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Accommodation of Safety Edge to Minimize Road Accidents

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ABSTRACT: Road accidents are the causes of death worldwide more than 1.5million are killed in road accidents worldwide. The occurrence of accident depends on like geometrics of road, vehicle, pavement condition and whether condition. When a vehicle leaved the travelled way and encounter a pavement shoulder drop-off, it can be difficult for driver to return on roadway. The side of the tire may scrub along the drop-off resisting the driver's attempts the steering angle of vehicle 'slingshot' across the road. This can result in collision with other traffic or loss of control on roadside. The safety edges are innovation treatment intended to minimize drop-off related crushes.

It has been noticed that potholes are also the main cause of accidents. To reduce these accidents rates occurring due to the portholes on pavements the chipfill system is developed.

I. INTRODUCTION

In today's world road and transport has become an integral a part of growth and development of a nation. Everybody may be a road user in one or other shape. This transport system has minimized the space but it's on the opposite hand increased the life risk. Every road crashed end in loss of lakh of lives and high to injuries to corers of individuals. India features a total of about 2 million kilometers of roads out of which 960,000 km are surfaced road and about 1 million km of roads in India are of poor quality.

As we experience increase in number of vehicles on road simultaneously road accidents also are increasing in same manner. Road accidents are one among the most important killers in India.

To deal with this accommodation of safety edges on pavement is developed. We notice that due to resurfaced pavements and edges on it also results in increasing the accidents rates. Safety edges make it easier for a driver to safely reenter the road way after in inadvertently driving on to the shoulder. Potholes are the cause of accidents and due to this fatal rates and injuries occurs. Overturning and turning of vehicles also may result. To deal with this chip-fill system is developed. Many road crews are ill-informed on the proper materials and methods for pothole repair. Correct selection of pothole patching materials and proper application of repair procedures can greatly increase the longevity of pothole repairs, lead to fewer driver frustrations, and lower road maintenance budgets.

II. LITERATURE REVIEW

The concept of safety edge was first introduced by **Gregory A. Howell** 1) **Gregory A. Howell** Worked on Working near the edge: A new approach to construction safety in august 2000, Development security has drastically improved, yet has arrived at a level .2) **Krammes, R., Brilon, W. (Eds.)** has worked on Safety in geometric design standards 1: Three Anecdotes. June 14-17, 2000. Many accept that streets planned to guidelines are protected streets. In the partner paper the case will be made that such streets are neither safe nor dangerous; that their security is unplanned3) **Keith W. Anderson**, Worked on Pavement Edge Treatment January 2013, Four projects were built over two construction sites using special devices attached to the asphalt machine that produces a 30° slope on the outside pavement edge in place of the near vertical drop-off common with conventional paving equipment.4) **Zheyuan Wang, Member IEEE**, 2018 has conducted study on Road Edge Detection in All weather and Illumination via Driving Video Mining, To obstruct the vehicles running through countryside, street edge location is a key function. Current work on street edge identification has not perfectly handled all climatic as well as environmental conditions..5) **Megan S Ryerson**, has Worked on Safety Edge: a Safely Frame Work to Identify Edge Conditions in the Future Transportation System with Highly Automated Vehicles, July2019 Atomized driving frameworks (ADS) have the potential for improving security yet also represent



the danger of expanding the transportation framework past its edge conditions, past the working conditions (operational plan space (ODD)) under which a given ADS or highlight Connected is expressed voluntarily to work.

III. METHODOLOGY

For the development of safety edge on pavements the recycle material are used that's coconut shell and e-waste this Material are economical and reduces the value of construction.

Safety edge is provided to securely re-enter the roadway after inadvertently arriving on to the shoulder .Various analysis are made on the traffic flow to detect the accidents rates increasing in day to day life .Analysis are supported location and supported the time were made .his analysis were made to scale back the accident rates and to makes traffic moments safe.

Chip fill is hot applied surface defect repair system specially designed to repair cracks and holes within the road. Firstly the broom and burner is applied on holes in road within the road. When heated, the chip fill thermoplastic becomes fluent, and therefore the binders in material find to the bitumen in asphalt. Chip fill may be a specially designed thermoplastic for repairing cracks and smaller holes with diameter around 15-20 cm and minimizing the danger of defects getting bigger. The repairing time is about 20 minutes from street to opening for traffic. This is the time reducing method which fills the potholes within minutes of time and this result in reducing the accident rates and also reduces the turning and overturning of the vehicles which may occurred due to the potholes on pavement.



Fig.1: Side Edge Of Kalmeshwar road

**Fig 2: Potholes on Kalmeshwar Road**

IV. OBSERVATION

As we experience increase in number of vehicle in road simultaneously road accidents also increase in same manner. Road accidents are one of the biggest killers in india. So to analyse road accidents we collected data from varies states of india .

The below figure shows the accidents rates in varies states in india.

Sr no.	2020	2021	
Share of 13 States	Percentage share	Number of Road Accidents	Number of Road Accidents
Tamil Nadu	14.9	71431	69059
Madhya Pradesh	11.2	53972	54947
Karnataka	9.2	44403	44011
Maharashtra	8.3	39878	63805
Kerala	8.2	39420	39014
Utter Pradesh	7.4	35612	32385
Andhra Pradesh	5.2	24888	24258
Rajasthan	4.8	23066	24072
Telangana	4.7	22811	21252
Gujrat	4.5	21859	23183
Chhattisgarh	2.8	13580	14446
West Bengal	2.8	13580	13208
Haryana	2.3	11234	11174

Table 1 shows the yearly as well as the state wise percentage accidents.

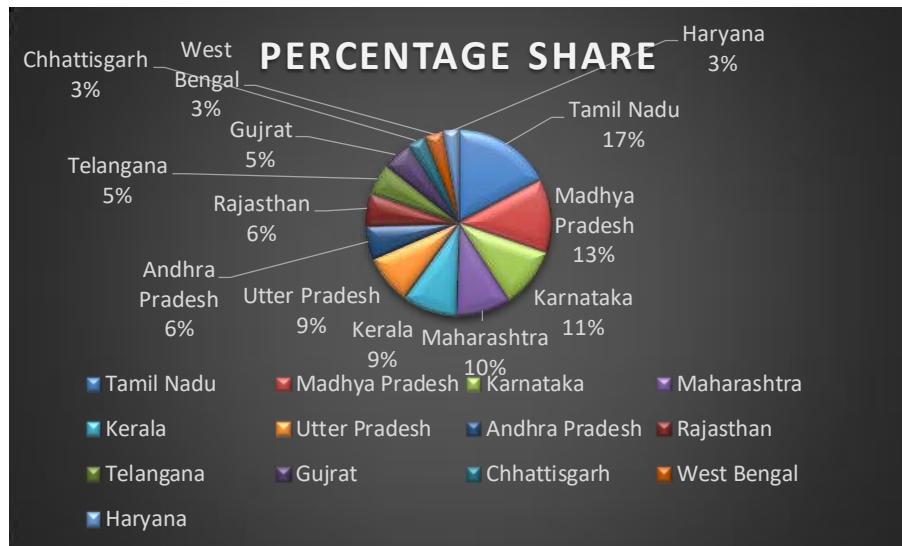


Fig 3 shows accidents rate distribution.

TIME					
	9-10am	11-12pm	1-2pm	5-6pm	6-7pm
DAYS	Traffic volume count				
Monday	42.2	39.41	35.46	40.85	41.13
Tuesday	55.08	38.75	33.06	39	38.83
Wednesday	51.91	38.58	30.45	43.5	40.08
Thursday	43.9	40.85	41.43	44.65	43.63
Friday	51.73	31.65	55.28	40.65	36.03
Saturday	53.83	31.65	55.28	40.65	36.03
Sunday	42.95	37.05	33.25	42.21	47.06
average	48.8	36.84	40.60	41.64	40.39

Table 2 shows that the time according to the days, the volume of the traffic flow as per hour, this is as per the selected location.

Year/ spots	Katolnaka	kalmeshwar	sadar	Gaddigudam
2017	127	189	120	90
2018	147	219	135	120
2019	170	245	110	138
2020	184	254	130	147

Table 3 shows the analysis based on road accidents occurred on the various spots.

Pot holes:-

- By using the chip fill method, we can avoid accidents on the roads.
- Because of quick filling the flow of vehicle, the vehicles can go smoothly and safely and there are less chances of accidents.
- As this method is quick and easy there is no time consumption. Its way easier and quick.
- There are having 4 methods used in chip fill method:-
 - Throw and go
 - Throw and roll
 - Semi-permanent
 - Spray –injection



- **Instarmac**:- firstly the aggregate is dumped into the pot holes .then the stamping is done on the pot hole on which the aggregate is put .then the spray is applied on the edge on the dry surface of potholes to get the strong bonding at the edge. Then the premix material is added on the pot hole and then compacted with the use of stamper. As soon as the stamping is done the traffic or vehicles is ready to go through the road.

Sr no.	Methods	How its applied	Cost	Time
1	Throw and go	Compaction is left up to traffic	Low	1-2 mins
2	Throw and roll	Compacted using truck tyres	Low	1-2 mins
3	Semi- permanent	Compacted using vibratory plate compactors	High	1-2 mins
4	Spray injection	No compaction needed	High	1-2 mins

Table 4 shows the differences between the methods according to the various aspect

V. RESULT & CONCLUSION

The safety edge treatment is suitable for use by highway agencies under a broad range of conditions on two-lane highways. While the evaluation results for total crashes were not statistically significant, there is no indication that the effect of the safety edge treatment on total crashes is other than positive

The cost-effectiveness of the safety edge treatment increases with increasing traffic volumes. The effect of the safety edge treatment would be cost-effective for two-lane highways.

The cost of adding the safety edge treatment to a resurfacing project is minimal. Overall project costs and the overall cost of asphalt resurfacing material did not increase for resurfacing projects with the safety edge compared to resurfacing projects without the safety edge.

The four most commonly used techniques for pothole patching are throw-and-go, throw and- roll, semi-permanent, and Chip Fill and the costs associated with each type of pothole patching can be broken into materials, labor and equipment.

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Analysis of Contamination of Ground Water Due To Dump Yard: Case Study of Bhandewadi Dump Yard, Nagpur, India

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ABSTRACT: Now a day's solid waste management and its proper disposing is major concern in the developing countries. The general method of disposing the solid waste is by land filling in dump yard. In this method the disposing site should be far away from the residential area. The present study is conducted on the ground water, in the vicinity of Bhandewadi Dump Yard in Nagpur. Urbanization and improper disposal of solid wastes lead to contamination of groundwater and surface water resources in this region. Municipal solid wastes of the city are presently disposed as open landfills at Bhandewadi region near Pardi east Nagpur. The leachate form due to solid waste is directly infiltrate into the ground and contaminate the ground and surface water resources which results into unsuitability of water for drinking and other utility purposes. Hence a detailed study and analysis is carried out on the ground water in the vicinity of this area. For this analysis four sample of different area of varying distances is collected from this study region, and these samples are analyzed for physical, chemical and biological parameters such as pH, Nitrate, BOD, etc. This study is try to analyze the suitability of ground water for drinking, household purpose, etc. by comparing with the standard parameters set by the Bureau of Indian Standard (BIS) and World Health Organization (WHO). The study indicates that the water quality parameters exceed the permissible limits for drinking at many locations leading the water unsuitable for drinking.

I. INTRODUCTION

Since the beginning, human kind has been generating waste, each household generated garbage or waste day in or day out either solid or semisolid form and generally exclude industrial hazardous wastes. Waste is a byproduct of life. High standards of living and ever increasing population have resulted in an increase in the quantity of wastes generated. During the last two decades groundwater quality has emerged as one of the most important environmental issues confronting much of the world's populace. Among the multitude of the environmental problem existing in the urbanizing cities of developing countries, MSW management and its impact on groundwater quality have become the most prominent in the recent years. Ground water contamination is generally irreversible i.e. once it is contaminated it is difficult to restore the original water, degrades water quality producing an objectionable taste, odor and excessive hardness. It is always better to protect ground water first rather than relying on technology to clean up water from a contamination source. Due to lack of efficient solid waste management system and improper dumping of MSW as open landfills, the groundwater and surface water in the Nagpur city is found to be contaminated in various places. The processing and disposal of the MSW generated by Nagpur city with environmentally safe and legally acceptable management is done by company namely Hanjer Biotech Energies Pvt. Ltd. NMC pays 275 Rs. per ton to these firms to treat garbage. Hanjer was allowed to sell the byproducts of treating garbage, which include wet organics, dry organics and plastics. Several studies have been carried out studying the impact of improper solid waste management mainly focused on pollution, health problems, diseases etc. To study the effects of solid waste on health of neighborhood inhabitants, Bhandewadi the only dumping yard of Nagpur city was chosen as primary testing area. It was assumed that the impact of solid waste would be more apparent and prominent at neighborhood settlements of Bhandewadi as these settlements are in proximity and in direct contact with the dumping yard.



II. LITERATURE REVIEW

1. Kalpana P. Deshmukh (2015): Have identified how much water is polluted and studied the possibility of damages on human health. The objective was to check the impact on water in nearby settlement of dumping yard and try to find out sessional difference between the pollution of water. This study was base on primary data collection, for testing the impact of dumping yard. Nearest six settlements was chosen. Samples were taken in two sessions, rainy and winter session for comparatively study. Sample was tested in laboratory in nine parameters. To test the water 'LTEK' field test kit was used. Water testing results of Bhandewadi proved that underground water of dumping yard Catchment area become pollutes. Hence on test of some parameters, water is safe but it's failed on any one parameter. In seasonal comparison water of rainy season are more safe than winter season. Excess water of rain mixed-up with well water so intensity become reduce. This kind of scope has not in the winter season so water is become concentrated.

2. Mohammed Asef Iqbal and S.G.Gupta (2009): Have studied on effect of municipal solid waste dumping on ground water quality index values. Recent increase in unplanned urbanization without any adequate provision for issues like waste generation and disposal and treatment by industries, agriculture and domestic users has increased the stress on water reservoirs of getting contaminated. Groundwater can also get contaminated due to such anthropogenic activities of man, if the generated waste is not disposed of in proper manner' the polluting chemicals in the solid waste undergo biological action and their seepage in the groundwater occurs during the rainy season. Hence the municipal solid waste poses a significant threat to the credibility of the groundwater as the safest source of water, For human consumption. The samples were collected at 21 sampling stations inbounding the dumping ground at Naregao. The samples were immediately transferred to the laboratory for the analysis' physicochemical parameters analysed were Dissolved Oxygen, pH, Biochemical Oxygen demand, Temperature, Phosphates, Nitrates and total Solids, additionally for biological status Fecal coliforms were also analysed. The analysis was carried out as per the standard methods prescribed by APHA (1995). The obtained results were used to determine the Water Quality Index (WQI) using NSFWQI method. The overall index of water qualityin the area is not satisfactory and can graded as bad for consumption. It is also observed that the water quality index is further deteriorating with the time. it was concluded that the open refuse dumping at Naregaon is adversely affecting the portability of the ground water in the area, which a serious of serious concern and immediate action should be initiated to prevent further deterioration of the groundwater sources.

3. P.Vasanthi, S.Kaliappan & R.Srinivasaraghavan (2007): Have studied impact of poor solid waste management on ground water. The leachate produced by waste disposal sites contains a large amount of substances which are likely to contaminate ground water. In this study, the quality of ground water around a municipal solid waste disposal site in Chennai was investigated. Chemical analyses were carried out on water samples collected at various radial distances from the boundary of the dumping yard, at intervals of 3 months and for a period of 3 years. The study has revealed that the ground water quality does not conform to the drinking water quality standards as per Bureau of Indian Standards. The effects of dumping activity on ground water appeared most clearly as high concentrations of total dissolved solids, electrical conductivity, total hardness, chlorides, chemical oxygen demand, nitrates and sulphate. Leachate collected from the site showed presence of heavy metals. The contaminant concentrations tend to decrease, during the post monsoon season and increase, during the pre monsoon season in most of the samples. The study clearly indicates that landfills in densely populated cities should have the ground water monitored on regular basis. Furthermore, ground water in and around the landfill sites shall not be used for drinking purposes unless it meets specific standards. Indiscriminate dumping of wastes in developed areas without proper solid waste management practices should be stopped.

4. Anju Anilkumar, Dipu Sukumaran, Salom Gnana Thanga Vincent (2015):Have studied the effect of Municipal Solid Waste (MSW) leachate on ground water quality by using water quality index (WQI) in Thiruvananthapuram corporation area, Kerala, India. Ground water samples were collected from dug wells 1 kilometer around the MSW dumping site and control samples from 10 kilometer away from the site both in two seasons (pre monsoon and post monsoon) for analysis of physicochemical and microbiological parameters. The characteristics of leachate of the MSW were also studied. Ground water near the MSW dumping sites were found to be more polluted than the control sites in both seasons. From this study, it is evident that the leachate from the MSW dumping site plays a major role in polluting the ground water in the area. The nitrate (88 mg/l) and total dissolved solids (TDS) (726 mg/l) concentration in ground water is in alarming state that should be taken into consideration before using for drinking purpose. The ground water



near the MSW dumping site was also contaminated by fecal coliform (8 CFU/100ml) which makes unsuitable for drinking purpose.

5. Nitin Kamboj and Mohrana Choudhary (2013): Have studied the impact of domestic wastes disposal on ground water quality at Delhi, India. The samples of ground water were collected and analyzed for various physico-chemical parameters viz. conductivity, total dissolved solids (TDS), alkalinity, total hardness, calcium, magnesium, chloride, sulphate, nitrate, phosphate, fluoride, sodium and potassium. Among these parameters, TDS were found higher. TDS were observed beyond the desirable limits of BIS at all the sampling sites. Maximum value of TDS was found to be 2061 mg/l. Maximum value of chloride was found to be 560 mg/l and rest all other parameters were found within permissible limit. The study concluded that the chloride and TDS in water samples were above to the desirable limit and below to the permissible limit of BIS and rest all other parameters were within desirable limit.

6. Gawsia John, Harendra K. Sharma1 & Vikas Vatsa (2014): Have studied the Impact of municipal solid waste dump on ground water quality at Danda Lokhand landfill site in Dehradun city, India. Ground water contamination is generally irreversible i.e., once it is contaminated it is difficult to restore the original water quality of aquifer. Excessive mineralization of ground water degrades water quality producing an objectionable taste, odour and hardness. So keeping in view the importance of ground water and the effect of municipal solid waste dump on ground water. They select the present dump site Danda Lokhand on Sahastradhara road, in Dehradun. The residential areas around this dump site mainly have bore-wells and hand pumps. The depth of these bore-wells & hand pumps around the site varies from 350-450 feet. The purpose of this study was to assess the physico-chemical properties and microbial activity of underground water was evaluated within 3 months. The physico-chemical properties such as temperature, total dissolved solids, pH, electrical conductivity, alkalinity, total hardness, phosphate, chloride, residual chlorine & microbial activities were studied & analyzed. The quality of ground water in various parameters is fair or satisfactory but the overall study has revealed that the ground water quality does not conform to the drinking water quality standard as per Bureau of Indian standards. The study clearly indicates that landfills in densely populated cities should have the ground water monitored on regular basis. Furthermore, ground water in and around the landfill sites shall not be used for drinking purposes unless it meets specific standards, indiscriminate developing of waste in developed areas without proper solid waste management practices should be stopped.

7. Donal Nixon D'Souza, P.S. Aditya, S. Savitha Sagari, Deepanshi Jain and Dr. N. Balasubramanya (2012): Have studied Groundwater Contamination Due to a Dump Yard. The study was conducted on the ground water, in the vicinity of Vamanjoor dump yard in Mangalore. Twenty eight ground water samples were collected and analyzed for physical and chemical parameters as per standard methods for water and waste water. The results were compared with BIS guideline values for potable water with the view to quantify the extent of ground water pollution, and its impact on health. The sampling and analysis of ground water showed contamination due to landfill leachate, as a result if excessive concentrations of one or more contaminants such as Iron, Nitrate, Cadmium, Total Dissolved Solids and Fluorides. The presence of these contaminants has rendered about 86% of the samples unpalatable. The variation in contamination is mapped using high resolution satellite data, with the help of GIS and Surfer mapping tools.

III. METHODOLOGY OF PROPOSED SURVEY

Sample Collection

In order to analyze the intensity of ground water contamination due to leaching of wastes into ground, nearest five settlements were chosen. From each settlement one ground water source were selected and the water samples were collected to analyze its quality. Five water samples were collected from the study area and analyzed for its physical and chemical characteristics as per standard procedure. The detailed inventory survey also carried out and the details such as depth of source and distance of source from the dumping yard are collected. Clean plastic bottles washed with detergent were used for ground water sampling. The sampling bottles were rinsed duly with distilled water before taking the samples and then on field the bottles were rinsed duly by using the representative ground water samples.

Details of Samples

Total five samples of groundwater were collected from different settlements in a sampler of capacity 2 liter. All the details of each sample and source from which the samples were collected is given in table.

**Table no. 8. 1 Washing of Samplers with Detergent**

SR. NO.	AREA	SOURCE	DEPTH (ft.)	DISTANCE FROM DUMPING YARD (m)
1.	ANTUJI NAGAR	BORE WELL	80	100
2.	ABBUMIYA NAGAR	WELL	40	200
3.	SANGHARSH NAGAR	BORE WELL	80	300
4.	GURUKRUPA NAGAR	BORE WELL	150	150
5.	CHANDMARI NAGAR	BORE WELL	150	650

Analysis of samples

The ground water samples were collected in field were send to the laboratory on the same day. These samples were tested in laboratory of **Water Resource Department of Government of Maharashtra** in Nagpur for three different Parameters are as follows:

pH

The term pH is a measure of the concentration of hydrogen ions in a diluted solution. It can range from 0 to 14, with 7 denoting a neutral value. Acidic water has a pH below 7; alkaline water, above 7. The health effects of pH on drinking water depend upon where the pH falls within its range. The U.S. Environmental Protection Agency, which classifies pH as a secondary drinking water standard, recommends a pH between 6.5 and 8.5 for drinking water. According to the World Health Organization, health effects are most pronounced in pH extremes. Drinking water with an elevated pH above 11 can cause skin, eye and mucous membrane irritation. On the opposite end of the scale, pH values below 4 also cause irritation due to the corrosive effects of low pH levels. WHO warns that extreme pH levels can worsen existing skin conditions.

Factors influencing the value of pH:

- The pH of a body of water is affected by several factors. One of the most important factors is the bedrock and soil composition through which the water moves, both in its bed and as groundwater. Some rock types such as limestone can, to an extent, neutralize the acid while others, such as granite, have virtually no effect on pH.
- Another factor which affects the pH is the amount of plant growth and organic material within a body of water. When this material decomposes carbon dioxide is released. The carbon dioxide combines with water to form carbonic acid. Although this is a weak acid, large amounts of it will lower the pH.
- A third factor which determines the pH of a body of water is the dumping of chemicals into the water by individuals, industries, and communities.

Nitrate (NO_3)

Nitrate is an inorganic compound that occurs under a variety of conditions in the environment, both naturally and synthetically. Nitrate is one of the most common ground water contaminants in rural areas. It is regulated in drinking water primarily because excess levels can cause methemoglobinemia, or "blue baby" disease. Although nitrate levels that affect



infants do not pose a direct threat to older children and adults, they do indicate the possible presence of other more serious residential or agricultural contaminants, such as bacteria or pesticides.

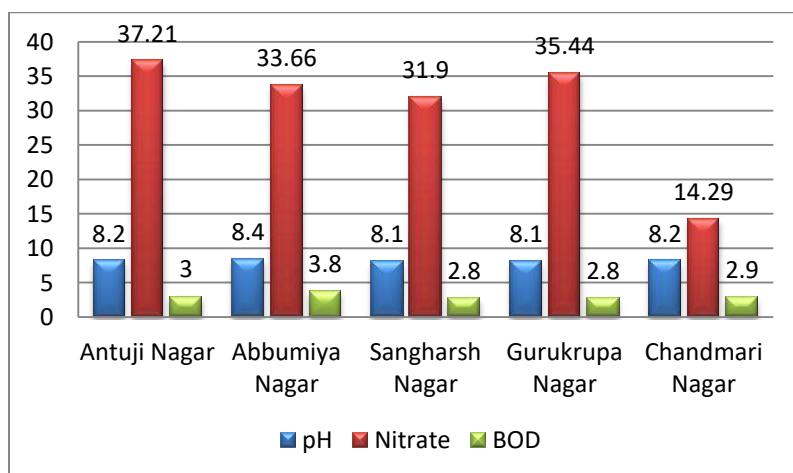
Nitrate in drinking water is measured either in terms of the amount of nitrogen present or in terms of both nitrogen and oxygen. The federal standard for nitrate in drinking water is 10 milligrams per liter (10 mg/l) nitrate-N, or 45 mg/l nitrate-NO₃.

Biological oxidation Demand (BOD)

BOD represents the quantity of oxygen which is consumed in the course of aerobic processes of decomposition of organic materials, caused by microorganisms. The BOD therefore provides information on the biologically-convertible proportion of the organic content of a sample of water. BOD indicates the amount of putrescible organic matter present in water. Therefore, a low BOD is an indicator of good quality water, while a high BOD indicates polluted water. Dissolved oxygen (DO) is consumed by bacteria when large amounts of organic matter from sewage or other discharges are present in the water.

IV. RESULT & DISCUSSION

For analyzing the ground water in the vicinity of Bhandewadi dumping yard five water samples were tested in the government laboratory of water resource department on the basis of three parameters pH, Nitrate and BOD. The results obtained are as follows.



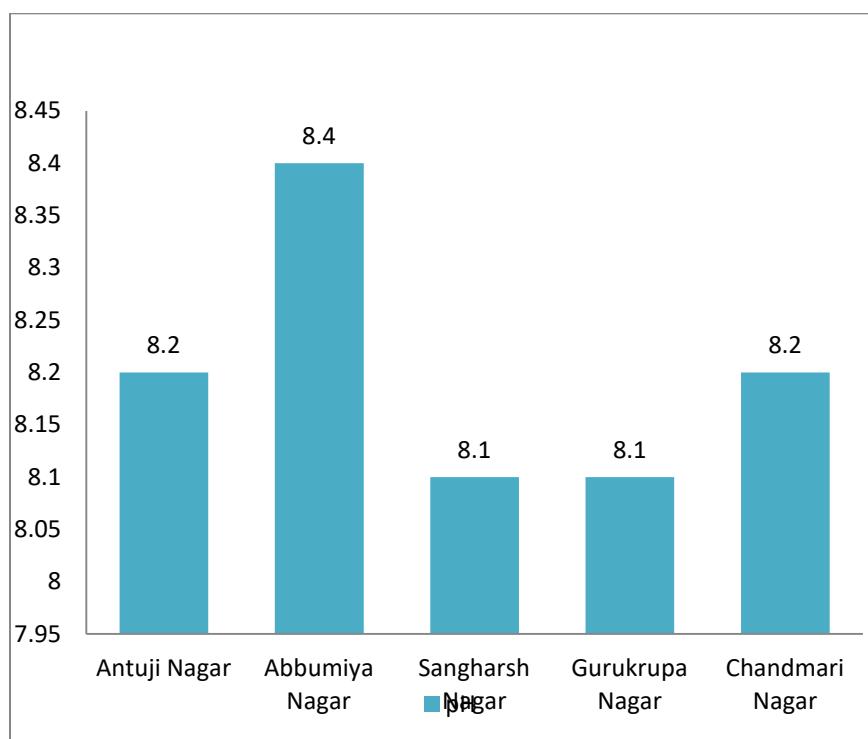
Graphical Representation of pH, Nitrate, BOD Value on the Basis of Region

pH

The pH of the above sample is found within permissible limits but it is very near to the permissible limits. The pH value of Abbumiya Nagar water sample is highest than all the five samples and it is very close to permissible with the difference of 0.1 value this is the indicates that this region is highly susceptible to contamination on the basis of pH value.

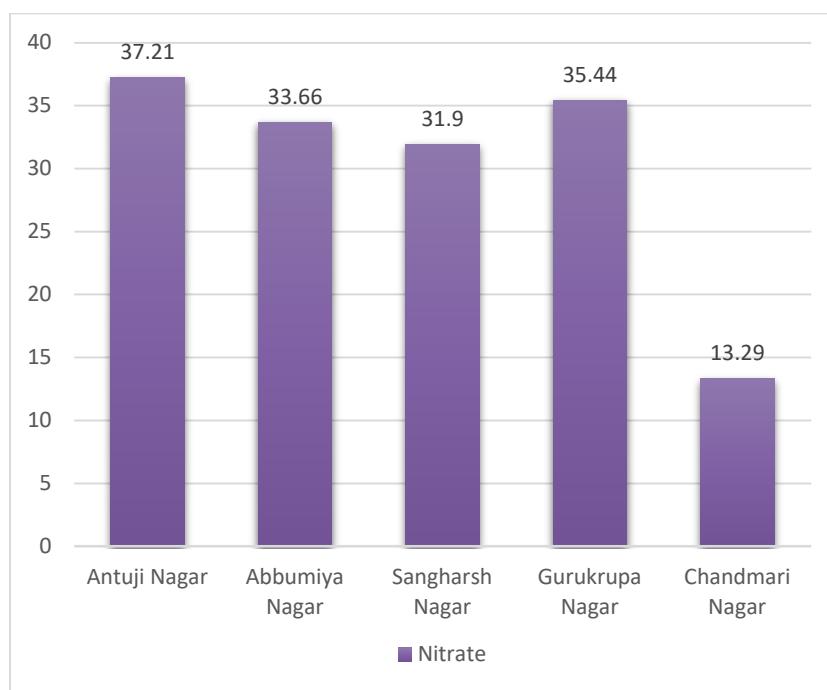
Table no. 8. 3 Samples Collected from Different Settlements (Areas)

SR. NO.	NAME OF THE AREA	PH VALUE	REQUIRED (ACCEPTABLE LIMIT)	RESULT
1	ANTUJI NAGAR	8.2	6.5-8.5	PORTABLE
2	ABBUMIYA NAGAR	8.4	6.5-8.5	PORTABLE
3	SANGHARSH NAGAR	8.1	6.5-8.5	PORTABLE
4	GURUKRUPA NAGAR	8.1	6.5-8.5	PORTABLE
5	CHANDMARI NAGAR	8.2	6.5-8.5	PORTABLE

**Nitrate (NO_3)**

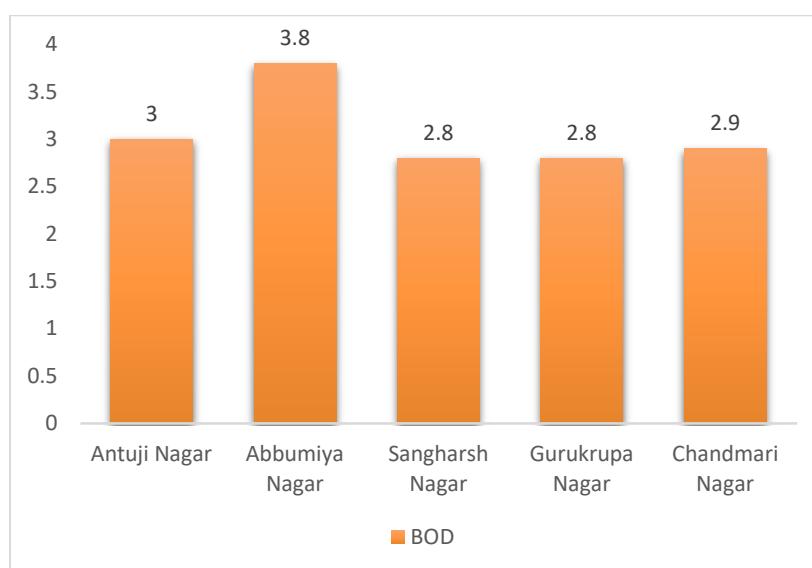
Nitrate content found in above five samples is high but lower than the permissible limits, as specified in BIS 2012 IS10500:2012. But it is very near and increases in the rainy seasons as proved in previous studies. In Antuji nagar it is found to be 37.21 which is very high and the source located 100m away from dumping yard. While the Nitrate value of Chandmari nagar's water sample is very less which is 13.29 mg/l and the source is located about 1000m away from the dumping yard. Hence the value of Nitrate is decreases as we move away from the dumping yard and found very high in the near regions.

SR. NO.	NAME OF THE AREA	NITRATE VALUE (MG/L)	REQUIRED (ACCEPTABLE LIMIT)	RESULT
1	ANTUJI NAGAR	37.21	45 MAX.	PORTABLE
2	ABBUMIYA NAGAR	33.66	45 MAX.	PORTABLE
3	SANGHARSH NAGAR	31.90	45 MAX.	PORTABLE
4	GURUKRUPA NAGAR	35.44	45 MAX.	PORTABLE
5	CHANDMARI NAGAR	13.29	45 MAX.	PORTABLE

**BOD (Biochemical Oxygen Demand):**

In above water sample analysis results it is found that while moving away from the dumping yard the value of BOD is reduces. Only the exception of Abbumiya nagar, it may be due the Abbumiya nagar is locate, in between both the dumping yard. The value of BOD according to BIS is should be zero but in the analyzed water sample is found to be 2.8-3.8 mg/l. Which is higher than the permissible limit and hence water in these regions is prohibited for drinking purpose.

SR. NO.	NAME OF THE AREA	BOD VALUE (MG/L)	REQUIRED (ACCEPTABLE LIMIT)	RESULT
1	ANTUJI NAGAR	3.0	---	NOT PORTABLE
2	ABBUMIYA NAGAR	3.8	---	NOT PORTABLE
3	SANGHARSH NAGAR	2.8	---	NOT PORTABLE
4	GURUKRUPA NAGAR	2.8	---	NOT PORTABLE
5	CHANDMARI NAGAR	2.9	---	NOT PORTABLE



V. CONCLUSION AND FUTURE WORK

As the parameters such as pH and Nitrate is found to be in permissible range, but the value of BOD is crosses its limit and found more than its permissible limit as specified in **BIS:2012, IS-10500:2012**. Hence the water samples collected from the vicinity of Bhandewadi dump yard is from different regions is found unsuitable, as it fails on the standard parameters specified by Indian government for drinking purpose. The samples were collected and analyzed in the winter season and only one parameters is found to be beyond the permissible limit, it can also be concluded that the intensity of dumping yard in rainy season will be high that of in winter season. This study shows that the ground water is highly contaminating day by day due to leachate percolation through dump yard. A necessary action is to be taken to stop this pollution of ground water. Indiscriminate dumping of wastes in developed areas without proper solid waste management practices should be stopped.

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Study of Generation of Electricity from Waste Food by Using Microbial Fuel Cell

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ABSTRACT: The major challenges to be faced nowadays are the excessive generation of food waste and the lack of alternative sources of energy. Current reliance on fossil fuels is unsustainable due to pollution and finite supplies. Both the challenges are of major economic and environmental concern. Microbial Fuel Cell (MFC) is a bio-electrochemical system that derives an electric current by using bacteria and mimicking the bacterial interactions found in nature. The easily available food waste is blended with distilled water and used to produce electric current. The idea of using microbes to produce electricity was conceived in the early twentieth century. Michael Cresses Potter initiated the subject in 1911. Potter managed to generate electricity from *Saccharomyces cerevisiae*, but the work received little coverage. In 1931, Barnett Cohen created microbial half fuel cells that, when connected in series, could produce over 35 volts with only a current of 2 millamps.

In this project we have studied the working of Microbial fuel cell and its component parts also we have compiled data from various research papers for more effective construction of Microbial fuel cell so that the output achieved is better. Research papers are downloaded from various sources and are studied thoroughly to formulate result and conclusion.

It is seen that when the number of salt bridge in the model of microbial fuel cell is 8, maximum current of 1675 micro amperes was obtained which was more than that when the number of salt bridges is less than 8. Therefore, the number of salt bridge used plays a significant role in electricity generation. Different combinations of electrodes were used, and it was found that Cu/Zn (Copper/Zinc) combination gave the best and consistent results. Acetate as a substrate was the most preferential for the generation of electricity with the highest CE (Coulombic Efficiency). The glucose-fed-MFC generated the lowest CE and greatest PD (Potential Difference) among the substrates used in the study. With the increase in molar concentration of salt in the salt bridge, the current decreases. Optimum results were obtained for salt bridge fabricated using 1M KCl and NaCl. It produced a maximum voltage 0.451 V and 0.372 V respectively. The voltage and power outputs achieved by using Waste Food as substrate is lower than MFCs fed with simple substrates like glucose and acetate but is comparable with other single chamber MFCs using waste food as substrate. Thus, this project proves that MFC can be efficiently used to tackle the problem of excessive waste food and lack of alternative sources of energy simultaneous.

I. INTRODUCTION

It is well recognized that alternative sources of energy are urgently required. Current reliance on fossil fuels is unsustainable due to pollution and finite supplies. While much research is being conducted into a wide range of energy solutions, it does not appear that any one solution alone will be able to replace fossil fuels in its entirety. As such it is likely that a few different alternatives will be required, providing energy for a specific task in specialized ways in various situations. The discovery that bacteria can be used to produce electricity from waste and renewable biomass has gained much attention. Recently the increased interest in microbial fuel cell (MFC) technology was highlighted by the naming of *Geobacter sulphureousness KN400*, a bacterial strain capable of high current production, as one of the top 50 most important inventions for 2009 by Time Magazine. This list was also populated with other energy related devices such as solar shingles, smart thermostats and energy reducing light bulbs, further stressing the importance currently placed on energy. The discovery that microbial metabolism could provide energy in the form of an electrical current has led to an increasing interest and a dramatic raise in the number of publications in the field of MFC research. These systems are very adaptable and hold much promise to provide energy in a sustainable fashion, but major improvements are required if widespread applications will be feasible. This review is unable to examine the entire field of MFC research in detail but hopes to highlight some important points regarding research in the field and recent important advances. Due to the shear, number of papers currently published regarding MFCs we hope that omission of many articles will not cause offence to their authors. This review article will examine MFC's currently in use, potential future applications and the limitations to implementing those applications. We



suggest methods for improving the current output of aMFC. We also examine MFC applications in which microbes accept electrons from an electrode instead of donating them. This review will hopefully highlight some of the potential of and limitations to MFC technology implementation.

