



Pimpri Chinchwad Education Trust's
Pimpri Chinchwad College of Engineering & Research



CIVIL PLUS

Technical Magazine

2018-19



Vision | Mission | PEOs | Pos | PSO

Vision of the Institute

To be a premier Institute of technical education and research to serve the need of society and all the stakeholders.

Mission of the Institute

To establish state-of-the-art facilities to create an environment resulting in individuals who are technically sound having professionalism, research and innovative aptitude with high moral and ethical values.

Department of Civil Engineering

To be the spearhead of Civil Engineering Education, imparting exhaustive know-how to create proficient and accomplished global technocrats.

Vision:

To be the spearhead of Civil Engineering Education, imparting exhaustive know-how to create proficient and accomplished global technocrats. reate proficient and accomplished global technocrats.

Mission:

M1: To upgrade continuously, to develop state-of-art laboratories and advanced computational facilities and be ever resourceful to disseminate contemporary knowledge.

M2: To inculcate the zeal for research and innovation and to improve the quality of education and research.

M3: To enforce rigorous appraisals so as to identify strengths and key competencies.

M4: To enhance industry interaction to develop competent entrepreneurs and employable professionals.

M5: To cultivate ethics, social awareness, soft-skills and appreciation for cultural diversity to evolve a truly global community.

Program Educational Objectives (PeOs):

PEO1: To develop accomplished technocrats, who are competent to provide Sustainable solutions to civilian issues.

PEO2: To impart state-of-the-art education to the aspirants so that they are capable of achieving a very rewarding occupation.

PEO3: To evolve technically sound graduates, skilled to succeed in competitive Examinations for higher education and employment.

Program Specific Outcomes (PsOs): Civil Engineering Graduates will be able to:

Ps01: Know the architectural, technical, social, cultural heritage of the nation, to remain connected to the roots of civilization and design the solutions which are based on ancient wisdom and modern technology.

PSO2: Use contemporaneous software to find solutions to various engineering problems and become well-versed and skilled to face competitive examinations without qualm.

HOD Desk



Dr. Sameer S. Sawarkar
HOD of Civil Engineering Departments PCCOER

Civil Engineering has to do with Civilization! With Civilization has developed Civil Engineering and with Civil Engineering has prospered Civilization! It is easily the oldest branch of Engineering. When the first human form thought of taking refuge in a cave, Civil Engineering was borne. Every man-made structure in this world is conceived, designed, constructed and maintained by Civil Engineers. A Civil Engineer is thus Vishwakarma of the modern world!

Civil Engineering is very versatile and diversified. It has many sub-disciplines such as; Structural Engineering, Water Resources Engineering, Environmental Engineering, Transportation Engineering, Foundation Engineering, Earthquake Engineering, Construction Engineering, Project Management etc. Civil Engineers could be entrepreneurs, offering consultancy to projects on varied scales. Civil Engineers could seek employment in Government, Semi-government and Private sectors, contributing to the growth of nation with their skills and services.

Civil Engineering Department at PCCOER has experienced, dynamic and dedicated faculty and state-of-art laboratories. We nurture our students with strong scientific and technical know-how and impart critical thinking skills on which, are founded their careers or higher studies. We endeavour to inculcate in our students, professional attitude, ethical values, creativity, leadership, innovative thinking, effective communication, team work, multidisciplinary approach and social awareness. The Department is committed to fostering a stimulating and intellectual environment in which both faculty and students excel in their professions.

- Dr. Sameer S. Sawarkar

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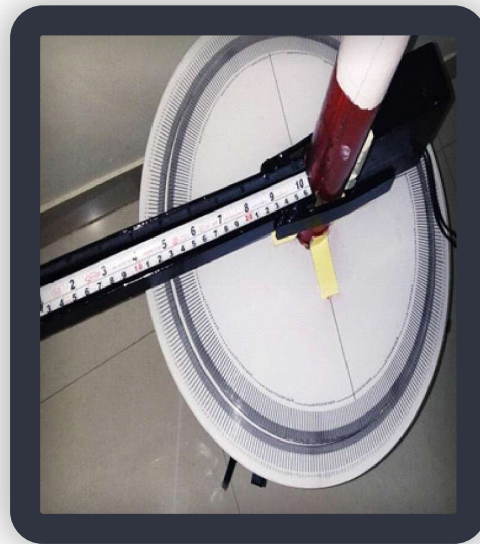
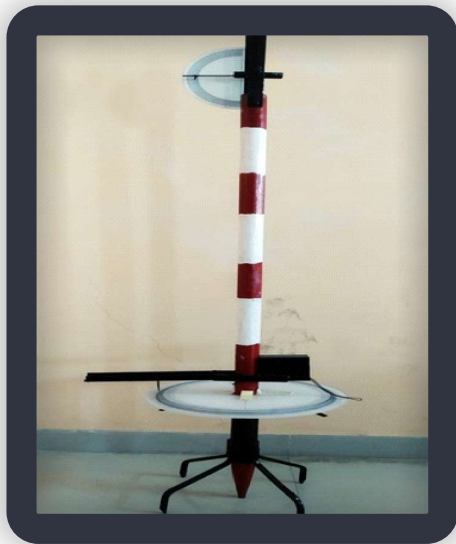


Mr. Sushant Balgude
Member



Department of Civil Engineering

Instrument for Time Optimization in Traditional Surveying



Product Name : Instrument for Time Optimization in Traditional Surveying.

Product Developed By :

Shreyas Dharmadhikari | Shreyas Bedagkar | Pranali Patil | Sushmita Wanjare

Name of Guide : Mr. Akash G. Gunjal

Objective : To Reduce Time And Cost Requirement In
Reconnaissance Survey

Outcome : Instrument is useful for reconnaissance survey.
Surveying operations such as ranging, leveling, angular measurements,
linear measurements can be performed. The instrument is inexpensive,
detachable, user friendly and its accuracy can be compared with
20 second theodolite.

Academic Year

2018-19



DESIGN OF SOLAR PLANT TO MEET ELECTRICITY NEEDS OF COMMON AREA

Dr. Sameer Sawarkar, Ranjit D. Khiste, Aditya A. Ghanvat, Shubham V. Ghodke, Shravan S. Gore, Hashal L. Ingawale.

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ABSTRACT In this paper calculation of total electricity need for an area and design of solar power plant for that need is studied. In this paper design of solar power plant for PCCOE&R, Ravet is given as a case study. Details about calculating total electricity need and generation of total electricity are also given. Details about calculation of payback period are also given.

I. INTRODUCTION

We know that fuels will finish someday. So it's our responsibility that we should convert natural energy into usable form. So we are in search of some abundantly available energy sources. But some processes of converting some forms of energy into electricity are costly and some are limited. E.g. converting atomic energy to electricity is very costly and producing solar energy from coal is limited. But some sources are cheaply available and unlimited. Solar energy is one of that. Solar powered photovoltaic panels convert sun's rays into electricity by existing electrons in silicon cells using the photons of light from the sun. So here we are planning to utilize solar energy as a power source for common use by using the solar panels.

II. LITERATURE REVIEW

1) Role of renewable energy sources in environmental protection: A review

N.L. Panwar S.C. Kaushik Surendra Kothari

Renewable technologies are considered as clean sources of energy and optimal use of these resources minimize environmental impacts, produce minimum secondary wastes and are sustainable based on current and future economic and social societal needs. Sun is the source of all energies. The primary forms of solar energy are heat and light. Sunlight and heat are transformed and absorbed by the environment in a multitude of ways. Some of these transformations result in renewable energy flows such as biomass and wind energy. Renewable energy technologies provide an excellent opportunity for mitigation of greenhouse gas emission and reducing global warming through substituting conventional energy sources. In this article a review has been done on scope of CO2 mitigation through solar cooker, water heater, dryer, biofuel, improved cookstoves and by hydrogen.

2) The Effect of Temperature on Photovoltaic Cell Efficiency

V.Jafari Fesharaki, Majid Dehghani, J. Jafari Fesharaki

Department of Electrical Engineering, Najaf Abad Branch, Islamic Azad University, Najaf Abad, Iran.

As a great potential renewable energy source, solar energy is becoming one of the most important energies in the future. Recently, there has been an enormous increase in the understanding of the operational principle of photovoltaic devices, which led to a rapid increase in the power conversion efficiencies of such devices. Solar cells vary under temperature changes; the change in temperature will affect the power, output from the cells. In this paper a relation between efficiency, sun radiation and temperature is proposed and under cloudy climate is simulated and temperature ambient PV module for a desired efficiency can be obtained.

A solar cell basically is a p-n semiconductor junction. When exposed to light, a dc current is generated. PVs offer several advantages such as: high reliability, low maintenance cost, no environmental pollution, and absence of noise. The solar cells vary under temperature changes. The change in temperature will affect the power output from the cells. The voltage is highly dependent on the temperature and an increase in temperature will decrease the voltage.

3) Impact of solar panels on global climate

Aixue H, Samuel Levis, Gerald A. Meehl, Weiqing Han, Warren M. Washington, Keith W. Oleson, Bas J. van Ruijven, Mingqiong He3 and Warren G. Strand

Regardless of the harmful effects of burning fossil fuels on global climate other energy sources will become more important in the future because fossil fuels could run out by



the early twenty-second century given the present rate of consumption. This implies that sooner or later humanity will rely heavily on renewable energy sources. Here we model the effects of an idealized large-scale application of renewable energy on global and regional climate relative to a background climate of the representative concentration pathway scenario. We find that solar panels alone induce regional cooling by converting incoming solar energy to electricity in comparison to the climate without solar panels. The conversion of this electricity to heat, primarily in urban areas, increases regional and global temperatures which compensate the cooling effect. However, there are consequences involved with these processes that modulate the global atmospheric circulation, resulting in changes in regional precipitation.

4) Concentrating solar power: A review of the technology

**HANS MÜLLER-STEINHAGEN, FRENG AND FRANZ TRIEB
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GERMANY**

In general, solar thermal technologies are based on the concept of concentrating solar radiation to produce steam or hot air which can then be used for electricity generation using conventional power cycles. Collecting the solar energy, which has relatively low density, is one of the main engineering tasks in solar thermal power plant development. For concentration, most systems use glass mirrors because of their very high reflectivity. Other materials are under development to meet the needs of solar thermal power systems. Point focusing and line focusing systems are used. These systems can use only direct radiation, and not the diffuse part of sunlight because this cannot be concentrated. Line focusing systems are easier to handle, but have a lower concentration factor and hence achieve lower temperatures than point focusing system.

5) Modelling of electric characteristics of 150-watt peak solar panel using Boltzmann sigmoid function under various temperature and irradiance

A A N G Saptaka, A A N M Narottam , A Winarta, K Amerta Yasa, P S Priambodo, and N Putra

Solar energy utilized with solar panel is a renewable energy that needs to be studied further. The site nearest to the equator, it is not surprising, receives the highest solar energy. In this paper, a modelling of electrical characteristics of 150-Watt peak solar panels using Boltzmann sigmoid function under various temperature and irradiance is reported. Current, voltage, temperature and irradiance data in Denpasar, a city located at just south of equator, was collected. Solar power meter is used to measure irradiance level, meanwhile digital thermometer is

used to measure temperature of front and back panels. Short circuit current and open circuit voltage data was also collected at different temperature and irradiance level. Statistically, the electrical characteristics of 150-Watt peak solar panel can be modelled using Boltzmann sigmoid function with good fit. Therefore, it can be concluded that Boltzmann sigmoid function might be used to determine current and voltage characteristics of 150-Watt peak solar panel under various temperature and irradiance.

6) Utilization of Solar Energy for Power Generation in Nigeria

J. O. Ojil*, N. Idusuyi2 , T. O. Aliu1 , M. O. Petinrin1 , O. A. Odejobi1 , A. R. Adetunji

This study presents the viabilities for power generation in Nigeria through the utilization of the sun's energy. Solar-thermal and photovoltaic options were discussed. It highlights the basic science for the design and selection of components for successfully harnessing solar power. Requirements for solar panel placement and orientation were also highlighted. It emphasizes that the knowledge and experience gained in solar energy as an abundant and convenient energy source, can play a role in steering the nation toward a permanent and sustainable development. The energy demand in Nigeria far outweighs the supply which is epileptic in nature. The acute electricity supply hinders the country's development notwithstanding the availability of vast natural resources in the country. Our ability to continue the trend for affordable energy will be severely tested in the coming decades, as evidenced by the widening trade imbalance, collapse of big manufacturing companies, sharp increase in the cost of doing business just to mention but a few. It is the issue of utilizing the sun's silent, inexhaustible, and non-polluting resource for power generation in Nigeria that this work addresses; hence it is the long-range review of the energy problem.

7) Generation and transmission prospects for solar electricity: UK and global markets

T. Muneer *, M. Asif, J. Kubie

World energy demands are assumed to double within the next 20 years. Fossil fuels are being depleted at a faster rate than ever before. Global warming and its associated climatic change are becoming serious concerns for governments worldwide. There is, thus, an urgent need for much more efficient and environmentally friendly energy resources to be exploited worldwide. Renewable energy is the solution to these challenges. Solar photovoltaic (PV) energy, is an elegant and effective renewable energy resource that is increasingly being seen as a promising candidate for provision of clean and sustainable power. Using up to 20 years of measured solar radiation data from seven widespread UK locations, the feasibility of interconnected, solar powered communities has been presently undertaken. This study has also explored the long



term prospects of large scale PV generation in arid/semi-arid locations, around the globe and its transmission using hydrogen as the energy vector. It is estimated that a single solar PV station of 250 250 km² area, or 12 decentralised stations each of 72 72 km² area would be sufficient to meet the year 2020 world electricity demand.

8) Solar energy: Markets, economics and policies

Govinda R. Timilsina^{a,*}, Lado Kurdgelashvili^b, Patrick A. Narbel^c

Solar energy has experienced phenomenal growth in recent years due to both technological improvements resulting in cost reductions and government policies supportive of renewable energy development and utilization. This study analyzes the technical, economic and policy aspects of solar energy development and deployment. While the cost of solar energy has declined rapidly in the recent past, it still remains much higher than the cost of conventional energy technologies. Like other renewable energy technologies, solar energy benefits from fiscal and regulatory incentives, including tax credits and exemptions, feed-in-tariff, preferential interest rates, renewable portfolio standards and voluntary green power programs in many countries. The emerging carbon credit markets are expected to provide additional incentives to solar energy deployment; however, the scale of incentives provided by the existing carbon market instruments, such as, the Clean Development Mechanism of the Kyoto Protocol is limited. Despite the huge technical potential, the development and large scale deployment of solar energy technologies world-wide still has to overcome a number of technical, financial, regulatory and institutional barriers. The continuation of policy supports might be necessary for several decades to maintain and enhance the growth of solar energy in both developed and developing countries.

9) Optimizing front metallization patterns: Efficiency with aesthetics in free-form solar cells

Deepak K. Gupta^{a,*}, Matthijs Langelaar^a, Marco Barink^b, Fred van Keulen^a

Free-form solar cells are cells of unconventional shapes (e.g. hexagonal, leaf-shaped etc). Their flexible shape adds to the aesthetics of the surroundings as well as allows to place them over objects where conventional solar cells might not fit. Evidently, these cells need to be efficient as well, and one of the important factors that controls their performance is the front metallization design. In this paper, we present the application of topology optimization (TO) to optimize the front metallization patterns for free-form solar cells. TO distributes the electrode material on the solar cell front surface in an efficient manner, such that the total power output is maximized. To demonstrate the capability of the proposed methodology, we use it to optimize front metal grids for several complex solar cell shapes e.g.

circular, hexagonal, leaf-shaped, motorbike fairings, etc. The results presented here demonstrate the capability of TO to generate efficient designs for these free-form shapes.

III. METHODOLOGY

- 1) Site surveying and area calculation.
- 2) Calculating amount of solar energy availability.
- 3) Calculating amount of energy needed.
- 4) Design of rooftop solar system.
- 5) Estimation and costing of project.
- 6) Calculation of payback period.

IV. CONCLUSION

Based on calculations and results the conclusion can be made that, solar energy is beneficial for environment. No any hazardous effects due to solar plants are found yet. So it is safe for use. The initial cost is high but the payback period is less. The solar power plants can be installed in very large scale to fulfill the electricity needs in huge amount.

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- 1) Role of renewable energy sources in environmental protection: A review
N.L. Panwar S.C. Kaushik Surendra Kothari
- 2) The Effect of Temperature on Photovoltaic Cell Efficiency
V.Jafari Fesharaki, Majid Dehghani, J. Jafari Fesharaki
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9) Optimizing front metallization patterns: Efficiency with
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Deepak K. Gupta a, *, Matthijs Langelaar a, Marco Barink b, Fred
van Keulen a



Flood and Drought control by Optimising Storage capacity of dam

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ABSTRACT: This project deals with improving storage capacity of Dam. Adapting the canal structure on the upstream side replacing the traditional method of excavating the area near Reservoir. We are providing this canals along the sides of River to increase the storage as well as reducing disaster effects during flood condition. We are providing Concrete Trapezoidal Canal which helps in increasing the capacity as compared to other types. This type of canals reduce hydraulic jumps, seepage, bursting, etc. We are providing two type of gates, one at the inner side of river and another facing towards reservoir due to which water stored in canals can be passed to downstream through reservoir and dam gates. Also it is economical as compared to disaster losses. It also focus on generating electricity by providing solar panels over canal and providing small turbine at the face of inner gate of river.

Keywords: - Dam, Reservoir, River, Storage, Canal, Gates, Panels, Turbines.

1.0 INTRODUCTION

In many countries, rivers prone to floods and drought are often carefully managed. Defences such as trees, bunds, reservoir and weirs are used to prevent rivers from bursting their banks. Floods are caused by many factors: heavy precipitation, severe winds over water, unusual high tides, tsunamis, or failure of dams, levels, retention ponds, or other structures that contained the water. A long-drawn-out period without rainfall can cause an area to dry out. Changes in climate, for instance, global warming can contribute to droughts.

Flooding and drought has many impacts. It damages property and endangers the lives of humans and other species. Rapid water runoff causes soil erosion and concomitant sediment deposition elsewhere (such as further downstream or down a coast). The spawning grounds for fish and other wildlife habitats can be polluted or completely destroyed. Some prolonged high floods can delay traffic in areas which lack elevated roadways. Economic effects of droughts usually involve loss of money by governments, enterprises, families or individuals.

A flooding may occur as an overflow of water from water bodies, such as a [river](#), [lake](#), or ocean, in which the water overtops or breaks [levees](#), resulting in some of that water escaping its usual boundaries, or it may occur due to an accumulation of rainwater on saturated ground in an areal flood. While the size of a lake or other body of water will vary with seasonal changes in [precipitation](#) and snow melt, these changes in size are unlikely to be considered significant unless they flood [property](#) or [drown domestic animals](#).

A drought is a natural disaster of below-average precipitation in a given region, resulting in prolonged shortages in the water supply, whether atmospheric, [surface](#)

[water](#) or [ground water](#). A drought can last for months or years, or may be declared after as few as 15 days. It can have a substantial impact on the [ecosystem](#) and [agriculture](#) of the affected region and harm to the local [economy](#). Annual dry seasons in the [tropics](#) significantly increase the chances of a drought developing and subsequent bush fires. Periods of heat can significantly worsen drought conditions by hastening evaporation of [water vapor](#).

In rainy season because of high precipitation excessive water of the river not get utilize it get wasted when river meets to the oceans and water get spread out in river basins. So that the excessive water which is get wasted in the rainy season it can be get stored by using this method and stored water can be used in the drought condition and summer season.

There are methods which can be used for controlling drought and flood condition. First method is by excavating and dredging the area near by the reservoir, by increasing the size of reservoir, it also increases storage capacity of reservoir. But because of that force which is exerted by the water on the inside wall of reservoir increases so there may be chances of failure of dam. There is one more drawback which occurs due to this method is migration of people from one place to another.

Another method is to provide better and effective solution i.e. by increasing the Capacity of Reservoir, by providing Canals on both the sides of River banks with opening valves, which stores good amount of water in overflow condition and let water pass to reservoir when required.

As we observe the amount of fluctuation in precipitation is very high, thus we have selected this topic to study and have provided remedies.



2.0 AIM AND OBJECTIVE :

To control floods and drought in case of catastrophe. By providing canal on both the sides of river with opening valves, which can store large amount of water. In overflow condition we can store it and let that water pass through reservoir when required. Replacing the existing practices used for controlling flood and drought disaster management with our idea, their would be more benefits and to reduce the economy loss occurred after flood and drought.

3.0 CONSTRUCTION

Canals are built in one of three methods, or a combination of the three, depending on available water and available path:

3.1 Human made streams :

A canal can be created where no stream presently exists. Either the body of the canal is dug or the sides of the canal are created by making **dykes or levees** by piling dirt, stone, concrete or other building materials. The finished shape of the canal as seen in cross section is known as the canal prism. The water for the canal must be provided from an external source, like streams or reservoirs. Where the new waterway must change elevation engineering works like locks, lifts or elevators are constructed to raise and lower vessels.

A canal can be constructed by dredging a channel in the bottom of an existing lake. When the channel is complete, the lake is drained and the channel becomes a new canal, serving both drainage of the surrounding **polder** and providing transport there. Examples include the **Lage Vaart**. One can also build two parallel dikes in an existing lake, forming the new canal in between, and then drain the remaining parts of the lake. The eastern and central parts of the **North Sea Canal** were constructed in this way. In both cases pumping stations are required to keep the land surrounding the canal dry, either pumping water from the canal into surrounding waters, or pumping it from the land into the canal.

3.2 Canalization and navigations :

A stream can be **canalized** to make its navigable path more predictable and easier to maneuver. Canalization modifies the stream to carry traffic more safely by controlling the flow of the stream by dredging, damming and modifying its path. This frequently includes the incorporation of locks and spillways, that make the river a navigation. Examples include the **Lehigh Canal** in Northeastern Pennsylvania's coal Region, **Basse Saône**, **Canal de Mines de Fer de la Moselle**, and **Aisne River**. **Riparian zone restoration** may be required.

3.3 Lateral canals :

When a stream is too difficult to modify with *canalization*, a second stream can be created next to or at least near the existing stream. This is called a *lateral canal*, and may meander in a large horseshoe bend or series of curves some distance from the source waters stream bed lengthening the effective length in order to lower the ratio of rise over run (slope or pitch). The existing stream usually acts as the water source and the landscape around its banks provide a path for the new body. Examples include the **Chesapeake and Ohio Canal**, **Canal latéral à la Loire**, **Garonne Lateral Canal** and **Juliana Canal**.

4.0 CANAL TYPES

- **Contour Canal:** A contour canal is an artificially-dug navigable canal which closely follows the contour line of the land through higher ground, building an embankment over lower ground, or constructing a canal
- **Side Slope Canal:** A side slope canal is that which is aligned at right angles to the contours; i.e. along the side slopes
- **Permanent Canal:** Perennial or permanent canals are lined with dams and barrages to provide water throughout the year, and they irrigate a vast area.
- **Inundation Canal :** Inundation canals are long canals taken off from large rivers. They receive water when the river is high enough and especially when in flood
- **Feeder Canal:** Canals used only for transportation, Feeder Canal is a canal associated with Farakka Barrage. If the severe drought brings down the Ganges water from its upper reaches, then less water is available in feeder canal.
- **Carrier Canal:** Canals used for transportation as well as providing water to irrigation fields.
- **Productive Canals:** Are those which are introduced with an idea of recovering all the expenditure, incurred during the construction, in a specified time limit.
- **Protective Canal :** It protects the crops from adverse effects of soil moisture
- **Lining Canal :** A protective layer. Lined canal means that canal is made of some material (such as brick, or cement concrete) which can block seepage of water into soil.
- **Unlined Canal :** A unlined canal doesn't have any such arrangement, therefore there is high seepage.

5.0 STUDY REPORT:

Kerala Floods Study :

- Kerala receives average annual rainfall of 3107 mm
- Kerala received heavy rainfall 75% that is usual rainfall.
- Thirty-five out of the fifty-four dams within the state were opened for the first time in history. All five overflow gates of the *IDUKKI* Dam were opened at the same time, for the first time in 26 years
- one of the largest rescue operations, 40 helicopters, 31 aircraft, 182 teams for rescue, 18 medical teams of defense forces, 58 teams of NDRF and 7 companies of Central Armed Police Forces were pressed into service along with over 500 boats and necessary rescue equipments.
- Solaiyar dam, kakkayam dam, idamalayar dam, Mullaiperiyar dam, Idukki dam peringalkuthu dam.
- Idukki dam water level dips below 2400ft.the water level in reservoir came down to 2399.88 feet on Friday compared to wing continues to release water from idukki dam at 200 cu m/sec apart from the 117 cu m/sec water being released for power generation.



This diastolic result may have been compressed or reduced to some extent by providing our methodology. So we have further proceeded to study on our project.

CHAPTER No. 4 WORKING

We are going to provide canals on both side of river at a regular interval. So that can be use for controlling and preventing the flood water which is get generated because of heavy rainfall. That excessive water can create disasters. Canals provided on both sides of the river near to the reservoir. When river get fully saturated because of flood water at that time gates provided on both inner sides of canal get open manually and after that flood water get distributed inside the canals. Flood water can be stored at certain capacity when canals get fully saturated then gates provided on inner side of the canals get closed and that stored water will be used in the drought condition or in the summer season. By using this technique high pressure and velocity of water can be reduced at a certain limit and that excessive water get stored inside the canal. Gates provided inner side of the canals have only one function that they will only allow to pass the flood water inside the canal.

Also high velocity and high pressure water can be used for hydro power generation. We are going to install mini hydro power plant inside the canal.

Also we are going provide solar panels over the canals that can control the evaporation of water and also generate electricity by using solar energy.

Lining is provided for canals that can reduces the erosion of the canals. And also reduces the seepage of water through the canals. We are going to provide design which is having maximum efficiency to control, prevent and stored flood water.

CHAPTER No. 5 PROJECT PLANNING

Initially we have considered two canals on both the sides. We can mainly use these canals in regions where there is high rainfall. Particularly in India there are many regions where there is high rainfall and in such areas controlling the flow of water is much important and accordingly many of the studies have tried various technique to prevent this flow of water but they have not met required expectations. So we came up with the idea of introducing canals. These canals will help us in preventing the excess flow of water. And this water can be later on used in draught conditions.

5.0 VISIT TO PAWANA DAM :

A site visit to Pawna dam was organised on 04th January 2019. Under the guidance of Dr. Sameer Sawarkar. Purpose of this visit was to collect the information related to flood and drought conditions occur during rainy season and summer season.

Irrigation - The construction of this dam was started in 1996. The major purpose of this dam is the supply of water to the agriculture, industries, and for drinking. Water supply is majorly done for Wai, Phaltan, Khandala, Bhor, Panchgani - Mahabaleshwar and the surrounding villages on the bank of the dam. This dam supplie's water to agricultural land of the Wai, Koregaon, Satara , Javli and Khandala talukas. The catchment area (42.77 km²) dams the Krishna River and forms the Dhom Lake which is approximately 20 km (11 miles) in length. Completed in 2002, it is one of the largest civil engineering projects commissioned after Indian independence. The Dhom Balkawadi electricity project is run by the Maharashtra State Electricity Board. Storage capacity of Dhom dam is 5.1 T.M.C

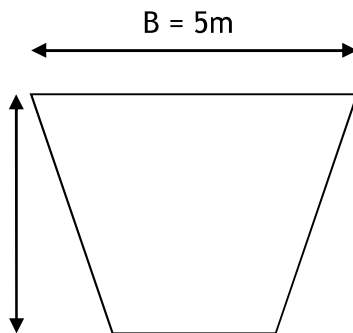
There are wide variations in water supply form a river or

canal during the year. This makes its necessary to store water by constructing a dam in order to insure the generation of power through out the year. The storage help in equalizing the flow of water so that any excess quantity of water at a certain period of the year can be made available during times of very low flow in the river. This leads to the conclusion that site selected for hydroelectric plant should provide adequate facility for erecting a dam and storage of water.

We had interaction with **Chief Engineer Gadwal Sir.** Sir told us improvement in our Project.



6.0 SELECTION OF DIMENSIONS :



6.1 CALCULATIONS :

- Area = $0.5(A + B)H$
 $= 0.5(5 + 3.5)3$
 $= 12.75 \text{ m}^2$
- Length = 20m
- Volume of 1canal = 12.75×20
 $= 255\text{m}^3$
- Volume of 1 canal = 255×10^3 litres

- Volume of 2 canal = 510×10^3 litres
- Volume of 10 canal = 2550×10^3 litres

7.0 EXPECTED OUTCOME:

- By studying on field problems and by testing the problems on model prepared, we are getting beneficial outcomes. Large amount of water quantity is stored in canals in flood conditions and that stored water is further utilized in drought conditions. We are also adding solar panels and small turbines so as to increase the benefits obtained by our methodology

8.0 CANAL MAINTANCE

- The correct estimation of conveyance water from losses from an irrigation system is vital for the protect management for the system .Seepage is the most dominant process by Which water is lost in the canal
- Reclamation developed this manual to provide basic guidance to help canal operators promote safe and effective operations and maintenance for canal systems
- Along the canal’s course, seepage losses inevitably occur. Seepage which travels downwards into the foundation does not threaten the integrity of the canal embankment, but this can affect the canal’s efficiency and ability to make downstream deliveries.
- Conditions can vary greatly along the length of a canal (Figure 2). The canal may traverse various geologic settings, transition from cut to fill construction depending on the surrounding terrain, and cross numerous natural drainages. Seepage and seepage related failures are most often attributed to conditions.
- Along embankment penetrations such as laterals, turnouts and buried utility crossings . Where canal lining has failed or is in disrepair .Where unauthorized embankment modifications have been made

9.0 FUTURE SCOPE :

- Further we will illustrate our project to government and various dam associates.
- Filling patent

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RESERVOIRS VERSION 2 CE IIT,
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DESIGN USING STOCHASTIC PROGRAMMING



Structural Audit of RCC Structure by using NDT methods

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ABSTRACT Auxiliary review is the specialized overview of the structure so as to check its quality and soundness. Auxiliary review is the initial phase in fixing methodology of the structure. Auxiliary review is for the most part suggested for more established structures. Basic review was first presented by Indian culture of auxiliary specialists. Auxiliary review helps in improving the well being, productivity and gives thought regarding the quality of the structure by point by point specialized investigation. In present examination endeavour have been made to complete basic review of the old RCC working via doing site investigation, performing NDT on the structure. Building is demonstrated and investigated utilizing ETABS and Demand to limit proportion is resolved. Subsequent to checking quality and strength of the auxiliary individuals appropriate proposals are given so as to retrofit hazardous basic part. At last basic review.

