



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



CIVIL PLUS

Technical Magazine
2019-20

Vision | Mission | PEOs | Pos | PSO

Vision of the Institute

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

Mission of the Institute

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

Department of Civil Engineering

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

Vision:

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

Mission:

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

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

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

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

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

Program Educational Objectives (PeOs):

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

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

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

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

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

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

HOD Desk



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

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

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

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

- Dr. Sameer S. Sawarkar

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Department of Civil Engineering

Sanifit+



Product Name : Sanifit +

Product Developed By : Jayesh Tatiya

Name of Guide : Mr. Sudarshan S. Bobade

Objective : To Avoid Carriage of Hand Sanitizer Bottles

Outcome : A hand band has a refill tank for sanitizer and used for sanitizing hands.

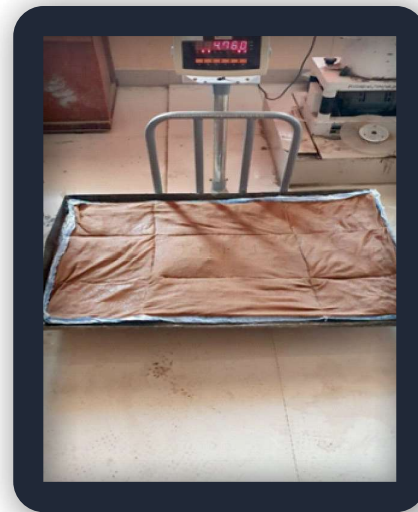
Academic Year

2019-20



Department of Civil Engineering

Concrete Curing Pad



Product Name : Concrete curing Pad

Product Developed By :

Suraj Alhat | Rohit Jawale | Rohit Borhade | Shubham Mali

Name of Guide : Mr. Anand B. Kudoli

Objective : To Cure RCC Components With
Optimum Use of Water

Outcome : Light weight curing pad saves lot of water that is
required for curing of RCC elements like slab, beam, column.

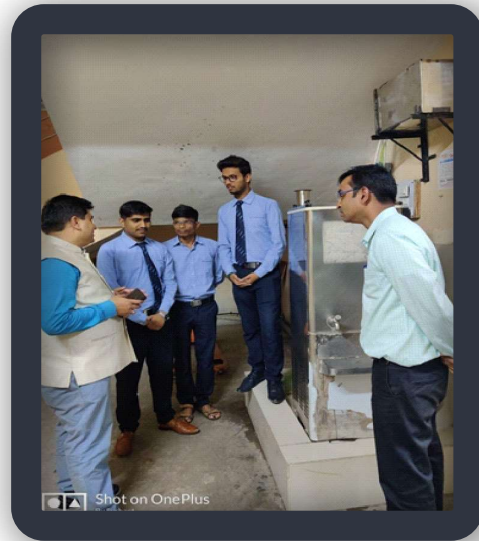
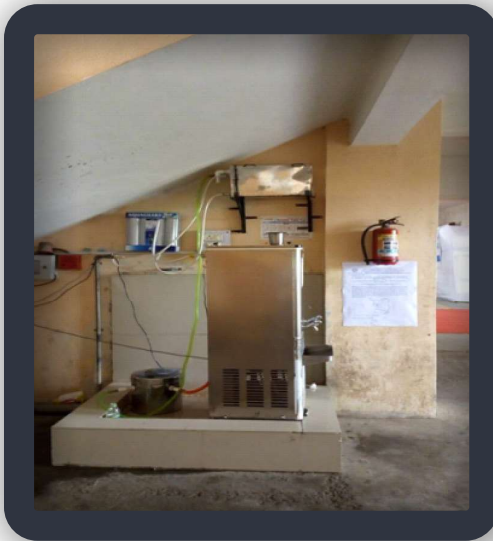
Academic Year

2019-20



Department of Civil Engineering

Smart System of Recycling Pure Water At Any Drinking Unit



Product Name : Smart System of Recycling Pure Water At Any Drinking Unit

Product Developed By :

Ajinkya Puranik | Nishant Gawhane | Kunal Malawade | Nachiket Patil

Name of Guide : Mr. Anand B. Kudoli

Objective : To Treat Water Which Is Usually
Wasted At Drinking Unit

Outcome : The system saves treated water by R.O.
which is otherwise wasted and feeds back to cooling unit.

Academic Year
2019-20

An Experimental Study on Effect of Sea Water on Compressive Strength of Concrete

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ABSTRACT This research work seeks to investigate the use of sea water as mixing and curing of concrete as 97% of the water on Earth surface is sea water and commonly water used for concreting is water from boreholes which contains number of salts and hence we are testing it for extreme case i.e. sea water case. For this concrete cubes were cast for a design mix of M-20, and M-25, using Ordinary Portland Cement (43 grade), Ordinary Portland Cement (53 grade) and Pozzolana Portland Cement. Three exposure conditions used, “mixing and curing with potable water”, “mixing and curing with sea water”, “mixing with potable water and curing with sea water”. The cubes were cast and cured for 3, 7, 14, 21, 28 days and was tested for compressive strength.

INDEX TERMS Compressive strength, concrete cubes, curing, design mix, mixing, potable water,

INTRODUCTION

Concrete is referred as artificial stone and is made from the mixture of cement, aggregate, sand, admixtures and water to form a uniform plastic material which sets gradually and gains strength with time.

With time all the natural resources are becoming scarce and water is one of them. According to the literatures available, it is said that in 2025, the half of the world will not have water even for daily necessities. Globally, billion of tons of water is used in concrete industry. Also, United Nations (UN) and World Metrological Organization (WHO) have predicted that 5 billion people will be in short of even drinking water. So, there is a need to explore alternative for potable water in construction

industry. A large number of structures are exposed to seawater either directly or indirectly. Thus, possibility of usage of sea water in concrete is studied.

In the present study, concrete with various types of cement adopted. Concrete grades of M-20 and M-25 design mix with a slump in between 75 to 100 mm were considered in the study. The exposure conditions of “Concrete mixing and curing with potable water”, “Concrete mixing and curing with sea water” and “Concrete mixing with potable water and curing with sea water” were adopted.

1. NECESSITY OF PROJECT

As population increases, demands of people increases and it becomes difficult to maintain balance between the demands and sustainable environment. Supply of fresh water is finite and predication says that in near future there will be shortage of drinking water. Hence, fresh water will not be available for concreting purpose. We use bore water for mixing as well as curing of concrete instead of fresh water.

The bore water available is neither free from impurities nor is considered as soft water. Here in this research work we are working on the effect of sea water as mixing and curing on concrete.

LITERATURE STUDY

According to **Water Encyclopaedia (2012)**, great bodies of water covers about five seventh of the earth's surface about 71 % in some places to depth more than ten kilometres.

Adebakin, H. I. (2003) describes fresh water as purified water which is free from impurities. **Akinkurolere O.O et.al (2007)** said sea water is a complex solution of many salts containing living matter, suspended silt, dissolved gases and decaying organic material. The average salt concentration of sea water is about 3.5% depending upon its location. The concentration of major salt constituents of seawater we are given in weight % of salt as 78%NaCl, 10.5% MgCl₂, 5% MgsSO₄, 3.9% CaSO₄, 2.3% K₂SO₄ and 0.3% KBr.

