained by mixing cement with water and sand and is the preferred material for masonry projects, such as the joining of bricks, stones, and tiles, and for filling cracks and holes. In addition to water, sand, and cement, concrete also contains gravel and small rocks, which provide strength to the mixture. Concrete is used in a variety of civil engineering projects, including buildings, bridges and roads, as well as fire-, moisture-, and chemical-proof structures. Concrete can also be molded in ready-to-use bricks, blocks, pipes, and other shapes that can be formed by 3D printing.

Indoors, ceramic tiles are used to cover floors, walls, kitchen countertops and sides (Tuscan style), and fireplaces. Tiles are very durable and hygienic construction products that add unrivaled beauty to any application. In interior design, tiles are also combined to form mosaics and wall paintings as a form of art and decoration.

II. Proposed Framework

The best way to recycle construction waste is using it in new projects, and there are many construction materials that can be recycled.

The following are some examples:
- Concrete
- Metals
- Asphalt
- Wood and untreated timber
- Glass
- Paper and Cardboard
- Gypsum
- Masonry
- Appliances and fixtures, such as sinks and bathtubs
- Windows, doors, and roofing
- Vegetation and trees
- Plastics

Environmental Benefits from Recycling Construction Materials:

Energy Savings: Recycling saves large amounts of energy, and in general it decreases the consumption of natural resources to produce new materials. For example, if all the concrete and asphalt waste generated annually in the US were recycled, it would save the energy equivalent of 1 billion gallons of gasoline.

Landfill waste reduction: Landfills are filling up, which means that alternative ways to manage waste must be developed. Recycled construction waste can be reused as it is, or turned into something new.

Economic Benefits of Recycling Construction Materials

Cost Savings: Recycling and reusing construction materials reduces the cost of disposal and transportation. Some recycling organizations even charge less compared with conventional disposal methods. Recycling also reduces the demand for new resources, which also cuts transportation and production costs.

Green Certifications: Construction companies that recycle materials have a competitive edge, due to the increasing importance of green building and environmental conservation. Recycling can help building owners earn points for LEED certification, which is the most popular green building rating system.

Ceramic and Glass:

Outdoors, ceramic tiles are mostly used for paving terraces, patios, staircases, porches, driveways, and pool sides. Ceramic shingles are very common in warm regions as an economic, long-lasting roofing material for architectural elegance and to ensure a proper water barrier against heavy precipitation and good insulation from the sun. Ceramic tiles are becoming “smart products” by the incorporation of solar cells or other devices, such as smartphone chargers. Bathrooms are furnished with sanitary ware (toilets, sinks, bathtubs, and shower trays) made from clay and kaolin with added quartz and feldspar, and subsequently glazed. The resulting product is very hard, resistant to wear and chemical attack, durable, and easy to clean.

Glass is another very common material in construction. Glass is primarily used for windows, but also for indoor partitions, mirrors, skylights, floors, and staircases. In addition, glass fibers can be found in insulation products, ceiling panels, and roofing shingles. They are also added as a reinforcement to concrete.

Plant-based Polyurethane Rigid Foam

Polyurethane Rigid Foam

Rigid foam has for long been used as insulation material in buildings. It was first used after a top manufacturer of surfboard material was fined by the EPA, and subsequently put out of business for using a toxic material. The new surfboard material was made from plant-based polyurethane rigid foam, which came from bamboo, kelp and hemp, rejuvenating the surfboard industry. It is now in use in the manufacturing process including that of turbine blades and furniture. The material is rigid and relatively immovable, meaning it can be used for insulation. Additionally, it offers protection against mold and pests. It is also heat resistant, protects against mold and pests, and can be perfect as sound insulation.

Reclaimed or Recycled Steel

Steel can be used for the framing process, in place of wood, increasing the durability of a structure against earthquakes and high winds. A 2,000-square foot house requires about 50 trees to build, but a frame made from recycled steel requires the steel equivalent of just six scrapped cars. Steel is 100% recyclable and significantly reduces the ecological impact of new construction. Mining, heating and shaping products made from aluminum and steel requires a lot of energy, but properly and efficiently reusing or recycling them into new products, lowers the energy used, and makes the material more sustainable, the recycled metal is long-lasting and does not require frequent replacements. It does not burn or wrap and is therefore perfect for roofing, building facades and structural support. Additionally, recycled steel is water- and pest-resistant.

III. Future Scope

Clay bricks are used to build homes and commercial buildings and for masonry projects because of their strength and visual appeal. Bricks can be fabricated with eco-friendly processes, can be easily assembled to create structures of various shapes and sizes, and will not burn, melt, dent, peel, warp, rot, rust, or be eaten by termites. Brick homes are better protected from weather phenomena, such as thunderstorms, hurricanes, and high humidity, than homes built with wood and vinyl or fiber-cement siding. In recent years, smart glass has become increasingly popular. Smart glass is a glass assembly that comprises chromogenic materials, in other words, materials that change their light transmission properties, turning from transparent to opaque or vice versa, when a voltage is applied. Various technologies are being applied to produce smart glass, such as electrochromic, polymer dispersed liquid crystals (PDLCs), and suspended particle devices (SPDs). In the construction sector, smart glass finds application in privacy glass, day lighting control for windows, and energy-saving panels. Windows are also becoming more intelligent with the incorporation of solar panels to generate electricity.

The main applications of ceramics and glass in construction are illustrated in the table below.

Figure 1 Brickwork Applications

Figure 2 Uses of Bricks

Figure 3 Glass Panels

Figure 4 Ceramic Materials

Figure 5 Smart glass samples

IV. Conclusion

Recycling construction materials provides an opportunity to achieve cost savings. These savings include the cost of new materials, and also transportation and disposal costs. The use of recycled materials also results in energy savings and reduced carbon emissions.

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Review of Recent Earthquake Resistant Technologiesfor Design of High Rise Building Structure

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***Abstract*—The turf of seismic activity Engineering has existed in our nation for over 35 years now. Indian Earthquake Engineers have made momentous hand-outs to the seismic safetyof a number of important structures in the country. However, as the recent earthquakes have shown, the performance of normal structures during past Indian earthquakes has been less satisfactory. This is mainly due to the lack of awareness amongst most practicing engineers of the special provisions that need tobe followed in earthquake resistant design and thereafter in construction. Earthquakes compose one of the supreme hazards of living and assets on the earth. Due to the abruptness of their happening,they are least understood and most dreaded. Theearthquake resistant construction is considered to be very important to mitigate their effects.This project presents the concise prerequisites of earthquake resistant construction and a few techniques to improve the resistance of buildingand buildingmaterials to earthquake forces, economically.In this paper we are reviewing the different technology which are used now a day formaking earthquake resistant structure that have been developed to prevent or mitigate the damage caused by earthquakes. Recently, there have been some notable advances in earthquake-resistant technology, including the following: Base Isolation, Viscoelastic Dampers, Steel Braced Frames, Fiber-Reinforced Polymer(FRP), Shape Memory alloy(MSA). The datacollected from the survey and analysis will be usedin curating a design using software like MidasGen, Etab or revit. The implementation of earthquake resistance design in future will prevent sudden collapse, loss of property and life making it an essential contribution.**

Keywords—earthquake, structure, resistant, insert, analaysis

I. INTRODUCTION

Earthquakes are known to have a huge potential to cause devastating impact on the built environment and human life. India has witnessed more than 9 major earthquakes in the last two decades between 1990 and 2010 and reports put the death toll at around 30,000. Although certain parts of the country are more prone to earthquakes (Seismic Zone V IS 1893 (Part 1)-2016) than the rest cannot no region to be considered an earthquake-free region. In the Indian scenario, multiple microearthquakes are reported daily near the subduction zone (Himalayan belt), while several large earthquakes have been recorded in the interplate region (Deccanplateau) over the years. Performance of the built environment in the past The earthquake proved its fragile nature and created an urge among engineers and architects to move to seismically efficient buildings. Most of India's landmass (about 60%) is vulnerable to moderate to very strong earthquakes. A large earthquake in an unpopulated area can cause minimal damage compared to a moderate earthquake in a densely populated area.

All field survey studies conducted after the great earthquake to building collapse.. Lack of knowledge about earthquakes and their their incorporation into the design and implementation of buildings leads to building failures. A large proportion of rural and urban dwellings are low-rise non-technical buildings and these are maximally damaged. During an earthquake, seismic waves travel in all directions. However, among the various components, horizontal vibration is considered to be the most prevalent cause of structural failure. Seismic waves tend to move the foundation of a building and induce inertial forces in various structural elements. The seismic performance of a structure during an earthquake depends on its overall shape, size, geometry and character of the load path. The philosophy of seismic design aims to ensure the safety of structural components and human life. It states that load-bearing structural members must suffer no damage in case of (frequent) mild shaking, suffer repairable damage in case of (occasional) mild shaking, and suffer severe damage without collapse in (rare) strong shaking. This article outlines the typologies of buildings encountered in the Indian subcontinent and their behavior during past earthquakes. We tried to look into current earthquake safe building practices. Furthermore, a brief description of future trends in increasing the earthquake resistance of buildings was provided. Overall, in addition to efficient and effective seismic design philosophies, it is necessary to ensure rigorous design and construction practices in compliance with regulations.

II.LITERATURE REVIEW

Earthquakes have been one of the most destructive natural indicated that the maximum number of reported casualties wasduephenomena, with a high potential to cause loss of life andproperty. Designing and constructing earthquake-resistant structures is, therefore, critical for saving lives and reducing property damage. This literature review provides an overview ofthe current state of knowledge regarding planning and designing earthquake-resistant structures.[2] Earthquakes are caused by themovement of tectonic plates, which can lead to the release ofenergy that creates seismic waves. These waves can cause the ground to shake, leading to the collapse of buildings and other structures. Understanding the nature of earthquakes and their effects is a crucial first step in designing earthquake-resistant structures.[3]

Many countries have established building codes and regulations that specify seismic design requirements for structures. These codes outline minimum standards for earthquake-resistant construction, including requirements for building materials,

structural design, and seismic load calculations. Following these codes and regulations is essential

in ensuring that structures are built to withstand seismic events.[1] Seismic hazard assessment is the process of estimating the likelihood and severity of earthquake shaking at a specific location. This assessment is essential in determining the seismic design parameters required for the structure. Several methods are used to conduct seismic hazard assessments, including probabilistic seismic hazard analysis and deterministic seismic hazard analysis.[4] Structural analysis and design are the processes of determining the structural response of a building to seismic loads and designing the structure to resist these loads. Several analytical methods are used to determine the behavior of structures under seismic loads, including the finite element method, the boundary element method, and the discrete element method. Designing structures that can resist seismic loads requiresa thorough understanding of the behavior of structures under different loading conditions.[5] Seismic retrofitting is the process of modifying existing structures to improve their resistance to seismic events. Retrofitting may involve adding new structural elements, strengthening existing elements, or modifying non-structural components such as partitions and cladding. Seismic retrofitting is essential for existing structures that do not meet current seismic design standards.[6]

I. NECESSITY OF EARTHQUAKE RESISTANT STRUCTURE

According to the 2011 census of India, there are over 330 million housing units in the country, (GOI,2011) with two-thirds of these being rural houses. The Geological Survey of India has classified the country into four seismic zones with varying seismic potential. Seismic zones IV andV constitute about 30% of the housing units. These rural building units are mainly constructed using locally available materials such as mud or unfired bricks, stone walls or walls made of fired bricks. In addition to the high proportion of rural housing stock, the last decade has witnessed the rapid growth of the urban population. Census of India shows a 32% increase in urban population from 286 million in 2001 to 377 million in 2011. It is expected that by the end of 2030, the urban population will reach nearly 590 million people. According to statistics, 50% of the demand for construction activities in India comes from the infrastructure sector, the rest from industrial activities, residential and commercial development, etc. (Make India, 2015). This rapid urbanization has increased the demand for infrastructure, basic amenities, housing schemes and community development. The time of day (day or night) of the earthquake plays an important role, because it directly affects the occupancy of the building. For example, the Latour earthquake (1993) occurred in the early hours, around 3:53 a.m., when most of the population in the affected area was asleep. Conversely, the Bhuj earthquake (2001) occurred around 8:46 AM, when most people were awake and building occupancy was minimal. These two earthquakes contributed to the poor performance of non-engineered building units such as mud mortar random rubble masonry with heavy roofs (Figure 3) and modern RC-framed multi-story buildings (Figure 2). The experience of the past earthquake shows the lack of seismic design in modern residential buildings. At the same time, the importance of incorporating seismic principles into structural design became more apparent so that buildings would function as a unit during an earthquake. We need to empower rural communities to ensure thesafety of buildings against earthquakes by raising awareness about the importance of earthquake and earthquake resistant buildings. Urban built environments require careful planning and design

II. RESEARCH OBJECTIVE

The main aim of a structural designer is to prevent the building damages and collapse related with the earthquake accidents to maintain emergency functioning of the facility. Also it is essential to reduce the severity of losses caused from seismic attacks. So the main objectives to do this research contain followings:

1. To optimize the behavior of structures especially R.C.C buildings against Seismic attacks using modern techniques.

2. To prevent such deflections that would produce the collapse of elements structures.

To become familiar of new and advanced methods andactivities performing worldwide. This can be achieved by: a. selecting appropriate materials for construction for optimizes earthquake effect. b. Proportioning of structural members. c.Having adequate knowledge and safety precautions to optimize its dangers. So that cost effectiveness and attractive solution can be arrived at. If failure behavior of building structure is known, this objective can be achieved.

III. MODERN CONSTRUCTION

4.1 Pre Stressed Concrete Members in earthquake-resistant construction this ensures proper connection between various components of a structure. Further, this technology has been widely adopted in New Zealand.

4.2 Shape memory alloys Unique properties are desirable in earthquake resistant buildings. They have the ability to dissipate significant energy without significant degradation or permanent deformation. The most common shape memory alloys are made from metal mixtures containing copper-zinc-aluminum-nickel, copper-aluminum-nickel, or nickel-titanium. This specific smart material is widely researched to explore its wide-ranging applications. Important structures such as hospitals, fire stations and other public buildings must remain functional after an earthquake. To do this, the response of the building to seismic loading must be controlled using appropriate control devices such as:

4.3 Base isolation It is one of the widely accepted and accepted approaches to protect the building from seismic forces. It is a set of structural elements responsible for separating the superstructure from the substructure. When the soil supporting the building's foundation shakes, this component undergoes lateral displacement, leaving the structure intact. There is now considerable interest among earthquake engineers in base-isolated systems – particularly in countries such as Japan, the USA and New Zealand – with a view to developing cheaper systems with wider applications.

4.4 Seismic dampers as an effective lateral load resistance system, diagonal braces were used in the moment frame. However, recent developments in the field of structural control of seismic response have led to the replacement of these stiffeners with seismic dampers. These dampers act like hydraulic shock absorbers in automobiles – much of the sudden jerks are absorbed in the hydraulic fluids and little is transmitted higher up to the car's chassis. When seismic energy is transmitted through them, the shock absorbers absorb part of it and reduce the magnitude of the force acting on the structure. Commonly used types of seismic dampers include viscous dampers (energy is absorbed by a silicone-based fluid

4.5 passing between an arrangement of piston cylinders),

friction dampers (energy is absorbed by surfaces with friction between them rubbing against each other), and elastic dampers (energy is absorbed by metal components). that revenue). In India, friction dampers were provided in an 18-storey RC frame structure in Gurgaon, India

4.6 Sheet Plate Shear Walls are considered an essential component of lateral load resistingsystemsand steel is well known for its tensile behavior. By combining these two desirable properties, an effective load-resistant system has been developed that has found wide application in Japan and North America. These walls are designed to buckle under lateral loads instead of buckling. These walls are significantly thinner and lighter, reducing the weight of the building. Furthermore, these walls do not need to be hardened, which speeds up the construction process. Carbon fibers The tensile characteristics and stable nature of the web have been studied by various researchers in Japan. An earthquake-resistant building made of carbon fabric – resembling a giant spider web – has been constructed in the city of Nomi in Ishikawa Prefecture, Japan. This is the world's first seismic reinforcement structure made of carbon fiber material

CONCLUSION

The Scientists Av. round the world are trying to produce cost-effective and efficient construction technologies using locally available materials. In Peru, for example, researchers have made traditional adobe structures much stronger by reinforcing the walls with plastic mesh. In India, engineers have successfully used bamboo to strengthen concrete. And in Indonesia, some houses now stand on easy-to-make bearings made from old tires filled with sand or stone. It has also been found that even unengineered structures sometimes have the required resistance to earthquake motions. Earthquake-safe construction technology should primarily include the use of ductile materials, earthquake- resistant building configurations, lightweight structural elements to reduce seismic forces, and robust architectural forms.

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Staibilization of Soil Using Fly ash as an Additive

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***Abstract*— Pavement construction necessitates a considerable amount of earth material. Most of the time flexible pavements are required to be created over bad subgrade having problematic soil which results to higher thickness of the pavement. Fly ash can be used efficiently to improve the engineering qualities of poor soil. The current study was conducted to investigate the influence of fly ash stabilization on the Maximum Dry Density, Optimum Moisture Content, and California Bearing Ratio of subgrade soil. Two types of soil, Soil A (Clayey soil) and Soil B (Silty gravel Sand), are stabilized with fly ash at varied percentages ranging from 5 to 20% by dry weight of soil. The outcome demonstrates that the 4 days soaked CBR value of sub grade soils considerably increase due to addition of fly ash.**

Keywords—stabilization, flyash, maximum dry density, optimum moisture content, california bearing ratio.