INDEX TERMS - Auxiliary, Well being, endeavour etc

1.0 INTRODUCTION

It is typically started as the initial step for fix. This is like the occasional well-being check-up suggested for more established individuals. A strategy for Structural Audit was first displayed by the Indian Society of Structural Engineers. "Basic review is the investigation or examination of the structure, to assess the quality in order to improve its propriety, well-being, productivity". The examination of soundness is in this manner basic for finding the present functionality of the structure and its extension for future improvements or for the adjustment in its use. This data is joined with cutting edge present preparing instruments on derive on the current operational state and remaining life. The decision of specific NDT strategy relies on the property of cement to be assessed, for example, quality, erosion, split observing and so on.

The variables impacting Corrosion of Reinforcement are specifically,

- Quality of Concrete
- Cover Thickness of Concrete Over Reinforcement
- Condition of Reinforcement
- Effect of Environmental and different Chemicals
- Porosity of Concrete
- Effect of High Thermal Stresses
- Freezing and Thawing Condition
- Total Loss of Steel because of Corrosion
- Storage and Stacking Of Reinforcement Steel

a) Reinforcement is as yet latent, I. e. consumption has not started since carbonation or chloride infiltration has not achieved the steel surface.

b) Reinforcement is eroding however the engendering is in the beginning times, e. g. solid spread isn't split and decrease in cross area of rebars is insignificant.

c) Corrosion of steel prompts loss of functionality of the structure, e. g. because of breaking, spalling or delamination of the solid spread and additionally more than unimportant loss of rebar cross segment.

The present paper focuses on condition appraisal of a current multi year old medical clinic building and the conceivable recovery attempts to improve the life expectancy of the structure with security. The primer evaluation of the state of the structure is finished by visual assessment, testing of breaks and spalls to see their degree; fortifications spread estimations and so forth. In the second stage conceivable quality estimations, carbonation estimations, reference anode estimations are finished by taking examples for research facility testing. At last, consolidating the investigation of consequences of different NDT strategies for evaluating the nature of structures has been done and the conceivable fix and rebuilding works are proposed

1.1 Objectives of the Proposed Work

- To recognize the types of structural defects.
- To identify any signs of material deterioration.
- To identify any signs of structural distress and deformation.
- To identify any alteration and addition in the structure, misuse this may result in overloading.

1.2 Non-Destructive Testing (NDT)

Nondestructive testing (NDT) is the way toward reviewing, testing, or assessing materials, segments or gatherings for discontinuities, or contrasts in qualities without decimating the functionality of the part or framework. At the end of the day, when the assessment or test is finished the part can at present be utilized. As opposed to NDT, different tests are ruinous in nature and are in this way done on a predetermined number of tests ("parcel inspecting"), as opposed to on the materials, segments or congregations really being put into administration.

2.0 METHODS OF NDT

- Visual Inspection
- Structural Stability
- Rebound Hammer Test
- Ultrasonic Pulse Velocity Test
- Carbonation Test

2.1 Visual Inspection

Visual testing is presumably the most vital of all non-damaging tests. It can regularly give significant data to the all-around prepared eye. These incorporate for example, breaks, pop-outs, spalling, crumbling, shading change, enduring, recoloring, surface flaws and absence of consistency. Broad data can be accumulated from visual investigation to give a fundamental sign of the state of the structure and permit plan of an ensuing testing program. The benefit of a prepared eye is best depicted by Sherlock Holmes when he expressed: "I see close to you however I have prepared myself to see what I see." The significance and advantages of visual overview ought not be underestimated. "It incorporates an intellectual part where in perceptions are related with learning of structure and with portrayals and graphs from administration writing." "It incorporates an intellectual part wherein perceptions are related with learning of structure and with portrayals and graphs from administration writing."

2.1.2 Typical Defects Found By Visual Inspection

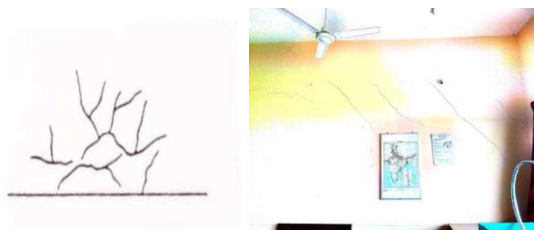


Fig 2.1.2 Defect appear when mortar has been mixed for too long or the time of transport has been too long.

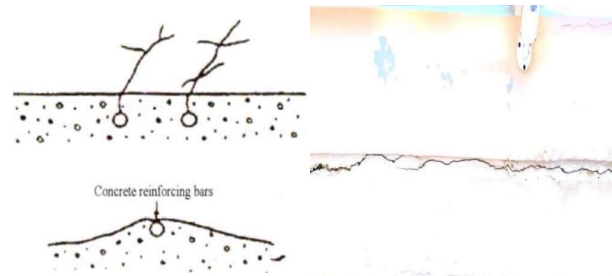


Fig 2.1.3 Defect appear due to sinking of mortar

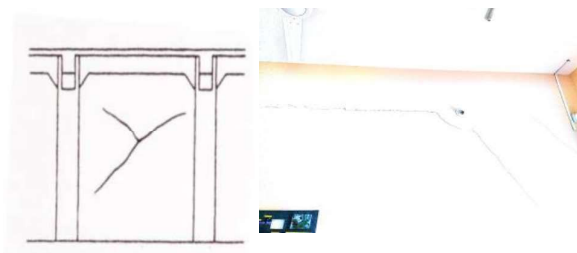


Fig 2.1.4 Defect appear due to unsuitable process at construction of joint.



Fig.2.1.5 Defect occurred due to Dampness

2.1.5 Visual Inspection Report

- Name of the Building: PCCOE&R, Ravet.
- Description: Educational building
- Address: Plot No. B Sector no. 110 Ravet, Pune 412101
- Age of the Building: 05 Yrs.

- Contact Person:- Principal of PCCOE&R.
- Inspection Report Date: 21/10/2018

2.1.6 Interference and Remedial Measures.

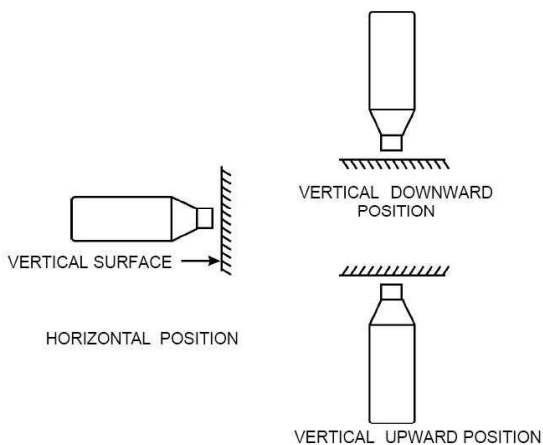
- Polymer Modified Mortar Treatment
- Water Proofing Treatment

2.2 Structural Stability

Structural stability report consist of data related work, name of building, owner of building, auditing member or structure, tests applied on building such data included in stability report.

2.3 Rebound Hammer Test

Prior to initiation of a test, the bounce back mallet ought to be tried against the test iron block, to get dependable outcomes. The testing iron block ought to be of steel having Brinell hardness number of around 5000 N/mm². The provider/maker of the bounce back sledge ought to demonstrate the scope of readings on the blacksmith's iron reasonable for various sorts of bounce back mallet. For taking an estimation, the mallet ought to be held at right edges to the outside of the structure. The test in this way can be directed on a level plane on vertical surface and vertically upwards or downwards on flat surfaces.



In the event that the circumstance so requests, the mallet can be held at middle of the road points likewise, yet for each situation, the bounce back number will be distinctive for similar cement. There are three positions taking while taking results. Vertical position, horizontal position and vertical

upward position.

2.4 Ultrasonic Pulse Velocity Test.

The hardware ought to be adjusted before beginning the perception and toward the finish of test to guarantee exactness of the estimation and execution of the gear. It is finished by estimating travel time on a standard alignment bar provided alongside the gear. A stage/arranging of reasonable tallness ought to be raised to have an entrance to the estimating areas. The area of estimation ought to be checked and numbered with chalk or comparative thing preceding genuine estimation (pre chosen areas).

2.4.1 Mounting of Transducers

The course in which the greatest vitality is engendered is typically at right edges to the essence of the transmitting transducer, it is additionally conceivable to identify beats which have gone through the solid some other way. The accepting transducer distinguishes the landing of segment of the beat which arrives most punctual

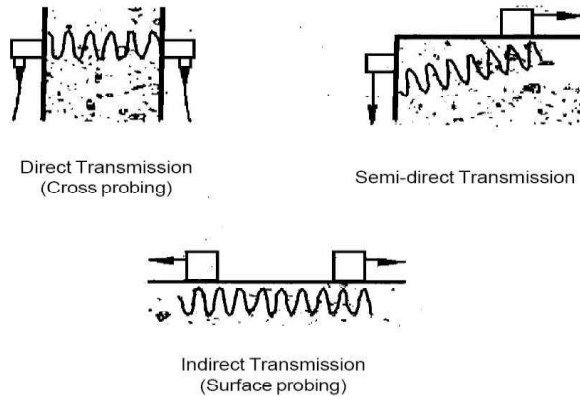


Fig. 2.3.1 Various Methods of UPV Testing

a) Direct Transmission (on inverse appearances) –

This plan is the most favoured course of action in which transducers are kept legitimately inverse to one another on inverse appearances of the solid. The exchange of vitality between transducers is most extreme in this course of action. The precision of speed assurance is administered by the exactness of the way length estimation.

(b) Semi-direct Transmission:

This game plan is utilized when it is beyond the realm of imagination to expect to have direct transmission (might be because of constrained access). It is less delicate when contrasted with direct transmission course of action.

(c) Indirect or Surface Transmission:

Aberrant transmission ought to be utilized when just a single face of the solid is available (when other two courses of action are impractical). It is minimal delicate out of the three game. plans. For a given way length, the accepting transducer get flag of just about 2% or 3% of sufficiency that delivered by direct transmission.

Sr No.	Pulse Velocity by cross probing (km/sec)	Concrete Quality Grading
1	Above 4.5	Excellent
2	3.5 to 4.5	Good
3	3.0 to 3.5	Medium
4	Below 3.0	Doubtful

2.5 Carbonation Test

The powder of cement is gotten by boring inside into cement at chosen area. At that point the gathered powder is made clammy and then phenolphthalein marker is dropped on it to check any shading change. In the event that the shading changes to pink, shows that solid isn't influenced via carbonation and if no shading change is watched, demonstrates concrete is influenced via carbonation.

3.0 TEST RESULT AND DISCUSSION

3.1 NDT Test by UPV Method as per IS 13311 (P1-P11):1992 Reaffirmed 2013

Sr no	Location	Dis. mm	Time sec	Velo. Mm/sec	Avg Re No	Com Stren ght
1	P01	550	121.6	4.5	44.00	48
2	P02	550	154.6	3.6	45.67	50
3	P03	550	122.1	4.5	44.23	48
4	P04	550	131.4	4.2	43.65	48
5	P05	550	118.8	4.6	45.66	50

6	P06	1450	319.6	4.5	45.33	50
7	P07	1450	308.9	4.7	44.50	49
8	P08	1450	311.2	4.7	43.20	47
9	P09	1450	333.3	4.3	45.67	50
10	P10	1450	318.8	4.5	44.67	49

NOTE:

1. RCC Member is Segment S1(P45-P46)-S10(P45P46)
2. Probe Direction is Direct.
3. Direction of Impact Horizontal.

Table No. 2: Velocity Criterion for concrete quality

3.2 Carbonation Test results

The colour changes to pink, indicates that concrete is not affected by carbonation.

(ISO 1920-12:2015 , Testing of concrete –Part 12: Determination of Carbonation Resistance Of Concrete)



Table No. 3: Average Rebound Number and comparative concrete quality as per IS (Part 2): 1992

**Reaffirmed 2013****4.0 CONCLUSIONS**

According to Visual inspection it is conclude that repairing work is required to the building

- By visual inspection it is found that non Structural element are getting damaged due to lack of building.
- The Structural element are still useful & undamaged hence there is no problems of collapse of building.
- Minor cracks should be repaired by injection of epoxy or using grouting method.

According to the NDT tests it is conclude that

- Ultrasonic Pulse velocity tests gives a better result than the Schmidt Rebound hammer test.
- Ultrasonic Pulse velocity test gives 91% results greater than the Rebound hammer tests.

According to results of Carbonation test the Structural member of the building are not corroded. The affect not reinforcement is nil. Hence further treatment does not required.

- By overall inspection and all above aspect the building should be good in condition and also increases life of building.

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4. ISO 1920-12:2015 , Testing of concrete –Part 12: Determination of Carbonation Resistance Of Concrete
5. Prof. P. S. Shinde¹ Prof. P. R. Thorat² Ms. P. S. Jadhav³ Ms. R. S. Chavan⁴ Mr. G. K. Mohite⁵ | IJSRD - International Journal for Scientific Research &

Sr No.	Average Rebound Number	Quality of Concrete
1	Above 40	Very Good Hard Concrete
2	30 to 40	Good Concrete
3	20 to 30	Fair Concrete
4	Below 20	Poor Concrete

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Use of Plastic Waste in Flexible Road Pavement

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ABSTRACT

In this paper the study of some of plastic waste materials which we can reusing and adding in the bitumen of grade VG30 as a homogeneous material to use in road construction as the bitumen is the primary and important binder during construction of road. The effectively using plastic content in bitumen and hence relatively to meet the challenges of society to reduce the problem of disposing the plastic as well as decrease in requirement of bitumen amount in actual road construction and increasing strength and life of the road in an economical way. Waste Plastic use as road material by blending it with bitumen to lay roads in India and compare with the environmental and economic conditions. Some of these materials are relatively cheaper and provide more strength as compared to traditional road materials. This project will come up with useful information and creating awareness amongst people and the learners in the industry regarding waste material. So that one can have a step towards further detailed information about these materials and thus be able to implement on field which will definitely improve the level of construction.

I. INTRODUCTION

The threat of disposal of plastic will not solve until the practical steps are not initiated at the ground level. It is possible to improve the performance of bituminous mixed used in the surfacing course of roads. Studies reported in the used of re-cycled plastic, mainly polyethylene, in the manufacture of blended indicated reduced permanent deformation in the form of rutting and reduced low temperature cracking of the pavement surfacing. The field tests withstood the stress and proved that plastic wastes used after proper processing as an additive would enhance the life of the roads and also solve environmental problems. Plastic is a very versatile material. Due to the industrial revolution, and its large scale production plastic seemed to be a cheaper and effective raw material. Today, every vital sector of the economy starting from agriculture to packaging, automobile, electronics, electrical, building construction, communication sectors has been virtually revolutionized by the applications of plastics. Plastic is a non-biodegradable material and researchers are found that the material can remain on earth for 4500 years without degradation. Several studies have proven the health hazard caused by improper disposal of plastic waste. The health hazard includes reproductive problems in human and animal, genital abnormalities etc., Looking forward the scenario of present life style a complete ban on the use of plastic cannot be put, although the waste plastic taking the face of devil for the present and future generation. We cannot ban use of plastic but we can reuse the plastic waste.

II. LITERATURE REVIEW

1. Johnson Kwabena Appiah et al.: Use of waste plastic materials for road construction in Ghana, Case Studies in Construction Materials, Volume 6, 2017, pp. 1-7.

This paper forms part of research to solve two main problems in Ghana: firstly, the management of municipal solid waste (MSW), particularly with regards to used plastics which have overwhelmed major cities and towns; secondly, the formation of potholes on roads due to excessive traffic and axle weight. This study examines the effect of blending waste thermoplastic polymers, namely High density polyethylene (HDPE) and Polypropylene (PP) in Conventional AC-20 graded bitumen, at various plastic compositions. The plastics were shredded and blended with the bitumen 'in- situ', with a shear mixer at a temperature range of 160 C–170 C. Basic rheological parameters such as penetration, ring & ball softening point and viscosity tests were employed to determine the resulting changes from base bitumen composite. It was observed that polypropylene polymer, showed profound effect on homogeneity and compatibility with slight linear increment in the viscosity, softening and penetration values as against relatively high changes for HDPE modified bitumen. the penetration values decrease as polymer-bitumen ratio increases while softening temperature generally increases as polymer ratio increases. The use of waste commodity plastics in binder modification carries the advantage of a cheap and effective means of enhancing conventional bitumen binder performance characteristics and is an alternative way to utilize plastic waste. The choice of



modifier for a particular project can depend on many factors including construction ability, availability, cost, and expected performance. Modification is achieved by two main procedures; Dry process involves direct incorporation of waste plastic, which is blended with aggregate before adding in bitumen, to prepare a plastic modified bituminous concrete mix and the Wet process which involves, simultaneous blending of bitumen and waste plastic. The use of polymer modified bitumen to achieve better asphalt pavement performance has been observed for a long time. The thrust of this study is to generate scientific data which will form basis for using plastic modified bitumen in the construction and repair of roads in Ghana, as well as provide scientific data on the alternative recycling options for managing plastic waste. Materials used for this research are bitumen of AC20 grade and plastic like plastic bags, bottles etc. These used for obtaining modified bitumen and tests for determining various parameters like viscosity, softening point, penetration value. Conclusion obtained from these tests is that as the plastic mixed with bitumen it improves its viscoelastic and rheological properties. They also used various references like journals and research papers.

2. S.S.Verma: Roads from Plastic waste, The Indian Concrete Journal, 2008, pp. 43-47.

This paper concluded that the concept of utilization of waste plastic in construction of flexible road pavement has been done since 2000 in India. In the construction of flexible pavements, bitumen plays the role of binding the aggregate together by coating over the aggregate. It also helps to improve the strength and life of road pavement. But its resistance towards water is poor. A common method to improve the quality of bitumen is by modifying the rheological properties of bitumen by blending with synthetic polymers like rubber and plastics. Use of plastic waste in the bitumen is similar to polymer modified bitumen. Polymer modified bitumen has better resistance to temperature, water etc This modified bitumen is one of the important construction materials for flexible Road pavement. This research paper gave some informative data obtained from survey like the average municipal solid waste production from 0.21 to 0.50 Kg per capita per day in India and total plastics waste consumption in India during last decade 1995 to 2011. This also gives the tables of information about the types of plastic and their origin of formation and available sources. Most of thermoplastics on heating soften at temperature between 130-140⁰C. The TGA analysis of thermoplastics has proven that there is no gas evolution in the temperature range of 130-180⁰C and beyond 180⁰C gas evolution and thermal degradation may occur. Thus the waste plastic can easily be blended with the bitumen as the process for road construction using bitumen is carried out in the range of 155-165⁰C. After that it gives the information about the properties of bitumen, its grades and types etc with different forms of bitumen. It also gives

the requirement of bitumen properties used for flexible road pavement. They used waste plastic mixed materials in road pavements by both methods like dry and wet process. There are various types of tests conducting on road after mixing of plastic waste like soundness test, Aggregated Impact Value, Los Angel's Abrasion Test, Marshall Stability, Softening point test, Ductility Index Test, Penetration Index Test, Flash and Fire point test and obtaining results comparatively. It concluded the advantages and disadvantages of dry and wet process. Researchers also concluded the study of plastic coated bitumen mix roads in India with various examples like In Tamil Nadu, length of roads around 1000 m in various stretches were constructed using waste plastic as an additive in bituminous mix under the scheme "1000 km Plastic Tar Road", and found that, the performance of all the road stretches are satisfactory. The performance of the road stretches constructed using waste plastic in Karnataka is also found to be satisfactory. Conclusion of this paper is that the use of modified bitumen with the addition of processed waste plastic of about 5-10% by weight of bitumen helps in substantially improving, strength, fatigue life and other desirable properties of bituminous concrete mix, which improves the longevity and pavement performance with marginal saving in bitumen usage. The process is environment friendly.

3. Amit Gawande et al : An overview on waste plastic utilization in asphaltting of roads, Journal of Engineering Research and Studies, E-ISSN0976-7916.

In this paper included that The threat of disposal of plastic will not solve until the practical steps are not initiated at the ground level. It is possible to improve the performance of bituminous mixed used in the surfacing course of roads. Studies reported in the used of re-cycled plastic, mainly polyethylene, in the manufacture of blended indicated reduced permanent deformation in the form of rutting and reduced low – temperature cracking of the pavement surfacing. The field tests withstood the stress and proved that plastic wastes used after proper processing as an additive would enhance the life of the roads and also solve environmental problems. The plastic constitutes two major category of plastics; (i) Thermoplastics and (ii) Thermoset plastics. The thermoplastics, constitutes 80% and thermoset constitutes approximately 20% of total postconsumer plastics waste generated. Plastics can be classified in many ways, but most commonly by their physical properties. Plastics may be classified also according to their chemical sources. The twenty or more known basic types fall into four general groups: Cellulose Plastics, Synthetic Resin Plastics, Protein Plastics, Natural Resins, Elastomers and Fiber. Various Grades of Bitumen used for pavement purpose Grade:30/40; Grade: 60/70; Grade: 80/100. This paper included research on Dry and Wet process. This paper gave the conclusion that This review intended to find the effective ways to reutilize the hard plastic waste particles as bitumen modifier for flexible pavements.

4. Shweta N. Rokdey et al : Use of Plastic Waste in Road Construction, International Journal of Computer Applications (0975 – 8887), International Conference on Quality Up-gradation in Engineering, Science and Technology (ICQUEST2015).

In this paper concluded that the concept of utilization of waste plastic in construction of flexible road pavement has been done. They gave properties of plastic Polymers have a number of vital properties, which exploited alone or together make a significant and expanding contribution to construction needs. They gave description and comparison between Dry and Wet Processes. Also it gives advantages and disadvantages of processes. Plastic will increase the melting point of the bitumen. This innovative technology not only strengthened the road construction but also increased the road life. Plastic roads would be boon for India’s hot & extremely humid climate, where temperature frequently cross 50°C.

III. METHODOLOGY

The proposed study will collect required materials and conducted various tests on modified and unmodified bitumen to determine changes in physical parameters of bitumen of grade VG30.

3.1. Material Description

1. Bitumen

The bitumen used, AC-20 grade, was obtained from a local authorized local RMC and Hot mix plant.

Physical properties of this bitumen are presented in Table 2. After the experimental procedures, the modified properties were compared with the Indian Highway Authority (bitumen specifications (Table 1).

2. Plastic

The plastic used was low density waste plastic like bags, wrappers, etc. collected from the residential areas and college campus.

3.2. Modified bitumen preparation

Bitumen (100 g) was heated in oven till fluid condition and polymer was slowly added. The mixture is mixed homogeneously by using stirrer between 160 C and 170 C. The concentration of PP, ranged from 0.5% to 2.5% by weight of blend with an increment of 0.5%. Mixing was continued until it produce homogenous mixtures.

Table 1: Indian Highway Authority Specifications for unmodified bitumen (VG- 30 Grade).

Penetration (mm) at 25 C, 100 g,5 s	45
Softening Point, C	47
Kinematic Viscosity at 135 C	350
Viscosity at 60 C	2400-3600

Table 2.Types of mixture samples with different proportion of bitumen and plastic.

Type of Mix	Bitumen (gm)	Plastic (gm)
M1	100	0
M2	99.5	0.5
M3	99	1.0
M4	98.5	1.5
M5	98	2.0
M6	97.5	2.5

3.3. . Laboratory testing

There are conducting three tests on unmodified and modified bitumen of VG30 according to mixture types as shown in above table.

3.3.1. Penetration value test

The standard 100 g, 25 C, 5 s penetration test was performed by penetrometer on base bitumen and PMB with the concentration of polymer varying between 0.5%-2.5% by weight of the bitumen.

The results of the test are shown in Fig. 1.

3.3.2. Softening point test

Ring and ball softening test, is the standard test to determine the consistency of the bitumen, which represent the temperature at which a change of phase from solid to liquid occurs. It is the temperature at which standard 3/8 inch steel ball weighing 3.55 g falls and touches the base plate which is 2.5 mm away. The results are shown in Fig. 2.

3.3.3. Viscosity test

Viscosity test was conducted viscometer, on unmodified bitumen. The absolute and kinematic viscosity measurements were made at 135 C respectively.

All tests were performed according to the standard specifications and conditions given according to the Indian Highway Authority.

IV. EXPERIMENTAL ANALYSIS

As various tests conducted on unmodified and modified bitumen it gives us the various results related to the tests regarding the plastic content in bitumen. Parameters like penetration, softening point and viscosity gradually changes as the plastic content changes from 0.5% to 2.5%. There are showing and comparison of various observations of physical parameters of bitumen of VG30 grade as shown in table(3).

Table.3. Comparison between specifications of unmodified and modified bitumen of VG30 grade.

	0%	0.5%	1.0%	1.5%	2.0%	2.5%
Penetration (mm)	65.8	60.2	58.1	56.33	54.33	50.6
Softening Point , C	45	48	50	51	53	54
Viscosity value (sec)	10.58	13.7	21.4	23.74	36.23	48.45

4.1 Graphs of Result

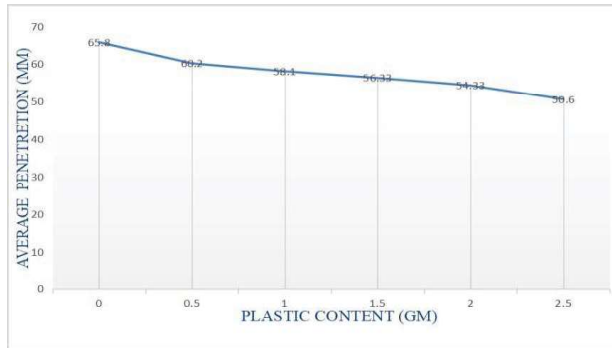


Fig.1. Penetration Value Test

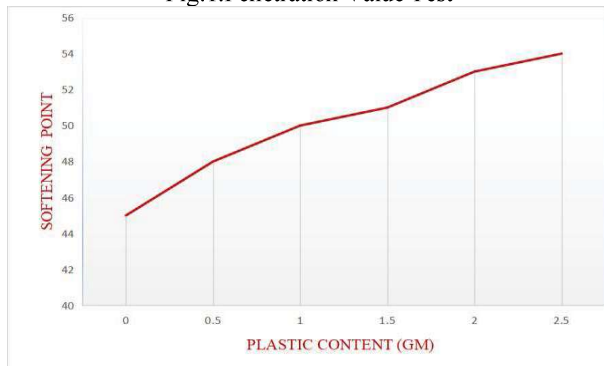


Fig.2. Softening Value Test

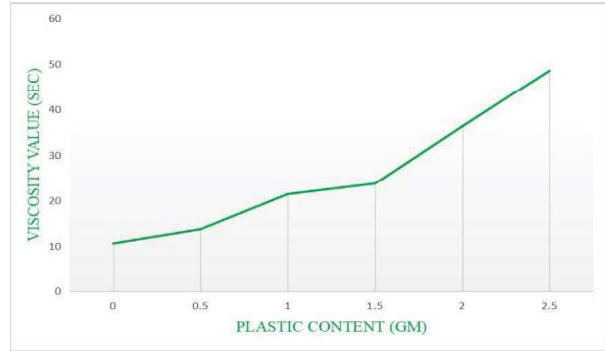


Fig.3. Viscosity Value Test

4.2 Penetration

From the result shown in Fig. 1, The penetration value of the bitumen decreases as the plastic content increases . The melting temperature PP is 165 C. Polyethylene at temperature above 160 C is in melt state; it mixed into the bitumen which increases the viscosity of the PMB. Thus it increases the viscosity by the end of mixing process, and by the time it cools harden mixture was formed. The hardening of the bitumen can be beneficial as it increases the stiffness of the material, thus the load spreading capabilities of the structure.

4.3 Softening point

The results obtained from Fig. 2, shows that there is a linear increase in the softening temperature for PMBs up to 2.5% concentration of polymer in bitumen as compared to base bitumen. Thermoplastic modification does not significantly affect the softening point as compared to the penetration . This is suitable to the internal structure formed by the polymer, which seems to be thermodynamically stable and does not significantly affect the softening point of the PMB. This confirms that the PMBs with an increase softening point have been found to show enhancement in pavement performance characteristics in terms of rutting, fatigue and temperature susceptibility. Again, it can also be observed that, PP offers lesser variation in softening point, which may be due to homogeneity achieved during blending of PP with unmodified bitumen as a result of its low molecular weight.