Studies were conducted during past on effect of mixing and curing of sea water in concrete. **Falah M. Wegian (2010)** investigated the effects of mixing and curing concrete with sea water on the compressive, tensile, flexural and bond strengths and reported that there are increases of strengths of concrete mixed and cured in sea water at early ages and a definite decrease for ages more than 28 days and up to 90 days. **Donald F. Griffin et.al (1964)** concluded that a small amount of sea water salts may be to concrete if rigid controls are exercised. Maximum compressive strength occurs between salinities of 18 and 36 gm/kg for concrete incorporating NaCl in the mixing water. Natural sea water does not deteriorate plain concrete; strength is generally increased with salinities up to nearly three times that of natural water. **Nobuaki Otsuki et.al (2011)** concluded from

the test results and discussions and are confident to safely use sea water as mixing water. **P. Krishnam Raju et.al (2014)** concluded that there is no reduction in compressive strength due to mixing and curing of sea water, whereas the average compressive strength arrived for designated concretes are more than the target strength. **O.O. Akinkulore et.al (2007)** concluded that concrete cast with sea water and cured with sea water increases the 28 days compressive strength dramatically and linearly beyond that obtained when cast in fresh water and cured in fresh water. **Preeti Tiwari et.al (2014)** performed series of experiments on M-30 grade and said that there is marginal increase in the strength of cubes cast and cured in salt water as compared to those of cast and cured in fresh water at all ages of curing and concluded that there is no reduction in the strength if we use salt water casting and curing the concrete. **F. Adeyemiet. al. (2014)** concluded that the strength of concrete batches cast with salt water and cured with fresh water was also observed to have increased even at 28 days and 90 days respectively. **K. J. Kucche et.al (2015)** quoted that from stream, river and even sea is also suitable, if it not contain brackish matter. **TarekUddin Mohammed et.al** said that seawater-mixed concrete shows earlier strength gain compared to the tap water-mixed concrete. However, after a long-term of exposure, no significant difference in compressive strength is observed.

MATERIALS AND METHODOLOGY

MATERIALS

The details of various materials used in the experimental investigation were:

- **Coarse Aggregate:-**Crushed granite stone aggregate of maximum size 20 mm confirming to IS 383-1970 was used. The specific gravity was found to be 2.925.
- **Sand (Fine Aggregate):-** The fine aggregate used was sand passing through 4.75 mm sieve. The specific gravity was found to be 2.83. The grading zone of fine aggregate was zone I as per IS specification.
- **Cement:-**Ordinary Portland Cement (43 grade), Ordinary Portland Cement (53 grade), Pozzolana Portland Cement (Ultratech Cement) was used.
- **Water:-** Ordinary clean potable water free from suspended particles and chemicals was used for mixing and curing of concrete.
- **Sea water:-**Seawater is water from a sea or ocean. Here sea water from Arabian Sea was used.

METHODOLOGY

Initial and Final Setting Time of Cement: Initial setting time is regarded as the time elapsed between the moment water is added to the cement, to the time that the paste starts losing its plasticity. The final setting time is the time elapsed between the moment the water is added to the cement, and the time when the paste has completely lost its plasticity and has attained sufficient firmness to resist certain definite

pressure. The effect of sea water on the setting time of cement was also observed.

EXPERIMENTAL PROCEDURE

To investigate the effect of sea water on compressive strength of concrete, three exposure conditions were used. The concrete cube size measuring 150×150×150 mm in dimension will be used. The batching of the concrete was carried out by weight. The mix proportion was calculated for characteristic compressive strength of 20 N/mm² and 25 N/mm². The concrete was properly mixed using the sea water and potable water respectively, the concrete cubes mould were filled in three layers. In each of the layer, the concrete cubes will be compacted 25 times respectively. The concrete cubes were cast and cured for 3, 7, 14, 21 and 28 days and will be tested for compressive strength.

Workability: Workability of cubes mixed with sea water and potable water are measured separately before casting of cubes. The workability maintained was medium i.e. slump was maintained between 75 mm to 100 mm for mass concrete.

Compressive Strength: The compressive strength is taken as maximum compressive load resisted by per unit area. For each of the curing period of 3, 7, 14, 21 and 28 days, cubes were tested and the average compressive strength recorded. The concrete cubes were tested in “Compression Testing Machine of capacity 2000 kN. The tests were carried out at “Vidya Vikas Pratishthan (VVP) Polytechnic, Solapur”.

Test Results: The observations for setting time of cement, workability of fresh concrete and compressive strength of hardened concrete are given in the following tables.

Table 1: Observations for Setting Time of Cement

Setting Time	Potable Water		Sea Water	
	Initial	Final	Initial	Final
Ordinary Portland Cement (43 Grade)	118	225	124	245
Ordinary Portland Cement (53 Grade)	130	238	138	261
Pozzolana Portland Cement	150	265	163	280

Table 2 : Observations for Slump Cone Test of Fresh Concrete

Slump of Concrete (mm)

	Potable Water	Sea Water
M-20 Grade of concrete using Ordinary Portland Cement (43 Grade)	94	90
M-20 Grade of concrete using Ordinary Portland Cement (53 Grade)	90	88
M-20 Grade of concrete using Pozzolana Portland Cement	88	87
M-25 Grade of concrete using Ordinary Portland Cement (43 Grade)	85	83
M-25 Grade of concrete using Ordinary Portland Cement (53 Grade)	84	82
M-25 Grade of concrete using Pozzolana Portland Cement	80	80

Figure 1 : Graph Showing Results for Slump Cone Test on Concrete

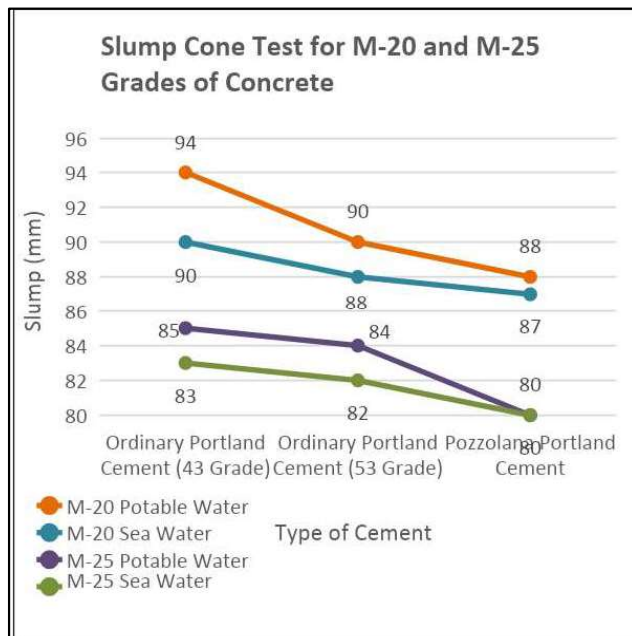


Table 3 : Quantities of Materials for Casting of 15 Cubes of M-20 Grade Concrete

Grade	M-20
Proportions	1 : 1.777 : 2.825
W/C Ratio (Potable/Sea)	0.47
Cement	32 kg
Fine Aggregate	56.864 kg
Coarse Aggregate	90.4 kg