I. INTRODUCTION

Soil Stabilization is the process of blending and mixing materials with a soil to improve certain properties of the soil. The process may include the blending of soils to achieve a desired gradation or the mixing of commercially available additives that may alter the gradation, texture or plasticity, or act as a binder for cementation of the soil.

The long-term performance of any construction project depends on the soundness of the under-laying soils. Unstable soils can create significant problems for pavements. Lack of adequate road network to cater to the increased demand and increase distress in road leading to frequent maintenance have always been big problem in our country. Evolving new construction materials to suit various traffic and site conditions for economic and safe design is a challenging task in road construction. Effective utilization of local weak soils by imparting additional strength using stabilization materials enable reduction in construction cost and improved performance for roads. Exploring the feasibility of such materials for sub grade and embankment stabilization will help the road building sector to evolve a stronger, durable and economic design. Desirable properties of subgrade are high compressive and shear strength, permanency of strength under all weather and loading conditions, ease and permanency of compaction, ease of drainage and low susceptibility to volume changes and frost action.

II. LITERATURE REVIEW

J. Trivedi, S. Nair and C. Iyyunni [1] carried out experimental studies to investigate optimum utilization of fly ash for stabilization of subgrade soil and concluded that OMC attains its highest value of 29.27 % for 10 % of fly ash as compare to 21.38 % for unstabilized soil whereas, CBR value increases from 5.64 % to 20.53 % for 20 % of fly ash. L. Yadu, R. Tripathi and D. Singh [2] conducted number of experiments for the comparison of fly ash and rice husk ash stabilized black cotton soil. Based on the CBR and UCS tests they reported the optimum amount of fly ash and rice husk ash was 12% and 9% respectively. Saving in the cost per km length of road has been estimated to be approximately 14% and 20% for RHA and FA respectively. B. Phanikumar and R. Sharma [3] studied the effect of fly ash on engineering properties of expansive soils and stated that optimum moisture content decreased and maximum dry unit weight increased with an increase in fly ash content. There is substantial history of use of soil stabilization admixture to improve poor subgrade soil performance by controlling volume change and increasing strength. R. Parson and E. Kneebone [4] studied the field performance of fly ash stabilized subgrade and stated that fly ash contributed to soil strength and stiffness while plasticity and swell potential were reduced. An improved subgrade contributes to the strength of the pavement system, and may provide savings through reduction in the thickness of the asphalt section. V. Pasupuleti, S. Kolluru and T. Blessingstone [5] conducted experimental study on effect of fiber and fly ash stabilized subgrade and stated that optimum CBR value was obtained at 15% of fly ash with 1.5 % fiber content. S. Mackiewicz and E. Ferguson [6] studied the stabilization of soil self-cementing coal ashes and reported that self-cementing class C fly ash can be effectively and economically used as stabilization agent for a wide range of construction applications. The reduction in maximum dry density and strength was dependent on the fly ash hydration rate and could vary significantly between different ash sources. E. Geliga and D. Ismail [7] investigated geotechnical properties of fly ash and its application on soil stabilization and reported that shear strength observed of sample mixture cured for 7 days were decreasing when amount of fly ash was 80% of the total weight of the mixture. R. Sharma [8] studied the sub grade

characteristics of locally available expansive soil mixed with fly ash and randomly distributed fibers. As per the results of investigation, it was reported that proportion of 70 % soil and 30 % fly ash was the best proportion having maximum dry density and maximum CBR value.

III. EXPERIMENTAL PROGRAMME

A. Material Selection

Two types of soil namely Soil A and Soil B available near Ulwa, Navi Mumbai and Taloja, Phase I, Navi Mumbai collected. The properties of both soils used in present study are given in Table I. As per the AASHTO soil classification system, Soil A is A-7-5 and Soil B is A-2-5. Similarly, class F fly ash is used in the present investigation. Its properties are listed in Table II.

TABLE I.

Sr. No	**Physical Properties of Soils used in present study**		
	Property	***Soil-A***	***Soil-B***
1.	Liquid Limit (%)	96	42.8
2.	Plastic Limit (%)	35	33.19
3.	Plasticity Index (%)	61	9.61
4.	MDD (gm/cm^3)	1.240	1.65
5.	OMC (%)	28	20
6.	CBR (%)	1.45	4.67
7.	UCS (kg/cm^2)	2.084	1.564
8.	Soil Classification as per AASHTO	A 7-5	A 2-5
9.	Typical name	Clayey soil	Silty Gravel Sand

B. Testing Programme

The Liquid limit and Plastic limit [IS 2720-Part (5)-1985], Proctor test [IS 2720-Part (7)-1980] and Soaked CBR [IS 2720 (part 16)-1987] were conducted on unstabilized as well as stabilized subgrade soils. The Percentage of fly ash increases from 5 % to 20 % at the step of 5 % by dry weight of soil. Based on test results, optimum percentage of fly ash required for maximum benefit was estimated.

Sr. No	**Properties of Class F Fly ash used in the present study**		
	Characteristics	***IS 3812 Grade***	***Result Obtained***
		Grade-I	
1.	Silicon Dioxide (Si02) + Aluminum Oxide (AI203) + Iron (Fe203) Min%	70.00	91.76
2.	Silicon Dioxide (Si02) By % Mass, Min	35.00	59.58
3.	Magnesium i.e., MgO Max %	5.00	3.30
4.	Sulphur Trioxide (SO3) Max %	2.75	0.22
5.	Moisture Content, Max %	-	0.08
6.	Loss on Ignition, Max%	6.00	0.50
7.	Available Alkalies as Sodium Oxide (Na2O),	1.50	0.70
8.	Fineness % Retained On 45-micron sieve Max %	34	11.40

IV. RESULT AND DISCUSSION

A. Effect on Liquid and Plastic Limit

Liquid limit and Plastic limit test were conducted on both subgrade soil A and soil B as well as subgrade soils stabilized with different percentage of fly ash. The result shows that the liquid limit consistently decreases and plastic limit consistently increases in both soil-A and soil-B.

The liquid limit and plastic limit of unstabilized subgrade soil-A is 96 % and 35 % respectively. The values decrease to 78.90 % and value of plastic limit increases to 39.84 % due to addition of 20 % of fly ash respectively.Simillarly the liquid limit and plastic limit of unstabilized subgrade soil-B is 42.8 % and 33.19 % respectively.

The value of liquid limit decreses to 36.35 % and the values of plastic limit increases to 35.42 % due to addition of 20 % of fly ash respectively. Table III shows the variation of liquid limit, plastic limit and plasticity index due to addition of different percentage of fly ash in subgrade soil-A and soil-B.

TABLE III.

Sr. No	**Effect of Fly ash stabilization on Liquid limit, Plastic Limit and Plasticity Index**						
	Fly Ash Content (%)	***Subgrade Soil-A***			***Subgrade Soil-B***		
		LL	PL	PI	LL	PL	PI
1.	0	96	35	61	42.8	33.19	9.61
2.	5	91.15	40.87	50.28	41.94	35.84	6.10
3.	10	83.67	41.15	42.52	40.96	37.14	3.82
4.	15	82.82	39.50	43.32	39.77	36.09	3.68
5.	20	78.90	39.84	39.06	36.35	35.42	0.93

B. Effect on Dry Density and Optimum Moisture Content

Standard Proctor Tests were conducted on unstabilized and stabilized soils using fly ash with different percentages varying from 5, 10, 15 and 20 percent by dry weight of soil.

The mixture was transferred in proctor mould in three equal layers and each layer compacted by giving 25 numbers of uniformly distributed blow.

The variation in maximum dry density and optimum moisture content with different percentage of fly ash for both subgrade soil-A and soli-B is tabulated in Table IV and Table V whereas; Fig. 1 and Fig. 2 show the typical plot for unstabilized and stabilized subgrade soil-A and soil-B and soils stabilized with 5 % fly ash by dry weight of soil.

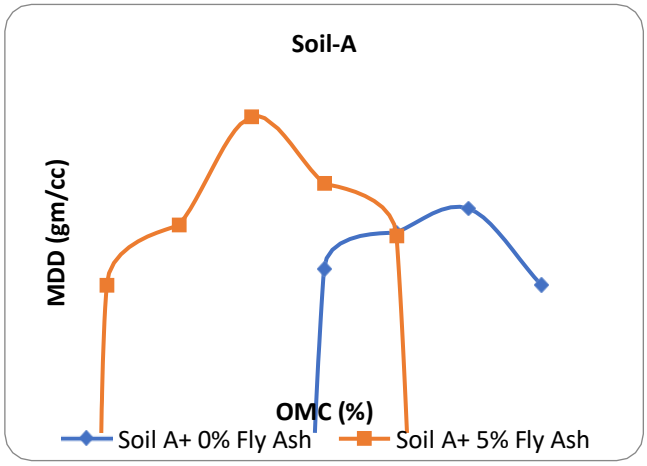

Fig.1 Variation of dry density with water content for Soil-A

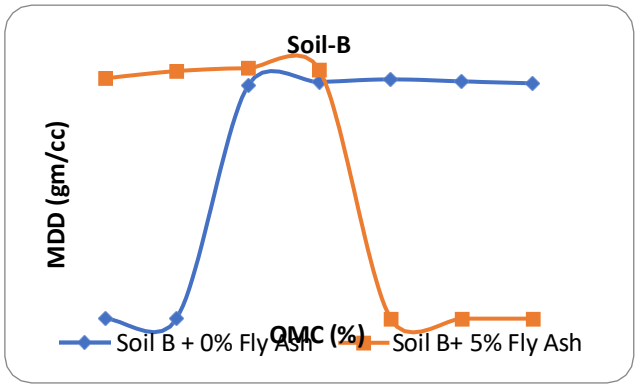

Fig.2 Variation of dry density with water content for Soil-B

The maximum dry density of subgrade soil-A and subgrade soil-B is found to be 1.24 gm/cm^3 and 1.65 gm/cm^3 respectively. These value increases to 1.474 gm/cm^3 and 1.727 gm/cm^3 respectively, thereafter, these values drop down. Increase in density may be due to heavy weight of fly ash replaced by soil and some of the compacting energy absorbed by fly ash. Table IV and Table V shows the variation of maximum dry density and optimum moisture content for the subgrade soil-A and soil-B mixed with different percentage of fly ash.

TABLE IV.

Sr. No	Variation of MDD and OMC and CBR value with Fly Ash content for soil-A				
	Fly Ash Content (%)	*MDD gm/cc*	*OMC (%)*	*CBR (%)*	*% increase*
1.	0	1.24	28	1.45	-
2.	5	1.298	22	2.825	94.82
3.	10	1.474	18	3.68	153.79
4.	15	1.432	6	2.606	79.72
5.	20	1.429	6	1.633	12.62

TABLE V.

Sr. No	Variation of MDD and OMC and CBR value with Fly Ash content for soil-B				
	Fly Ash Content (%)	*MDD gm/cc*	*OMC (%)*	*CBR (%)*	*% increase*
1.	0	1.65	20	4.67	-
2.	5	1.727	16	5.973	27.90
3.	10	1.695	18	8.13	74.09
4.	15	1.537	14	6.45	38.11
5.	20	1.578	14	5.68	21.63

C. Effect on CBR Value

CBR tests were conducted on unstabilized and stabilized soils with different percent of fly ash. CBR values at different fly ash content and percentage increase in CBR with respect to unstabilized soil A are presented in Table IV. It is observed that, the CBR value of subgrade Soil A is 1.45 %. This increases to 2.825, 3.68, 2.606 and 1.633% due to addition of 5, 10, 15 and 20% fly ash respectively as shown in Table IV. Maximum improvement in CBR is observed when soil-A is stabilized with 10% of fly ash content.

Similarly, the CBR value of unstabilized soil B is 4.67 %. This increases to 5.973, 8.13, 6.45 and 5.68 due to addition of 5, 10, 15 and 20% fly ash respectively as shown in Table V. Maximum improvement in CBR is observed when subgrade soil-B is stabilized with 10% of fly ash content.

From CBR test, it is seen that maximum improvement in terms of CBR is observed at 10 % fly ash for both subgrade soil-A and soil-B. Hence it can be considered as optimum percentage of fly ash required for maximum benefits.

V. CONCLUSION

- Liquid limit decreases with increase in percentage of fly ash by dry weight of both subgrade soil-A and soil-B.
- Plastic limit increase with increase in percentage of fly ash up to 10% thereafter it starts decreasing but effect is very marginal.
- With an increase in fly ash content up to 10 %, the maximum dry density increases and thereafter it drop

down whereas; the optimum moisture content consistently decreases for subgrade Soil-A.

- With an increase in fly ash content up to 5 %, the maximum dry density increases and thereafter it drop down whereas; the optimum moisture content consistently decreases for subgrade Soil-B.
- The percentage increase in CBR for subgrade soil A is 94.82, 153.79, 79.72 and 12.62 for the fly ash percentage of 5, 10, 15 and 20 respectively whereas the percentage increase in CBR for subgrade soil B is 27.90, 74.08, 38.11 and 21.62 for the fly ash percentage of 5, 10, 15 and 20 respectively.
- For both subgrade soil-A and soil-B, the optimum Fly ash content is 10% indicating that flexible pavement resting on both subgrade soil A and soil B can be economical for these optimum fly ash content in terms of saving of natural resources and cost.
- Percentage increase in CBR at 10 % fly ash content in case of subgrade soil A is much more than that of subgrade soil B. It indicates that fly ash stabilization is much effective for weaker soil than stronger one.

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An Economic Water Dispenser Machine Considering Hygiene

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***Abstract*— It is concerned that any person is simply moved to do a specific task while in need or whilst challenged by using the environment. the invention discloses an automatic water dispenser and a design method thereof. The design method is characterized in that a cooling adjusting device and an automatic water adding tool are respectively disposed on an existing water dispenser, and water dispenser computerized control is performed. the automated water dispenser designed by combining the cutting-edge new generation and daily requirements solves the problem that water temperature manage is inappropriate due to the fact cold water and hot water proportion of a common water dispenser is controlled manually, brings good consumer experience, recommends drinking water temperature consistent with surrounding temperature, and provides consuming water with healthful temperature suitable for drinking. in the meantime, the water dispenser has the automatic water adding feature and a timing water boiling function, and convenient, quick, and affordable water drinking experience can be provided to users** [1].

Keywords--- temperature, dispenser, drinking, experience, tool, timing, invention, device, consumer, problem

I. INTRODUCTION

The availability of a water supply, adequate in terms of quantity and quality, is essential to human existence.

Historically, humans recognized the importance of water from quantity viewpoint. It is an established fact that civilizations have developed around the water bodies that could support agriculture, transportation and provide drinking water. Of late, the importance of water quality has now been recognized as a result of the developments of biological, chemical, and medical sciences. Such advancements have clearly established a link between water quality and its effects on human health and well-being [2]. Water is a very important resource needed to sustain life, and safe drinking water is a fundamental requirement for human existence [3]. Economic Water Dispenser is containing a series of many functions like controlling the water level, filtering, and purifying the water, showing the value of temperature, and automatic ejection of water [4].

In order to resolve this problem of impurities in water we have analyze and made an economic water dispenser for multiple purposes. This dispenser will help to solve the major issue of water to some extent.

The water fit for drinking purposes should:

(i) be free from bacteria, which may cause diseases

(ii) be colorless and sparkling clear.

(iii) be tasty, odorless, and cool.

(iv) be free from all objectionable matter

(v) not corrode the pipes

(vi) have dissolved oxygen and free carbonic acid

This paper is focused in presenting the embedded into case study of and economic portable water dispenser. The thing by which we get motivated is the wastage of water and the impurity of water. We also know that it will help the environment and water cycle by which we can save water for our future and economy.

II. LITREATURE OF STUDY

In the society, water dispensers' machines are growing in numbers, mostly in public places such as: parks, stations, schools, or even remote rural areas– dispensing healthy safe water at any place. Health situation of locals and other issues such as maintenance of the machines while providing a greater number of dispensers for everyone including congested regions, becomes a concern that the government must focus. This requires attention of the dispenser manufacturers to be capable of providing drinkable water, installing, servicing, and maintaining the units.

In recent paper, prepared titled "Automatic water dispenser" in a Journal of Control and Instrument Engineering, A case study on water dispenser was provided with same Arduino based electrical system intended to use in the dispenser machine proposed in this research. While the mentioned paper focuses on usage of IoT for creating a smart dispenser this study provides an affordable, portable machine dispensing safer water reducing the health risk.

The future upgrade of this water dispensing machine can be designed using Smart monitoring system for controlling the usage of water resulting in reduction of water wastage, providing hot and cold water using solar systems in the small areas, as the machine is originally designed for, where

electricity is crucial issue, or vending machines as coin-based system in urban areas to upscale the proposed model in the research and using recyclable materials for production of the machine.

III. Methodology

1. Procurement of Materials

A steel frame as main structure of Galvanized steel for support & portability. 50 liters of Plastic tank (food grade) to maintain the economy, Filter media (UF/UV) of capacity 22000 lit. electronic sensor chips would be used to detect the pH, TDS, TSS parameters. A display unit to display this parameter based on treated water. Braking mechanism to the wheels according to the slope of road. AC power/ Battery operated system. Recycled plastic PET bottles, etc.