4.4. Viscosity

The results obtained from Fig 3, The viscosity of the bitumen decreases with the increase in plastic content. It is suddenly increases with the each plastic content increases. It is observed that as the viscosity increases the modified mixture tend to become more and more stiff which resulted in decrease in workability. Above the plastic content 2.5% plastic content, the bitumen shows very exceedingly viscous nature which is not suitable for road construction. the viscous bitumen mixture gives higher strength, low penetration which leads toward the highly working capacity and durability of a road with longer lifespan.



VI. CONCLUSION

The addition of thermoplastic modifiers to conventional bitumen increasing the softening point, decreasing penetration value whilst enhancing the overall viscosity of the binder which are workable in the range of **0.5- 2.5%** plastic content of weight of bitumen in the VG30 grade. Above the **2.5%** plastic content the properties of bitumen exceeds the specified results according to IS codes and material becomes more stiff and less workable. The maximum amount of household plastic that can be added in the bitumen of grade VG-30 for making the roads is **2.5%** . the amount of bitumen required is also decreased, due to this the construction of road is more economical.

ACKNOWLEDGMENT

We feel immense pleasure in presenting this project report on “**Use of Plastic Waste in Flexible Road Pavement**”. We wish to express true sense of gratitude towards **Prof. Amar D. Shitole**, our project guide who at very discrete step in study of this project, contributed their valuable guidance and helped to solve every problem that arose.

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OPTIMIZATION AND ANALYSIS OF VERTICAL AXIS WIND TURBINE WITH ANSYS CFD SIMULATIONS

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ABSTRACT This Project (Design Wind Turbine) is tied in with structuring and assembling a Vertical Axis Wind Turbines VAWT to exchange the wind speed to a rotational movement utilizing these turbines. These turbines will be set in expressway medians that will resemble a cutting, edge plan, which can be introduced in and around any open zone, for example, streets, parks, boats, parallel to railway tracks. Wind Turbines are intended to create control up to 300 watts for every turbine. In this work, the flow conduct was analysed, which influenced the power coefficient, just as the torque coefficient of a Savonius rotor, is researched by methods of CFD. Three-bladed Savonius rotors have a high coefficient of static torque at certain rotor edges and a negative coefficient of static torque at certain rotor edge. To expand the proficiency of all rotor points. 3-Blade turbine the introductions considered were 0 degree, 30 degree, 60 degree and 90 degree in reference to the bearing of the wind. Computational Fluid Dynamics (CFD) investigations were directed for each case to discover the torque and power produced by the turbines for every introduction To guarantee the exactness of the outcomes.

INDEX TERMS Vertical axis Wind turbine, Ansys, CFD simulation, Vertical axis wind turbine, Savonius VAWT

1. INTRODUCTION

A vertical axis wind turbine (VAWT) is a kind of wind turbine where the blades are vertical to the ground and all the parts like generator, gears are situated at bottom. This plan enables the generator and gearbox to be found near the ground, encouraging administration and fix. VAWTs should be pointed against the wind, which expels the requirement for wind-detecting and introduction systems.

If the proficiency of the wind turbine is expanded, at that point more power can be produced accordingly diminishing the requirement for costly power generators that reason contamination. This would likewise lessen the expense of intensity for ordinary citizens. The wind is truly there for using freely and doesn't cost any cash. Power can be produced and put away by a wind turbine with next to zero contamination.

Since its creation man has continually attempted to improve the windmill. Subsequently, throughout the years, the quantity of cutting edges on windmills has diminished.

Wind energy is by a long shot the quickest developing sustainable power source asset. These wind turbines can be utilized to give steady lightning of houses, road lights and so forth.

The vertical axis wind turbine for the most part comprises of 3 involutes in a setup that uses the mass energy of the wind to turn the edges around a focal shaft. Power is connected to the sharp edges by the wind both entering and leaving the turbine, permitting most extreme extraction of energy from the wind.



Figure 1: VAWT Blades

The focus for Renewable Energy Resources has expanded essentially as rising energy request and exhausting petroleum product assets. Diverse sources of sustainable power source incorporate biomass, sun based, geothermal, hydroelectric, and wind energy.

Among these assets, the wind has turned out to be a less expensive elective energy asset and consequently broad research endeavours have been put to improve the innovation of power age through wind energy. The world has a colossal potential for wind energy that ought to be used for power age. The wind energy extraction innovation has an interesting specialized character in perspective on the techniques utilized for structure. The yearly energy yield for the turbine has expanded hugely and the loads of the turbine and the clamour they produce have been diminished, as it were, in the course of the most recent couple of years. Indian Renewable Energy Development Agency (IREDA) and the wind business are cooperating to achieve these enhancements through different innovative work program.

2. OBJECTIVES

- Analyse proposed VAWT using ansys CFD simulation software.
- To find most efficient angle of turbine blades.
- Analyze how different geometry of the wind turbines would affect the output power of the wind turbine.

3. DESIGN CONCEPT

Computational Fluid Dynamics, a part of Fluid Mechanics is characterized as PC innovation that gives a way to model and concentrate the stream mechanics of about a physical issue. CFD has built up the way engineers used to take care of complex liquid stream issues. For instance, CFD programming gives the intend to reproduce the stream of gases and fluids, moving bodies, synthetic response, warmth and mass exchange, liquid structure cooperation, and acoustics through PC modelling.

Table 1 Shows the design parameters used in this paper

Parameter	Value
Swept area	0.08 m ²
Aspect ratio	2
Diameter-Height	200-400 mm
Number of blades	3
Blade thickness, t	10 mm
Mass density	2700 kg/m ³
Tensile strength	68935600 N/m ²
Yield strength	27574200 N/m ²
Poisson's ratio	0.33

4. SIMULATION AND ANALYSIS

Components of CFD:

- Pre-handling: The program pre-preparing are CAD or geometry creation, work age and applying limit conditions with the end goal of this proposal.
- Solving (Simulation): The solving segment is where the

real computations are performed, and information results are accumulated. This progression was performed utilizing the Fluent's CFD code and solver.

- Post-handling: Fluent additionally gives the last advance in an investigation which includes the post-preparing stage. Familiar's post-handling programming gives various instruments that can be utilized to control information and method shading based CFD pictures and movements.

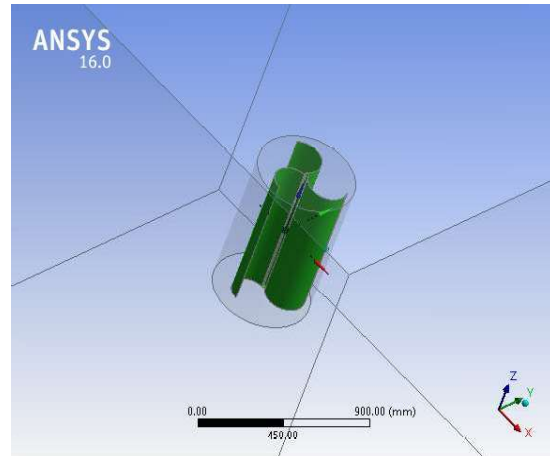


Figure 2: VAWT Model

5. EXTERNAL FLOW ANALYSIS

The flow type of Savonius rotor blade is considered in this paper as outer stream since it includes a strong demonstrate which is surrounded by the stream. The liquid stream isn't limited by any external surface the stream is limited by the computational space limits. The computational space is non uniform is characterized to 1m that implies the Savonius rotor is encased by this district and volume is fixed in this area.

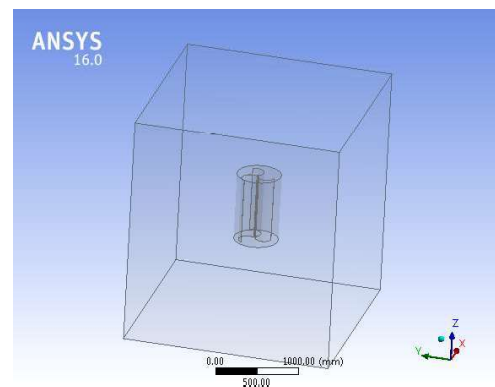


Figure 3: Model

All faces of the rectangular space have distinctive sort of limit conditions which can be expressed as pursues:

- Velocity Inlet-Fluid Inlet
- Pressure Outlet-Fluid outlet
- Symmetry-Side where chamber is cut
- Symmetry-Side inverse of the chamber

Again, the purpose behind these investigations was to discover the impacts of utilization of wind on a Savonius turbine with three edges and break down the speed profile and pressure distribution, power and movement and so on.

To do this investigation a model of wind turbine was separated into four cases, each case showing the cutting edges of a Savonius turbine arranged at various edges to finish a 360 degree turn.

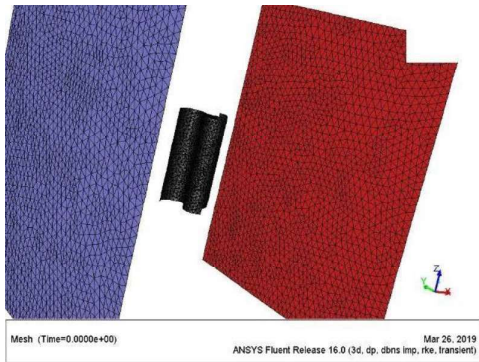


Figure 4: Blade Turbine in a Fluid domain

Case 1 : Blade Turbine-0 Degree Angle

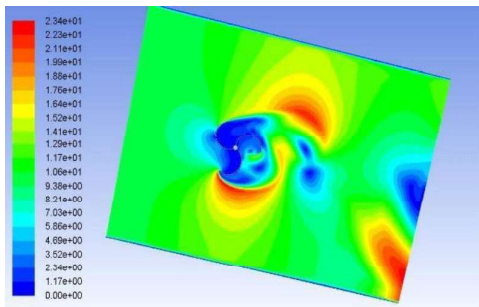


Figure 5: 3 Blade Turb.-Initial Position-Velocity Magnitude

The stream display that was utilized for this case was transition SST model. The input velocity was consistently conveyed over the inlet opening at 10m/s.

The speed size is processed on most of the node point that exist inside the default inside of the area. It very well may be seen that the most extreme velocity on the turbine is 23.45m/s which is created over the turbine. Further, we can see that the greatest speed happens at the tip of sharp edge 3 which keeps on framing a high-speed locale on the base side of cutting edge 3.

The wind gets redirected by cutting edge 1 towards positive Y-axis (upwards) making a high-speed region over the turbine. Awake region is likewise created on the right side of the turbine.

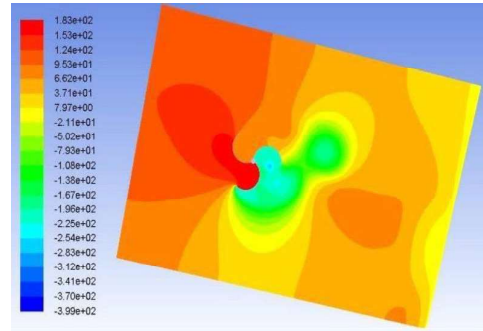


Figure 6: 3 Blade Turb.-0 Degree Orientation- Static Pressure distribution

The fig 6 presents variety of static pressure. The outcomes demonstrate that there is negative pressure created on the downstream side (output) of the turbine and positive pressure on the upstream side (inlet) of the turbine. The most extreme negative pressure is grown just to the correct side of the turbine with an estimation of - 254e+02 Pascal. This is the zone which faces most extreme turbine and has made a wake region on the downstream. The most extreme positive pressure is created in the zone between sharp edge 1 and edge 2 whose esteem is 182.58 Pascal, which is a lot more noteworthy than the pressure created on the downstream side.

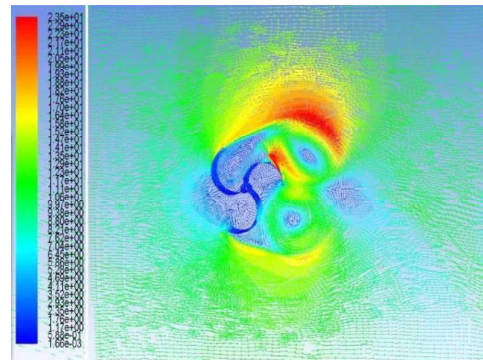


Figure 7: 3 Blade Turb.0 Degree Orientation - Velocity Vector Display

The figure 7 showcases the stream of air over the turbine in speed vector structure. The speed vectors are rendered with broad detail. The figure shows that a turnaround stream is created in the middle of the territory of sharp edge 2 and cutting edge 3. The invert stream is additionally created on the downstream side of turbine.

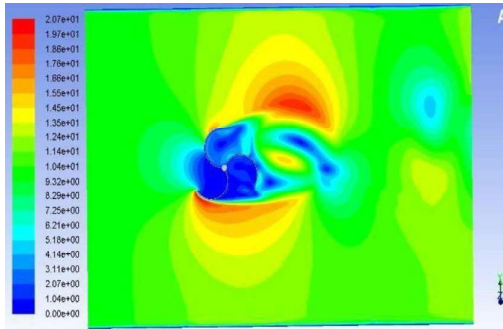


Figure 8: 3 Blade Turb. 30 Degree Orientation

The fig 8 demonstrates that at 30-degree introduction of edges, a high-speed territory was made close to the tips of edge 1 and cutting edge 3. If we investigate the speed at the tip of the sharp edge 1 and 3, we can say that the speed is generally around 15.5 m/s, which is not exactly the most extreme speed. The region close to the cutting edges has speed going from zero to a most extreme estimation of 5.18 m/s. This decrease in speed can likewise be seen on the downstream side (output) of the turbine. The air gets avoided upwards when it interacts with cutting edge 1 and along these lines most of the wind gets occupied upwards, making a high-speed district over the turbine.

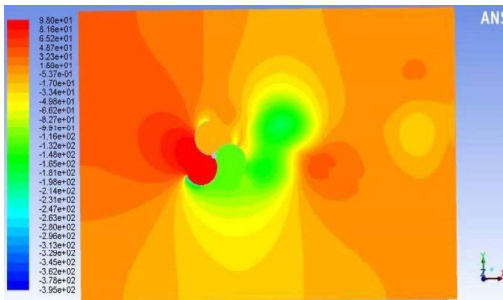


Figure 9: 3 Blade Turb. 30 Degree orientation -Static Pressure

As observed from the figure 9 the greatest static pressure of significant worth 98 Pascal is forced in the region between sharp edge 1 and edge 3. The suction side of sharp edge 3 faces negative pressure generally of esteem - 2.47e-02 Pascal. Subsequently we can say that cutting edge 3 is confronting high stresses because of high positive pressure on the pressure side of sharp edge 3 and high negative pressure on the suction side of edge 3. The static pressure likewise drops to a negative an incentive in the wake area made just to the correct side of the turbine. See that the estimation of negative pressure created in the territory between edge 2 and edge 3 is more in CASE I when

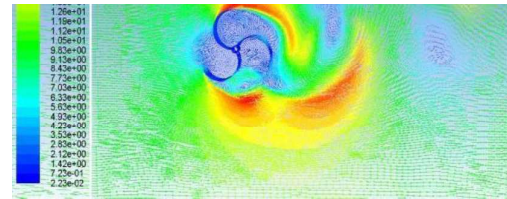


Figure 10: 3Blade Turb. 30 Degree orientation- Velocity Vector Display.

Fig 10 represents to the stream of wind over the turbine cutting edge in the space. It very well may be clearly observed that a turnaround stream happens in the territory close to the turbine cutting edges and furthermore in the wake region. This is appeared filled-arrows which shows the bearing in which the wind streams. It very well may be seen that the air originates from beneath edge 3 and gets occupied upwards cutting the wake locale.

Case 3 : Blade Turbine- 60 Degree Angle

An input velocity of 10mps was uniformly distributed over the inlet face. The data was monitored after every 50 time steps.

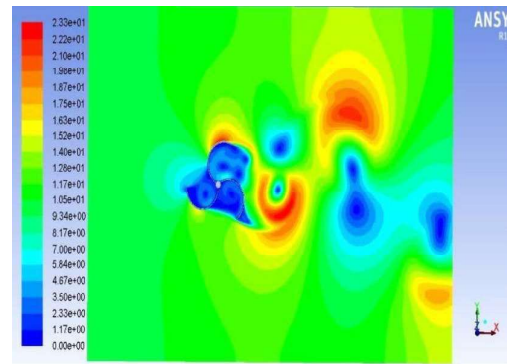


Figure 11: - 3 Blade Turb. 60 Degree orientation- Velocity Contours

Figure 11 presentations the velocity circulation. The estimation of most extreme velocity is 23.35mps which happens in the nearby region of cutting edge 1. As the turbine is pivoted by 60 degrees from its unique position, the structure of the wind stream over the turbine has additionally changed. A high-speed zone is created on the suction side of cutting edge 1. The high-speed territory which was created above edge 1 in CASE II, has moved downstream (output). Additionally, it tends to be seen that speed drops to very nearly zero in certain regions to the correct side of the turbine. This demonstrates nearness of wake locale which is encompassed by high-speed belt

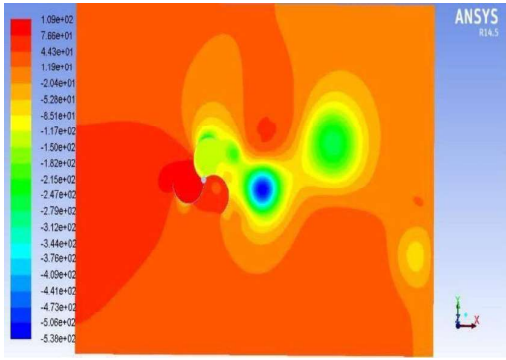


Figure 12: 3 Blade Turb. 60 Degree orientation

As can be seen from the figure 12, the most extreme positive pressure (108.97 Pascal) lies in the territory between sharp edge 1 and cutting edge 3. The estimation of most extreme negative pressure is - 538.00 Pascal which happens in the wake locale, made to the correct side of the turbine. The downstream side (Output side) faces negative pressure while the upstream side (Input side) faces positive pressure. Cutting edge 1 grew more power on its pressure side and suction side since each side is confronting negative pressure and positive pressure individually. See that the estimation of negative pressure is considerably more than those in the past CASE I and CASE II. The wake locale is moved from over the turbine to right half of the turbine where estimation of pressure is - 538 Pascal.

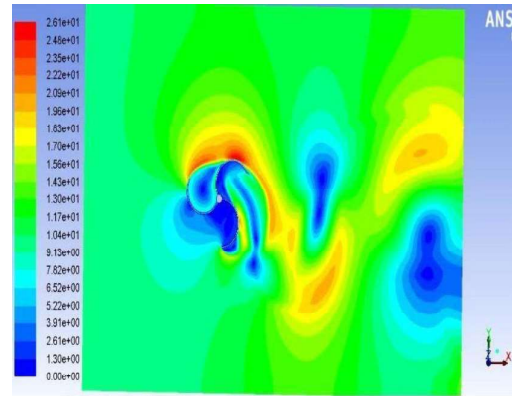


Figure 14: – 3 Blade Turb. 90 Degree Orientation– Velocity Magnitude

Figure 5.15 demonstrates the velocity dispersion of the three-edge turbine. The legend in red shows the most extreme speed which has the estimation of around 26.07m/s. This speed shows up on the ebb and flow of cutting edge 1 and furthermore at the tip of sharp edge 3. The high-velocity zone stretches out from over the turbine to the right side of turbine covering more zone on the base side and top side close to the yield face (downstream of the turbine). This demonstrates a district of high disturbance, therefore meaning wake area. Note that the all-inclusive zone of high speed does exclude the most extreme speed which is 26.07 M/s, however it scopes to generally around 22.2m/s. The speed drops to right around zero in a portion of the parts in the downstream side.

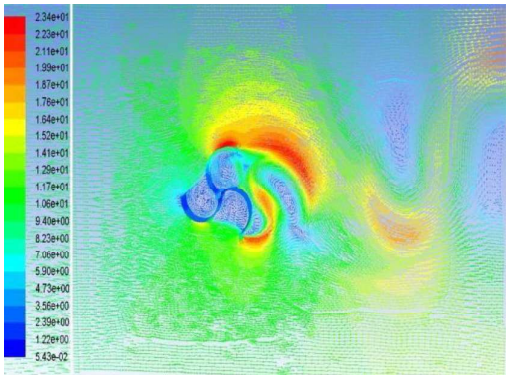


Figure 13: 3 Blade Turb- 60 Degree Orientation- Velocity [Air Flow over turbine]

The figure 13 shows the velocity vectors and the course in which the stream happens. The turnaround stream happens in the pressure side of all the three sharp edges. The wind stream additionally gets redirected in a turnaround bearing in the wake locale making a negative pressure region.

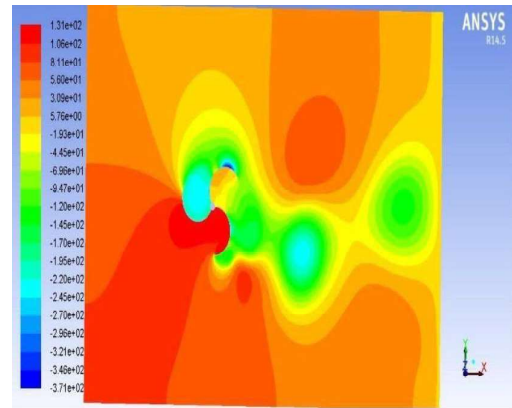


Figure 15: 3 Blade Turb. 90 Degree Orientation– Static Pressure

Figure 15 stipulates the dissemination of static pressure. The legend in blue demonstrates most extreme negative pressure having an valve generally around - 3.71e+02 Pascal. This pressure curvature of edge 1, close to the tip of the cutting edge. The region between the cutting edge 1 and sharp edge 3 additionally faces negative pressure having values

generally around - 2.20e+02 Pascal. The estimation of most extreme positive pressure is 131.30 Pascal and can be seen in the territory between sharp edge 2 and cutting edge 3. Because of the high turbulence the pressure drops in couple of territories on the downstream side, close to the yield face. The wake area has pressure drop appeared by the legend in light blue (water) shading on the suction side of sharp edge 2.

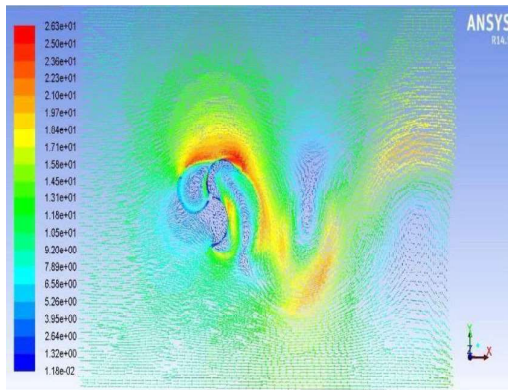


Figure 16: 3 Blade Turb.- 90 Degree Orientation- Velocity Vector [Air Flow over turbine]

Figure 16 showcases the stream of air over the turbine in speed vector structure. The speed vectors are rendered with broad detail, which gives the clear representation of direction of wind. This is critical for complex models of invert stream and vortices are clearly represented. It very well may be seen that the wind currents from over the turbine and advances downwards and again rotates toward the sky. Turn around stream can likewise be seen in the wake region.

6. RESULTS

Sr. no.	Parameter	Static Pressure	Maximum valve
1	0-degree	1.83e+02	3.58e+08
2	30-degree	9.80e+01	3.58e+08
3	60-degree	1.09e+02	3.58e+08
4	90-degree	1.31e+02	3.58e+08

The CFD investigation demonstrates that a wide range of pressure determined are not exactly the material most extreme valve and, in this way, Savonius turbines made of mild steel can be utilized as they give strength just as great electrical yield. The part of strength is tested in this paper and the outcomes are acceptable.

7. CONCLUSION

Number of blades will impact the revolution of the rotor of wind turbine models. The three blades wind turbine produces higher rotational speed and tip speed proportion.

Various designs were adjusted for improving the execution of the Savonius wind turbine. Every design of the Savonius rotor gives great performance characteristics. In past examinations demonstrate that the execution of Savonius wind turbine was influenced by certain parameters like aspect ratio, number of cutting edges, rotor shapes, Reynolds number, disturbance power, blade angle's shaft interface, the course of wind stream. For predicting performance accuracy experimental and CFD simulation technique was utilized. Experimental method is costly and time consuming and other hand Cfd simulation method technique is less expensive and tedious.

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Enhancing the Compressive Strength of Concrete Lost due to Hatching

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ABSTRACT Concrete is given shape by formwork. The quality of cement relies upon kind of formwork. Therefore, formwork plays an essential job in development rehearses. Once formwork is expelled, one gets a smooth surface where upon it is required to get prevalent of concrete. Exactly when concrete is set in molds it helps in and catching air from inside. The caught air diminishes quality and cripples the bond among concrete and steel. In like manner the strong must be genuinely compacted. After evacuation of formwork, concrete individuals are roughened for the simplicity in putting. A smooth surface can't hold the solid paste decidedly. To construct the joining between the smooth surfers and bond strong paste, the surface must have a couple of impressions. In case the impressions are made by beating on the smooth surface, the quality may get impacted. Thus, it is cautioning to use roused formwork. The process is bring forth where solid individuals are hit hard with an uncommon equipment. Hatching helps in simple putting however influences the quality of member. Hence an option for the equivalent is utilizing extraordinary sort of formwork that is embossed plates. These plates build the solidness of the formwork and there was an average increase of strength of 15.96%, 10.44% and 6.73% for M20, M25 and M30 respectively. Thus, it is a best option for bring forth.

INDEX TERMS hatching, embossed plates, plastering, compressive strength

1. INTRODUCTION

Concrete is a standout amongst the most promptly utilized materials in the development time. The development includes utilization of substantial mass of indistinct cement. So as to give shape and geometrical measurements to the ill-defined crisp solid, self-supporting structures are utilized. These are known as formwork. The formwork takes the heaviness of the wet concrete just as other development loads. Cost is primary angle similarly as formwork is concerned. For enormous tasks formwork should be utilized more than once. In such cases steel formwork is practical. The expense of formwork ranges 20 % of the absolute development cost and thus it must be planned without bargaining quality and productivity.

Formwork is a brief structure which underpins crisp cement till it ends up sufficiently able to continue its very own weight. After setting of cement, the formwork is expelled and a strong structure of required shape and size is created. This is the very imperative component in the development of structure. For some a long time, in the field of development, utilization of ordinary for example wooden formwork was a customary practice. Presently the situation of development field is entirely different, yet the examination is required in request to pick the appropriate formwork with various points of view. Cost and time are the fundamental parameters yet alongside that we ought to likewise concentrate on quality, wellbeing and development squander age amid the procedure.

Presently days, low waste formwork frameworks for development are being utilized. The vast estimated sections in structures are currently being supplanted by little thickness shear/RCC Walls. So, it gives a vast rug

region and expulsion of balances in the structure. Also, the nature of development is getting updated. Right now, numerous formwork arrangements are accessible in the market, however the examination must be done so as to pick the best formwork for a specific kind of building. Concrete, the blend of totals with water and bond, is taking off. Its best industrially followed and recorded part, Portland concrete or its variations, has been encountering a phenomenal improvement since the turn of the thousand years, coordinated just amid a couple a long time. Very nearly twenty years after this bounce back, no conspicuous indication of backing off is noticeable, as this paper is composed.

Disliked by the lion's share but then universal, concrete is one of the mainstays of our created social orders, on equivalent foot with silicon, oil and gas, each in its own field: foundations, skyscraper, and expansive private structures for solid; data and correspondence advancements for silicon; and, up until this point, transportation for oil and gas. Increasingly concrete is created than some other engineered material on earth. Twice to such an extent cement and mortar is utilized in development – approximately 35 billion tons as the aggregate of all other mechanical structure materials including wood, steel, plastic and aluminium. Streets, spans, burrows, dams, control plants, ports, airplane terminals, embankments and seawalls, squander and new water plants and systems, every one of these frameworks depend on the broad utilization of concrete, much the same as the establishments of our structures, if not the whole structures themselves. There is a wide agreement that the extraordinary late development of bond and solid utilization on the worldwide scale is expected to a bunch of

performing artists just among the rising nations, China specifically. Be that as it may, there are additionally valid justifications to think about that the reason for this enduring development dwells in the present combining needs in created and creating nations. Alongside a colossal reasonable lodging challenge, the world is by and by likewise confronting a phenomenal foundation challenge.

The quality of concrete relies on the time of formwork expulsion. The solid ought to be disregarded for somewhere around two days to guarantee that it gets totally dry. In the event that the formwork is expelled before 2 days the solid starts to droop, split and breakdown. So as to get simplicity of plastering, solid sections are hatched. The hatching of section expands the simplicity of plastering, anyway it influences the quality. The quality is decreased by 20%. This affects the life of the structure. So as to keep this, one can supplant bring forth physically by utilizing formwork having impacts on its own (Embossed plates). Using such sort of formwork expands quality, increases strength as well as is practical. On the off chance that formwork with impressions is utilized, there will be significant increment in the attributes of the concrete member. Also, the quality won't be influenced any longer. Additionally if steel plates are put over timber formwork the sturdiness of this formworks will likewise be expanded.

2. OBJECTIVES:

- To study the loss of strength of concrete due to hatching.
- To find optimum measures to increase the strength and an alternative for hatching (embossed plate).
- To compare the variation in strength of hatched and embossed mould.