Water (Potable/Sea)	16 kg
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Table 4 : Results for M-20 Grade of Concrete Using Ordinary Portland Cement (43 Grade)

	Average Compressive Strength (N/mm ²)		
Age in Days	Mixing and Curing with Potable Water	Mixing and Curing with Sea Water	Mixing with Potable Water and Curing with Sea Water
3 Days	9.795	10.482	10.285
7 Days	20.351	21.198	20.864
14 Days	27.759	30.296	29.397
21 Days	30.338	31.895	31.496
28 Days	32.055	31.104	31.965

Figure 2: Test Results for M-20 Grade Concrete Using Ordinary Portland Cement (43 Grade)

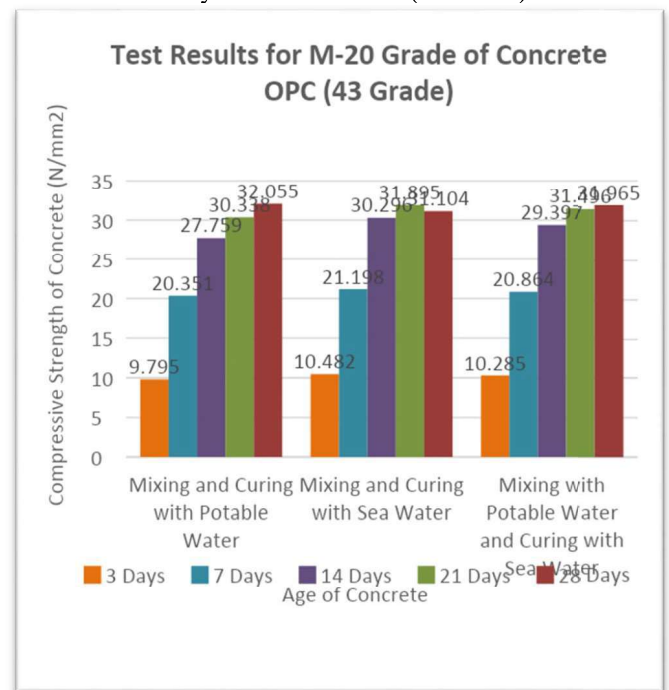


Table 5: % Increase in Average Compressive Strength of M-20 Grade of Concrete Using Ordinary Portland Cement (43 Grade)

Age in Days	% Increase in Average Compressive Strength when Mixed and Cured with Sea Water (N/mm ²)	% Increase in Average Compressive Strength when Mixed with Potable Water and Cured with Sea Water (N/mm ²)
3 Days	7.0137	5.0025

7 Days	4.1619	2.5208
14 Days	9.1393	5.9008
21 Days	5.1321	3.817
28 Days	-2.9667	-0.2808

Table 7 : % Increase in Average Compressive Strength of M-20 Grade of Concrete Using Ordinary Portland Cement (53 Grade)

Age in Days	% Increase Average in Compressive Strength when Mixed and Cured with Sea Water (N/mm ²)	% Increase in Average Compressive Strength when Mixed with Potable Water and Cured with Sea Water (N/mm ²)
3 Days	10.9897	8.0518
7 Days	6.1347	4.2423
14 Days	11.0177	8.5381
21 Days	7.8154	5.1036
28 Days	1.1094	2.0725

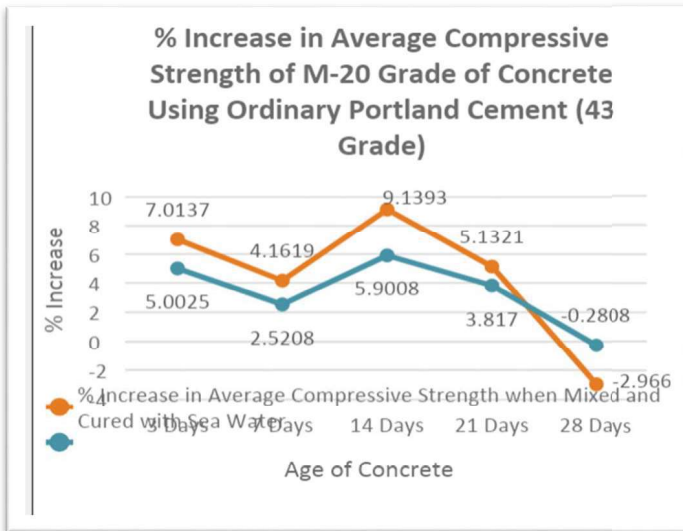


Figure 3 : % Increase in Average Compressive Strength of M-20 Grade of Concrete Using Ordinary Portland Cement (43 Grade)

Table 6 : Results for M-20 Grade of Concrete Using Ordinary Portland Cement (43 Grade)

Age in Days	Average Compressive Strength (N/mm ²)		
	Mixing and Curing with Potable Water	Mixing and Curing with Sea Water	Mixing with Potable Water and Curing with Sea Water
3 Days	10.892	12.089	11.769
7 Days	20.979	22.266	21.869
14 Days	28.191	31.297	30.598
21 Days	30.939	33.357	32.518
28 Days	32.811	33.175	33.491

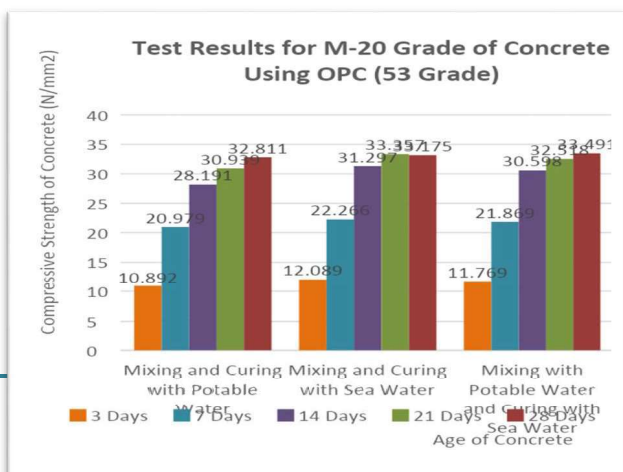
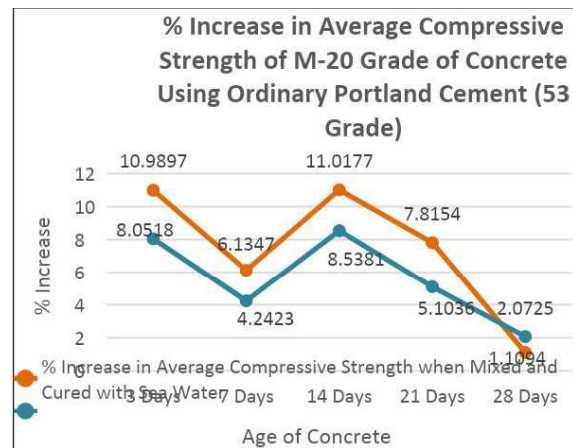