2. Assembling body

Upon construction of the machine, we would be designing technique that would enable supply of respective quantity of water. Steel frame is constructed by welding as per requirement. Once the frame is constructed, the (UV/UF) filter is placed on it under which the plastic tank is placed. The water from plastic tank is filled by an inlet which would be attach to a BMC tap, the water will get filtered through the UV/UF purification process. Once the purification is done it will flow to outlet tap, The sensors will detect the water parameter and show it on display unit which will above the outlet of water tap.

3. Building filtration unit

Mount the sediment pre-filter housing to the wall using the included fittings and brackets, then insert the filter cartridge. Mount the UV system. Attach the UV system to the wall, downstream of the sediment filter. Leave enough space around the unit to allow for proper maintenance. Plumb in the UV unit. Connect the flexible tubing to your plumbing and the UV unit, following the instructions in your user manual. Keep in mind that UV light degrades plastic, so don't use plastic fittings. Insert the lamp. Slot the lamp into the sleeve and slide it into the chamber. Plug the unit in. Plug the unit into your power supply and switch it on. Check for leaks. If you notice leaks around the fittings or connections, tighten them or use Teflon tape to secure the connections.

4. Testing pH TDS, TSS, turbidity, MPN ecolii total hardness

As per Standards parameters:

- The pH of normal water should be within 6.5- 8.5 which is acceptable according to IS 10500-1985.
- Total Dissolved Solid (TDS) should be between 50 – 150 ppm, but the upper limit is 500 ppm.
- Total Suspended Solids (TSS) > 5 NTU as per IS 10500- 2012, by INTU
- Turbidity of drinking water should not be more than 5 NTU, and should ideally be below 1 NTU as per IS 3025-1984.
- The current acceptable upper limit for E. coli content in fresh surface water is 900 cfu/100 ml.
- As per IS 10500: 1991, what is the permissible limit in the absence of alternative sources for the total hardness of drinking water is 600 mg/l.

Considering the following parameter, the parameters of filtered water are yet to be tested.

5. Business model

This prototype would be profitable as less capital investment is required to the unemployed. It can replace the normal dispenser in which the 20L bottles are placed on it. As consideration of hygiene, purity, maintenance, this dispenser would give us surety. The initial cost of dispenser will be 15,000(including battery and cooling per unit) and if one employee sells 50 liters of water in 10 days then by end of the month he will generate the revenue of 15,000/- and after the maximum limitation of filter is crossed (22,000 liters) the maintenance of dispenser is done which would cost about 1000-1500/- charge. A separate team of maintenance will do the routine inspection of machine. Also special care is to be taken for supplying water of required quantity in paper cups, and recycled bottles.

Cost	Water in ml.	Cost with bottle
2.00	200 ml	3.00 Rs
5.00	500 ml	7.00 Rs
10.00	1000 ml	12.00 Rs

IV. Result & Discussion

The water which would be dispensed is expected to meet the BIS standards.

Problem of availability and accessibility is solved as the dispenser is mobile and installed at any place.

Quality water would be made more economical.

V. Conclusion

The dispenser would achieve all its targets of affordability, maintaining the standards, availability, as well as being economic in nature.
Generation of employment can be done and depending upon the sales, the profit margin can be calculated.
Thus, higher the sales, higher the profits for the dealer & higher the health standards for the customer

VI. Future Scope

It will be more beneficial as it is/will be more economical than other dispensers available in market.
Reduction and recycling of plastic for bottles will save our future.
Generation of income for unemployed group.
If patent, it can be rebuilt as coin vendor machine, apart from being mobile.
It can be effectively placed in corners of street food junctions, malls, stadiums where requirement of water is essential.

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Use of Conventional Water Treatment Methods to Rejuvenate Powai Lake Water.

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***Abstract*—The original potable water supply to Mumbai metropolitan city and its suburban areas, are largely dependent upon Five lakes namely: Tulsi, Tansa, Vaitarana, Vihar and Powai. These lakes had been constructed during British Indian period during the middle to last phase of eighteen centaury and beginning phase of nineteen centaury. All lakes are still functioning well, except the Powai Lake. The Powai Lake has been under severe environmental degradation, garbage and waste disposal, causing deterioration in lake water quality and enhancing lake sedimentation by local residents. Several attempts have been made for revival and survival of Powai lake by eminent environmental engineers, chemists, zoologists and limnologists but seem to be futile in the want of desired success.**

We have worked on the rejuvenation and the reimagination of the Powai Lake and its periphery. This will generate revenue to make it a tourist attraction. Also problems like water hyacinth and eutrophication are taken into consideration in this research and ideology.

Keywords:- **revival and survival, eutrophication, environmental**

I. INTRODUCTION

Powai water supply was brought into Mumbai for the first time in 1891. Complaints were received from the public regarding quality of Powai water. Later it was found that water is not potable. Within couple of years Tansa water supply was introduced and Powai lake was stopped due to its bad water quality. More than 100 years old, Powai Lake represents a typical case of environmental degradation due to urbanization. Bioremediation measure alone as in the case of Powai Lake has been unable to achieve lake equilibrium in full. The main source of pollution is by Lord Genesh idols made from plaster of Paris and the chemical paints used to paint those idols. These idols are immersed in Powai Lake during Ganpathi visarjan in Mumbai. Also the wast+e water released through the 13 outlets in the periphery of Powai Lake is the major cause of wide range of pollution and damage. All these aspects evoked to work on the quality of Powai Lake water. The Powai Lake has gone through many stages of water quality degradation. The lake water which used to supply drinking water for Mumbai has been declared unfit to drink.

Figure 1 – Outlet of waste entering Powai Lake

Figure 2 –Old Powai Lake

II. OBJECTIVES

- Past and Present status of Powai Lake.
- To check the physiochemical properties of Powai lake water.
- To provide the solution over the problems identified during data processing.

III. METHODOLOGY

1. Visit for the identification of the problems.
2. Team conducted survey of Powai lake with questionnaire and found increased growth of algae and water hyacinth, indicating ecological imbalance. Further investigation needed to understand the situation and preserve the lake's health.
3. After having discussion with locals and studying literature we found that, Water in Powai Lake water can be contaminated by both natural processes and human activities such as directly discharging sewage water from city sewer lines. This discharge of sewer water increasing water pollution in powai lake the factors responsible casing pollution of waster are BOD, COD, Chemicals present in water etc. The major concern in Powai Lake is the growth of water hyacinth and algae blooms, caused by the presence of nutrients in the water such as nitrates, phosphates, and sulphates.
4. Having discussions with locals, fishermen, BMC officers for data collection.

   We have identified 19 outlet sewer lines from nearby Mumbai city but 15 of them directly discharged into Powai lake without any treatment.
5. Collecting water samples from Powai lake and testing it in laboratory.
6. Analyzing the lab test data for perfect solution.
7. Predicting the use of Pythorid for the treatment of Powai lake water.

A. To remove BOD/COD: -

Dissolved oxygen (DO) is an important factor in the health and quality of aquatic ecosystems. High levels of DO help to support the growth and survival of aquatic plants and animals, while low levels of DO can lead to decreased water quality and harm aquatic life.

Windmill aerators work by increasing DO levels in bodies of water, such as lakes and ponds, to reduce BOD (Biochemical Oxygen Demand) and COD (Chemical Oxygen Demand). BOD and COD are measures of the amount of organic matter present in water and the amount of oxygen required to break down this organic matter, respectively.

Windmill aerators work by using wind power to drive a turbine that pumps air into the water, increasing its oxygen levels. The aerator typically consists of a diffuser, which spreads the oxygen-rich air throughout the water, and a drive shaft that transfers energy from the wind turbine to the aerator. The increased oxygen levels help to break down the organic matter present in the water, reducing BOD and COD levels. This improves the overall quality of the water, supporting the health of aquatic ecosystems and improving water quality for human use.

Windmill aerators are an eco-friendly alternative to other methods of water treatment, as they do not require any electricity or other sources of power. They also do not produce any harmful by-products, making them an attractive option for those who want to minimize their impact on the environment.

B. To remove phosphate: -

Lime treatment: Lime treatment involves adding

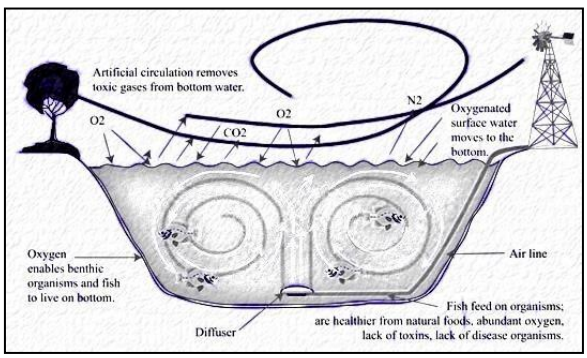

Figure 3 – working of wind mill aerator

calcium hydroxide to a water body to control the growth of algae blooms and water hyacinth. The required amount of lime is calculated, added through fountains and mixed with the water for uniform distribution. It raises the pH level, making the water less suitable for algae and plant growth. However, it may increase the cost of sludge removal due to the formation of calcium carbonate precipitates.

C. Pythorid process: -

The Phytorid process is a self-sustainable wastewater treatment technology that uses specific plants to absorb nutrients and remove organic matter. It is a natural method that can recover and reuse treated water for various purposes, such as gardening and drinking. The treatment system uses plants found in natural wetlands and involves a constructed wetland designed for municipal, urban, agricultural, and industrial wastewater. The process is subsurface flow type, with wastewater applied to a cell filled with porous media. The system requires an area of approximately 35 square meters for 20 m3/day of water. This technology can replace the growth of Water Hyacinth, provide a habitat for fish, and treat water in a natural manner.

The Phytorid process utilizes specific plants, such as Canna Lilly, Water Lilly, Yellow Flag Iris, Elephant Grass, Vetiver, and Water Lettuce, to remove organic matter and pollutants from wastewater. These plants are grown on floating beds around the lake and act as nutrient sinks, absorbing nutrients directly from the water. This technology is based on the principle of a constructed wetland designed for the treatment of various types of wastewater. The process involves a subsurface flow system, where wastewater is applied to a cell filled with porous media, such as crushed bricks, gravel, or stones. The flow is maintained in a manner that the wastewater does not reach the surface, allowing the plants to effectively absorb the nutrients. This natural treatment method provides a sustainable solution for water treatment and can be used to recover and reuse treated water for various purposes.

IV. RESULT

1. Testing part of project work not yet started, in current semester and upcoming semester testing of Powai lake water will be done.
2. Then the results will be produced accordingly.

V. CONCLUSION

The Powai lake water needs to be treated with the help of Pythorid treatment methods. Previously the waste water treatment plant was setup for Powai lake water but this modern technologies are expensive, not sustainable, the output need lot of technical resources. So, we are planning to adopt Pythorid as a water treatment method on Powai lake. Which may provide expected results and become a self-sustainable solution for cleaning waste water from urban lake.

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Revitalization Schemes in Mumbai

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***Abstract* – In this on the role of state and central government for housing projects involving upgrading and redevelopment of large informal settlements (slums) occupying. With a population of 17,159 lakh people is said to surpass that of Mumbai by the year 2025 what has now become a costly real estate. It focuses on a Problem Peculiarity of Mumbai. The paper is based on the field work completed in the slums in the city of Mumbai. With a population of more than 17 lakh people in Mumbai living today, Mumbai is the most crowded city in India. There are several lessons that can be learned from Mumbai's Slum rehabilitation efforts. Government can play vital role in the development of slums. The Government of Maharashtra might have achieved the perfect balance between over-involvement and under-involvement. The lesson learned is that government can play a passive and aggressive role by de-regulating the development controls. It can play a major role in redistributing real estate to reduce the gap between the urban rich and poor.**

Keywords: Land Use Regulation, Density Regulation, Land Market and Land Prices.

I. INTRODUCTION

Revitalization refers to the process of renewing and improving the physical, economic, and social aspects of a community, city, or region. The goal of revitalization is to rejuvenate an area that may have become rundown or economically depressed, and to make it more attractive to residents, businesses, and visitors. Revitalization can involve a variety of activities, including physical improvements (such as the construction of new buildings or the renovation of existing ones), economic development initiatives (such as job training programs or tax incentives for businesses), and social initiatives (such as programs aimed at reducing crime or improving public health).

The cluster redevelopment scheme in Mumbai, which was meant to incentivize the reconstruction of old and dilapidated buildings in clusters, is not finding many takers, despite a provision of a higher floor space index (FSI). City developers say this is mainly due to the criteria that the plot size should be a minimum of 6,000 square meters in suburbs, and 4,000 square meters in the city. Cluster redevelopment, they say, will only become successful if the minimum plot size requirement is reduced.

"For carrying out cluster redevelopment in the suburbs, the minimum plot size requirement is 6,000 square meters. At least five to six buildings must be brought in together. This is complicated. Therefore, several standalone buildings are being constructed in the suburbs," Hitesh Thakkar, a developer from Mumbai suburbs, said. Redevelopment of just one or two buildings itself is a task as all members of these buildings should reach a consensus, Thakkar pointed out.Another developer underlined the fact that the cluster redevelopment scheme provides more open space opportunities, which is not the case with standalone building developments where rooftop amenities are provided due to a lack of space. Therefore, to make the cluster scheme viable, the government should consider reducing the minimum plot size, especially in suburbs, the developer said in Mumbai, the minimum plot size of a building is around 1,000-1,500 sq mt. Therefore, with the present cluster redevelopment criteria, nearly 5-6 buildings need to come together if the builder wants to take advantage of the cluster scheme. Anand Gupta, the chairperson of the Housing and RERA Committee of the Builders' Association of India, said that to 'collect' 6,000 sq mt of plot size to take advantage of the cluster redevelopment project is not easy in a city like Mumbai. "I believe the plot size should be below 4,000 sq mt to make it viable and successful," he said. It takes a developer one or two years to get the consent of all the residents of a single housing society, Gupta said. "In cluster redevelopment, as more housing societies need to be clubbed, the entire process may take years. So reducing the plot size from say 6,000 sq mt to 4,000 sq mt and more in the suburbs may increase the probability of cluster redevelopment scheme

adoption," he added.

As per new rules for SRA in Mumbai 2021, according to FPJ, the Maharashtra Cabinet sub-committee, has approved a proposal to reduce time of selling SRA Mumbai flats from 10 years to 3 years. The SRA Mumbai flats can be sold after 3 years of demolition of hutment.

Fig.1. Mumbai Slum

majority realized from the very beginning that this was merely apolitical gimmick

After coming to power, the program was pursued by the Government for implementation. But if failed miserably and as expected, led to serious violations of land, and housing rights, including the abuse of human rights. The slum-dwellers have been subject to greater abuse and threat of displacement. This policy is being proudly continued by the present government led by the Congress and Nationalist Congress coalition. This government has further introduced a host of new concessions to facilitate and appease the developers and reinforce the earlier governments' oppressive plans and programs. These do not benefit the slum-dwellers.

The tragedy in housing in the city has all along been thefact that the plans and policies have continuously alienated the people. The capability of the slum-dwellers and their co- operatives in undertaking (direct) responsibility for the development of their own housing has been denied. Instead, the Government has continuously resorted to violent attacks on the slum-dwellers and demolition of their houses, refusing to recognize the people's right to housing and the denial of slum-dwellers participation in the drafting of the various policies and programs for them. The planning process and the experience with development projects so far indicate that citizens have been totally excluded from the discussion about the location and nature of development projects, their size, their socio-environment impact, the distribution of their costs and benefits, and course, the magnitude of displacement and the procedures of rehabilitation. Such denial of people's right to participation in the decision-making process betrays the spirit of the Indian Constitution'. (Fernandes and Paranjpye, pg.11 – Rehabilitation Policy & Law in India) (-Baxi 1989). The government has always addressed the issue of housing by promoting real-estate interest(s) and major construction plans rather than the development of social and environmental conditions. The state itself has also come to threaten its own citizens, often as a direct consequence of its commitment to the project of development, which has regularly placed enormous burdens on those people least able to defend themselves. (Khilnani, 1997:11 – The Idea of India). For Mumbai, in an area of 437 sq. kms. Having a population of around 17 million, conservative estimates put over fifty-five percent as slum population. This slum population spread over around 2,500 settlements occupies 2,525 hectares, whichconstitutes merely 6% of city's total land area. The slum settlements have come up on private lands (50%), State Government lands (25%), and Municipal Corporation lands (25%). The balance (5%) is spread over various Central Government and State Housing Board lands. The housing situation in Mumbai is tragic.

The ultimate aim of revitalization is to create a more vibrant, thriving, and sustainable community that offers a higher quality of life for its residents.

II. MEGA CONSTRUCTION SYNDROME AND THE REAL ESTATE AGENDA

Housing today is looking upon merely in real estate terms. This is what the building industry wants so as to monopolize and control land development. The real-estate agenda is encouraged today due to the privatization thrust in housing and corporatization of the various development and construction activities. Housing projects are evaluated in terms of size, the built-up area, the FSI consumed, the financial turnover, and various other business and marketing merits. The bigger the project, the better it is and the greater the attraction for developers in undertaking the scheme. A huge network is thus established between the developers, the landowners, and thefinancial institutions wherein the slum-dwellers find no place.