3. RESULTS

BATCH	HATCHED BLOCKS STRENGTH (N/mm ²)	PLAIN BLOCKS STRENGTH (N/mm ²)
BATCH-1	13.64	16.22
BATCH-2	9.24	10.97
AVERAGE-	11.44	13.59

TableNo. 1 (Results of Preliminary Tests)

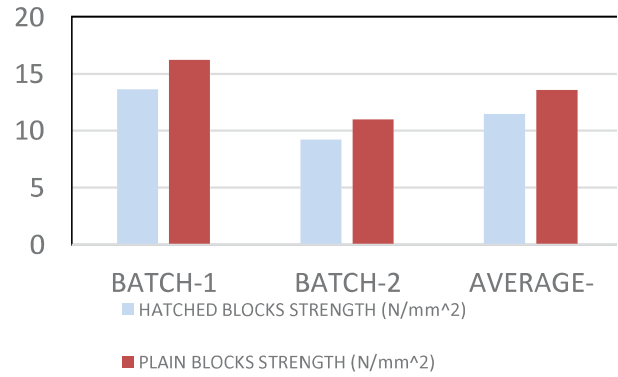


Fig No.1 (Graph of Preliminary Tests)

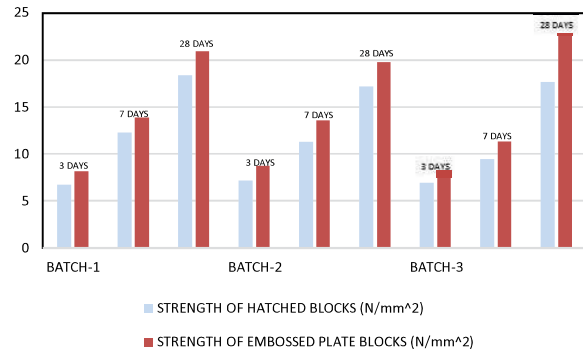
BATCH	DESIRED DAY STRENGTH	STRENGTH OF HATCHED BLOCKS (N/mm ²)	STRENGTH OF EMBOSSED PLATE BLOCKS (N/mm ²)	% STRENGTH GAIN
BATCH-1	3-DAYS	6.71	8.18	17.97
	7-DAYS	12.3	13.9	11.51
	28-DAYS	18.4	20.97	12.25
BATCH-2	3-DAYS	7.15	8.75	18.28
	7-DAYS	11.3	13.6	16.91
BATCH-3	28-DAYS	17.2	19.8	13.13
	3-DAYS	6.93	8.18	15.28
AVERAGE-	7-DAYS	9.44	11.36	16.90
	28-DAYS	17.68	22.82	22.52

TABLE NO. 2 (Compressive Test Results of M20 grade)

Fig No. (Graph of M20 Results)

BATCH	DESIRED DAY STRENGTH	STRENGTH OF HATCHED BLOCKS (N/mm ²)	STRENGTH OF EMBOSSED PLATE BLOCKS (N/mm ²)	% STRENGTH GAIN
BATCH-1	3-DAYS	13.78	13.94	1.16
	7-DAYS	15.6	16.6	6.02
	28-DAYS	23.42	25.16	6.91
BATCH-2	3-DAYS	13.6	13.79	1.37
	7-DAYS	15.2	16.9	10.05
	28-DAYS	21.6	25.63	15.72
BATCH-3	3-DAYS	12.84	13.98	8.15
	7-DAYS	14.16	15.32	7.57
	28-DAYS	23.06	25.26	8.70

TABLE NO. 3 (Compressive Strength Test Results of M25)



BATCH-3	3-DAYS	8.53	9.56	10.77
	7-DAYS	17.68	19.31	8.44
	28-DAYS	30.35	32.82	7.49

TABLE No. 4 (Compressive Strength Test Results of M30)

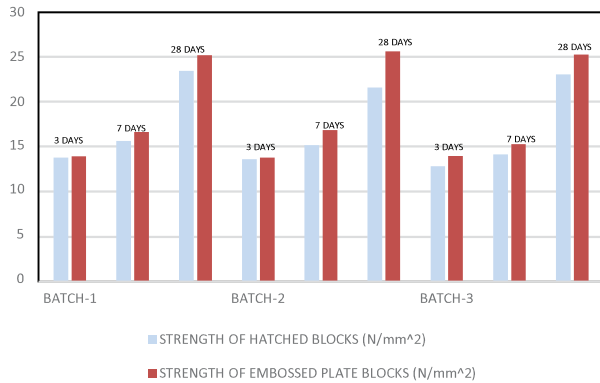


Fig No. 3 (Graph of M25 Results)

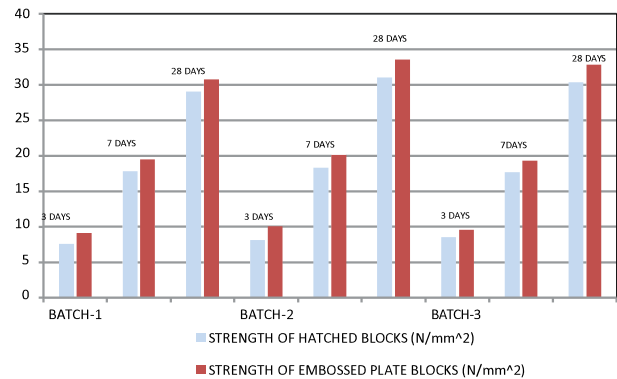


Fig No. 4 (Graph of M30 Results)

BATCH	DESIRED DAY STRENGTH	STRENGTH OF HATCHED BLOCKS (N/mm ²)	STRENGTH OF EMBOSSED PLATE BLOCKS (N/mm ²)	% STRENGTH GAIN
BATCH-1	3-DAYS	7.55	9.08	16.85
	7-DAYS	17.82	19.50	6.61
	28-DAYS	29.02	30.78	5.71
BATCH-2	3-DAYS	8.13	10.08	19.44
	7-DAYS	18.31	20.11	8.95
	28-DAYS	31.02	33.57	7



Fig No. 7 (Embossed Plates Mould & Casted Blocks)



Fig No. 8 (Embossed plates columns casted for plastering purpose)



Fig No. 9 (Even surface obtained after plastering the columns casted using embossed plate formwork)

4. CONCLUSION

1. With the help of embossed plate, we obtained an adequate rough surface for plastering and hence hatching was eliminated.
2. As hatching is eliminated the loss of strength due to hatching is also eliminated and we obtain the desired strength in the concrete.
3. The metallic embossed plates serve as a impermeable membrane which doesn't allow the water to get in contact with the wooden formwork, which results in increased life of the formwork.
4. There is an increase in cost of the formwork after using the embossed plates but using them also results in a considerable increase in the life of formwork. This finally results in cost reduction.

ACKNOWLEDGMENT

We express our deep gratitude to **Prof. Dr.H.U.Tiwari** principal of **PCET's, Pimpri-Chinchwad College of Engineering & Research** for their encouragement and co-

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In particular we are indebted to **Prof. Nidhi Khare** & **Prof. A.B.Kudoli**, our guides who had a faith in this project, believed in our ability, whispered the words of encouragement and made helpful suggestion from time to time.

We are most grateful to **Siddhivinayak RMC, Kiwale**, for offering us their space, equipments and materials. This helped us in easy completion of our project work.

We will be failing in our duty if we do not acknowledge to our parents, without their help and moral support this would not have been possible to complete this report.

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TIME OPTIMISATION IN TRADITIONAL SURVEYING METHODS

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ABSTRACT Number of operations in Surveying requires different instruments. While plotting a traverse, ranging rods requires for ranging, tape is used for linear measurements and theodolite is used for angular measurements. To avoid carriage of different instruments on site, we have manufactured a new instrument which has united all these operations by single set up. This instrument set up is able to perform different functions i.e. ranging, leveling, traverse plotting simultaneously.

This invention consist of a two ranging rod connected to each other at the bottom portion with the help of metallic tape. Above that 360 degree protractor and vernier scale is provided to measure the horizontal angle between any two points to an accuracy of 20 seconds. It can also used to measure the linear distance between two stations. It is also helpful in measuring bearings of the survey line with the help of compass attached to it. With the help of telescope and vertical protractor, vertical angles and level difference can be easily worked out.

INDEX TERMS Traverse Plotting, Ranging, Theodolite, Reconnaissance, Preliminary.

1. INTRODUCTION

Surveying has been an element in the development of human environment since the beginning of recorded history. Planning and execution of most forms of construction requires it. It is also used in transport, communication, mapping, and other definitions of legal boundaries for land ownership. It is an important tool for research in many other scientific discipline. Various surveying devices are used to carry out the survey of large stretch of land.

Commonly used instruments are total station, theodolite, auto level, dumpy level, prismatic compass, measuring tape etc. Most precise and mosly used instrument is total station but it is very costly as compared to other instruments hence it limits its use in extensive projects only. For small projects theodolite is mostly preferred. Theodolite is used to measure horizontal as well as vertical angles. Auto levels and dumpy levels are used to measure the elevation of the different levels of the ground. Prismatic compass is used to measure bearings of the angles. Measuring tape is used to measure distance between two points.

These are some commonly used conventional instruments in surveying. As this instruments are very costly they involve very high investment and each instrument is used for certain special measurements. Theodolite is used for measurement of horizontal as well as vertical angles. Measurement tape is used for measurement of distance between two points. So we have combine characteristics of these instruments to construct a new

instrument which will measure horizontal, vertical angles, level difference, bearings of line, plotting of offsets as well as horizontal distances on ground simultaneously which improves the speed of the surveying and the instrument is economical as compared to other conventional instruments.

2. OBJECTIVES OF THE PROJECT

1. Time and cost optimization in traditional surveying methods.
2. To introduce ease in handling of surveying instruments.
3. To perform various surveying operations at the same time to promote faster surveying.
4. To reduce the accessories carried on to the site for surveying.
5. To unite all surveying operations to form single instrument set up.

3. SCOPE OF THE PROJECT

1. This instrument can be used for reconnaissance survey work with better accuracy for measuring the area of the plot, measurement of angles, level differences, bearing of traverse.
2. This instrument will increase the speed of the surveying work.
3. As it is too much user friendly, non-technical person can work out areas of plots, level



differences with the help of this instrument.

4. METHODOLOGY

For surveying small areas surveying instruments like theodolite, measuring tape, prismatic compass etc. are used. But these instruments are very costly and need skilled personnel to operate it. So there is a need of such instrument which will perform all the necessary functions with a single instrument setup with a reduced cost.

We have combined all these functions which can be performed from single set up. We required to carry number of accessories to the site for the preliminary survey work. There is a need of such instrument which will carry out number of operations with the help of single instrument which will reduce the time required for preliminary surveying work and also the accessories required for it.

We have incorporated the main scale and the vernier scale to measure the horizontal angle up to accuracy of 20 seconds and we have connect the two ranging rods with the help of tape to measure the horizontal distances when two rods are kept apart from one another.

5. LIMITATIONS OF INSTRUMENTS

1. As the linear distance measurement is dependent on the tape, tape length influences the length of distance measurement. We can fluctuate the range of the instrument by changing the length of the tape.
2. Linear distance measurement cannot be accurate due to sagging of the measurement tape. We can avoid this difficulty by replacing tape with electronic distance meter and making it digital.

6. COMPONENTS OF INSTRUMENT

Our instrument comprises of following components:

1. Ranging rod
2. Vernier scale
3. Telescope
4. Measuring tape
5. Base stand
6. Vertical scale
7. Level Tube
8. Compass

7. PROCEDURE OF MEASURING HORIZONTAL ANGLE

There are two ranging rods connected to each other by means of measuring tape. By placing one ranging rod at station A second rod is moved to the station B. While moving second rod vernier scale moves over main scale and pointer points the angle on the main scale. In this way angle between two points can be

measured.

8. PROCEDURE OF MEASURING VERTICAL ANGLE

Vertical circle is provided at the side of the telescope for measurement of vertical angle. Pointer is attached to denote the angle. As we rotate the telescope the needle rotates around the semicircular protractor to measure the vertical angle between two points. By knowing vertical angle between two points by using trigonometric calculations we can find out the level difference between two points.

9. ADVANTAGES OF INSTRUMENT

1. **Cost of Instrument:** This instrument is very much less costlier than theodolite. Theodolite costs about 30,000-40,000. This instrument costs near about 10,000.
2. **Functions:** Theodolite can measure only horizontal and vertical angles. This instrument can measure horizontal angle, vertical angle, linear distances, as well as bearings of the angles too.
3. **Carriage of Instrument:** Theodolite is tedious to carry to the required location. This instrument facilitates easier transportation.
4. **Measurement of irregular area:** To calculate the area of the irregular area lengths of sides as well as angles should be known. By using theodolite we can measure angles only but this instrument measures lengths as well.
5. **Operation:** Operation of theodolite is quite difficult whereas operation of this instrument is little bit easier.

10. FIELDS OPERATIONS

1. **Area:** It can be used to calculate the area of the irregular shape land by measuring the lengths of the sides and angles between the sides.
2. **Difference in elevation:** By calculating vertical angle between two points by using trigonometric calculations we can find out the level difference.
3. **Traverse plotting:** It can be used to plot the traverse on the open land by taking required angles.
4. **Ranging:** With the help of two ranging rods we can perform the function of ranging.
5. **Measurement of Linear Distances:** Two rods are connected by using tape therefore distance between two points can be directly measure using measuring tape.
6. **Bearing:** We can measure the bearings of the survey lines using this instrument.

11. CASE STUDY

We have carried out the measurement of area of irregular area with the help of theodolite and our instrument for the purpose of validation. We consider a particular area under consideration for the measurement of area. We measure the sides of the quadrilateral with the help of measuring tape and measured the angles with the help of theodolite. Then we measure the sides and angles of the quadrilateral with our instrument and validate the result as follows:

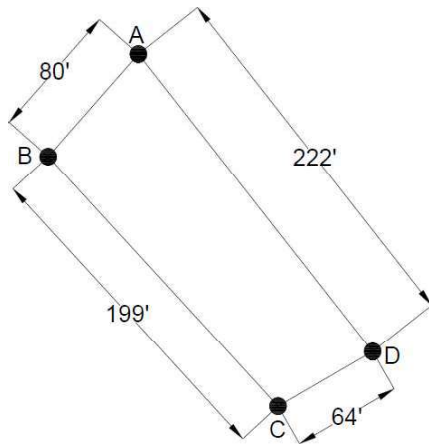


Fig No. 1

We have consider above irregular area for the measurement of area. We measure above area with the help of theodolite and with our instrument. We got the following results:

Area measured using Theodolite	14876 sq.feet
Area measured by our instrument	14875.09 sq feet



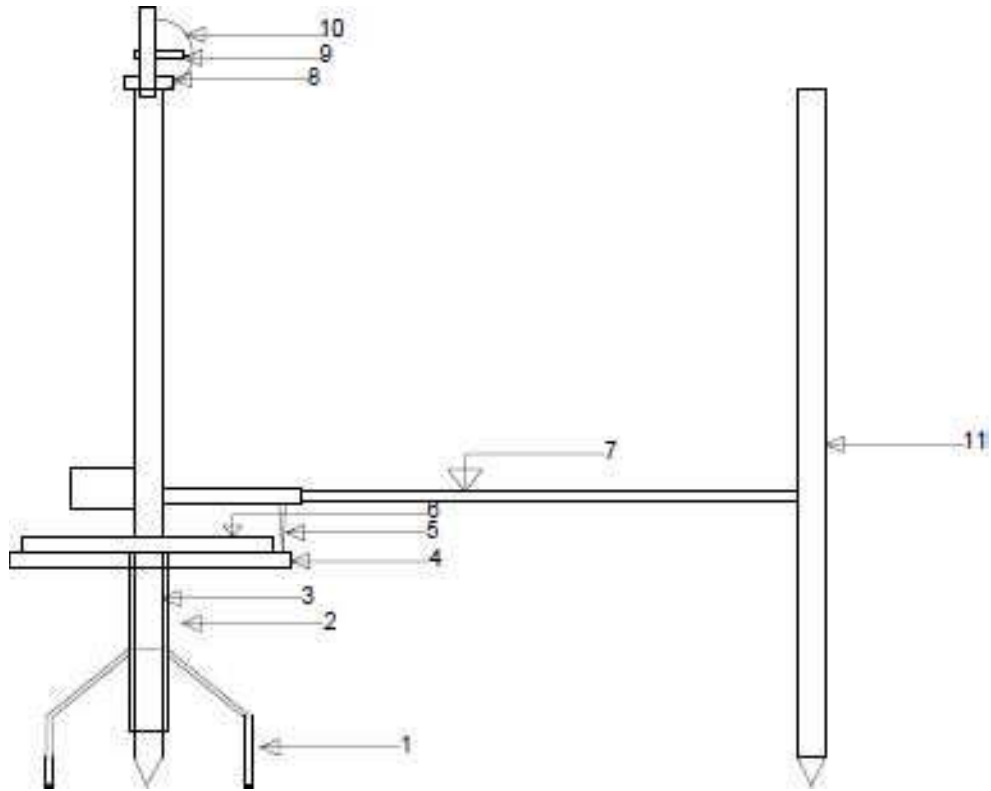


Fig No. 3 Schematic representation of Instrument

**Application ID: 201821027109
Patent Docket No. 31872**

- 1. Base Stand
- 2. Base Stand Rod
- 3. Rotating Rod A

- 4. Main Scale
- 5. Needle
- 6. Vernier Scale

- 7. Measuring Tape
- 8. Compass
- 9. Vertical Circle Needle

- 10. Vertical Circle
- 11. Rotating Rod 11



Fig No:4
Protractor with Telescope



Fig No: 5
Base Stand

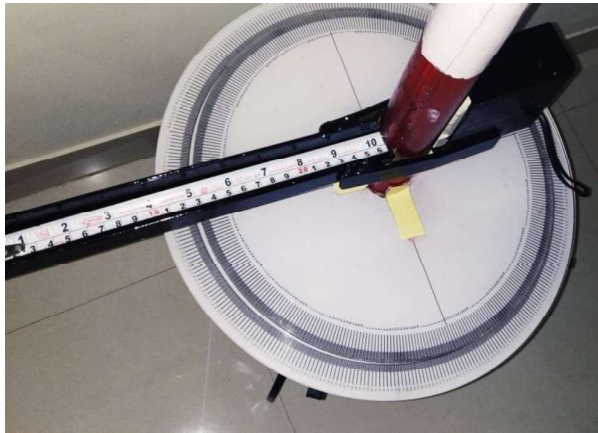


Fig no: 6
Measuring Scales



Fig No: 7
Measuring Scales



CONCLUSIONS:

Traditional equipments like chain, tape, cross staff, prismatic compass, ranging rod are used for reconnaissance survey. These instruments are able to perform single surveying operations which obviously consumes ample of time and manpower. By uniting all these functions and replacing them by single setup leads to finish all surveying operations within a very short time and limited manpower.

We can easily perform functions such as plotting of traverse, measurement of horizontal angle, measurement of vertical angle, determination of level difference between two points, bearings of survey lines, measurement of area using horizontal angle and linear distances, plotting of curves simultaneously. As all parts of this instrument is detachable, this instrument is much handy and convenient to carry out preliminary surveying work.

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Study and Analysis of Bicycle Track (From Nigdi to Mukai chowk) (May 2019).

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Abstract-This report aims to determine the potential of bicycle as a sustainable mode of transport from Nigdi to Mukai Chowk via Aundh-Ravet BRT road. The study examines the perception and preferences of commuters towards the use of bicycle as a mode of transport for commuting various distances. It includes various socio-economic and spatial differences. This study is carried out to identify how commuters perceive and value the proposed change in the bicycle infrastructure and its attributes in view of providing affordable, quality and accessible service. A questionnaire-based survey was administered to a selected sample size using a stated preference and a revealed preference approach to understand how the bicycle (potential/regular) users perceive and prefer the bicycle attributes.

The commuters' preferences are analyzed and discussed with respect to the different land use attributes and with their socio-economic characteristics. A choice model can be employed to estimate the bicycle attribute parameters.

A general method has been adopted to design a sustainable cycle track. First, potential bicycle users in city are characterized and identified through a household survey and street survey. This data is to be used to design a cycle track by considering the factors which people usually face while cycling. The results indicate that most important criteria taken into consideration are: (a) safety (b) comfort (c) convenience. The main finding of this report was that at present only 9% of people in city use bicycle and there are many places where the need for cycle track design is must and this may also help in reducing pollution and traffic congestion.

I. INTRODUCTION

A study in 2008 by Wilbur Smith and Associates commissioned by the Ministry of Urban Development indicated clearly that the modal share of non-motorized transport (bicycles) is rapidly declining, especially in small and medium towns. The National Urban Transport Policy published by the Ministry has given special importance to non-motorized transport modes as these are not only non-polluting but also serve the needs of the urban poor people. Recognizing that these modes are neglected and have become less safe the Urban Transport Policy calls for equitable allocation of road space by reserving lanes and corridors exclusively for public transport and non-motorized modes of travel. With the launch of the Jawaharlal Nehru National Urban Renewal Mission (JNNURM), the Ministry while sanctioning funds to cities to build Bus Rapid Transit (BRT) systems, also made the construction of dedicated cycle tracks along the bus corridors mandatory. As a result, Pune, which under the JNNURM has been sanctioned 1051 crores to build 115.67 km of BRT, has also built cycle tracks along most of these corridors. However it quickly turned out that poorly designed, poorly constructed and poorly maintained cycle tracks were all but unusable by cyclists, which either fell into disuse or were encroached. This in turn made it even less likely to be used by cyclists. City councilors (corporators) were quick to realize that cycle tracks are not being used, but instead of trying to ascertain the reasons for this, assumed that this was due to the fact that cyclists either do not exist or do not care for having segregated cycle tracks and asked for their removal, in order to provide more

space for vehicular traffic. As public officials become more aware of the connection between physical activity levels, environmental degradation, and the design of the transportation system infrastructure, many municipalities are increasing their efforts to develop a network of bicycle facilities. In the United States, this often means retrofitting existing roadways. Bicycle plans are developed that prioritize projects aimed at improving bicycling conditions (e.g., installing bicycle lanes), but little guidance is available about how to conduct such a prioritization.

The work presented here proposes a systems level approach to infrastructure project selection that has the potential to save costs over other, simpler approaches.

In urban areas, there is a positive correlation between accessibility and income security. Accessibility not only determines the place of work and time taken to reach the place but also, in many cases, the type and availability of work. With fast urbanization in low income countries in general and India in particular, the demand for a whole new set of services is increasing. These service providers either belong to organized or unorganized sectors. These people either walk or use bicycles for the short distance travelling. Bicycle travelling generally involves short or medium distances travelling (5-10kms). These distances involve going to school or colleges, running errands and delivering goods or services. However bicyclists' presence is however ignored by society and policy makers and planners it became very necessary to take action against this issue.

So special cycle tracks are to be provided in large cities for reducing the accidents and controlling the haphazard traffic flow.

II. LITERATURE REVIEW

2.1 Bicycle tracks and lanes (November 7, 2007) [Soren Underlien a Member of TRB committee on Bicycle Transportation]

This paper presents a before and after crash, injury and traffic study of constructing bicycle tracks and marking bicycle lanes in Copenhagen, Denmark. Correction factor for changes in traffic volume and crash/injury trends are included using a general comparison group in this non-experimental observational study. Analysis of long term crash trend points towards no significant abnormal crash counts in the before period.

The safety effects of bicycle tracks in urban areas are an increase of about 10% in both crashes and injuries. The safety effects of bicycle lanes in urban areas are an increase of 5% in crashes and 15% in injuries. Bicyclists safety worsened on road, where bicycle facilities have been implemented. Design of bicycle facilities and parking condition for motor vehicle clearly seems to have safety implications, especially at intersections. Study has revealed a few points in relation to this. Construction of bicycle tracks resulted in a 20% increase in bicycle/moped vehicle traffic mileage and a decrease of 10% in motor vehicle traffic mileage, whereas marking of bicycle lanes resulted in 5% increase in bicycle/moped traffic mileage and decrease of 1% in motor vehicle mileage. The changes in traffic do result in health benefits due to more physical activity, less air pollution and less traffic noise.

2.2 Risk of injury for bicycling on cycle tracks versus in the street (February 9, 2011) - (Anne C Lusk, Peter G Furth, Patrick Morency, Luis F Miranda-Moreno, Walter C Willett, Jack T Dennerlein)

Most individuals prefer bicycling separated from motor traffic. However, cycle tracks (physically separated bicycle-exclusive paths along roads, as found in The Netherlands) are discouraged in the USA by engineering guidance that suggests that facilities such as cycle tracks are more dangerous than the street. The objective of this study conducted in Montreal (with a longstanding network of cycle tracks) was to compare bicyclist injury rates on cycle tracks versus in the street. For six cycle tracks and comparable reference streets, vehicle/bicycle crashes and health record injury counts were obtained and use counts conducted. The relative risk (RR) of injury on cycle tracks, compared with reference streets, was determined. Overall, 2.5 times as many cyclists rode on cycle tracks compared with reference streets and there were 8.5 injuries and 10.5 crashes per million bicycle kilometers. The RR of injury on cycle tracks was 0.72 (95% CI 0.60 to 0.85) compared with bicycling in reference streets. These data suggest that the injury risk of bicycling on cycle tracks is less than bicycling in streets. The construction of cycle tracks should not be discouraged. Bicycling could address obesity, cancer, stroke, diabetes, asthma, mortality and pollution; however, the bicycling environment is a limiting factor. The predominant bicycle facilities in The Netherlands and Denmark are cycle tracks, or bicycle paths along streets that are physically separated from motor traffic, bicycle-exclusive and with a parallel sidewalk. Due to the separation from vehicles afforded by 29000 km of cycle tracks in The Netherlands plus other initiatives, 27% of Dutch trips are by bicycle, 55% are women, and the bicyclist injury rate is 0.14 injured/million km. In the USA, 0.5% of commuters bicycle to work, only 24% of adult cyclists are women, and the injury rate of bicyclists is at least 26 times greater than in

The Netherlands. The chief obstacle to bicycling, especially for women, children and seniors is perceived danger of vehicular traffic. The construction of cycle tracks should not be discouraged.

2.3 Modeling the Effects of Pro Bicycle Infrastructure and Policies Towards Sustainable Urban Mobility (ASCE October 1, 2013) [Luigi dell'Olio; Angel Ibeas (et.al)]

This paper aims to determine the potential of bicycle as sustainable mode of transport in medium size Spanish city with strong inclines and relatively inclement weather. For this purpose, a general methodology has been designed that could serve as an example for other areas. First, potential bicycle users in city are characterized and identified through a household survey, which included a complete travel diary. Then they were asked to participate in a stated preference survey design to find out the relative importance of certain key variables, previously identify, associated with making bicycle journey.

2.4 Optimization Framework for Bicycle Network Design (ASCE April 25, 2014) - (Jennifer Duthie; Avinash Unnikrishnan)

This paper presents a new formulation for the network design problem as it relates to retrofitting existing roadway infrastructure for bicycles. The goal of the problem is, for a minimum cost, to connect all origin-destination pairs with paths where each roadway segment and intersection meets or exceeds a lower bound on its bicycling level of service. The length of each optimal path is constrained to be no greater than a given upper bound, which is expressed as a function of shortest path length.

2.5 Measuring the impact of bike-to-work day events and identifying barriers to increased commuter cycling (ASCE paper January 13, 2015) - (Daniel Piatkowski; Rachael Bronson; et.al)

This paper aims to understand the following:

(1) Who attends BTWD (Bicycle to work Day); (2) The impacts of these event-based promotional strategies across different groups; (3) Lessons for increasing commuter cycling in general? Over 1,000 surveys were collected in the Denver region. Using an ordered logit model, the authors then identify significant factors for grouping cyclists by behavior category. The results suggest that event attendees vary widely, from those who only bicycle on BTWD to those who report year-round bicycling, while reasons for participation and impacts of participation vary across bicycling behavior groups. This research also identifies specific barriers to increased commuter cycling.

2.6 Cycle-Length Strategies for Diverging Diamond Interchange in a Coordinated Arterial (ASCE August 8, 2016) [Christopher. M. Day (et.al)]

Six different origin-destination (O-D) scenarios are tested in a micro simulation study. Results are presented in terms of the number of stops, movement delays at the DDI, queue lengths, and delay by O-D path. The outcomes show that the half-cycle strategy yielded lower total and average delays yet resulted in more stops along the arterial and higher arterial O-D path delays. The full-cycle option, meanwhile, tended to achieve fewer stops and lower delays for arterial routes but increased total and average delays for other movements. The three-phase strategy often reduced delays and queue lengths for the arterial movements exiting the DDI, but increased these for other movements.



2.7 Cycle Track Concepts for Burlington ON: Design Lessons-
(Apeldoorn NL)

Norma Moores, P. Eng. IBI Group)

A concept for a "quality framework" for the cycling network was developed. This concept focuses on improving cycling quality of two existing linear trails that traverse the City, creating a new crossing of the QEW freeway, introducing cycle tracks on a future rapid transit corridor along the northern boundary of the City, and filling in the framework with bike lanes and bicycle priority streets. One element that was discussed was the high level of government support to encourage and support cycling in Apeldoorn" cycling is not just a cultural preference among the Dutch but government policy:

- ☑ Design comfortable infrastructure and visible space for cyclists on roadways
- ☑ Enact legislation that protects cyclists
- ☑ Support cycling education for all school children
- ☑ Host cycling events to promote the cycling culture
- ☑ Encourage large employers to provide end-of-trip facilities for cyclists
- ☑ Provide secure bicycle parking at destinations.

2.8 Promote cycling in urban areas by developing cycling infrastructure in cities, introducing cycle-sharing schemes, and promoting awareness campaigns-

(Akshima T Ghate, TERI, All India Cycle Manufacturers' Association (AICMA))

Given the severe lack of cycling infrastructure in cities, the following suggested approach needs to be urgently adopted at the city level in order to ensure development of quality cycling infrastructure in cities:

Ensuring provision and maintenance of cycling infrastructure in cities

Make non-motorized transport (NMT) projects a mandatory requirement for central funding.