Table 8 : Results for M-20 Grade of Concrete Using Ordinary Portland Cement (53 Grade)

Age in Days	Average Compressive Strength (N/mm ²)		
	Mixing and Curing with Potable Water	Mixing and Curing with Sea Water	Mixing with Potable Water and Curing with Sea Water
3 Days	9.811	10.736	10.209
7 Days	20.772	21.83	21.557
14 Days	28.121	30.877	29.872
21 Days	30.911	32.602	32.18
28 Days	32.062	31.769	31.836

Figure 6 : Test Results for M-20 Grade Concrete Using Pozzolana Portland Cement

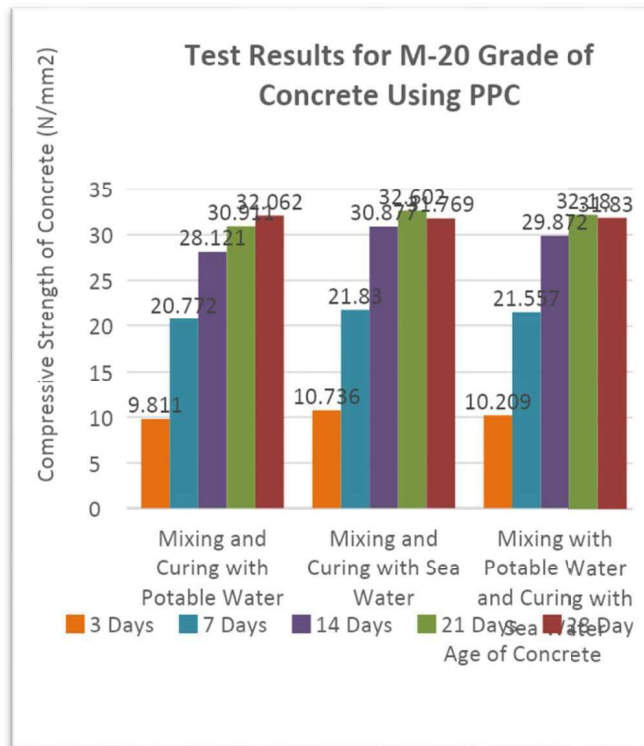


Table 9 : % Increase in Average Compressive Strength of M-20 Grade of Concrete Using Pozzolana Portland Cement

Age in Days	% Increase in Average in Compressive Strength when Mixed and Cured with Sea Water (N/mm ²)	% Increase in Average Compressive Strength when Mixed with Potable Water and Cured with Sea Water (N/mm ²)
3 Days	9.4282	4.0567
7 Days	5.0934	3.7791
14 Days	9.8005	6.2267
21 Days	5.4705	4.1053
28 Days	-0.9138	-0.7049

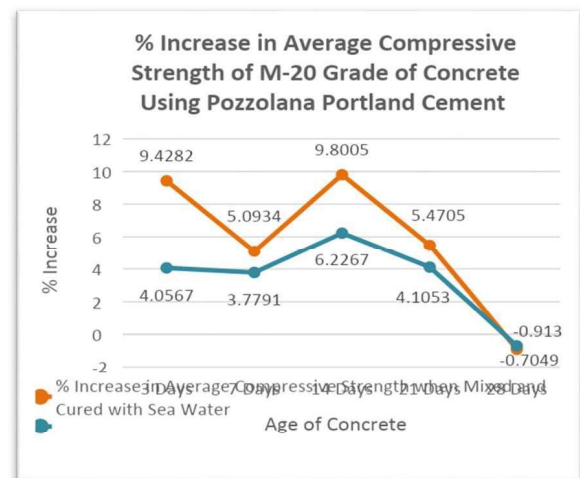


Figure 7 : % Increase in Average Compressive Strength of M-20 Grade of Concrete Using Pozzolana Portland Cement

Table 10 : Quantities of Materials for Casting of 15 Cubes of M-25 Grade Concrete

Grade	M-25
Proportions	1 : 1.777 : 2.825
W/C Ratio (Potable/Sea)	0.47
Cement	32 kg
Fine Aggregate	56.864 kg
Coarse Aggregate	90.4 kg
Water (Potable/Sea)	16 kg

Table 11 : Results for M-25 Grade of Concrete Using Ordinary Portland Cement (43 Grade)

	Average Compressive Strength (N/mm ²)		
Age in Days	Mixing and Curing with Potable Water	Mixing and Curing with Sea Water	Mixing with Potable Water and Curing with Sea Water
3 Days	10.944	11.932	11.71
7 Days	24.045	25.422	25.255
14 Days	32.242	35.685	34.543
21 Days	35.804	36.625	36.88
28 Days	37.572	35.672	37.685

Table 12 : % Increase in Average Compressive Strength of M-25 Grade of Concrete Using Ordinary Portland Cement (43 Grade)

Age in Days	% Increase Average in Compressive Strength when Mixed and Cured with Sea Water (N/mm ²)	% Increase in Average Compressive Strength when Mixed with Potable Water and Cured with Sea Water (N/mm ²)
3 Days	9.0278	6.9992
7 Days	5.7268	5.0322
14 Days	10.6786	7.1366
21 Days	2.293	3.0052
28 Days	-5.0569	0.3008

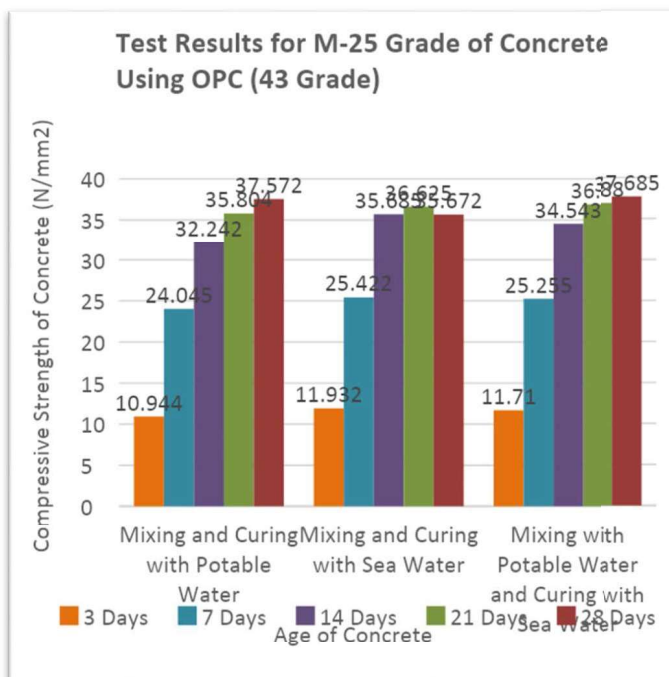


Figure 8 : Test Results for M-25 Grade Concrete Using Ordinary Portland Cement (43 Grade)