The idea of using microbes to produce electricity was conceived in the early twentieth century. Michael Cresses Potter initiated the subject in 1911. Potter managed to generate electricity from *Saccharomyces cerevisiae*, but the work received little coverage. In 1931, Barnett Cohen created microbial half fuel cells that, when connected in series, could produce over 35 volts with only a current of 2 milli ampere. A study by DeLuca et al. used hydrogen produced by the fermentation of glucose by *Clostridium botulinum* as the reactant at the anode of a hydrogen and air fuel cell. Though the cell functioned, it was unreliable owing to the unstable nature of hydrogen production by the micro-organisms. This issue was resolved by Suzuki et al. in 1976, who produced a successful MFC design a year later. In the late 1970s, little was understood about how microbial fuel cells functioned. The concept was studied by Robin M. Allen and later by H. Peter Benetton. People saw the fuel cell as a possible method for the generation of electricity for developing countries. Benetton's work, starting in the early 1980s, helped build an understanding of how fuel cells operate, and he was seen by many as the topic's foremost authority. In May 2007, the University of Queensland, Australia completed a prototype MFC as a cooperative effort with Foster's Brewing. The prototype, a 10 L design, converted brewery wastewater into carbon dioxide, clean water and electricity.

II. NEED OF STUDY

It has been known for almost one hundred years that bacteria could generate electricity. But only in the past few years has this capability become more than a laboratory novelty. The microbial fuel cell (MFC) is a new form of renewable energy technology that can generate electricity from what would otherwise be considered waste. The reasons for this recent interest in using bacteria to generate electricity are a combination of the need for new sources of energy, discoveries about microbial physiology related to electron transport, and advancement of fuel cell technologies.

Microbial fuel cells produce electricity from organic matters. Unlike conventional fuel cells, MFCs have certain advantages like high energy-conversion efficiency and mild reaction conditions. In addition, a fuel cell's emissions are well below regulations. MFCs also use energy much more efficiently than standard combustion engines which are limited by the Carnot Cycle. In theory an MFC is capable of energy efficiency far beyond 50%. In fact, using the new microbial fuel cells, conversion of the energy to hydrogen is 8 times as high as conventional hydrogen production technologies. In an MFC, bacteria are separated from a terminal electron acceptor at the cathode so that the only means for respiration is to transfer electrons to the anode. An MFC is thus a bio-electrochemical system that derives electricity by mimicking bacterial interactions found in nature. Microorganisms catabolize compounds such as glucose, acetate, or wastewater. It is a device that converts chemical energy to electrical energy by the catalytic reaction of microorganisms.

III. AIM AND OBJECTIVE

AIM - To study the process of electricity generation from waste food by using Microbial Fuel Cell (MFC) and provide data for effective construction of MFC model.

OBJECTIVES - The major objectives of the project are:

- i. To study the working of Microbial Fuel Cells.
- ii. To study the various instrument required for construction of MFC.
- iii. To study the decomposition process such as aerobic and anaerobic.
- iv. To study specific literature available on MFCs and materials used in them to make an efficient MFC model.
- v. To derive conclusion based on the literature studied for MFCs.

PROPOSED MATERIAL AND METHODOLOGY

MFC is a promising technology for generation of electricity from organic substances. In our project we are using different research papers to study the working of Microbial fuel cell with different types of materials used for Electrode and Substrate also number of salt bridge used and impact of different salt concentration in the salt bridge on the electricity generated from Microbial fuel cell.

An MFC consist of 4 parts: the anode chamber, the cathode chamber, a salt bridge, and electric circuit. Multi-meter used for measuring the current.

The proposed methodology for this project work is given below:

- The research papers required for the study of Microbial fuel cell will be collected from the internet.



- The shortlisted research papers will be studied to understand the functioning of Microbial fuel cell in which different materials are used for electricity generation.
- The graphs representing the amount of Electricity generated from Microbial fuel cell will be used to show the results.
- Based on the above study, project report will be prepared for submission work which will include the details of above study including result, discussion, and final conclusion.

III. LITERATURE REVIEW

Literature review of relevant literature published earlier, technical papers by various agencies is carried out. In this literature review attention is given study of microbial fuel cell on food waste for generation of electricity. The purpose of this literature review is getting an overview of new microbial fuel cell technology by used of food waste and to know various research studies to efficient and economical use of microbial fuel cell to achieve this purpose, study results given by various authors are mentioned here in this literature review.

3.1.1- A state of art review on microbial fuel cells: a promising technology for wastewater treatment bioenergy

The authors Zuweid, Hourani, Tingyu Gu (2007) stated that it has been known for many years that it is possible to generate electricity directly by using bacteria to break down organic substrates. The recent energy crisis has reinvigorated interests in MFCs among academic researchers as a way to generate electric power or hydrogen from biomass without a net carbon emission into the ecosystem .The paper includes Introduction about MFCs and the chemical reaction involved in it ,history of Microbial fuel cell development ,Microbes used in Microbial fuel cells Design of Microbial Fuel Cells Performances of Microbial Fuel cells Effects of operating conditions Effects of electrode pH buffer and electrolyte Proton exchange system Operating conditions in anodic and cathodic chambers, Applications{ 1.Electricity generation : MFCs are capable of converting chemical energy stored in chemical compounds in a biomass to electrical energy with the aid of microorganisms. The MFC technology has to compete with the mature methanogenic anaerobic digestion technology that has seen wide commercial applications because they can utilize the same biomass in many cases for energy productions.

3.1.2- Electricity generation from food wastes and microbial community structure in microbial fuel cells

The authors Jeanna Jia, Yu Tang, Bing Feng Liu, et.al(2013) stated that Microbial fuel cell (MFC) was studied as an alternate and a novel way to dispose food wastes (FWs) in a waste-to-energy form. Different organic loading rate obviously affected the performance of MFCs fed with FWs. The maximum power density of 18 W/m³ (556 MW/m²) was obtained at COD of 3200 = 400 mg/L and the maximum coulombic efficiency (CE) was 27.0% at COD of 4900 350 mg/L. The maximum removals of COD, total carbohydrate (TC) and total nitrogen (TN) were 86.4%, 95.9% and 16.1%, respectively.

MFC configuration and operation -

Single-chamber air cathode MFCs with liquid volume of 28 ml (cylindrical chamber with a length of 4 cm and a diameter of 3 cm) were constructed as previous description. Cathodes (carbon cloth based) with area of 7 cm², Pt catalyst and three diffusion layers were prepared as previously described (Cheng et al., 2006). Anodes were made of brushes (length and outer diameter are both 2.5 cm) consisting of graphite fibres and a titanium core. The volume of liquid media was about 22 ml due to the occupation by the brush anode. Six MFCs were randomly divided into three groups, which meant each test was carried out in duplicate.

IV. METHODOLOGY

STUDY OF MICROBIAL FUEL CELL BY USING WASTE FOOD

4.1 FOOD WASTE AND ITS TYPES

Food waste or food loss is food that is not eaten. The causes of food waste or loss are numerous and occur throughout the food system, during production, processing, distribution, retail, and consumption. Global food loss and waste amount to between one-third and one-half of all food produced. In low-income countries, most loss occurs during production, while in developed countries much food – about 100 kilograms (220 lb.) per person per year – is wasted at the consumption stage.



- The various types of Food Wastes are as follows

4.1.1 Production food waste

They usually take place due to destruction caused by predator or insects or from natural disaster, ill managed government programs encouraging farmers to produce certain foods in excess, farmers aligning to selective harvesting, or inability to harvest anything because of bad crop yields or reduced market rates. Different kinds of food waste also occur at the farms during storage caused either by pest or food decay.

4.1.2 Processing food waste

Food processing wastes prime contributing factors include ineffectual processing methods for removal of edible and inedible parts of food and spillage. Also, in developed western counties large portion of processing wastes are accounted for in the inedible parts of food namely bones, skins, eyes, peels, blood and other low quality minuscule products.

In practice, the wastes generated from food processing industry have the below indicated distinct qualities:

Higher number of proteins, carbohydrates, and lipids.

Distinct quantity of suspended solids largely dependent on the source

High amount of chemical or biochemical oxygen demand.

4.1.3 Distribution food waste

These food waste categories are due to inefficient handling of food, during food packing, conveyance, overstocking of certain food stocks, and improper stock cycle. Also, larger portion of food service waste arises due to plate leftovers, significant food service waste comes from plate scraps, which in some countries are not retrieved due to food safety because of food safety criteria and larger food portion sizes

4.1.4 Consumer food waste

They occur during food acquisition, preparation, and consumption. Improper or extended storage is a pivotal cause of consumer food waste. During preparation, consumers may try to remove inedible or defective portions of foods along with edible portions such as skins to obtain desired sensory or nutritional qualities. Remnant foods may be fed to pets, decreasing the amount of unutilized food but also reducing availability of foods for humans. The availability of cheap food, particularly in industrialized nations, encourages buying in excess and stockpile habits that result in waste.

Various types of vegetables, fruits, coffee filters, eggshells, newspaper, meat, food grains, bread, dairy produce etc. can be composted. Food waste has distinctive properties as a raw compost agent. Also, as they have increased moisture contents and reduced physical structure, it becomes imperative to blend fresh food waste with a bulking agent that will absorb part of surplus moisture and in turn augment structure to the mixture. Typically, sawdust, yard waste are preferred choices of bulking agents due to their high C: N ratio.

4.2 CAUSES OF FOOD WASTE

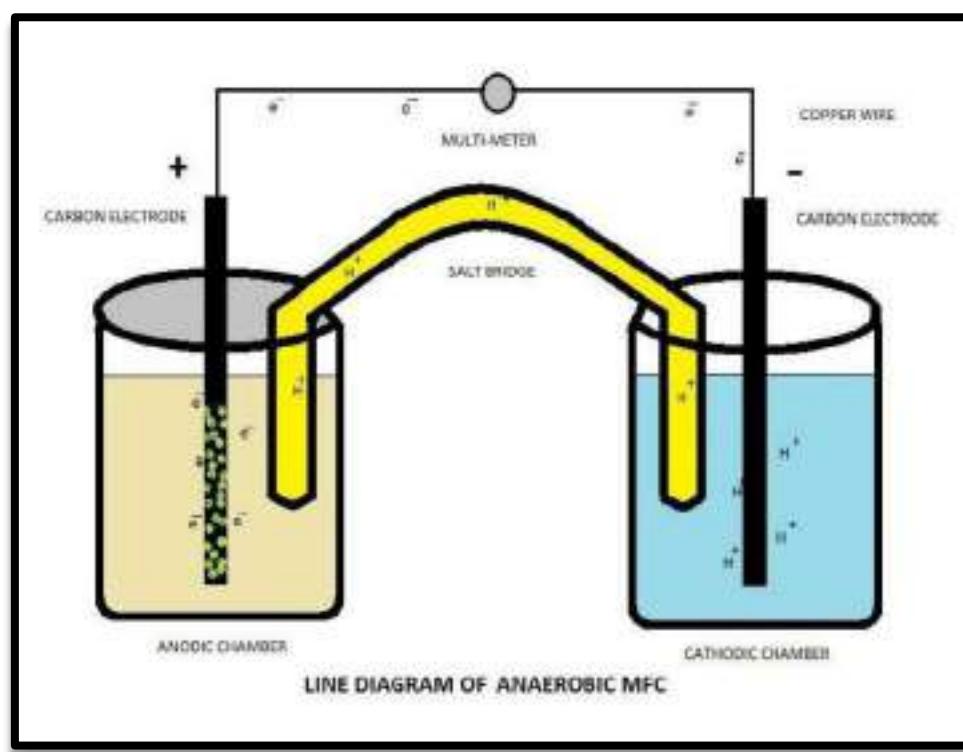
- Lack of appropriate planning: one of the top contributors to food wastage is because of appropriate planning on the consumer part. Sometime people buy lots of food without making plans on when and how the food will be prepared for consumption.
- Purchase and preparation of too much food: most of the time food is also wasted because of purchasing or preparing too many foods.
- Over preparation of food in restaurants, hotels and the foods service industry.



Figure 3.1 Causes of Food Waste

4.3 DECOMPOSITION PROCESS OF FOOD WASTE

- **Aerobic process:** Aerobic decomposition process is most common in nature. In aerobic composting, aerobic organisms utilize considerable amount of oxygen in decomposing organic matter. In aerobic process, when microorganisms consume a substance such as sugar in aerobic condition, they produce carbon dioxide and water.
- **Anaerobic process:** This process is done in the absence of oxygen. It is the process by which micro-organisms breaks down biodegradable materials in the absence of oxygen. The process is used for industrial or domestic purpose to manage waste or to produce fuel from research, anaerobic process gives more power or current as compared to aerobic process. In anaerobic process when microorganisms consume a substance, they produce carbon-dioxide, hydrogen ions and electrons.





V. CONCLUSION

From this study we conclude that,

1. The working of Microbial fuel cell was studied, and the various instruments required in its construction were also studied.
2. When the number of salt bridge in the model of Microbial fuel cell is 8, maximum current of 1675 micro amperes was obtained which was more than that when the number of salt bridges is less than 8. Therefore, the number of salt bridge used also plays a significant role in electricity generation.
3. Different combinations of electrodes were used, and it was found that Cu/Zn (Copper/Zinc) combination gave the best and consistent results.
4. Acetate as a substrate was the most preferential for the generation of electricity with the highest CE (Coulombic Efficiency). The glucose-fed-MFC generated the lowest CE and greatest PD (Potential Difference) among the substrates used in the study.
5. With the increase in molar concentration of salt in the salt bridge, the current decreases. Optimum results were obtained for salt bridge fabricated using 1M KCl and NaCl. It produced a maximum voltage 0.451 V and 0.372 V respectively.
6. When waste food is used in the MFC, the voltage rapidly increased to higher than 0.54V in 6 h, and then remained stable at an average voltage of 0.51 V until the 116th hour when the voltage began to dramatically decrease. The voltage and power outputs achieved by using Waste Food as substrate is lower than MFCs fed with simple substrates like glucose and acetate but is

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Design of Rigid Pavement by Using Geosynthetic Materials (Polypropylene Fibre)

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ABSTRACT: Geosynthetics have been used to reinforce the base layer of rigid pavement systems for the past thirty years. However, and in spite of the good field evidence that geosynthetic reinforcements can improve pavement performance, the specific conditions or mechanisms that enable and govern the reinforcement function are, at best, unclear as they have remained largely unmeasured. Overall, the selection of design parameters for geosynthetics has been complicated by the difficulty in associating their relevant properties to the improved pavement performance. Field evidences indicate that geosynthetic reinforcements can improve pavement performance. Yet, the specific conditions or mechanisms that enable and govern the reinforcement function are, at best, unclear as they have remained largely unmeasured.

Significant research has been recently conducted with the objectives of:

- Determining the governing mechanisms and relevant properties of geosynthetics that contribute to the enhanced performance of pavement systems,
- Developing appropriate analytical, laboratory and field methods capable of quantifying the above properties for geosynthetics, and
- Enabling the prediction of pavement performance depending on the various types of geosynthetics used.

In this paper Polypropylene Fiber (.50%,1%,2%,6%,8%12%) adding with concrete for experimental study. For polypropylene - The capability of durable structure to resist weathering action, chemical attack, abrasion and other degradation processes during its service life with the minimal maintenance is equally important as the capacity of a structure to resist the loads applied on it. Although concrete offers many advantages regarding mechanical characteristics and economic aspects of the construction, the brittle behavior of the material remains a larger handicap for the seismic and other applications where flexible behavior is essentially required.

KEYWORDS- Geosynthetic Materials, Rigid Pavement, Polypropylene Fiber

I. INTRODUCTION

Geosynthetics have been widely used to serve a variety of roles that greatly lead to roadways performing well. These provide isolation, filtration, stabilization, stiffening, drainage, barrier, and safety functions. Any or more of these different features is used in at least six major roadway applications. The applications include migration of reflective cracking in asphalt overlays, isolation, road base stabilization, ground soft subgrade stabilization, and lateral drainage. The American Society for Testing and Materials (ASTM) Committee D35 on geosynthetics has described geosynthetics as planar products made from polymeric materials used with materials related to soil, rock, earth, or other geotechnical engineering as an integral part of a man-made project, structure, or system. Geosynthetics is the term used to describe a variety of polymeric materials used in construction of civil engineering works. The concept is commonly considered to cover eight major categories of goods. These include geotextiles, geogrids, geonets, geomembrane, liners of geosynthetic mud, geofoam, geocells, and geocomposite. The geotextiles and geomembrane are the most common geosynthetics employed. The ASTM (1994) describes geotextiles as permeable textile materials used as an integral part of a civil engineering project, structure, or device in contact with soil, rock, earth, or any other geotechnical substance. Geomembrane is an inherently impermeable membrane, in the shape of a sheet that is commonly used as cut-offs and

liners. These are also used to landfill lineups. Geotextiles, as permeable textile materials, are used as an integral part of a civil engineering project, structure or system in contact with soil, rock, earth or any other associated geotechnical material.

Geosynthetic Advantages:

Geosynthetics, including geotextiles, geomembranes, geonets, geogrids, geocomposites and geosynthetic clay liners, often used in combination with conventional materials, offer the following advantages over traditional materials:

- Space Savings - Sheet-like, geosynthetics take up much less space in a landfill than do comparable soil and aggregate layers.
- Material Quality Control - Soil and aggregate are generally heterogeneous materials that may vary significantly across a site or borrow area. Geosynthetics on the other hand are relatively homogeneous because they are manufactured under tightly controlled conditions in a factory. They undergo rigorous quality control to minimize material variation.
- Construction Quality Control - Geosynthetics are manufactured and often factory "prefabricated" into large sheets. This minimizes the required number of field connections, or seams. Both factory and field seams are made and tested by trained technicians. Conversely, soil and aggregate layers are constructed in place and are subject to variations caused by weather, handling and placement.
- Cost Savings - Geosynthetic materials are generally less costly to purchase, transport and install than soils and aggregates.
- Technical Superiority - Geosynthetics have been engineered for optimal performance in the desired application.
- Construction Timing - Geosynthetics can be installed quickly, providing the flexibility to construct during short construction seasons, breaks in inclement weather, or without the need to demobilize and remobilize the earthwork contractor.
- Material Deployment - Layers of geosynthetics are deployed sequentially, but with a minimum of stagger between layers, allowing a single crew to efficiently deploy multiple geosynthetic layers.
- Material Availability - Numerous suppliers of most geosynthetics and ease of shipping insure competitive pricing and ready availability of materials.
- Environmental Sensitivity – Geosynthetic systems reduce the use of natural resources and the environmental damage associated quarrying, trucking, and other material handling activities.

Plain concrete possess a very low tensile strength, limited ductility, and little resistance to cracking. Internal micro cracks are inherently present in the concrete and its poor tensile strength is due to the propagation of such micro cracks, eventually leading to brittle failure of the concrete. The most widely accepted remedy to this flexural weakness of concrete is the conventional reinforcement with high strength steel. Restraining techniques are also used to. Although these methods provide tensile strength to members, they however do not increase the inherent tensile strength of concrete itself. Also the reinforcement placing and efficient compaction of RCC is very difficult if the concrete is of low workable especially in the case of heavy concrete.

In plain concrete and similar brittle materials, structural cracks (micro-cracks) develop even before loading, particularly due to drying shrinkage or other causes of volume change. The width of these cracks seldom exceeds a few microns, but their two dimensions may be of higher magnitude. When loaded, the micro cracks propagate and open up, and owing to the effects of stress concentration, additional cracks form in places of minor defects. The development of such micro crack is the main cause of inelastic deformation in concrete. It has been recognized that the addition of small, closely spaced and uniformly dispersed geo-fibres to concrete would act as crack arrester and would substantially improve its and dynamic properties. This type of concrete is known as fibre reinforced concrete. Polypropylene fiber's do the same effect and perform better than any other fiber's.

Polypropylene Reinforced Concrete can be define as a composite material consisting of mixtures of cement, mortar or concrete and discontinuous, discrete, uniformly dispersed geo-fibres. Fiber reinforced concrete is concrete containing fibrous material which increases its structural integrity. It contains short discrete fibers that are uniformly distributed and randomly oriented. Fibres include steel fibres, glass fibres, synthetic fibres and natural fibres. Within these different fibres the character of fibre reinforced concrete changes with varying concretes fiber materials, geometries, distribution, orientation and densities. It is true that plain cement concrete possess a very low tensile strength.

II. LITERATURE REVIEW

2.1 POLYMER CONCRETES: A DESCRIPTION AND METHODS FOR MODIFICATION AND IMPROVEMENT

G. Martínez Barrera, Vigueras-Santiago, Gencel and H.E. HaggLobland (2011)

Portland cement concrete (PCC) has been successful in many applications. However, since the 1960s technological investigations concerning modifications of concrete by polymeric materials have been conducted. Attention has been focused on concretes in which the continuous phase is some kind of polymeric resin and the discrete phase is some type of mineral aggregate. Such composite materials are known as Polymer concrete (PCt) and boast several advantages such as higher strength and a shorter curing process. In spite of these advantages, there are deficiencies that could be addressed by fiber incorporation into PCts, however this kind of approach is not typical. Here we acquaint readers with the nature of polymer concretes as these materials have not yet gained wide recognition. We describe recent developments regarding the influence of fiber reinforcements on PCts. The curing process is a critical concern in dealing with polymer concretes as it is with Portland cement concrete. Studies on the effects of gamma ionizing radiation on the curing process and on final properties of PCts are ongoing. Developments in this area are also described here. In particular, the effects of gamma irradiation on the mechanical properties are discussed. Notably, improvements of the Young's modulus E described here have wider implications and may be indicative of improvements or modifications to other properties not directly tested. Specifically, the modifications to the Young's modulus can be a defining measure of whether one will obtain a ductile or more brittle concrete.

Conclusion:

The objective of this report has been to describe the special characteristics of polymer concretes (PCt) as well as the role of how additives and processing can enhance PCt properties. In that regard we have discussed fiber reinforcement of PCts, and especially the effects of gamma irradiation on the curing process. It has been shown that combining fiber reinforcements and the matrix curing effects of irradiation can provide significant improvements to the properties of PCt. It is hoped that further studies into developments of PCt properties and applications may find this overview a useful resource.

2.2 PERFORMANCE OF GLASS FIBER REINFORCED CONCRETE

Yogesh Iyer Murthy, Apoorv Sharda, Gourav Jain (2012)

In the present investigation, the compressive strength, flexural strength and workability of concrete containing varying proportions of glass fiber as replacement of fine aggregate is studied. The result of these parameters is compared to those of standard M30 grade concrete. The increase in compressive strength is nominal while the flexural strength increased significantly as expected with the increase in percentage of glass fiber. Also, significant reduction in the slump value of the glass fiber reinforced concrete was observed with increase in glass fiber content. The preliminary investigations reveal that the use of this industrial waste is not only improving the properties of concrete but also provides a safe and efficient means of disposal of such non-biodegradable wastes.

Conclusion:

The present research work deals with the use of glass fiber in concrete which is obtained from the glass industry as a waste product. The work is in nascent stage but is promising, as the preliminary results satisfy the basic needs which the alternate material should fulfill in concrete. Though, as expected, the compressive strength of concrete did not increase much, the flexural strength showed almost 30% increase in strength compared to the beam with 0% fibers. The slump value decreased with increase in fiber content. The reasons for these behaviours are discussed. Thus, it can be concluded that the use of fiber glass in concrete, not only improves the properties of concrete and can do a small cost cutting, but also provides an easy outlet of the efficient disposal of this environmental hazard.

2.3 MECHANICAL PROPERTIES OF POLYPROPYLENE FIBRE REINFORCED CONCRETE FOR M 25 & M 30 MIXES: A COMPARATIVE STUDY

Saman Khan, Roohul Abad Khan, Amadur Rahman Khan, Misbahul Islam Saman Nayal (2015)

This paper represents comparative experimental study on mechanical performance of polypropylene fibre reinforced concrete (PFRC) under compression and split tensile loading. The cube compressive strength and cylinder split tensile strength of conventional concrete and polypropylene fibre reinforced concrete were determined in the laboratory. The M25 and M30 grades of concrete mixes and polypropylene mono-filament macro-fibres of length 35 mm at volume fractions of 0.0%, 0.5%, 1.0%, 1.5%, 2.0%, 2.5% and 3.0% were used in the research. All specimens were tested at curing age of 28 days. In this paper the relationship between cube compressive strength and cylinder split tensile strength for conventional and polypropylene fibre reinforced concrete were established and compared with standards. The study suggested the significant improvement in compressive and tensile strength for concrete mixes reinforced with polypropylene fibres. The samples with added polypropylene fibres of 1% and 1.5% showed better results in comparison with the others.

Conclusion:

Inter comparison of compressive strength and tensile strength with fibre the maximum strength is achieved in M20 mix.

- So on an average to gain maximum compressive and tensile strength with mono-filament macro fibre the optimum dosage be limited 1% to 1.5%, after further increase these strength properties decreases.
- The comparison of compressive strength concludes that with increase in cement content the strength gain due to percentage of fibre decreases.
- The increase in cement content with increased percentage of fibre caused loss of strength even greater.
- So we can say that the increased compressive strength due to fibre percentage is due to fibre and aggregate bonding and not due to cement paste bonding. The fibres are acting as anchors between the cement paste and the fine and coarse aggregates which results in increased durability of concrete before failure.

2.4 A REVIEW ON EFFECT OF FIBER REINFORCED CONCRETE ON RIGID PAVEMENT

Ms. Amreen N. Ali, Mr. Milind. V. Mohod (2015)

Road transportation is undoubtedly the lifeline of the nation and its development is a crucial concern. In recent years, cement concrete pavements are being adopted in many new road projects in India in view of their longer service lives, lesser maintenance requirements and smoother riding surface. This paper presents a comprehensive review on work done on fiber reinforced concrete pavement using polypropylene, steel, hybrid and glass fibers. Polymer fiber reinforced concrete pavement is a recent advancement in the field of reinforced concrete pavement design. Polymer fiber reinforced concrete pavements are more efficient than ordinary cement concrete pavements. Various issues and behavior of fiber reinforced concrete in pavement are also discussed.

Conclusion:

- 1} Steel fiber reinforced concrete with 2% steel fibres yields slightly more stress as compared to 1% & 3% steel fibre reinforced concrete for both Positive curling temperature gradient & negative curling temperature gradient.
- 2} The increment in stresses for SFRC lies in the range of 20-41% when compared with those of conventional concrete.
- 3} Frictional stresses in steel fibre reinforced concrete pavements are almost similar to the stresses obtained for conventional concrete pavements.
- 4} The increased diameter and reduced stiffness of the GFRP dowels results in lower bearing stresses between the concrete and dowel, which are major causes of dowel looseness and slab faulting.
- 5} Hybrid fibers improve the compressive strength marginally as compared to mono fibers. Hybridization also improves split tensile strength and flexural noticeably.
- 6} Fibrillated fibre is more effective in reducing the settlement of concrete than multifilament fiber. However, it has lesser effect on slump reduction than multifilament fiber at the same fiber content.
- 7} Polypropylene fibers reduce the water permeability, plastic, shrinkage and settlement and carbonation depth.

2.5 DIAGNOSING PERFORMANCE OF POLYPROPYLENE FIBRE IN CONCRETE MIX DESIGN FOR RIGID PAVEMENT

Gopi J. Sutaria, Prof.C.B.Mishra, Prof.N.F.Umrigar (2015)

India has a road system of more than 4.87 kilometers according to MoRTH, Techsci Research July 2015 and the second biggest road system on the planet. Development of Road and Highways are the foundation of infrastructure improvement upgrading the vital main thrust to accomplish quick and supported economic growth in the changing technological innovation. It is undoubtedly the lifeline of the nation which is a never ending process activity in India. Because of rising oil costs and a more tightly monetary environment, cement is turning into a more alluring choice for base venture comprehensively contrasted with conventional bituminous asphalts. The Ministry of Road Transport and Highways in India noticed that advanced society can't work adequately without concrete roads. Cement has a few deficiencies as low tensile strength, limited fatigue life and is characterized by brittle failure resulting in nearly complete loss of loading capacity, once failure is initiated. This paper manages exploratory examination on mechanical properties of M35 grade concrete by adding polypropylene fibers in the blend at measurements of 0.6 %, 0.8% and 1.0% by weight of cement added to the mix. A comparative analysis has been carried out for conventional concrete to that of the fiber reinforced in relation to compressive and flexural strength.

Conclusion:

PFRC can be used advantageously over normal concrete pavement. Polymeric fibers such as polypropylene are being utilized because of their This study has been made to focus the impact of polypropylene fibers in suitable measurements on strength of concrete. The research facility examinations gave the accompanying conclusions: Up to 0.6% including of concrete with polypropylene fiber 12 mm length there is ideal rate to increment in the improved compressive strength and flexural strength which will allow lessening of slab thickness in wearing surface of cement concrete pavements and because of higher flexural strength prompts less material use. This will further prompt reserve funds in material and work cost by taking out traditional support. A consequence of 0.8% and 1.0% demonstrates that compressive and flexural strength declines.

III. PROPOSED METHODOLOGY

3.1 MATERIALS USED

3.1.1 POLYPROPYLENE FIBRE

Polypropylene fibre was first used to reinforce concrete in the 1960s. Polypropylene is a synthetic hydrocarbon polymer, the fibre which is made using extrusion processes by hot-drawing the material through a die. Polypropylene fibres are produced as continuous mono-filaments, with circular cross section that can be chopped to required lengths, or fibrillated films tapes of rectangular cross section. Polypropylene fibres are hydrophobic and therefore have the disadvantages of poor bond characteristics with cement matrix, a low melting point, high combustibility and a relatively low modulus of elasticity. Long polypropylene fibres can prove difficult to mix due to their flexibility and tendency to wrap around the leading edges of mixer blades.

Polypropylene fibres are tough but have low tensile strength and modulus of elasticity; they have a plastic stress-strain characteristic. Monofilament polypropylene fibres have inherent weak bond with the cement matrix because of their relatively small specific area. Fibrillated polypropylene fibres are slit and expanded into an open network thus offering a larger specific surface area with improved bond characteristics. Polypropylene fibre contents up to 12% by volume are claimed to have been used successfully with hand-packing fabrication techniques, but volumes of 0.1% of 50 mm fibre in concrete have been reported to have caused a slump loss of 75 mm. Polypropylene fibres have been reported to reduce unrestrained plastic and drying shrinkage of concrete at fibre contents of 0.1 to 0.3% by volume. Polypropylene Micro Fibre was procured from Bajaj Reinforcement Nagpur and was used in the present study. Specifically engineered and manufactured ISO 9001-2000 certified facility for use as concrete reinforcement at the recommended dosage rate of 1 kg per cubic meter for effective performance.



(Fig.3.1: Polypropylene Micro Fibre)

Table 3.1 : Chemical and Physical Properties of Polypropylene Micro Fibre
(Bajaj Reinforcement Nagpur)

Characteristic	Material Properties	Characteristic	Material Properties
Fibre Length	20 mm	Type/Shape	Monofilament Fibre
Absorption	Nil	Diameter	30 micron
Specific Gravity	0.90	Thermal Conductivity	Low
Tensile strength	4.5 kgf	Melt Point	162 ° C (324 ° F)
Acid and Salt Resistance	High	Electrical Conductivity	Low

3.2 PREPARTION OF MOULDS

3.2.1 MIX CALCULATIONS

Examples of concrete mix proportioning

For M20 Grade concrete

A-1 Design stipulations for proportioning

- a) Grade designation : M20 (1:1.5:3)
- b) Type of cement : PPC (J K Laxmi)
- c) Maximum nominal size of aggregates : 20 mm
- d) Minimum cement content : 300 kg/m³
- e) Maximum water cement ratio : 0.4

f) Workability	: 100 mm (slump)
g) Exposure condition	: Severe (for reinforced concrete)
h) Degree of supervision	: Good
i) Type of aggregate	: Crushed angular aggregate
j) Maximum cement content	: 450 kg/m ³

3.2.2 TEST DATA FOR MATERIALS

a) Cement used	: PPC (J K Laxmi)
b) Specific gravity of cement	: 3.15
d) Specific gravity of Coarse aggregate	: 2.74
Fine aggregate	: 2.74
e) Water absorption Coarse aggregate	: 0.5 percent
Fine aggregate	: 1.0 percent
f) Free (surface) moisture Coarse aggregate	: Nil (absorbed moisture also nil)
Fine aggregate	: Nil
g) Sieve analysis Coarse aggregate	: Conforming to Table 2 of IS: 383
Fine aggregate	: Conforming to Zone I of IS: 383

Calculation for M20 (1:1.5:3)

1. Volume of Mould = $150 \times 150 \times 150 \text{ mm}^3$
 $= 3375000 \text{ mm}^3$
 $= 0.003375 \text{ m}^3$
2. Volume of Cement = $300 \text{ kg/m}^3 \times 0.003375 \text{ m}^3$
 $= 1.0125 \text{ kg}$
3. Volume of sand = $450 \text{ kg/m}^3 \times 0.003375 \text{ m}^3$
 $= 1.519 \text{ kg}$
4. Volume of Aggregate = $900 \text{ kg/m}^3 \times 0.003375 \text{ m}^3$
 $= 3.0375 \text{ kg}$
Volume of water = $120 \text{ kg/m}^3 \times 0.003375 \text{ m}^3 = 0.405 \text{ kg}$

Calculation for 3 moulds

1. Volume of Cement = $3 \times 1.0125 \text{ kg}$
 $= 3.0375 \text{ kg}$
2. Volume of sand = $3 \times 1.519 \text{ kg}$
 $= 4.557 \text{ kg}$
3. Volume of Aggregate = $3 \times 3.0375 \text{ kg} = 9.112 \text{ kg}$
4. Volume of water = $3 \times 0.405 \text{ kg}$
 $= 1.215 \text{ kg}$

3.2.3 PROCEDURE OF CASTING CUBES

We tried to check the **Compression test** by preparing test cubes from the freshly prepared concrete of partially replacement of cement with marble powder. We carried out different tests using different percentage of polypropylene fibre they are as follows 0.5%, 1%, 2%, 6%, 8%, 12%.

The method of compression strength of concrete cubes:

- The cube moulds are made for specimen size 15 x 15 x 15 cm.
- The metal moulds can be assembled and taken apart by bolting or unbolting.
- The concrete is hand compacted and then machine compacted.

- The specimens are covered with wet gunny bags for 24 hours and the immersed in curing tank containing fresh, clean water.
- These are kept in water for 7, 14 and 28 days and then taken out and tested under compression testing machine.
- The failure load divided by cross sectional area, i.e. 225 cm^2 gives the ultimate compression strength of the cubes.
- Two cubes each of 7, 14 and 28 days curing are tested and can give a good idea about the rate of increase of strength.
- Pozzolana Portland cement concrete shows about 70% strength gain in the first 7 days and remaining gain in the days thereafter.
- Thus from the 7, 14 and 28 days tests the pattern of strength acquiring can be studied and we modified that if needed.
- The co-relation of test result is done by testing on 3 specimens at each curing period.
- We compute the durability, impermeability and other characteristics from the test results.

3.3 COMPRSSIVE STRENGTH TEST ON MOULDS

3.3.1 COMPRESSIVE STRENGTH

Concrete is a construction material which has always been meant to resist compressive stresses most efficiently. Hence unless or otherwise mentioned, the strength of concrete means Compressive strength.

The tensile strength of concrete is the very less and this drawback is over by combining steel rod with concrete.

The compressive strength depends upon a number of factors, in addition to the main factor which is water- cement ratio, these are:

1. Type of cement and its quality.
 2. Texture of aggregates.
 3. Curing.
 4. Temperature at which the concrete is hardened.
 5. Time of hardening.
- The compressive stress is tested by casting cubes of concrete of concrete of 15 cm side, in standard cube moulds.
 - Strength at 3 days, 7days, 14 days and 28 days are tested.
 - The 28 days strength gives the compressive strength of the concrete. 3days, 7days & 14 days strength indicate the rate of hardening or gaining strength and can be useful in deciding the removal of formwork.

The method of compression strength test of concrete cubes:

- This test is carried out by preparing test cubes from the freshly prepared concrete.
- The cube moulds are made for specimen size $150 \times 150 \times 150 \text{ mm}$.
- The metal moulds can be assembled and taken apart by bolting or unbolting.
- The concrete is hand compacted and then vibration machine compacted.
- The specimens are covered with wet gunny bags for 24 hours and the immersed in curing tank containing fresh, clean water.
- These are kept in water for 3, 7, 14 and 28 days and then taken out and tested under compression testing machine. i.e. Compression Testing Machine or Universal Testing Machine.
- The failure load divided by cross sectional area, i.e. 225 cm^2 gives the ultimate compression strength of the cubes.
- Two cubes each of 3, 7, 14 and 28 days curing are tested and can give a good idea about the rate of increase of strength.
- Portland cement concrete shows about 70% strength gain in the first 7 days and remaining gain in the days thereafter.

- Thus from the 3, 7, 14 and 28 days tests the pattern of strength acquiring can be studied and we modified that if needed.
- The co-relation of test result is done by testing on 3 specimens at each curing period. We compute the durability, impermeability and other characteristics from the test results.

3.4 Testing of Concrete Cube

The following figures show the experimental setup and failure pattern of the concrete cubes. The figure shows the failure patterns of cube after 28 days, as the maximum strength of concrete is developed at 28 days as per IS 456:2000.

Specimen (Cube)



(Fig.3.2: Experimental Setup of the Conventional Concrete Cube)

Cracks Pattern



(Fig.3.3: Conventional Concrete Cube with cracks during testing)

Fig. shows the conventional concrete at the age of 28 Days curing. The cracks developed by applying the load of 600 KN. Cracks developed in inclined pattern but near to the centre of the cube because the cracks appear in the centre due to the zero percent of fibre used, the crack patterns shown in figure.