Cities should implement city-wide cycle-sharing schemes.

Government of India should initiate awareness campaigns for promoting cycling.

2.9 Cycle Tracks: A Technical Review of Safety, Design, and Research (Toole Design Group for the City of Cambridge & New York City Department of Transportation, and Alice Brown)

Accessible for All: Cycle Tracks Increase Ridership and are Preferred by More People. A review of research, preference surveys, and bicycle data around the world has shown a clear trend: cycle tracks increase overall ridership, and are preferred by more types of potential bicyclists. Below are some of the key findings:-

In Washington, DC, more bicyclists began riding on 15th Street after the one-way cycle track was installed. After the two-way cycle track was installed, there was a 205% increase in bicycle volumes.

A study of nine large North American cities show a clear trend in safety in numbers, and " as the levels of cycling increase, injury and fatality rates per trip and per km traveled fall dramatically. Thus, if we can increase cycling, it will almost inevitably be safer,

More and better bicycling facilities have dramatically increased bicycle share trips in cities without any tradition of cycling for daily travel.

The City of Vancouver, BC, conducted counts before and after the installation of a cycle track on Hornsby Street. Ridership increased from 10,000 bicyclists per month prior to construction to 55,000 bicyclists per month two years after construction.

III. METHODOLOGY

Survey of existing bicyclists and potential bicyclists had been conducted which have not influence on commuting bicycles

1. Deciding the sample size for the survey work-sample should be representative of the people who potentially affected by action.
2. Target groups-Decide the target groups using the secondary data.
3. Zoning is done based on socio-economic activities such as income.
4. It includes three types of different land use characters.

QUESTIONNAIRE

FOR SURVEY

(A)SURVEYOR INFORMATION: 1. Name : 2. Sector/survey ward: (B) ORIGIN & DESTINATION SURVEY: 1. Distance between 2-5 km = YES NO 2. People travelling whole distance from origin to destination= YES NO (C) SOCIO-ECONOMIC DETAILS: . Name: . Sex: . Age: . Occupancy: 1. Which mode of Transport they use? (a) Auto Rickshaws (b) Bicycle (c) Bike/Scooter (d) Car (e) Public Bus (f) Metro/ train 2. Do you take shortest route to work place by bicycle? YES NO 3. If NO, reason why they do not use bicycle?(a) Discomfort due to weather(b) Pollution(c) Lack of infrastructure facilities(d) Long commuting distances(e) Risk of road accidents 4. If proper facilities are provided will they use bicycle in future? YES NO 5.On average, how frequently do you bicycle for the following reasons? (a).Go to work (b).Go to School (c).Go to transit stop (d).Exercise or go to the park 6.How important do you think the following improvements would be insupporting Bicycling in pradhikaran,nigdi region?(a)Provision of bicycle track(b)Provision of bicycle parking near transit area(c)Awareness about benefits of bicycling 7.If it were safe and convenient,how likely would you be willing to bicycling for the Following reason?(a).Go to work (b).Go to School(c).Go to transit stop (d).Exercise or go to the park 8.Reasons for not cycling?(a).Disability,other health reasons (b).Too busy(c).Don't want to enjoy it (d).Othertransportation is faster.

IV SCOPE OF PROJECT

Cycling to work may soon become a reality in Pune, and not just for poor but also for urban population. With pollution and shrinking road spaces, the city is under pressure to adopt the model that promoted cycling as an alternative to driving. "Cycle is the future in Pune, India but the voice has to reach out". A new study revealed on March 22 by the Centre for Science and Environment (CSE) states that Pune has to wake up to the mobility crisis with non-conventional, eco-friendly and easier



systems of transport. According to various studies the increased use of cars in the city has reduced the carrying capacity of roads and by 2020, if the city has to meet its target of 80% of public transport share it will have to spend more on cycling, this will help in reducing pollution and control the traffic.

Through this project we propose to develop a travel choice model for the use of bicycle in PCMC urban area. For implementing this project it is therefore necessary to understand whether safe and comfortable infrastructure is created for bicycle users. What impact will it have as choice of bicycle as a commuting mode.

If we implement some changes in context of bicycle as mode of choice such as infrastructure development, safety, comfort, etc.; to check whether there will be change in bicycle modal shift? After changing the infrastructure and after meeting the needs of people, will people use bicycle as mode of transport on large scale or not?

V. DESIGN

Design Speed:The average speed range of NMT is about 5 km/hr — 15 km/hr. In rare cases, it can be seen to be 20 km/hr. It is important for cyclists gain a cruising speed for constant usage. Interruptions due to parking, side roads, access to properties affect the desirable speed and make it difficult for the cyclist. **Clearances and Widths:** The width requirement for a NMV in movement is higher than its physical dimensions. This is on account of two main factors: zigzagging movement (side to side movement to maintain balance during riding) and fear of obstacles (or maintenance of manoeuvring gap). Bicyclists carrying goods and pillion riders may experience higher zigzagging on account of the extra weight carried, while cycle rickshaws experience minimal or no zigzagging.

VI. CONCLUSION

Potential cyclist are higher than cyclist

Male cyclist are more than female cyclist

There are few respondents (17%) does not like to use bicycles because of various reasons like (long commuting distance , accident fear)

From the analysis it is observed that the highest no of potential cyclist are from the age group of 10 to 45.

The observation obtain from the final survey by using the questionnaire did not give detailed information like the purpose of cycling (leisure, Fitness etc.) and hence its need to revised for some sections.

Most of the respondents gave the reason for not using bicycle as lack of infrastructure facility, so we need to provide cycle track to increase the number of cycle users.

It is not possible for everyone to own the cycle so provision of PBS (Public Bicycle Share System) in the locality is essential.

It will be a boost for intermodal passenger transport system as it is the most effective mode for last mile connectivity.

In this locality, mostly bungalows are constructed (on main proposed cycle route) creating problem for providing segregated and raised type of cycle track

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Accident Cause Model For Talawade, Pune, Maharashtra.

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ABSTRACT It is projected that road traffic injuries will move up to the third position by the year 2020 among leading causes of the global disease burden. Talawade being a major industrial area in P.C.M.C. due to which lot of heavy vehicles operate along with the local travellers. Hence, the area is prone to accidents. We studied the various accident causes in Ganeshnagar by preparing questionnaire & creating Google form. From which 40% being due to road condition, 32% overtaking problems, 14% improper pedestrian crossing 10% maintenance problem & 4% personal problem. We analyzed the geometric errors on the location & also the peak hour of occurrence was observed to be 8.00am -11.00am & 3.00pm-10.00pm. The outcomes of the study will help in minimizing the accidents & allow the safe travel with growth in the industrialization.

INDEX TERMS black-spot, Questionnaire, collision diagram, accident cause model.

I. INTRODUCTION

A road traffic accident (RTA) is any injury due to crashes originating from, terminating with or involving a vehicle partially or fully on a public road. The Global status report on road safety 2013 indicates that worldwide the total number of road traffic deaths remain unacceptably high at 1.24 million per year. Road traffic injuries are the leading cause of death among young people, aged 15–29 years. Children, pedestrians, cyclists and older people are among the most vulnerable of road users constituting half of those dying on the world's roads. India is no exception and data showed that more than 1.3 lakh people died on Indian roads, giving India the dubious honor of topping the global list of fatalities from road crashes. Rapid urbanization, motorization, lack of appropriate road engineering, poor awareness levels, nonexistent injury prevention programmes, and poor enforcement of traffic laws has exacerbated the situation. India has the highest road traffic accident rate worldwide with over 140,000 deaths annually, beating even China. Every hour, nearly 14 lives are lost due to road accidents in India. Total deaths in Maharashtra are 9205 in year 2015 as per survey.

II. LITERATURE REVIEW

Road condition :-

Identification of factors in road accidents through in-depth accident analysis by Mouyid bin Islam, Kunaw Kanitpong thailand.

This paper addresses an in-depth study through crash investigation and reconstruction. This research paper establish the linkage between the causes and consequences with event. They studied accidents by drawing the driving path on software. They have listed the various factors like - Lack of street lighting, No "Speed Limit" sign along the roadside. Lack of conspicuity of the static roadside objects during nighttime.

A Descriptive Study on the Consciousness of Traffic Rules among the people of 'Amdavad' By Poonam Arora.

One of the biggest problems regarding transportation that the city is facing is the congestion that millions of commuters face each day on roads.

The paper reveals and concludes that the majority of the drivers does not follow rules and traffic signs while driving. A very small chunk doesn't believe in following traffic signal which causes accidents and other traffic problems.



Failing to keep lane . Failing to yield right of the way .
Driving in excess of speed .

B. Vehicle condition:-

Traffic Analysis and Road Accidents: A Case Study of Hyderabad using GIS by **M. Bhagyaiah1, B. Shrinagesh**.
This Paper addresses to increase of vehicle the major accidents are happened. The increase of vehicle has lot of pressure on the existing roads and ultimately resulting in road accidents. From 2001 there is an increase of 202 percent of two wheeler and 286 percent of four wheeler vehicles with no road expansion. Motor vehicle crashes are a common cause of death. GIS helps to locate the accident hotspot.

C. Age of Driver : -

Road Traffic Accidents in India: - Issues and challenges by Sanjay Kumar Singh.

This research paper is based on the age group of drivers. The age group of 30-59 years is the most vulnerable population group In this group the most road accidents are happened. The age group of 30-59 males face higher level of fatalities and injuries than the female. Road accidents are relatively higher in extreme weather and during working hours.

Fatal Road Traffic Accidents among Young Children by Harnan.Singh,AD.Aggarwal.

This Paper addresses to studied the major accidents are caused by young children's. Children themselves were at fault in majority of cases Young children's are extremely vulnerable to such injuries which are vastly preventable 59 cases of fatal road traffic accidents in children aged below 16 years were studied. The most common age group involved was 13-16 years. The study highlights the pattern of fatalities due to road accidents in children and suggests suitable preventive measures to reduce burden of childhood mortality due to road accidents

D. Human Behaviour : -

Preventing Traffic Accidents With in Vehicle decisions Support System – The Impact Of Accident Hotspot Warning On Driver Behaviour by Benjamin Ryder

This paper is based on the road accidents are happened due to the human behavior while driving. In this paper they provide the evidence in- vehicle decision support systems (DSSs) can have significant positive effects on driving behavior and collision avoidance.

E. Provide Safety & Prevention Measures:-

Safety Measures for Controlling road Accidents Injuries And Fatalities by Manisha Minesh Desai.

It is difficult to imagine life without it tremendous growth of both road network and road traffic in India brought the problem of road accident resulting in injuries and fatalities In this paper we studied graph ,road accident statistics Vs no of accident ,as per WHO 12 Lakh people die every year out of which more than 83000 people die in India while 5 times is seriously injured. In this paper we have studied some safety provisions regarding the driver which include driver training and testing, driver behavior, over speeding, Drug or alcohol consumption etc

Road Traffic Accidents In India by S.M. Sharma.

There is tremendous rise in road traffic accident due to vehicular volume, increase in vehicle speed, poor driving skills, drunk driving, bad roads, poor traffic controls, lack of public awareness etc. So the solution for this is to reduce vehicular traffic give training to the drivers regarding road safety measures it can also be improved by introducing some strict rules and regulations. Theroads must be displayed with various regulatory signs and signal, boards crossings and highway, stop and give way sings and traffic lights. Road accidents are increased due to rapid urbanization and industrialization and due purchasing power of people they are able to buy all kinds of vehicle .and construction of alternative routes has not kept the pace with volume of traffic we see.

METHODOLOGY

This study is focused on the collection of data of accidents through respected authorities, studying the causes which may trigger accidents. It also deals with studying various suggestions and applying according to the feasibility & recommends it to the authorities.

CASE STUDY [Talawade] :

The area of talawade is the accident prone area. We observed this from the news obtained from 'TIMES OF INDIA' newspaper and also from the people's opinion.



CHARACTERSTICS OF ROAD

Location of site : Ganeshnagar, near MSCB office Talawade road, Pune 411062
Width of road : 15m
Length of road(A) : 86.4 m
Length of road (B) : 100 m
Average speed: 40 km/hr
Side Margin : 3.6 m
B opposite side : 4.3 m (Right)
MSCB side : 5.6 m

TECHNICAL TERMS

Stopping sight distance:

The clear distance ahead needed by a driver to bring his vehicle to a stop before meeting a stationary object on the road is called as stopping sight distance

$$SSD = Vt + V^2/gf$$

Super elevation:

The inward transverse inclination provided to the cross section of the carriageway at horizontal curved portion of the road is called super elevation

$$e = V^2/127R$$

Here, V= 40kmph

t= 2.5 sec

g= 9.81

f = 0.15

R = 300m

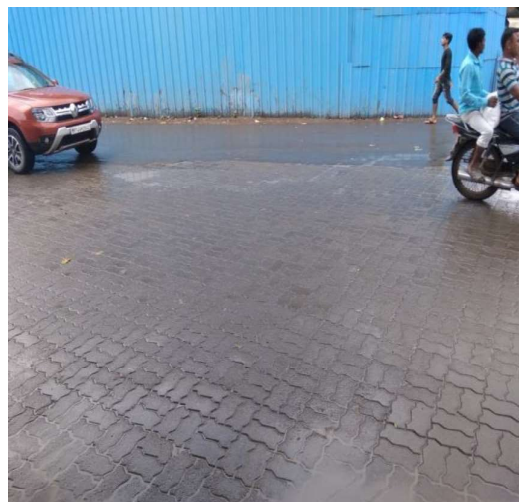
$$SSD = (40*2.5+40^2/9.81*0.15)$$

$$= 1187.32m$$

$$e = 40^2/127*300$$

$$=4.19\%$$

Condition of Road



As per our observation people face many problems due to improper sight distance, super elevation & no provision of traffic control devices. We visited RTO office at Moshi and Dehuroad Police Station for collection of accident data.



Pratap (Shopkeeper)
Questioner for road accident
 → 6-7 months High traffic route.

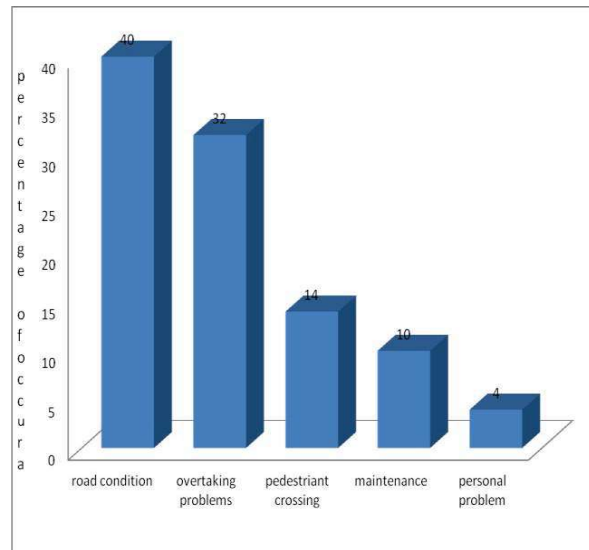
- Area :
- Area of travel (location): Ganeshnagar -
- Time of travel :
- Type of Road:

1) Any accident witnessed : YES NO ()
 Description: Road crossing, pedestrian.
 Buses & trucks (from 4 traffic).
 &

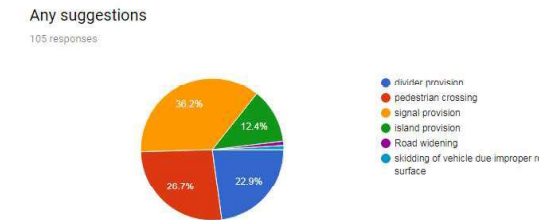
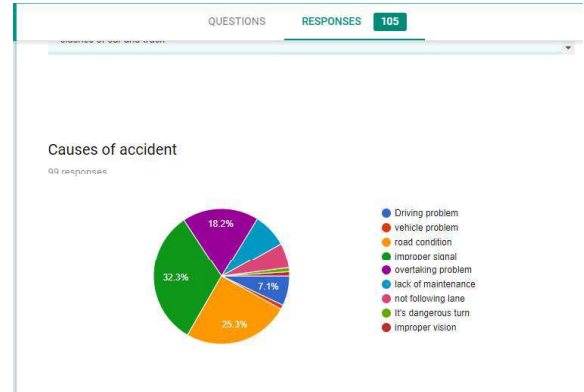
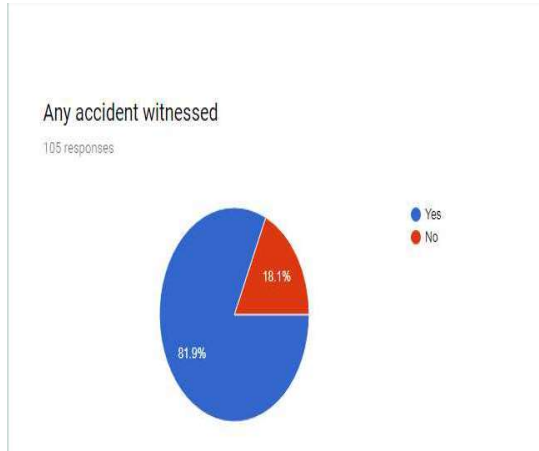
2) Causes :

- Personal : Driving problem
 Vehicle problem
- Road conditions → 10-15 days. road is bad
- Improper signal
- Overtaking
- Overturning
- lack of maintenance
- Not following lane
- Any other

3) Any suggestions regarding preventive measures for mentioned causes:
 Speed breaker, divider, circle.



DATA GENERATED BY CREATING GOOGLE FORM



Description of accident witnessed
7 responses

Because of road condition
Regular due to heavy traffic
Nothing
due to heavy vehicles
Slip of my bike
Drivers
At the turn where there are two roads , collision of two bikes

ACCIDENT CAUSE MODEL

We have developed an accident cause model by regression method as follows:

The equation is,

$$ACM=0.4IS+0.387RC+0.408DP+0.365OP+0.258VP$$

Where,

- IS = Improper Signal
- RC = Road Condition
- DP = Driving Problem
- OP = Overtaking Problem
- VP = Vehicle Problem

For example:

eg 1. $n= 3, x= 40$

then $\bar{x} = 40/3 = 13.33$

Now, $r = cov(x)/\sigma x$

$$= [1/3(40-13.33)] / [\sqrt{1/3(40^2 - 13.33^2)}$$

$$= 8.89/21.77$$

$$= 0.40$$



SR NO.	CAUSES	NO OF USER REVIEW
A.	Driving Problem	10
1	Psychological Problem	2
2	Speed	5
3	Distraction to Driver	3
B.	Vehicle Problem	
1	Improper Maintenance of vehicle	2
C.	Road Conditions	43
1	Improper Camber	14
2	Road Width, Road Margin	10
3	Improper Vision	9
4	Potholes	10
D.	Improper Signal	40
1	Height of Signal	17
2	Signals are not in working condition	13
3	Time Cycle	10
E.	Other problems	55
1	Overtaking Problem	35
2	Lack of Maintenance	13
3	Not Following Lane	5
4	It's Dangerous Turn	1
5	Improper Vision	1

Cause no	No of accidents (X)	No of causes (n)
A	10	3
B	2	1
C	43	4
D	40	3
E	55	5

Obtaining the data from the police station we found the values of certain causes of accidents.

Causes	No of accidents
I.S	42
R.C	45
D.P	13
O.P	60
V.P	5

Substituting values in the formula

$$ACM = 0.4*42+0.387*45+0.408*13+0.365*60+0.258*5$$

$$= 63 \text{ no. of accidents in a week}$$



CONCLUSION :-

The following model concludes that huge number of accidents occur weekly.

The model consist of various causes by which accidents may occurs in that area.

RESULTS:-

Obtaining the data from the police station we found the values of certain causes of accidents .

Cause	No of accidents
I.S	42
R.C	45
D.P	13
O.P	60
V.P	5

Substituting values in the formula

$$ACM = 0.4*42+0.387*45+0.408*13+0.365*60+0.258*5$$

$$= 63 \text{ no. of accidents in a week}$$

DISCUSSION

So from above results we have observe that due to overtaking problem, lack of maintenance, not following lane, and dangerous turns accident may take place and from the model we have concluded that 63 no of accidents takes place in week.

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Automated Drip Irrigation System Using Soil Moisture Sensors

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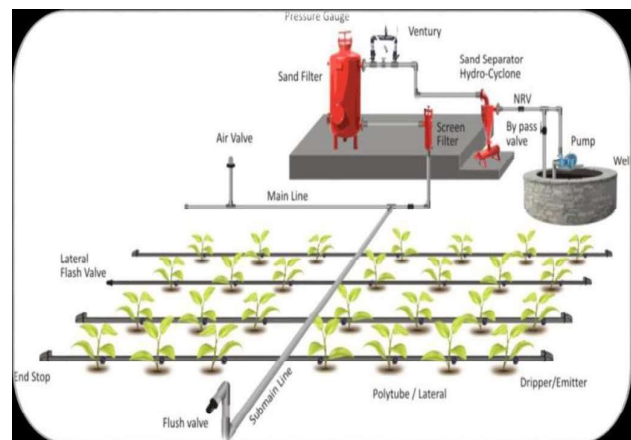
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ABSTRACT -Use of soil moisture sensors to optimize the drip irrigation system and increase the efficiency of conventional drip irrigation system. The wastage of even little amount of water is also not there and it can be useful in reducing the wastage of water.

INDEX TERMS - drip irrigation, soil moisture sensors

1. INTRODUCTION

1. As the current drip irrigation system is the advanced and most modern technique of irrigation in INDIA, so it is used mostly in irrigation of almost all the crops. Sometimes, in this system also there are some difficulties and the most seen difficulty is not giving the exact amount of water to the crops and it gets extra and there is loss of some amount of water.
2. To solve this problem soil moisture sensors are introduced in the drip irrigation system.
3. They detect moisture easily and a programmed system beside the drip irrigation makes it possible to reduce the wastage of water.



2. RESEARCH METHODOLOGY

1. Various fields were visited to enquire about the drip irrigation system and all setup with the problems associated with it.
2. The problems associated with the conventional drip irrigation system were studied in detail and solutions were made out from them.
3. Soil moisture sensors were introduced to reduce the water wastage problem so that the efficiency of the system can be increased.

3. ANALYSIS

1. Various parameters of soil were studied and the moisture parameter is being studied for resolving the problem.
2. Different plants' duty, delta and base period and moisture were also studied and it was found that most of the plants average range of moisture goes between 20%-60%.
3. Exception comes for some crops which sometimes need excessive water and some plants need less than the average initial value i.e., <20%

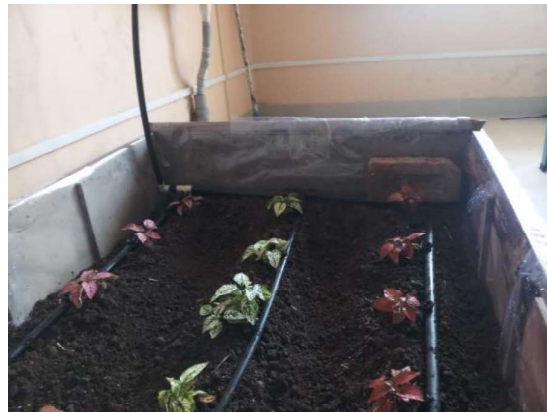


FIGURE 1.- conventional drip irrigation system

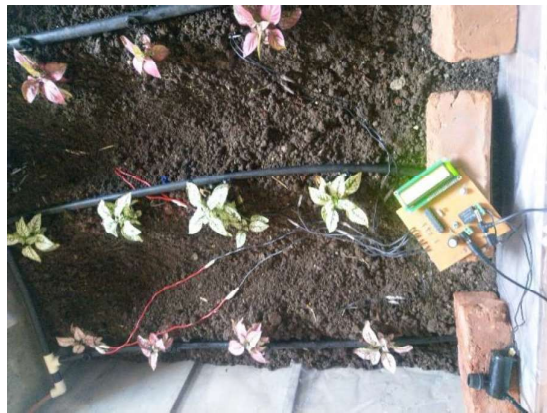


FIGURE 2. automated drip irrigation system

4. MODEL DETAILS

Description	value
Type of soil used	Black cotton soil
Dimension of box	1.1m x 1m
Type of sensor	Capacitance sensor
Length of sensor	6 cm
Range of sensor	8 cm

5. BASIC MATHEMATICAL EQUATIONS USED

$$\Delta = 8.64 \times B / D$$

B= base period in days

▲ = delta in meters

D= duty in hectares/cumec

6. CONCLUSION

From analysis and results we can conclude that the moisture parameter can be taken to resolve the water wastage problem in the fields in which the drip irrigation system is installed within a range of 20%-



50%. The higher limit is 50% and the lower limit is 20%

6. Rio Laitonjam (BE CIVIL)

ACKNOWLEDGMENT

It gives us an immense pleasure in submitting our research paper on "Determination of loss in strength of steel due to stacking on construction site". We take this opportunity to show panegyrics and thanks to our guide **Prof. A. B. Kudoli** and Coordinator **Prof. Nidhi Khare** whose suggestions helps us a lot throughout the duration of our efforts on research.

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Soil Characteristics Study For Rainfall Induced Landslides, A Case Study In Mahad Tehsil (May 2019)

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ABSTRACT

In this paper the comparative study of change in soil characteristics due to rainfall intensity is studied. Effort has been taken to correlate the rainfall intensity and landslide to nearly predict the landslide in study area. A parametric study is conducted at Dasgaon from Mahad Tehsil, Maharashtra. To find out current actual input design parameters, various geotechnical laboratory tests were conducted on the soil sample collected from backfill such as particle size distribution, natural moisture content, Atterbergs limit, coefficient of permeability, maximum dry density and optimum moisture content, cohesion and internal angle of friction by direct shear test, and results were calculated. The results of these tests are used to find out the factor that should be considered for predicting the landslide in study area depending upon the research conducted in the area.

I. INTRODUCTION

Landslides very commonly occur during a long period of heavy rainfall and occur every year in many parts of the world, especially in environments that provide a prolonged and intense rainfall, steep slopes, sparse vegetation and an abundant source of incoherent fine-grained soils, including colluvium and residual soils. These landslides are common sights in tropical countries, and in some cases, in temperate regions where residual soil prevails. In tropical countries, most landslides occur annually between July and September, in which period the frequency and intensity of rainfall is higher than any other months.

Worldwide, rainfall-induced landslides have claimed untold numbers of human lives and have caused economic losses every year. During the last ten years, the landslide events have resulted, either directly or indirectly, in more than 537 deaths and economic losses at about US\$ 10 million annually. For this reason, these landslides have been the subject of numerous studies in order to understand the hydrologic condition of failure initiation or mechanism of the failures, and to develop a system for predicting the occurrence of failures. Studies on landslides have involved a multi-disciplinary field of soil mechanics and hydrology. The study requires good knowledge of not only strength properties of the soil, but also hydrologic behaviour of the soil governed by the soil seepage properties.

This paper aims to present the current state of the art hydrological approach for landslide investigation, mainly considering the technological and software based analysis using ARC-GIS and SWAT (Soil Water Assessment Tool).

II. LITERATURE REVIEW

1. **Aditya, Muchamad Reza, Reymon Agra Medika, Yosua Alfontius, Zukhruf Delva Jannet, and Eddy Hartantyo. "Zonation of Landslide-Prone Using Microseismic Method and Slope Analysis in Margoyoso, Magelang." In Journal of Physics: Conference Series, vol. 1011, no. 1, p. 012039. IOP Publishing, 2018.**

This paper describes Margoyoso Village, Salaman Sub-district, Magelang Regency, Central Java is one of the villages that were included in landslide prone areas. The steep slopes and land use in this village were quite apprehensive. There were fractures with 5 cm in width and a length of 50 m. Moreover, these fractures appeared in the home residents. Although the local government has established a disaster response organization, this village is still not getting adequate information about the landslide prone areas. Based on the description before, we conducted research with geophysical methods and geotechnical analysis to minimize the danger of landslides. The geophysical

method used in this research was microseismic method and geotechnical analysis. The microseismic measurement and slope stability analysis at Margoyoso village was a step in analysing the landslide-prone zone boundary. The results of this research indicated that landslide potential areas had a low peak ground acceleration values with a range from 36 gal to 46 gal. Measurement of slope stability indicated that a slope angle values between 55o-78o are a potential landslide slope because the soil in this village has very loose properties so it is very easy to move.

2. **Richards, R. "Tilting failure of retaining walls including p-delta effect and application to Kobe walls." In Proc. 12th World Conf. on Earthquake Engrg. 2000.**

The purpose of the research described in this paper is to generalize the Richards and Elms (1979) procedure for prediction of seismically induced permanent displacement of retaining walls for the case of mixed sliding and rotation modes. A simplified mathematical model and modified computational method based on the work of Siddharthan et al (1992) is presented. In the model presented in this paper seismic reduction of bearing capacity is included in the Siddharthan approach; and the P- Δ effect, and corresponding magnification of displacements is also considered in the analysis. Initially, the model is applied to a simple problem to demonstrate the concepts and application. Finally, as a check on the validity of the analysis, retaining walls located in Kobe, Japan are investigated using an available time history of acceleration record from the Hyogoken- Nambu Earthquake as input. The results from the calculation are in good agreement with the observed behavior of the Kobe walls.