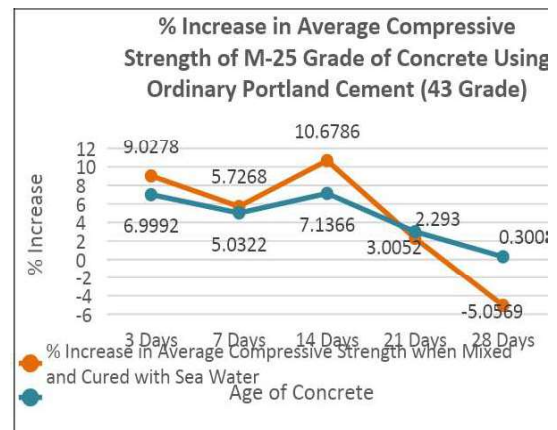


Figure 9 : % Increase in Average Compressive Strength of M-25 Grade of Concrete Using Ordinary Portland Cement (43 Grade)

Table 13 : Results for M-25 Grade of Concrete Using Ordinary Portland Cement (53 Grade)

	Average Compressive Strength (N/mm ²)		
Age in Days	Mixing and Curing with Potable Water	Mixing and Curing with Sea Water	Mixing with Potable Water and Curing with Sea Water
3 Days	12.335	13.471	13.032
7 Days	24.502	26.257	25.977
14 Days	32.734	36.792	36.171
21 Days	36.418	37.884	39.033
28 Days	37.884	37.632	38.418

Figure 10 : Test Results for M-25 Grade Concrete Using Ordinary Portland Cement (53 Grade)

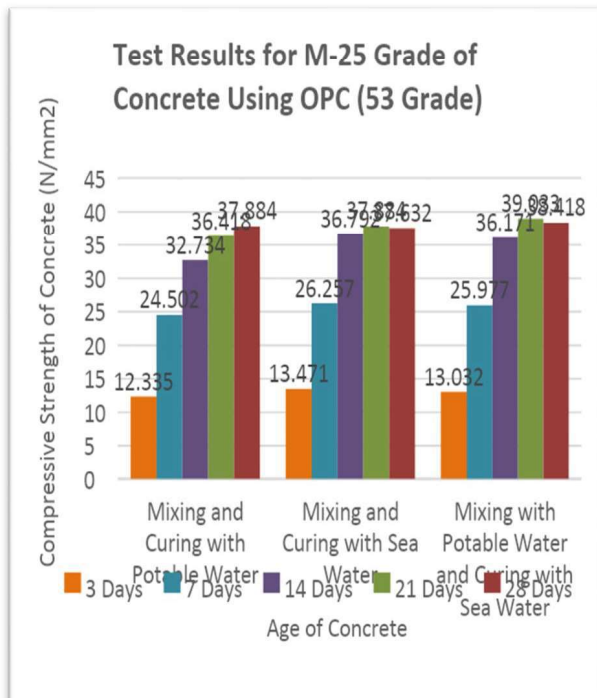


Table 14 : % Increase in Average Compressive Strength of M-25 Grade of Concrete Using Ordinary Portland Cement (53 Grade)

Age in Days	% Increase Average in Compressive Strength when Mixed and Cured with Sea Water (N/mm ²)	% Increase in Average Compressive Strength when Mixed with Potable Water and Cured with Sea Water (N/mm ²)
3 Days	9.2096	5.6506
7 Days	7.1627	6.0199
14 Days	12.3969	10.5
21 Days	4.0255	7.1805
28 Days	-0.6652	1.4097

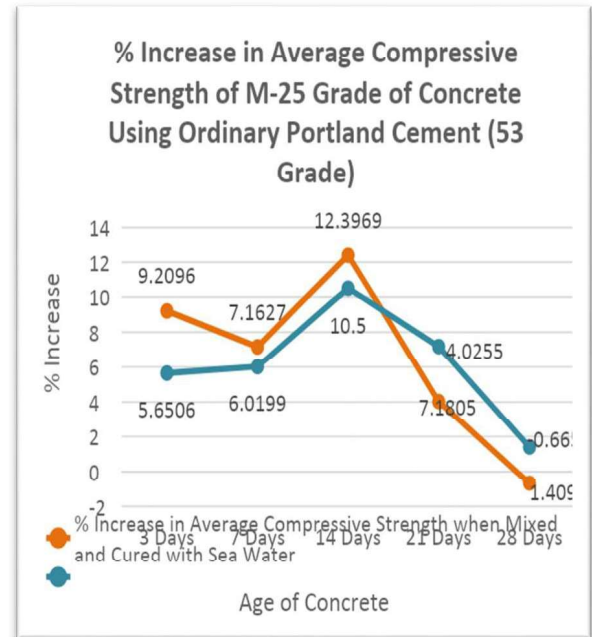


Figure 11 : % Increase in Average Compressive Strength of M-25 Grade of Concrete Using Ordinary Portland Cement (53 Grade)

Table 15 : Results for M-25 Grade of Concrete Using Pozzolana Portland Cement

	Average Compressive Strength (N/mm ²)		
Age in Days	Mixing and Curing with Potable Water	Mixing and Curing with Sea Water	Mixing with Potable Water and Curing with Sea Water
3 Days	11.642	12.536	12.252
7 Days	24.303	25.804	25.631
14 Days	32.675	35.954	35.106
21 Days	36.239	37.398	38.063
28 Days	37.8	36.533	37.193

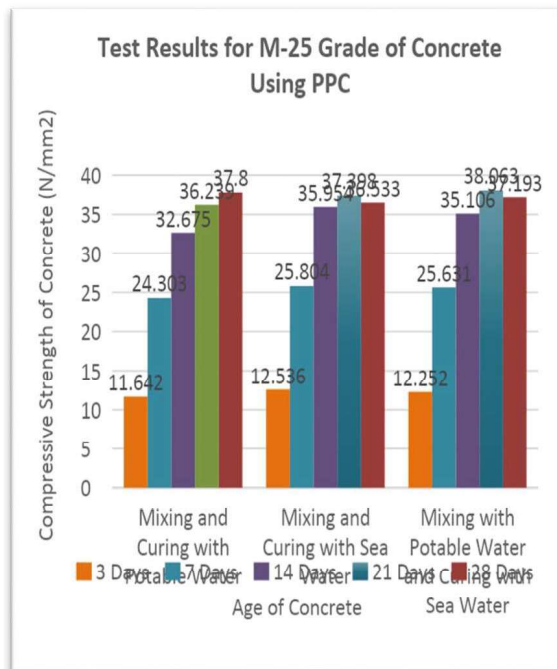


Figure 12 : Test Results for M-25 Grade Concrete Using Pozzolana Portland Cement

Table 16 : % Increase in Average Compressive Strength of M-25 Grade of Concrete Using Pozzolana Portland Cement

Age in Days	% Increase Average in Compressive Strength when Mixed and Cured with Sea Water (N/mm ²)	% Increase in Average Compressive Strength when Mixed with Potable Water and Cured with Sea Water (N/mm ²)
3 Days	7.6791	5.2396
7 Days	6.1762	5.4643
14 Days	10.0352	7.4399
21 Days	3.3198	5.0333
28 Days	-3.3518	-1.6058