Problem definition IN 2022 – 2023 Inflation and Interest Rates.Geopolitical Risk.Hybrid Work.Supply Chain Disruption.

Energy.

- Labor Shortage Strain.
- The Great Housing Imbalance.

Regulatory Uncertainty

IV AIM & OBJECTIVES

The aim of this study is to evaluate the slum restoration/redevelopment carried out under the SRS inMumbai.

1) Studying the impact of Slum rehabilitation/redevelopment schemes in Mumbai

2) The extent to which slum redevelopment has been beneficialin terms of physical infrastructure.

3) The aim of this study is to find out answers to the following research questions regarding SRS

III LITREATURE SURVEY

1. Malvika Singh Parmar et.al. [1] "A case study of slum

A.redevelopment in Jaipur, India: Is neglecting women an option?"

This paper focuses on the role of women in communitydevelopment in slums in the developing nations. Fieldwork was conducted in the slums of Jaipur, India during the summer of 2009 and analyzes in particular the urban development program in the city, „The Rajasthan Urban Infrastructure Development Program". The paper examines the different ways in which the women in slums could contribute to better planning and execution of slum redevelopment plans. It is proposed that a greater involvement of women is needed at the planning stage and to make women become active participants rather than passive recipients of aid. In the past decade, slums in developing nations have gained greater attention throughout the world and have been recognized as a key challenge of urbanization (UN-HABITAT, 2006).

Several countries have adopted different models for slum redevelopment, which in the long-run have had limited success. However, there is one factor that often goes neglected in most slum redevelopment plans, which is the involvement of women. It is women who largely bear the brunt of the sub-human living conditions in slums (Moser, 1987; Amis, 2001) as they are the ones fetching water from far distances, trying to maintain cleanliness to keep the family healthy, taking care of a family"s nutrition, running the house on a shoestring budget and so on.

This paper is based on the fieldwork completed in the slums in the city of Jaipur, India in 2009. The paper identifies the new area of concern regarding the involvement of women in the already existing domain of community development as well as the inherent weakness of the approach of "planning for women" rather than "planning with women." The research methods include interviewing the women living in the slums, as well as the government officers and NGO workers working on plans for improving the living conditions of the city slums. The study also analyzes the ongoing urban development program in the city, the Rajasthan Urban Infrastructure Development Program.

The research has uncovered various reasons supporting the view that women"s participation is crucial to slum redevelopment. In addition, the paper examines the different ways in which the slum women, who are for most part illiterate, could contribute to better planning and execution of slum redevelopment plans, and how women"s empowerment plays a key role. However, the mere inclusion of women in the plans as beneficiaries is not enough. A greater involvement of women is needed at the planning stage, coupled with a thorough needs assessment survey with emphasis on specific women"s needs. Women must become active participants in the programs and not just recipients of aid. Finally, the paper concludes with an analysis of the approaches used and offers some suggestions based on the fieldwork regarding the approaches to address these complex and important problems.P K Das et. al.[2] Slums Improvement and Development Schemes & Policies The Shiv Sena – BJP Government in Maharashtra came into power in March 1995. One of the promises given in the `WachanNama' or Charter of Commitments of the Shiv Sena – BJP alliance in Maharashtra was the promise of providing free houses to 40 lakh slum- dwellers in Greater Mumber. This was the greatest bluff ever perpetrated on the city's poor. While a small section of the slum-dwellers, mostly the slum-lords, (a) large number of elected representatives and the highly opportunistic self-styled leaders were excited by the offer, the majority realized from the very beginning that this was merely a political gimmick. In many interviews and discussions both in the press and otherwise, Mr.Bal Thackeray, founder and leader of the Shiv Sena who was also the architect of this scheme of free houses to the slum-dwellers, could not elaborate or how this target would be achieved, nor did he have any definite program to do so.

After coming to power, the program was pursued by the Government for implementation. But if failed miserably and as expected, led to serious violations of land and housing rights, including the abuse of human rights. The slum-dwellers have been subject to greater abuse and threat of displacement. This policy is being proudly continued by the present

government led by the Congress and Nationalist Congress coalition. This government has further introduced a host of new concessions to facilitate and appease the developers and reinforce the earlier governments' oppressive plans and programmes. These do not benefit the slum-dwellers. The tragedy in housing in the city has all along been the fact that the plans and policies have continuously alienated the people. The capabilit y of the slum-dwellers and their co- operatives in undertaking (direct) responsibility for the development of their own housing has been denied.

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2. Uday Athavankar et. al. [3] Think Bottom-up: Can You Use that in Mumbai Slum Upgrade?

The paper deals with housing projects involving upgrading and redevelopment of large informal settlements (slums) occupying what has now become a costly urban real estate. It focuses on problems peculiar to Mumbai. The first section reports the current understanding of in-situ upgrading of informal settlements and it's financing. The second section argues that peculiar Mumbai context requires that we change our understanding of upgrade to include in-situ rehabilitation, where free tiny apartments for the dwellers are financed through incentive regulation and cross-subsidy. It then goes on to elaborate current deterrents to in-situ rehabilitation like development financing, delays and cost overruns due to conflicts. Considering that the statewill never have resources to provide houses to its poor, section three discusses the role an enabler of housing. Later, it argues that as an enabler it cannot restrict its activities only to policymaking and lists what more it can potentially do. It also suggests that policies cannot treat all slums as equal and find one grand solution that fits all. The forth section summaries the discussion and pleads that along with taking short-term view, it is important to see slum redevelopment in thecontext of the future growth and development of the city and the region. In developing economies, considering the income and savings of the urban poor, even affordable housing is an expensive proposition. Slumsexist as the only affordable alternatives. The problem is even more acute in large metropolises with high cost of living and needs a special focus. In Mumbai slum dwellers have already 'settled', their dwellings and occupy relatively large parcels of land that have over time, become costly urban real estate. (See figure 1) Besides, these dwellers have the power of numbers with them and insist that they should be rehabilitated in the same place. So, the paper treats housing alternatives to Mumbai slums as a special class of the housing upgrade problem. The problemin itself is complex and compounded further by severe space constraints. The problem is not only complex, but is more urgent and politicized besides being challenging due to severe space constraints.

3. Krish R. Villaitramani et. al.[4] PREFABRICATED CONSTRUCTION FOR MASS HOUSING IN MUMBAI Urbanization is the rapid influx of people migrating to cities. The UN has predicted that by 2050, 64.1% and 85.9% of the developing and developed world respectively will be urbanized. With limited resourcesof labour, time and finance, slums around the world continue to grow in size in uninhabitable conditions for humans. Prefabrication of houses, an innovation that has potential to address environmental and sustainability concerns at a rapid pace, mechanizes the constructionprocess, enabling mass manufacture of affordable houses. This paper discusses the case of Mumbai, the city of maximum slum population density in the world, where prefabrication can be a promising solutionto housing scarcity.Prefabrication, in one form or the other, has been in practice since many centuries. However, the first prefabricated building is known tobe constructed in the year 1905. In the early years, materials such as stone and logs were extensively used, and such a construction was called as ultra-light construction. However, the boom in the prefabrication market occurred after the end of World War I. And sincethen, massive prefabricated buildings have been constructed, owing to the fluctuating trends in construction industries and demand for homes at cheaper rate, due to tremendous losses suffered in World War 1. The countries at the forefront of prefabrication were United States of America and the Western Europe.

IV C

A) REDEVELOPMENT ALTERNATIVES

3.1 SRD Amendments-Necessary amendments to the present Slum Redevelopment Policy regulated by the SRA should be carried out to plug the various loopholes and make it more slum dweller friendly.

3.2 SUP-Slum dwellers be given the option to upgrade or improve their slums if they so desire. Particularly where people are opposed to SRD schemes led by the builders.

3.3 Reconstruction Plan- Reconstruction of slums can be carried out by the slum dwellers' cooperatives in partnership with the government (and not with the builder). The government's contribution will be in the form of infrastructure development while the slum dwellers pay for the construction of their houses. Government and its various agencies like MHADA must play a pivotal role in steering and facilitating the projects, including its planning. Any new housing constructed will be under the possession of the government and it may be used for the relocated slums and/or made available for new demands.

3.4 Ward Based Redevelopment- Relocation, rehabilitation and reconstruction of slums must be undertaken on a ward basis. This means a comprehensive review of slums within each ward is undertaken to minimize the dislocation of the slum dwellers and to integrate them into the development of the ward itself.

3.5 Finance/ Loans - Once the government legalizes slum land and provides the slum dwellers with tenurial rights they can individually and/or through their co-operatives take loans from housing banks to pay for the construction cost of their houses. The slum dwellers will then be able to mortgage their houses against the loan.

3.6 Planning/ Designing- the slum dwellers' co-operatives will along with the government agencies like MHADA etc steer the projects. The government agencies may provide professional services and assistance to them in planning and designing. Government agencies may constitute a panel of architects and planners to provide professional services.

B) *Bottom of approach for Mumbai slum upgrade*

3.1 Densely packed Mumbai slums: Redefining upgrade

Mumbai has been grappling with the slum problem for the past four decades. Implementation of various slum improvement schemes and policies over four decades shows that after initial experiments with modest slum improvement/upgrade schemes, it has now come around to accept the idea of in-situ redevelopment as a viable option.2 Taking Dharavi slum improvement in Mumbai as a context Mukhija shows that, though upgrade is a viable proposition elsewhere, it is not necessarily suitable for densely packed slums on high value lands in Mumbai, where each hut almost occupies the entire plot. His well-researched case study shows that when the cost of the land is high as in Mumbai, the only way to realise the potentials is by combining incentive Floor Space Index (called FSI and refers to the amount of floor space that you can build on a plot) with in-situ redevelopment, where the dwellers get to own a small but free apartment of 180 to 225 sq. ft. (18 to 22 M2) in a new in situ construction. Though such apartments belong to middle class building typology alien to the slum dwellers, they get more valuable housingand social respectability by staying in an apartment. He suggests that inorder to cash-in on potentially high land value, three things must happen. 1] Lots have to be aggregated into bigger units. 2] Additional incentive FSI must be claimed by the dwellers by acting collectively to redevelop the property and 3] Construction must be cross subsidized by selling balance FSI in the market (Mukhija, 2000: 175). His documented Mumbai experience offers compelling evidence that the idea of in-situ upgrade must become inclusive to accept in-situ redevelopment.

3.7 *Conflicts and delays cost money*

Slum improvement projects on the ground are actually pegged with delays, because there are too many different agencies involved in sanctioning, financing and construction, approval of building design as well as later changes and sanction of housing loans. When larger real estate groups are involved, process of completing legal formalities and legal agreement related work progress faster than normal course. A lot of time is also wasted in negotiations and sometimes litigations between multiple agencies, each trying to rightfully protect their institutional interests. Interestingly, cross subsidizing also brings in new conflicts that delay the construction, particularly when incentives increase with every new state scheme. For instance where there is a chance of additional gains through extra FSI, all the stakeholders claim larger shares of the gain. Splitting of the gains from the surplus FSI for sale becomes the bone of contention. This also means taking new sanctions, new agreements, retiring earlier financial commitments and so on. Decision-making often leads to conflicts based on claims to high value assets (Mukhija, 2000: 176). In an inflationary economy, delays always increased the holding cost of the project leading to unaffordable cost overruns.Policy formulations based on incentives is a tough task, because the incentive FSI should be proportionately higher when the real estate value of the area is lower. Besides, stakeholders' agreeing to the quantum of incentives is always a problem. Many a time Media reports show that redevelopment, there were large differences in the calculations of FSI and TDR by the developer's lobby and the NGOs. Such resultant delays cannot be major or give a specific time line.

V CONCLUSION

The importance of demographic information cannot be undermined for a meaningful quantitative analysis. During the empirical survey, background and general information from the respondents were also sought. As the aim of the research is focused on the construction phase of the project, so it was predicted to get on board all the key players of construction project team having satisfactory professional experience. demographic information. Analysis of the feedbacks shows that respondents are mainly from the private sector and having satisfactory working experience. Among them, 36.2% of the respondents have working experience within the range of 11 to 20 years, while 43.54% have more than 20 years of field experience. The result of the survey shows that 88% of the respondents have completed their bachelor's education. Some of the respondents have also acquired additional postgraduate qualifications i.e. MSc and Master degree with a percentage of 3.25% and 4.8% respectively. Demographic data also show the involvement of construction firms in different infrastructure projects. This mainly includes roads, highways, bridges, and pipelines construction projects. The respondent's demographic information reveals that they have good academic backgrounds and satisfactory knowledge for providing sufficient details and inputs for the outcome of this research work. The statistics represent that the questionnaires are mostly filled by experienced and senior professionals having vast experience in construction projects. Their opinions and views are quite important and valueable in order to establish the findings.

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Comparative Study of Vertically Irregular Buildings Subjected to Seismic Load

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Abstract: **Structures nowadays are advancing in terms of its planning and construction technologies due to the rise in demand of aesthetics and uniqueness in the ever-developing world. This development has also given rise to the planning of irregular buildings to achieve the desired aesthetics and functions in the structure. With such developments, these buildings due to their irregularities are becoming more prone to earthquakes and hence it has become essential to consider earthquake loads while designing these buildings. Therefore, in the course of this study, we shall be analyzing the seismic response of such vertically irregular buildings using response spectrum analysis on Etabs software. The results obtained from different models with different forms of vertical irregularities will be compared on the basis of seismic parameters such as base shear, storey of displacement, etc. After obtaining the results, a comparison will be made to draw out a meaningful conclusion with respect to the effective height and use of vertically irregular buildings in various earthquake zones.**

Keywords: Irregular building, Seismic force, Response spectrum analysis, Base shear, Storey drift, Displacement, Earthquake zone.

I. INTRODUCTION

In today's times, most of the structures are delineated by irregularities in both plan and vertical configurations. Thus to analyse or design such irregular structures an extra level of attention and effort is required. The repercussions of failure in such buildings would be greater than those with regular ones. Hence, irregular structures require detailed structural analysis to succeed in an acceptable behavior throughout a devastating earthquake. There might be cases where shape of the plot for the construction of a structure may not be a regular one, may also have topographical variations because of which the structure might be influenced due to the configuration of the plot. Hence, it will be interesting to study the stability of buildings with different geometry or shape and their behavior against seismic and other forces. In present study we will analyses such vertically irregular regular plan buildings using response spectrum analysis on Etabs software frames possess very low shear force compared to setback irregular frames.

Oman Sayyed, et.al. (2017) carried out the seismic performance & behavior of 8 models of G+10 regular and vertical with soft irregular building is analyzed by Response spectrum analysis method with the help of Etabs 2015software. By the different seismic response to compare the regular and irregular building.

II. LITERATURE REVIEW

The present work is aimed at comparative study on analysis of vertically irregular buildings. A literature review is carried out on various studies of such types of vertically irregular buildings. A review of the work is presented in the following paragraphs.

Girish Deshmukh & Shaikh Abdul Aijaj Abdul Rahman (2013) The seismic analysis performed on G+10 vertical irregular building of two frame with similar dimension but having the stiffness irregular in 2nd frame. The dynamic analysis is analysed by Etabs software as per IS: 18931-2002. The dynamic response result to compare the both frame. The frame-1 (vertically irregular) develops least storey drifts while the building with stiffness irregularity on vertically irregular building (frame-2) shows maximum storey drift on the respective storey levels. The building was modeled as a simplified lump mass model having stiffness irregularity at fourth floor. The response parameters like storey drift, storey deflection and storey shear of the building were evaluated. The results show that, stiffness irregularity causes instability in the building and attracts huge storey shear.

Bansal and Gagandeep (2014) carried out response spectrum analysis (RSA) and time history analysis (THA) of vertically irregular RC building frames. They considered mass, stiffness and vertical geometric irregularity. They found that mass irregular building experience larger base shear than similar regular building. The stiffness irregular building experienced lesser base shear and has larger inter storey drifts.

Mahesh and Rao (2014) studied the behavior of regular and irregular G+11 residential building under seismic motion. They considered different seismic zones and three different types of soils namely hard, medium and soft. The analysis was done by two software ETABS and STAAD PRO.

Rana and Raheem (2015) studied the performance of vertical geometric irregular RC frame structures under seismic motion. A comparative study between one regular frame & four irregular building frames were carried out. Various seismic responses like shear force, bending moment, storey drift, storey displacement etc. were obtained. It was concluded that regular building.

The storey displacement and storey drift in case of stiffness irregular buildings is more than that of the regular building. The result remarks the conclusion that, a building structure with stiffness and setback irregularity provides instability during seismic loading. To control the instability, a proportionate amount of stiffness is beneficial in RC building.

Shaikh Abdul Aijaj Abdul Rahman & Ansari Ubaidurrahman Salik (2018) The seismic response of G+10 storey of two frames having the same dimension with mass and the vertical irregular building has been analyzed by linear static and dynamic method with the help of Etabs software as per IS:1893-2002. The dynamic response of the structure frame-1 (vertically irregular) develops least storey drifts while the building with mass irregularity on vertically irregular building (frame-2) shows maximum storey drifts on the respective storey levels. Hence, this is the most vulnerable to damages.