3. **Arvind, G., P. Ashok Kumar, S. Girish Karthi, and C. R. Suribabu. "Statistical Analysis of 30 Years Rainfall Data: A Case Study." In IOP Conference Series: Earth and Environmental Science, vol. 80, no. 1, p. 012067. IOP Publishing, 2017.**

This paper tells about rainfall is a prime input for various engineering design such as hydraulic structures, bridges and culverts, canals, storm water sewer and road drainage system. The detailed statistical analysis of each region is essential to estimate the relevant input value for design and analysis of engineering structures and also for crop planning. A rain gauge station located closely in Trichy district is selected for statistical analysis where agriculture is the prime occupation. The daily rainfall data for a period of 30 years is used to understand normal rainfall, deficit rainfall, Excess rainfall and Seasonal rainfall of the selected circle headquarters. Further various plotting position formulae available is used to evaluate return period of monthly, seasonally and annual rainfall. This analysis will provide useful information for water resources planner, farmers and urban

engineers to assess the availability of water and create the storage accordingly. The mean, standard deviation and coefficient of variation of monthly and annual rainfall was calculated to check the rainfall variability. From the calculated results, the rainfall pattern is found to be erratic. The best fit probability distribution was identified based on the minimum deviation between actual and estimated values. The scientific results and the analysis paved the way to determine the proper onset and withdrawal of monsoon results which were used for land preparation and sowing.

4. **Du, Dong-Ning, Lai-Gui Wang, Xiang-Dong Zhang, and Shu-Kun Zhang. "Study on sand particles creep model and open pit mine landslide mechanism caused by sand fatigue liquefaction." In IOP Conference Series: Earth and Environmental Science, vol. 69, no. 1, p. 012021. IOP Publishing, 2017.**

This paper informs about the sand particles in the sand - rock composite slope of the open pit mine occurs creep deformation and fatigue liquefaction under the action of vehicle load vibration and hydraulic gradient, which causes landslide geological disasters and it destroys the surface environment. To reveal the mechanism, a mechanics model based on the model considering the soil structural change with a new "plastic hinge" element is developed, to improve its constitutive and creep curve equations. Data from sand creep experiments are used to identify the parameters in the model and to validate the model. The results show that the mechanical model can describe the rotation progress between the sand particles, disclose the negative acceleration creep deformation stage during the third phase, and require fewer parameters while maintaining accuracy. It provides a new creep model considering rotation to analyze sand creep mechanism, which provides a theoretical basis for revealing the open pit mine landslide mechanism induced by creep deformation and fatigue liquefaction of sandy soil.

5. **Feranie, S., Adrin Tohari, and F. D. E. Latief. "Prediction of landslide run-out distance based on slope stability analysis and center of mass approach." In IOP Conference Series: Earth and Environmental Science, vol. 29, no. 1, p. 012003. IOP Publishing, 2016.**

Mitigation of landslide hazard requires the knowledge of landslide run-out distance. This paper presents the application of slope stability analysis and center of mass approach to predict the run-out distance of a rotational landslide model with different soil types. The Morgenstern-Price method was used to estimate the potential sliding zone and volume of landslide material. The center of mass approach used a simple Coulomb friction model to determine the run-out distance.

Results of the slope stability analysis showed that the soil unit weight can influence the depth of sliding zone, and the volume of unstable material. The slope model of silty sand and gravel would have the largest volume of unstable mass. From the Coulomb friction analysis, this slope model has higher run-out distance and velocity than other slope models. Thus, the run-out distance will be influenced by soil type and the dimension of unstable soil mass.

6. **Habil, H., E. Yuliza, M. M. Munir, and M. Irsyam.** "Instrumentation system design and laboratory scale simulation of landslide disaster mitigation." In *Journal of Physics: Conference Series*, vol. 739, no. 1, p. 012056. IOP Publishing, 2016.

Research on landslide has been developed recently because it may endanger human life. Landslide is the movement of rock, detritus, or soils caused by the action of gravity. Landslides are influenced by several factors such as ground slope, degree of rainfall, land cover (ground layers), and the vibration around the slopes. From these factors, tilt detection sensors and soil moisture sensor have been developed to detect landslide failure. These sensors mounted so that it can detect the occurrence of landslides. The study was conducted on a container which contains the sloping ground. Landslide, slope processes, and soil humidity were investigated in this container. MMA8451Q accelerometer was used as a tilt sensor to detect the acceleration assembled in MEMS (Micro Mechanical System) technology since it is easily available, massproduced, inexpensive, and high-precision output data. Landslide simulator has been developed hence the process leading to landslide event can be directly analyzed without the need of real life occurrence of landslides. The simulator was made from glass with size 80 cm × 20 cm × 40 cm that was filled by soil. Based on the simulation results, there were changes on accelerometer and soil moisture data during the landslide occurrence.

7. **Lin, Jiayuan, Meimei Wang, Jia Yang, and Qingxia Yang.** "Landslide Identification and Information Extraction Based on Optical and Multispectral UAV Remote Sensing Imagery." In *IOP Conference Series: Earth and Environmental Science*, vol. 57, no. 1, p. 012017. IOP Publishing, 2017.

This paper has to offer information about landslide, one of the most serious natural disasters which caused enormous economic losses and casualties in the world. Fast and accurate identification of newly occurred landslide and extraction of relevant information are the premise and foundation for landslide disaster assessment and relief. As the places where landslides occur are often inaccessible for field observation because of the temporary failure in transportation and

communication. Therefore, UAV remote sensing can be adopted to collect landslide information efficiently and quickly with the advantages of low cost, flexible launch and landing, safety, under-cloud-flying, and hyperspatial image resolution. Newly occurred landslides are usually accompanied with those phenomena such as vegetation burying and bedrock or bare soil exposure, which can be easily detected in optical or multispectral UAV images. By taking one typical landslide occurred in Wenchuan Earthquake stricken area in 2010 as an example, this paper demonstrates the process of integration of multispectral camera with UAV platform, NDVI generation with multispectral UAV images, three-dimensional terrain and orthophoto generation with optical UAV images, and identification and extraction of landslide information such as its location, impacted area, and earthwork volume.

8. **Matziaris, V., A. M. Marshall, C. M. Heron, and H. S. Yu.** "Centrifuge model study of thresholds for rainfall-induced landslides in sandy slopes." In *IOP Conference Series: Earth and Environmental Science*, vol. 26, no. 1, p. 012032. IOP Publishing, 2015.

This paper tells about rainfall-induced landslides, very common natural disasters which cause damage to properties and infrastructure and may result in the loss of human life. These phenomena often take place in unsaturated soil slopes and are triggered by the saturation of the soil profile due to rain infiltration which leads to the decrease of effective stresses and loss of shear strength. The aim of this study is to determine rainfall thresholds for the initiation of landslides under different initial conditions. Model tests of rainfall-induced landslides were conducted on the Nottingham Centre for Geomechanics geotechnical centrifuge. Initially unsaturated plane-strain slope models made with fine silica sand were prepared at varying densities at 1g and accommodated within a centrifuge container with rainfall simulator. During the centrifuge flight at 60g, rainfall events of varying intensity and duration, as well as variation of groundwater conditions, were applied to the slope models with the aim of initiating slope failure. This paper presents a discussion on the impact of soil state properties, rainfall characteristics, and groundwater conditions on slope behaviour and the initiation of slope instability.

9. **Qalbi, Harisa Bilhaqqi, Akhmad Faqih, and Rahmat Hidayat.** "Future rainfall variability in Indonesia under different ENSO and IOD composites based on decadal predictions of CMIP5 datasets." In *IOP Conference Series: Earth and Environmental Science*, vol. 54, no. 1, p. 012043. IOP Publishing, 2017.

This paper tells about climatic information companies like El Niño-Southern Oscillation (ENSO) and Indian

Ocean Dipole (IOD) are amongst important climate drivers that play a significant role in driving rainfall variability in Indonesia, especially on inter-annual timescales. The phenomena are suggested to have an association with interdecadal climate variability through the modulation of their oscillations. This study aims to analyse the characteristics of future rainfall variability in Indonesia during different condition of ENSO and IOD events based on decadal predictions of near-term climate change CMIP5 GCM data outputs up to year 2035. Monthly data of global rainfall data with 5x5 km grid resolutions of CHIRPS dataset is used in this study to represent historical rainfall variability as well to serve as a reference for future rainfall predictions. The current and future rainfall and sea surface temperature data have been bias corrected before performing the analysis. Given the comparison between rainfall composites during El-Nino and positive IOD events, the study showed that the future rainfall conditions in Indonesia will become drier than the historical condition resulted from the same composite approach. In general, this study showed the Indonesian rainfall variability in the future is expected to respond differently to a different combination of ENSO and IOD conditions.

10. Su, Lijun, Xingqian Xu, Hongjian Liao, and X. Y. Geng. "Shear wave velocity analysis of a deep seated gravel landslide structure using the microtremor survey method." In IOP Conference Series: Earth and Environmental Science, vol. 26, no. 1, p. 012026. IOP Publishing, 2015.

This paper tells about study of landslide failures. The depth and geometry of potential failure surface is the fundamental for evaluating the mechanisms of a landslide. Traditional techniques to acquire information on potential sliding surface are mainly drilling, pitting, and trenching, but these techniques are time consuming and expensive. In this study, microtremor signals and the dispersion curves of surface wave are extracted from the vertical component of microtremor records using the spatial autocorrelation (SPAC) method to estimate shear wave velocity structure. The results suggest that the buried depth of phyllite bedrock is approximately 47.4m, and the thickness of weathered bedrock layer is about 9.9m at about 57.3m deep, which could be interpreted as the potential sliding surface of this landslide, in accordance with borehole data. The microtremor survey method (MSM) is flexible, non-invasive, relatively quick and deployable on the landslide. It clearly demonstrates that it is an effective tool to improve the drilling success rate, and hence allow a large scale and high density investigation of structure characteristics of a deep seated landslide.

11. Sugiarti, K., and S. Sukristiyanti. "TRIGRS Application for landslide susceptibility mapping." In IOP Conference Series: Earth

and Environmental Science, vol. 118, no. 1, p. 012040. IOP Publishing, 2018.

This paper tells about essential data required for landslide evaluation. The Transient Rainfall Infiltration and Grid-Based Regional Slope-Stability Analysis (TRIGRS) is essential for landslide susceptibility mapping study. TRIGRS generates more satisfactory results than other landslide susceptibility analysis models, for example, SINMAP (Stability INDEX MAPPING) [1]. TRIGRS model is ideal for landslide hazard zoning for land-use planning on a regional scale [1,2]. It is suitable for landslide susceptibility mapping study in Indonesia. TRIGRS is capable of reproducing the frequency of the size of the patches of terrain predicted as unstable by the model [3]. TRIGRS used for the landslide ratio of each predicted FS class (hereafter LR class) is employed for evaluating the unstable slope basins under various rainfall conditions [3]. TRIGRS model is a powerful tool for decision makers on susceptibility mapping, especially if integrated with numerous advanced applications using Geographic Information System (GIS) spatial functions [4]. TRIGRS model is a Fortran program designed for modeling landslide susceptibility by combining an infinite slope stability calculation and an analytic, one-dimensional solution for pore-pressure diffusion in a soil layer of finite depth in response to time-varying rainfall [5]. The TRIGRS analysis has been successfully used by [2,4,6-14]. TRIGRS model was used to evaluate regional shallow landslide susceptibility in a GIS framework [7-10]. This paper aims to present a current state-of-the-art science on the development and application of TRIGRS. Some limitations of TRIGRS, some developments of it to improve its modeling capability, and some examples of the applications of some versions of it to model the effect of rainfall variation on landslide are reviewed and discussed.

12. Take, W. A., and R. A. Beddoe. "Physical modelling of rainfall-induced flow failures in loose granular soils." In IOP Conference Series: Earth and Environmental Science, vol. 26, no. 1, p. 012001. IOP Publishing, 2015.

This paper refers to a case study. The tragic consequences of the March 2014 Oso landslide in Washington, USA were particularly high due to the mobility of the landslide debris. Confusingly, a landslide occurred at that exact same location a number of years earlier, but simply slumped into the river at the toe of the slope. Why did these two events differ so drastically in their mobility? Considerable questions remain regarding the conditions required to generate flow failures in loose soils. Geotechnical centrifuge testing, in combination with high-speed cameras and advanced image analysis has now provided the landslides research community with a powerful new

tool to experimentally investigate the complex mechanics leading to high mobility landslides. This paper highlights recent advances in our understanding of the process of static liquefaction in loose granular soil slopes achieved through observations of highly-instrumented physical models. In particular, the paper summarises experimental results aimed to identify the point of initiation of the chain-reaction required to trigger liquefaction flow failures, to assess the effect of slope inclination on the likelihood of a flowslide being triggered, and to quantify the effect of antecedent groundwater levels on the distal reach of landslide debris with the objective of beginning to explain why neighbouring slopes can exhibit such a wide variation in landslide travel distance upon rainfall-triggering.

13. Tohari, Adrin. "Study of rainfall-induced landslide: a review." In IOP Conference Series: Earth and Environmental Science, vol. 118, no. 1, p. 012036. IOP Publishing, 2018.

This paper completely focuses upon rainfall-induced landslides, which pose a substantial risk to people and infrastructure. For this reason, there have been numerous studies to understand the landslide mechanism. Most of them were performed on the numerical analysis and laboratory experiment. This paper presents a review of existing research on field hydrological condition of soil slopes leading to the initiation of rainfall-induced landslide. Existing methods to study field hydrological response of slopes are first reviewed, emphasizing their limitations and suitability of application. The typical hydrological response profiles in the slope are then discussed. Subsequently, some significant findings on hydrological condition leading to rainfall-induced landslides are summarized and discussed. Finally, several research topics are recommended for future study.

14. Vasudevan, Nirmala, and Kaushik Ramanathan. "Geological factors contributing to landslides: case studies of a few landslides in different regions of India." In IOP Conference Series: Earth and Environmental Science, vol. 30, no. 1, p. 012011. IOP Publishing, 2016.

This paper tells about landslide and human life relationship. Research on landslide has been developed recently because it may endanger human life. Landslide is the movement of rock, detritus, or soils caused by the action of gravity. Landslides are influenced by several factors such as ground slope, degree of rainfall, land cover (ground layers), and the vibration around the slopes. From these factors, tilt detection sensors and soil moisture sensor have been developed to detect landslide failure. These sensors mounted so that it can detect the occurrence of landslides. The study was conducted on a container which contains the sloping ground. Landslide, slope

processes, and soil humidity were investigated in this container. MMA8451Q accelerometer was used as a tilt sensor to detect the acceleration assembled in MEMS (Micro Mechanical System) technology since it is easily available, massproduced, inexpensive, and high-precision output data. Landslide simulator has been developed hence the process leading to landslide event can be directly analyzed without the need of real life occurrence of landslides. The simulator was made from glass with size 80 cm × 20 cm × 40 cm that was filled by soil. Based on the simulation results, there were changes on accelerometer and soil moisture data during the landslide occurrence.

15. Yuliza, E., H. Habil, M. M. Munir, M. Irsyam, and M. Abdullah. "Study of soil moisture sensor for landslide early warning system: Experiment in laboratory scale." In Journal of Physics: Conference Series, vol. 739, no. 1, p. 012034. IOP Publishing, 2016.

This paper tells about the rainfall intensity and occurrence of landslide. The high rate of rainfall is the main trigger factor in many cases of landslides. However, each type of soils has unique characteristics and behavior concerning the rainfall infiltration. Therefore, early warning system of landslide will be more accurate by monitoring the changes of ground water condition. In this study, the monitoring of ground water changes was designed by using soil moisture sensor and simple microcontroller for data processing. The performance of soil moisture sensor was calibrated using the gravimetric method. To determine the soil characteristic and behavior with respect to water content that induce landslides, an experiment involving small-scale landslide model was conducted. From these experiments, the electric resistance of the soil increased as soil water content increases. The increase of soil water content led to the rise of the pore pressure and soil weight which could cause soil vulnerability to the movement. In addition, the various soil types were used to determine the responses of soils that induce the slope failure. Experimental results showed that each type of soils has different volumetric water content, soil matrix suction and shear strength of the slope. This condition influenced the slope stability that trigger of landslide.

16. Rientjes, T.H.M., 2004. Inverse modelling of the rainfall-runoff relation: a multi objective model calibration approach. PhD Thesis, Delft, 371 pp.

This paper tells about runoff, one of the major factor for occurrence of rainfall induced landslides. The term runoff can be applied to stream or river discharge. It can also be employed in reference to the gravitational movement of a fraction of rainfall over the surface of land or as subsurface flow from an area peripherally bound by a water divide, towards a water body. Runoff is expressed in terms of



volume per unit of time and its generation largely depends on the amount of rain water that reaches the earth's surface.

17. Ward, R.C. and Robinson, M., 1990. Principles of hydrology. McGraw-Hill, London, 365 pp.

This paper tells about the distribution of rainfall water at the initial stage. Rainfall that is not lost to interception and reaches the soil surface either infiltrates into the soil, is stored in surface depressions or evapo-transpires. The remaining excess rainwater travels over land as surface runoff. Surface runoff occurs either when the soil is saturated from above or from below. If the rate at which rain falls to the ground is higher than the rate at which it infiltrates into the soil and surface storage is full then, the excess water at the surface flows along its gravitational gradient as surface runoff. This is referred to as saturation from above or overland flow. On the other hand, if the soil is already saturated due to previous rainstorm events and the infiltration capacity of the soil is zero, saturation from below occurs. In this case, most of the rain that reaches the ground is converted to overland flow after satisfying surface storage and no or very little water infiltrates into the soil.

18. White, R.E., 1997. Principles and practice of soil science: the soil as a natural resources. Blackwell Science, Oxford, 348 pp.

This paper tells about importance of soil properties in occurrence of landslides. The most important soil properties that influence the rate of infiltration, as mentioned above, are the physical properties of the soil. The size of the particles that make up the soil, the extent of soil particle aggregation and the way in which the aggregates are arranged are properties of the soil that make it a porous permeable medium through which water can flow (Schwab et al., 1981). These properties vary extensively both spatially and temporally, and are a consequence of the geology and geomorphology of an area. They can also be influenced through catchment management practices.

Hydraulic conductivity of the soil refers to the soil's ability to conduct water down its profile. It largely determines the amount of water that can pass into the soil and therefore it is directly proportional to the infiltration rate (White, 1997). During a rain fall event, rainwater reaching the surface of the earth is drawn into the soil through pores by a suction gradient and a gravitational head gradient. If the soil at the start of a rainfall event is dry then, the suction head gradient becomes the strongest force pulling the water into the soil. As the soil fills up with water however, the suction head force decreases and the gravitational head gradient becomes the driving force conducting water down the soil profile. With continued saturation of the soil, the rate at which water moves into the soil approaches the saturated hydraulic conductivity. Under such conditions, if the rainfall intensity is greater than the rate at which the soil accepts water, ponding occurs at the surface. Further input

of rainwater causes the capacity of surface storage to be exceeded resulting in surface runoff.

19. Hillel, D., 1980. Fundamentals of Soil Physics. Academic Press, New York etc., 413 pp.

This paper focuses on specific soil properties responsible for landslides. Soil structure and texture influence the hydraulic conductivity of soils (Hillel, 1980). In general, soils with high clay content have lower saturated hydraulic conductivity values whereas coarse textured soils such as sandy soils have higher values because of the larger pore space between the soil particles. As such, the infiltration rate of clayey soils is much lower than that of sandy soils. The infiltration rate can range from approximately 5mm/h for clay soils to 200mm/h for sandy soils (Morgan, 1995). In terms of soil structure, the extent of the soil porosity and the arrangement of soil aggregates determine the hydraulic conductivity of soils. Porous soils with stable aggregates have higher saturated hydraulic conductivity values than soils that are compact and dense.

20. Green, C.H., Parker, D.J. and Tunstall, S.M., 2000. Assessment of Flood Control and Management Options, Thematic Review IV.4 prepared as an input to the World Commission on Dams, Cape Town.

This paper tells about the conversion of rainfall to runoff, there are a number of stages in the hydrologic cycle that rainwater goes through before runoff is generated in a catchment. These different stages result in different losses from the total rain, reducing the amount of water that will be available for overland flow. Through catchment management practices, man has had considerable influence over certain aspects of these stages. This has brought notable differences in the rate at which surface runoff is generated.

Soil compaction brought about as a result of changes in land use/cover practices in a catchment disrupts the natural arrangement of soil particles and their aggregates. This disruption causes soil particles to be more closely packed which reduces soil porosity, increases soil bulk density and destabilizes soil aggregates (Hillel, 1980; Schwab et al., 1981). This in turn causes a decline in the hydraulic conductivity of soils which directly influences the rate at which rain water infiltrates into the soil. In addition to hydraulic conductivity, other hydraulic properties of the soil including suction head and soil moisture deficit which are functions of soil porosity and closely related to infiltration characteristics of the soil can also be affected as a result of a disruption in soil structure.

21. Dunne, T. and Black, R.D., 1970. Partial Area Contributions to Storm Runoff in a Small New England Watershed. Water Resources Research, 6(5): 1296-1311.

This paper focuses upon Runoff, not in itself a form of land degradation but it is one of the major causes of land degradation problems, of which the main ones are erosion and flooding. Furthermore, the rate at which runoff is generated can be increased because of land degradation problems. Runoff on the one hand is an essential process in that it maintains water level in lakes and rivers preventing them from drying out and providing fresh water on which many living beings including humans largely depend. If however the rate of runoff is increased as a result of catchment management practices it can result in severe land degradation problems.

Areas having shallow and compact soils ensuing from a combination of poor farming techniques, exploitation of marginal lands, deforestation and excessive erosion are susceptible to higher rates of runoff. High runoff rate leads to an increase in soil erosion by running water. On the other hand, areas with deeper, more porous soil structures that are densely vegetated contribute to a reduction in the amount of water available for runoff which results in reduced rates of erosion (Schwab et al., 1981; White, 1997). Land use/ cover changes that increase runoff rates therefore ultimately influence the rate at which soil loss occurs. Soil loss brings about problems of soil degradation which in turn further aggravates problems of runoff.

III. METHODOLOGY

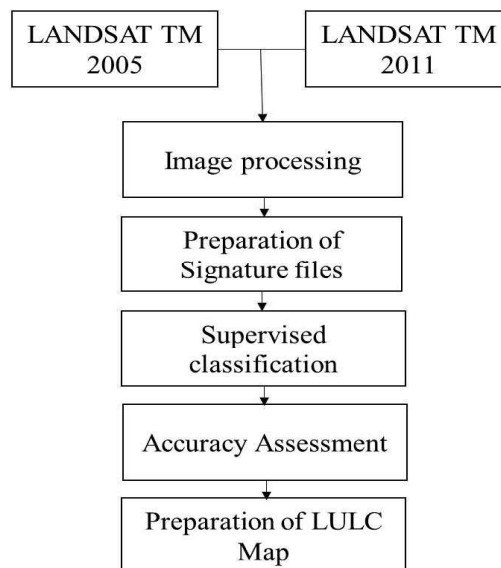
The proposed study will correlate the impact of changes in soil characteristics with respect to change in rainfall intensity in study area.

- To carry out the rigorous literature survey to define the methodology to carry out the project work. To select the satellite imagery, digital elevation models database and recent geoinformatics tools for achieving greater efficiency.
- List of the various software used in this study:
Geospatial analysis
ArcMap 10.5
ARC SWAT
Microsoft word and excel
- This study primarily focus on three objectives:
1. Preparation of Land use and land cover map

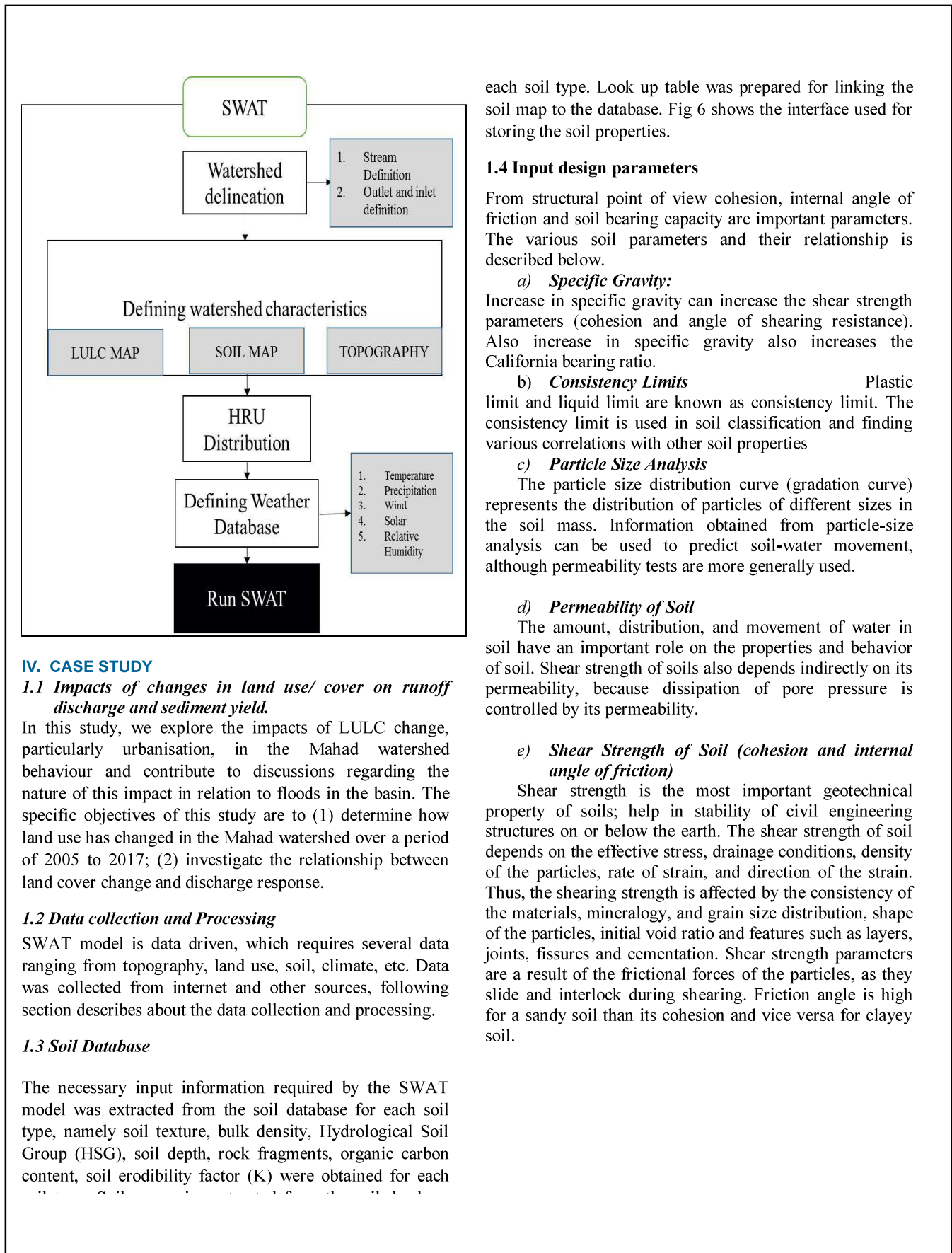
for Mahad watershed for years 2005 and 2017 respectively.

2. To quantify the rate of runoff and soil erosion in the study area between the period of 2005-2017.

3. To investigate the impacts of changes in land use/ cover runoff discharge by using SWAT.



- Run off and sediment yield estimation



each soil type. Look up table was prepared for linking the soil map to the database. Fig 6 shows the interface used for storing the soil properties.

1.4 Input design parameters

From structural point of view cohesion, internal angle of friction and soil bearing capacity are important parameters. The various soil parameters and their relationship is described below.

a) Specific Gravity:

Increase in specific gravity can increase the shear strength parameters (cohesion and angle of shearing resistance). Also increase in specific gravity also increases the California bearing ratio.

b) Consistency Limits

Plastic limit and liquid limit are known as consistency limit. The consistency limit is used in soil classification and finding various correlations with other soil properties

c) Particle Size Analysis

The particle size distribution curve (gradation curve) represents the distribution of particles of different sizes in the soil mass. Information obtained from particle-size analysis can be used to predict soil-water movement, although permeability tests are more generally used.

d) Permeability of Soil

The amount, distribution, and movement of water in soil have an important role on the properties and behavior of soil. Shear strength of soils also depends indirectly on its permeability, because dissipation of pore pressure is controlled by its permeability.

e) Shear Strength of Soil (cohesion and internal angle of friction)

Shear strength is the most important geotechnical property of soils; help in stability of civil engineering structures on or below the earth. The shear strength of soil depends on the effective stress, drainage conditions, density of the particles, rate of strain, and direction of the strain. Thus, the shearing strength is affected by the consistency of the materials, mineralogy, and grain size distribution, shape of the particles, initial void ratio and features such as layers, joints, fissures and cementation. Shear strength parameters are a result of the frictional forces of the particles, as they slide and interlock during shearing. Friction angle is high for a sandy soil than its cohesion and vice versa for clayey soil.

IV. CASE STUDY

1.1 Impacts of changes in land use/ cover on runoff discharge and sediment yield.

In this study, we explore the impacts of LULC change, particularly urbanisation, in the Mahad watershed behaviour and contribute to discussions regarding the nature of this impact in relation to floods in the basin. The specific objectives of this study are to (1) determine how land use has changed in the Mahad watershed over a period of 2005 to 2017; (2) investigate the relationship between land cover change and discharge response.

1.2 Data collection and Processing

SWAT model is data driven, which requires several data ranging from topography, land use, soil, climate, etc. Data was collected from internet and other sources, following section describes about the data collection and processing.