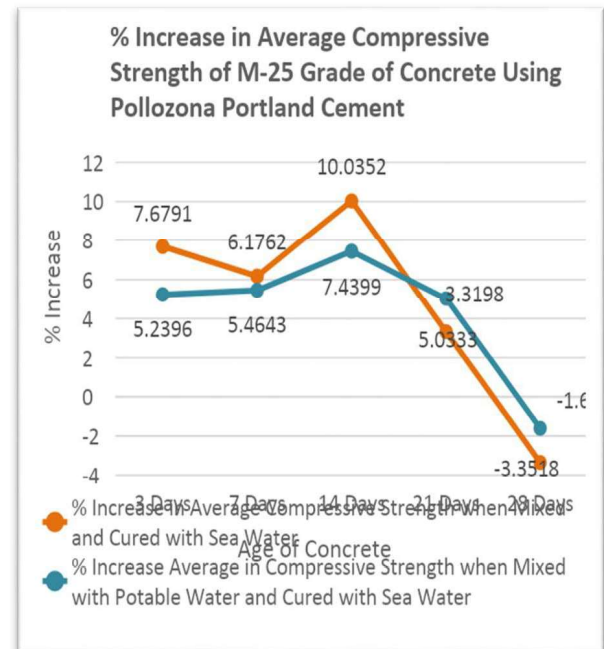


Figure 13 : % Increase in Average Compressive Strength of M-25 Grade of Concrete Using Pozzolana Portland Cement

CONCLUSION

- There was an increase in initial and final setting time of cement when cement is mixed with sea water but it satisfies the IS specification clause of initial and final setting time of cement.
- The condition medium workability attained by using sea water for mixing of concrete.
- After casting and demoulding, the sea water concrete cubes has a darker surface than the reference concrete cubes, when cured in sea water a deposit of salt formed on a specimens.
- Series of experiments were conducted on M-20 and M-25 grade of concrete using Ordinary Portland Cement(43 grade), Ordinary Portland Cement (53 grade) and Pozzolana Portland Cement. From the results it can be said that, there is an increase in the of compressive strength of concrete cubes at early ages which were cast and cured with sea water as compared with the concrete cubes cast and cured with potable water. The strength increases by 4-10% at 3 days, 4-8% at 7 days and 6-13% at 14 days.
- Reduction in strength for the exposure condition “Concrete mixing with potable water and curing with sea water” is less than that for “Concrete mixing and curing with sea water”
- There is no remarkable reduction in compressive strength due to mixing with potable water and curing the concrete with sea water or mixing and

curing of the concrete with sea water, the strength decreases by about 0.3-5% at 28 days when sea water is used as compared to characteristic target strength when concrete mixed and cured with potable water.

- The reduction of strength percentage is most for Pozzolana Portland Cement and least for Ordinary Portland Cement (53 grade) for both M-20 and M-25 grade of concrete.

- Studies may be carried out for higher grades of concrete i.e. M-30 and above and other types of cements, other types of admixtures and ground granulated blast furnace slag cements etc.

From the above finding we can conclude that there is no remarkable variation in the compressive strength if sea water is used for casting and curing the concrete. This concrete can be safely used for mass concreting without any alteration in strength properties.

Long terms studies may also be carried out to investigate the durability aspects when sea water is used both for mixing and curing. Studies may be carried out for flexure strength and split tensile strength.

ACKNOWLEDGMENT

This project arranged and supported by our directing staff we are thankful to HOD and all the staff members who have contributed and confident in completing. Last but not least, we would like to thanks all those who directly and indirectly involed in this project.

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A SOLUTION TO SOLVE DRAUGHT OF MARATHWADA THROUGH GODAWARI MANJARA INTERLINK

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ABSTRACT

India is one of the few countries in the world endowed with the reasonable land and water resources. Being a monsoon country the rainfall is erratic, unevenly distributed and hence water scarcity in some parts and floods in other parts frequently occur. Marathwada which is a region of Maharashtra state is as dry as hell in dry seasons. The people of Marathwada are facing the critical problems related with storage and distribution of water due to erratic rainfall and uneven distribution of water. The water scarcity in Marathwada region results in suicide of many farmers and this number is goes on increasing every year. Water scarcity is also responsible for lack of drinking water during summer season and Maharashtra government transfer water from Miraj to Latur district by Water train known as Jaldoot. Green revolution is not possible without blue revolution in Marathwada, so to tackle with all water scarcity related problems, We have proposed Godavari-Manjara interlink project in which the surplus water of Godavari river in rainy season is diverted towards the reservoir constructed in Latur and Beed district.

This paper identifies the reservoirs Manjara Dam and Babhagaon dam as part of proposed Godavari-Manjara link and examines inundated regions of Beed, Osmanabad and Latur district after completion of the project.

KEY WORDS Godavari, Manjara, Interlink, irrigation, discharge, submerged area, canal.

INTRODUCTION

Water is undoubtedly the most important natural resource on the planet, as it sustains all aspects of life in a way that no other resource can. Water plays a significant role in the field of agriculture also. Water resources are however limited due to developmental activities, industrialization, pollution, population, dropped rainfall levels, droughts, floods and other factors. The only time when people realize the scarcity of water is when there is drought or water supply of water is not been regulated. Increased pollution, population, industrialization, deforestation, urbanization and depleting natural resources. Drought and Flood are natural disasters caused by climate change which are the major water concerns in the country happens due to heavy and low rainfall. India is one of the few countries in the world endowed with the reasonable land and water resources. Being a monsoon country the rainfall is erratic, unevenly distributed and hence water scarcity in some parts and floods in other parts frequently occur. Keeping in mind the increasing demand for water, the government of India has developed a new National Water Policy which claims that water is a prime natural resource, a basic need and a precious national asset. India's National Water Development Agency (NDWA) has suggested the Interlinking of River project which is best known as (ILR) project.

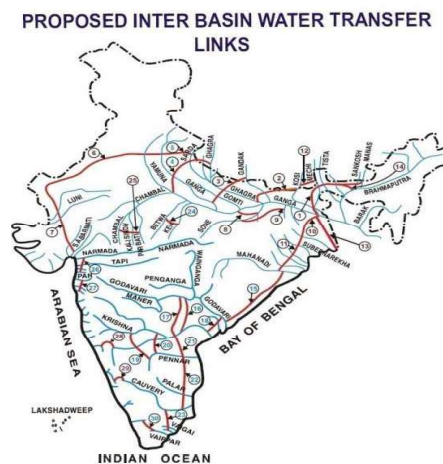


FIG.1 INTERLINKING PROJECTS IN INDIA

OBJECTIVE

The objectives of Godavari-Manjara Interlink Project are as follows :

- To use the available water of Godavari river effectively by transferring the surplus water towards water scare areas.
- Godavari-Manjara Interlink Project meets the

water requirement of Districts like Beed, Latur and Osmanabad of Marathwada region.