(Fig.3.4: Experimental Setup of concrete Cube M20 (1% Polypropylene in Concrete))

Fig shows the M20 concrete at the age of 28 days curing. The cracks developed by applying the load of 600 KN. The failure pattern of concrete after applying the load is seen at outer face of the cube because Polypropylene Micro fibre is not completely homogeneous mix with concrete it is separate while mixing due to this it create cracks on corner of the cube the cracks pattern are as shown in figures.



(Fig.3.5: Experimental Setup of concrete Cube M20 (1% of Fibre))

Figure shows the M20 concrete at the age of 28 days curing. The cracks developed by applying the load of 660 KN. The failure pattern of concrete after applying the load is seen at outer face of the cube because polypropylene macro fibre not completely homogeneous mix with concrete it separate while mixing due to balling of fibre and its low density, so it create cracks on outer face of the cube the cracks pattern are shown in figure.



(Fig.3.6 : Experimental Setup of concrete Cube M20 (0.5% Polypropylene Micro Fibre))

Cracks Pattern



(Fig.3.7: concrete Cube with cracks after testing)

Figure shows the M20 concrete at the age of 28 days curing. The cracks developed by applying the load of 660 KN. The failure pattern after applying the load is seen at outer face of the cube in inclined line and very fine crack because Polypropylene Micro Fibre mix completely and make homogeneous mix with concrete it do not separate while mixing due to use of 0.5% Polypropylene Micro Fibre and 0.5% of Polypropylene Micro fibre due to availability of both fibre the bonding of fibre with concrete is very good. The cracks patterns are shown in figure.



(Fig.3.8 : M20 Concrete Cube with cracks after testing)

Figure shows the M20 concrete at the age of 28 days curing. The cracks developed by applying the load of upto 660KN. The failure pattern after applying the load is seen at outer face of the cube because polypropylene micro fibre not completely homogeneous mixes with concrete. The cracks pattern appears on the face of the cube the macro cracks are seen and micro cracks are very much reduce due use of 0.5% polypropylene micro fibre the cracks pattern are as shown in figure.

IV. RESULTS AND DISCUSSION

4.1 General

In this chapter the experimental results of all the cubes, with conventional concrete compared with Hybrid Fibre Reinforced Concrete (HFRC) are interpreted. Their behaviour throughout the test is described using recorded data on test, compressive test. Cubes, were tested for 7 days of curing and cubes, were tested for 28 days curing. The cubes cured in water tank for the period of 7 days and 28 days, the results compared between conventional concrete, individual fibre concrete and HFRC.

4.2 Concrete Strength

Here the strength of cubes, at different fibres were analysed. Compressive strength, Tensile Strength of each cube are compared with conventional concrete and Individual Fibre and Different Fibre mix proportion. For calculation of compressive strength of concrete the compressive testing machine was use.

4.3 Compressive Strength of Concrete

Compressive strength of concrete, out of many test applied to the concrete, this is theutmost important which gives an idea about all the characteristics of concrete. By this single test one judge that whether concreting done properly or not. For testing of concrete cubical moulds of size 150 mm x 150 mm x 150 mm are commonly used. Results of all specimens which are tested for Compressive strength are presented in the table.

Table 4.1: COMPRESSIVE TEST

Crushing strength in 28 days	0.5%	1%	2%	6%	8%	12%	Plain M20
7 days	445KN	481KN	505KN	515KN	410KN	200KN	280KN
14 days	590KN	560KN	590KN	265KN	400KN	200KN	290KN
28 days	660KN	600KN	610KN	240KN	410KN	260KN	480KN

V. CONCLUSION

From the experimental study it is observed that 0.5% and 1% of polypropylene fibre used with replacement of cement gives better result than Normal Plain Cement concrete. But as the ratio increased to 6% to 12% and above the result decreases and it is found to be very low range as compared to Normal Plain Cement Concrete, 0.5% and 1%. So it is concluded that polypropylene fibre can be used as a partial replacement with Cement only up to 2%.

So alternatively we may propose to replace some percentage of cement with polypropylene fibre. So that we may reduce the usage of cement and at the same time we may utilize the waste material for the building industry itself, by utilizing this waste materials we are also reducing environmental pollution to some extent. The further investigations regarding the practical point of view will be continued in future on this project.

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Experimental Investigation on Replacement of Fine Aggregate with Manufactured Sand and Partial Replacement of Cement with (GGBS)

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ABSTRACT: One of the most widely used construction materials in civil engineering industry is concrete because of its high structural strength and stability. The concrete industry is looking for supplementary cementitious material or industrial by-product with the objective of reducing the carbon dioxide emission which is harmful to environment. Ground-granulated blast-furnace slag (GGBS), the solid wastes generated by industry, is used as a replacement material for cement. Manufactured sand is used to reduce the excessive natural sand consumption. This paper deals with the effective utilization of waste material in concrete production as a partial replacement for cement and partial replacement for sand. The cement has been replaced by GGBS in the range of 10%, 20% and 30% by the weight of cement for M15 and M20 grade mix. Workability test was carried out on fresh properties of concrete while the compressive strength was carried out on hardened concrete. It is found that the partial replacement of cement with GGBS and partial replacement of sand with manufactured sand helped in improving the strength of the concrete substantially compared to normal mix concrete. Compressive strength test was carried out for 7 & 14 days.

I.INTRODUCTION

One of the most widely used construction materials having high compressive strength is concrete. The ordinary Portland cement (OPC) is the main component for making concrete. Production of one ton of cement requires about two tons of raw materials of shale and limestone, and also releases large amount of carbon dioxide to the atmosphere that significantly contributes to greenhouse gas emissions. One method to reduce the carbon dioxide emissions of the concrete is the replacement of ground-granulated blast-furnace slag (GGBS), which is the by-product of the industrial waste used as supplementary cementitious material in concrete. The supplementary cementitious materials not only improve the mechanical properties of concrete but also reduce the cement consumption by replacing part of cement with these pozzolanic materials. Manufactured sand, produced from granite stone, has been used as an alternative to fine aggregate that 50% replaces the river sand which is far superior to river sand in all aspects. This project work is to determine the material properties of cement, GGBS, aggregates and manufactured sand, and to study about the mechanical and durability properties.

II.RELATED WORK

MATERIALS USED

FINE AGGREGATE

Fine aggregate (Sand) Fills voids between aggregates. It forms the bulk and makes mortar or concrete economical. It provides resistance against shrinking and cracking. It is naturally available. Fine aggregate conforms to the grading curve zone II with specific gravity 2.55, and a fineness modulus 2.1 was thus obtained as per IS 383-1970 specifications



FIG.1

COARSEAGGREGATE

Foreign materials in coarse aggregates such as coal, lignite, soft fragments and clay lumps should not exceed 5 per cent of its weight. Coarse aggregate 20 mm nominal size with specific gravity 2.66 and water absorption 0.5% conforming to IS:383-1970 specifications and tested as per IS 2386 standards.



FIG.2

MANUFACTURED SAND

M Sand is nothing but artificial sand made from crushing of rock or granite for construction purposes in cement or concrete. M sand differs from natural river sand in its physical and mineralogical properties. Nowadays, sources of natural sand such as river sand, pit sand, stream sand, sea sand and other sands for use as an aggregateconstruction are becoming scarce and exhausted due to environmentaldegradation. The driving need for alternative aggregates in construction has given the source to M Sand. Another cause for the use of M sand is its active availability, reducing transport distances and minimize pollution M Sand is a better substitute to river sand as it is produced by machines in proper proportion with particle size.

Greater Durability:-

The physical and chemical properties in M Sand are balanced and can withstand any harsh climatic conditions. It has the ability to overcome the defects in concrete like segregation, honeycombing, corrosion of reinforcement steel, voids, capillary, bleeding etc.

Higher Strength:-M Sand has smooth surface texture and free from elongated and flaky particles as it is shaped by using VSI shaping machine. The cubicle shaped particles provide greater durability, higher strength and long life to the concrete

Greater Workability:-The cubical shape and proper gradation (particle should be from 150 microns to 4.75 mm in proper proportion) give good flexibility to mortar producing excellent workability.

Reduce Construction Defects:-Use of M sand in concrete reduces voids, bleeding, segregation, etc. as it has optimal initial and final setting time with excellent fineness properties.

GROUNDGRANULATED BLAST-FURNACE SLAG:-The chemical composition of a slag varies considerably depending on the composition of the raw materials in the iron production process. Silicate and aluminate impurities from the ore and coke are combined in the blast furnace with a flux which lowers the viscosity of the slag. In the case of pig iron production the flux consists mostly of a mixture of limestone and forsterite or in some cases dolomite. In the blast furnace the slag floats on top of the iron and is decanted for separation. Slow cooling of slag melts results in an unreactive crystalline material consisting of an assemblage of Ca-Al-Mg silicates.

The main components of blast furnace slag are CaO (30-50%), SiO₂ (28-38%), Al₂O₃ (8-24%), and MgO (1-18%). In general increasing the CaO content of the slag results in raised slag basicity and an increase in compressive strength. The MgO and Al₂O₃ content show the same trend up to respectively 10-12% and 14%, beyond which no further improvement can be obtained. Several compositional ratios or so-called hydraulic indices have been used to correlate slag composition with hydraulic activity; the latter being mostly expressed as the binder compressive strength.

GGBS is the granular material formed when molten iron blast iron slag is rapidly chilled by immersion in water. It is a granular product with very limited crystal formation, is highly cementitious in nature and ground to cement fineness, and hydrates like OPC. The specific gravity of GGBS is 2.88.

PROPERTIES OF GGBS

Durability:-GGBS cement is routinely specified in concrete to provide protection against both sulfate attack and chloride attack. GGBS has now effectively replaced sulfate-resisting Portland cement (SRPC) on the market for sulfate resistance because of its superior performance and greatly reduced cost compared to SRPC. Most projects in [Dublin's Docklands](#), including [Spencer Dock](#), are using GGBS in subsurface concrete for sulfate resistance. Bulk Electrical Resistivity is a test method that can measure the resistivity of concrete samples. (ASTM 1876-19) The higher electrical resistivity can be an indication of higher ion transfer resistivity and thus higher durability. By replacing up to 50% GGBS in concrete, researchers have shown that durability can be significantly improved.

Strength:-Concrete containing GGBS cement has a higher ultimate strength than concrete made with Portland cement. It has a higher proportion of the strength-enhancing [calcium silicate hydrates](#) (CSH) than concrete made with Portland cement only, and a reduced content of free lime, which does not contribute to concrete strength. Concrete made with GGBS continues to gain strength over time, and has been shown to double its 28-day.

CEMENT:-Ordinary pozzolana cement conforming to IS 12269:53 was used and tested as per the Indian Standards IS 4031-1988. A cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cement is seldom used on its own, but rather to bind sand and gravel (aggregate) together.

WATER:-Portable water confirming to the requirements of IS 456-2000 specifications was used. Water is an important ingredient of concrete as it actively participates in chemical reaction with cement.

III.OBJECTIVES

The main objective of this experiment is to evaluate the mechanical properties of concrete made with manufactured sand as fine aggregate. Also 20% GGBS is replaced with cement and material properties, workability and compressive strength are studied in detail since to protect surplus natural river extraction.

Why Manufactured Sand Is Used?

- Manufactured sand is an alternative for river sand.
- Due to the fast growing construction industry, the demand for sand has increased tremendously, causing deficiency of suitable river sand in most parts of the world.
- Due to the depletion of good quality river sand for the use of construction, the use of manufactured sand has been increased.
- Another reason for the use of M-sand is its availability and transportation cost.

- Since this sand can be crushed from hard granite rocks, it can be readily available at the nearby place, reducing the cost of transportation from far-off river sand bed.

Advantages of Manufactured Sand

- M Sand has higher Fineness Modules Index compared to the natural river sand, which gives good workability for concrete.
- M sand is free from silt and clay particles which offer better abrasion resistance, higher unit weight and lower permeability.
- Less disruptive to the environment, as it reduces sand mining from river beds.
- Perfect grading and cubical shape of M Sand gives high strength and great durability to concrete.
- More cost-effective than river sand due to low transportation cost and consistency in availability.

Why Ground-Granulated Blast-Furnace Slag Is Used?

- GGBS or ground-granulated blast-furnace slag (GGBFS) is obtained by quenching molten iron slag (a by-product of iron and steel-making) from a blast furnace in water or steam, to produce a glassy, granular product that is then dried and ground into a fine powder.
- However, it can also be blended with OPC clinker in a cement factory and marketed as ‘Portland-slag’ or ‘Blast furnace’ cement. These alternative routes have little effect on the properties of the finished concrete and the savings in carbon dioxide emissions are broadly similar.
- GGBS cement can be added to concrete in the concrete manufacturer's batching plant, along with Portland cement, aggregates and water. The normal ratios of aggregates and water to cementitious material in the mix remain unchanged. GGBS is used as a direct replacement for Portland cement, on a one-to-one basis by weight. Replacement levels for GGBS vary from 30% to up to 85%. Typically 40 to 50% is used in most instances.
- The use of GGBS in addition to Portland cement in concrete in Europe is covered in the concrete standard EN 206:2013. This standard establishes two categories of additions to concrete along with ordinary Portland cement: nearly inert additions (Type I) and pozzolanic or latent hydraulic additions (Type II). GGBS cement falls in the latter category. As GGBS cement is slightly less expensive than Portland cement, concrete made with GGBS cement will be similarly priced to that made with ordinary Portland cement.
- It is used partially as per mix ratio.

IV. TESTS PERFORMED

Quality Tests on Fresh Concrete :

SETTING TIME :-

The action of changing mixed cement from a fluid state to a solid state is called “Setting of Cement”.

INITIAL SETTING TIME is defined as the period elapsing between the time when water is added to the cement and the time at which the needle of 1 mm square section fails to pierce the test block to a depth of about 5 mm from the bottom of the mold.

FINAL SETTING TIME is defined as the period elapsing between the time when water is added to cement and the time at which the needle of 1 mm square section with 5 mm diameter attachment makes an impression on the test block

WORKABILITY TESTS :-

Workability of concrete mixture is measured by, Compaction factor Test, and Slump test.

Compaction factor Test:- The compacting factor test is designed primarily for use in the laboratory but it can also be used in the field. It is more precise and sensitive than the slump test and is particularly useful for concrete mixes of very low workability and normally used when concrete is to be compacted by vibration.

The method applies to plain and air-entrained concrete, made with lightweight, normal weight or heavy aggregates having a nominal maximum size of 38 mm or less but not to aerated concrete or no



Slump test:-

FIG.4

The concrete slump test measures the consistency of fresh concrete before it sets. It is performed to check the workability of freshly made concrete, and therefore the ease with which concrete flows. It can also be used as an indicator of an improperly mixed batch. The test is popular due to the simplicity of apparatus used and simple procedure. The slump test is used to ensure uniformity for different loads of concrete under field conditions. A separate test, known as the [flow table, or slump-flow, test](#), is used for concrete that is too fluid (non-workable) to be measured using the standard slump test, because the concrete will not retain its shape when the cone is removed.

V.TESTS ON HARDENED CONCRETE

COMPRESSIVE STRENGTH :-

The compressive strength of concrete cube test provides an idea about all the characteristics of concrete. Compressive strength is the ability of material or structure to carry the loads on its surface without any crack or deflection. A material under compression tends to reduce the size, while in tension, size elongates.

Procedure: Compressive Strength Test of Concrete Cubes

or cube test two types of specimens either cubes of 15cm X 15cm X 15cm or 10cm X 10cm x 10cm depending upon the size of aggregate are used. For most of the works cubical mould of size 15cm x 15cm x 15cm are commonly used. This concrete is poured in the mold and appropriately tempered so as not to have any voids. After 24 hours, molds are removed, and test specimens are put in water for curing. The top surface of these specimen should be made even and smooth. This is done by placing cement paste and spreading smoothly on the whole area of the specimen. These specimens are tested by compression testing machine after 7days curing or 14 days curing. Load should be applied gradually at the rate of 140 kg/cm² per minute till the Specimens fails. Load at the failure divided by area of specimen gives the compressive strength of concrete.

VI. PROJECT DESCRIPTION**M20 GRADE CONCRETE :-****PROCEDURE:-**

- Plain cement concrete of M20 grade is prepared.
- Ratio for one cube – 1.36:2.04:4.08
- Representative samples of concrete are taken and used for casting cubes of $150 \times 150 \times 150$ mm³.
- Concrete is prepared using GGBS (10%, 20%, 30% of cement) cement, water and fine aggregate.
- In that concrete, 50% of sand was replaced with M-sand
- Representative samples of concrete are taken and used for casting cubes of $150 \times 150 \times 150$ mm³.
- The specimens are tested after 7 and 14 days and are placed in the machine in such a way that the loads are applied to the opposite sides of the cubes.
- The loads were applied without shock until the resistance of the specimen to the increased load breaks down. The maximum load applied to the specimen is recorded:
- Compressive strength = Breaking load (N)/Area of Cube(mm²)

CALCULATION:-

For M20 Grade (1:1.5:3)

$$1+1.5+3=5.5$$

$$\text{Volume of one cube} = 0.15 \times 0.15 \times 0.15 = 3.375 \times 10^{-3} \text{ m}^3$$

$$\text{Volume of wet material} = 3.375 \times 10^{-3} \text{ m}^3$$

Accounting 54% for dry volume

$$\text{Total dry volume} = 5.1975 \times 10^{-3}$$

Calculation for cement

$$\text{Volume of cement} = 1/5.5 \times 5.1975 \times 10^{-3}$$

$$= 9.45 \times 10^{-4} \text{ m}^3$$

$$= 9.45 \times 10^{-4} \times 1440$$

$$= 1.36 \text{ Kg}$$

$$\text{Volume of sand} = 1.36 \times 1.5 = 2.04 \text{ Kg}$$

$$\text{Volume of aggregate} = 1.36 \times 3 = 4.08 \text{ Kg}$$

$$\text{Water cement ratio} = 0.49$$

OBSERVATION TABLE:-**PCC:**

Date Of Casting	Date of testing	No of days	Breaking load(N)	Area of cube(mm ²)	Compressive strength N/mm ²
25/02/2020	03/03/2020	7	304006.2	22500	13.5
25/02/2020	11/03/2020	14	402072.7	22500	17.87

10% GGBS :-

Date Of Casting	Date of testing	No of days	Breaking load(N)	Area of cube(mm ²)	Compressive strength N/mm ²
26/02/2020	04/03/2020	7	353039.4	22500	15.69
26/02/2020	11/03/2020	14	46091206	22500	20.49

30%GGBS :-

Date OF Casting	Date of testing	No of days	Breaking load(N)	Area of cube(mm^2)	Compressive strength N/ mm^2
26/02/2020	04/03/2020	7	274586.2	22500	12.20

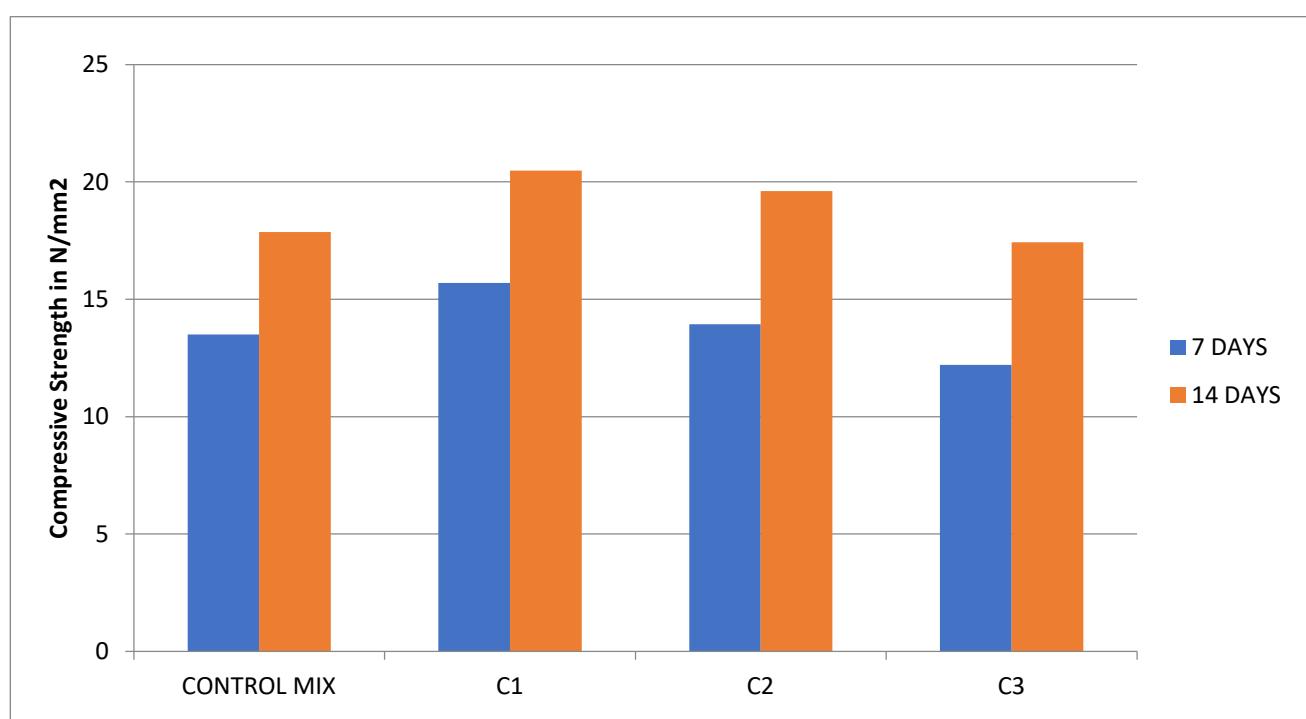
Test Results of Cubes for Compression

FIG.5 Percentage of GGBS

C1- GGBS 10% & M-Sand 50%

C2- GGBS 20% & M-Sand 50%

C3- GGBS 30% & M-Sand 50%

M15 GRADE CONCRETE :-**PROCEDURE:-**

- Plain cement concrete of M15 grade is prepared.
- Ratio for one cube – 1.06:2.12:4.24
- Representative samples of concrete are taken and used for casting cubes of $150 \times 150 \times 150 \text{ mm}^3$.
- Concrete is prepared using GGBS (10%, 20%, 30% of cement) cement, water and fine aggregate.
- In that concrete, 50% of sand was replaced with M-sand
- Representative samples of concrete are taken and used for casting cubes of $150 \times 150 \times 150 \text{ mm}^3$.

- The specimens is tested after 7 and 14 days and is placed in the machine in such a way that the loads are applied to the opposite sides of the cubes.
- The loads were applied without shock until the resistance of the specimen to the increased load breaks down. The maximum load applied to the specimen is recorded:

$$\text{Compressive strength} = \frac{\text{Breaking load (N)}}{\text{Area of Cube}(\text{mm}^2)}$$

Calculations :-

For M15 Grade (1:2:4)

$$1+2+4=7$$

$$\text{Volume of one cube} = 0.15 \times 0.15 \times 0.15 = 3.375 \times 10^{-3} \text{ m}^3$$

$$\text{Volume of wet material} = 3.375 \times 10^{-3} \text{ m}^3$$

Accounting 54% for dry volume

$$\text{Total dry volume} = 5.1975 \times 10^{-3}$$

Calculation for cement

$$\begin{aligned} \text{Volume of cement} &= 1/7 \times 5.1975 \times 10^{-3} \\ &= 7.425 \times 10^{-4} \text{ m}^3 \\ &= 7.425 \times 10^{-4} \times 1440 \\ &= 1.06 \text{ Kg} \end{aligned}$$

$$\text{Volume of sand} = 1.06 \times 2 = 2.12 \text{ Kg}$$

$$\text{Volume of aggregate} = 1.06 \times 4 = 4.24 \text{ Kg}$$

$$\text{Water cement ratio} = 0.49$$

OBSERVATION TABLE :-**PCC :-**

Date OF Casting	Date of testing	No of days	Breaking load(N)	Area of cube(mm ²)	Compressive strength N/mm ²
28/02/2020	06/03/2020	7	32361905	22500	14.38
28/02/2020	13/03/2020	14	421685.9	22500	18.74

10%GGBS :-

Date OF Casting	Date of testing	No of days	Breaking load(N)	Area of cube(mm ²)	Compressive strength N/mm ²
28/02/2020	06/03/2020	7	411879.3	22500	18.30
28/02/2020	13/03/2020	14	441299.3	22500	19.61

30%GGBS :-

Date OF Casting	Date of testing	No of days	Breaking load(N)	Area of cube(mm ²)	Compressive strength N/mm ²
28/02/2020	06/03/2020	7	333426.1	22500	14.82
28/02/2020	13/03/2020	14	392266.0	22500	17.43

Test Results of Cubes for Compression

COMPONENTS & COST

Rates of materials in market :-

- **Riversand** –Fine aggregate (Sand) Fills voids between aggregates. It forms the bulk and makes mortar or concrete economical. It provides resistance against shrinking and cracking. It is naturally available.The cost of the sand is Rs-2200/ton.
- **Msand** – M Sand is nothing but artificial sand made from crushing of rock or granite for construction purposes in cement or concrete. M sand differs from natural river sand in its physical and mineralogical properties. Nowadays, sources of natural sand such as river sand, pit sand, stream sand, sea sand and other sands for use as an aggregate construction are becoming scarce and exhausted due to environmental degradation. The cost of manufactured sand is Rs-900/ton.
- **Cement** –A cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cement is seldom used on its own, but rather to bind sand and gravel (aggregate) together. The cost of cement is Rs 300/bag.
- **GGBS** –GGBS is the granular material formed when molten iron blast iron slag is rapidly chilled by immersion in water. It is a granular product with very limited crystal formation, is highly cementitious in nature and ground to cement fineness, and hydrates like OPC. The cost of ggbs is Rs-3/kg.

VII.CONCLUSION

The concrete was prepared for the M20 and M15 grade concrete with partial replacement of cement with GGBS with various percentages of 10% , 20%, 30% and also 50% of fine aggregate by M sand. The specimens were casted for 7 days and 14 days then tested. The results are presented below.

From the above results following conclusions are made;

- Based on the compressive strength result, the strength of concrete with 10% ggbs and 50% of M-Sand are higher than the conventional concrete of m20 grade and similar result obtain for m15 grade concrete.
- Due to decrease in cement heat of hydration will be reduced.
-

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Stopping Water Pollution By Using Coconut Drainage Net

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ABSTRACT:Water is the basic need for the existence of life on earth. In spite of 70% water on earth majority of the water is not suitable for drinking purpose. Our proposed system is used to clean and control the drainage level using mechanical control technique include total or halfway sorting of waste material through flowing water by applying sock-like traps at the end of the drainage pipes. Plastic pollutants and floating trash in water resources is an ever-growing global problem. Not only it is dangerous for human being, but also for the wild life as well.

The worthy replacement of traditional water drainage system is drainage system with use of net made of coconut fiber. A general view looks like sock-like net that fits over a stormwater drainage outlet to collect rubbish. It has been described as the “simple pollution control solution” over some areas outside India. we face daily problem with such a waste like plastic containers, bottles, paper and vegetation discharge into the city’s waterways by stormwater drains. With huge population like our country India, this idea could be more profitable than other countries as we are using coconut fiber as a mesh which has been placed on the outer mouth of the drainage pipes.

KEYWORDS:Coir-Coconut fibre, gutter underground concrete pipes

I. INTRODUCTION

Water pollution is the contamination of water bodies, usually as a result of human activities. Water bodies include for example lakes, rivers, oceans, aquifers and groundwater. Water pollution results when contaminants are introduced into the natural environment. For example, releasing inadequately treated wastewater into natural water bodies can lead to degradation of aquatic ecosystems. In turn, this can lead to public health problems for people living downstream. The net drainage system is a robust and modern filtration system for use where there are cost or space constraints or specialised cleaning equipment is not available. This system is designed to specially capture and retain large gross pollutants as well as small particles. This system has unique net release mechanism that eliminates any adverse hydraulic impact traditionally encounter with direct screenin trash racks.it contains stainless steel sleeveextension that is fitted into existing or new ,outlets and a removable polyethylene net. There are numerous techniques available for removing gross pollutants fromwater. The most effective strategies involve a combination of non-structural measures(e.g.education and waste management programs, and source controls) and structural treatmentsIt is a subsurface structure that consists of a perforated pipe that is installed flat in a yard with a sloped trench that helps move water runoff from a highest point at thestart to the lowest at the end, where it goes into a sewer, cistern, or swale. French drains help to redirect water from wherever the drain starts—usually close to the foundation of a structure to some sort of sewer or cistern. In general, French drains are used to help the natural flow of water from high to low. These systems are usually found around commercial buildings, including restaurants and loading docks. You can also find them on city streets and even pool deck.

II. RELATED WORK

It is a subsurface structure that consists of a perforated pipe that is installed flat in a yard with a sloped trench that helps move water runoff from a highest point at thestart to the lowest at the end, where it goes into a sewer,

cistern, or swale. French drains help to redirect water from wherever the drain starts usually close to the foundation of a structure to some sort of sewer or cistern. In general, French drains are used to help the natural flow of water from high to low. These systems are usually found around commercial buildings, including restaurants and loading docks. You can also find them on city streets and even pool deck. Like the surface field drainage systems, the subsurface field drainage systems can also be differentiated in regular systems and checked (controlled) systems. When the drain discharge takes place entirely by gravity, both types of subsurface systems have much in common, except that the checked systems have control gates that can be opened and closed according to need. They can save much irrigation water. A checked drainage system also reduces the discharge through the main drainage system, thereby reducing construction costs. When the discharge takes place by pumping, the drainage can be checked simply by not operating the pumps or by reducing the pumping time. In north-western India, this practice has increased the irrigation efficiency and reduced the quantity of irrigation water needed.

III. METHODOLOGY

Material Selection

Coir-Coconut fibre, is a natural fibre extracted from the outer husk of coconut and used in products such as floor mats, doormats, brushes and mat-tresses. Coir is the fibrous material found between the hard, internal shell and the outer coat of a coconut. Other uses of brown coir (made from ripe coconut) are in upholstery padding, sacking and horticulture. White coir, harvested from unripe coconuts, is used for making finer brushes, string, rope and fishing nets. It has the advantage of not sinking, so can be used in long lengths in deep water without the added weight dragging down boats and buoys. Coir fibres are found between the hard, internal shell and the outer coat of a coconut. The individual fibre cells are narrow and hollow, with thick walls made of cellulose. They are pale when immature, but later become hardened and yellowed as a layer of lignin is deposited on their walls. Each cell is about 1 mm (0.04 in) long and 10 to 20 μm (0.0004 to 0.0008 in) in diameter. Fibres are typically 10 to 30 centi-metres (4 to 12 in) long. The two varieties of coir are brown and white. Brown coir harvested from fully ripened coconuts is thick, strong and has high abrasion resistance. It is typically used in mats, brushes and sacking. Mature brown coir fibres contain more lignin and less cellulose than fibres such as flax and cotton, so are stronger but less flexible. White coir fibres harvested from coconuts before they are ripe are white or light brown in colour and are smoother and finer, but also weaker. They are generally spun to make yarn used in mats or rope. The coir fibre is relatively waterproof, and is one of the few natural fibres resistant to damage by saltwater. Fresh water is used to process brown coir, while seawater and fresh water are both used in the production of white coir. It must not be confused with coir pith, or formerly cocopeat, which is the powdery material resulting from the processing of the coir fibre. Coir fibre is locally named 'coprah' in some countries, adding to confusion.

Material properties

The breaking load of single fibres obtained from four localities of Kerala was determined for the first time by using a modified Oniel's torsion tester of constant load type for grading purposes. There was no reference to the size of the fibres tested except that the strengths of the fibres were computed by using the fineness of the fibre (i.e. weight of the fibre in g of a km or 9 km length expressed as tex or denier) in order to account for the non-uniform cross-section of the fibre. The fibres tested varied in their impurity content (pith and sand) and also in their colour, (golden yellow to black). One set of these fibres (which was found to be the best in terms of strength and colour) was also chemically treated individually with water, sulphuric acid, oxalic acid, bleaching powder, tartaric acid, chlorine water and SO₂ solution before being subjected to tensile load. No other details of the tests are available. From a statistical evaluation of the strength data it was reported that the tensile strength of the coir fibre varied from place to place. However, it is not clear whether the variation in the strength of the fibre is due to difference in retting process adopted in these places or due to the locality from where the husks were procured. Mathai et al (1948a, b) concluded that the quality of the fibres depends on various factors like size, maturity and variety of coconut, as well as the processing methods adopted. Similarly chemical treatments affected the strength considerably. However, no satisfactory explanation has been given for the observed variation in the strength of the fibres.

For our project we have used coconut rope and bind with each other so that it formed mesh. By making intertwining them so that the trash should sort by the mesh. This mesh has to make at approximately 10 cm. As the rope is readily

available so we had brought from the market. Coconut rope [10-20- kg, 91rs per kg,four twist double type rope,25mm diameter] and selected gutter underground concrete pipes [Thickness: 40 -70 mm, Diameter: 100 mm to 2000 mm] Drainage entrance treatments involve preventing entry into the stormwater drainage system, or capturing the pollutants at drainage entrance points. This can be achieved by restricting the stormwater entrance size, capturing pollutants as stormwater falls into the drainage system, or retaining the pollutants in the entrance pit. Entrance treatments are free draining as collected pollutants are suspended above the base of a drainage pit. More recent designs use fine mesh bags or nets that can contain much finer material including gravel and coarse sediments. The site of the experimental site must be estimated before placing the experiment. The diameter of the pipe must be estimated first before placing. Before placing the mesh we must put placing holder inside the hollow pipe. These pipe holder must be big enough to withstand the flow of the water as well as the weight of the coconut mesh rope. Now we have to place the mesh inside the holder as per the placing of the holler in the hollow site of the pipe. We can even place the iron sheet over the placing holder so that the mesh would not come out easily. As we are placing mesh make sure we have to wear long boots for protection as the slag must be sticking over the body. The length of the mesh must be too long so that trash stuck it will lead to the end of the mesh by the flowing water and the flowing water must not stop. Now as the strength of the mesh is high the maintenance will be done at approx 6-7 months.

IV. CONCLUSION

The drainage nets effectively address the litter problem the City of Kwinana has in its bush reserves because of the effective and frequent maintenance the City performs on their devices. Additionally, the selected drain outlets were highly suitable for the nets given that the discharge basins are mostly dry systems with ease of access for maintenance vehicles. The remaining work of this study will endeavour to optimise/standardise the City's monitoring methodology based on the findings of this analysis. It is advisable to test the benefits of the proposed process by applying it to other local governments GPTs locations. It is also recommended to study the impacts of these GPTs on water quality and hydraulics to fully understand the implications of these devices and guide informed future decisions on their use and applications. From a disposal cost sense, GPTs are grouped into two main categories according to whether a dry or wet load is stored. This means that collected items are either stored above (dry) or below (wet) standing water levels.

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Experimental Study on Effect of Nailing in Cohesionless Soil

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ABSTRACT: Soil nailing is a construction remedial measure to treat unstable natural soil slopes or as a construction technique that allows the safe over steepening of new or existing soil slopes. There is failures of soil nailing and most happening failure is a pullout failure, so there is a need to identify the pullout resistance of the soil before any construction of soil nail and it's become compulsory if the soil is cohesionless, because pullout failure is generally happen in a cohesionless soil. This paper gives the experimental study to identify pullout resistance of soil in horizontal direction in a cohesionless soil.

I.INTRODUCTION

The work forms a part of continuing research of soil reinforcement at Oxford University, which has included pull-out and direct shear tests of several types of reinforcement using a large scale direct shear apparatus, investigations of the analysis and design theory of unpaved roads on soft soil, and a study of the role of bending stiffness of nails on the stability of nailed slopes. In this research programmed, rather than trying to consider all the numerous parameters which may affect the performance of soil nailing, it was decided to concentrate on relatively simple models using ideal soils, nails and facing walls in the experiments, in the hope of understanding the fundamental mechanics and developing an appropriate design theory of soil nailing. It will then be possible to investigate full scale earth structures constructed with more complex soils and boundary conditions. The most important feature of soil nailing as opposed to the ground anchor technique is that the nail force is passively generated by the displacement of the soil, and the displacement is in turn due to the nail force.

II.RELATED WORK

PULLOUT TEST OF A NAIL: In a soil nail as well as reinforced soil walls the friction between reinforcing element and the surrounding soil plays a major role in improving the stability of earth structures. Since the axial force in a nail is generated by the relative displacement between the nail and the soil, a full understanding of soil nailing requires an understanding of the interaction mechanism between them. It is not however, an easy task to achieve because the interaction is influenced by several factors, such as the properties of the soil, roughness and the stiffness of the nail and the boundary conditions of the test apparatus, as reported by Palmeira and Milligan (1989). Furthermore, the change in stress on the nail due to dilatancy of the soil, when a nail is pulled out, makes the interaction mechanism very complicated and difficult to analyse (Schlosser and Guilloux, 1979).

1. Pull-out Device

The pullout device permits the pullout loads to be applied in a displacement rate controlled manner _up to 6.0 mm/min_. Its maximum pullout capacity is 50 kN, which is adequate for carrying out pullout tests of grouted nails in sandy fills. During the test, the device was mounted on a frame at the required inclination for pulling the nail along its longitudinal direction.

Its reaction force was transferred to a steel beam mounted on the front wall of the tank. A load cell was installed between the nail and the pulling device to measure the pullout force. The displacement of the nail during the pullout was measured by means of LVDT having a maximum travel of 100 mm.

2. TESTING ON SOIL

The quality of the soil on site plays a key role in a construction projects. As a result, need to identify the characteristics of the soil to determine its ability to support the structure soil testing provides a vital data for inform decision making and planning. Soil testing examine the chemical and geotechnical properties, enabling to determine the suitability of soil and assess whether it can accommodate a construction project. To identify the different types of soil on site and their location. To test a soil strength, density, compaction, contamination, organic and sand content, and assess their impact on construction project. To gain the data need to compile technical and safety data reports to support planning applications. To get precise results and observe the development of the soil throughout the project for maximum quality and safety.