1.3 Soil Database

The necessary input information required by the SWAT model was extracted from the soil database for each soil type, namely soil texture, bulk density, Hydrological Soil Group (HSG), soil depth, rock fragments, organic carbon content, soil erodibility factor (K) were obtained for each

Sl. No	Name of Test	Unit	Test Results	Test Method
1	Light Compaction Procter Test			
	a) Maximum dry density (MDD)	g/cc	1.98	IS:2720:1983 (P-8) (RA 2015)
	b) Optimum Moisture Content (OMC)	%	15.05	
2	Lab CBR (Soaked) 96 Hrs		9.96	IS:2720:1987 (P-16) (RA 2011)
3	Natural Water Content	%	16.95	IS:2720:1973 (P-2) (RA 2015)
4	Natural Compaction By Core Cutter	%	96.50	IS:2720:1973 (P-29) (RA 2015)
5	Atterberg's limit's Liquid limit (LL)	%		Non Plastic - Sandy Soil IS:2720:1985 (P-5) (RA 2015)
6	Atterberg's limit's Plastic limit (PL)	%		Non Plastic - Sandy Soil IS:2720:1985 (P-5) (RA 2015)
7	Atterberg's limit's Plasticity Index (PI)	%		Non Plastic - Sandy Soil IS:2720:1985 (P-5) (RA 2015)
8	Specific Gravity		2.48	IS:2720:1985 (P-3) Sec-1 (RA 2016)
9	Free swell index	%	10	IS 2720:1977 (Part 40) (RA 2011)

soil related activity like landslide due to rainfall, land-use and land-cover phenomenon along with erosion of soil.

Due to help of various software combinations like ARC-GIS, ARC-Map, SWAT (Soil Water Assessment Tool) hydrological modeling is possible which gives satisfactory results which are beneficial for mankind.

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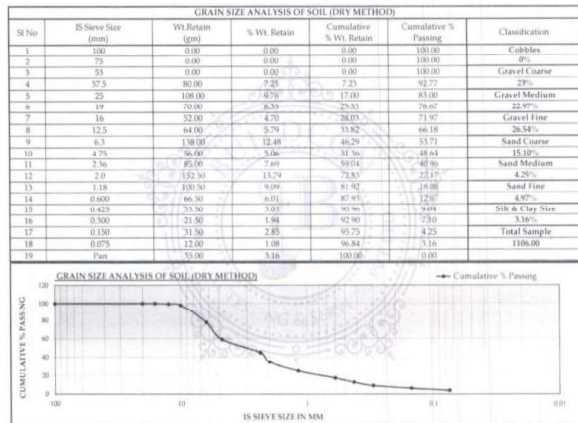


Table 1. Order, number and lengths of streams in different watersheds

Watershed No.	Stream characteristics	Stream Order				
		1st	2nd	3rd	4th	5th
WS 1	Total Stream Length (Km)	54.37	38.35	25.61	-	-
	Cum. Stream Length (Km)	54.37	92.72	118.33	-	-
	Total Number of Streams	21	7	1	-	-
	Mean Stream Length (Km)	2.59	5.47	25.61	-	-
WS 2	Total Stream Length (Km)	122.07	60.07	33.85	28.50	22.36
	Cum. Stream Length (Km)	122.07	182.14	215.99	244.49	266.85
	Total Number of Streams	49	9	3	2	1
	Mean Stream Length (Km)	2.49	6.67	11.28	14.25	22.36
WS 3	Total Stream Length (Km)	131.64	41.77	37.88	47.93	23.90
	Cum. Stream Length (Km)	131.64	173.41	211.29	259.22	283.12
	Total Number of Streams	59	10	4	2	1
	Mean Stream Length (Km)	2.23	4.177	9.47	23.96	23.90
WS 4	Total Stream Length (Km)	34.99	23.94	11.70	22.73	-
	Cum. Stream Length (Km)	34.99	58.93	70.63	93.36	-
	Total Number of Streams	19	6	2	1	-
	Mean Stream Length (Km)	1.84	3.99	5.85	22.73	-
WS 5	Total Stream Length (Km)	173.15	97.01	45.00	32.92	38.06
	Cum. Stream Length (Km)	173.15	270.16	315.16	348.08	386.14
	Total Number of Streams	65	17	4	2	1
	Mean Stream Length (Km)	2.66	5.70	11.25	16.46	38.06
WS 6	Total Stream Length (Km)	72.83	17.89	27.81	16.26	-
	Cum. Stream Length (Km)	72.83	90.72	118.53	134.79	-
	Total Number of Streams	26	4	2	1	-
	Mean Stream Length (Km)	2.8	4.47	13.90	16.26	-
WS 7	Total Stream Length (Km)	243.87	140.40	72.70	41.87	100.61
	Cum. Stream Length (Km)	243.87	384.27	456.97	498.84	599.45
	Total Number of Streams	101	28	10	3	1
	Mean Stream Length (Km)	2.41	5.01	7.27	13.95	100.61
WS 8	Total Stream Length (Km)	53.32	31.71	32.33	9.40	-
	Cum. Stream Length (Km)	53.32	85.03	117.36	126.76	-
	Total Number of Streams	25	7	4	2	-
	Mean Stream Length (Km)	2.13	4.53	8.08	4.70	-

VI. CONCLUSION

Landslide and especially large catastrophic landslide causes significant change in natural state and economy of the affected region. The use of multi-sourced soil data obtained from laboratory tests used in the GIS Tool for hydrological modeling under the SWAT (Soil Water Assessment Tool) model which had made it possible to study the evolution of



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Interlocking Brick (May 2019)

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ABSTRACT There is a need to identify innovative technologies to supplement age-old concrete and burnt clay brick mortar based construction for masonry work. Today we need technologies which are sustainable in terms of one or more of the following parameters i.e. use of locally available resources – material & manpower, cost effectiveness, eco-friendly, easy to adopt in construction practice, can be cast – in situ to reduce transportation, faster to build and energy efficient. The paper addresses the technical specifications, raw material options, construction procedure, structural performance energy and conformity with the building standards. The use of interlocking bricks masonry has gained rapid popularity in many foreign countries as an alternative to conventional bricks for sustainable housing. It is being always challenge for researchers to make interlocking brick light weight, low cost and improve the performance against aggressive environment. An experimental effort made in this concern. This paper gives the results of an experimental investigation in which the compressive strength, water absorption and density were investigated by using varying percentage of fly ash, stone dust, and sand with different mix proportion. The interlocking bricks will prove to be economical from manufacturing point of view, may eliminate plaster and prove to be user friendly and eco-friendly as waste materials like fly ash will be used.

INDEX TERMS interlocking, flyash, eliminate plastering, ecofriendly.

1. INTRODUCTION

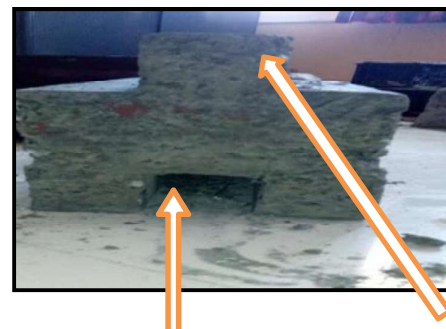
A very high amount of waste is being produced all around the world. The most common method of managing waste is through its disposal in landfills creating in that way huge deposits of waste. In this situation, waste recycling is gaining increasing importance [1]. At present in India, about 206 coals based thermal power plants are producing about 160 million tons of fly ash every year, the current annual production of fly ash worldwide is estimated around 600 million tonnes. The dry stacked interlocking block masonry replaces the conventional brick and mortar construction masonry by interlocking blocks masonry construction. The other components of the conventional building system remain largely unchanged. The system is a dry stacked Interlocking masonry but can be done with mortar/slurry/grout also that enables aesthetic and affordable building, speedier construction of high quality in stretcher bond, and as well as in the normal English/Flemish bond with mortar. The blocks have an extremely appealing face brick/wash finish and provide a pre-pointed straight masonry. The walls may be left exposed, plastered/rendered or finished with cement wash.

Mortarless technology is directly associated with interlocking bricks: so the two terms will be used interchangeably.

2. METHODOLOGY:

1. Design of the Brick:

Initially the size of the brick was decided and then accordingly the shape was finalized. The main focus was on the design of the interlocking male and the female parts so that the bricks can be locked with each other with less use of mortar.



Female part

Male part

2. Making of the mould:

A mould was made in plywood and a no. of bricks were casted from the mould.

Size of the brick= 18” x 8” x 8”

3. Material:

1. Flyash:

The main material to be used in production of the brick will be flyash. Flyash being a waste product it is easily and cheaply available, hence results in lightweight, economical brick.

Material	Chemical Constituents	Percentage
Fly ash	Silica (as SiO ₂)	64.23 %
	Alumina (as Al ₂ O ₃)	25.82 %
	Iron (as Fe ₂ O ₃)	4.06 %
	Sodium (as Na ₂ O)	0.40 %
	Sulphur Trioxide (as SO ₃)	0.27 %
	Magnesium Oxide (as MgO)	0.78 %
	Loss of ignition (as I.OI)	0.39 %

2. Cement:

Cement to be used along with flyash to increase the bonding and to provide enough strength to the block.

3. Sand/Crush Sand/River Sand:

Sand i.e., fine aggregate obtained locally from nearest river is used or we can also use crush sand instead.

4. Water:

Water used for mixing the soil should be free from dissolved contaminants, suspended particles. Ordinary tap water was used for both mixing the constituents of the bricks as well as for the curing of bricks.

3. DESIGN TRIALS FOR BRICK



Fig 2. Model of brick made using soap



Fig 3. Locking of bricks with one another



Fig 4. Locking of bricks with one another

4. VARIOUS DESIGN MIXES :

A number of design mixes were made and cubes of 150 mm x 150 mm x 150 mm were casted and its compressive strength was checked, of which some are shown in the table:

Sr No	Cement	Sand	Flyash	Compressive Strength	Weight (kg)
1.	1 (20%)	1(20%)	3(60%)	3.7 MPA (3 Days)	7.300
2.	1 (30%)	0.67 (20%)	1.67 (50%)	3.81MPA (3 Days)	8.210
3.	1 (10%)	1(10%)	8(80%)	Failed	6.720
4.	1 (15%)	0.67 (10%)	5(75%)	Failed	6.830
5.	1 (25%)	1(25%)	2(50%)	7.3 MPA (7 Days)	8.120

Table 1.

5. FUTURE SCOPE

1. Reduction in wastage of mortar.
2. Economy in construction.
3. Lightweight construction.
4. Eco-friendly bricks.
5. User friendly bricks.



construction.

7. High finish blocks are made; result in exposed finish aesthetic walls, saving on plaster/rendering & finishes.

6. CONCLUSION

1. Interlocking bricks are economical as flyash(waste) is used.
2. They will help eliminate plaster due to their high quality finish.
3. They will help reduce the wastage of mortar.
4. They will be user friendly.
5. They are lightweight and cover area as much as covered by 5 conventional clay bricks(19cm x 9cm x 9cm)

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Slope Stability Analysis Against Earth Retaining Structures: Case Study (May 2019)

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ABSTRACT In this paper the comparative study of input design parameter in pre and post construction condition of earth retaining structure is studied. RCC retaining structures are constructed for total lifespan of 30-60 years but generally it cannot withstand for its total life. A parametric study is conducted to assess the durability of cantilever earth retaining wall at Dasgaon from Mahad Tehsil, Maharashtra. To find out current actual input design parameters, various geotechnical laboratory tests were conducted on the soil sample collected from backfill such as particle size distribution, natural moisture content, atterbergs limit, coefficient of permeability, maximum dry density and optimum moisture content, cohesion and internal angle of friction by direct shear test, and results were calculated. The results of these tests are used to find out the factor of safety considered for structural safety while designing cantilever retaining structure and the effect of changed input design parameters on factor of safety is compared and conclusion about durability is noted.

I. INTRODUCTION

Retaining walls are relatively rigid walls used for supporting the soil mass laterally so that the soil can be retained at different levels on the two sides. Retaining walls are structures designed to restrain soil to a slope that it would not naturally keep to typically a steep, near-vertical or vertical slope. They are used to bound soils between two different elevations often in areas of terrain possessing undesirable slopes or in areas where the landscape needs to be shaped severely and engineered for more specific purposes like hillside farming or roadway overpasses. Earth retaining structures (ERS) are used to hold back earth and maintain a difference in the elevation of the ground surface. The ERS is designed to withstand the forces exerted by the retained ground or "backfill" and other externally applied loads, and to transmit these forces safely to a foundation and/or to a portion of the restraining elements, if any, located beyond the failure surface.

Drainage is one of most important parameter used in construction of earth retaining structures. Earth retaining structures such as [retaining walls](#) also need to consider [groundwater](#) drainage. Typical retaining walls are constructed of impermeable material which can block the path of groundwater. When groundwater flow is obstructed, hydrostatic [water pressure](#) buildups against the wall and may cause significant damage. If the water pressure is not drained appropriately, retaining walls can bow, move, fracture and seams separate. The water pressure can also erode soil particles leading to voids behind the wall

and [sinkholes](#) in the above soil. Traditional retaining wall drainage systems can include, [French Drains](#), drain pipes or weep holes. To prevent soil erosion, Geotextile filter fabrics are installed with the drainage system. Disturbance in surface and subsurface drainage affects serviceability of earth retaining structures (ERS).

II. LITERATURE REVIEW

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In this paper author presents the experimental results of a comparative study carried out on the Bristol shaking table. The behaviour under seismic loads of two similar models of retaining walls has been investigated. One of them modelled a reinforced soil wall, while the other was a confined wall. The test programme used three types of inputs: sinedwell, Calitri and EC8. Since testing objectives were the settlements, horizontal displacements and induced accelerations at five different levels appropriate recording devices were provided. A total of 50 quakes with gradually increasing intensities were performed: 26 for the gravity model and 24 for the confined one. The tilting phenomenon experienced by prototype retaining walls in the Kobe earthquake also occurred in the shaking table tests. However, the two models behaved essentially differently. While the induced accelerations were much amplified by



the gravity model, the confined model showed a strong attenuation. Both conceptual design and further research of practical interest for developing advanced numerical models are supported by the results.

- 2) **Richards, R. "Tilting failure of retaining walls including p-delta effect and application to Kobe walls." In Proc. 12th World Conf. on Earthquake Engrg. 2000.**

The purpose of the research described in this paper is to generalize the Richards and Elms (1979) procedure for prediction of seismically induced permanent displacement of retaining walls for the case of mixed sliding and rotation modes. A simplified mathematical model and modified computational method based on the work of Siddharthan et al (1992) is presented. In the model presented in this paper seismic reduction of bearing capacity is included in the Siddharthan approach; and the P- Δ effect, and corresponding magnification of displacements is also considered in the analysis. Initially, the model is applied to a simple problem to demonstrate the concepts and application. Finally, as a check on the validity of the analysis, retaining walls located in Kobe, Japan are investigated using an available time history of acceleration record from the Hyogoken- Nambu Earthquake as input. The results from the calculation are in good agreement with the observed behavior of the Kobe walls.

- 3) **Yang, Su, Amin Chegnizadeh, and Hamid Nikraz. "Review of Studies on Retaining Wall's Behavior on Dynamic/Seismic Condition." Journal of Engineering Research and Applications, ISSN (2013): 2248-9622.**

Current theories, experimental investigations and numerical findings for retaining walls subject to dynamic excitations are reviewed. Brief features of each method, and experimental and numerical methods are introduced and compared. Tables are listed after each section for a clear and brief view of methods in a categorized manner. Conclusive comments plus current concerns and future expectations of this area are made at last. This review aims at shedding light on the development and concepts of different researches in dynamic retaining wall design and analysis.

- 4) **Manchanda, M. L., M. Kudrat, and A. K. Tiwari. "Soil survey and mapping using remote sensing." Tropical ecology 43, no. 1 (2002): 61-74.**

Soil survey constitutes a valuable resource inventory linked with the survival of life on the earth. The technological advancements in the field of remote sensing and Geographical Information System have been a boon for such surveys. Present paper describes the role of remote sensing and Geographical Information System (GIS) technologies for mapping and characterizing soils at various scales. The spectral behaviour of soil and its components,

which is fundamental to deriving information from remote sensing data, is also discussed with illustrations. Furthermore, the scope of present day remote sensing data for varying levels information generation is also reviewed.

- 5) **Thine, Christian, K. Shepherd, M. Walsh, M. Coe, and G. Okwach. "Application of GIS and remote sensing in characterization of soil hydraulic properties for soil physical quality assessment." Project report (2004).**

Populations in sub-Saharan Africa depend heavily on natural resources but land degradation is posing a serious threat to future public welfare. In tropical watersheds, particularly the semi-arid and arid areas within Eastern Kenya, it is believed that soils are undergoing rapid degradation (Okwach, 2002) both chemically (e.g. nutrient depletion) and physically (e.g. soil infiltration and erosion). Progress in addressing these problems is impaired by a lack of methodology for reliable and repeatable measurement of soil degradation over large areas. However, recent advances in technology for GIS and remote sensing at different scales provide new opportunities for large area rapid assessment.

III. METHODOLOGY

The proposed study will correlate the impact of changes in drainage pattern on ERS by using geo-informatics tools and hydro processing models.

- To carry out the rigorous literature survey to define the methodology to carry out the project work. □ To select the satellite imagery, digital elevation models database and recent geoinformatics tools for achieving greater efficiency.
- Comparing the results obtained from the RS and GIS techniques against laboratory test for ground truth study.
- To carryout various geo-technical tests to suggest the input database for structural design of ERS.
- To run the hydrological models to achieve the variables that affect the design of earth retaining structures.
- To formulate mathematical equation amongst proposed changes in drainages and its impact on reduction of serviceability of ERS.
- To derive the effects of various conditions on the structure and the decrease in the life of the structure and predicting its failure.

IV. CASE STUDY

1.1 Background & History

The present Raigarh district owes its name from the historical fort of Raigarh built by Shri Chhatrapati Shivaji Maharaj and is the erstwhile Kolaba district of Maharashtra state. The reorganization of state in 1956, the Kolaba

district was incorporated in Bombay state. Since 1960, it forms a part of Maharashtra state. Kolaba district has been renamed as Raigarh district from 1st January 1981. Raigarh district forms a part of Konkan coastal plain and has a north-south coastline of Arabian Sea about 240 km. The district has natural scenic beauty and historical background with forts and ports constructed by Shri Chhatrapati Shivaji Maharaj.

1.2 Location

Raigarh district is situated in Konkan region of Maharashtra state covering an area of 7148 sq km which is about 2.27 per cent of the total area of the state. (Fig. 2.1) It lies between 17o51’ and 19o 80’ N latitude and 72o 51’ and 73o 40’ E longitude with an altitude of 10 to 50 metres above mean sea level (MSL). Raigarh district covers 240 km out of 720 km coastal length of Arabian Sea.

1.3 Materials and Procedures

The soil sample for the purpose of this research was collected from Dasgaon Village in Mahad Tehsil. The soil sample A shows the result of soil at foundation and soil sample B shows the result of soil at backfill material. In design, the important input design parameters are specific gravity, plastic limit, liquid limit, plasticity index, particle size distribution, coefficient of permeability, cohesion, internal angle of friction and soil bearing capacity. This all parameters are depending on natural condition. The local parameters for Dasgaon cantilever retaining wall are calculated by laboratory test. For sample A 1.5 Kg sample and for sample B 1 kg sample is used for particle distribution of soil by sieve analysis test. The particle size distribution of soil and backfill are shown in table 1.

1.4 Input design parameters

From structural point of view cohesion, internal angle of friction and soil bearing capacity are important parameters. The various soil parameters and their relationship is described below.

a) Specific Gravity:

Increase in specific gravity can increase the shear strength parameters (cohesion and angle of shearing resistance). Also increase in specific gravity also increases the California bearing ratio.

b) Consistency Limits

Plastic limit and liquid limit are known as consistency limit. The consistency limit is used in soil classification and finding various correlations with other soil properties

c) Particle Size Analysis

The particle size distribution curve (gradation curve) represents the distribution of particles of different sizes in the soil mass. Information obtained from particle-size analysis can be used to predict soil-water movement, although permeability tests are more generally used.

d) Permeability of Soil

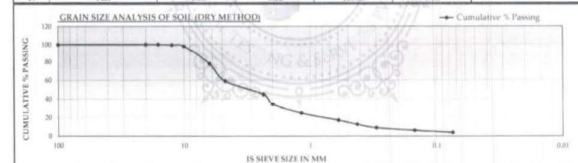
The amount, distribution, and movement of water in soil have an important role on the properties and behavior of soil. Shear strength of soils also depends indirectly on its permeability, because dissipation of pore pressure is controlled by its permeability.

e) Shear Strength of Soil (cohesion and internal angle of friction)

Shear strength is the most important geotechnical property of soils; help in stability of civil engineering structures on or below the earth. The shear strength of soil depends on the effective stress, drainage conditions, density of the particles, rate of strain, and direction of the strain. Thus, the shearing strength is affected by the consistency of the materials, mineralogy, and grain size distribution, shape of the particles, initial void ratio and features such as layers, joints, fissures and cementation. Shear strength parameters are a result of the frictional forces of the particles, as they slide and interlock during shearing. Friction angle is high for a sandy soil than its cohesion and vice versa for clayey soil.

SL.No	Name of Test	Unit	Test Results	Test Method
1	Light Compaction Procter Test			
	a) Maximum dry density (MDD)	g/cc	1.98	IS:2720:1983 (P-8) (RA 2015)
	b) Optimum Moisture Content (OMC)	%	15.05	
2	Lab CBR (Soaked) 96 Hrs		9.96	IS:2720:1987 (P-16) (RA 2011)
3	Natural Water Content	%	16.95	IS:2720:1973 (P-2) (RA 2013)
4	Natural Compaction By Core Cutter	%	96.50	IS:2720:1973 (P-29) (RA 2013)
5	Atterberg's limit's Liquid limit (LL)	%	Non Plastic - Sandy Soil	IS:2720:1985 (P-5) (RA 2013)
6	Atterberg's limit's Plastic limit (PL)	%	Non Plastic - Sandy Soil	IS:2720:1985 (P-5) (RA 2013)
7	Atterberg's limit's Plasticity Index (PI)	%	Non Plastic - Sandy Soil	IS:2720:1985 (P-5) (RA 2013)
8	Specific Gravity		2.48	IS:2720:1985 (P-3) Sec-1 (RA 2016)
9	Free swell index	%	10	IS 2720:1977 (Part 40) (RA 2011)

Sl No	IS Sieve Size (mm)	Wt Retain (gm)	% Wt. Retain	Cumulative % Wt. Retain	Cumulative % Passing	Classification
1	100	0.00	0.00	0.00	100.00	Cobbles
2	75	0.00	0.00	0.00	100.00	2%
3	55	0.00	0.00	0.00	100.00	Gravel Course
4	37.5	80.00	2.25	2.25	97.75	2%
5	25	108.00	3.00	5.25	94.75	Gravel Medium
6	19	70.00	2.00	7.25	92.75	2%
7	16	52.00	1.50	8.75	91.25	Gravel Fine
8	12.5	64.00	1.80	10.55	89.45	26.54%
9	6.3	130.00	3.75	14.30	85.70	Sand Coarse
10	4.75	96.00	2.75	17.05	82.95	15.18%
11	2.5	85.00	2.40	19.45	80.55	Sand Medium
12	2.0	152.00	4.35	23.80	76.20	4.25%
13	1.18	100.50	2.85	26.65	73.35	Sand Fine
14	0.600	66.50	1.90	28.55	71.45	4.97%
15	0.425	33.50	0.95	29.50	70.50	Sub & Clay Size
16	0.300	21.50	0.60	30.10	69.90	1.26%
17	0.150	31.50	0.90	31.00	68.90	Total Sample
18	0.075	12.00	0.35	31.35	68.65	1106.00
19	Pass	53.00	1.50	32.85	67.15	



1.5 Drainage Morphology

The streams of the area display a sub-dendritic pattern characterised by sharp, nearly right-angled bends. They are short and flow westwards over a humid tropical landscape of 280 to 100 meters ASL, along narrow to broad V-shaped valleys. Rivers in the region originate from Sahyadri range and attain their base level of erosion within a distance m 20

km. They have their knick points along the base of the scarps and have east to west course in general. Ulha~ Patalganga, Amba, Kundalika, Kal and Savitri are some of the major rivers. The river systems are young and owing to heavy rainfall, they exhibit headward erosion capability, resulting in river piracy at places. In the lower reaches, many of them are tidal in nature (Das, 1999). The district is spread over 15 watersheds viz. WS 1, WS2, WS3, WS4, WS5, WS6, WS7, WS8, WS9, WS10, WS11, WS12, WS13, WS14 and WS15. Out of this, WS1, WS12 and WS13 fall only partially in the district.

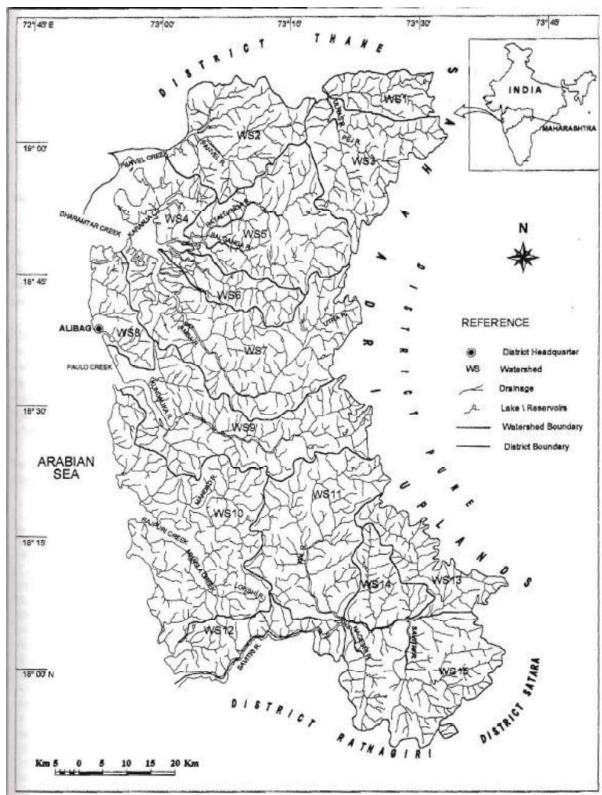


Fig.1. Drainage map of the study area showing watershed boundaries.

Table 1. Order, number and lengths of streams in different watersheds

Watershed No.	Stream characteristics	Stream Order				
		1st	2nd	3rd	4th	5th
WS 1	Total Stream Length (Km)	54.37	38.35	25.61	-	-
	Cum. Stream Length (Km)	54.37	92.72	118.33	-	-
	Total Number of Streams	21	7	1	-	-
	Mean Stream Length (Km)	2.59	5.47	25.61	-	-
WS 2	Total Stream Length (Km)	122.07	60.07	33.85	28.50	22.36
	Cum. Stream Length (Km)	122.07	182.14	215.99	244.49	266.85
	Total Number of Streams	49	9	3	2	1
	Mean Stream Length (Km)	2.49	6.67	11.28	14.25	22.36
WS 3	Total Stream Length (Km)	131.64	41.77	37.88	47.93	23.90
	Cum. Stream Length (Km)	131.64	173.41	211.29	259.22	283.12
	Total Number of Streams	59	10	4	2	1
	Mean Stream Length (Km)	2.23	4.177	9.47	23.96	23.90
WS 4	Total Stream Length (Km)	34.99	23.94	11.70	22.73	-
	Cum. Stream Length (Km)	34.99	58.93	70.63	93.36	-
	Total Number of Streams	19	6	2	1	-
	Mean Stream Length (Km)	1.84	3.99	5.85	22.73	-
WS 5	Total Stream Length (Km)	173.15	97.01	45.00	32.92	38.06
	Cum. Stream Length (Km)	173.15	270.16	315.16	348.08	386.14
	Total Number of Streams	65	17	4	2	1
	Mean Stream Length (Km)	2.66	5.70	11.25	16.46	38.06
WS 6	Total Stream Length (Km)	72.83	17.89	27.81	16.26	-
	Cum. Stream Length (Km)	72.83	90.72	118.53	134.79	-
	Total Number of Streams	26	4	2	1	-
	Mean Stream Length (Km)	2.8	4.47	13.90	16.26	-
WS 7	Total Stream Length (Km)	243.87	140.40	72.70	41.87	100.61
	Cum. Stream Length (Km)	243.87	384.27	456.97	498.84	599.45
	Total Number of Streams	101	28	10	3	1
	Mean Stream Length (Km)	2.41	5.01	7.27	13.95	100.61
WS 8	Total Stream Length (Km)	53.32	31.71	32.33	9.40	-
	Cum. Stream Length (Km)	53.32	85.03	117.36	126.76	-
	Total Number of Streams	25	7	4	2	-
	Mean Stream Length (Km)	2.13	4.53	8.08	4.70	-

1.6 Ground Water Resources

Central Ground Water Board and Ground Water Survey and Development Agency (GSDA) have jointly estimated the ground water resources of Raigarh district based on GEC-97 methodology. The same is presented in Table-4. Ground water assessment is done for an area of 3747 sq. km of which 152.94 sq. km area is under command and 3594.65 sq. km area is under non-command. As per the estimation the total annual ground water recharge is 591.65 MCM with the natural discharge of 29.87 MCM, thus the net annual ground water availability comes to be 561.77 MCM. The gross draft for all uses is estimated of 67.48 MCM with irrigation sector being the major consumer having a draft of 46.53 MCM, whereas the domestic and industrial draft is to the tune of 20.94 MCM. The net ground water availability for future irrigation is estimated to be 473.35 MCM, whereas the allocation for domestic and industrial supply up to next 25 years is 41.88 MCM. Stage of ground water development varies from 6.22% (Karajat) to 32.97% (Alibaga). The overall stage of ground water development for the district is 12%. All the talukas and watersheds of the district fall in "Safe" category.