- To increase the irrigation potential of the drought prone area.
- To help to reduce the stress on ground water and to effectively increase the ground water level.
- The water scarcity in Marathwada region results in suicide of farmers due to crop failure and economic losses. We have proposed this project to meet the water requirement for irrigation purposes and to stop the suicide of farmers.
- To make ample water available which will increase the irrigation potential of the drought prone area and will ultimately increase the productivity of land.
- The crops in the Marathwada region are mainly rain fed crops. The farmers depend upon rain water for the crop production. This project will inspire farmers to take cash crops and their annual income will increase considerably.

Thus, the objective of this project is to transform the Dry Hell of Marathwada region into Nandanvan.

WATER CRISIS IN MARATHWADA

While most parts of Maharashtra receives average monsoon rainfall this season so far, water stock in the drought-prone Marathwada region in central Maharashtra stands at just 20 percent of it's total capacity. Currently villages across Marathwada are still relying on 339 tankers of a total of 500 deployed in the state for drinking purposes. In July, Marathwada received only 54% of the normal rainfall. Marathwada has been reporting frequent droughts over the past few years, which has made a region a centre for farmer suicides and agrarian crisis due to falling prices of produce. In the year 2018, around 689 farmers have ended their life because of crop failure and worst economical conditions.

The following tabular data shows the information about Beed and Latur districts.

1) BEED DISTRICT

Population	29,79,634
Annual Rainfall	692.8 mm
Source available	Manjara Dam (8 TMC) Majalgaon Dam (11TMC) Ground Water (42.78 TMC) Other Reservoirs (4 TMC)
Total Cultivable Land	9,52,000 ha
Total Irrigated Land	1,69,000 ha
Percentage of Irrigation	17.7%
Water required	For Drinking – 7.58 TMC

For Agriculture- 170 TMC
(by considering 100% irrigation)

2) LATUR DISTRICT

Population	28,54,196
Annual Rainfall	700 mm
Source available	Manjara Dam (8TMC) Ground Water (33.72TMC) Other Reservoirs (7 TMC)
Total Cultivable Land	7,08,669 ha
Total Irrigated Land	1,13,008 ha
Percentage of Irrigation	15.9%
Water required	For Drinking – 7.26 TMC For Agriculture- 140 TMC (by considering 100% irrigation)

HYDROLOGY OF GODAVARI BASIN

The river Godavari rises at an elevation of 1,067 m in the Western Ghats near Trambakeshwar Hills in the Nasik district of Maharashtra. After flowing for about 1,465 km., in a generally south-east direction, it falls into the Bay of Bengal. Godavari is an important river in India and it flows from western to southern india. The drainage basin of the river is present in Maharashtra, Karnataka, Telangana, Andra Pradesh and Puducherry. Godavari river flows through Aurangabad, Beed, Jalna, Parbhani and Nanded districts in Marathwada region. It extends a total geographically calculated area of 302065.10 Sq. km with a maximum length and width of about 995 km and 583 km, respectively.

The hydrology of Godavari basin and it's tributaries are shown in the following figure:

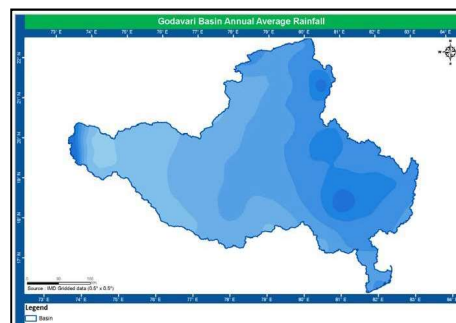


Fig 2: Godavari River Basin

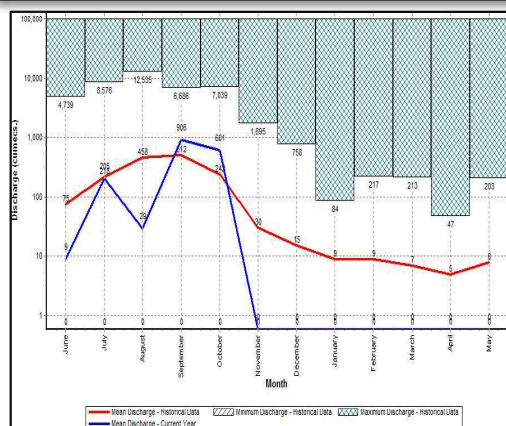
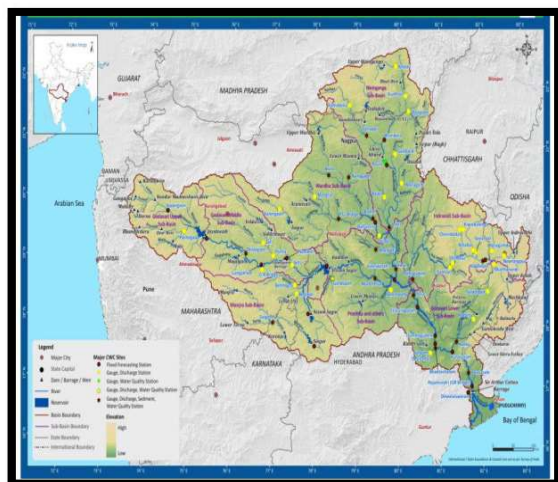


Fig.3 Rainfall in Godavari basin

DISCHARGE OBSERVED

The below Hystograph shows the monthly discharge values at Yelli station. From this Histogram it is computed that the annual discharge of Godavari river at Yelli is about 148 TMC which flows in Telangana State. The total amount of water flowing towards Telangana state is about 176.45 TMC which includes the discharge of Manar (4.45 TMC) and Lendi (24TMC) rivers. But the total water requirement of Telangana state is about 120 TMC including the total capacity of Sriramsagar Dam (90 TMC) and Nizamsagar Dam (30 TMC). So, the total surplus water available is about 56.45 TMC. By considering need of Telangana state and other parameter we can divert 23 TMC of water from yelli station towards draught prone area of Marathwada.

Month	Average discharge cumec
June	9
July	215
August	29
September	906
October	601

November	0
December	0
January	0
February	0
March	0
April	0
May	0

Fig 4. Monthly Average Runoff based on period : 1978-2016

$$\begin{aligned}
 \text{Total discharge Observed} &= 9+215+29+906+601 \\
 &= 1760 \text{ cumec} \\
 &= 1760 \times 30 \times 24 \times 60 \times 60 \text{ m}^3 \\
 &= 4.562 \text{ km}^3 \\
 &= 4.562 \times 32.35
 \end{aligned}$$

Total discharge Observed= 147.58 TMC

Godavari - Manjara Link Route :

The source of Godavari-Manjara Link is situated at Yelli village in Nanded district where the yearly discharge observed is about 148 TMC. The total length of the canal is 318 km and the project is divided into four phases. The first phase of the project includes canal link from Yelli (Nanded District) to Kalka (Nanded District). The length of canal in phase one is about 59 kilometers. The second phase of the project has canal link from Kalka (Nanded District) to Telgaon (Latur District). The length of canal in phase two is about 55 kilometers. The Third phase of the project has canal link from Telgaon (Latur District) to Kallam (Beed District) where Manjara dam is situated. The length of canal in phase Three is about 112 kilometers. The Fourth phase of the project has canal link from Telgaon (Latur District) to Bahhalgaon. length of canal is 55 kilometers. It includes construction of Bahhalgaon Dam which will store water for Latur District and transfer of water from bahhalgaon dam to reservoir situated in Nilanga by canal of length 37 kilometers.