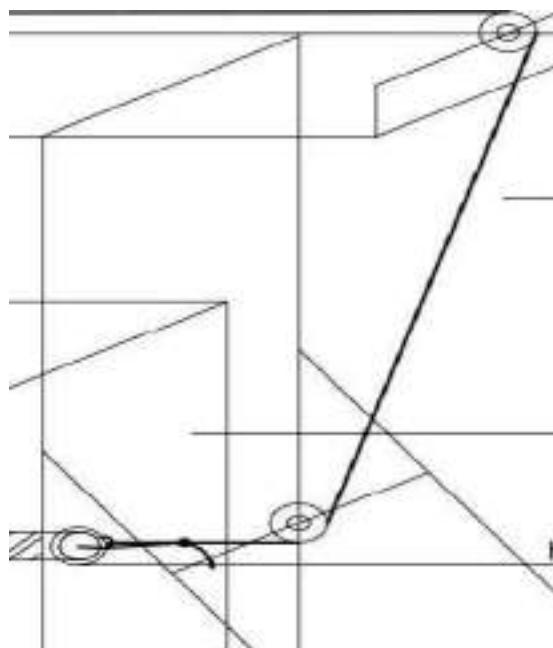


Fig.1 Pulley arrangement used for pulling the nail



Fig.2 Apparatus of Sieve Analysis

1. Procedure

- (a) For soil samples of soil retained on 75 micron I.S sieve.
 - (b) The proportion of soil sample retained on 75 micron I.S sieve is weighed and recorded weight of soil sample is as per I.S 2720.
 - (c) I.S sieves are selected and arranged in the order as shown in the table.
 - (d) The soil sample is separated into various fractions by sieving through above sieves placed in the above mentioned order.
 - (e) The weight of soil retained on each sieve is recorded.
 - (f) The moisture content of soil if above 5% it is to be measured and recorded.
1. No particle of soil sample shall be pushed through the sieves.
 2. No particle of soil sample shall be pushed through the sieves.

OBSERVATION TABLE:

IS SEIVE IN mm	WEIGHT OF FINE AGGRIGATE RETAIN DETERMINATION NO.				WEIGHT RETAIN ED (gm)	CUMULA- TIVE OF RETINED	PERCENT- AGE PASSING (%)	PERMISSIBLE PERCENTAGE PASSING AS PER IS:383
	1Kg	2Kg	3Kg	Av g.(gm)				
4.75	0.03	0.02	0.02	23	23	23	2.3	97.7
2.36	0.02 5	0.01 5	0.02	20	20	43	4.3	95.7
1.18	0.03	0.03	0.04	33	33	76	7.6	92.4
0.6	0.61	0.52 5	0.68 5	60 6	606	682	68.2	31.8
0.2	0.29	0.39	0.22	30	303	985	98.5	1.5

2. Calculation:

The percentage of soil retained on each sieve shall be calculated on the basis of total weight of soil sample taken. Cumulative percentage of soil retained on successive sieve is found.

$$D_{10} = 310 \mu, D_{30} = 580\mu, D_{60} = 960\mu,$$

$$Cu = D_{60}/D_{10}$$

$$= 0.96 / 0.31$$

$$= 3.09$$

$$Cc = (D_{30})^2 / (D_{60} \times D_{10}) = 0.58^2 / (0.96 \times 0.31) =$$

$$1.13 Cu > 6$$

Cc should be greater than 1.

Hence, uniformly gap graded soil.

III.PYCNOMETER TEST

For determination of specific gravity of soil by Pycnometer'. Volumes of soil solids and water are taken same. The volume of known weight of soil grains can be obtained by using a container of known volume; and the Archimedes Principle, "that a body submerged in a volume of water will displace a volume of water equal to the volume of the submerged body." The container of known volume as the volumetric flask or Pycnometer, which holds a standard volume of distilled water at 20°C. At temperature more than 20°C, the volume will be slightly more, below 20°C, the volume will be slightly less. In routine work, generally, tap water is used instead of distilled water.

Specific Gravity of Soil Definition: The specific gravity of soil is defined as the unit weight of the soil mass divided by the unit weight of distilled water at 4°C. It is sometimes required to compare the density of the soil solids to the density of water. This comparison is in the form of ratio and is termed as the specific gravity of the soil. Together with the soil moisture content and unit weight, specific gravity is frequently used to solve for the various phase relationships, such as void ratio, porosity, and degree of saturation. Specific gravity is also required in the calculations associated with the grain size analysis, the consolidation, and compaction (Standard Proctor Test and Modified Proctor Test).



FIG.3 PYCNOMETER

3. Procedure:

1. Weigh the empty and dry volumetric flask / Pycnometer to the nearest 0.01 gram and record the weight as W1.

2. Take about 100 grams of oven dried soil and put it into the Pycnometer.

3. Now weigh the Pycnometer and dry soil to the nearest 0.01 gram and record the weight as W2.
4. Add water in the Pycnometer until about it is two thirds full. Gently and carefully agitate the mixture.
5. Add some more water in the Pycnometer until the bottom of the meniscus is exactly at the volume mark. Weigh the Pycnometer and record it as W3.
6. Empty the pycnometer and wash it. Then fill it with water up to the mark and weigh as W4.
7. Repeat the above Procedure three times.
8. Record the temperature of soil water mixture by the thermometer.
9. Specific Gravity of Soil is then, computed by diving the weight of soil by the weight of an equal volume of water as below.

Observations and Calculations

Note: 1. wt. weight.

2. gm = gram.

3. Gs = Specific Gravity of Soil.

Soil sample = 200gm

W1 = Weight of pycnometer empty = 0.645 Kg W2 =

Weight of pycnometer with sand = 0.845 Kg

W3 = Weight of pycnometer with sand + water = 1.70 Kg W4 =

weight of pycnometer with water = 1.420 Kg

$$Gs = (W2-W1) / \{(W4-W1)-(W3-W2)\}$$

$$Gs = (0.845-0.645) / \{(1.420-0.645)-(1.7-0.845)\}$$

Specific Gravity = 2.73

4. Result

Average Specific Gravity of Soil = 2.73

5. Precautions

1. Weigh the Pycnometer carefully.

2. Shake the Pycnometer well to extract air by fully saturating the soil.

3. Do not shake vigorously.

IV.RESULT AND ANALYSIS

OBSERVATIONS:

Sr.no	Nail diameter(mm)	Applied load in(kg)	Applied load in (N) Or (W)	u	Pull out Force (N) or T3	Displacement (cm)
1.	6	11	108	0. 2	211.49	9
2.	6	15	147	0. 2	287.51	9.5
3.	6	19	186	0. 2	401.86	10
4.	6	22	216	0. 2	423	11

ii. Graph between Displacement and Pullout Force

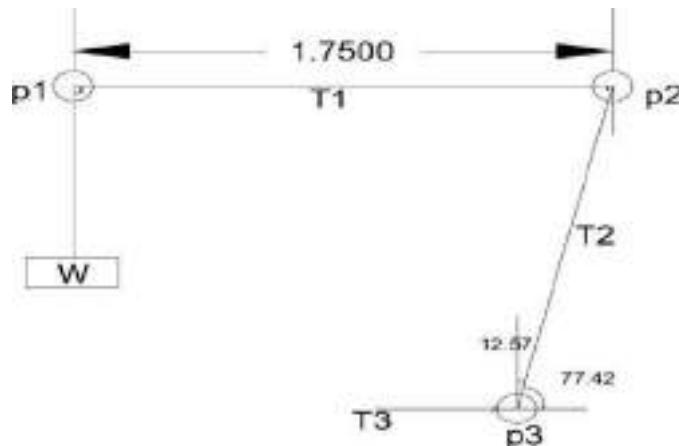
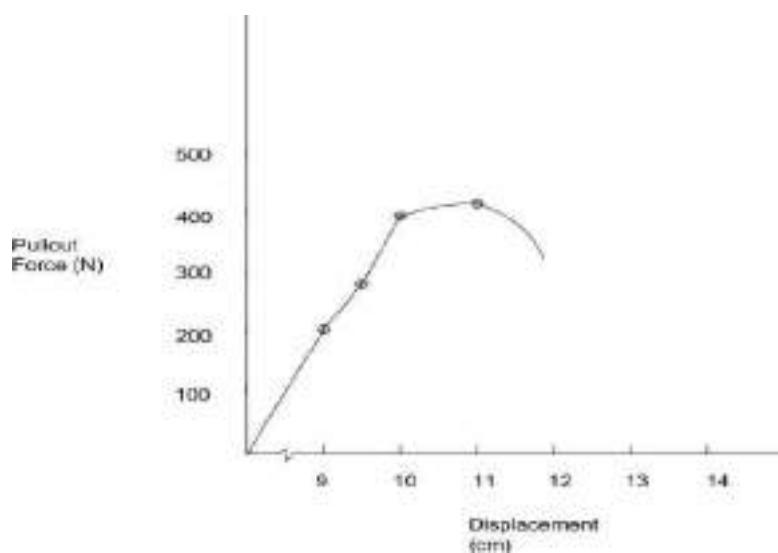


FIG.4 FREE DIAGRAM



The above graph represent the displacement of the nail is plotted on X- direction and the Pullout force is taken on Y- direction. As shown in fig.6.2 the Peak Pullout force is 423N at which displacement is 11cm and after that the nail is fully pull out.

iii. Calculation:

Calculation of Pullout Force

A. For 11 kg Applied load:-

1) For pulley p1,

$$\text{Slipping} = (T_1/w) = e^{u \times \beta}$$

Where, $u=0.2$, $\beta=\pi/2$ & $w=108\text{N}$

$$T_1=?$$

$$\text{So, Slipping} = (T_1/108) = e^{0.2 \times \pi/2}$$

$T_1 = 147.86\text{N}$

2) For pulley p2,

$$\text{Slipping} = (T_2/T_1) = e^{u \times \beta}$$

Where, $u=0.2$, $\beta=\pi/2$ & $T_1=108\text{N}$

$$T_2=?$$

$$\text{So, Slipping} = (T_2/147.86) = e^{0.2 \times \pi/2}$$

$T_2 = 202.43\text{N}$

3) For pulley p3,

$$\text{Slipping} = (T_3/T_2) = e^{u \times \beta}$$

Where, $u=0.2$, $\beta=0.219$ & $T_2=202.43\text{N}$

$$T_3=?$$

$$\text{So, Slipping} = (T_3/202.43) = e^{0.2 \times 0.219}$$

B. For 15 kg Applied load:-

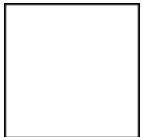
1) For pulley p1,

$$\text{Slipping} = (T_1/w) = e^{u \times \beta}$$

Where, $u=0.2$, $\beta=\pi/2$ & $w=147\text{N}$

$$T_1=?$$

$$\text{So, Slipping} = (T_1/147) = e^{0.2 \times \pi/2}$$



$$T_1 = 201N$$

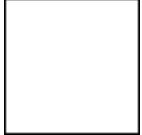
2) For pulley p2,

$$\text{Slipping} = (T_2/T_1) = e^{u \times \beta}$$

Where, $u=0.2$, $\beta=\pi/2$ & $T_1=201N$

$$T_2=?$$

$$\text{So, Slipping} = (T_2/201) = e^{0.2 \times \pi/2}$$



$$T_2 = 275.19N$$

3) For pulley p3,

$$\text{Slipping} = (T_3/T_2) = e^{u \times \beta}$$

Where, $u=0.2$, $\beta=0.219$ & $T_2=275.19N$

$$T_3=?$$

$$\text{So, Slipping} = (T_3/275.19) = e^{0.2 \times 0.219}$$



$$T_3 = 287.51N$$

C. For 19 kg Applied load:-

1) For pulley p1,

$$\text{Slipping} = (T_1/w) = e^{u \times \beta}$$

Where, $u=0.2$, $\beta=\pi/2$ & $w=186N$

$$T_1=?$$

$$\text{So, Slipping} = (T_1/186) = e^{0.2 \times \pi/2}$$



$$T_1 = 254.65N$$

2) For pulley p2,

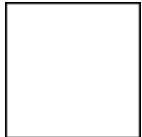
$$\text{Slipping} = (T_2/T_1) = e^{u \times \beta}$$

Where, $u=0.2$, $\beta=\pi/2$ &

$$T_1=254.65\text{N} \quad T_2=?$$

$$\text{So, Slipping} = (T_2/254.65) = e^{0.2 \times \pi/2}$$

$T_2 = 384.64\text{N}$



3) For pulley p3,

$$\text{Slipping} = (T_3/T_2) = e^{u \times \beta}$$

Where, $u=0.2$, $\beta=0.219$ & $T_2=384.64\text{N}$

$$T_3=?$$

$$\text{So, Slipping} = (T_3/384.64) = e^{0.2 \times 0.219}$$

$T_3 = 401.86\text{N}$

1. D. For 19 kg Applied load:-

1) For pulley p1,

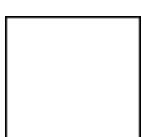
$$\text{Slipping} = (T_1/w) = e^{u \times \beta}$$

Where, $u=0.2$, $\beta=\pi/2$ & $w=216\text{N}$

$$T_1=?$$

$$\text{So, Slipping} = (T_1/216) = e^{0.2 \times \pi/2}$$

$T_1 = 295.727\text{N}$



2) For pulley p2,

$$\text{Slipping} = (T_2/T_1) = e^{u \times \beta}$$



Where, $u=0.2$, $\beta=\pi/2$ &

$$T_1=295.72\text{N} \quad T_2=?$$

$$\text{So, Slipping} = (T_2/295.72) = e^{0.2 \times \pi/2}$$

$$T_2 = 404.88\text{N}$$

3) For pulley p3,

$$\text{Slipping} = (T_3/T_2) = e^{u \times \beta}$$

Where, $u=0.2$, $\beta=0.219$ & $T_2=404.88\text{N}$

$$T_3=?$$

$$\text{So, Slipping} = (T_3/404.88) = e^{0.2 \times 0.219}$$

$$T_3 = 423\text{N}$$

2. Calculation Pullout Resistance

The pullout resistance (q) of the nail was obtained by dividing the peak pullout

force by the active surface area of the nail, which is

$$qs = p/\pi DL$$

where, p - peak pullout force interpreted from the pullout force-

displacement curve (KN)

D - diameter of the nail,

L - length of nail in contact with the soil

$$qs = 423 / 6 \times \pi \times 0.6096$$

$$= 35.81 \text{ N/m}^2$$

iv. **RESULT:**



The Pullout Resistance of the Nail in Cohesion less soil having diameter 6mm and length 2ft is.... 35.81N/m^2 ...

V.CONCLUSION

A Laboratory study was conducted to investigate the behavior of soil nail imbedded in Cohesionless soil. The Pullout Resistance of the Nail in Cohesion less soil having diameter 6mm and length 2ft is about 35.81N/m^2 . The interfaces parameter of the grouted nail from pullout test is fairly close to soil strength parameters determine by the direct shear box test. The study has also demonstrated that the laboratory test can provide the fairly good estimation of the field pullout resistance.

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Accident Prevention and Road Safety for Hilly Road's at Hairpin Bend

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ABSTRACT: “The increasing number of road accident on National Highways & State Highways in India, which constitute about 4.9% of the total road network accounts of 1/3rd of the total fatalities. More than 1,40,000 were killed in India’s roads, according to the figures released by the Govt. of India. More than half of the people killed in more than 6,00,000 road accidents in 2019 were age 15 - 43. Road accidents cause death or sever injuries and loss of potential income and hence road safety has becoming an issue of national concern. The main objective of this study is to describe the basic principles of a road traffic injury control that differentiate the current situation of the traffic accidents, and define the specific interventions that can be implemented in different settings to prevent the road traffic injuries and reduce the number of blackspots and to suggest various measures to strengthen the disaster risk governance to manage the risk of the disaster so that new efforts can be implemented to correlate the traffic accidents.”

I. INTRODUCTION

“Road traffic injuries are among the ten leading causes of death worldwide, and they are leading cause of death among young adults age 15-43 year. Such accident also lead to 20-50 million non-fatal injuries, and many people incur a disability as a result of their injury. According to WHO, 1.25 million people worldwide died in road traffic accident in 2018, to provide some context, this figure is more than five times the death toll of the 2004 Indian ocean tsunami, one of the deadliest nature disasters ever recorded In hilly regions the road accident scenario is further gloomy due to various obvious reasons. Some of the reasons for accidents in hills are narrow roads, steep slope/gradient, hairpin bends, narrow and sharp curves, presence of valley/ river at one side of the road, poor visibility in winter, monsoon, landslides, width/type of shoulder, pavement surface, maintenance standard etc.”



Figure 01- Hairpin Bend Road

1.1 WHAT IS HAIRPIN BEND ROAD?

A hairpin turn is a bend in a road with a very acute inner angle, making it necessary for an oncoming vehicle to turn about 180° to continue on the road.

A hair pin curve bend is located on the section having minimum cross-slope and maximum stability. It must be safe against land-slide and ground water seepage.

1.2 ACCIDENT IN HILLY ROAD

Driving in hills, especially in adverse and severe weather condition is a difficult task than in plains. Reasons of accidents in hilly roads are serpentine curves, Hairpin bend, steep grades, and blindness in horizontal and vertical curves, steep terrain, and hazards of Rolling stone, Landslides, & Extreme climate conditions. Fig. 01 shows the view of a hill road at hairpin bend on SH 26 (M.P.).

1.3 REASON OF ACCIDENT

- Poor Visibility.
- Over Speeding.
- Atmospheric condition
- Over Loading.
- Drunken Driving.
- Distractions to Driver.
- Avoiding Safety Gears like Seat belts and Helmets.
- Non-adherence to lane driving and overtaking in a wrong manner.



Figure 02 – Road Accident

1.4 EFFECTS

- Death
- Injury
- Vehicular damage
- Road Damage
- Permanent Disability
- Temporary disability

II. LITERATURE REVIEW

Bellis, W. (1990), worked on ‘Capacity of Traffic Signals & Traffic Signal Timing’. The data collection was done at three signalized intersections in New Jersey by using a five - person field crew pressing telegraph keys wired to a 20-pen chart recorder for two types of vehicles such as, passenger car and truck (single unit truck). Bellis identified heavy trucks as having an average length of 12.8 m (42 ft), which suggests that today’s heavy trucks may be bigger and heavier, and the trucks he study closer to SU (single unit) vehicles. This data is useful for determining the average travel times were reported for one location at six positions. The data was collected for passenger cars were too incomplete, it is not useful for finding the acceleration of vehicle or for analysis purpose, but the data was collected for the truck is complete and to be useful for analysis purpose, but the truck data had fewer gaps and exhibited a linearly decreasing relationship with $\alpha = 1.67$ (5.47) and $\beta = 0.1229$. So regarding to the value the suitable model was proposed was linearly decreasing acceleration model with respect to speed.

Guensler R. & Hallmark S. (1998), worked on ‘Stop Line Distribution of Speed & Acceleration for Signalized Intersection’ he determines the feasibility of using simulation models to predict on-road speed acceleration profile and to identify potential problems in their use as such, a study intersection was modeled in NETSIM, and the simulation output was compared with data collected from field studies of signalized intersections. A modal approach to emissions modeling offers promising benefits, actual implementation is limited by the ability to realistically model on-road modal vehicle activity. A major advantage to simulation modeling is the ability to make multiple runs and compare different scenarios, such as comparing the effect of different traffic timing plans on individual vehicle delay.

Mehmood Arif (2009), work done on ‘Determinants of speeding Behavior of Drivers’ on roads of Al Ain (United Arab Emirates). The data was collected based on the questionnaire designed for the research. Data was collected for three years from 2005 to 2007 in two main sections, one having demographic data like gender, age, nationality, education level, driving experience, location of driving, and type of vehicle and the other having data regarding attitudes on a 5-point liker type scale from ‘strongly agree’ to ‘strongly disagree’. About 650 drivers were selected to respond out of which 67% were male and 33% were female. Authors concluded that as drivers mature through age and develop sense of responsibility and lower the speed of vehicle. However, what is the effect of lowering the speed on acceleration and deceleration is not reported in the study.

G. A. Hindle et al. (2011) reported the rate of personal injury collision (PIC) over the past decade on the road on English local authority areas. A significant difference in improvement rate was very much depended on prior PIC risk levels. The study featured the accident scenario of site under the continual surveillance of camera and its impact on accident.

III. METHODOLOGY

The use of sensors, LED light and speed breaker; this system make alert to the driver. It also not makes any destruction to drivers while driving, Drive easily sees the Red or Green Signal on the display and listen buzzer of any vehicle comes from the opposite side of road. The driver can easily keep an eye on the movement of the vehicle coming toward them and can make proper used of breaker acceleration and timing avoiding any accidents.

Using mirror rather than LED light signal and sensors, has many sides effect such as reflection of some rays which can destruct the driver attention. At night due to insufficient light, it does not break.

on image in the mirror of the opposite road. It also becomes more complicated to set the mirror of a given angle so that vehicles at opposite side of the road will be reflected and the image can be given in the mirror. setting the mirror at a given angle also has a demerit, such as the headlight of the vehicle at opposite side of the road will on the mirror and will be reflected toward the raining season due to presence of water and moist in the mirror it deposit allows the observer to see the reflected image of the vehicle in that mirror.

3.1. WORKING

As shown in fig. 03

- ‘A’ vehicle come from left side of hill can pass from sensor then the buzzer/alarm ON on the right side and red light show on the signal at right side
- If any vehicle not passed from the left side, then on the Right Side, Green LED Signal Display and buzzer not sound

- ‘B’ vehicle come from the right side of hill can pass from sensor then, the buzzer/alarm ON on the left side and red light show on the signal at left side
- If ant vehicle not passed from the Right Side then the left side, Green LED Signal displayed and buzzer not sound.
By the above technique driver get prior idea about upcoming vehicle from other side of hill of hairpin bend and avoid collision with vehicle comes from other side of hill.



Figure 03 - Sensor Detect the Vehicle



Fig 04. Accident at Hairpin Bend in Hilly Road

3.2. ADVANTAGES

- Avoid Accident in Curve Road, Mountain Road, and Hill Road.
- Saves Thousands of Lives.
- Easily Implementable.
- Fully automated (No person is required to operate).
- Installation Cost is very less.

IV. CONCLUSION

- In this system, we get to know about the accident which occurs on the roads at Ghats section, Hilly region bend roads, we understand the causes and effect of accident and then founded out a solution introducing a new technique to avoid such accident.
- This new technique consists of two LED signals on the either side of road and sensor in the road. This help in reducing the accident and to enjoy the safe ride



- Life is important than any other things, once can gone can't be regained. So, to save this valuable life, this method has important role. It can help road users in hilly region roads from being killed in a serious injury.

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Black Water Filtration by using Sodium Compound

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ABSTRACT: Black water is the mixture of urine, feces and flushwater along with anal cleaning water or dry cleaning materials. black water requires biological or chemical treatment and disinfection before reuse by which can save the maximum water ..if the black water or grey water is reused then the ground water minimizes and increases the level of water. Black water is any wastewater that is contaminated with water discharged from a toilet ,bathtubs, washing machine and kitchen sinks.after the black water filtration .we can reuse for various purposes like car washing, gardening,floor washing plantation and for irrigation purposes.

In black water filtration the materials which is used locally available the materials used in it , limestone, charcoal,fine sand and coarse sand ,sodium dichloroisocyanurate as well as there is no need of electricity for filtration so it is very economical .in black water filter the five steel tanks are used of size 18cm × 30 cm..

In first storage tank black water can be stored as a source , sedimentation tank is a tank in which water can be distributed condition for 30 min by adding sodium dichloroisocyanurate in it which helps to settle down the impurities.this impurities is used to making the fertilizer and this fertilizer used for agricultural land and garden plantation land..after the sodium compound added in water .next process the valve of sedimentation tank open and water can be entered into the filtration tank and in this tank limestone and sand is used as filter media.size of limestone is 2.5cm and sand size is 2.36mm retained in IS sieve second filtration tank use charcoal and size 2.5cm and fine sand is used.

The charcoal and fine sand can help to remove the impurities . charcoal can remove colour ,odour, iron,manganese and oil then the water can pass into a disinfection tank in which potassium permanganate is used for disinfection the tank is connected to a pipe of this type the filtration process can be done..

1. INTRODUCTION

1.1 General Introduction:-

BLACK WATER :-

Blackwater is the mixture of urine, feces and flushwater along with anal cleansing water (if water is used for cleansing) and/or dry cleansing materials. Blackwater contains the pathogens of faeces and the nutrients of urine that are diluted in the flush water.

Blackwater in a sanitation context denotes wastewater from toilets, which likely contains pathogens. Blackwater can contain feces, urine, water and toilet paper from flush toilets. Blackwater is distinguished from greywater, which comes from sinks, baths, washing machines, and other kitchen appliances apart from toilets. Greywater results from washing food, clothing, dishes, as well as from showering or bathing.

1.2 Objectives :-

The objective of Waste Water Treatment:-

- To remove harmful bacteria, to make water safe and attractive for drinking and domestic purposes.
- Design of the treatment plant for a specific water treatment requirement.
- Installation and set-up of the whole plant on a small scale.

2. LITERATURE REVIEW

1. George W. Fuller

George Warren Fuller (December 21, 1868 – June 15, 1934) was a sanitary engineer who was also trained in bacteriology and chemistry. His career extended from 1890 to 1934 and he was responsible for important innovations in water and wastewater treatment. He designed and built the first modern water filtration plant, and he designed and built the first chlorination system that disinfected a U.S. drinking water supply. In addition, he performed groundbreaking engineering work on sewage treatment facilities in the U.S. He was President of both the American Water Works Association and the American Public Health Association, and he was recognized internationally as an expert civil and sanitary engineer.

2. Manoj N Hedao, Anand G Bhole, Nitin W Ingole,

Yung-Tse Hung Handbook Of Environment And Waste Management: Air and Water Pollution Control, 431-473, 2012 The basic function of wastewater treatment is to speed up the natural processes by which water is purified. There are two basic stages in the treatment of wastes, primary and secondary, which are outlined here. In the primary stage, solids are allowed to settle and removed from wastewater. The secondary stage uses biological processes to further purify wastewater. Sometimes, these stages are combined into one operation.

3. Karin Larsdotter

Vatten 62 (1), 31, 2006 Microalgae can be used for tertiary treatment of wastewater due to their capacity to assimilate nutrients. The pH increase which is mediated by the growing algae also induces phosphorus precipitation and ammonia stripping to the air, and may in addition act disinfecting on the wastewater. Domestic wastewater is ideal for algal growth since it contains high concentrations of all necessary nutrients. The growth limiting factor is rather light, especially at higher latitudes. The most important operational factors for successful wastewater treatment with microalgae are depth, turbulence and hydraulic retention time

3. METHODOLOGY

4.

3.1. SITE WORK :-

The various locations of Nag River, from which water samples can be collected, were visited. Various locations of Nag River are:

1. Yashwant Stadium, Sitabuldi
2. Reshimbagh
3. ST. Xavier High School, Hiveri Nagar

COLLECTION OF WATER SAMPLES:-

The water samples for analysis were collected from above Three locations starting from Yashwant Stadium to Hiveri Nagar and the sampling location at this site is as below:

1. Yashwant Stadium, Sitabuldi: - Near theShiv temple, near the residential area
2. Reshimbagh:-Near the vehicular road bridge behind the 'LokanchiShala' High School.
3. ST.Xavier High School, Hiveri Nagar:-Near the vehicular road bridge along the agricultural land.
- 4.

TESTS CONDUCTED:-

The following tests were conducted on the water samples collected from various locations of NagRiver like pH Value,DissolvedOxygen,Biochemical Oxygen Demand, ChemicalOxygen Demand,Nitrate,Faecal Coliforms.

The temperature at various sampling location is found almost the same because the samples were collected in the afternoon with a time interval of 15 minutes at every sampling location

3.2 Methods :-

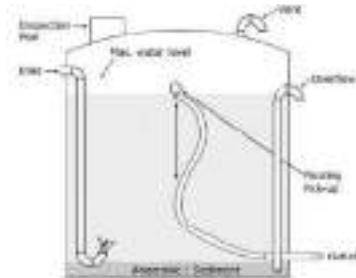
- 1) Black water filter consists of a tank of size 18 cm X 30 cm which is made up of Steel and connected to each other by pipe.
- 2) This whole assembly is placed on a stand made up of bamboo.
- 3) Storage tank is a tank in which day Black water can be stored as a source.
- 4) The sedimentation tank is a tank in which water can be stored in a distributed condition for 30 minutes by adding Sodium dichloroisocyanurate in it which helps to settle down the impurities.
- 5) In the sedimentation tank, we will keep the impurities which are settled at the bottom side, as we will make fertilizer.
- 6) This waste solid impurities is used to make the fertilizer and this fertilizer is well good for the field or agricultural land and also garden plantation land. This fertilizer is economical and free from other harmful chemicals.
- 7) After this process the value of the sedimentation tank is open and water can be entered into the filtration tank.
 - a) Filtration tank 1) :- in his tank the Limestone and sand is used as a filter media .The size of Limestone is 2.5 cm and sand size is 2.36 mm retained on IS sieve.
 - b) Filtration tank 2) :- in this tank the charcoal of size is 2.5 cm and fine sand is used. The charcoal and fine sand can help to remove the impurities.

3.3. WORKING OF BLACK WATER FILTRATION :-

In this process of Black water filter the five tanks are used which are placed at the stand which is made up from the bamboo then this tank is as follows.

3.3.1. Storage Tank :-

Storage tank is the in which the black water can be stored and it is used as a source. The tank is made of steel, size 18X30 cm.



3.3.1. STORAGE TANK

3.3.2. Sedimentation tank :-

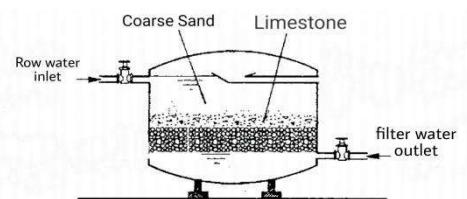
The sedimentation process the water can store in undisturbed condition for 30 min by adding 14.28 gm per liter Sodium dichloroisocyanurate in it as a coagulant which can help to settle down colloidal impurities. Flocculation refers to water treatment processes that combine or coagulate small particles into larger particles, which settle out of the water as sediment. Filtration process of removing particles bacterial impurities which could not be removed in earlier processes from water by passing it through porous media.



3.3.2. SEDIMENTATION TANK

3.3.3. Filtration tank 1 :-

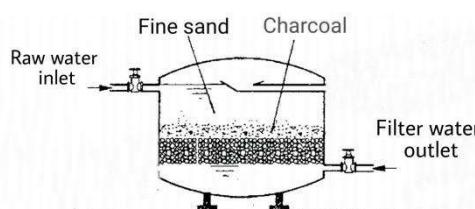
In this tank the limestone and sand is used as filter media. The size of tank is 18 X 30 cm and size of limestone is 2.5 cm and size of sand is 2.6 mm retained



3.3.3. FILTRATION TANK 1

3.3.4. FILTRATION TANK 2 :-

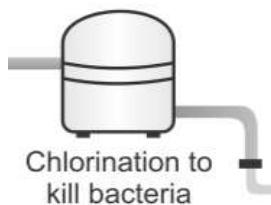
In this tank charcoal and fine sand are used as a filter media the charcoal of size 2.5 cm and finds and up size 1.1 8mm passing from IS sieve



3.3.4. FILTRATION TANK 2

3.3.5. DISINFECTION TANK :-

The tank is made of steel of size 18X30 cm in this tank the process of disinfection can be done many new or modified treatment process are being investigated as an attempt to solve the serious water supply and wastewater disposal problems of the growing population and industries



3.3.5. DISINFECTION TANK

3.4 MATERIALS USED IN BLACK WATER FILTER :-



3.4.1. LIMESTONE 2.5 CM



3.4.2. SODIUM DICHLOROISOCYANURATE



3.4.3. COARSE SAND 2.36 MM



3.4.4. FINE SAND 1.8 PASSING



3.4.5. CHARCOAL 2.5 CM

3.5 Analysis :-

In this filtration process the water can be stored into a storage tank from the sewer as a source in this tank the screening process can be done and the floating matter can be removed. then tank valve can be opened the water can enter into the sedimentation tank in this tank the Sodium dichloroisocyanurate ($C_3Cl_2N_3NaO_3$) is used as a coagulant the solution of Sodium dichloroisocyanurate can be made and added in it for sedimentation process under the action of gravity for 30 min the colloidal and suspended particle can be settle down at the bottom.

After this process the second valve can be opened and allow the water to enter into filtration tank 1 in this tank the sand can kill some bacteria and make the water clean in some amount and impurities retain on the sand bed. Then the next valve can be opened and water entered into filtration tank 2 in this tank the fine sand and charcoal can be used the charcoal can be helped to remove iron, magnesium, oil, and colour odour. Then in the next step the water can enter into the disinfection tank for the disinfection process. So this type of clean water can be obtained

IV.RESULT & DISCUSSION

4.1 PH VALUE :-

The pH of most drinking-water lies within the range 6.5–8.5. Natural waters can be of lower pH, as a result of, for example, acid rain or higher pH in limestone areas. The pH of an aqueous sample is usually measured electro metrically with a glass electrode.

SR. NO.	TYPE OF WATER	PH
1	drinking water	4.87
2	mineral water	7.52
3	distilled water	5.73
4	Black water filter	7.69

4.1.1. PH VALUE

4.2. TURBIDITY VALUE :-

Turbidity is the measure of relative clarity of a liquid. It is an optical characteristic of water and is a measurement of the amount of light that is scattered by material in the water when a light is shined through the water sample. The higher the intensity of scattered light, the higher the turbidity.

SR. NO.	WATER SAMPLE	TURBIDITY
1	Black water	10 NTU
2	Tap water	4.5 NTU

4.2.1. TURBIDITY VALUE

4.3 TOTAL DISSOLVED SOLID (TDS) :-

Total dissolved solids (TDS) is a measure of the combined inorganic and organic substances dissolved in water. It is directly related to the electrical conductivity of water and as such can be used as an indication of change.

SR. NO.	BEFORE FILTRATION (BLACK WATER) PPM	AFTER FILTRATION (FILTERED WATER) PPM	DURATION OF FILTRATION MIN
1	507	410	34:72 MIN
2	513	472	35:02 MIN
3	473	390	34:00 MIN
4	766	447	35:06 MIN

4.3.1 TOTAL DISSOLVED SOLID (TDS)

V.CONCLUSION & FUTURE SCOPE

- The overall performance of the laboratory scale integrated treatment plant was excellent, producing very high quantity effluents.
- The overall performance of the plant for treatment of kitchen and bathroom blackwater demonstrate deduction competency of water pollution such as COD (84%),BOD (92%), coliform (98%) , TSS (87%), TDS (76%), turbidity (64%) and total hardness (70%)
- The COD (84%) removal was lower than (92%) removal implying that the Black water make contains more biodegradable pollution then non biodegradable
- The pH level of bathroom Black water (8.1 to 7.7) was higher than kitchen grey water (7.5 to 7.0)
- The parameters BOD, TSS, Coliform and total hardness were found at higher level in kitchen Black water then the bathroom black water
- The filtration state found major role in the winter season and lakes in the spring season because in the spring season the pollution are more dissolved in the surface and groundwater
- The present study demonstrate that Black water is suitable for the purpose of landscaping gardening and toilet flushing
- The treatment technology can be considered as a variable alternative conventional treatment plant in rural region
- The benefit of treatment system are low in energy demand less
- Operating and maintenance cost and lower the load of freshwater
- The treatment system is environmental friendly, without any chemical operation, cost effective and resourceful of rural development
- Recycling of blackwater provides new water supplies to made for the need and help to protect public health and safety

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Design of Water Cleaning Management System for Nag River

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ABSTRACT: India is a holy country and during festival like Ganesh Visarjan, Navratri, Durga Puja and daily waste dumping etc. there is a lot of water pollution done on nearby water bodies. These water pollutions are a very serious concern, for e.g.: Futala Lake. Due to increase in water pollution in the form of waster debris, it is hazardous to the life of aquatic animals as they can consume it and choke or die instantly. Not only the aquatic animals but also humans are in danger due to this problem. As this water is used for irrigation and drinking purpose it is not safe for us humans. This water when used for irrigation can infect the vegetable and can cause health issues for us. If drink then it can cause respiratory as well as diseases caused by water like jaundice and can also cause skin disease. As per a report published every year, we dump 29 crore liters of sewage waste in the Ganga river. Government and NMC are constantly working to remove the waste from these water bodies. One such moment was started by NMC under the guidance of 'Sir. TUKARAM MUNDE' to clean the Nag River in Nagpur in 2016. In total over 5,000 tons of garbage and other waste was removed from a 17.68km stretch of the Nag River, starting from Ambari's overflow point to the confluence with Pili River beyond Bharatwada during a 15-day campaign. While doing this The Times of India newspaper gave the report of the amount of waste daily being dumped in the river to be around a ton. The major populations to be dumping waste in the rivers are those living in the slum areas. Every year the NMC is approximately removing at least half a ton of waste from nearby lakes.

I. INTRODUCTION

City of Nagpur is named after the Nag River. Nag River originates from a lake called Ambazari, which is located to the west of Nagpur City. Catchment of Ambazarilake was the present MIDC area and also some area beyond. Hence recharge of the lake was perennial. Overflow of lake constituted the river Nag. There is another lake called Gorewada, which is to the north-west of the city and its overflow constitutes origin of another river called Pili. This river ultimately meets the river Nag.

Classification of water of Nag River Basins / Sub-Basin by Environment Department, Government of Maharashtra. Notification is reproduced below. Environment Department, Government Of Maharashtra has classified 20 main rivers & their sub basins in A-I, A-II, AIII & A-IV on their best designated use.