Taluka	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses	Provision for domestic and industrial requirement supply to 2025	Net Ground Water Availability for future irrigation development	Stage of Ground Water Development (%)	Categorisation (in ham)
Alibaga	3189.75	617.87	433.83	1051.50	867.66	1704.43	32.97	Safe
Karajat	6614.76	265.77	146.75	412.50	291.66	6057.17	6.22	Safe
Khalapur	4779.45	248.15	159.78	407.93	319.58	4211.83	8.54	Safe
Mahad	4410.13	300.09	155.80	455.89	311.58	3798.41	10.34	Safe
Margason	8106.59	236.62	178.24	414.86	352.58	7519.03	5.12	Safe
Uthasda	1934.73	417.31	66.58	483.89	133.71	1785.06	29.01	Safe
Murud	2016.57	226.85	45.61	272.45	91.80	1699.35	13.51	Safe
Parant	5098.74	824.84	359.42	1184.26	718.83	3555.03	23.23	Safe
Pan	3266.22	169.77	98.56	268.33	197.13	2899.36	8.22	Safe
Potapur	1922.00	60.56	81.68	148.24	163.37	1692.07	7.71	Safe
Roha	6376.60	358.95	128.84	487.78	257.88	5760.29	7.65	Safe
Shrawadhan	1415.04	375.34	56.54	431.87	113.09	926.64	30.52	Safe
Sushagad	3745.26	185.87	99.20	285.07	198.30	3300.95	7.81	Safe
Jala	1329.49	163.14	34.67	217.81	71.90	1160.51	16.38	Safe
Uran	1972.62	177.04	40.61	226.65	90.21	1695.75	11.40	Safe
Total	56177.28	4653.96	2094.08	6748.05	4188.16	47335.15	12.0	Safe



VI. CONCLUSION

Comparing the results of retaining wall design obtained by two sets of input design parameter shows the changes observed in current design parameters due to impact of rainfall intensity, overall climatic conditions and manmade activities like nearby construction. This proves that due to change in the considered input design parameters at current condition the serviceability of cantilever earth retaining structure is about to decrease against pre decided lifespan of 60 years. This triggers the need to study the input design parameters periodically so as to one can able to manage these parameters in safe range to achieve and enjoy the service for design lifespan of 30-60 years.

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Automated Drip Irrigation System Using Soil Moisture Sensors

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Abstract- Use of soil moisture sensors to optimize the drip irrigation system and increase the efficiency of conventional drip irrigation system. The wastage of even little amount of water is also not there and it can be useful in reducing the wastage of water.

Indexed Terms- drip irrigation, soil moisture sensors

I. INTRODUCTION

- 1) As the current drip irrigation system is the advanced and most modern technique of irrigation in INDIA, so it is used mostly in irrigation of almost all the crops. Sometimes, in this system also there are some difficulties and the most seen difficulty is not giving the exact amount of water to the crops and it gets extra and there is loss of some amount of water.
- 2) To solve this problem soil moisture sensors are introduced in the drip irrigation system.
- 3) They detect moisture easily and a programmed system beside the drip irrigation makes it possible to reduce the wastage of water.

II. RESEARCH METHODOLOGY

Various fields were visited to enquire about the drip irrigation system and all setup with the problems associated with it.

The problems associated with the conventional drip irrigation system were studied in detail and solutions were made out from them.

Soil moisture sensors were introduced to reduce the water wastage problem so that the efficiency of the system can be increased.

III. ANALYSIS

Various parameters of soil were studied and the moisture parameter is being studied for resolving the problem.

Different plants' duty, delta and base period and moisture were also studied and it was found that most of the plants average range of moisture goes between 20%-60%.

Exception comes for some crops which sometimes need excessive water and some plants need less than the average initial value i.e., <20%



Fig 3(a) - conventional drip irrigation system



Fig 3(b) - drip irrigation piping system

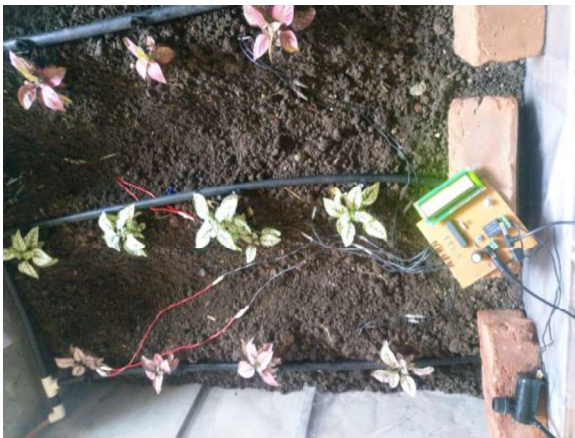
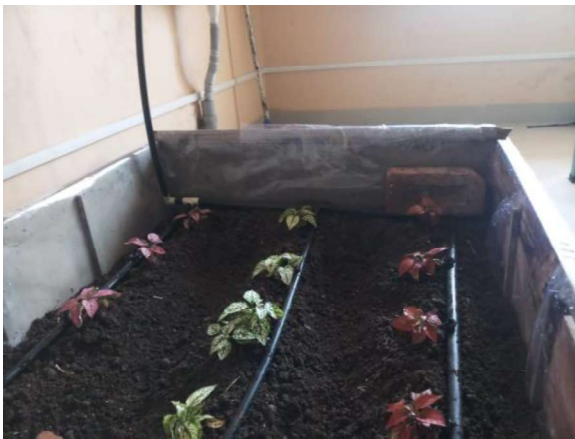


Fig 3(c) - automated drip irrigation system.

IV. CONCLUSION

From analysis and results we can conclude that the moisture parameter can be taken to resolve the water wastage problem in the fields in which the drip irrigation system is installed within a range of 20%-

50%. The higher limit is 50% and the lower limit is 20%

ACKNOWLEDGMENT

It gives us an immense pleasure in submitting our research paper on "Determination of loss in strength of steel due to stacking on construction site". We take this opportunity to show panegyrics and thanks to our guide Prof. A. B. Kudoli and Coordinator Prof. Nidhi Khare whose suggestions help us a lot throughout the duration of our efforts on research.

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Analysis of Compressive Strength of Hardened Concrete: Replacing Natural Sand by Steel Slag

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ABSTRACT

The natural resources are getting depleted day by day. The need to preserve natural resources has become necessary. This problem can be overcome by finding an alternative for natural aggregates. The huge amount of waste generated during steel production and its disposal is a serious environmental issue. The steel manufacturing industries in India produce 12MT/year by-product called steel slag. When this steel slag is directly dumped to ground it causes acquisition of huge land and also degrades the soil quality. In this research work, steel slag is used as a replacement for fine aggregates in concrete. Hence solving the problem of depletion of natural aggregates and dumping of steel slag, also reducing the cost of concrete up to some extent. The use of steel slag in concrete has enhanced the compressive strength of concrete.

Keywords :— Aggregates, Compressive Strength, Concrete, Natural Sand, Steel Slag

I. INTRODUCTION

In construction material, concrete plays an important role. Concrete is prepared by mixing various materials like cement, aggregates, water etc. which are locally available. Availability of natural aggregates is getting depleted and also is becoming costly. To meet the scarcity, it is necessary to find a suitable alternative to natural aggregates for preparing concrete. Therefore replacement is becoming necessary, and in this research work an attempt has been made to replace natural aggregates by steel slag. As compared to other countries utilization of steel slag is very less in India.

Steel slag is a by-product which is obtained from the steel industry. It is generated as a residue during the production of steel. It is obtained either from the conversion of iron to steel in the Basic Oxygen Furnace (BOF), or by the melting of scrap to make steel in the Electric Arc Furnace. Slag consists of calcium, magnesium, manganese and aluminium silicates in various combinations. The slag material is non-hazardous in nature as per the chemical analysis report of CPCB. Slag actually has many uses and it can rarely go to waste. Slag is a by-product of the iron and steel manufacturing process. The first step in the production of steel is to manufacture iron. Iron ore, a mixture of oxides of iron, silica and alumina, together with a fuel consisting of coke, oxygen and pulverized coal and also limestone as a fluxing agent, are fed together into a blast furnace consisting of a large vertical chamber through which large volumes of hot air are blasted. The chemical reaction further results into two products. They are molten iron metal and molten slag. Slag, which has a relatively lower specific gravity, does not mix with the molten metal and it leaves the furnace which is commonly called Blast Furnace slag. Generally a blast furnace operates on a continuous basis and

produces approximately 250-300 kg of slag per tonne of iron produced.

The liquid blast furnace slag flows into pits where it is air cooled and sprayed with a small quantity of water. The cooled slag is then transported to a crushing and screening plant where it is further processed into various products.

Alternatively, liquid slag can be rapidly quenched using large volumes of high-pressure water to produce a sandy-like material called Granulated Blast Furnace Slag (GBFS). It can be used as an aggregate, as ballast and also as a component of phosphate fertilizer.

II. PROBLEM STATEMENT

Waste management is one of the most common and challenging problems in the world. According to the Indian Mineral Year Book 56th edition in the year 2017, 12 MT per annum of steel slag is generated and disposed off. As a result a large area of land is being sacrificed for the disposal of this waste. As natural aggregates are getting depleted day by day and their increasing cost is making construction activities non-economical. Depletion of natural aggregates is creating a serious impact on the economy of construction. Hence an alternative is found out to replace natural aggregate in construction by using steel slag aggregate. The awareness of steel slag as a useful material is very limited in India. However many other countries especially economically developed countries have been using steel slag in a variety of applications.

III. SCOPE

The scope of the project is limited to test the physical and chemical properties of steel slag and use it as a replacement material for

fine aggregate .Further work consist of testing the sample and distinguish the cost and hardened properties with and without steel slag.

IV. MATERIALS

CEMENT

Ordinary Portland cement of grade 45 was used. The specific gravity of cement is 3.15.

FINE AGGREGATE

Crush sand passing through 4.75mm sieve with a specific gravity of 2.85. The grading zone of aggregate was zone 3.

COARSE AGGREGATE

Angular crushed aggregate of 20mm size were used. The specific gravity of coarse aggregate was 2.9.

STEEL SLAG

Steel slag has been sourced from JSW steel industries ,dolvi. The specific gravity of steel slag was 2.54

CONCRETE MIX DESIGN

Design concrete mix of 1:2.566:4.12 is adopted to attain 38.25 N/mm² . The water-cement ratio of 0.45is used.

V. METHODOLOGY

The basic tests were conducted on OPC43 grade cement, fine aggregate , coarse aggregate and steel slag to check the suitability for making concrete. The experimental investigation has been carried out on the test specimens of cubes to study the strength properties as a result of partially replacing fine aggregate by steel slag in various percentages such as 0%,15%, 25%, 30%, 35%. Compressive strength test was conducted on hardened concrete after 7days, 14days, and 28 days of curing. And slump test was conducted on fresh concrete.

VI. RESULT

a) Slump Test

Slump Test was done on fresh concrete for various replacement of steel slag.

	For 0 %	For 15%	For 25%	For 30%	For 35%
Slump Value	80mm	70mm	65mm	60mm	60mm

b) Compressive Strength

12 cubes of M30 grade concrete were casted for each replacement . Among them 3 cubes were tested on 7th day , 3 on 14th day and 3 on 28th day, Total 60 cubes were casted and out of that 45 cubes were tested. Specimens were casted as per mix design and its size was 150mm*150mm*150mm.

Compressive strength on	For 0%	For 15%	For 25%	For 30%	For 35%
7 days	28.63	30.51	32.97	30.12	29.37
14 days	32.29	33.706	35.74	33.7	34.21
28 days	39.61	42.1	44.04	43.07	41.89

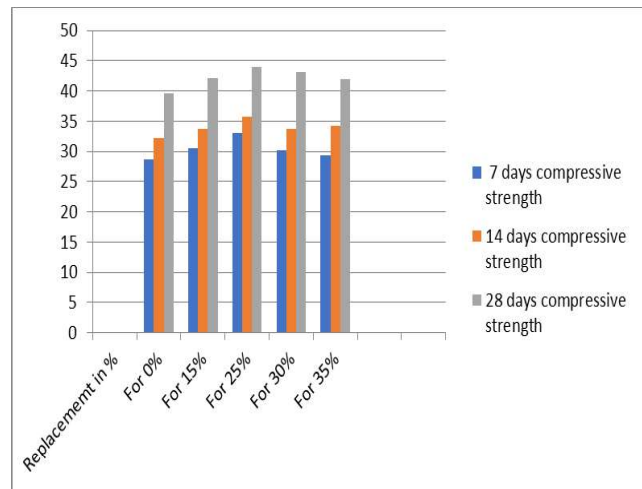


Fig. 1 Graph of average Compressive Strength in MPa



Fig. 2 Testing of Cubes

VII. CONCLUSIONS

Compressive strength increases with increase in % of steel slag upto 25% replacement .

Compressive strength starts decreasing after 25% replacement of steel slag.

From the results of compressive strength of 7days , 14 days and 28 days of curing , 25% replacement of fine aggregate by steel slag is the optimum % of replacement for M30 grade of concrete.

The replacement of steel slag as fine aggregate in concrete has positive impact on compressive strength , hence use of steel slag in concrete will eliminate one of the environmental problem created by steel industry and preserve natural sand.

Materials in Civil Engineering 16, no. 3 (2004): 230-236.

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Plastic Embedded Concrete

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Abstract- Now a day's plastic waste is a new issue of being disposal. Generation of waste plastic is in tremendous manner and its recycling process is insufficient to hold the waste plastic and its recycling. In India more than 15000 tons of plastic waste is generated out of which 6000 tonnes of plastic remains uncollected and littered. This paper discusses about recycling the PET plastic which is non-biodegradable. So our aim is to use PET plastic in moulded form to recycle more volume of plastic in single concrete block. This will not recycle the plastic but also will gain the strength of concrete equal or more than normal concrete block. Volume of plastic is about 15% to 20% in one single concrete block.

Index Terms- Compressive strength , Plastic Embedded concrete block , PET plastic plate , PET plastic strip I.

1. INTRODUCTION

Plastic waste is a huge problem as the population increased the generation of plastic waste is also goes on increases. The availability of dumping yard is insufficient to handle the waste plastic. By using the plastic waste in concrete block we can reuse and also load on dumping yard will be reduce. Many researchers have used plastic in proportion form in concrete. We are going to use plastic in casted form so more volume can be utilize in one single concrete block. This will reduce the load on recycling plant and more space will be available for other waste. The size of concrete block is 390x190x190 mm and size of the plastic strip is 210x60x50 mm.

II. MATERIAL USED

The materials used for this experiment are as follows:

1. Cement: Portland Pozzolona Cement (PPC) was used for this experiment.
2. Sand.
3. Crushed sand.
4. Plastic: The PET plastic in moulded form of size of 210 x 60 x 20 mm.

5. Water: Potable water was used for casting and curing of the concrete samples.

III. METHODOLOGY USED

Following steps were followed in the sequence to complete this research.

A. Preparation of plastic strip

The raw material such as PET bottle and other plastic will be collected in a shredded waste plastic form and then rinsed. Rinsing will be done in order to remove any kind of foreign particles such as grease and dust particles. After the rinsing the bottle will be dried and then shredded to smaller sizes for convenience of melting.

Melting was done under the controlled temperature of 240 - 250 C. The molten plastic was poured in a mould and then allow to set for 24 hrs. Finally it was cooled and the plastic strip was made.



Fig. Casted PET plastic strip

B. Concrete Mix Design :-

M10 mix was designed and a volumetric mix proportion of 1:3:6 was obtained. Water cement ratio of 0.45 was adopted for the mix design.

Sr.no	material	weight in kg
1	Cement	2.33
2	Sand	7
3	Crushed sand	14

IV.PROCEDURE

A. Form work for block :-

For these we have selected the lightweight aluminum composite panel. The size of formwork is 430x230x210 mm.

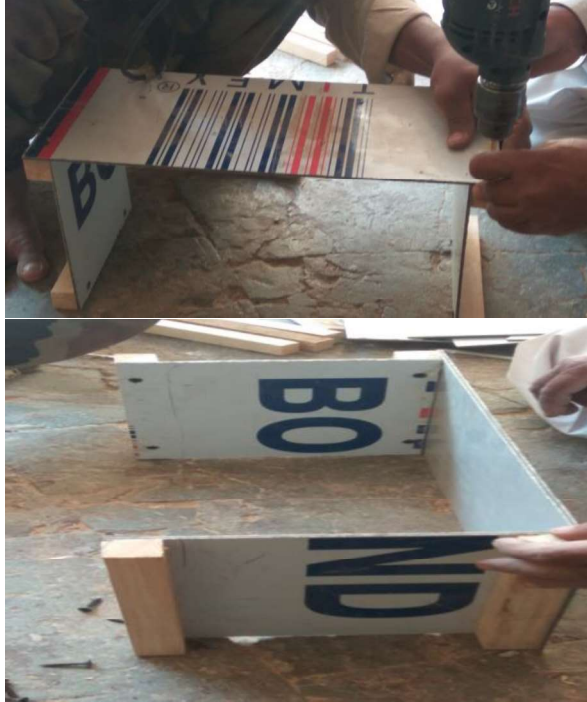


Fig. Making of aluminum composite material mould for casting concrete block

Total 3 block are made for casting concrete block. In these mould the first layer was filled with concrete at 95mm from bottom side. Then plastic strip was placed at the Centre of the block and compaction was done from side of the plastic strip then after the concrete was filled up to the top level of the mould .

B. Formwork for plastic mould :-

For these we have used lightweight aluminum plates of ½ inch thickness. The size of these block is 210x60x50 mm. It has three holes of diameter 2cm at 2.5cm center to center.

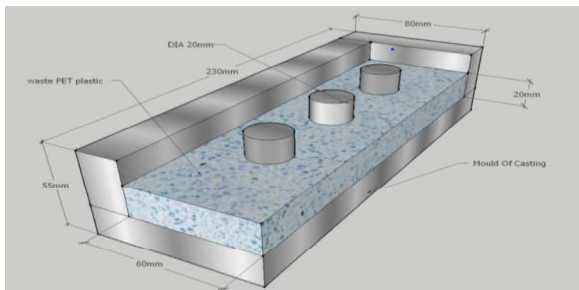


Fig. Details of the mould of PET plastic strip

First we have melted the plastic in a pan at 160°. These molted plastic placed in a aluminum mould carefully. For 1 hours we kept it for cooling purpose. After it was set completely then it was removed and placed in a concrete block at the Centre.



Fig. Melted PET plastic in the mould

For this 3 blocks were casted in which the casted plastic strip was placed. The size of concrete block is 390x190x190mm and plastic strip is 210x60x20mm with three holes of diameter 2cm at 2.5cm Centre to Centre distance provides the proper bonding with concrete.



Fig. Plastic strip placed after one layer of concrete in mould

Curing

Samples that was casted was placed for curing for the period of 7 days and 28 days in potable water. (Fully submerged)

Testing

Our project aim was to check the plastic embedded solid concrete block for the compressive strength. Out of the 3 blocks 1 block was tested to check the compressive strength under the CTM and another 2 was tested under the UTM machine and the obtained results are compared with the standard strength of M10 concrete block. (As the strength of our block is near to strength of Standard M10 block.)



Fig. Testing of block under CTM machine"

1. Strength of the standard M10 concrete block : 10 MPA for 28 Days curing period.
2. Plastic embedded concrete block strength : 7.24 MPA for 14 Days curing period.

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TEST REPORT
(Solid blocks)

Sample No:	CYL10411-15-001_1 to 1	Report No:	CYL10411-15-001
Customer Name:	Mayur S. Khadke	Date Of Receipt:	11 Apr 2018
Customer Address:	Puneet Chhatral College Of Engineering Sector -26, Pradhikaran, Nigdi Stop, Akurdi Railway Station PUNE, Maharashtra India -411044	Date Of Testing:	11 Apr 2018
Client Name:		Report Date:	20 Apr 2018
Consultant name:		Sample Condition:	Acceptable
Site:	Plastic Embedded concrete block project PCCOE PUNE, Maharashtra India -411044	Witnessed By:	
Sample Identification Letter Ref:		As Per:	IS:1041 & IS:1000

Observation Table & Test Results:

Compressive strength of Solid block		Test Particulars		1	Average	Test Method
1	Length (mm)			200	--	--
2	Width (mm)			100	--	--
3	Height (mm)			100	--	--
4	Crack section area (sq mm)			74100	--	--
5	Max Load (kN)			548.2	--	--
6	Compressive Strength (N/ sq mm)			7.4	7.4	IS:1041 & IS:1000

Specification Limits as per IS 15 2185 (P-102003)						
Sl No	Grade	Min density of block (kg/m ³)	Min Avg. Comp. strength (N/m ²)	Min Individual Comp strength (N/m ²)	Max water absorption (Percent)	
(i)	C-5	1800	5.0	4.0	10	
(ii)	C-4	1800	4.0	3.2	10	

Remarks:

Note: (i) The test report and result relate to the particular specimen/ sample (s) of the material as delivered/ received and tested in the laboratory. (ii) Any test report shall not be considered correct in full, without the written permission from Constrologix.

Tested By: Amol Sankhane

Authorized Signatory
Vijay Surve (Manager- Technical)

Reporting Conditions Overleaf

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V. OUTCOME OF THE WORK

The plastic embedded blocks are tested for the compressive strength and the results are nears to the standard strength of M10 block that is 10 N/m. If we compare the plastic embedded concrete block with standard M10 block - both are producing the same strength, so we can use this "Plastic embedded concrete blocks" for various purposes.(ex For construction of compound wall). These use of PET plastic in concrete block will help to reduce PET plastic disposal problem around the world.

VI RESULT OF THE WORK

We got the strength of 7.24 MPA after 14 Days of curing period.

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Determination of Loss in Strength of Steel Due To Stacking on Construction Site

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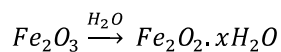
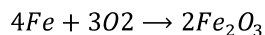
Abstract- Use of corroded steel for reinforcement work is frequently carried out construction activity of human beings. The construction technology has advanced since the beginning of primitive construction technology to the present a concept of modern house buildings. The present construction methodology for buildings brought for the best aesthetic look, high quality & fast construction, cost effective & innovative appearance. But use of corroded and deteriorated steel is directly hampering the strength of the structures. Around 40% of structure failure occur due to deterioration of steel reinforcement. Due to fluctuation in cost of steel material used in construction industry, people prefer to buy the material in bulk quantity when the cost is low. But the steel starts gradually deteriorating due to prolonged stacking time. Such deteriorated steel used in reinforcement work leads to reduction in life span and strength of the building. This also involves the strength reduction along with increase in the stacking period. The study involves comparative analysis of newly manufactured steel bars and corroded steel bars. It also covers inspection of materials used on site for reinforcement activities

Index Terms- Strength loss, Corrosion, Tensile strength,

I. INTRODUCTION

The steel available on construction site looks different from the newly manufactured steel, this is due to the steel on construction site comes in contact with oxygen and moisture leading to slow oxidation process causes corrosion generally known as rusting of iron.

CHEMICAL REACTION:



(Rust)

Handling and storing steel on construction site leads to deterioration and corrosion. This leads to reduction in strength of steel material further leading to failure of structure. Hence Exposure to water and air has an adverse effect on steel leading to corrosion. As a result the structure will become less durable with increase in

severity of corrosion. As factor of safety of 1.5 is considered for steel according to load criteria, there is no consideration of factor of safety for use corroded or deteriorated steel for reinforcement work.

To find out the actual loss in strength of the steel after rusting we carried out few investigations and tests and calculated the strength difference between newly manufactured steel and corroded steel.

I. RESEARCH METHODOLOGY

Various construction sites were visited to inspect the reinforcement steel used for construction activities. We found that deteriorated steel which was stored for long time span from one month to three years was also used for reinforcement of slabs, beams, columns etc.

Collected deteriorated steel bars of different stacking period from construction sites was done to carry out tests to find out strength difference between newly manufactured steel bars and deteriorated steel bars. All the specimen collected were of 12mm diameter.

The collected samples were tested on UTM by conducting tensile test. During first test newly manufactured bars and one month old stacked bars were tested. During second test, bars of longer time span on stacking were tested. Comparison of these test results along with new bars test results were done in order to study the strength variation and difference of the bars after getting deteriorated. Firstly the gauge length on all the 66cm long bars was marked by applying the formula 5Φ . The bars were further clamped in the UTM, tensile load was applied

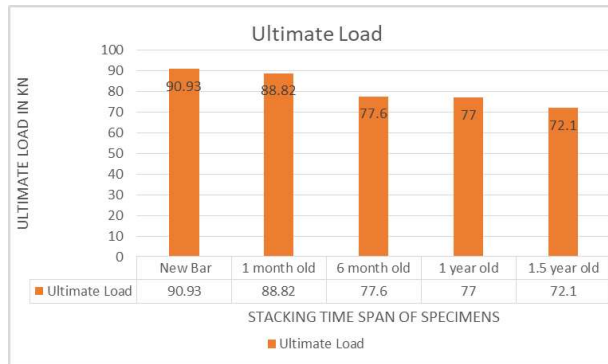
gradually on the clamped specimen by means of control knob. Gradual deformation of the specimen was displayed on the screen in the graphical format. Similar procedure was applied for all the specimens. Hence further analysis of the test results was done.

II. ANALYSIS

Tensile test conducted on six samples of 66cm long 12mm diameter TMT bars of grade fe500. Three bars were new and three bars were one month old.

Second tensile test conducted on three samples of 66cm long 12mm diameter TMT bars of grade fe500. Three bars were of different life span i.e. 6 months, 1 year, 1.5 years (approximately). Following graphical representations shows the test results

Results indicates that stacking period of steel is directly proportional to decrease in strength of steel.



The deteriorated steel bars when compared with newly manufactured steel bars, one month old bar's strength is found to be decrease by 3%. Similarly for 6 month, 1 year, and 1.5year old bar's strength is decreased by 14.65%, 15.32% and 20.71% respectively when compared with newly manufactured steel bars.



Fig 3(a) Failure of newly manufactured steel bars



Fig 3(b) Failure of Deteriorated steel bars

VI. CONCLUSION

From analysis and results we can conclude that strength reduction of steel on site is directly proportional to time period of stacking of steel material. Awareness to the community and construction industry can be created to reduce economical losses and structure failure. Deteriorated steel should not be used for reinforcement work during construction activity. Bonding strength of steel in concrete decreases due to formation of layer of rust on surface of steel bars. In coastal areas or in case of long storage, apply protective coating of primer to prevent scaling.

ACKNOWLEDGMENT

It gives us an immense pleasure in submitting our research paper on "Determination of loss in strength of steel due to stacking on construction site". We take this opportunity to show panegyrics and thanks to our guide Prof. A. B. Kudoli and Coordinator Prof. A. G. Gunjal whose suggestions helps us alot throughout the duration of our efforts on research.

We are also indebted to Dr. S. S. Sawarkar, Head of the Department who was constant source of inspiration to us during completion of this research work.

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- [3] Indian standard code of practice for corrosion protection of steel reinforcement in RB and RCC construction. (Clause 5.3) Protective coating on concrete cover and reinforcement and APPENDIX B (Clause 5.3.3) procedure of application of protective coating.



CIPCIS 2019 : P-114

Laser Assembly Used For Surveyor's Tripod Centering

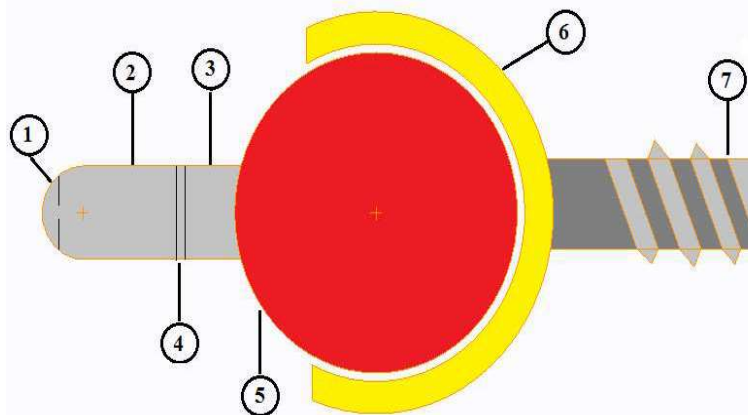
Onkar Anandkumar Indlkar and Akshay Kirit Kacha

Department of Civil Engg., PCCOER, Ravet, (MS) India

ABSTRACT-

An apparatus is set forth for providing vertical alignment and indication of a fixture positioning with relative to a ground reference point, wherein the apparatus includes a laser emitting diode mounted with axial ball and socket and the socket is fixed with tripod stand. The laser member is fixed with ball to focus a laser beam on the ground surface. an laser emitting diode situated in cylindrically shaped compartment being battery operated. The socket is threadably connected to the bridge screw (tripod head) and has an aperture through which the laser beam is emitted wherein the beam is aligned a reference position on the ground, with a fixture target point on the ground. Vertical alignment is provided by the use of laser beam directed from the laser diode through the objective and focusing lens respectively regardless of the relative planer relationship of the ground surface. An on/off switch is provided along with a rechargeable battery.

DIAGRAM/SCHEMATIC –



IPR APPLICATION / PATENT NO. – 201621027266

*"There are three epics in this world...Ramayan,
Mahabharat and Structural Mechanics!"*

Dr. Sameer Sawarkar