III. Methodology

The study to be conducted for this project will mostly be done using ETABS software. Modelling the building in the software and carrying out subsequent analysis for obtaining results will be done. A detailed step by step procedure of the methodology is as follows. 1. In present research we have used different models of vertically irregular multi-storied buildings. 2. Model the structures in ETABS. 3. Seismic analysis will be done as per IS 1893-2016. 4. Running the models in ETABS. 5. Obtaining seismic parameters like base shear, storey drift and displacement. 6. Comparing results of these parameters. 7. Conclusion

IV. Structural modelling

In this study, structure will be modeled for the following cases

1. 40 storeyed building with geometric irregularity at 10th & 30th storey on different sides.
2. 40 storeyed building with geometric irregularity at 10th & 30th storey on same sides.
3. 40 storeyed building with geometric irregularity on ALL sides at 10th, 20th & 30th storey.
4. 30 storeyed building with geometric irregularity at 10^{th}, 12^{th}, 14^{th}, 16^{th}, 18^{th}, 20^{th}, 22^{nd}, 24^{th} & 26th storey on 3 sides. 5. 30 storeyed building with geometric irregularity at 10th storey.

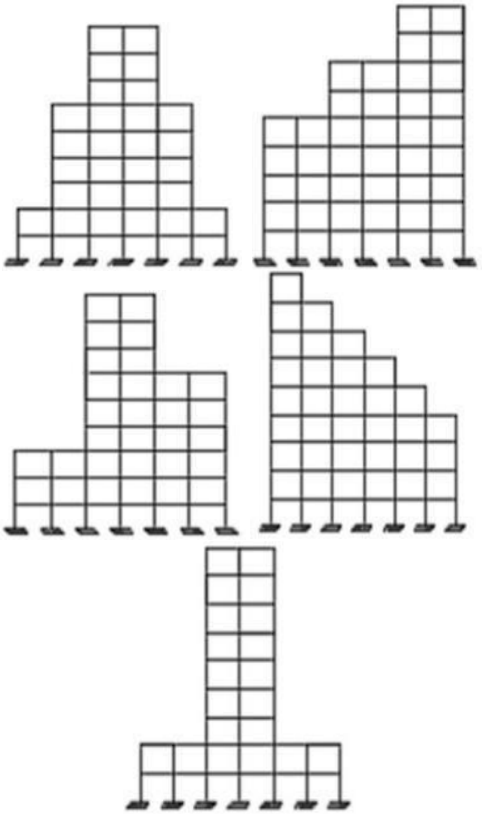
All the above cases will also be modelled for seismic zone III, IV & V as specified in IS:1893 2016

V. PRELIMINARY DATA

Following are the data assumed for carrying out this study. 1. Length in X direction = 40m. 2. Length in Y direction = 32m. 3. Typical storey height = 3m. 4. Ground storey height = 3.5m. 5. No of stories: 30 and 40. 6. Height of buildings = 90.5m & 120.5m. 7. Bay spacing in X direction = 4m. 8. Bay spacing in Y direction = 4m. 9. Plan Area = 1280 sq.m. 10. Size of beams = 300*450 mm. 11. Size of columns = 400*800 mm. 12. Grade of concrete = M40. 12. Grade of steel = Fe500 mm. 13. Type of support – fixed. Seismic Zone: I, II, III.

VI. Models

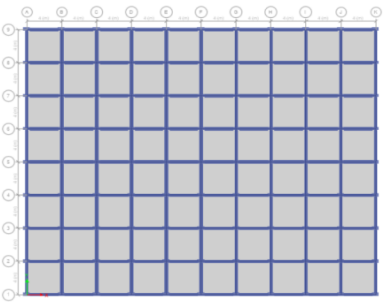
Models are considered for 30 and 40 storeys in seismic zones I, II and III as per IS-1893 2016.



VGI-1 **VGI-2**
VGI-3 **VGI-4**
VGI-5

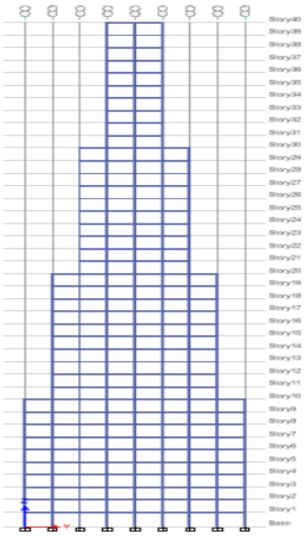
VII. Discussion And Results

Same plan for all five models



Plan

VGI-1



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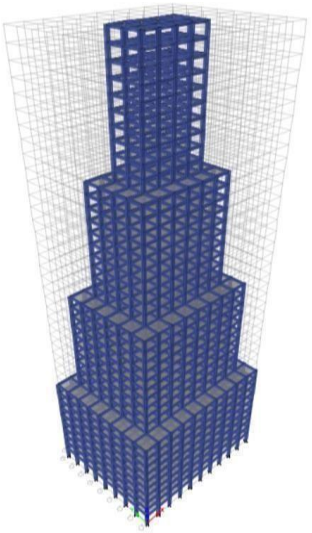
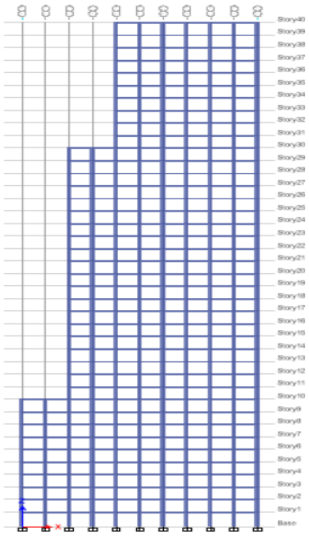


3D

VGI-2



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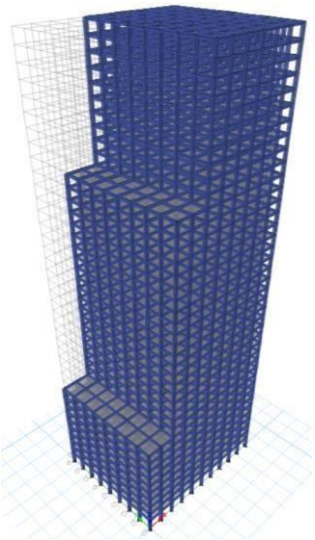

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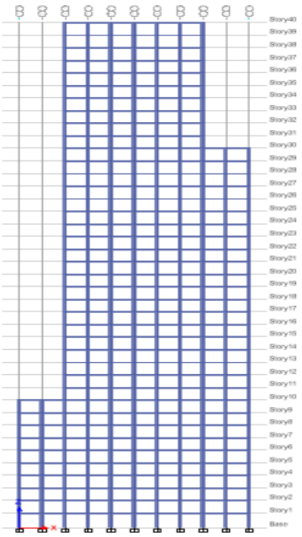
Table 1: **Result VG-1**

Zones	Seismic Parameters Load Cases	Base Shear (KN)	Displacement (mm)		Storey Drift (mm)	
			X direction	Y direction	X direction	Y direction
Zone III	RSX Max	3379.839	66.88	-	3.319	-
	RSY Max	2775.44	-	86.11	-	4.825
Zone IV	RSX Max	4663.52	100.32	-	4.979	-
	RSY Max	4163.17	-	129.166	-	7.238
Zone V	RSX Max	6995.289	150.48	-	7.468	-
	RSY Max	6244.751	-	193.749	-	10.856

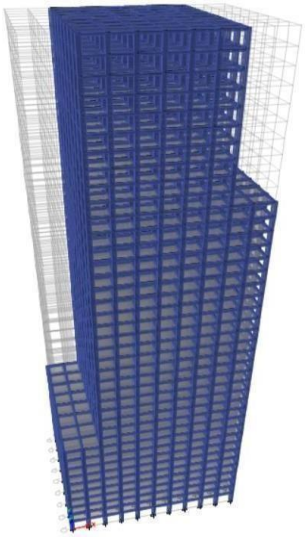
Table 2: **Result VG-2**

Zones	Seismic Parameters Load Cases	Base Shear (KN)	Displacement (mm)		Storey Drift (mm)	
			X direction	Y direction	X direction	Y direction
Zone III	RSX Max	4921.579	94.128	-	3.325	-
	RSY Max	4393.539	40.26	145.244	1.567	5.142
Zone IV	RSX Max	7382.39	141.192	-	4.987	-
	RSY Max	6590.321	60.39	217.867	2.35	7.713
Zone V	RSX Max	11073.6	211.789	-	7.481	-
	RSY Max	9885.482	90.585	326.8	3.525	11.57

VGI-3

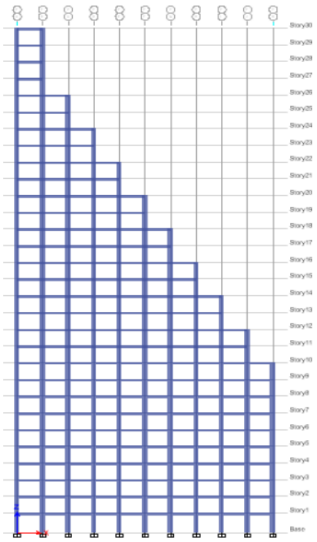


Elevation



3D

VGI-4



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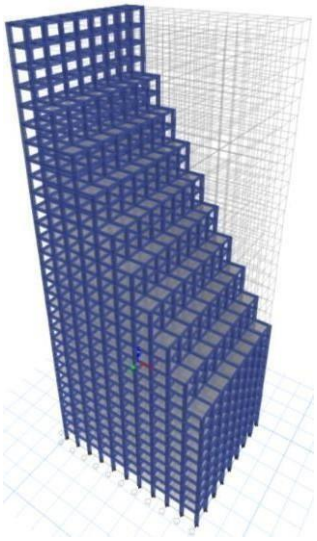


3D

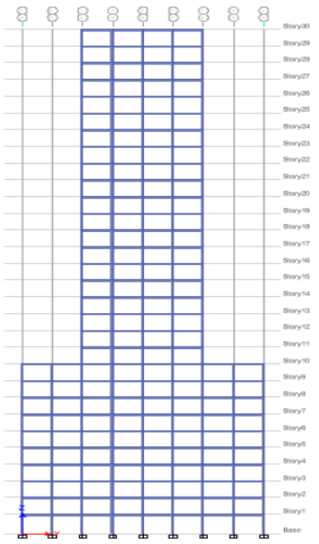
Table 3: Result VG-3

Zones / Seismic Parameters Load Cases		Base Shear (KN)	Displacement (mm)		Storey Drift (mm)	
			X direction	Y direction	X direction	Y direction
Zone III	RSX Max	4921.59	93.814	-	3.327	-
	RSY Max	4393.539	-	113.861	-	4.191
Zone IV	RSX Max	7382.39	140.722	-	4.99	-
	RSY Max	6590.321	-	170.792	-	6.286
Zone V	RSX Max	11073.6	211.083	-	7.485	-
	RSY Max	9885.48	-	256.188	-	9.429

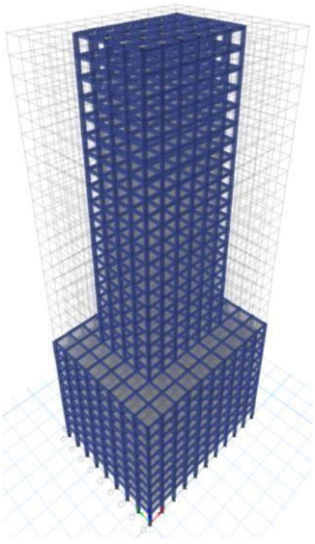
Table 4:Result VGI-4

Zones / Seismic Parameters Load Cases		Base Shear (KN)	Displacement (mm)		Storey Drift (mm)	
			X direction	Y direction	X direction	Y direction
Zone III	RSX Max	3948.079	54.603	-	3.132	-
	RSY Max	3536.82	45.134	76.64	2.327	3.994
Zone IV	RSX Max	5922.121	81.904	-	4.699	-
	RSY Max	5305.241	67.7	114.96	3.49	5.992
Zone V	RSX Max	8883.189	122.856	-	7.048	-
	RSY Max	7907.469	100.908	171.348	5.202	8.93

VGI-5



Elevations



3D

Table 5: Result VGI-5

Zones	Seismic Parameters Load Cases	Base Shear (KN)	Displacement (mm)		Storey Drift (mm)	
			X direction	Y direction	X direction	Y direction
Zone III	RSX Max	3296.89	48.775	-	2.822	-
	RSY Max	2953.461	-	57.314	-	3.308
Zone IV	RSX Max	4945.33	73.163	-	4.232	-
	RSY Max	4430.192	-	85.971	-	4.963
Zone V	RSX Max	7417.998	109.744	-	6.348	-
	RSY Max	6645.291	-	128.956	-	7.444

The structural behavior of multi-storey frames with single and combinations of irregularities is studied. The results indicate that irregularity considerably affects the structural response. In all the cases analysed, change in response is observed for frames having single or multiple irregularities with respect to the regular configuration. The present study indicates that the presence of irregularities does not always amplify the response. Certain combinations of irregularities bring down the structural response. All the single irregularity cases analysed have shown an increase in response when compared to the regular configuration under seismic loads.Among these cases, the configurations with vertical geometric irregularity have given maximum response. The combination of stiffness and vertical geometric irregularities has shown maximum displacement response whereas the combination of re-entrant corner and vertical geometric irregularities has shown less displacement response. The Torsion and Base shear values of the building decreases with increase in height of the structure. Greater the height of the structure (building), higher will be the Storey Displacement. It has been concluded that the Storey Overturning moment decreases with increase in the storey height. The Drift values increases along with the storey height to some extent and then decreases.

In the modern world, where people are not ready to compromise with their needs, incorporation of combinations of irregularity in structures is inevitable. As the structural response depends on the type, location and degree of irregularity, these factors need to be taken care while designing any structure. This would help in incorporating irregularities in structures without compromising their performance.

VIII. CONCLUSION

1. The first four cases chosen for the study was modelled and consequently response spectrum analysis was performed using ETABS.
2. Results were obtained for all the cases for seismic zone III, IV and V as per IS 1893:2016.
3. The results obtained show increase in base shear value as height of building decreases, however base shear values decrease considerably from seismic zone V to III.
4. Displacement values increases with the increase in building height as well as variation in seismic zones.
5. Displacement values decrease considerably from seismic zone V to III.
6. Storey drift does not vary a lot with decrease in building height, but shows huge decrease with variation in seismic zones.
7. In case of stiffness irregular buildings, the overturning moment and storey shear force in case of irregular buildings are slightly greaterthan that in regular building. A moderate increase in the slope of the shear force curve has been observed at the irregular storeys.

8. In case of stiffness irregular buildings, a sudden decrease in stiffness of the building has been observed at the irregular storeys. The results of setback irregular buildings show that, as the amount of setback increases the stiffness of the building decreases.
9. The analysis shows that the vertical irregularities widely affect the performance of a RC building under seismic loading.
10. As far as possible these irregularities must be avoided, but if it has to be introduced they must be properly designed.

IX. FUTURE SCOPE

The topic chosen for research has many more fields to explore and can yield useful results. As we are well aware of the increasing population and due to urbanization there is decrease in area of development land. This sometimes more often than not these days give little option but to plan an irregular building. Hence intensive research in this topic can be very helpful. Some avenues that can be considered for further research are listed below.

- Studies can be done for irregular plan with vertical irregularity as well.
- Design of actual buildings of such irregularity can yield meaningful results.
- Analysis can be carried out for such buildings with a lateral support system or combinations.
- Research can be carried out for construction of such buildings on sloping land in hilly terrains.
- Analysis can be done for buildings with other irregularities such as diaphragm discontinuity or combination of irregularities.

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Design of Water Supply Network In Rural/Urban Area.

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***Abstract*—**

Water supply is the provision of water by public utilities, commercial Organisations, community endeavors or by individuals, usually via a System of pumps and pipes. Public water supply systems are crucial to Properly functioning societies. These systems are what supply drinking Water to populations around the globe.[1] Aspects of service quality Include continuity of supply, water quality and water pressure. The Institutional responsibility for water supply is arranged differently in Different countries and regions (urban versus rural). It usually includes Issues surrounding policy and regulation, service provision and Standardization.

***Key words:-* water supply, Institutional responsibility supply drinking, service quality, policy and regulation**

I. INTRODUCTION

The water in the supply network is maintained at positive pressure to Ensure that water reaches all parts of the network, that a sufficient fflo Is available at every take-off point and to ensure that untreated water in The ground cannot enter the network. The water is typically pressurised By pumping the water into storage tanks constructed at the highest lloca Point in the network. One network may have several such sservic RReservoirs In small domestic systems, the water may be pressurised by a ppressur Vessel or even by an underground cistern (the latter however does need Additional pressurizing). This eliminates the need of a water tower or any Other heightened water reserve to supply the water pressure. These systems are usually owned and maintained by local governments Such as cities or other public entities, but are occasionally operated by a Commercial enterprise (see water privatization). Water supply network Are part of the master planning of communities, counties, and Municipalities. Their planning and design requires the expertise of city Planners and civil engineers, who must consider many factors, such as Location, current demand, future growth, leakage, pressure, pipe size, Pressure loss, fire fighting flows, etc.-using pipe network analysis and Other tools.