Table no. 01

Sr No.	Name of the River	Strech of A-I class	A-II class	A - IV Class
1.	Nag River	—	Origin to Ambazari Lake	Ambazari Lake are Confluence with Kanhan River
2.	Pioli River	—	Origin Lake Gorewada Tank	Gorewada Tank to Confluence with Nag River

Nagpur city has a Municipal Corporation and is the Sub Capital of the State of Maharashtra. Population of Nagpur city is about 27,00,000 as per 2001 census.

II. LITERATURE REVIEW

Salfali Sayyad, adarshdorlikar, sneharatnaparikh, tanvibhagat (2016) conducted a detail study on “**Design and fabrication of river cleaning machine**”. In this Method River water is used for irrigation which in return gives food to the people. They also maintain the ecology of region and bring prosperity. This project is used to clean the river and control the pollution of river which is very beneficiary for our society. In this project turbine rotates by flows of river water and through the mechanical gear arrangement we arrange the conveyor belt. The conveyor belt is used to picks the solid waste from the river and collected in the collecting bin.

Ganesh khekare, uravashidhanre, Gaurav dhanre, sarikayede (2014) conducted a study on “**Design of optimized and innovative remotely machine for water surface garbage assortment**”. While conducting study the issue arises i.e. loss of machinery is too high. There are so many methods used for collection of waste floating on the river like manually, by boats, thrush skimmers etc. and are deposited to the shore of river. Hence the designing and fabrication of the remote operated river cleaning machine is proposed. The machine is consist of the collecting plate which is coupled with conveyor belt and chain drives are rotating continuously by the motor. The collecting plate is coupled between the two chain drives to collect the waste materials from river. Then the collected waste is thrown on the collecting tray. The propeller is use to give motion to the machine hence drive the machine on the river. The propeller run with help of PMDC motor. The total electrical devices are controlled by RF transmitter and receiver which use to control the machine remotely.

Tejpalparshwanikar, pritambanabakode (2011) conducted a detail study on “**design of automatic river cleaning machine**”. In this project “**DESIGN AND FABRICATION OF AUTOMATIC RIVER CLEANING SYSTEM**” there is a conveyor belt which is located on the front side of the boat and would be driven with the help of two rotor motors. The frame of the boat is entirely made from U-PVC pipes (of 5mm thickness) the conveyor belt is having dimensions of 1300X1000X500 (mm) (LXBXH). At the back side of the boat a tank made from plastic is used which is used to collect all the garbage collected from the water body, the dimensions of the tank could be varied as per the limitations of the length and breadth of the boat and its volume would vary accordingly. The collection bin is removable and could be removed for safe disposal of the waste in it. To run the boat a propeller is provided which would turn in either clockwise or anti-clockwise direction so as to make the boat go in forward or backward direction. The boat is going to be operated by a remote control (wired). The waste collected would then be brought back to the shore and from there the collection bin would be removed from the boat and then the waste would be collected in a garbage truck and then will be disposed off safely in the dumping yard.

Madhavi N. Wagh, KashinathMunde, (2018) conducted a detail study on “**Design and analysis of Water Cleaning Machine**.” The work has done looking at the situation of our national rivers which are dump with crore litters of sewage and loaded with pollutants, toxic materials, debris etc. automation plays an important role in mass production. In this



project they fabricated the remote operated river cleaning machine. The main aim of the project is to reduce the man power, time consumption for cleaning the river. In this project they automated the operation of river cleaning with the help of a motor and chain drive arrangement. They used RF transmitter and receiver to control the cleaning machine. Automation can be achieved through computer, hydraulics, pneumatics, robotics, etc. of these sources, pneumatics form an attractive medium for low cost automation.

Prof.Ketan V. Dhande, Abhijeet M. Ballade, Vishal S. Garde, Akash S. Lahane. (2018) conducted a detail study on "River Cleaning Machine". The river cleaning machine works on hydropower to extract waste water debris, plastics and garbage from Godavari River at Nasik. In this machine the main aim of this machine is to lift the water surface and dispose them in the tray. Form that tray all the garbage collected is dropped to the conveyer belt which convey all the garbage out of the river. It is a non-convectional river cleaning system. It's initial and maintenance cost was low. And it is environment friendly. It was applicable to reduce water pollution in the river, ponds, and oceans.

III. METHODOLOGY OF PROPOSED SURVEY

While conducting study the issues arises i.e. cost of machinery is too high. There are so many methods used for the collection of waste floating on river or lacks manually, by using boat, trash skimmers etc. and that deposited to the shore of rivers. These methods are risky, costly and time consuming. By considering all the parameters of river surface cleaning and eliminating the drawback of the methods used earlier, the design of the remote operated river cleaning machine which will help in river surface cleaning effectively, efficiently and eco-friendly is proposed.

Hence the designing and fabrication of "**NAG RIVER REVIVING MACHINE**" is proposed. This machine consists of collecting plate which is connected to the conveyor belt. The collecting plates are made up of PVC material, that when get in contact with water will not get corrode and the lifespan on collecting plates will get increase. The size of the collecting plates are considering according to the width of the river, at each corresponding section. The conveyor belt to which this collecting plates are attached will rotate continuously at a constant and suitable speed. So that all the floating material and debris present in the river will be collected by the collecting plates. These waste materials are then directly forwarded to the transferring belt. The transferring belt is placed at the downward side of conveyor belt such that all waste collected by the collecting plate drops directly on the transferring belt. This waste is then forwarded to the collecting bin which is situated just aside the whole setup at the shore. All the waste collected in the bin is then collected by NMC garbage truck and get deposited at their desired place and can be decomposed.

All the electricity required to operate this machine will be generated through solar plates. By providing these solar plates the electricity will also be safe.

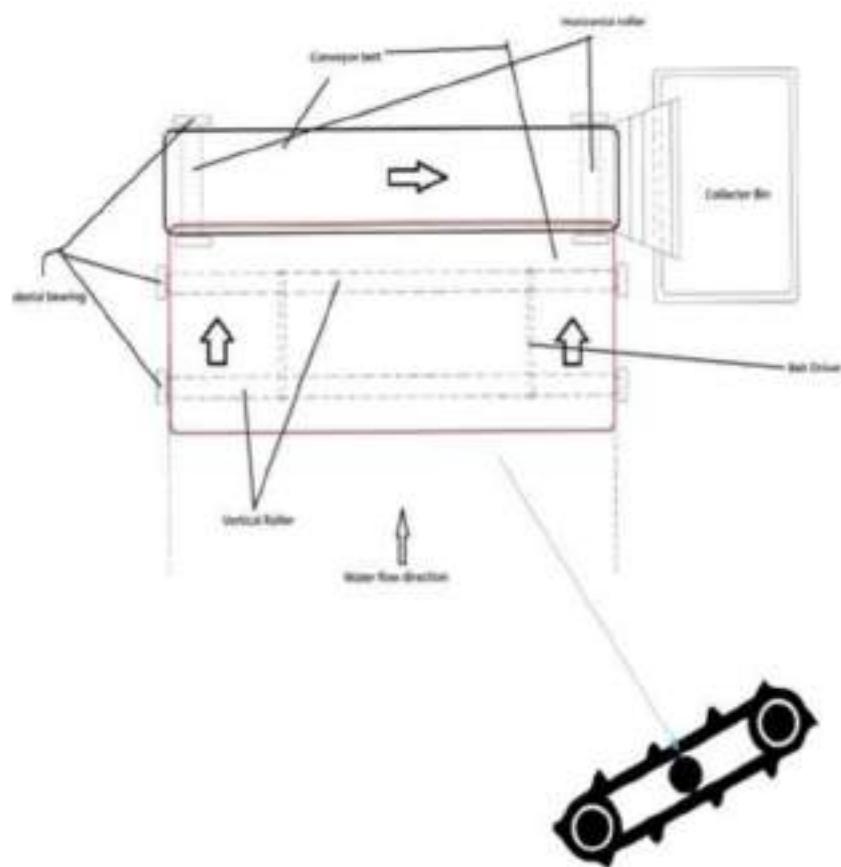
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This whole setup is known as "**NAG RIVER REVIVING MACHINE**". This type of 5-6 setups will be provided to 17.68 KM long NAG RIVER for continuous flow of waste free water in the river. By doing this method we can make our NAG RIVER which is today known as NAG NAALA again a "**NAG RIVER**" to be known. On which our Nagpur culture is based.

There will be total 06 cleaning stations at which the machine will be placed which will be operated continuously to keep NAG RIVER clean. Below table shows the gathered information of sewage flow, amount of solid waste, amount of floating material present and amount of impurities present at each station.

Table 1: OBSERVATION TABLE

SR NO.	Stations	sewage flow at station (lps)	No. of solid waste present at the station (kg)	amount of floating material present (%)	amount of impurities present (ppm)
01.	Station A	136	100-120	20-30	560
02.	Station B	158	150-180	20-40	674
03.	Station C	384	200-230	40-60	780
04.	Station D	432	200-250	40-70	754
05.	Station E	289	170-190	30-50	678
06.	Station F	397	140-170	20-40	864



BELT WITH PADDALS FOR
COLLECTING FLOATING MATERIALS

Figure 1: Overall Construction of River Cleaning Machine



IV. CONCLUSION AND FUTURE WORK

River Cleaning Machine is designed with an intention of cleaning the water debris floating on the river, by using portable lever we can collect many floating material present on the water.

In future this project can be improved to sort more categories of waste. In this system we can use advance conveyor system and conveyor material for increasing the efficiency of collection of garbage. To modify the size of machine according to its waste collecting capacity is increases. This project makes only for small lake and by doing some modification in its size and capacity it can be used in big lake and river like Ganga.

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Highway Maintenance with Rubber Rolling Barriers to Reduce Accident

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ABSTRACT: The highway transportation rank high in travel and also in reportable accidents. Nowadays, there are various changes in road network and infrastructure developments done in our country. But according to the statistical report "Road Accident in India 2012" released by the Government of India, Ministry of Road Transport and Highways the reportable accidents, injury and fatality rates were in increasing order for the past decade up to 2011 and there is only a slight decline in the year 2012. In these accidents a considerable amount of accidents are due to vehicle-divider and vehicle-barrier collisions. This paper suggests and devises flexible median divider using suitable material, so as to reduce the risk level during median divider accidents.

The government is always looking at the latest technology that can ensure safety of road users, as outlined in the construction industry transformation plan. The Development of a country depends on the connectivity of various places with adequate road network. Roads are the major channel of transportation for carrying goods and passengers. They play a significant role in improving the socio-economic standards of a region.

I. INTRODUCTION

Development of a whole country depends upon transportation system and the transportation system should be well developed in roads, railway, waterways, and air ways. Developed transportation systems are essential for the development of a country as well as for reducing the cost of communication and arrival of daily commodities. It is seen that road transportation is the nearest to the people & easily travel to any places. The road network could serve the remotest villages of the vast country. People depend on roads and highway for the movement of a good transportation, for travel from one place to another, for service, for social and recreational purpose and many other activities necessary to the functioning of our complex society. But roads are not free from any failure of construction. If construction of road is done very carefully, the failure of road chances will be minimized to reconstruct. But for having mistaken in construction procedure and the defects of used materials, the road surface is failed. The maintenance of this failures is required to repair & also to increase the life of the road, to reduce operating vehicle and maintenance cost and to keep the road in serviceable condition. The based on structural and design purpose, road pavements are generally divided into two types as flexible pavement and rigid pavement. In the India flexible pavement is mostly constructed for having advantages than rigid pavement. But India is a developing country so rigid pavement also get the priority for construction. Now a days rigid pavement as roads with definite length, available fund, materials, equipment and workers according to the requirements. Most of the roads of the city are constructed and maintained by the Roads and Highway Department. Deteriorations of flexible pavements occurred every year due to poor quality of construction coupled as well as due to heavy rainfall and bad drainage condition. So, it requires more money for road construction as well as for the maintenance. However, the requirements are not satisfied. Because of these reason rigid pavements get constructed.

II. LITERATURE REVIEW

Mehedi Hasan

Total length of paved road in Rajshahi City is about 186.64 km (2011 census). It shows that about 23% of total road lengths are present in failure condition. This study shows an investigation to compute the flexible pavement's failure types, to define and identify the causes, and select the best maintenance for that failures of flexible pavement within Rajshahi City.



There are many types of failures occur on the roads such as different types of cracks, potholes, raveling, water bleeding, corrugation and shoving, depression, and rutting. The possible causes of flexible pavement failures are improper bituminous mixes with poor quality of materials, heavy traffic loads, heavy rainfall, and bad drainage on pavement. The failures are gradually raised due to lack of proper planning, inspection, and treatment. These failures create different types of disadvantages like traffic jam, discomfort to the passengers as well as drivers, increasing vehicle operating, maintenance cost, etc. This study proves that the authorities practice maintenance procedures to repair the failures of pavement which are about 60% similar to the conventional road maintenance procedures. The authorities as Roads and Highway Department and Rajshahi City Corporation are suggested to do maintenance according to the requirements of urgent maintenance and availability of fund which is found in this investigation.

Kunj Bihari Verma

As we know that about 35% of total road in kota city are in very bad conditions the types of failures on the road such as water bleeding, edge cracking, rutting extra and some others also such as over loading of vehicles, traffic jam, accident of vehicles and many bad drainage systems. which make disc comfortable for the passengers in travel time. for maintenance use of the appropriate design structure of the highway. we have to avoid unnecessary congestion which make the road to damage. The highway maintenance include surface maintenance, traffic service, bridge maintenance and drainage maintenance extra.

Today we are not using the new ideas for maintenance of road for giving more strength, we are using low quality materials for maintenance in pavement road that in case more failure in road. The purpose of this study is to identify common defects of cracks and defects in kota city road and use good suitable maintenance process. I selected 10km of road for study. This survey has been explored for several reasons of cracking and the failure of many different types of pavement.

Muhammad Farhan

The latest emerging technologies for road safety focuses on finding ways to avoid or minimize road accidents to road users with special concern by reducing the causes of road accidents. As depicted by data of certain advanced countries like Korea, Malaysia, Australia, United States of America, the major number of accidents causing death was very high during a previous couple of years due to the increased number of vehicles on road, which is getting unmanageable. However, Urethane Rollers invented in Korea has served to re-direct the uncontrolled moving vehicles and to balance it again causing reduction of accidents. In this paper, a study is carried out to explain its need in India perspective for using "Rolling Barriers" (RB) which has minimized the accidents rate in the above-mentioned countries. Rolling barriers provides cushioning effect during a crash, reduces the high-speed effect, constitutes material resilience with stiffness and have other performance characteristics that reduce injury to occupants and damage to the vehicle. The roller barriers are extremely effective and its implementation has given signified results in reducing the road accidents at flat roads, curved roads sections, ramps, medians, entrances/exit ramps in the parking garage etc. steep curved roads as in the mountainous terrain

Mehedi Hasan

The government is always looking at the latest technology that can ensure safety of road users, as outlined in the construction industry transformation plan. A small Korean manufacturing company invented a new concept longitudinal barrier, (The Rolling Barrier) which had continuous pipes covered with urethane rings. This study aims to evaluate the effectiveness of the "Rolling Barrier" and to understand the Rolling Barrier's characteristics of crash cushioning, how to correct the vehicles running direction and the required strength of barriers. They convert that impact energy into rotational energy to propel the vehicle forward rather than potentially breaking through an immovable barrier. When a car hits the barrier, the rotating barrel converts shock from the vehicle to rotational energy. Upper and lower frames adjust tires of large and small vehicles to prevent the steering system from a functional loss. The Rolling Barrier can be effectively used in curved roads sections, ramps, medians and entrance or exit ramps in parking garages. In this paper, the description and studies of Rolling Barriers are elaborated.

Pathom Chaloeywares

The Development of Natural Rubber for Traffic Devices in Thailand has been researched in several years. The enormous budgets have also been invested for the increasing of rubber prices. One of Traffic Devices is the application of natural rubber sheets for the protection of motorists driving motorcycles as crashed through concrete barriers. The number of road side accidents on rural roads in Thailand is about 3 fatalities per 10 kilometers. Therefore, the 11.20 MTB per a Fatality of accident cost is evaluated to be 3,360 TB per km. This leads to the mitigation methods to remedy a symptom's motorist



from severity to moderate and mild respectively. The solution is to find the best practice of road barrier which is applied with natural rubber latex glued with concrete barrier. In addition, the composite materials will be calculated of the modulus of elasticity and properties such as, strength and durability. The simulation of crashes, finite element of materials, LRFD and Concrete Technology methods will be taken into consideration. The testing of material in Thailand will be firstly applied for these, for example the road crash testing under the standard of NCHRP – TL3 (100 kph) will be taken into account.

III. METHODOLOGY

Parameters for location selection

Location:

Location of the spot for accident survey was chosen to be from LIC to Gaddigodam. Vehicles from Tahasil Office Bridge to NH 7 were counted. The reason of this site selection because that location is high turning point. There is cause lot of accident on police record.

Date:

Data for accidents level on particular location was collected on 15 June 2021. It was Tuesday from police station.

Time: Time of data collection accidents level study from 6:00 pm to 6:30 pm.

Observation: Classified Vehicle accidents.

Equipment: Plane sheet, Board, pen, scale, etc.

Number of person: Two

Methodology of reconnaissance survey

Before we have conducted a reconnaissance survey on the previous day of actual work. We just visited the spot of study after collecting the data. Next day we went directly to the spot.

IV. OBSERVATION

Observation of accidents level on spot location of road

Table 6.2(a) Observation of yearly accidents on location

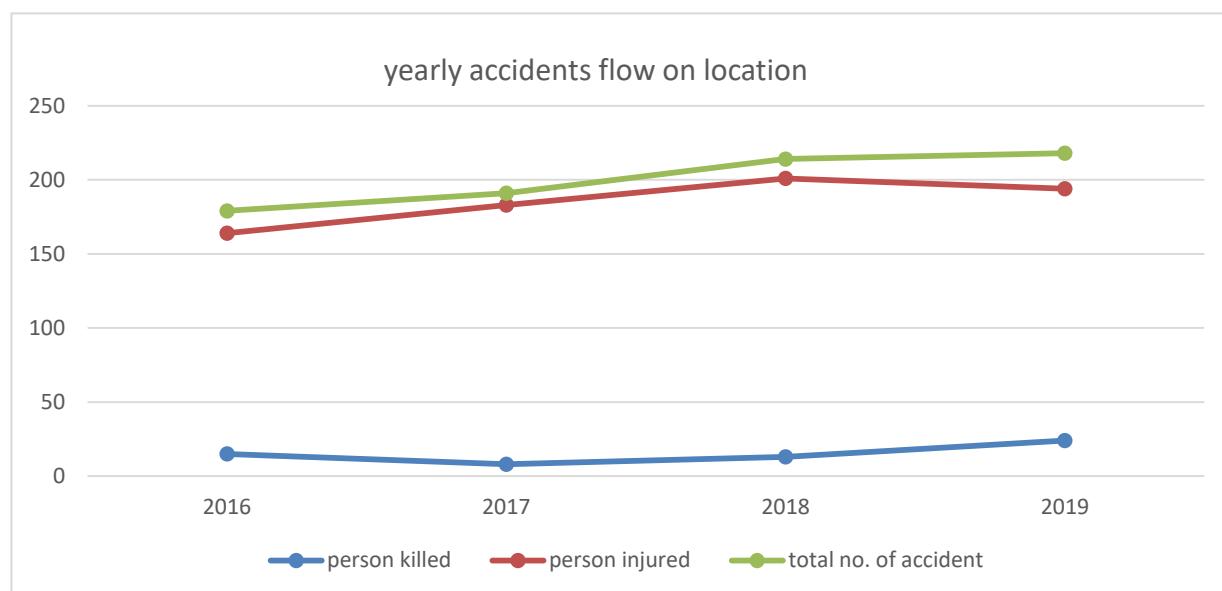
Sr. No.	Year	Total No.of Accidents (in numbers)	Total No. of persons killed (in numbers)	Total No. of person injured (in numbers)
1	2016	179	15	164
2	2017	191	8	183
3	2018	214	13	201
4	2019	218	24	194

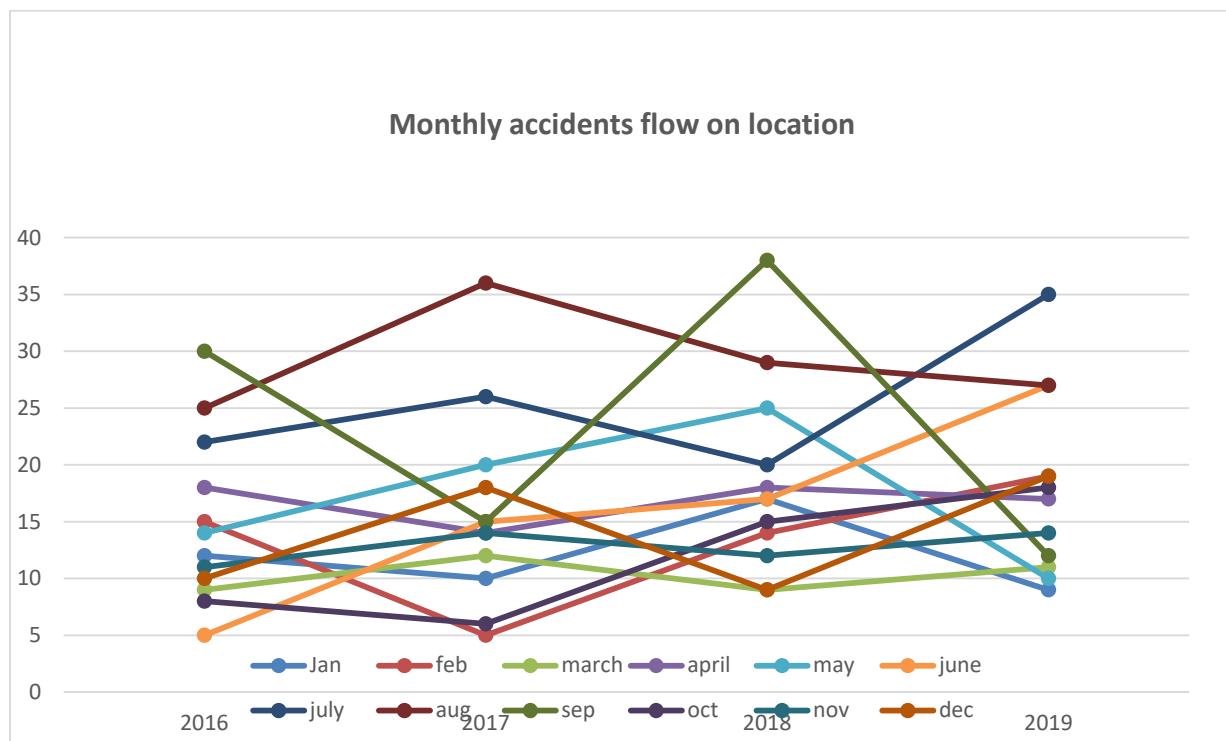
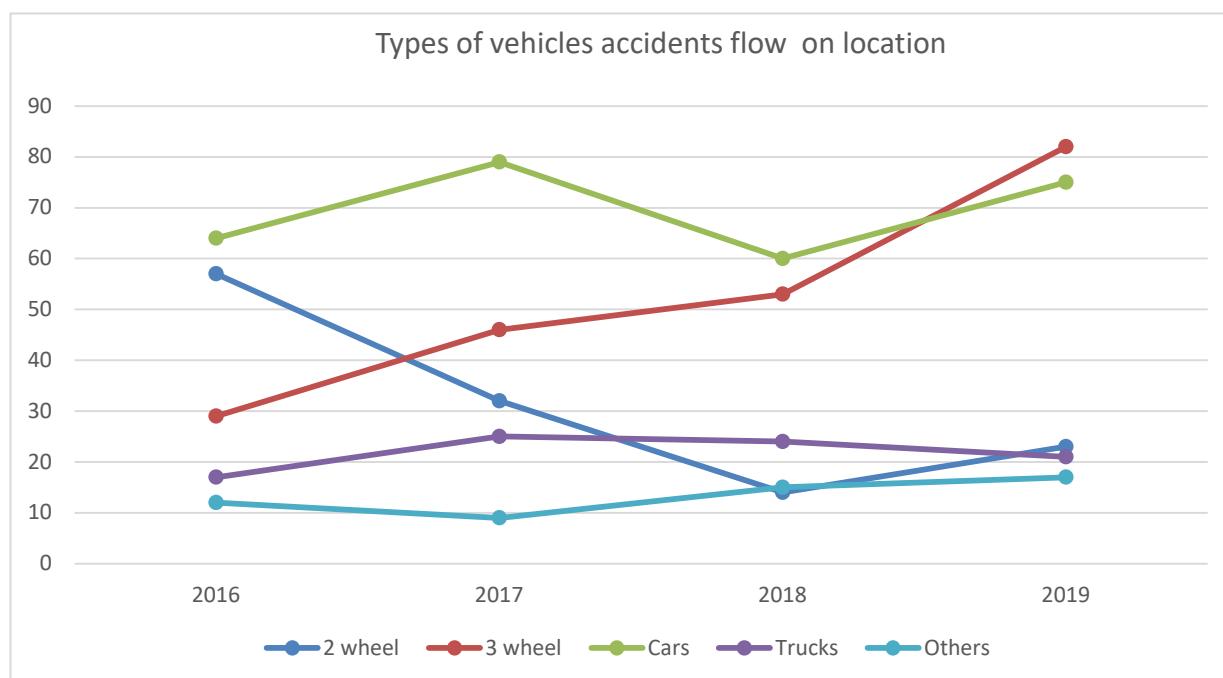
Table 6.2(b) Observation of types of vehicles accidents on location

Sr. No.	Year	Types of vehicles					Total no. of accidents on road
		2 wheel	3 wheel	cars	trucks	others	
1	2016	57	29	64	17	12	179
2	2017	32	46	79	25	9	191
3	2018	14	53	60	24	15	214
4	2019	23	82	75	21	17	218

**Table (c) Observation of monthly accidents on location**

Sr. No.	No of accidents in Months	Year			
		2016	2017	2018	2019
1	Jan	12	10	17	9
2	Feb	15	5	14	19
3	march	9	12	9	11
4	april	18	14	18	17
5	May	14	20	25	10
6	June	5	15	17	27
7	July	22	26	20	35
8	aug	25	36	29	27
9	Sep	30	15	38	12
10	Oct	8	6	15	18
11	Nov	11	14	12	14
12	Dec	10	18	9	19

Graphical representation of accidents level on spot location of road





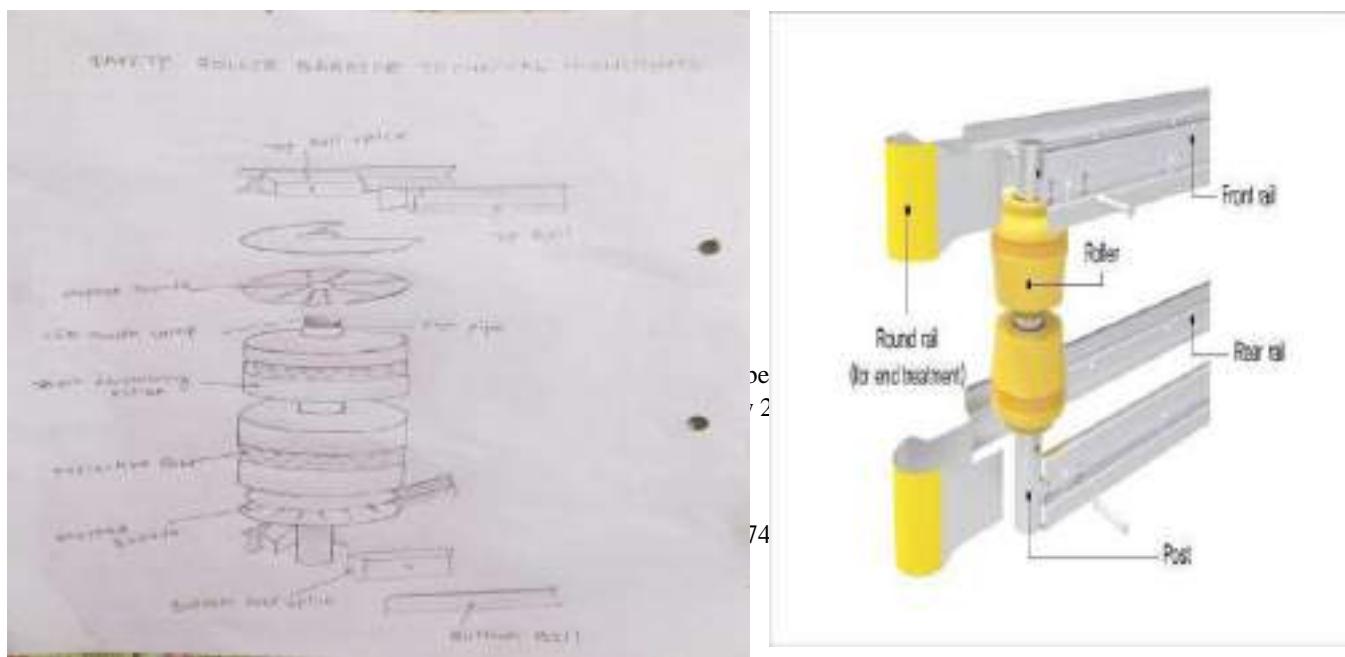
As the rolling barrier activates the rolling friction when vehicles hit the barrier, the rolling barrier reduces severity of traffic accidents. After installation of rubber rolling barrier the accident level can be decrease up to 80%.

Cost

This material is not introduced in India yet. So there have no specific costing about it. But in internationally there have the cost of rolling barrier. The features of rolling barriers are LED light, the hard rubber type plastic material (round shape), stainless steel, we use a lighting tape, when the vehicle's light hit the tape it will brighter known as radium tape or reflective tape. The price of a roller is 40-45 USD (2965-3336 Rs). In this rate the LED light and the radium tape or reflective tape also included. But the price of the tape is 6 USD (445 Rs) per roll. The main thing of this barrier is the stand which is made of stainless steel. The price of stainless steel is 2-5 USD per kg (148 -370 Rs). Some company giving the whole part of the rolling barrier the cost of the total barrier is 230-290 USD per meter (17053-21501 Rs)

Maintenance cost

The main problem of rolling barrier is, its maintenance cost is very higher than concrete and steel made barriers. Due to periodical inspection, maintenance of the rolling barrier system is in high level. At high temperatures in summer season, the rubber characteristic material is that it tends to low resistance property. So, that plays a major role in rolling barrier system but can be restricted or maintained by proper inspections periodically (once in two to four weeks or once in a month). Also a technique to cool down the heat is to sprinkle water on this rolling system. Because of temperature or after crash the rolling barrier is damaged much so there need more maintenance. More maintenance means more labor work but advantage is that the maintenance system is easy. Just change the damaged roller of the barrier.



7.2 Test:-

Passenger safety performance

- Theoretical head impact velocity (THIV): 32.4km/hr (below 33km/hr)
- Post impact head deceleration (THD): 9.9 m/s-2(below 20 m/s-2)

Test vehicle behavior performance



- Not over thrown or a sudden stop after collision.
- 76.9% (Exit speed: 74.8km/hr): 43.7% (Exit angle: 8.74 degree)

V. CONCLUSION AND FUTURE WORK

The accidents are the errors which are occurred or done by humans while on the usage of motor vehicles and also sometimes the nature creates problems like rainy and cold weather conditions for slippery surfaces of roads, which will create chaos situations and tends to hit the other vehicles or hit the barriers installed on the outer edge of the roads. There have some different of accident and crash. Accident means it just happened there had no way to prevent the accident but crash means it can be prevented or improve the situation of accident. These barriers are of different types and have their own characteristic features but the new idea is about the installations of the rolling barrier systems which will stop the accidents occurring to surpass the road to gravel or steep hill down or other part of the road, and also saves life of the people present inside the vehicle. Ultimately life is more precious than vehicles but when it comes to rolling barrier system usage, it safes life and also prevents maximum damage level of the vehicles. The rolling barrier systems are the future technology in Civil Engineering or Transportation Engineering.

The domain of material advancements in the last few decades we have developed exciting materials in engineering science. For materials election or fabrication of rolling barrier and cost factors will play a significant role. While selecting material for rolling barrier we need to see the properties required in the installed component. One of the most important properties in this regard is resilience and shock absorbing capacity, as this is the primary feature of the rolling barrier in absorbing the impact Energy imparted by the decelerating vehicle .Crash cushioning property plays an important role in fulfilling the main purpose of the rolling barrier. Another property which can add to the Functionality of the rolling barrier is thermal resistance, as large amount of heat is generated during the impact event. Using materials that are thermal insulators will ensure the proper working of the rolling barrier.

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Bricks by Cow Dung using Lime and Clay

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ABSTRACT: This study was conducted to investigate the effect of cow dung, clay and lime in strengthening of clay bricks for the construction of environment friendly buildings. There is a need to explore sustainable approaches to building construction with the increasing demand for low cost housing and the high cost of building materials. Bricks which are the core material in building construction are made from clay, which is processed either by sundried or burnt, Lime prevents shrinkage of raw bricks.

A local earth was stabilized chemically by Cow dung. A better compressive strength at the dry state and after 10 minutes of immersion in water was obtained with cow dung stabilization at content of 15 to 30% by weight of earth. Bricks stabilized with 15 to 30% Cow dung contents by weight of earth have a dry and wet compressive strength of 6.64 and 2.27MPa respectively. There is an increase of about 25% in the dry compressive strength of bricks stabilized with 30% cow dung content over that of the plain earth brick without stabilizer. The 30% cow dung content resulted in lower migration of water into the brick (i.e. lower permeability). Also the abrasive resistance increased with increase in the cow dung content up to 30%. The highly decreased in compressive strength after 10 minutes of immersion in water, even with optimum Cow dung content, indicated that appropriate building design that would prevent stabilized earth bricks from coming into direct contact with rainwater is important. The study recommends that appropriate construction specification is necessary to prevent cow dung stabilized earth bricks from coming into any prolonged direct contact with rainwater.

I. INTRODUCTION

With the increasing demand for low cost housing and high cost of building material, there is a need to explore sustainable approaches to the needs of the building industry. Bricks as the core material in building construction can be produced by clay which is processed either through sundried or burned. The latter however is expensive and technically exhausting whereas sundried bricks can be produced by the layman. In order to ensure the durability and optimal strength output with sundried clay bricks, fibrous materials is believed to enhance such characteristics. This study intends to explore how cow dung can be used to enhance the quality of clay bricks that can be used for low cost building construction in various communities around Nagpur.

Clay bricks have been used since 4300BC and are still widely used today (Krakowiak et al., 2011). Next to concrete and steel, masonry is the most used construction material on Earth. Clay has the property of forming a coherent sticky mass when mixed with water, being readily mouldable when wet but if dried retains its shape (Okolode, et al, 2012). The brick making technology is driven by using the soil onsite or near to site, and then a certain amount of fibre is mixed into the soil, depending on the characteristics of the soil, and then stabilized by compaction, so as to improve the engineering properties of the produced bricks. (Makunza, 2006)

This research is driven by the objective of making extensive use of raw earth, containing a natural component of clay, as the main building material, aided by a fibrous material, which in this case is cow dung. This is to develop technologies that are energy saving, eco-friendly and sustainable (Okolode et al., 2012). The scope of this report presents the fundamental investigation and procedures for the manufacture of the clay brick of which the constituents are clay, cow dung, sand, silt and water. The principal processes and procedures for forming the bricks are researched, tested, analyzed and discussed, and appropriate conclusions and recommendations are drawn

Earth is one of many alternative materials that can be used in place of residential stick building. A number of binders have been used to stabilize earth, for construction. Such binders are aimed to improving water proofing or wear resistance properties of vulnerable earth based construction. Such binders include cements, lime, tars and bitumen's, sodium silicate, casein, oils and fats, molasses, and certain locally specific plant-based materials such as gum Arabic, other specific resins and the sap, latexes and juices from specific trees and other (Corum, 2005). Blast furnace slag and pulverized fuel ash are the two waste materials which are being used to the greatest extent in construction. These materials can make a particular



contribution in conserving energy in the manufacture of cementitious materials and of lightweight aggregates. A study on the reuse of paper de-inking sludge, undertaken in Spain, showed that, it has the potential as raw material for producing a binding material with pozzolanic properties (Asavaspisit and Chotklang, 2004; García , Vigil de la Villa, Vegas, Frías and Sánchez de Rojas, 2008). A research conducted by García , et. al.,(2008) showed that calcination paper sludge has higher pozzolanic characteristics as compared to other industrial pozzolanic by-products, such as fly ashes normally used in cements. Another research results on paper sludge as pozzolanic addition in cement manufacturing, indicated that a significant gain of compressive strengths (approximately 10%) was achieved; when 10% calcined paper sludge was blended with ordinary Portland cement (Moisés Frías Iñigo Vegas, Raquel Vigil de la Villa and Rosario García Giménez, 2012). In recent years, the use of solid waste derived from agricultural products as pozzolans in the manufacture of blended mortars and concrete has been the focus of researchers in the construction materials sector. The addition of ashes from combustion of agricultural solid waste to concrete is at present, a frequent practice because of the pozzolanic activity of the ashes toward lime. One of the most interesting materials is the ash obtained from the combustion of sugar cane solid wastes (Yalley and Bentle, 2009; Martins, et. al., 2012).

II. LITERATURE REVIEW

V.S.R. Pavan Kumar.Rayaprolu, P. Polu Raju, they carried out on the topic about Incorporation of Cow Dung Ash to Mortar and Concrete This paper presents result on study of cow dung ash (CDA) as supplementary cementing material in mortar and concrete. This paper mainly highlights the significance and necessity of consumption of these waste materials for the manufacturing of sustainable concrete for construction of green buildings in future.

T. Omoniyi, S. Duna, A. Mohammed. They studied on the topic Compressive Strength Characteristic of Cow dung ash blended cement Concrete. This work reports on an investigation into the use of cow dung ash (CDA) as Supplementary Cementitious Material (SCMs) in concrete. Cement was replaced with cow dung ash (CDA) up to 30% at 5% interval. Setting times (initial and Final) and slump test were carried out on the fresh cement/CDA blended paste and concrete respectively.

Peter Paa-Kofi Yalley, he studied and research on the topic based on Strength and Durability Properties of Cow Dung Stabilized Earth Brick. This research, reports on the investigation into the strength and the durability properties of earth brick stabilized with Cow dung. A local earth was stabilized chemically by Cow dung. A better compressive strength at the dry state and after 10 minutes of immersion in water was obtained with cow dung stabilization at content of 20% by weight of earth. Bricks stabilized with 20% Cow dung contents by weight of earth has a dry and wet compressive strength of 6.64 and 2.27MPa respectively.

Mr. Mohammed Majzoub, he studied on the topic utilization of cow-dung in brick making. This paper review about Some agricultural residues and animal wastes are useful in brick making. Examples are: saw dust, groundnut shell, "garad" seed, charcoal fines, bagasse and cow-dung. Cow dung, when added to brick clays modifies properties of those clays and results in better brick qualities compared to other organic waste additives. Addition of cow-dung to clays improves plasticity, reduces green breakage and acts as internal fuel in firing bricks thus reducing firing cracks.

P. Thej Kumar, R. Harshini Reddy and DVS Bhagavanulu, They conveys about project on the topic —A study on the replacement of cement in concrete by using cow dung ash|. Cement was partially replaced with four percentages (5%, 10%, 15%, and 16%) of cow dung ash by weight. Consistency limits and chemical composition of ordinary Portland cement (OPC), cow dung ash and OPC mixed with cow dung ash were determined. The compressive strengths of the mortar and concrete specimens were determined at 7, 14 and 28 days respectively. Test results indicated that the consistency limits increased up to an optimum content and decreased further with the increase in the % of CDA in cement. The compressive strength is increased when the cement is replaced by 5% of CDA and decreased with the increase in the cow dung ash content. This study observed that During hydration, the Calcium Hydroxide (CH) produced reacts with the silica from CDA over time to form the more stable Calcium Silicate Hydrates(C-S-H) which can be responsible for the appreciable strength gain. It has been reported by several researchers that incorporation of pozzolanic materials into cement reduces the CH formation (which promotes micro cracking) and enhances formation of C-S-H, which promotes later strength gain.



Sruthy B, Anisha G Krishnan, Gibi Miriyam Mathew, Sruthi G Raj, They conveys about —An experimental investigation on strength of concrete made with cow dung ash and glass fibre. Cow dung is used as fuel for the domestic purpose, which generates solid waste as ash. This paper presents the result on the study for the use of Cow Dung Ash (CDA) as partial replacement of cement in production of concrete. This replacement was designed to study the effects of adding Cow Dung Ash (CDA) in various percentages by weight (6%, 8%, 10%, 12% and 14%) of cement. To strengthen the CDA concrete and making it more durable 0.5% glass fiber is being added, as it is an economically strong material, have excellent flexural strength, crack resistance and can also be used as an alternate material for concrete construction. The M25 mix design for the proposed concrete mix is calculated. Results showed that up to 8% replacement of cement by cow dung ash there was an increase in compressive strength. They finally resulted that The replacement of cement with cow dung ash 6% and 8% leads to increase in compressive strength whereas the percentage replacement of 10% leads to decrease in compressive strength.

Aiyedun;D.M. Raheem; F.T. Owoseye and B.U. Anyanwu They studied on the topic Production and characterization of clay – cow dung insulating fire – bricks. The use of clay is of high economic potential in Abeokuta, South West Nigeria, to metallurgical, chemical and allied, ceramic and glass industries. This research work was carried out to investigate the suitability of using clay – cow dung to produce insulating firebrick and to determine the optimal ratio of the constituent. The results showed that all the brick samples had good insulating characteristics, suggesting that cow dung can be used as additive in production of insulating fire- bricks.

III. METHODOLOGY OF PROPOSED SURVEY

Data Collection

Composition required for making brick

1. Cow dung = 0 to 30 %
 2. Lime = 5%
 3. Clay or Grass = 75%
 4. Cow urine or water = as per requirement
- Proportion of material can be increase or decrease

Methods

2.2 Test methods A few small-sized bricks without stabilizer were produced as a preliminary test to assess the optimum compression pressure that might be required to produce a brick of maximum strength. The optimum moisture content of earth in its natural state (not dried in oven) and also the mass of earth required to produce a batch of 15 bricks were also required. A BREPAK earth brick press (see Figure 1) that could deliver pressures of up to 35 MPa, was used Civil Engineering the laboratory, for the bricks production block mould pressure pump handle handle extension block mould cover base barometer

Figure 1 Brick moulding equipment

Preliminary tests such as dry density and moisture content of the earth in the natural state were first conducted on the earth bricks without stabilization and with 15%, 20%, 25%, and 30% cow dung stabilization to ascertain the optimum water content for each batch. Afterwards investigation was conducted on bricks with 0%, 15%, 20%, 25%, and 30% of cow dung by weight of earth material and its effect on the dry density, compressive strengths, abrasive resistance and water absorption coefficients at the optimum moistures contents were analyzed after 28- days of air curing. Five batches of 15 bricks per batch were produced for the study. In all a total of 75 bricks were used in the studied.

Preparation of Clay

Preparation of Clay Pure clay is taken for the preparation of bricks. The clay in top layer of soil about 200mm depth is thrown away, as it may contain impurities. After the top layer is removed, the clay is dug out from the ground and is spread over the plain ground. The clay is cleaned of stones, vegetable matters and other wastes in visible form. The lumps of clay are broken down manually. The cleaned clay is then exposed to atmosphere for softening. A weathering period of 4 weeks is provided.

**Mixing**

In the work, only hand mixing is used to mix the ingredients together. Clay is mixed with cow dung and lime in different proportions. Lime is kept constant as 5%. dung and lime are added as excess materials.

Moulding

The prepared clay is moulded into brick shape. Wooden rectangular shaped moulds of size (200x100x100) mm were used for the purpose. The longer sides of moulds are projected out of the box in order to serve as handles. The mixture is filled in the mould in three layers and tamping is provided for each layers by using a wooden tamping rod. The top surface is leveled using a trowel. After setting, the mould is removed and the bricks are taken for drying purposes.

Drying

After moulding the bricks were taken for drying. It is done to avoid the formation cracks. The bricks are laid in stacks in way so as to allow sufficient circulation of air between them. The bricks are kept under sunshade for a period of 3 days for drying. Drying provides rigidity and also avoids the formation of cracks

Testing

After drying, the bricks were taken for testing. Compressive strength and water absorption are two major physical properties of bricks and they also indicate the bricks ability to resist cracking of face. So, compression test and water absorption test are conducted and results were analyzed

IV. OBSERVATION**Density test**

The objective of this test was to determine how the moisture content influences the density of the bricks and the effect of cow dung on density of the bricks. Three bricks from each batch were selected after four weeks of curing. These bricks were gently wiped with non-absorbent cloth in order to remove any dust or loose matter stuck to them. Each dimension of these bricks in the middle of each face was measured and the average calculated (see Figure 2). Their volumes were then calculated. These bricks were then oven-dried at a temperature of 105°C until constant masses of the bricks were obtained (BS1880, Code of for earth, 1990). The mass of the bricks were considered to be constant when the difference between two weighing at 24 hour intervals was less than 0.1% of the initial masses. On removal from the oven the bricks were left open to ambient air to cool (typically for two hours). After cooling, the bricks were weighed and then the densities were calculated and the average was then taken from each batch.

1. Put a brick in the ventilated oven and dry it at a temperature of 105° — 115° C

Till it achieves appreciable constant mass.

2. Then cool it in room temperature and record its mass as M.

3. After that, measure the dimension of the brick and calculate its volume.

Calculation:

The bulk density of brick is calculated by the following formula:

Bulk Density = Mass (M) / Volume (V)

$$\text{Length, } L = \frac{L_1 + L_2}{2} \quad \text{Height, } h = \frac{h_1 + h_2}{2} \quad \text{Width, } w = \frac{w_1 + w_2}{2}$$

Dry Compressive strength test

Three bricks which had no surface cracks visible to the naked eye were selected from each batch of moulded bricks. The bricks were oven-dried to a temperature of 40°C until constant masses were obtained (BS1880, Code of for earth, 1990). The bricks were then removed from the oven and left to cool in open air, and gently wiped of any dust or loose dirt stuck to them. The bricks were then tested for their dry compressive strength using a compression test machine.

1. Place the specimen with flat face horizontal and mortar filled face facing upwards between plates of the testing machine.
2. Apply load axially at a uniform rate of 14 N/mm² (140 kg/cm²) per minute till failure occurs and note maximum load at failure.
3. The load at failure is maximum load at which the specimen fails to produce any further increase in the indicator reading on the testing machine.



Calculation Compressive Strength of Bricks = Maximum Load at Failure (N)/Average area of bed face (mm^2)

Wet Compressive strength

Buildings are often exposed to the effect of water, particularly as a result of capillarity and of spraying from rain water. The mechanical strength of wet bricks is found to be weaker than those of dry bricks. The main purpose of this test was to find the minimum strength of the bricks and also to improve on the strength of the wet bricks if they were found to be unsatisfactory. Again three bricks were selected from each batch and oven-dried at 40°C until constant masses were obtained. The bricks were then air cooled. The bricks were dusted and then fully immersed in water of temperature of about 20°C in the laboratory for 10 minutes. The bricks were then removed from water and dried with a tissue. The bricks were then tested for their compressive strength using compression test machine.

Water absorption test (IS-3495 part-3)

Water absorption of brick depend on their porosity which is due to void of various size present in brick. Almost all brick absorb water by capillary action. But porosity and water absorption does not give proper indication as to whether brick work can keep away the rain water and protect the interior from dampness travelling from outside. Permeability measure the travel of moisture through a brick. Percentage of water absorption give indication of compactness which is obtain from burning (1) 24 Hour Immersion Cold water Test. Dry bricks are kept in oven (105-115 C) till attains constant mass. After cooling the bricks to room temp. Weight recorded as W_1 . Now bricks are immersed in water at a temperature of 27+2 C for 24 hour. Bricks are then taken out of water and wiped with a damp cloth and weight as W_2 after 3 min.

Water absorption in % = $W_2 - W_1 / W_1 \times 100$

Average water absorption shall not be more than 20% by weight up to class 125 and 15% by weight for higher class

Five- Hours Boiling Water Test

Weight of the oven dried bricks (W_1) is recorded as above. Then the specimen is immersed in the Water and boiled for five hours, followed by cooling down to 27° 2°C by natural loss of heat within 16-19 hours. Then bricks is taken out of water and wiped with a damp cloth and the weight is recorded as W_3 .

Water absorption in % = $W_3 - W_1 / W_1 \times 100$

Comparison between red brick, cow dung brick and fly ash brick

Properties	Red Bricks/Clay Bricks	Cow dung brick (30%)	Fly Ash Bricks	Remarks
Density	1600-1900 kg/m ³	1800-1850 kg/m ³	1700-1850 kg/m ³	Higher load bearing
Compressive strength	30-35 kg/cm ²	45-50 kg/cm ²	90-100 kg/cm ²	Higher load bearing
Absorption	15-25%	12%	10-14%	Less dampness
Dimensional stability	Very low tolerance	Low tolerance	High tolerance	Saving in mortar up to 25%
Wastage during transit	Up to 10%	Up to 8%	Less than 2%	Saving in cost up to 8%
Plastering	Thickness vary on the both sides of wall	Not much vary	Even on both sides	Saving in plaster up to 15%.
Cost	Less cost	Very low cost	High cost	20% cost reduce
Weight	2.92 kg	2.82 kg	2.84 kg	Slightly less

Table 1: comparison between bricks



Note

1 Mpa = 10.1972 kg/cm²1 kg/cm² = 0.0980665 Mpa**V. RESULT & DISCUSSION**

By conduction of this study & analysis of data following result has been made based on experimental investigation and research.

The effects of moisture on Dry Density Table 2 shows the results of the preliminary test. It could be seen that there were different optimum moisture contents for earth bricks with cow dung as stabilizer compared to those without any stabilizer. The optimum water content for the earth bricks without stabilization and for bricks with 15% cow dung content was 10% by weight of earth. The corresponding maximum densities were 1748 kg/m³ and 1841 kg/m³ respectively. The optimum moisture content for earth brick stabilized with 20%, 25% and 30% of cow dung at 28-day curing age was found to be 11% and had maximum densities of 1847 kg/m³, 1861 kg/m³ and 1910 kg/m³ respectively. Although 1% addition of water seemed only a small amount (about 450g), it was possible that 1% additional water added permitted more complete hydration of the cow dung. The 1% addition of water gave water to cow dung ratio of 0.2, 0.25 and 0.33 for earth bricks with cow dung content of 30%, 25%, and 20% respectively. The minimum water/cement ratio for adequate hydration is between 0.22 and 0.5. The 1% excess water gave water/cow dung ratio values between 0.2 and 0.33 for bricks with cow dung stabilizer, which thus fall within the range of water requirement for adequate hydration for stabilized Lateritic Earth.

The batches are labeled such that Xi represents batch X with % of water content by weight of earth.

Specimen	Dry density kg/m ³	Weight (kg)
A10	1748	2.69
A11	1739	2.67
A12	1713	2.63
B10	1841	2.83
B11	1797	2.76
B12	1766	2.71
C10	1797	2.76
C11	1847	2.84
C12	1807	2.78
D10	1817	2.79
D11	1861	2.86
D12	1758	2.70
E10	1813	2.79
E11	1910	2.93
E12	1837	2.82

Table 2: dry density of sample

Furthermore, batches with 0%, 15%, 20%, 25% and 30% of cow dung content were assigned letters A, B, C, D and E respectively



Weight calculated by density multiply by volume

Volume of brick = $0.190 \times 0.090 \times 0.090 \text{ mm} = 0.001539 \text{ m}^3$

Weight = Density X density

Table 3 Mechanical characteristics and strength of Cow dung Stabilized Earth Brick (CSEB)

Specimens	Dry density (kg/m ³)	Dry compressive strength (MPa)	Wet compressive strength (Mpa)	Water absorption coefficient, C _b (%)
A	1748	4.56	0.00	16.80
B15	1797	4.70	0.85	19.90
B20	1910	5.77	2.76	10.40
B25	1861	5.14	2.25	11.00
B30	1847	4.62	1.94	12.00

NB. The batch with 0%, of cow dung content is assigned letters A and those with certain level of cow dung content are labeled such that Bi represents batch B with i% of cow dung content by weight of earth.

Dry Compressive strength

The compressive strength at the dry state is given in Table 3 and as depicted in Figure 6. It could be seen that bricks with 20% of cow dung content had the highest dry compressive strength of 5.77 MPa which was an increase of about 67% over unstabilized earth brick but beyond that, there was a decrease in dry compressive strength to 5.14 and 4.62 MPa for bricks stabilized with 25% and 30% cow dung content respectively. This then implies that the optimum cow dung content for compressive strength is 20% by weight of earth. This might be attributed to the fact that the hydration products of the cow dung up to 20% was just enough to fill in the pores of the matrix and enhanced the rigidity of its structure by forming a large number of rigid bonds connecting earth particles.

Wet Compressive strength

The compressive strength after immersion in water for 10 minutes at the age of 28 days is given in Figure 6. The immersion in water for 10 minutes reduced the compressive strength by an average of 67% for cow dung stabilized samples compared to the compressive strength in their dry state. Furthermore, complete disintegration of un-stabilized specimens was observed in a few minutes after immersion in water. Again bricks with 20% cow dung content as stabilizer had the highest wet compressive strength of 2.76 MPa. Specimens with cow dung content above 20% did not give any significant improvement of strength of the wet samples. The lower strength of the wet samples could be prevented by treating the surface with cow dung render, with polymers or cow dung-lime renders, especially when the construction is to be exposed to water.

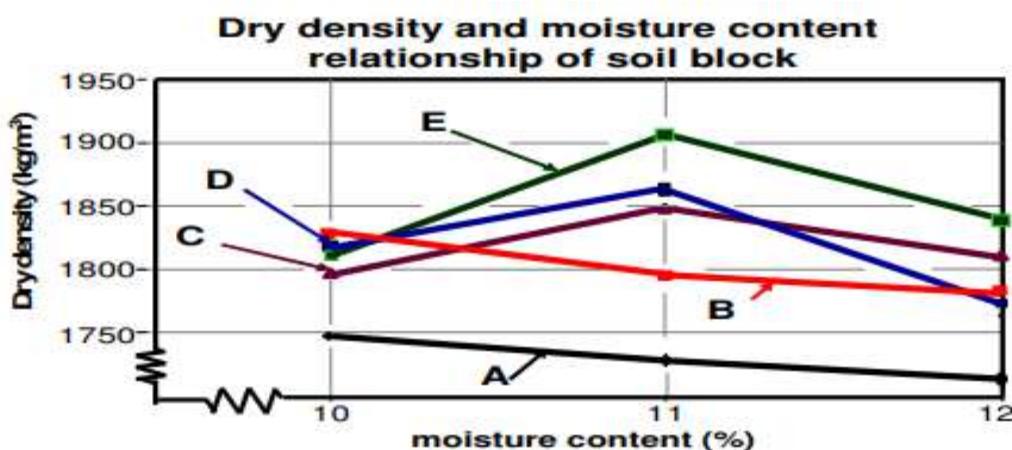
Water absorption by capillary

Cow dung stabilization reduced substantially the water absorptivity from 16.8% for 0% cow dung content to 14.2%, 10.4%, 11 and 11.36%, when cow dung contents were 15%, 20%, 25% and 30% respectively (Figure 8). The 20% cow dung content thus resulted in lower migration of water into the brick (i.e. lower permeability). This could be explained that the presence of cow dung up to 20% eventually led to higher hydrated cow dung and higher mortar content. The higher mortar content makes the brick with some amount of cow dung less porous and more impermeable than the earth matrix, probably by infilling the voids and displacing some of the earth with far less permeable cow dung hydration products, thereby reducing paths for water ingressions. Again increasing cow dung content above 20% did not much improve the impermeability of the bricks.



VI. CONCLUSION AND FUTURE WORK

By conduction of this study following conclusion has been made based on experimental investigation and research.



Optimum Moisture content and try density of earth brick

Cow dung brick can be considered as a sustainable building material. These bricks are eco-friendly, and lighter in weight. The brick obtained by partial replacement of clay with Cow dung. It maintain low temperature both inside & outside of building as compared to other brick, its resist control pollution inside the building and it will be save the electric power. Cow dung brick are cheaper, light weight and have good strength and cost effective over traditional brick so it is good eco friendly substitute over traditional brick for general building work.

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Partial Replacement of Quarry Dust and Cement with Ground Granulated Blast Furnace Slag

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Abstract:

Concrete is an essential part in the development of infrastructure Viz., buildings, industrial structures, bridges and highways etc., preeminent to usage of great quantity of concrete. The construction industry in today's date is growing expeditiously. Cement is a prime material in the concrete mixture which manufactured by the materials like lime and silica. The value of concrete is attributed to value of its ingredients are high cost. Thus this study is carried out to find the alterative option in ingredients of concrete, like GGBS (Ground Granulated Blast furnace Slag) can be used as a replacement of cement in the concrete. This replacement will lower the cost and will make less use of cement in concrete. In this experimental study the compressive strength of concrete with GGBS as ingredient will be understand. Along with that the cost analysis is also done to suggest the most optimized percentage of GGBS to be used in various condition.

Keyword: GGBS; Compressive Strength; Cement; Concrete

I. INTRODUCTION

Concrete is now-a-days no longer a material consisting of cement, aggregates, water and admixtures, but it's manufactured by different types of ingredients performed in different conditions exposures. Engineers are tailoring concrete with different specific applications and it contain different materials like micro silica, colloidal silica, binders, fillers and pozzolanic materials. One of the main reasons for the deterioration of concrete in the past is that too much emphasis is laid on concrete compressive strength rather than on the

performance of concrete. Concrete has tendency to harden and attain strength for few more years. Concrete withstands compression (crushing), but is extremely poor in tension (stretching). After the water cement is the prime ingredient of concrete. But the productions of cement is more costly and expensive and major problem for environment and civil engineer is resolution to find out the need.

Many researchers have resolved the path of reducing the cement as ingredient to avoid the CO₂ emissions. Several by-products are replaced with cement like Fly ash, Silica Fume, GGBS. River

sand is also a most expensive ingredient in the concrete and due to high usage of river sand its environmental danger and its results into high price. That's why we have to find the alternative material to replace the sand. Quarry dust the option to replace the sand. Thus, we have studied the replacement of cement with GGBS and sand with Quarry dust. Ground-granulated blast- furnace slag (GGBS or GGBFS) is obtained by quenching molten iron slag (a by-product of iron and steel making) from a blast furnace in water or steam, to produce a glassy, granular product that is then dried and ground into fine powder. Ground-granulated blast furnace is highly cementitious and high in CSH (calcium silicate hydrates) which is a strength, durability and appearance of the concrete.



Quarry dust is the residue from the granite quarry. Quarry rock dust can be economical alternative to the sand. It's largely used in the highways and finishing material and used to manufactured hollow blocks and light weight concrete. After processing fine particle of size less than 4.75mm is used in this work. In New York, construction of the World Trade Centre has about 40% GGBS as replacement of cement in the concrete (Slag Cement Association, 2005).

II. LITERATURE REVIEW

1. Geological study is carried out on the behavior of fly ash based bricks by saravana Raja Mohan et al (2013), Fly ash bricks shows better result against sulphate attack for which experiment is conducted of cycles of salt exposure. It means nil Efflorescence. When compare to clay bricks, fly ash brick is 10.609a lighter.
2. A Sumathi (2014), conducted experimental study to find the optimum mix percentage of fly ash brick. From the result it was found that among the seven proportions the maximum optimized compressive strength is obtained for optimal mix percentage of Flyash-15' to, Lime-30' o, Gypsum-2' quarry dust-53' o.
3. Experimental study find out on fly ash bricks and differentiating with clay brick by Aakash Suresh Pawar (2014). Manufactured fly ash brick having high load carrying capacity and it is superior than commercially available clay bricks. The characteristics values of fly ash bricks are exceptional.
4. Krishnamoorthy et al (1994) researched the quantum of fly ash when added to soil for making good bricks. Fly ash are obtained from Vijaywada thermal power station was mixed with soil in varying ratios such as 0' o, 10' o, 20' o, 30' o, 40' o, 50' o are described that the bricks cannot be produced with large swelling soils without additives. The property of strength and water absorption of bricks made with replacement of soil by 50' o of fly ash was suitable and strength were ranging from 9.8 to 11.5 N/mm² but for the country brick, it was about 3.5N/mm².
5. Pathan V.G, Ghutke V.S and Pathan G have resusltant in their project that ground granulated blast furnace slag is good replacement of cement than various other alternatives. The rate of strength gain in slag replaced concrete is less in speed in

early stages but with proper curing the strength goes on increasing enormously. The compressive strength decreases when the cement replacement is greater than 50%. Use of slag or slag cements usually improves workability and decreases the water demand due to the increase in paste volume caused by the lower relative density of slag. From their results they concluded that 45% replacement of cement by GGBS gives the highest amount of compressive strength. They suggested that the replacement of cement with slag should be limited to 40% in India.

2. Testing on Cement

- 1) Fineness Test
- 2) Standard Consistency Test
- 3) Initial and Final Setting time
- 4) Physical properties of cement

S.NO	CHARACTERISTICS	VALUES
1	FINENESS	3.12
2	NORMAL CONSISTENCY	36%
3	INITIAL SETTING TIME	48 MIN
4	FINAL SETTING TIME	240MIN
5	SPECIFIC GRAVITY	4.8%

3. Characteristics of Fly Ash Bricks

1. The standard size of the brick is 230 x110x70 mm.
2. The bricks are manufactured and tested as per IS 12894-2002.
3. Fly ash bricks are sound, compact and uniform in size, shape and colour. Smooth rectangular faces of the bricks are accompanied with sharp and square corners.
4. They are free from visible cracks, warpage, flaws, and organic matter.
5. Economical and environment friendly.
6. 28 % lighter than ordinary clay bricks.
7. Compressive strength: - 7.5 N/mm² on an average.

III. METHODOLOGY

1. Collection of raw materials

- 1) Fly Ash: Fly ash is a by-product of burning pulverized coal in an electrical generating station
- 2) Quarry Dust: It is residue taken from granite quarry
- 3) Cement: The cement of grade 53 was used. 53 Grade OPC is a higher strength concrete.
- 4) GGBS: Ground-granulated blast-furnace slag (GGBS or GGBFS) is obtained by quenching molten iron slag (a by-product of iron and steel making) from a blast furnace in water or steam, to produce a glassy, granular product that is then dried and ground into fine powder.

It is evident that about 85-100% of total raw materials are either waste materials or byproduct barring sand. Hence there is a lot of saving of natural resources like fertile soil and coal, if compared with red bricks activity.

IV. TEST RESULT AND OBSERVARTION

1. Water Absorption Test After 21 Days

Sr No.	Ratio	Average Water Absorption (%)
1	N	1.88

2	S1	1.59
3	S2	1.31
4	S3	0.63
5	C1	0.98
6	C2	0.67
7	C3	1.26

2. Compressive Strength of 7 Days

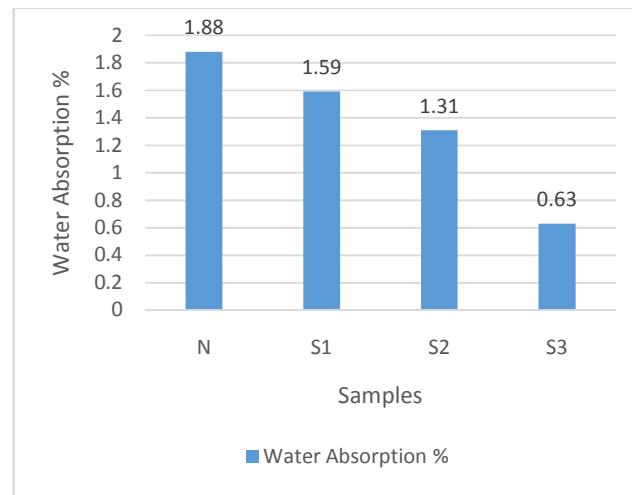
Sr No.	Ratio	Avg Compressive Strength (N/mm ²)
1	N	9.32
2	S1	11.24
3	S2	8.17
4	S3	13.23
5	C1	10.43
6	C2	8.13
7	C3	7.80

3. Compressive Strength of 21 Days

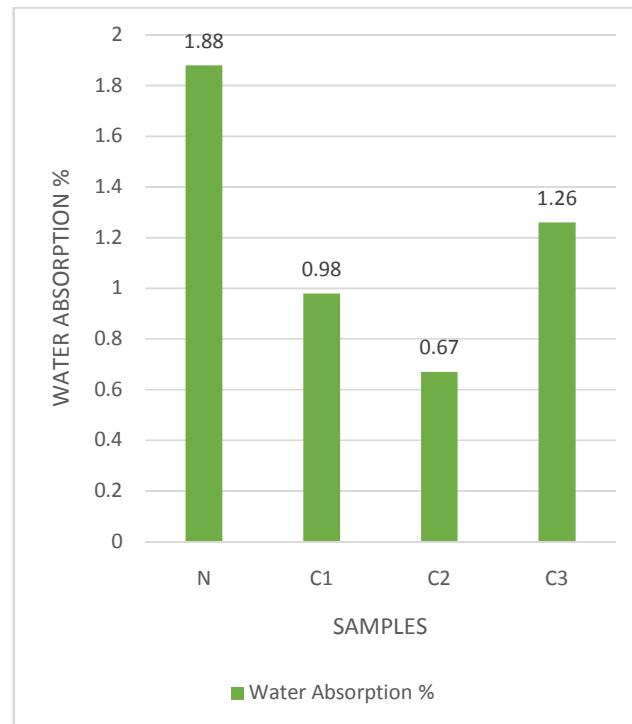
Sr No.	Ratio	Avg Compressive Strength (N/mm ²)
1	N	15.34
2	S1	18.78
3	S2	13.56
4	S3	22.31
5	C1	17.28
6	C2	13.59

7	C3	11.35
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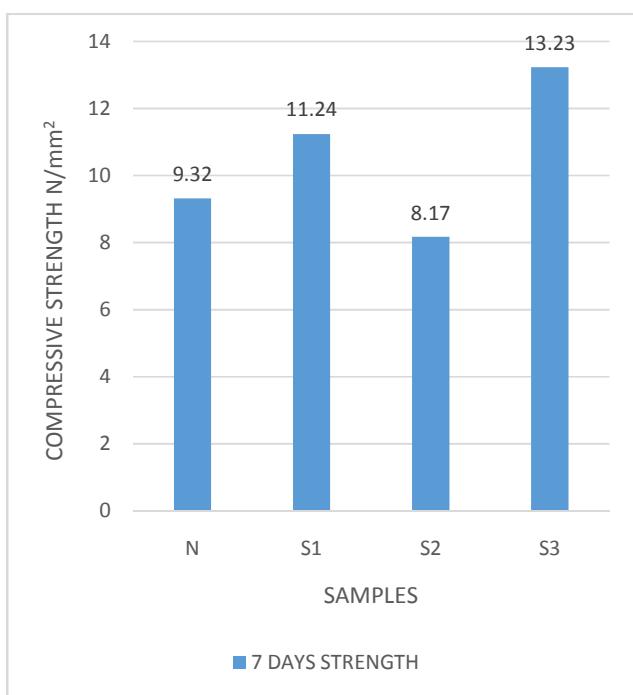
4. Graphs



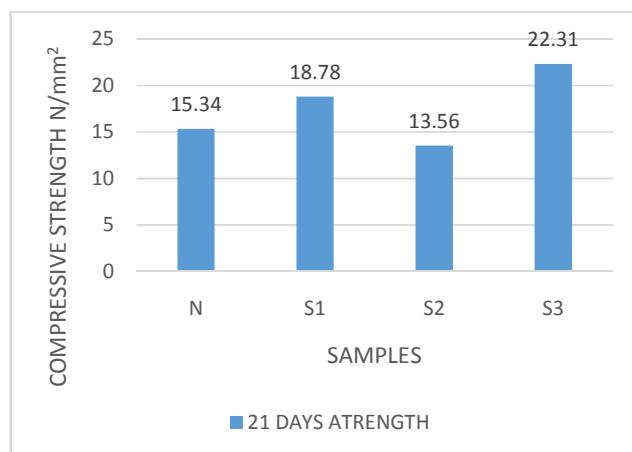
Graph 1: Water Absorption % in partial replacement of Quarry dust with ggbs



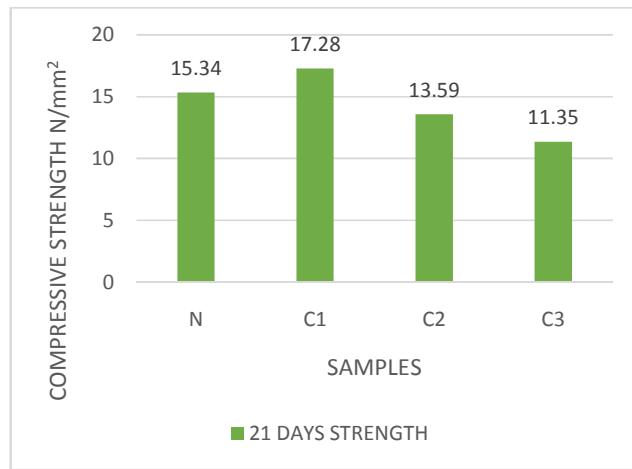
Graph 2: Water absorption % in partial of cement with ggbs



Graph 3:- Graph showing compressive strength of brick after 7 days of curing in partial replacement of quarry dust with ggbs



Graph 5:- Graph showing compressive strength of brick after 21days of curing in partial replacement of quarry dust with GGBS



Graph 6:- Graph showing compressive strength of brick after 21days of curing in partial replacement of cement with ggbs

V. CONCLUSION

During the experiment and investigation on fly ash bricks in partial replacement of cement and quarry dust with ground-granulated blast-furnace slag following results were found and recorded.

1. In partial replacement of quarry dust with ggbs, the % of water absorption decreases with increase in the % of ggbs.

Graph 4: Graph showing compressive strength of brick after 7 days of curing in partial replacement of cement with ggbs

2. In partial replacement of cement with ggbs, the % water absorption increases with increase in the % ggbs.
3. From the results it was found that, among the seven proportions the maximum optimized compressive strength is obtained for optimum mix percentage of Flyash-50%, cement-10%, Quarry dust-10% and ggbs-30% as 22.31N/mm².
4. The weight of brick is lighter than the normal fly ash brick and its saves cement and also have environmental benefits.
5. The cost comparison between “N” sample and “C3” sample, the cost of brick are quite similar i.e. N=3.08 Rs and C3=3.02 Rs and it also satisfies specification of I.S. 3495(P-I)-1976, Determination of Compressive Strength (Second Revision).

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Storm Water Runoff Solution by Infiltration Bed

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Abstract – The purpose of research such that, urban flooding is a major problem in many parts of the world and is one of the most natural disastrous event which takes place every year, especially in a coastal cities. Urban flood, being a natural disaster, cannot be avoided; however, the losses occurring due to flooding can be prevented by proper flood mitigation planning. As such, it is necessary to have a proper estimation of flood extent and flood hazard for the different flow conditions so that proper flood evacuation and disaster management plan can be prepared in advance. In coastal urban cities like Mumbai, mostly severe flood scenarios take place due to combination of surface flooding.

The report is comprised of a technology review and explores a solution on “Runoff Storm Water by Infiltration Bed”. The basic Design of the study of project Consist of layers. The most upper layer is of porous pavement (permeable pavement layer), middle layer will be infiltration bed in which consist of clean uniformly graded aggregates with depth of 5 – 8 thickness. Then below the layer of aggregates percolated PVC Pipe will provide for collection of Infiltrate water. That water is transferred towards the Municipal Corporation and again it will filtered then its delivered to utilization purposed.

Overall the report aims that – Urban flood in the city causes great amount of distraction and inconvenience, it cause heavy traffic jam due to street water logging, paralyzes day by day activities, damage the urban Infrastructure (i.e. Road, parking lots, electric poles...etc) causing sewer economic damage. So, here advancing that runoff storm water is penetrated through porous pavement road and it infiltrated by providing Infiltration Bed. The filtered storm water runoff collected in PVC pipe and transfer to the Municipal Corporation for the utilization in better way.

Keywords- *Road runoff, Storm water treatment, Permeable pavement with infiltration bed, infiltration rate.*

I- INTRODUCTION

1.1 General Introduction; Storm water, also spelled storm water, is water that originates from rain, including snow and ice melt. Storm water runoff is water resulting from rainfall that does not get absorbed by the surfaces it touches and can be observed flowing over yards, streets, buildings, parking lots, and other surfaces when it rains. Storm water can be seen flowing down the sides of roads during a heavy rainstorm. All properties with impervious surfaces (e.g., roof, driveway, sidewalk, etc.) generate storm water runoff. Storm water runoff flows across the land or in more developed areas into a Storm water systems also include green treatment infrastructure like rain gardens, infiltration swales, etc. Storm water is

ultimately conveyed to our local streams, rivers, ponds, and lakes – sometimes with treatment, but often time simply by direct conveyance without treatment.

Increase in world Population urbanization leads to decrease in available resources. Due to the increase in Population, it becomes necessary to build commercial and residential building like houses, office, factories, shopping complexes and construction like Road, building, etc. to complete the demands of people. Thus more and more land is being covered with concrete. This results being cut to clear the land (deforestation). Forests bring rain. Due to the excessive deforestation the natural resources are day by day decreases. Sometimes sun rays are directly contact with earth surface and also many gasses are present in the atmosphere it becomes increase the earth temperature it cause global warming.

With increasing population, demand for industrial goods has increased. All industries require water for different purposes. Groundwater is the main source of water for most of the industries. This also results in the depletion of the water table. The water table is getting deflected because excess water is drawn out and is not being replaced at the same rate. These are the reasons behind The Natural cycle disturbed.

Due to the Natural cycle is disturbed, in the past few decades the frequency and intensity of extreme weather event (ex. rainstorms) caused by climate change. Agriculture is the occupation of most of the people in India. As rainfall is irregular and limited to a few months, farmers use groundwater for irrigation. However, there are some places where canals are made for irrigation but these also have less or no water due to less rainfall. To meet the demands of increasing population, farmers grow more crops thus more and more groundwater is used every year. Hence, there is not enough surface water available to last throughout the year.

In natural landscapes, such as forests, soil absorbs much of the Storm water. Plants also reduce Storm water by improving infiltration, intercepting precipitation as it falls, and by taking up water through their roots. In developed environments, unmanaged Storm water can create two major issues: one related to the volume and other related to potential contaminants the water is carrying (water pollution). Storm water is also an important resource as human population and demand for water grow, particularly in arid and drought-prone-climates. Storm water harvesting techniques and purification could potentially make some urban environments self-sustaining in terms of water.

In Urban area, urban runoff is surface runoff of rainwater created by urbanization. This runoff is a major source of flooding and water pollution in urban communities worldwide. Impervious surface (roads, parking lots and side walk) are constructed during land development. During rain storms and other precipitation events, these surfaces (built from materials such as asphalt and concrete), along with rooftops, carry polluted Storm water to storm drains (Storm water drains, which are designed to address high rainfall concentrated in a short period of time, face clogging with garbage and sewage), instead of allowing the water to percolate through soil. This causes lowering of the water table (because groundwater recharge is lessened) and flooding since the amount of water that remains on the surface is greater. Most municipal storm sewer systems discharge untreated Storm water directly into the streams, rivers or other water bodies (surface water).