Materials and Methods

Drinking water is domestic water used for both drinking and hygiene purposes [24]. It can be supplied from different sources. Figure 1 shows The six available sources for such water in Kazakhstan. Centralized water Provision is distributed through taps and standpipes, with water supplied from either surface or groundwater and this water is usually treated. Standpipes are provided along the pipelines at specified intervals. However, tap water inside a house is available only at the expense of a house owner. The government provides the centralized water supply, Therefore the local administrative authority shall regularly check it for The presence of contaminants. Decentralized water supplies ffro Boreholes and wells do not have any delivery services to houses and can Be used public or individual. A permit for drilling new boreholes and wells Is provided by the local administrative authority based on prior Investigation of the field. They are also intended to do regular wwate Quality tests throughout the operation period. However, the population Sometimes use unregistered boreholes and wells, which means nn

Control by the local administrative authority. Other sources of drinking Water, such as tankered water and water from open sources, are not Considered safe. Rural people have to use multi-sources due to the lack of a stable water Supply system in the villages. Households usually classify them based on Their purpose for using water [26]. For instance, tap water for drinking Wells for hygiene, rainwater and thawed water for garden irrigation, etc.
Master planning of communities, counties, aan Municipalities. Their planning and design requires the expertise of city Planners and civil engineers,

II. DISCUSSION

Water installed in villages by the government was not able to fully ssatisf The populations' drinking water demands. There had been some Constant interruptions in the systems due to technical problems, wwhic In turn worsened the quality of the supplied water. The quality was Further reduced, because the population had underused the system's Capabilities [33,34,35]. Even though villagers were provided with tap Water by the government, significant numbers used water from Alternative sources of an unknown quality. When analyzing the reasons That led to this situation, it turned out that respondents most oofte Indicated in the questionnaire the following: doubts regarding the Quality of tap water; use of other sources by habit, as they were Accustomed to it during water scarcity; and availability of cheaper or ffre Water sources. The villagers also explained that scheduled water supply Was the reason for searching for other water sources despite having a Tap at home.

K. Ishii and T. Katsumata (2007) published a paper Journal of Water Supply: Research and Technology-Aqua

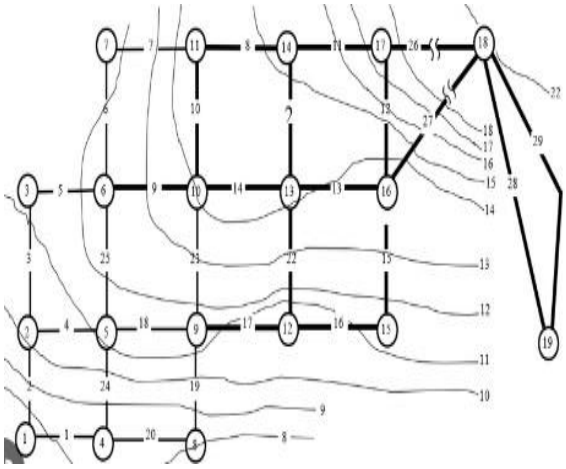
The performance indicators defined in Guidelines for the management and assessment of a drinking water supply service, which was published In 2005 by the JWWA Technical Committee in Japan, are often applied To compare ones of different water supply utilities. On the other hand, The Pls are useful to estimate results of a new project which a water Supply utility will plan. This paper shows results of the evaluation of an imaginary project which the authors intend to promote concerning replacement of old Pipelines using the numerical model of Pls on condition that any factors Of the existing water supply utility are not changeable. The authors can Estimate numerical variation of the other Pls caused by pipeline Replacement, which are water charge, leakage ratio, pipeline burst ratio, redundancy of water resource and so on. This study shows that Pls make it easy to evaluate a new project. Keywords Cost to water supply, earthquake-resistant pipeline, evaluation of water Supply project, leakage rate, performance indicator (PI), pipeline Replacement

Water Distribution Svstems Reliability: A Review of Research Literature

Alireza Gheisi at all liune2016)

Every water distribution system (WDS) fails partially or completely at Some point or points during its lifetime. Measurement of reliability for a WDS under various failure conditions is necessary. Numerous techniques Have been developed for estimating WDS reliability. This study provides An in-depth review of the relevant research literature (subsequently referred to simply as "literature") in the context of mathematical

Methods for measuring WDS reliability. It was found that the literature is vague as types of failure (mechanical, hydraulic, and water quality Failure) and techniques of reliability analysis are mixed together Inappropriately. This research organized and classified the available Techniques into three major categories and discussed which technique Should be used depending upon the type of a failure. A particular state Of failure could have several simultaneous unfavorable impacts on a WDS operation. Deep insight into the relevant literature revealed that simultaneous multiaspect/state analysis has received relatively no Attention. The research demonstrated the need for simultaneous Multiaspect/state performance analysis of a WDS. Reliability is defined as the system's capacity to satisfy the consumer's needs (i.e., in terms of water flow, pressure, and water quality) under all Operative conditions at a given period that can arise during an Operation's working life (Gheisi et al. 2016). This study estimates tth Reliability index using the availability of pipes, hydraulic, and water Quality aspects under normal and abnormal working conditions… . The WDN could be vulnerable to three types of failure: pressure, water Flow, and water quality (Gheisi et al. 2016). The vulnerability index Related to pressure is determined based on the nodal head…



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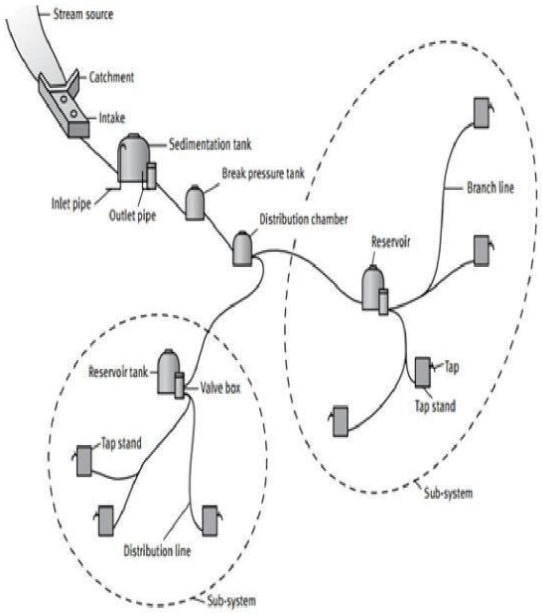


Figure 4 Typical components of a gravity flow water system (WaterAid 2012

State Sector Rural Water Supply Programme

The projects for NC, PC, Iron affected habitations are also required to be taken up under State Sector Rural Water Supply Program also, as providing safe drinking water supply is included under 20 point program & the targets are fixed for coverage of habitations. More over, since projects can be taken up under NRDWP only for restricted parameter as above & the availability of fund under NRDWP is also limited, the projects for Renovation/Improvement of existing schemes are required to be taken up under State Sector only. Moreover, to avail the benefit under NRDWP, matching State share of 10% of the Project costs under NRDWP is required to be provided by the State Govt.

During past years, several water supply schemes were required to be taken up in different villages to mitigate the inadequacy of safe drinking water due to popula disproportionate increase in YES tion .Besides in view of the large scale deforestation all around before the ban imposed by the honourable Supreme Court through landmark judgement, man made damage has been caused to the nature resulting in reduction of discharge of many water sources & even total drying up of some of the water sources. The cascade effect of destruction of forest covering necessitated taking up number of reconst uction/renovation chemes. There are also many water supply schemes implemented earlier, which has become non functional/partially functional due to theft, damage by wild elephants, inter village rivalry. Habitations have turned from Fully Covered (FC) to Partially Covered (PC) or even Not Covered (NC) category. New habitations have also come up. Schemes are required to be taken up for this. The need for taking up projects under Rural Drinking water Supply Program is therefore quite high. The Availability of fund both under under State & Central plan is much less than the requirement.

Strategy adopted under Rural Water Supply Programme

1. Supplementing with new schemes for the habitationsserved by outlived schemes.
2. Rejuvenation of the outlived schemes which arefunctioning below their rated capacity.
3. Providing the regional schemes from alternative safe sources by extending new pipelines.
4. Providing rainwater-harvesting structures. Reviving the traditional sources.
5. Utilizing low cost technology for mitigation of qualityaffected habitations.
6. Providing water supply from alternate sources for coverage of habitations with no safe source.
7. Sustainability of Rural Water Supply sources
8. For Sustainability of Systems, Department has undertaken extensive exercise for institutionalization of community participation in O&M of rural drinking waterinfrastructure.

Low-cost technologies are being promoted not only for meeting drinking water requirements, but also for re-charging of the water table.

Source strengthening measures proposed to be made an integral part of all Rural Water Supply schemes.

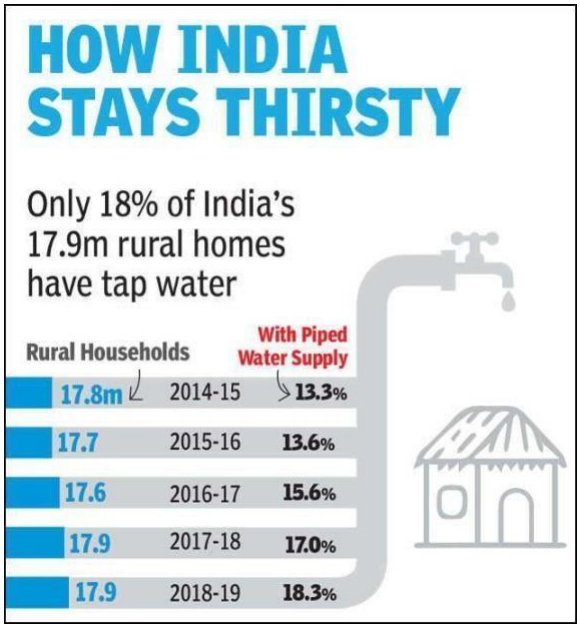
Convergence of efforts of all Departments in watershed development and management would go a long way in meeting the drinking water needs.

Sustainability measures such as involvement of PRIs / VWSCs in Operation and Maintenance of assets created in the past. In addition, some contribution towards capital cost of new assets to be created for generating sense of ownership among local community.

Need for a system of incentives for PRIs / VWSCs for ensuring village level O&M of assets.

Capacity building of PRIs / VWSCs.

Sustainability of sources by creating re-charging structures and regulating over-exploitation of underground water.



.Types of Rural Water Supply SchemesThe Types of Water Supply Schemes Implemented by the dept. are: Ring Well Spring Tapped Chamber Deep Tube Well (DTW) with India marked-II Hand Pump D.T.W. with Power Pump Gravity Feed Water Supply Scheme Pumping Schemes with Diesel or Electricity from river or stream source The schemes are implemented giving preference in the above-mentioned order to make it economically viable.

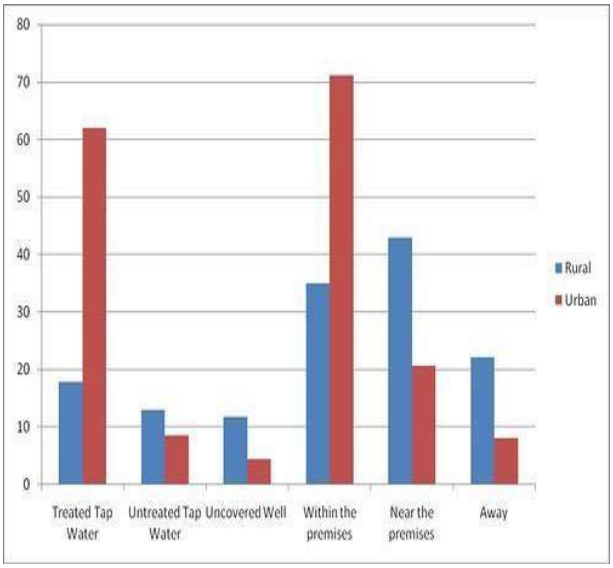
The sanctioned projects are priority projects and hence executions of all the sanctioned projects were taken up immediately after sanction. However, with the limited Plan Resources, it is not possible to provide sufficient fund for completion of all the schemes.

Sustainable delivery of drinking water of adequate quantity/quality sits at the core of rural development paradigms worldwide. The overarching goal of this study was to assess operational performance of rural water supply services (RWSS) in India to help authorities understand challenges/shortfalls vis-à-vis opportunities. Data on habitation-level coverage, aggregated by states between 2013 and 2018, were obtained from the National Rural Drinking Water Programme (NRDWP) database, against two water supply norms, namely, 40 lpcd and 55 lpcd (litres per capita per day). Results indicate that certain states are faring better (providing full coverage to over 90% habitations) while others are lagging (e.g., the north-eastern region, and Kerala and Karnataka in the South, for both norms). Several states yet fail to provide 55 lpcd to over half of their rural habitations. Overall, RWSS is marked by high spatial heterogeneity, inequality and recurrent slip-backs (decline in year-to-year habitation coverage) that thwart the basic motto of NRDWP—Har Ghar Jal (Water for All). Ground-level experience reveals a mismatch between theoretical systems' output (40 lpcd and 55 lpcd) and on-site delivery, and highly intermittent services. Moreover, frequent scheme failure/abandonment adds to systems' uncertainties and water users' plight. A multitude of operational/organisational flaws, associated with government waterworks bodies, at different levels of systems' hierarchy, limit RWSS operational performance. To that end, the concluding section argues for a demand-driven RWSS model (bottom-up systems' governance) and highlights the core tenets of the same that call for integration of environmental, social, cultural, ethical and political perspectives in RWSS systems' thinking/design.

Pune district and case study blocks

Pune district is relatively prosperous with strong administrative, industrial, and scientific organizations (e.g., the Indian Meteorology Department and Maharashtra Groundwater Surveys and Development Agency (GSDA)). Its capital, the Pune Municipal Corporation, is located approximately 150 km east of Mumbai. The district is roughly triangular in shape and extends from the high elevation Western Ghats eastward to the confluence of the Ghod–Bhima and Nira rivers. These two rivers delimit parts of the district's northern and southern boundaries (Government of Maharashtra, 1885/2007). District governments in Maharashtra are called zilla parishads. Pune district comprises 14 blocks or talukas, which are governed by panchayat samitis. Local governments are called gram panchayats, which may contain one or more revenue villages, which may contain one or more small habitations. Pune district currently consists of one urban block (Pune city) and 13 rural blocks. These blocks have 1,401 gram panchayats, 1,877 revenue villages, and 9,207 habitations (Government of India, Ministry of Drinking Water and Sanitation, 2018).

Pune district was selected for its strong gradient of demographic, environmental, and economic conditions



from west to east (Figure 2). Monsoon rainfall declines from 3,000 mm/yr in the west to 500 mm/yr in the east. It is a part of a geological area known as the Deccan Volcanic Plateau, which is underlain by shallow basalt bedrock and hard rock aquifers that slope from northwest to southeast. Erosion has produced terrain that varies from steeply sloping highly dissected ridges and buttes in the west to moderately dissected plateau lands and river valleys in the middle and broad irrigated plains in the east (Wescoat, 2018). Villages in the hilly west are small in size and population, mixed in size in the middle of the district, and relatively large in size but low in population density in the east. Villages in the hills have mixed resource-based economies, while villages in the middle are increasingly urbanized and those in the eastern plains are agrarian. These general patterns helped identify four subregions and case study blocks for detailed GIS and field analysis. The case study blocks follow the gradient from west to east and had high response rates to the mobile app survey described later in the paper (>70% of villages in each block).

ACKNOWLEDGMENT

The difference seems more ironic since most of the water supply to cities comes from rural areas. Delhi, though located on the banks of the Yamuna, gets most of its water from the Bhakra Dam in Himachal Pradesh and Ramganga Dam in Uttarakhand. It could soon also get water from the Renuka lake, which is around 300 km away in Himachal Pradesh. Mumbai is almost completely dependent on a series of dams such as the Vaitarana, Tansa and Bhatsa in rural areas of Maharashtra.

Only 17.9% of rural households get treated tap water compared to 62 percent of the urban. (Source: Census 2011)

(Within the premises: Source was located within the premises of the household. Near the premises: Source was located within a range of 100 metres from the premises in urban areas and within a distance of 500 metres in rural areas. Away from the premises: Source was located beyond 100 metres from the premises in urban areas and beyond 500 metres in rural areas.)