Storm water management is the science of limiting this negative impact on the environment and enhancing the positive impact or catering for the hydraulic needs of a development while minimizing the associated negative environmental impacts (CSIR 2000). Because of the impermeable surface in urban area, flooding occurs very often as a human made event, Runoff from such surface has a high velocity, which adds to Storm water drainage system. This increases peak flow and overland flow volume and decreases natural ground water flow (as no percolation is possible) and evapotranspiration furthermore, urban runoff has an increased pollution load. Which lead to water pollution. The traditional model of Storm water management based on a misconception. It aims the draining of urban runoff as quick as possible with the help of channels and pipes; which increases peak flow and cost of Storm water management. This type of solution only transfers floods problem from one section of the basin to another section. Urban runoff contains a large amount of solids and a higher concentration of metals and other toxic components.

- Water is a precious Natural Resources and need to be conserved. The only one method to save water is to conserve it and avoid its wastage.

We can save the rain water in following ways :

1. Rainwater harvesting.
2. Drainage system.
3. Permeable pavement system.
4. Runoff water management.
5. Strom water management (conserved the rainwater)...etc.

II - CONSTRUCTION OF THE INFILTRATION BED

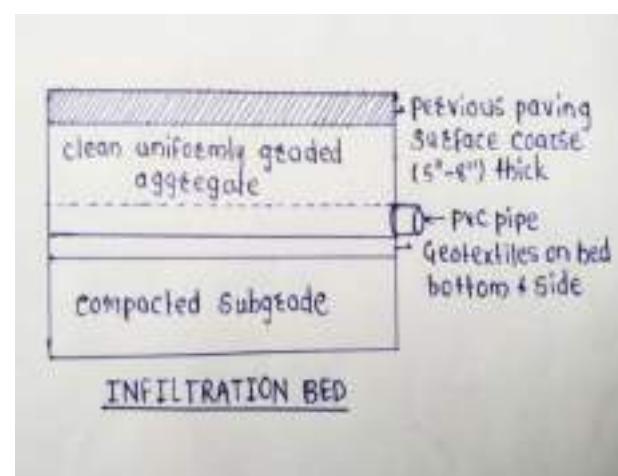


Figure No.1 Infiltration Bed

2.1 Layers of Infiltration bed

2.1.1 First layer: pervious paving surface

- It is upper most part of the infiltration bed.
- Thickness of permeable pavement is 3 inches.
- It is made of coarse aggregates, cement and admixture.
- Void content: 15% to 35% thickness.

2.1.2 Second layer: Uniformly graded aggregate

- The underlying infiltration bed is typically 12 – 36 in deep.
- Uniformly graded aggregate with approximately 40% void space.
- Size of aggregate used in the infiltration bed is AASHTO No. 3 (2.5 to 3 inches top) which range 1.5 – 2.5 inch in gradation.
- Depending on local aggregate availability, both larger and smaller size aggregate has been used.
- Geotextile is used on bed bottom and side to improve stability of soil and increasing property of material percolated PVC pipe.
- Pipe should be continuously percolated, smooth interior with a minimum. Inside diameter of 8 inches high density polyethylene pipe should meet AASHTO.

2.1.3 Third layer: Compacted Soil

- Compaction is the densification of soil by removing air void using mechanical equipment.
- In general soil densification includes compaction and consolidation.
- Compact is one kind of densification that is realized by rearrangement of soil particle without of water. It is realized by application of mechanic energy. It does not involve value fluid flow. But with moisture changing altering. Compaction is the application of mechanical energy to a soil to rearrange the particles and reduced the void ration.
- Increase bearing capacity of foundation.
- Control undesirable volume changes.

III - MODEL DESCRIPTION AND RESEARCH METHOD

3.1 Procedure

- Porous pavement bed consists of a porous Surface course underlain by a stone bed of uniformly graded and clean washed course aggregate.

- The porous pavement many consists of porous asphalt porous concrete and pervious pavement unity.
- Storm water drains through the surface is temporarily held in void at the stone bed and the slowly filtrates into underlying compacted soil mantle.
- The stone bed is designed with an overflow surface so that during large storm events peak rate controlled and no time does the water level rise to be pavement level.
- The bed bottom should be level and compacted. If fill is required it should consist of additional stone and not compacted soil.
- PVC pipe is provided in uniformly graded coarse aggregate to collected water. PVC pipe should be percolated. Thus some amount of water collect for our purpose and some amount of water will be under soil to increased water table.
- Collected water will transferred in housing areas for the purposes of utilization by municipal corporation.

3.2 Test Conducted on Infiltration bed

3.2.1 Percolation Test

Period to the start of construction, percolation test were conducted at select locations within and outside the Continues of what would soon become the infiltration bed to determine whether or not the soil on site were conducive for an infiltration BMP. The two location test pit one and two, figure below soil description were also noted as the test pits were excavated to the desired depth.

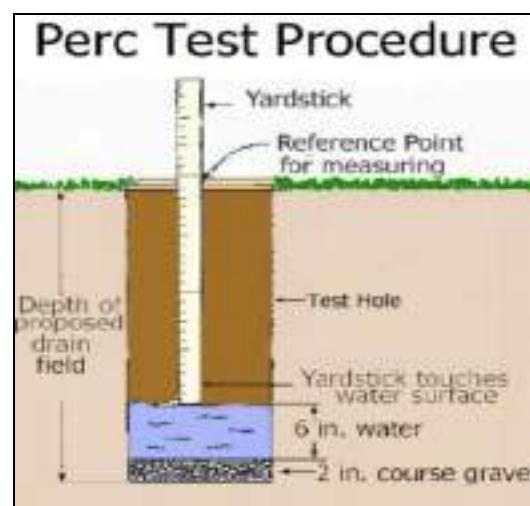


Figure No. 2 Percolation Test

3.2.2 Sieve analysis

A Sieve analysis (or Gradation Test) is a practice or procedure used in civil Engineering to assess the particle size distribution called as Gradation of a granular material by allowing the material to pass through a series of Sieve of progressively smaller mesh size and weighing the amount of material that is stopped by each Sieve as a fraction of whole mass.



Figure No. 3 Sieve Analysis

3.2.3 Pavement surface preparation

Used a broom to remove all debris from the pavement surface prior to conducting in the test. Debris left on the pavement surface can hinder the sealing of the permeameter to the pavement surface.

3.2.3.1 Permeameter setup

- Insure that both side of the square, rubber base and bottom of the square, metal base plate are free of debris.
- Apply sealant to one side of the square, rubber base.
- Place the side of the square, rubber base containing the sealant into the pavement surface. Evenly apply pressure to the top of the square, rubber base with hand pressure to force the sealant into the surface voids.
- The apply sealant on to the bottom of the square, metal base plate.

3.2.3.2 Pavement saturation

- Fill the standpipe to just above the top cap of the permeameter.
- Allow the water to remain in the bottom of the stand pipe for not less than one minute. it may be

necessary to add water to keep water level above the top cap of the permeameter.

- Check for leaks through seal. If leaking is noted, apply additional land pressure or repeat sealing processes.

3.2.3.3 Permeability Test

- To start the test, introduce water into the stand pipe to just above the desired initial head.
- When the water level is at the desired initial head, start the timing device. Stop the timing device when the water level within the stand pipe reaches the desired final head record the initial head, final head and time interval between the initial and final head.
- Repeat steps one and two without removing the permeameter from the test area .



Figure No.4 water permeability testing apparatus
(Elevation view – Approximate dimension)

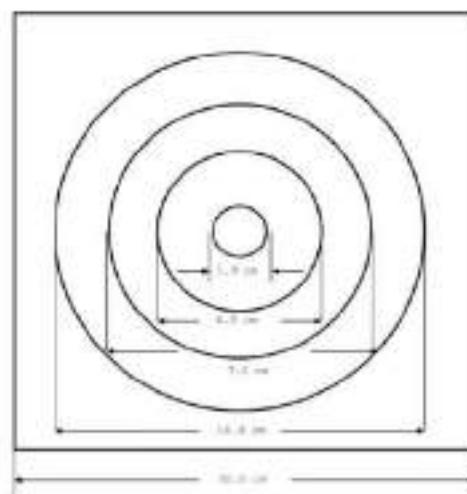


Figure No.5 water permeability testing apparatus
(Plan view – approximate dimensions and inside diameter of stand pipe)

IV - RESULT AND DISCUSSION

4.1 Introduction

The purpose of this chapter is to summarize the results of the test conducted and expand upon their significance.

4.2 Test

4.2.1 Results of Sieve analysis

Size of sieves to be used,

- For fine aggregate – 4.75 mm, 2.36 mm, 1.18 mm, 600 microns, 300 microns, 150 microns.
- For coarse aggregates – 25 mm, 20 mm, 12.5 mm, 10 mm, 4.75 mm.

For fine aggregates

- Take 1 kg of sand from the laboratory sample.
- Arrange the sieves in order of IS Sieves no. 12.5, 9.5, 4.75, 2.36, 1.18, 0.60 and 0.75. Keeping sieve no. 12.5 at the top and 15 at the bottom and cover the top.
- keep the sample in the top sieve no. 12.5
- Carry out the sieving in the set sieves for not less than 10 minutes.
- Find the weight of sample retained in each sieve.
- Tabulate the values in given tubular column.

For coarse aggregates

- Taken 1 Kg of coarse aggregates.
- Arrange the Sieves one over the other in relation to their size of opening. (25 mm, 20 mm, 12.5 mm, 10 mm, 4.75 mm).
- Carry out the sieving for the specified the time.
- Find the weight of aggregate retain on each sieve taken in order and presented in table.

Table No. 1 Sieve Analysis

Standard Sieve Size	% Passing
12.5 mm	100
9.5 mm	92 – 98
4.75 mm	34 – 30
2.36 mm	14 – 20
1.18 mm	7 – 13
0.60 mm	0 – 4
0.75 mm	0 – 2

4.3 Permeable pavement test

4.3.1 Measurement of permeability from falling head tests in boreholes

In situ falling head permeability tests were conducted at regular intervals in three boreholes down to the depth of 40-m, in accordance with the procedures provided in BS 5930

The test is performed by filling the casing with water which is allowed to seep into the soil. the water depth inside the casing is measured at specific time intervals from the start of the test. These measurements are made until the rate of drop is very small or a sufficient number of readings are obtained to accurately determine the permeability. Field falling head test provide more reliable data compare to laboratory test as they avoid soil disturbance and test a relatively larger volume of soil. In comparison with pumping test, the falling head test measures the permeability of a limited volume of soil but provides a more detailed profile of the permeability versus depth.

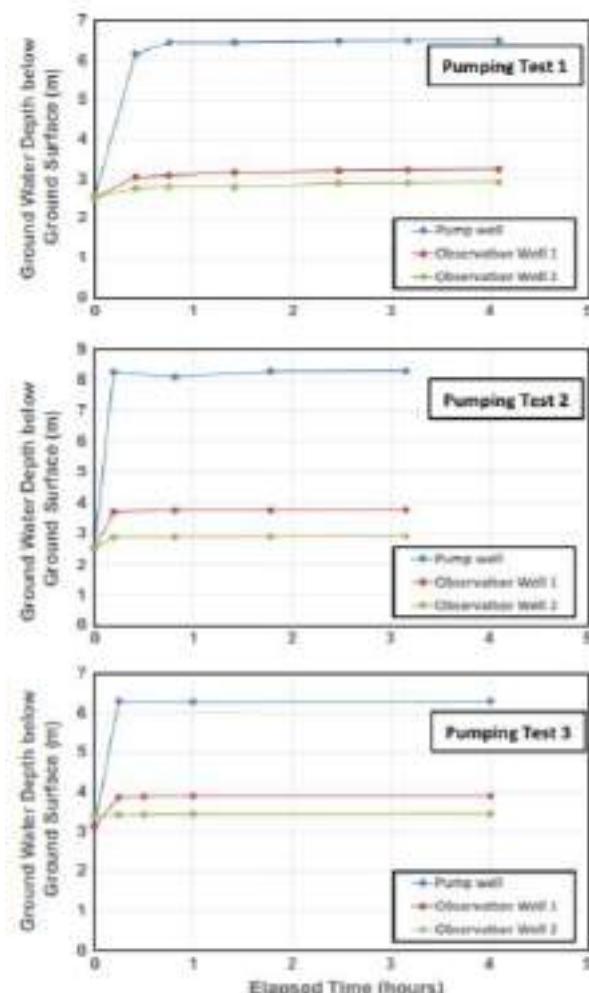


Fig No. 6 Variation of water level with time at the location of the pump and observation well.

4.4 Infiltration rate

The infiltration rate is the velocity or speed at which water enters into the soil. It is usually measured by the depth (in mm) of the water layer that can enter the soil in one hour. An infiltration rate of 15 mm/hour means that a water layer of 15 mm on the soil surface, will take one hour to infiltrate.

In dry soil, water infiltrates rapidly. This is called the initial infiltration rate. As more water replaces the air in the pores, the water from the soil surface infiltrates more slowly and eventually reaches a steady rate. This is called the basic infiltration rate.

The infiltration rate depends on soil texture (the size of the soil particles) and soil structure and is a useful way of categorizing soils from an irrigation point of view.

The most common method to measure the infiltration rate is by a field test using a cylinder or ring Infiltrometer.

Table No,2 Basic Infiltration rates for various soil types

Soil type	Basic infiltration rate (mm/hour)
sand	less than 30
sandy loam	20 - 30
loam	10 - 20
clay loam	5 - 10
clay	1 - 5

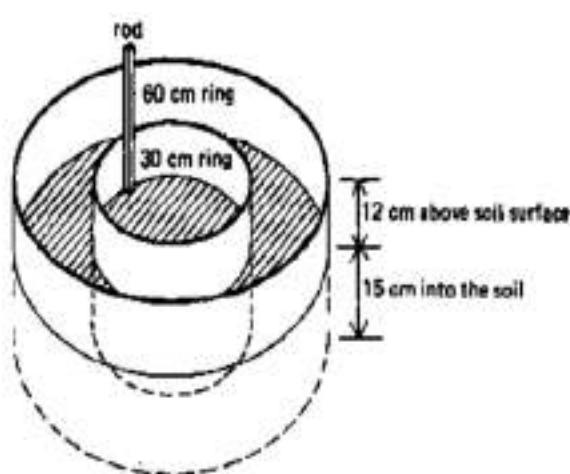


Figure No.7 Set-up of the field test

V - CONCLUSION

The overall Study Conclude that, by providing the Infiltration bed and water is collected into percolated PVC pipe. Which transferred to the Municipal Corporation (Utilization).And some amount of water is go towards the soil. But due to the compacted soil the water holding capacity is Maximum and that hold water is penetrate into the pipe. That's why we can use maximum amount of water.

VI - FUTURE SCOPE

Implementation of "Storm water runoff solution by infiltration bed".

- Proper drainage of surface runoff.
- Collected water can be reused for ground water recharge, urban landscaping or forming,..etc.
- Treatment of storm water in a early stage.
- Avoids damages on Infrastructure (private properties, streets, damps....etc); flood prevention.
- Can be integrated into the urban landscape and provide green and recreational areas.

Therefore, the research to be empirical and applied nature in the future. Here, collected runoff water will be used in various purpose. It implemented as, it reduce the traffic jam during the flooding. It must be important that it controlled the flood. Therefore the review of the research would be applied in the future.

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Self Curing of Concrete

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ABSTRACT: As water is becoming a scarce material day-by-day, there is an urgent need to do research work pertaining to saving of water in making concrete and in constructions. Curing of concrete is maintaining satisfactory moisture content in concrete during its early stages in order to develop the desired properties. However, good curing is not always practical in many cases. Curing of concrete plays a major role in developing the concrete microstructure and pore structure and hence improves its durability and performance. Keeping importance to this, an attempt has been made to develop internal-curing concrete by using Poly Ethylene (PEG-400). In this experimental investigation the strength characteristics of Normal Strength Concrete and high strength concrete, cast with the self-curing agent PEG-400 have been studied and compared with the corresponding conventionally cured concrete. IS method of mix design was adopted, for the normal strength internal curing concrete of grade M20 and for M50 grade of concrete is design on trial and error basis. For producing internal-curing concrete trial dosage of 1%, 2% and 3% of PEG-400 by weight of cement was used and tested. It was observed that after implementation of new technique the water consumption for Curing was significantly reduced by 100%

Keyword- To prevent evaporation from temperature, compressive strength, economical at desert, etc.

I.INTRODUCTION

Curing plays a chief function in the growth of concrete properties throughout construction. Curing is often used to provide the method by which hydraulic cement concrete mature and increase hardened property more than time as a product of the constant hydration of the cement in the occurrence of enough water (ACI, 2008). The function of curing is to lessen water disappearance from concrete and keep acceptable moisture content, especially throughout early ages, for continuance of the hydration method that is essential for the growth of cement microstructure. This will lead to a improved class cement adhesive and concrete and will help to attain the preferred properties. Though, good curing is not realistic in lots of cases and a amount of researchers have questioned whether it is feasible to set up self-curing concrete. It was establish that the improvement of use self-curing agent is to lessen water fading from concrete, therefore rising its water preservation capability compare with that of conservative concrete and that water soluble polymers may have this potent. Building industry make use of bunch of water in the name of curing. The days are not far-off that all the building industry has to button over to an substitute curing system, not simply to save water for the sustainable growth of the atmosphere but also to encourage inside and open-air construction behaviour even in inaccessible areas where there is shortage of water.

II.NEED OF SELF-CURING

When mineral admixtures respond totally in blend system, their require for curing can be lot larger than that in a conservative normal cement concrete. When this water do not willingly obtainable, due to percolation of capillary porosity. Due to contraction happening throughout cement hydration, vacant pores are formed inside cement paste, most important to a diminish in its interior relative dampness and also to contraction which may reason early-age crack. This state is intensified in HPC due to normally advanced cement content, abridged water/cement (w/ c) percentage (fly ash, silica fume). The unfilled pores formed during self-desiccation bring contraction stresses and also control the kinetics of cement hydration procedure, restraining the last degree of hydration. The strength achieve by IC might be additional than that probable under soaked curing circumstances. frequently especially in HPC, it is not simply achievable to offer curing water from the top face at the rate necessary to gratify the current chemical contraction, due to the particularly low permeability's frequently achieved.

III.SIGNIFICANCE OF SELF-CURING

When mineral admixtures reply entirely in a combine cement structure, their order for curing water can be a lot better than that in a conservative ordinary cement concrete. When this water is not willingly obtainable, important autogenously bend and cracking may consequence. Due to chemical contraction taking place throughout cement hydration, vacant pores are created inside the cement adhesive, chief to a decrease in its inner relative dampness and to contraction which can reason early-age cracking.



Potential material for internal curing:-

The subsequent materials can give internal water reservoir:

- Aggregate
- Fine aggregate
- OPC cement
- Polyethylene Glycol PEG

IV.METHODOLOGY

Self-Curing of Concrete using Polyethylene Glycol PEG-400

Experimental Programme:

The experimental program was designed to investigate the strength of internally cured concrete by adding **Polyethylene glycol PEG-400 @ 1%, 2% and 3%** by weight of cement to the concrete. The experimental program was aimed to study the compressive strength. In this investigation cube compressive strength of conventionally cured normal strength and high strength concrete has been compared with normal strength and high strength internal cured concrete for this experimental program mixes of M20 GRADE and M50 GRADE as normal strength and high strength respectively were considered.

Mix Design Tests:

The test done on the materials for the mix design:

- Sieve Analysis of fine Aggregates (IS: 2386 Part I 1963)
- Specific Gravity of Sand (IS: 2386 Part III 1963)
- Water Absorption of aggregates (IS: 2386 Part III 1963)
- Specific Gravity of Coarse Aggregate (IS: 2386 Part III 1963)

V.CONCLUSION

TABLE NO.5.1 : Compressive strength results

Grade	Mix	Average compressive strength(N/mm ²)			
		3 days	7days	14days	28 days
M20	CC	14.56	15.82	18.32	24.53
	1% PEG	19.43	20.46	22.8	25.93
	2% PEG	14.66	18.8	21.10	23.13
	3% PEG	12.33	14.53	17.23	20.96
M50	CC	31.96	35.02	40.39	51.13
	1% PEG	34.02	42.24	46.29	53.20
	2% PEG	35.09	47.15	50.42	56.98
	3% PEG	31.81	38.13	43.52	52.23

- The self-curing agent PEG-400 was found to be effective.



- It was found that every grade of concrete has one optimum percentage of dosage which it requires to give the maximum strength.
- It was found that PEG at an optimum dosage gives a better results whereas adding it in excess may decreases the strength of concrete
- Also it was found that the optimum dosage for M20 was 1% and for M50 it was 2% so with this we can conclude that with the increase in grade of concrete it is required to increase the dosage of self-curing agent for better results.
- Compressive strength of concrete with 1% and 2% PEG-400 dosage gives higher compressive strength as compared to conventionally cured concrete.
- As the dosage of PEG-400 increases the strength of concrete reduces.
- The compressive strength of conventional concrete at 28 days can be obtained in 7 days and 14 days by adding 1% and 2% PEG-400 respectively with conventional concrete.
- By the use of PEG-400 it is observed that the workability of concrete also increases and concrete becomes flowable.
- We conclude that use of PEG-400 is a better option to form an internally cured concrete which does not require any external curing water without compromising with its strength
- 100% curing water can be saved as there is no need of curing process required for internally cured concrete.
- It has been observed during testing, internally cured concrete (conventional mix + PEG400) shows lesser cracks than the conventional concrete.
- It is observed that price of PEG-400 is 544Rs/kg whereas PEG-4000 is 800Rs/litre hence PEG-400 is more economical self-curing agent.
- The cost of conventional concrete was same as internally cured concrete.
- As Gujarat sand was used in this investigation which is of superior quality, therefore the cost of concrete is higher than the usual hence this factor might have come different if locally available sand would have been used.

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Study and Analysis of Ground Water Quality

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Abstract: Today's drastic issue takes place due to human behavior in our environment. And we are discussing about the issue of water pollution and harmful substance present in water which contaminates the ground water quality, so it may affect the ground water which drilled out through borewell or casing. A study has been carried out to get its physic -chemical characteristics of bore well and dug well water which are collected from Nagpur Region. Water samples were collected from different locations near from Nagpur region. The main aim of our study is assessing the water quality index (WQI) for ground water. At particular distance from Nagpur city .And analyzed for PH, conductivity, total hardness, Dissolved Oxygen, total alkalinity, sulphates, chlorides, temperature, TDS, physic - chemical Parameters and biological characteristics of ground water sample suggest that the monitoring of water quality below the ground surface as well as water quality management should be carried out periodic and as well as to protect the source of water resources. The study indicates the need for periodic monitoring and GIS based study of ground water in the study area which is high dense with population.

Keywords: pH, Turbidity, Conductivity, total hardness, Chloride, Bore-well and Dug well

I. INTRODUCTION

The first thing we can search on the moon is water, so you can imagine that water importance of water in our everyday life. Water is the most essential requirement in our daily life. Without water our life affected badly we can't imagine our life without water. Unfortunately water gets contaminated by chemicals as well as microorganisms. Sources of chemical pollution is industrial waste where as that of microbial pollution is domestic and storm waste. Polluted water is responsible for spread of water borne disease. As can be seen, the share of tube wells has increased exponentially, indicating the increased usage of ground water for irrigation by farmers. The dependence of irrigation on ground water increased with the onset of the Green Revolution, which depended on intensive use of inputs such as water and fertilizers to boost farm production. Incentives such as credit for irrigation equipment and subsidies for electricity supply have further worsened the situation. So it is necessary to analyze the present environment. Well water are examined to locate the suitable sources of water and to determine the extent of treatment necessary to make it portable. Ground water constitutes 97% of global fresh water and many regions, ground water sources are the single largest supply for serving drinking water to the community. Ground water sources often necessitate. Water is second to oxygen as being essential for life. People can survive days, weeks, or even longer without food, but only about few days without water. The population of India has exceeded thousand million today and also the urban population more than four million, which indicate the large demand of water for domestic purposes .The ill health in the developing and under developing countries is mainly due to lack of safe drinking water. Water is one of the essential commodities of everyday life. Although it is nature's abundant gift but most of it is present in oceans (97%) and in the icebergs in the Polar Regions (2%) which are of no use for utilization and the remaining (1%) of all earth's water, which is available in lake, rivers and underground for utilization. More over this available water is also contaminating day by day due to different human activities. The largest component of ground water use is the water extracted for irrigation. The main means of irrigation in the country are canals, tanks and wells, including tube-wells. Of all these sources, ground water constitutes the largest share. Wells, including dug wells, shallow tube-wells and deep tube wells provide about 61.6% of water for irrigation, followed by canals with 24.5%. Over the years, there has been a decrease in surface water use

and a continuous increase in groundwater utilization for irrigation. These pollutions are mainly due to rise standard of living, urbanization, expansion of agriculture and increase of population.

II. LITERATURE REVIEW

Nawal Prasad Singh (2010)[1] The paper shows the statistical data of Delhi city such as its area and population which directly imposes load on the use of Groundwater. In this paper, the sources of pollution are divided into point and non-points sources which defines the characteristics of the pollutant. In the study, water samples collected from many locations and their respective parameters were determined and also their ill effects are discussed. The author has shown spatial distribution of the contaminating parameters using RS and GIS techniques to display them in geographical image. The results obtained shows that Nitrate & TDS contamination have rise to such an extent that it is giving warning that the present groundwater resources are under threat. It is also observed that ground water level is depleted about 6 to 8 m within a decade.

Sneha S. Phadatare et al (2016)[3] This paper gives the method for development of water quantity index (WQI). Regarding with the quantity of the contaminates in the water present by various activities. It should be preserved and should be free from harmful contents. According to WHO, about 80% of all the disease in human being are caused by water. For this, there are certain ways to determine the water quantity index on basis of following category's. Human being includes health & population. Ecosystem being includes assessment of pH & water quality.

Dr. V. P. Thergaonkar (2017)[4] This paper consist of the ground water quality evaluation of dug well & bore wells in and around Nagpur city. This study was conducted on the water samples collected from Bore wells & Dug wells. This study involves physic-chemical analysis of the samples collected and are used to compare the quality of ground water is shallow & deep aquifers. The study suggests the consumption ability for the relative use of water & remedies & treatment.

III. METHODOLOGY

We can study on the ground water quality and also the profile of soil. We collected the groundwater sample from dug wells and bore wells and from the different area of Nagpur region of Maharashtra, India during the year 2020-21 covering post monsoons as well as winter and summer periods were analyzed for the present study on groundwater quality. Samples were collected in sterilized glass bottles for bacteriology and for physicochemical analysis of sample; the pre-cleaned plastic polyethylene, 1000ml polyethylene bottles for all other chemical parameters. Prior to sampling, all the sampling containers were washed and rinsed thoroughly with the groundwater to be taken for analysis.

The samples were analyzed for different physical, chemical and bacteriological parameters including nine parameters of water quality index (PH, Temperature, TDS, Conductivity, Total Hardness, Dissolved Oxygen and Turbidity) using standard methods. PH and Temperature were measured in the field itself, dissolved nutrients were estimated by after filtration of sample, Chloride, Total Hardness was determined by titration method while barium chloride method was employed for the determination of sulphate. All the test procedure were followed as per NEERI Manual for Water analysis.

3.1 Water Quality Index

WQI is computed for each factor as the product of Q-value and weighting factor.

$$\text{WQI} = \text{Q-value} \times \text{Weighting factor}$$

The overall WQI is the weighted average of all Q-values:

$$\text{Overall WQI} = \sum(\text{Q-value} \times \text{Weighting factor}) / \sum \text{Weighting factors}$$

If all the 9 factors are considered for computation of WQI, the sum of weighting factors is 1. Less than 9 factors (6 or more) may also be used for WQI.

Sr. No	Parameters	IS: 10500, 1991, 1991	
		Requirement (Desirable limit)	Permissible limit in the absence of alternate source
1	Color	5 HU	25 HU
2	Odour	UO	UO
3	Temperature	-	-
4	PH	6.5 to 8.5	No relaxation
5	Turbidity	5	10
6	Conductivity	-	-
7	Dissolved Oxygen	-	-
8	Total Hardness	300	600
9	Total solids	500	2000
10	Total alkalinity	200	600
11	Chloride	250	1000
12	Sulphate	200	400
13	Calcium	200	400
14	Magnesium	30	100

Table: Standard Parameters of Water Characterization

Sr. No	WQI Rating	Quality Of Water
1	91-100	Excellent water quality
2	71-90	Good water quality
3	51-70	Medium or average water quality
4	26-50	Fair water quality
5	0-25	Poor water quality

Table: [WQI] Average Rating Quality of groundwater

Sr. No	Tests	Ranges As Per [BIS]
1	pH	6.5 - 8.5
2	CONDUCTIVITY ($\mu\text{S}/\text{cm}$)	0.5 - 5
3	CHLORIDE (mg/lit)	250 - 1000
4	TOTAL DISSOLVED SOLIDS (mg/lit)	500 - 2000
5	TURBIDITY (NTU)	05 - 10
6	ALKALINITY (mg/L)	200 - 600
7	HARDNESS (mg/L)	200 - 600

IV. TEST

4.1 Chloride

Titrimetric Method:-Chloride is determined in a neutral or slightly alkaline solution by titration with standard silver nitrate, using potassium chromate as an indicator silver chloride is quantitatively precipitated before red silver chromate is formed.

4.2 Turbidity

Electrometric Method:-Turbidity can be measured either by its effect on the transmission of light which is termed as Turbidimetry or by its effect on the scattering of light which is termed as Nephelometry. Turbidometer can be used for sample with moderate turbidity and nephelometer for samples with low turbidity. Higher the intensity of scattered light

higher the turbidity.

4.3 Total Dissolved Solids (TDS)

Oven dried Method:-A known volume of filtered sample is evaporated and dried in a weighed dish at 105°C to constant weight the increase in weight over the empty dish represents the dissolved solids.

V. RESULTS

In this sample the range of Conductivity, Chloride and Total Dissolved Solids exceed as per their permissible limit. The result of all the parameters under the permissible range. So the Groundwater of that location is Beneficial for drinking and other purpose. The result of the Physic-Chemical analysis of Groundwater samples in most of the locations in Nagpur region, Maharashtra, India in the present study of groundwater resources and the profile of soil are shown in Tables. Which is necessary to a make a comparison of water quality given by IS: 10500-2012. Guidelines for Drinking Water Quality have been published by BIS.

PARAMETERS	RANGE as per (BIS)	RESULTS				
		S1	S2	S3	S4	S5
pH	6.5-8.5	8.2	8.0	7.22	7.59	7.96
CONDUCTIVITY ($\mu\text{S}/\text{cm}$)	0.5-5	0.815	1.009	1.130	5.930	0.892
CHLORIDE (mg/lit)	250-1000	30	64.97	84.97	719.78	20
TOTAL DISSOLVED SOLIDS (mg/lit)	500-2000	675	695	858	4000	655
TURBIDITY (NTU)	05-10	NIL	NIL	NIL	NIL	NIL
ALKALINITY (mg/L)	200-600	382	348	338	162	374
HARDNESS (mg/L)	200-600	162	374	490	214	112

VI. CONCLUSION

The results of the water quality parameters (Temperature, pH, Conductivity, Chloride, TDS, Alkalinity, Hardness and Turbidity) collected from five locations in and around Nagpur Division in the months of January-February 2021 observations are recorded. The above results, values refer to the maximum and minimum water samples collected of different location as per their permissible range given by BIS – 10500 (2012) for physic chemical analysis of water. The summary of the finding results are given below:-

VII. FUTURE SCOPE

In next few years ground water plays vital role for irrigation in Nagpur district due development of town and increasing in population, as a result the ground water levels are depleting at faster rate. To avoid over-exploitation of ground water resources, there is a need to increase irrigation facilities from surface water sources and to conserve water flowing out from area through rivers and nalabs at various places like houses, commercial buildings, NIT gardens, by constructing different types of water conservation structures. These structures will not only prevent outgoing surface run-off from the small watersheds, but also will act as artificial recharge structures and arrest soil erosion. Demonstrative Project of artificial recharge was taken in government stuctures in Nagpur under Central Sector Scheme. Under this scheme 49 water conservation structures were constructed for rainwater harvesting and artificial recharge of ground water. It is aimed to use the structures as demonstrative model for State government, NGOs and public sector.

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Traffic Signal Designing and Analysis for Heavy Traffic Road in Nagpur

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ABSTRACT: Traditional traffic signal system only gives instructions to stop and not to vehicle driver. But if someone is breaking the signal then this system is not able to catch them and there are chances of taking bribe. Therefore, to increase the security of traffic signal and to reduce human efforts and to avoid the bribery we are introducing smart traffic signal system through this mini project. Smart traffic signal based on the microcontroller & ultrasonic sensor, in which ultrasonic sensors are placed at one side of road in such a way so as to cover particular necessary area of road from where the vehicles are restricted to pass. If the signal is red and any vehicle is breaks the signal then ultrasonic sensor detect it and microcontroller take immediately action to buzzer alarm along with camera capture the image of that vehicle. It also makes record of when, where, which vehicle breaking signals by saving image in particular folder as name of current date and time.

I. INTRODUCTION

A set of automatically operated colored lights typically red, amber and green for controlling traffic at road junctions, pedestrian crossings and round about. Fig. traffic signal light Generally Traffic is defined as the movement of a person vehicles or any type of goods or person in between the site locations, and thus includes pedestrians and all types of vehicles mechanized, motorized or non-motorized. Nagpur is at present third largest city in Maharashtra which faces traffic congestion problems mostly in the different road intersection due to rapid development of the infrastructure and increasing population. While the seven intersection the vehicles are stopping for their turn to clear the particular patch of road, on the signal point the vehicle travelers to keep their vehicle engine on so that it leads to loss of fuel and they also keep unnecessary Thus it leads to delay in vehicle & noise pollution generally increased at the signal or seven intersections. This used to reduce congestion on the particular intersections the Bus Bay is to be provided for the city buses moving on the particular patch. Today man has his own vehicles to get transport from one place to another place. The Noise pollution, congestions and air pollution and the results in ill effects to the health and frustration have become addicted now a day. In this Analysis respectively increase in demand for survey is to be taken for vehicle count and analysis is done to increase future development of Transport Network in Nagpur city. In this Traffic volume analysis is give an idea to make better planning of roads routes, flyovers and in future Metro. To reduce the environment impacts the species of some plants which absorbs air pollutants described.

II. LITERATURE REVIEW

Lee et al. (2012) developed a real-time crash prediction model by taking total travel time and crash potential reduction. The study result indicated the variable speed limit could reduce crash potential by 5-17 %. **omchainuek et al.** (2013) investigated road side safety on thai nk. The result showed that speeding vehicles were involved in roadside crashes accounted for about 70% of the total crashes and 30% of road side crashes were due to road side trees.

Zegeer et al. (1991) studied the relationship between lane or shoulder widening and accident reduction rate. He concluded that 21% reduction in accident can be achieved by widening the lane 4 feet per side.



Rio et al. (1991) studied the blood samples reports of 5745 spanish drivers killed in road accident. He found psychoactive drugs among 50.1% of those driver killed in road accidents. Mainly alcohol(43.8%), illicit drugs (8.81%) and medicinal drug(4.7%).for one every three cases (32 %) a bac (breath analyser coefficient)over 0.8g/l was recorded, cocaine(5.2%), opiates(3.2%) and cannabis(2.2%) were three illicit drugs most frequently detected. Among medicinal drugs were benzodiazepines (3.4%), antidepressant drugs (0.6%) and analgesics (0.4%)

Hougant et al. (2011). Investigated hospitalized drivers who were involved in road traffic collision in uac.a logistic model was ed using the variables like drivers denographic data, Lime, date, location, mechanism of collision, speed at collision and Sleepiness. The conclusion was sleep is uimportant factor to road traffic collision. Further they advised to discontinue driving on highways reeling sleepy especially during hunar month of ramazan. Driver fatigue is a main problem in long journey due to restlessness.

mukmed et al. (2013) studied on crash related tsibility alstruction due to fog and smoke in florida. It was found that fog smoke related crashes are more likely to occur at night without street lighting leading to more severe injuries. Head-on and rear-end are common crashes in terms of crash risk and severity. These crashes are more prevalent on high speed road, undivided roads, roads with no sidewalks and two lane nud roads.

Sreedharan et al. (2010) explored the determinants use of crash helmets among motorcyclist in india. A cross sectional study conducted in kerala .the study found only 73.1% of motorcyclist were not using helmet which results more head injuries during crash in that region.

Oduro (2012) surveyed a number of accidents and found that 83% break failure result in accident. Brake ineffectiveness is due to vehicle overloading, uneven tyre pressure, incorrect brake adjustment, air in breaking system, automatic brake adjuster not working. brake fluid on lining brake failure is due to broken pipe, low brake fluid level, cracked brake drum, brakes overheating.

III. METHODOLOGY

Literature Survey

- Accidents: In India near about 4.40.123 accidents are happened per year and most of the accidents are happened at Traffic Signal.
- Deaths: In India near about 1, 34, 834 people are dying per year only because of road accidents and most of the accidents are causes at Traffic Signal
- At Every 3 minutes an Indian loses life just only because of road accidents
- Bribe taking one another big issue found at Traffic Signal by Traffic Police then how can we recognized the irresponsible people.

Time of Survey: As per to the data collection the traffic volume survey is done while the peak hours of morning and evening time. The peak hours which refers time on morning high traffic volume and same for evening (9:00 am to 11:30 am and 5:00 PM to 6:30 PM) were taken into attention for getting of the maximum traffic moving on the seven intersections. The termpeak hours defined by the number of city buses or ST, office Bus traveling people, shop owners, school and college going students majorly the maximum flow of traffic. Peak hours are the time at which traffic volume is maximum.

3.2.2: Up Flow / Down Flow: The Up flow and the Down flow of the seven intersections was recorded by manual count so that the total number of vehicles count on that road on that particular Peak hours were done respectively at in between seven intersections from Subhash Nagar to YCCE.

Counting

Manual counts are typically used to collect data for purpose of vehicle identification, on turning, travel on which direction, pedestrian on road or vehicle usage by the particular person. Manually count is to be done on the seven intersections by getting the number of vehicles Le.HMV, LMV, etc. on different days in peak hour time i.e. from 9 am to 11 am on every day.Further is the collection of data is given as up and down represents adding and getting out at the particular intersection



Data Collection Selection of Site



Fig-1: site selection Subhash Nagar sq. To VCCC

Table-1: Traffic volume on Seven Intersections from Subhash Nagar sq. To VCCC Nagpur.

Intersection	Date	Time	Mode of travel	Count	Mean of week days	Mode of travel	Mean of week days
Subhash Nagar sq.	18/	9-10 am	Cars	238	28	Cars	28
		11am	Cars	219	22	Cars	22
Prabhavati nagar sq.	18/	9-10 am	Cars	141	16	Cars	16
		11am	Cars	148	13	Cars	13
Majusik	19/	9-10 am	Cars	402	28	Cars	28
		11am	Cars	248	21	Cars	21
Baburng peth	19/	9-10 am	Cars	206	22	Cars	22
		11am	Cars	194	19	Cars	19
K. Nagar	19/	9-10 am	Cars	198	20	Cars	20
		11am	Cars	191	19	Cars	19
Bhadrash village sq.	19/	9-10 am	Cars	193	20	Cars	20
		11am	Cars	172	17	Cars	17
VCCC	19/	9-10 am	Cars	218	23	Cars	23
		11am	Cars	189	16	Cars	16

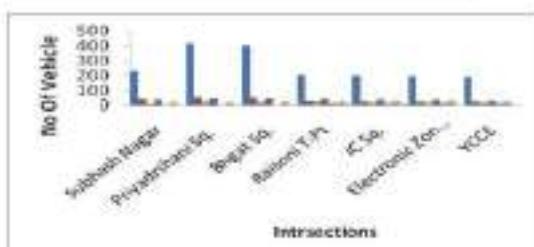


Chart-1: Traffic flow for Upcoming on intersection

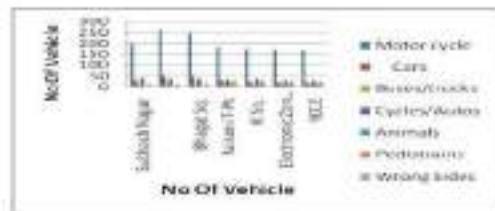


Chart-2: Traffic flow going Down on intersection

Traffic Noise Pollution

Traffic Noise Of Road

Road traffic noise is the most important major source of people noise especially near important road intersections with high volume of traffic of the city. The Roads are in bad condition in the country in certain region and poorly maintained and has considerable the usage of the number of vehicles travelled in particular patch of old model technology, the road traffic noise adopts much more importance

**Method and Measurement:**

The different parameter for the study is the Noise parameters which is the functions composition traffic, traffic flow, time and day of recording data on the morning peak hour time in morning 9 am to 11 am and same for evening from 4:30 pm to 6:00 pm. Location for the Noise parameter is same from Subhash Nagar to Ycce college.

Result of Noise Measurement:

Noise measurements were carried out in weightage in fast mode using the sound level meter 210 sound level meters. It is measured in "Db" Le. Decibel Noise levels were recorded on seven intersections on the given site locations during morning and evening peak hours. The Noise levels at a rate of one reading per 30 min were noted. The distance of sound level meter is kept 3-4 feet from the level of the pavement surface.

$$L_{eq} = L_{50} + \frac{(L_{10} - L_{90})^2}{56}$$

Advantages and Disadvantages**Advantages:**

- Provide for orderly moment of traffic
- Increase traffic handling capacity of an intersection
- Reduce frequency and severity of certain type of crashes Especially right-angle collision
- Provide for continuous moment of traffic at a definite speed along a give route
- Interrupt heavy traffic at intervals to permit other vehicles or pedestrians to cross

Disadvantages:

- Excessive delay
- Increase traffic congestion, air pollution and gasoline consumption
- Disobedience of signals
- Increased used of less-adequate streets to avoid traffic signals
- Increased frequency of crashes, especially rear-end collision.

IV. OBSERVATION

Table Changes for all seven intersection of Noise level

Intersections /Time	L Equivalent(dB)						
	Subhash Sq	T-Point	Bhagat Sq	Raisoni T-Point	IC Sq	Electronic Zone	YCCE Collage
9.00am-9.30am	85.4	93.9	81.5	91.5	82.6	86.6	88.3
9.30am-10.00am	85.8	81.5	81.9	81.6	85.5	81.1	86.5
4.30pm-5.00pm	85.8	92.3	85.6	80.3	85.6	79.6	82.3
5.00pm-5.30pm	76.3	86.9	82.3	80.5	81.3	78.5	87.5
5.30pm-6.00pm	72.3	90.2	80.3	79.3	80.1	81.3	88.1

V. RESULT AND DISCUSSION

Traffic congestion is a global as well as local problem. All over the world, the major cause of traffic congestion is on street parking of the buses or any other vehicles. In Hingna Road, traffic congestion is a common issue like Nagpur city. Different infrastructural and managerial projects are granted for reducing traffic jam. However in Hingna Road this type of policy is not adopted yet. Plantation of the species it reduces the pollution.

By providing the bus bay at an intersection the congestion may be reduced. Traffic congestion limitations can be upgraded by implementing various strategies such as road widening, improved road infrastructures, restricting routes for Rickshaw and hawkers, and application of Fly over, in future metro.



As per Indian standards for noise level values particularly area in city in commercial area is in between 65 dB to 55 dB for Industrial area is in between 75 dB to 70 dB and for Industrial area is in between 55 dB to 45 dB for day time and night time respectively. Average noise level of seven intersection of Subhash Nagar Square to YCC College Hingna, Nagpur city are 87.11 dB and 84.5 dB during daytime and night time respectively, which is ill effective on human health and environment

VI. CONCLUSION AND FUTURE WORK

- We have used sense in signal design which is economic compare to other methods.
- Traffic characteristics of the road can be improved.
- By doing the above measures accident rates can be decreased.
- Hence the death mortality rate can be reduced and driving would be safe on road.

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Use of Software for Estimation of RCC Buildings

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ABSTRACT: Early stage cost estimate plays a significant role in the success of any construction project. All parties involved in the construction of a project; owners, contractors, and donors are in need of reliable information about the cost in the early stages of the project, where very limited drawings and details are available during this stage. Construction cost estimating is a cumbersome process. It takes a long time for an estimator to complete an accurate estimate and construction contractors must prepare cost estimates quite often in order to prepare bids for new projects. This presents a challenge to an estimator who has to prepare several estimates in a short period of time. In recent years, computers and estimating software have reduced the amount of manual work necessary for preparing an estimate by organizing and providing fast access to latest labor, material and equipment costs, quickly performing calculations and generating reports. There is room to improve the estimating process even more. This can be accomplished by using the latest CAD and visualization technologies. Improvements can be made in how information is transferred from design files to estimating applications and in visually matching CAD elements with estimating database assemblies.

KEYWORDS: 3DCAD, Estimation, Construction, Digitizing Tablets

I. INTRODUCTION

1.1 GENERAL

Cost estimating is an essential task for budgeting and bid preparation for any construction project. A good estimate depends on many factors including time given to the estimator, estimator's experience, and a wide range of assumptions regarding the project (Jrade and Alkass, 2007). Construction cost estimating involves collecting, analyzing, and summarizing all available data for a project (Holm et al., 2005). This chapter will focus on detailed estimates, the information needed for a detailed estimate and an example illustrating how the information is used to make an estimate. Today's detailed estimating technologies and the difficulties associated with detailed estimates are also reviewed.

1.2 2.3 DETAILED COST ESTIMATES AND THE ESTIMATING PROCESS

Detailed cost estimating is a time-consuming process. It is prepared when all documents of the construction project have been completed. Creativity and knowledge are essential for preparing a construction cost estimate. Different contractors use different processes, methods, and technologies during construction. Therefore, estimators need knowledge, creativity, and experience to execute the estimating task successfully. Detailed cost estimating consists of two important steps: quantity estimate, also known as quantity takeoff, and pricing.

In a detailed cost estimate, the estimator divides the project into individual work items and estimates the quantities of materials for each work item. This is also known as quantity takeoff. Labor, equipment, and material needed for executing a work item are then determined based on the specification and the construction method.



After the element has been selected for cost estimating, the estimator must select work items necessary for the element. Construction of a building element may consist of a number of work items. For example, a concrete slab element may consist of several work items such as forming, reinforcing, concrete pouring, finishing, and curing.

1.3 TODAY'S TECHNOLOGIES FOR DETAILED COST ESTIMATE

As one can see, detailed cost estimating is a cumbersome process that involves a lot of data and calculations. Any technology that could assist the process of construction cost estimating would help reduce estimator's work load. Computers are considered to be effective tools for assisting estimators during the construction cost estimating process. Computers provide many benefits including reducing estimation errors and the time needed to produce an estimate. Today's estimating technologies include, but are not limited to, spreadsheets, cost estimating software, digitizing tablets, on-screen digitizing systems, and the yet to be matured 3-D CAD parametric estimating software.

1.3.1 Spreadsheet Estimating

A spreadsheet is a computer application that simulates a paper worksheet. It provides the user with cells that are compiled into rows and columns. Each cell can contain either text, numerical values, or formula can be defined in cells to obtain calculated value from the related cells. Complicated mathematical calculations can be automated with a change of a single cell with the use of formula in the spreadsheet. Contractors use worksheets to accelerate the estimating process. The estimator can set up a template with saved formula in the spreadsheet. Estimator can also perform quantity takeoff calculations within a spreadsheet. Although a spreadsheet requires a lot of input from the estimator, it eliminates the cumbersome and error prone manual calculations during the quantity takeoff and pricing.

1.3.2 Construction Cost Estimating Software Packages

Various software packages are available to assist the estimator during the detailed cost estimating process. The capabilities of software packages vary greatly. Some include labor, equipment, and material cost databases, which facilitates the estimating process after the database is set up. In order to perform a quantity takeoff, estimating software packages include technologies such as digitizing tablets, on-screen digitizing systems, and 3D CAD models.

1.3.3 Digitizing Tablets

A digitizing tablet is a computer input device that uses a stylus and a tracking surface to capture the drawing on to the computer system. The drawing traced on the tracking surface transfers point coordinates to a computer, thus it can be used for many different purposes including construction cost estimating. Digitizing tablets' purpose in construction cost estimating is to digitize the paper-based blueprints provided by the owner of the project or the designer. For example, the estimator can get the length, perimeter, or area out of the drawing by the scale provided in the blueprints. These parameters are available when using the digitizing tablet via software package. The software package may also include estimating software. After the paper blueprints have been digitized and the quantities for all work items have been determined, the estimator can use those quantities to estimate the prices of items.

1.3.4 3-D CAD

3-D computer aided drawing (CAD) models help estimators visualize what is going to be built in the 3-D environment. The ability to digitally extract and transfer data can speed up cost estimating process. A building model can be seen in many different views, where details of elements, including their dimensions can be extracted and transferred to the estimating software. A software company named Innovaya (Innovaya Website, 2009) has already attempted construction cost estimating using 3-D CAD; however, it is still a work in progress. Innovaya uses the estimating engine from Timberline (Timberline Website, 2009) or MC2 ICE (MC2 ICE Website, 2009).

Today, detailed cost estimating is done using computer-assisted technologies, which includes spreadsheets and estimating software. However, error prone and time consuming processes are a few difficulties that could arise during the estimating process. Although, the process of estimating has been improved, a solution to these difficulties could ease the estimator's task of construction project cost estimating. 3-D CAD and visualization can provide the estimator with a tool necessary to cope with the ever increasing complications in design.

II. BUILDING INFORMATION MODELING

2.1 INTRODUCTION TO CAD AND BIM

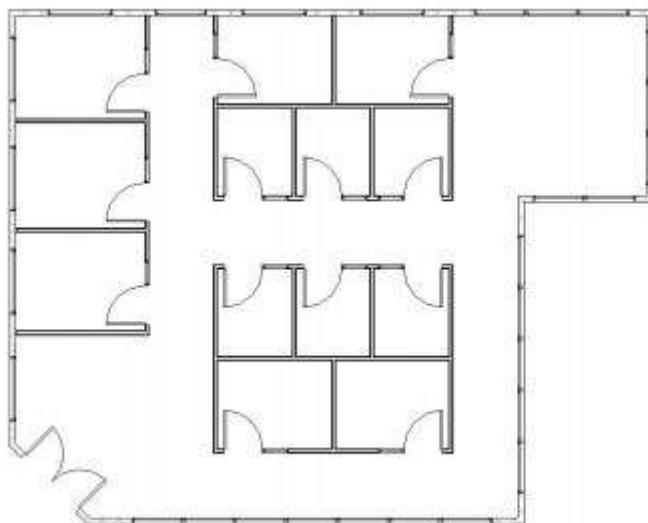
A cost estimate for a construction project can be prepared at any phase of the construction project. However, detailed cost estimates require a complete set of plans and specifications. Although most plans and specifications today are in 2D CAD format, advanced technologies have changed the way drawings are prepared, and 3D CAD drawings are playing a bigger role in documenting design intent. Building information modeling (BIM) is another technology that is

making an impact and becoming popular throughout the architecture, engineering, and construction (AEC) industries. The use of BIM enables architect to improve design efficiency. Structural designs can be optimized by the engineer and contractors can improve the planning for the construction of the project. This chapter will discuss in more detail CAD, BIM, the differences between the two technologies, BIM's applications, and the future of the construction industry with BIM technology.

2.2 COMPUTER-AIDED DRAWINGS

Computer-aided drawings (CAD) have been a significant tool helping architects and engineers in the engineering and design process (Jrade and Alkass, 2007). The basic function of CAD software is to allow the user to prepare drawings by manipulating lines, circles, rectangles, and text interactively on the computer screen. Some types of architectural specific software offer graphical libraries of commonly used building elements such as doors and windows. Creating a drawing is not the main advantage of using CAD because it could be done on a paper-based medium; however, the main advantage of CAD is its ability to easily edit a design (Sun and Howard, 2004). CAD allows users to delete, move, copy, rotate, scale, and mirror design elements with ease. CAD also has the functions to create repetitive design components, create elements at equal distance on a line, a circle, or on a grid, extending lines, trimming lines, and fillet any corners of an edge. These tasks are not easily carried out on the paper based drafting. CAD allows designers to concentrate on the creative aspects of the design instead of being distracted from unproductive activities (Bazjanac, 1975). CAD can be divided into two major categories: two dimensional (2D CAD) and three dimensional (3D CAD).

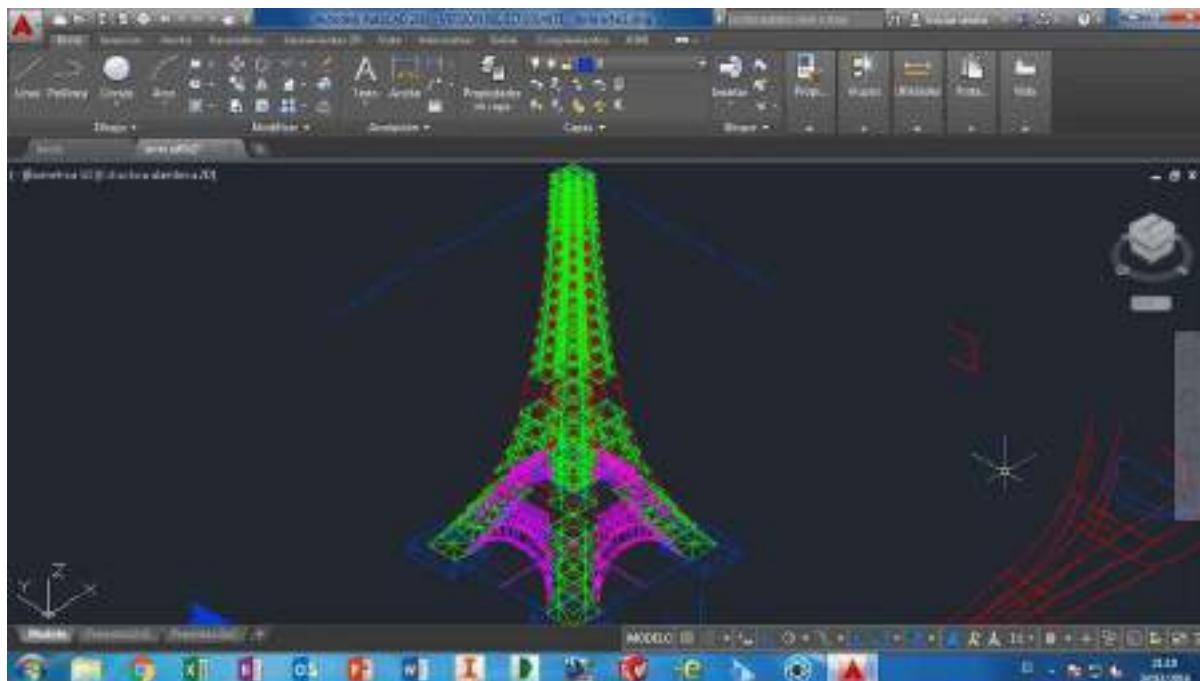
2D CAD is considered to be fast and easy to use. It is the most popular method of drafting in today's construction industry (Sun and Howard, 2004). A 2D CAD drawing, as shown in Figure 2.1, is a vector-based display of a project.



(FIGURE 2-1: A 2D CAD Drawing)

Although it is fast and easy to use, 2D CAD uses lines to draw components instead of the actual elements. Viewing of 2D drawings does not provide designer with different angles of the design. 3D CAD is an alternative to 2D CAD, allowing views from different angles and potential virtual environment capabilities of walking through or flying through the structure.

3D CAD can be created from 2D CAD by adding depth and elevation to the design. 3D CAD models are three dimensional drawings which represent objects in the X, Y, and Z axis (Reffat, 2002). The benefit of 3D CAD is the ability to visualize the building; designers can determine spaces available, thus improving the design. 3D CAD can also be turned into animation and visualization system where clients can experience the design at various settings of the project from different angles and views (Dzambazova, Demchak, and Krygiel, 2008; Vince, 2004; Sun and Howard, 2004).

**(FIGURE 2-2: 3D CAD Wire Frame Model)**

Different types of views, such as a wire 3D or a solid provided by the 3D CAD model, can be used extensively for different purposes. For example, wire 3D model, as shown in Figure 2-2, can be used to evaluate the structural integrity of the design. Solid model, as shown in Figure 2-3, can be used to see if the design will fit in the surrounding environment.

**(FIGURE 2 -3: Rendered 3D CAD Model)**

2.3 BUILDING INFORMATION MODELING

Although 3D CAD helps visualize the proposed structure during the design process, building information modeling or BIM can provide a better alternative. The process of BIM could help improve many aspects of the construction project.

Building Information Modeling (BIM) is one of the most promising developments in the Architecture, Engineering, and Construction (AEC) industries (Azhar et al., 2008).

According to Khemlani, BIM is a revolutionary technology that goes well beyond the design phase to impact construction and lifecycle management of the project (AECbytes Website, 2009). BIM is a data-rich, object-oriented, intelligent and parametric digital representation of the facility, from which views and data appropriate to various users' needs can be extracted and analyzed to generate information that can be used to make decisions and to improve the process of delivering the facility (AGC, 2005). Information provided by BIM includes, but is not limited to, dimensions, coordinates, properties, and other element details for the building. BIM technology would provide the potential for improving communication between participants involved in the construction project, improving the quality of information, the quality of services delivered, and reducing cost at every stage in the life cycle of a building (Smith and Tardif, 2009).

As today's technology grows more complex, building design has become more complicated. The involvement of the computer technology at the earliest phase of the design process is becoming more common. Difficulties of the design associated with the complexity of the building could provide many problems to not only the designer but also the engineers and the contractors who build it. BIM provides the ability for the designer to design the building with the modeling tool that creates object elements instead of different types of lines connected to make up a model. The 3D parametric model that BIM provides does not only provide the visualization of the model in three dimensions, but it also stores information about the elements that make up the building. This information includes its physical characteristics such as dimensions, locations, and texture of the objects. Functional characteristics could also be found in the parametric model, including the information about manufacturers and operating and maintenance procedures (Azhar et al., 2008).

Contractors can also benefit from BIM. It provides many features that help contractors avoid costly errors during construction of the project. Element clashes can be detected before the construction has started, saving contractors' time and money. Complexity of the construction or the design of the building could also provide many difficulties during the preparation of plans and specifications. With an integrated parametric 3D model, it's possible to detect spatial clashes between the multitudes of systems in the building (Dzambazova, Demchak, and Krygiel, 2008). Computer analytical systems could support design decision making by enabling designers to test and evaluate design alternatives rapidly in the search for an optimum solution (Bazjanac, 1975). Ambiguities in the design can also be highlighted by any team member and resolved before the design has been finalized. Constructability issues can be raised and debated among the parties involved (Levy, 2006). Time that is normally spent manually checking all the drawings by the design consultants and by the contractor and their subcontractors will be reduced considerably. This allows all parties to be more productive on other tasks such as project management or quality control.

III. COST ESTIMATING DATABASES

Construction cost estimating requires a lot of data on building elements, material, equipment, labor, and other related information. These data need to be organized in a way that they can be easily accessed. One way to solve the problem is to use a database for storage of the data. A database is a storage facility or a collection of related records or documents. Databases are designed, built, and populated with data for a specific purpose and has an intended group of users and some applications in which these users are interested (Retik and Langford, 2001). The estimating software designed for visual estimating adopts database technology to store all the information necessary for estimating. The cost estimating database will also be used to store new estimate information. This chapter will discuss why databases are used, database models especially the relational model, and how the estimating database used in this study was designed.

Estimating requires the input of data from many sources. The ability to integrate this data into the estimating process would be beneficial during an estimate. A cost estimating database was developed to store all the data required for the estimating application developed in this study. The application is named Visual Estimating Application. This section will present what should be stored in the cost estimating database, how the database was designed using the relational database model, and how the estimating data are related to each other. The cost of a building element is the sum of the costs of the work items necessary for the construction of the element. The data needed for estimating include labor, equipment, material costs and productivities. Figure 5.4 shows the schema of the database developed for storing the necessary data.

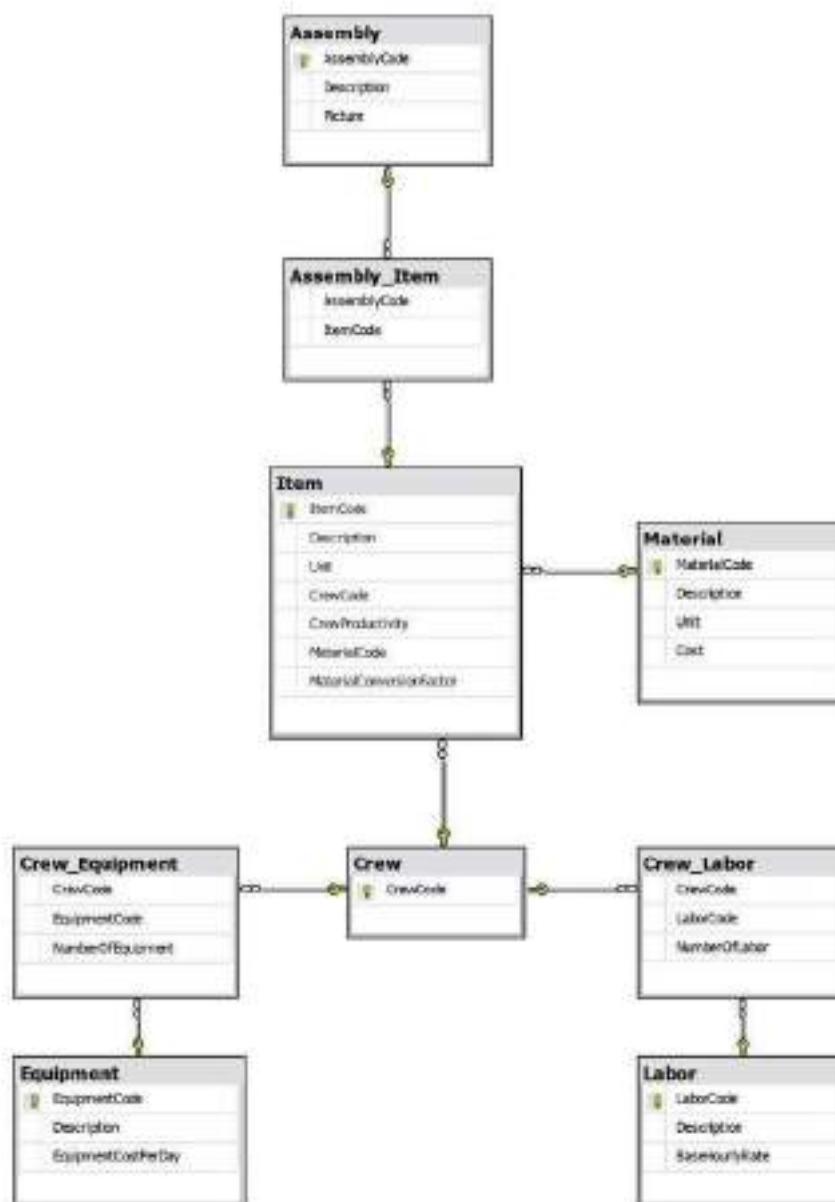


FIGURE 5-4: Cost Estimating Database Schema.

IV. CASE STUDY

4.1 BASIC COMPONENTS OF THE GRAPHICAL USER INTERFACE

The Visual Estimating Application allows an estimator to visually select elements from a 3D model and estimate their costs. The application was developed based on how human brain perceives and processes information; therefore, minimizing the load on the estimator's long-term memory while preparing an estimate. Access and use of the

application's Revit element extractor, 3D visualization system, database management module, and cost estimating module.

4.1.1 Revit Element Extractor

Revit element extractor (as shown in Figure 4-1) interfaces with Autodesk Revit to extracts all Revit elements from a 3D CAD model. The user must create a directory and save the extracted project element information in a file. After extraction, the user does not need the parent software (Revit Architecture) and the Revit model file.



(FIGURE 7-1: Revit Element Extractor)

4.1.2 Visualization System

The visualization system interface allows users to visually interact with the 3D model and estimate a building element. The main functions of this interface are discussed below. Navigation: Navigation inside a 3D model is done by using the mouse and the keyboard. To move forward, the right key is pressed. To look around the building, the left key is pressed and the mouse is moved around to the desired direction. To look up and down, both left and right keys must be pressed together. Element Selection: A building element can be selected for estimating by changing the interface state from "Navigate" to "Select". This enables users to select any element in a 3D model to be estimated. An element is highlighted after it has been selected.

4.2 DESCRIPTION OF DATABASE MANAGEMENT SYSTEM

This section provides a step-by-step description for managing the cost estimating database. Users can choose whether to add, edit, or delete data from different tables in the cost estimating database. Since each table has its own dialog box, one can select the table that he/she wants to view and adjust any data necessary for that table.

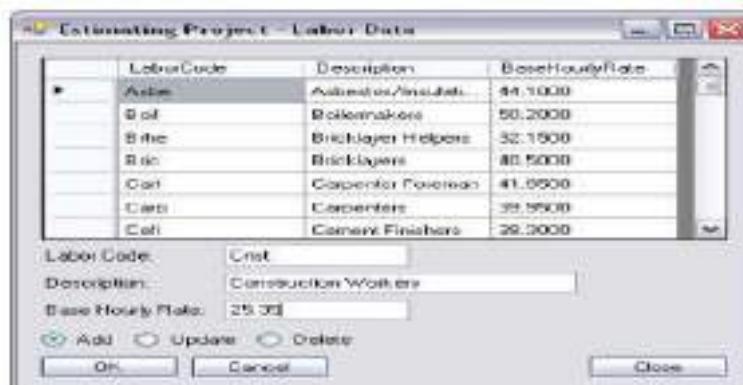
Adding Data:

To add new data, the user can select "Add" radio button; as illustrated in Figure 7- 5 for the Labor table dialog box. After the button is clicked, textboxes are enabled for the user to input data into the database as can be seen in Figure 7- 6. After the necessary data have been entered, the estimator can click "OK" to add the data into the estimating database, or the estimator can click "Cancel" to abort data entry. Figure 7-7 shows databases' data grid view after an update with the latest data entry.

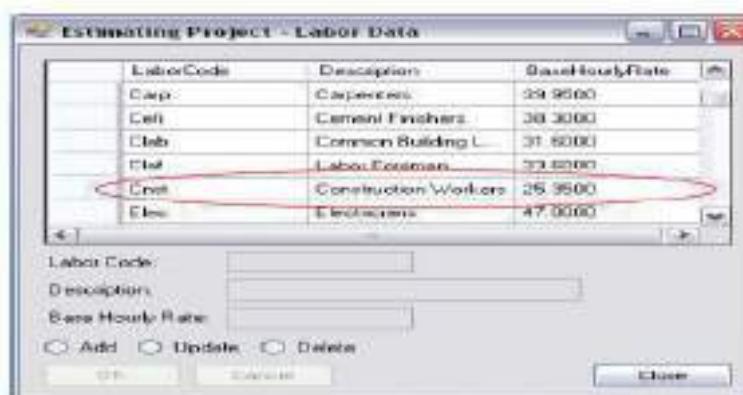
Estimating Project - Labor Data		
LaborCode	Description	BaseHourlyRate
Auto	Autodesk Instructors	44.0000
Bld	Bricklayer	50.0000
Btne	Bricklayer Helpers	32.0000
Bric	Bricklayers	40.0000
Cst	Carpenter Foremen	41.0000
Cmp	Carpenters	32.0000
Cfl	Concrete Finishers	30.0000

Labor Code:
 Description:
 Base Hourly Rate:
 Add Update Delete
 OK Cancel Close

(FIGURE 7-5: "Add" Radio Button in the Labor Table Dialog Box)



(FIGURE 7-6: After the “add” button is clicked, textboxes, “OK”, and “Cancel” buttons are enabled)



(FIGURE 7-7: After the estimator has clicked “OK” and the list will be updated automatically.)

Editing or Updating Data:

To edit or update data in the estimating database, data has to be selected first. The selection can be done using the data grid view that shows content from the database. Selected data and its attributes are then shown in textboxes. Figure 7-8 illustrates that ‘Roof’ has been selected for update. The description for ‘Roof’ will be changed to ‘Asphalt Roof’ and a picture will be added to this assembly.



(FIGURE 7-8: Roof is selected and the update button is clicked.)

To update the picture, the “Update Picture” button has to be selected. A dialog box will appear, as shown in Figure 7-9. Figure 7-10 shows the Assembly table dialog box after the “Asphalt Roof” has been updated to the database.



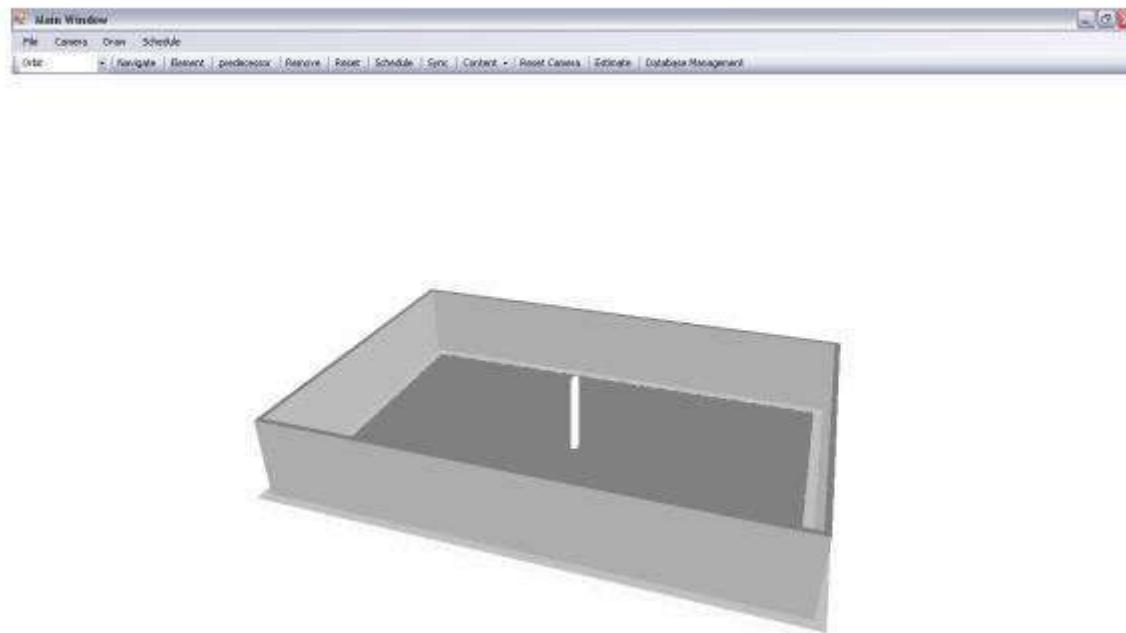
(FIGURE 7-9: Update picture dialog box. Asphalt roof picture was selected.)



(FIGURE 7-10: After “Roof” has been updated to “Asphalt Roof”. A picture was also added.)

3D Model in the Visualization System:

Users can create a 3D model in the visualization system using the element properties extracted from the CAD model. Figure 7-13 shows a few elements drawn in the visualization system.



(FIGURE 7-13: Model shown in the visualization system module.)

Figure 7-18 shows an estimate report. Estimate reports can be saved in PDF file format for future use.

Estimating Project - Estimating Report									
	Element	LineItem	Assembly	Code	ItemCode	ItemDescription	Quan	Waste	Total
North Wall									
	E2010156	04 21 13 13 0001	Brick veneer, mai	0.00	0.00	0.00	0.00	0.00	0.00
	E2010156	04 21 13 13 0009	Brick veneer, str	4.00	15.00	4.66	369.86	315.33	8.00 274.19
	E2010156	04 22 10 14 0001	Concrete Mason	0.00	0.00	0.00	0.00	0.00	0.00 0.00
	E2010156	04 22 10 14 1105	CMU normal wth	300.00	10.00	693.00	209.00	477.00	0.00 289.09
	E2010156	04 22 10 16 0001	Concrete Block	0.00	0.00	0.00	0.00	0.00	0.00 0.00
	E2010156	04 22 10 16 2100	Including grout & s	60.00	5.00	63.00	192.00	311.36	0.00 253.36
	E2010156	04 22 10 32 0001	Concrete Block	0.00	0.00	0.00	0.00	0.00	0.00 0.00
	E2010156	04 22 10 32 0259	8" x 8" x 8", 244	0.00	0.00	0.00	0.00	0.00	0.00 0.00
	E2010156	04 05 13 30 2000	Mortar with Portl	0.00	0.00	0.00	0.00	0.00	0.00 0.00
	E2010156	04 05 13 30 2100	Type M, 1:14:3	23.00	20.00	27.70	701.74	49.07	3.54 753.06
	North Wall			710,338.61	7,453.65	7.34	387.59		
South Wall									
	E2010156	04 21 13 13 0001	Brick veneer, mai	0.00	0.00	0.00	0.00	0.00	0.00 0.00
	E2010156	04 21 13 13 0009	Brick veneer, str	4.00	15.00	4.66	369.86	369.72	8.00 354.76
	E2010156	04 22 10 14 0001	Concrete Mason	0.00	0.00	0.00	0.00	0.00	0.00 0.00
	E2010156	04 22 10 14 1105	CMU normal wth	393.33	0.00	993.33	309.34	226.06	0.00 236.21
	E2010156	04 22 10 16 0001	Concrete Block	0.00	0.00	0.00	0.00	0.00	0.00 0.00
	E2010156	04 22 10 16 2100	Including grout &	60.00	0.00	60.00	180.00	296.54	0.00 136.54
	E2010156	04 22 10 32 0001	Concrete Block	0.00	0.00	0.00	0.00	0.00	0.00 0.00
	E2010156	04 22 10 32 0259	8" x 8" x 8", 244	0.00	0.00	0.00	0.00	0.00	0.00 0.00
	E2010156	04 05 13 30 2000	Mortar with Portl	0.00	0.00	0.00	0.00	0.00	0.00 0.00
	E2010156	04 05 13 30 2100	Type M, 1:14:3	22.83	0.00	22.83	599.54	41.10	2.75 543.39
	South Wall			641,914.94	6,533.21	2.75	556.96		
	Grand Total:							1,352.55	986.87
									6.08 1381.49

(FIGURE 7-18: Estimating report created by the Visual Estimating Application)

V. CONCLUSION

The goal of this research was to make the process of construction cost estimating simpler and more intuitive. It also introduced the use of visualization in estimating. The developed application digitally transfers project information from a BIM model to the estimating application; this reduces the manual data entry which is a very time consuming process.

This study provided a visual approach for estimating that allows an estimator to walk inside a virtual building and select elements for estimating interactively.

The developed Visual Estimating Application helps ease the estimating process by utilizing 3D CAD models and information extracted from a 3D CAD model. A visualization module is used to help the estimator navigate and interact with the model. A cost estimating database is used to store cost data for the Visual Estimating Application. Although several database models can be used for storing cost data, the relational database model was adopted in this study. The developed visualization module interfaces with Revit Architecture using Revit API via C# programming language. The visualization module extracts from a Revitmodel not only a building element's geometry, but also element material properties. The visualization module uses Microsoft DirectX graphical library to generate a virtual prototype of the project.

The Visual Estimating Application matches an element extracted from a Revit model to an assembly from the cost estimating database for preparing an estimate. An estimate report could also be generated. Although some of the tedious estimating tasks have been eliminated, the estimator input is still a must. Different project has different methods of construction and circumstances. Even though computers can assist some process during estimating, it could only do so much while judgment and experience of estimator is also needed.

FUTURE SCOPE

- Elements from the 3D CAD model have to be matched to an assembly from the cost estimating database. Automating this process could provide the estimator with an easier task of searching for an assembly in the database.
- Since cost of equipments and materials changes on a regular basis. Cost estimating database should be updated automatically from remote resources such as suppliers' web sites. This would help save time by not having to update individual entries in the cost estimating database.
- Computer network capability can be added to facilitate collaboration among estimators. For example, an estimator can work on project walls while another estimator works on footings.

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