Urbanised states score better

Urbanisation is termed as the percentage of state population living in cities and towns. States that are more urbanised than others have better drinking water facilities. In 2011, 22.1% of rural households got their drinking water from distant sources when compared to only 8.1% of urban households. There has been a sharp decline in the use of wells in the villages for two reasons:

The usage of tap water and hand pumps have increased, and

Groundwater levels have decreased.Also, only 1.5 percent of wells in rural India have covers on them. Uncovered wells make up 11.8 percent as compared to only 4.5 pecent in urban areas

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Microbial Fuel Cell- A Review

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***Abstract*—Fuel cells are electrochemical conversion devices using fuel and oxidant with no limitation for cycle. Thermodynamics, which is the study of change in energy from one state to another and the fuel cell performance can be predicted using thermodynamic equations. Fuel cell converts the fuel value into electrical energy and also into thermal energy and the ratio varies, depending on the type of fuel cell. The first and Second laws of thermodynamics, helps in writing down the thermodynamic potentials to specify how energy can be transferred from one form to another. This chapter defines how reversible fuel cell voltages, which predicts the fuel cell performance, are affected by departures from the standard state. This chapter also includes enthalpy, entropy, specific heat, Gibbs free energy, net output voltage irreversible losses in fuel cells and fuel cell efficiency.**

Keywords—Fuel Cell, Microbial, electrochemical, electrogenic

I. INTRODUCTION

Fuel cell is a energy conversion based device. This will hardness the power of hydrogen. Hydrogen Is a handy fuel, which has the potential to handle everything. Its versatility can produce clean and sustainable power. A fuel cell load cell is simple in its operation. It is nothing but electrochemical cell, which converts Chemical energy from fuel cell into electricity. It occurs through electrochemical reaction of hydrogen and oxygen. There occurs from one electrode to another through the electrolyte. There is classification based on types of electrolyte. Its working is very easy to understand. The electrolysis is being reversed by recombining and products are water. Hence the electric current generated. The hydrogen fuel is being burnt or combustion takes place reaction, which is represented are as follows:

$$2H2 + O2 \rightarrow 2H2O$$

II. HISTORICAL BACKGROUND

The first reference to hydrogen fuel cell was appeared in October 1838 but published in December 1838 edition of London and edinburg philosophical Magazine and general of science, welsh physicist and barrister sir William grove Wrote about the development of his first crude fuel cells. He used the combination of sheet iron, copper, porcelain plates, and a solution of sulphate of copper and dilute acid.

In a later to the Same publication written in December 1838 but published in June 1839, German physicist Christ friend-rich discussed the first fuel cell that he had invented. His letter discussed the current generated from hydrogen and oxygen dissolve in water. Grove later sketched his design in 1842 in the same journal. The fuel cell he made used similar materials to today's phosphoric fuel cell.

III. CLASSIFICATION OF FUEL CELLS

Fuel cell is classified based on electrolyte they is used in operation. These employs to the chemical characteristics of type of fuel cell. The kind of electrochemical reaction in the operation defines it's type. There are certain factors like the fuel required which directly tends towards the type of electrolyte used that is the type of chemical reaction in the mechanism. Addition to these the characteristics mentioned will obviously affects the application of fuel cell. There are certain fuel cells designed for a particular usage. Each fuel cell has its own characteristics, advantages and limitations. There potential is defined by these. There are still ongoing researches which gives birth to the newer fuel cell.

IV. LITERATURE REVIEW

The literature review overhere provides a revelant information about the MFC technology and will give the comprehensive understanding of its function, design, and the potential commercial use in the real world.
:- The literature review over here provides a revelant information about the MFC technology and will give the comprehensive understanding of its function, design, and the potential commercial use in the real world.

2.1 Microbes

Firstly, we would understand about some basic functions of the bacteria present in the fuel cell and how does it work. The bacteria firstly breaks downn the organic matter present and release the energy in process. The more attention is paid to the bacteria which have ability to generate electricity and to which transforms the energy to the anode. This type of bacteria is called as exoelectrogens. It means that "exo" for exocellular and "electrogens" based on the ability to direct transfer the electrons to the chemical or to the material which is not the immediate acceptor. Exoelectrogenic bacteria are the most suited to function within an MFC due to the ability to transport electrons outside the cell. This type of bacteria is useful in mediator-less MFC. MFC system which do not require a "mediator" to assist in electron. Some mediator include thionin, sulphate or sulphide methylene blue, pyocyanin etc. as well as others [3]
Acoording to Du et Al this electrons can be found in number of places such as in the soil, marine sediment, fresh water sediment and activated sludge which are rich with these micro organisms.

Microbes used in Mediator-less MFC'S are listed below
Aeromonas hydrophila (microbes) Acetate (substrate)
Mediator-less MFC [4] (application)
Rhodoferax ferrireducens (microbes)
Glucose, Xylose (substrate)
Mediator-less MFC [5] (application)

2.2 Principal of fuel cells:-

MFC are electrochemical devices that are used for the metabolic activity of micro organisms to oxidise fuels, generating current by direct or mediated electron transfer to electrodes. [3]. MFC converts the biodegradable substrate directly into electricity. The bacteria generate protons and electrons as the organic substrate is being converted into energy. This energy is used and stored by the microbes for growth. Not all bacteria species are able to transfer electrons directly therefore the use of the chemicals such as "thionine" neutral red , methyl blue is required. This are called are Redox Mediators.

2.3 Components

The Microbial fuel cell consists of simple yet vital componnents to effectively harness the energy are as follows:-
*Electrodes – in anode and cathode both
*Proton exchange membrane
*Substrate- matter used as source of energy for micro-organisms
*Bacteria- most suited for MFC applications.
From the above mention components the anode is made up of materials like graphite, carbon paper etc ; the cathode is made up of same as anode materials.
The anodic chamber is made up of glass, polycarbonate, pelxiglass same for the cathodic chamber; whereas cathodic chamber is optional. The proton exchange membrane is made up of Naflon, Ultrex, polyethlene.poly, salt bridge, procelainn septum or solely electrolyte. The proton exchange membrane is necessary for the reactions taking place and lastly the electrode catalyst Pt, Pt black, MnO_2, electron mediator immobilized on anode.

V. RESEARCH OBJECTIVE

A fuel cell uses the chemical energy of hydrogen or other fuels to cleanly and efficiently produce electricity. If hydrogen is the fuel, the only products are electricity, water, and heat. Fuel cells are unique in terms of the variety of their potential applications; they can use a wide range of fuels and Feed stocks and can provide power for systems as large as a utility power stationed as small as a laptop computer.

VI. RESEARCH DEVELOPMENT

1.Cost—Research, development, and demonstration (RD&D) focuses on the development of low-cost fuel cell stack and balance of plant (BOP)components and advanced high-volume manufacturing approaches to reduce overall system cost. Platinum represents one of the largest cost components of a direct hydrogen fueled polymer electrolyte membrane fuel cell, so there is emphasis on approaches that will increase activityand utilization and reduce the content of current platinumgroup metal (PGM) and PGM- alloy catalysts, as well as PGM- free catalyst approaches for long-term applications. 2.Performance—To improve fuel cell-efficiency and performance, RD&D focuses on innovative materials andintegration strategies. Efforts include developing ion-exchange membrane electrolytes with enhanced efficiency and durabilityat reduced cost; improving membrane electrode assemblies (MEAs) with high power density through integration of state- of-the-art MEA components; modeling to understand system design and operating conditions; and developing-stacks with high efficiency at rated power and high- performing BOP components, such as air management components with low parasitic losses.
3. Durability—Fuel cell applications generally require b adequate performance tobe maintained over long periods of time. DOE has set ultimate targets for fuel cell system lifetime under realistic operating conditions at 8,000 hours for light-duty vehicles, 30,000 hours for heavy- duty trucks, and 80,000 hours for distributed power systems. In the most demanding applications, system reliability and robustness is required under dynamic and harsh operating conditions. Realistic operating conditions include starting and stopping, freezing and thawing, impurities in the fuel and air, and humidity and dynamic load cycles that result in stresses on the chemical and mechanical stability of the fuel cell system materials and components. RD&D focuses on identifying and understanding the fuel cell degradation mechanisms and developing materials and strategies to mitigate their effects.

Application of the fuel cells

The fuel cell are in the lime light due to its accountability of efficiency. It is very simple in operation. The facts of Its low emission device and silence is the authentication that it creates the space into its use in today's era. It confirms strongly that this technology has such compatible features that it is must better in comparison to the ongoing combustion engines, pistons and turbine technologies.

VI. CONCLUSION

Fuel cell are simple environmental clean, efficient, and low emission device. These factors in itself makes fuel cell to hold wide range of application. There is thrust to find the way mankind can generate as much as electricity in an sustainable way. Fuel cells have real potential to qualify as technology from which electricity can be generated with harmless by products.

As our demand for electrical power grows, it becomes increasingly urgent to find new ways of meeting it both responsible and safely.In the past, the limiting factors of renewable energy have been the storage and transport of that energy. With the use of fuel cells and hydrogen technology, electrical power from renewable energy sources can be delivered where and when required, cleanly, efficiently and sustainably.

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Experimental Investigation On Properties Of Plastic Waste Reinforced Subgrade Soils

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***Abstract*— Plastic waste is identified as the biggest health hazard to human life in recent years. Efforts to ban use of plastic by various sanctions have been futile due to their economic advantage, usefulness, durability, and versatile nature. To address the challenges posed by indiscriminate dumping of plastic waste various efforts to recycle it have been initiated but they have remained insufficient due to the high cost of collection, cleaning, and sorting before they can be recycled. And therefore, it is important to upcycle the plastic waste into secondary purposes where their strength and durability can be used to the advantage of the society. Many studies have incorporated plastic waste in road construction where some of the weak properties of road construction material have been improved by plastic waste in bituminous layers. Taking inspiration from improvement in bituminous properties, this study focuses on soil reinforced with plastic waste as the compacted soil subgrade occupies about 50-70% volume of a flexible pavement. Locally available marine clay and fine gravel were reinforced with plastic waste, the results demonstrate an increase of 11% and 18% in California bearing ratio (CBR) respectively. This enhancement of strength can be a boon in construction of roads as this may prevent failure of pavement, increase durability of roads and support the PW handling small business to ultimately provide a sustainable approach to plastic waste management.**

Keywords— plastic waste, sustainable road, upcycling, styling, durable road, waste management

INTRODUCTION

Plastics perform essential role in our everyday life due to its lightweight, versatility, low cost of production, durability, electrical and thermal insulation in comparison with its competing materials. These properties have positioned plastics to become relatively indispensable in every aspect of life[1] But once discarded, they become a huge menace to the society, it is observed that just 9% of all plastic manufactured gets recycled, 12% is incinerated, and 79% is accumulated in landfills or the natural environment[2] It has been recorded that various seabirds, turtles, fish and whale species experience the bad effects of consumption of Plastic waste (PW) particles and from entrapment in plastic debris. Further, PW can suffocate marine flora by preventing gas trade on the ocean bottom [3] The root cause for indiscriminate dumping of PW is the cost of managing it in developing countries[4] And therefore it is necessary to upcycle PW into places where the durability and strength of PW can enhance strength of a weaker material to make PW upcycling a profitable endeavor, only this can motivate private participants in PW management. This study evaluates behavior of soil reinforced with PW. Low density polyethylene (LDPE) is the most common type of PW which is dumped in landfills and hence milk pouches and carry bags made from LDPE were shredded in different sizes and mixed with soil to evaluate the effect of size and concentration of PW on California Bearing Ratio (CBR) of soil used for making road subgrade.

SOIL REINFORCEMENT WITH FIBERS

Behaviour of Soil reinforced with different fibers

Numerous studies have demonstrated improvement in properties and behavior of sands in combination with plastic[5][6] Coir fiber added to soft soils in concentrations of 0-1% have improved compaction, elastic modulus as well as CBR performance[7] Soil reinforced with polypropylene (PP) fiber with aspect ratios of 50, 84, and 100 demonstrated increase of 4.33%, 6.42%, and 18.03% in CBR value and the unconfined compressive strength (UCS) also increased to 7.16, 9.056, and 9.712 megapascal (MPa) respectively [8]Soil reinforced with plastic and natural fiber demonstrate that deviatoric stress for 1% concentration of natural fiber was 65 kilopascal (kPa) and that for plastic fiber was 80 kPa. By increasing concentration of fibers to 3% it was found that deviatoric stress were 226 and 240 kPa for natural and plastic fiber respectively. The study demonstrated superior performance of plastic fiber as compared to natural fiber[9] Expansive soil reinforced with 0.5 and 1% PP fiber demonstrated reduction in swell capacity of soil[10] coarse, medium, and fine sands strengthened with plastic multioriented hexa-pods improved the peak deviatoric stress and angle of internal friction as compared to unreinforced sands[11] freezing performance of fiber-reinforced soil added with 0%, 0.5%, and 1% fibers suggest that 1% fiber reinforcement decreases the effects of freeze-thaw cycle[12] cohesive soil reinforced with glass fiber demonstrated significant improvement in soaked CBR value and secant modulus as compared to unreinforced soil[13] shear strength and CBR value of plastic waste reinforced sands with waste percentages: 0, 0.5, 0.75 and 1.0 of the dry weight of sand demonstrate higher shear strength and higher penetration resistance at 0.75% concentration, further it was observed that penetration resistance of the reinforced sand increased to 9%[14] Clayey soil blended with sisal fibers demonstrated crack width reduction of 74% and surface crack reduction of 35% at 1% fiber content[15] clayey soil mixed with 1.5 % and 3.0 % plastic waste is tougher than plain clay as it enhances shear strength and reduces compressibility of plain clay[16].

plastic fibers. Most of the plastic fibers were specially manufactured for reinforcement purpose and very few research papers have utilized PW fibers.

EXPERIMENTAL INVESTIGATION

To make roads sustainable it was decided to use only PW fibers for reinforcement of soil, since very few studies have been conducted on behavior of PW reinforced marine clay and fine gravel soil, the same were chosen as a study material. It was observed that most omnipresent constituent of PW in landfills were milk pouches hence they were chosen to be reinforcing material, the milk pouches were cut into filaments of 5mm width and length in the range of 20-80mm as shown in Fig. 1. Optimum moisture content (OMC) for marine clay and fine gravel soil were found to be 18.5% and 7.7% and maximum dry density (MDD) was 1.621 gm/cc and 1.970 gm/cc respectively as per IS 2720-8 [17] it was found that addition of fiber reinforcement does not affect OMC and MDD[18].

Figure 1 - Reinforcing filaments made from Milk pouches

Un-reinforced marine clay was tested for soaked CBR value as per IS 2720-16[19] marine clay was mixed with PW fibers Fig. 2. and compacted in three layers with light compaction as shown in Fig. 3.

Figure 2 - Marine clay mixed with PW

PW fibers with constant width of 5 mm and length in the range of 20 mm to 80 mm with concentrations increasing by 1% was mixed for each sample of marine clay as displayed in Table 1. CBR values obtained for various concentration and length of PW are plotted in Fig. 5.

Figure 3 - CBR sample of PW reinforced marine clay

Table 1 - Marine clay reinforced with PW

PW %	Length of Plastic filaments (mm)	Soaked CBR Value (%)	Load taken by sample at 2.5 mm penetration (kg)	Change in CBR Value %
0	0	0.92	12.60	0%
1	20	0.928	12.71	1%
	30	0.935	12.81	2%
	40	0.941	12.89	2%
	50	0.95	13.02	3%
	60	0.96	13.15	4%
	70	0.99	13.56	8%
	80	0.98	13.43	7%
2	20	0.941	12.89	2%
	30	0.955	13.08	4%
	40	0.968	13.26	5%
	50	0.981	13.44	7%
	60	0.991	13.58	8%
	70	1.021	13.99	11%
	80	0.965	13.22	5%
3	20	0.948	12.99	3%
	30	0.941	12.89	2%
	40	0.935	12.81	2%
	50	0.929	12.73	1%
	60	0.914	12.52	-1%
	70	0.908	12.44	-1%
	80	0.901	12.34	-2%

During sample preparation it was observed that up to 30 mm length the fibers were not causing any discomfort in mixing, but beyond 40 mm length and with 2% concentration the mixing effort had to be increased considerably for marine clay.

Fine gravel soil obtained from site was moist hence it was first air dried for 7 days and after breaking the lumps sample was oven dried for 24 hours and then was sieved through 20 mm IS sieve sample retained on 4.75 mm sieve.

The oven dried soil was mixed with water equal to OMC and CBR sample was prepared using light compaction Fig. 5. the test was performed as per IS 2720-18, the same procedure was repeated for addition of plastic waste in different length and concentration as described for marine clay.

Beyond 40 mm length mixing of PW with fine gravel was difficult due to resistance caused by fibers.

The effect on CBR value due to variation in PW fiber length and concentration can be observed in Table 2. The results of soaked CBR of fine gravel soil was plotted in Fig. 6. There was a sharp increase in CBR value for PW longer than 40 mm for each concentration.

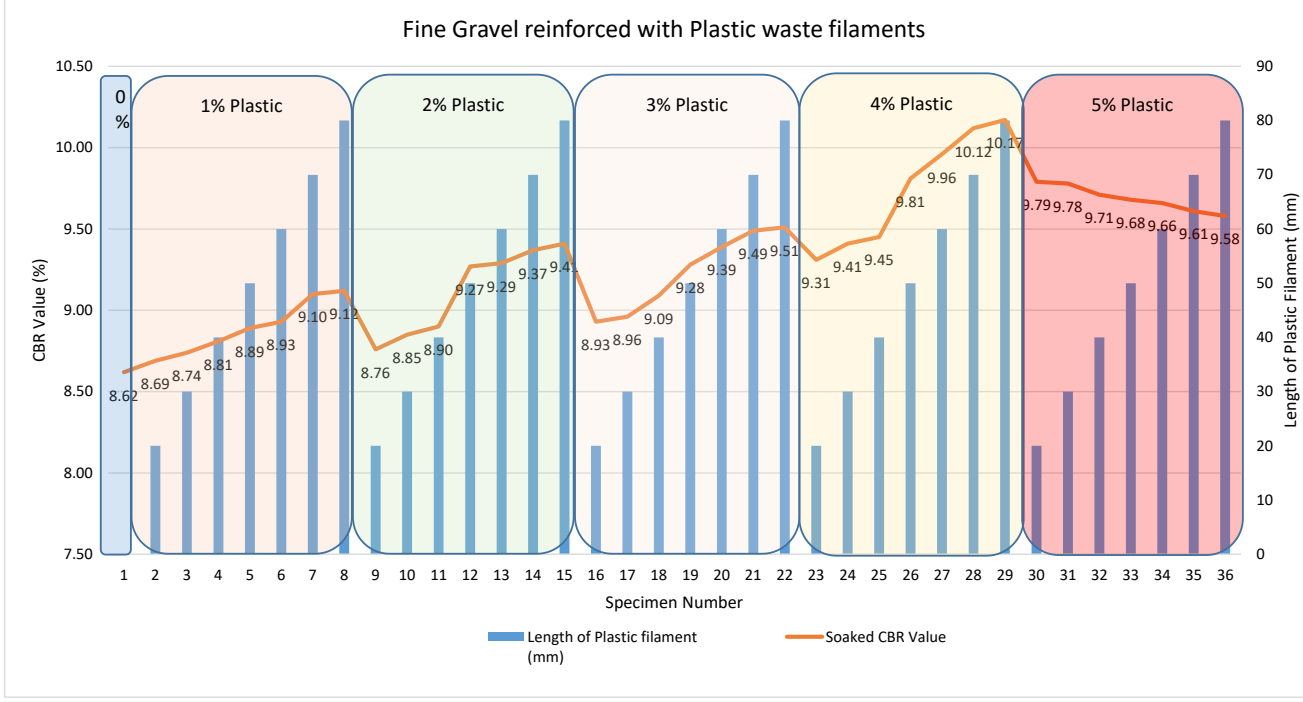

Figure 4 - Fine gravel reinforced with PW

RESULT AND CONCLUSION

For 1% and 2% concentration of PW the CBR value of marine clay increased for 60 to 70 mm length and started reducing as PW concentration increased, Significant drop of CBR value was observed at 3% concentration for all lengths of PW, Highest improvement in CBR value was observed at 2% concentration and 70 mm length, at optimum length and concentration of PW the CBR value was 18% higher as compared to un-reinforced specimen.

The increased CBR value of marine clay is statistically significant but still does not reach CBR value 5 which is the benchmark stated by IRC 37-18 [1] and hence even at this optimum PW level it be used as a subgrade material for flexible pavement.

It was observed that PW reinforcement in fine gravel gradually increased CBR value up to 4% PW concentration, beyond which the increase in PW concentration reduced the CBR value. Fine gravel reinforced with PW have demonstrated 18% improvement in CBR value as compared to un-reinforced sample. Further it is evident that 40 to 80 mm length PW fibers have given highest reinforcing action up to 4% concentration.

From this study it can be concluded that 70 to 80 mm long PW fibers at concentration of 4% by dry weight of fine gravel may be optimum reinforcement for fine gravel to increase the CBR value significantly. In future sensitivity analysis between concentration and length of PW may be done to identify the significant contributor for increase in CBR value as the same is not clear from this study.

To utilize marine clay as a subgrade material it may be blended with fly ash at optimum length and concentration of PW as described in this paper to achieve desired CBR value.

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Evaluation of Permeability Characteristics of Dense Graded Bituminous Mixes

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Abstract: **In this paper efforts have been made to evaluate the effect of nominal maximum aggregate size (NMAS) on properties of bituminous concrete (BC) mix with VG-30 grade bitumen. The primary focus of paper is on introducing a new NMAS i.e. 9.50 mm in MORTH Specification. Three BC mixes having NMAS 19 mm, 13.2 mm, and 9.5 mm were used with VG 30 grade of bituminous binder for preparing BC mix. Marshall Mix design method used to determine stability, flow, and void parameters of the mixes. To determine permeability, Florida Department of Transport Test method has been used for all gradations. Result show that the requirement of bituminous binder is higher in case of 9.50 mm NMAS, but the increment is too insignificant i.e. only 0.1% more is needed to obtain the OBC. However, when life span of the BC layers of 9.50 mm NMAS is considered, it provides more durability if executed properly. From the results of permeability test, it can be concluded that the seepage through 9.50 mm NMAS is the minimum and it may prevent damage caused by water.**

Keywords: **Permeability, Gradation, NMAS**

1. INTRODUCTION

Transportation plays an important role in development of any country. Indian road network of 33 lakh kilometers is second largest in world. Categorically, it consists of around 6.5 lakh kilometers of Highways and Major District roads and 26.5 lakh kilometers of Rural and other district roads. Furthermore, about 65% of freight and 80% passenger traffic is carried by the roads in India. As per National Highway Authority of India (NHAI), Most of the Indian Highways are flexible pavements, which shows the importance of research work to be carried out for Bituminous Concrete (BC) mix.

Currently, India uses BC mix grading of 19.00 mm and 13.20 mm NMAS for binder and wearing course in construction of bituminous roads. In other countries, such as USA, finer 9.50 mm NMAS mix is also used for wearing course.

In India, due to increasing demand in highway construction, scientists and researchers are constantly trying to improve the performance of flexible pavements. Many researchers have recommended the usage of 9.5 mm NMAS mix for medium to light traffic conditions in India. But USA uses such mix on National Highway. This shows that there is a good scope to introduce such a mix in India.

II. OBJECTIVES

1. To evaluate the Marshall Mix Design properties of dense graded bituminous concrete (BC) mix with 9.5 mm nominal maximum aggregate sizes (NMAS) Compare it with to those of 13.2 and 19 mm NMAS mixes.
2. To evaluate the water permeability of mixes with NMAS of 9.5 mm, 13.2 mm and 19 mm.

2. Materials

2.1 Binder:

In this work bitumen was collected from Bharat Petroleum Corporation Limited (BPCL) Company conforming to VG 30 grade. In this project we have used bitumen of BPCL Company of VG 30 grade as main binder content for making bituminous concrete for construction of road.

2.2 Aggregates:

In this work 20mm down, 10mm down, Crushed Sand & Stone Dust Size aggregates were adopted. The aggregates were collected from Paya quarry, Navi Mumbai.

2.3 Aggregate Gradation

The individual particle size distribution was determined using dry sieve analysis. Thereafter, the proportions of different aggregates for computing combined gradation was determined using the trial and error method. To ensure that the combined gradation lied withing the reference limits, a confirmatory sieve analysis was conducted.

Table 1: Properties of Bituminous Binder VG 30 Grade as per Specifications of (IS73: 2013)

Sr. No.	Test Parameters	Required	Results	Test Code (BIS)
1	Penetration at 25^0C, 100 gm, 5 secs, 0.1mm.	45Min	64	1203
2	Absolute Viscosity at 60^0C, poises.	2400-3600	3165	1206 (P-2)
3	Softening Point (R&B), ^{0}C.	Min. 47	53^0C	1205
4	Ductility at 25^0C, after RTFOT	Min. 40	77	1208
5	Specific Gravity at 27 ^{0}C.	Min. 0.99	1.1	1202

Table 2: Properties of Aggregate and Stone Dust as Per MoRTH

Sr. No	Test	Required	Results	Test Code (BIS)
1	**Bulk specific gravity**	-	-	IS:2386 Part III
	20mm	-	2.86	IS:2386 Part III
	10mm	-	2.82	IS:2386 Part III
	Crushed Sand	-	2.74	IS:2386 Part III
	Stone Dust	-	2.65	IS:2386 Part III
2	**Water absorption**	Max 2%	1.02 % (Avg.)	IS:2386 Part III
	20mm	Max 2%	0.78%	IS:2386 Part III
	10mm	Max 2%	0.89%	IS:2386 Part III
	Crushed Sand	Max 2%	1.17%	IS:2386 Part III
	Stone Dust	Max 2%	1.25%	IS:2386 Part III
3	Flakiness and elongation index	Max 35%	18.48%	IS:2386 Part I
4	Aggregate impact value	Max 24%	12.57%	IS:2386 Part IV
5	Aggregate crushing value		16.49%	IS:2386 Part IV
6	Los Angles abrasion value		17.50%	IS:2386 Part IV

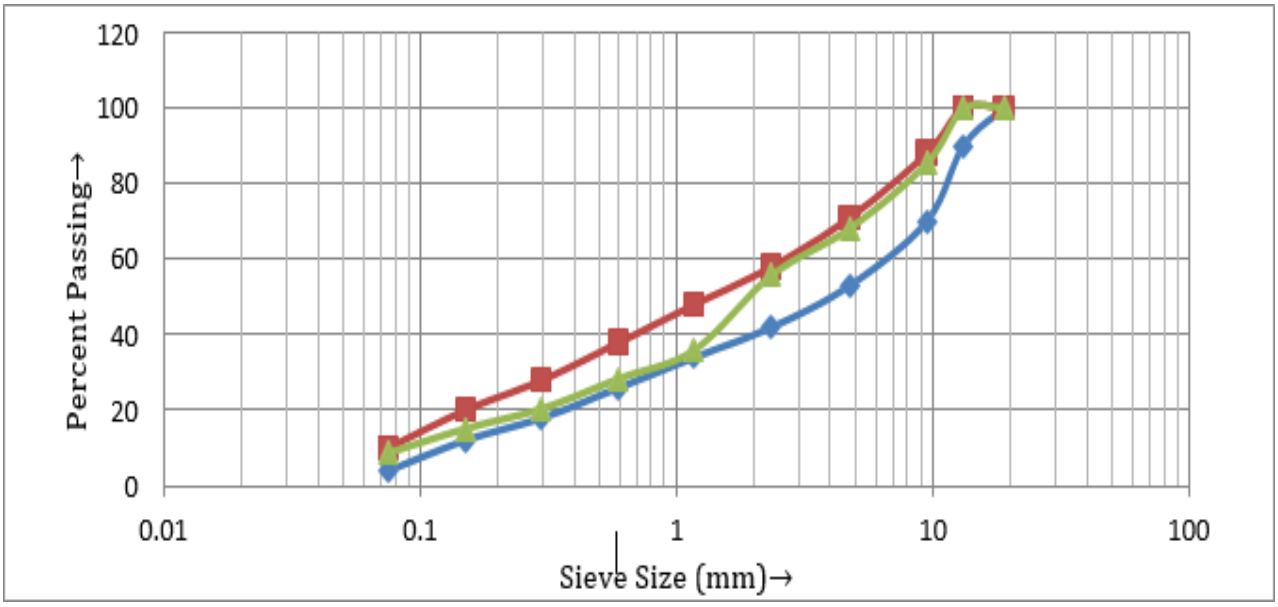

Figure:1 Combined Gradation resulting from Confirmatory sieve analysis 13.20 mm NMAS

III. RESULTS AND DISCUSSION

2.4 Marshall Mix Design

Results of Marshall Parameter at 4% air voids are given in table 3.

Table 3: Results of Marshall Mix Design

Properties	BC 19.00 mm	BC 13.20 mm	BC 9.50 mm
Optimum Binder Content (OBC)	4.91%	5.05%	5.1 %
Corrected Marshall Stability @ OBC	1427 kg	1198 kg	1197 kg
Marshall Flow @ OBC	2.67 mm	3.43 mm	3.63 mm

2.5 Results of Florida DoT Permeability Test

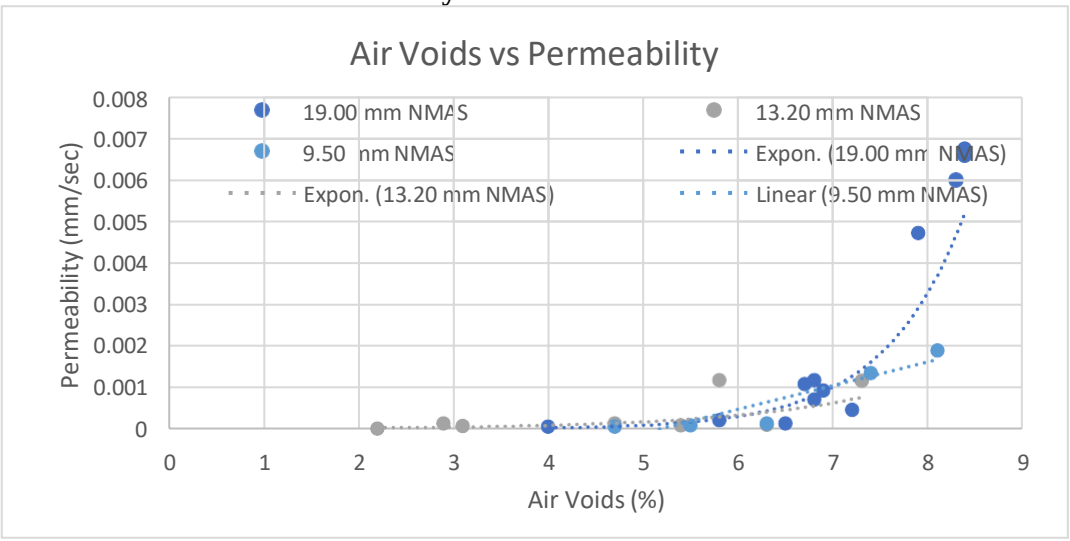

Figure 2: Permeability Test Result

III. CONCLUSIONS

The conclusions of the study are as follows

i) All the gradations satisfy the minimum requirements satisfactorily. The requirement of bitumen is higher in case of 9.50 mm NMAS but that increment is too marginal i.e. only 0.1% more is needed to obtain the OBC. Such mixes may prove better under medium or low traffic condition in urban area.

ii) From the results of permeability test, it can be justified that the seepage through 9.50 mm NMAS is the minimum. This may result in greater resistance against damage caused by water.

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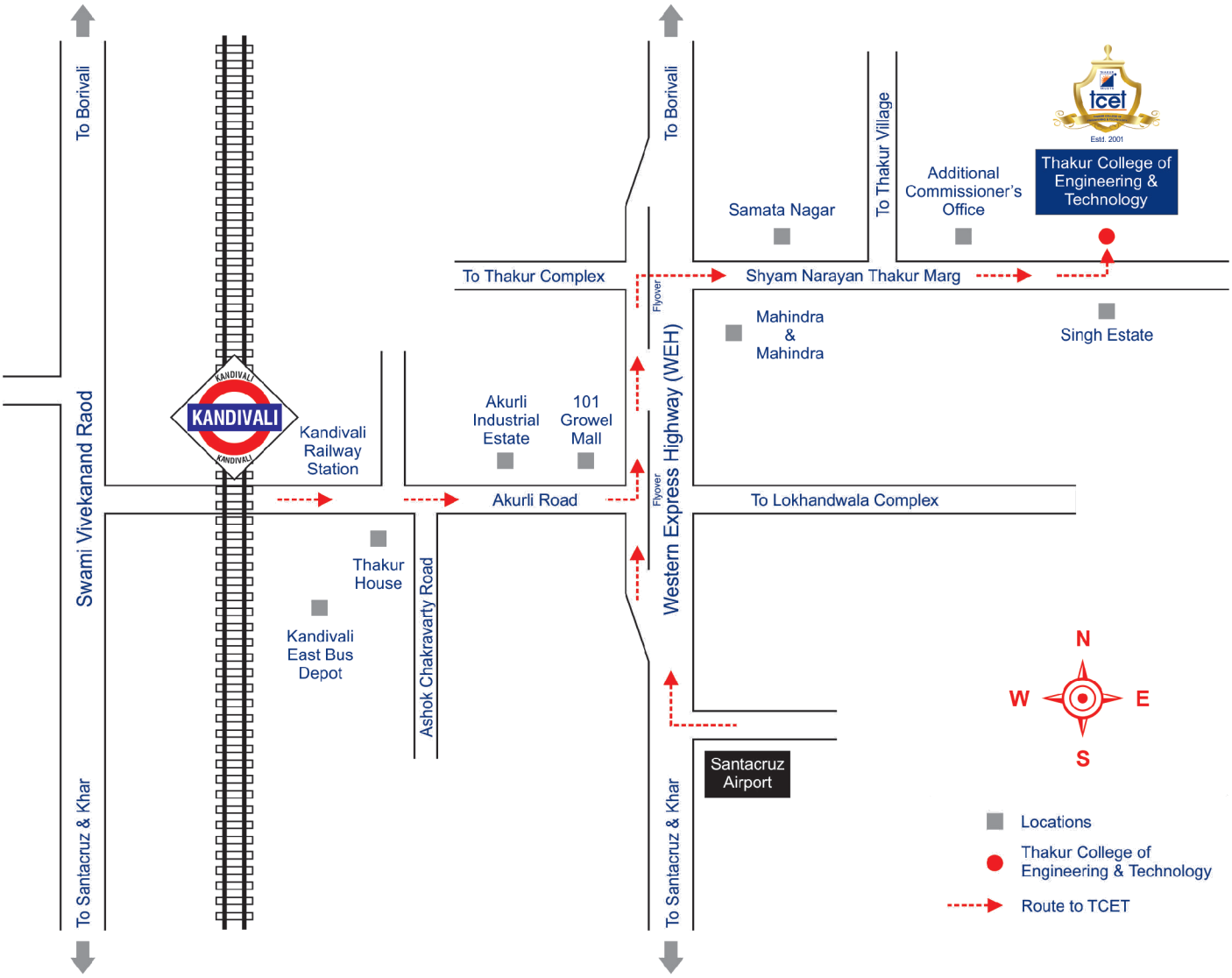
Location Plan



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