The Link route of Godavari-Manjara Interlink is shown in the figure 5 which passes through three districts of Marathwada region which are Nanded, Latur and Beed.

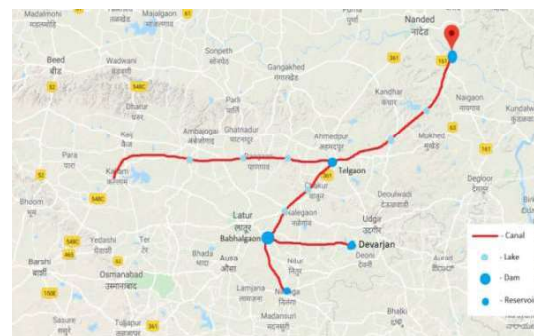


Fig.5 GodavariManjara link route

PHASE I (YELLI TO KALKA)

Canal link from Yelli to Kalka in Nanded district. This phase will include the construction of water divergent structure on Godavari river at yelli which will store and divert water towards Manjara dam through canal. The total capacity of this reservoir at yelli will be 15 TMC. The total length of the canal in phase I will be 59 kilometers. The flow of water through canal will be gravity flow.

Phase I Specifications

Source	Yeli (383m)
Destination	Kalka (371m)
Length of canal	59 km
Number Of Reservoir	1 (Yeli dam)
Cross Section Of Canal	Trapezoidal

Table no. 3
Reservoir Specifications

Name	Yeli dam
River	Godavari
Location	Yeli Village
Height	45m
Total capacity	15 TMC
Submergence Land	1886 ha approx.
Land to be acquired	2452 ha approx.
Purpose	Irrigation Drinking
Area Irrigated	30000 ha (Nanded)
Water Distribution	Nanded District- 50% Latur, Beed Districts- 50%

PHASE II (KALKA TO TELGAON)

Phase II of the project includes canal link from Kalka to Telgaon. The Telgaon station is at higher elevation than kalka. There is difference of about 189 m in the elevation of telgaon and Kalka. Water in the canal is required to be lifted to overcome the route obstructions. There will be Pumping Station situated near Kalka which will pump the water from small reservoir constructed for pumping purpose. The water will be lifted upto suitable height and further it will pass through tunnel constructed in the hill and the water will be discharged in the canal on the other side.

Table no. 4 Phase II Specifications

Source	Kalka (371m)
Destination	Telgaon (560m)
Length of Canal	55 km
Reservoir	Near Telgaon (1TMC) Lake (0.2 TMC)
Pumping Power Station	Required
Cross Section of Canal	Trapezoidal

PHASE III (TELGAON TO KALLAM)

Phase III of the project consists of canal link from Telgaon (Latur District) to Kallam (Beed District) where Manjara dam is situated. The total length of this link will be 112 kilometers. Similar to phase II, pumping of water will be required due to obstruction of Balaghat mountain range which has a elevation of 600 meters above mean sea level. To overcome this obstruction, one pumping station will be provided near Saygaon.

The water from canal in phase III will be discharged in Manjara Dam in Beed district. The current capacity of Manjara Dam is 8 TMC. Manjara dam supplies water to Beed, Osmanabad and Latur districts.

Table no. 5 Phase III Specifications

Source	Telgaon (560m)
Destination	Kallam (628m)
Length of Canal	112 km
Reservoir	Near Saygaon (0.3 TMC) Near Pangaon (0.3 TMC) Near Kumbephal (0.2 TMC)
Pumping Power Station	Required
Cross Section of Canal	Trapezoidal

Table no. 6 Manjara Dam

Name	Manjara dam
River	Manjara
Location	Near Kallam City
Height	25m
Current capacity	8 TMC
Purpose	Irrigation Drinking Industry
Area Irrigated	32000 ha

PHASE IV (TELGAON TO BABHALGAON)

Phase IV includes transfer of water from Telgaon to Babhalgaon and construction of Babhalgaon dam which will be constructed on Manjarariver in Latur district. Water will be supplied to Babhalgaon dam and Manjara dam from the Yelli dam through canal as per requirement to tackle with water scarcity condition in summer season. The babhalgaon dam will fulfil the water requirement of Latur district. Further water in Babhalgaon dam will transfer to Reservoir in Nilanga through canal of length 37 kilometers to solve the problem of water scarcity in Nilanga region. Water will also transfer to Devarjan by pipelines to solve water scarcity problem in that area.

Table no. 7 Phase IV Specifications

Source	Telgaon (560m)
Destination	Babhalgaon (508m)
Length of Canal	55 km
Reservoir	Babhalgaon dam (12 TMC) Reservoir Near Nilanga (1.5TMC) 2 Lakes between Telgaon to Babhalgaon of capacity 0.25 TMC
Pumping Power Station	Required
Cross Section of Canal	Trapezoidal

Table no. 8 Construction of Babhalgaon Dam

Name	Babhalgaon dam
Location	Near Babhalgaon (Latur District)
River	Manjara
Height	41m
Total Capacity	12 TMC
Submergence land	1800 ha
Benefited Area	Latur District
Area Irrigated	25000 ha.
Water reserved	3.5 TMC (for March, April, May, June)
Canal	Babhalgaon dam to Nilanga Reservoir (37 Km) Water transfer from dam to Devarjan Lake through pipeline (42 Km)

Maharashtra has maximum number of large dams in country but state has failed in providing water to its people. In Marathwada water table has gone down by 3 to 4 metre in the past 2 years. Only transfer of water not solve the problem of scarcity completely. Proper distribution of water, Proper cropping pattern which is suitable to geographical situation of particular region, proper allocation of water are plays important role to tackle with water scarcity problem. Many times water is utilize for water intensive crops like sugarcane and for industries like sugar factories and it will create problem of water scarcity in summer season hence in this project we reserved some water in both the dams (Babhalgaon&yelli dam) for four months of summer season to tackle with water scarcity problem in summer season in Marathwada.

ADVANTAGES

Godavari-Manjara link route aims to transfer surplus water of Godavari river towards the drought prone areas of Marathwada region to tackle with the water scarcity conditions. If this project is executed by the Central Government, then it will have following advantages :

- The Godavari-Manjara Link route will bring Water Revolution in drought prone Marathwada.
- Marathwada region faces drought condition almost every year due to erratic rainfall and uneven distribution of water. The Godavari-Manjara Interlink Project will meet the water requirement of Districts like Beed, Latur and Osmanabad of Marathwada region for both drinking as well as irrigation purposes.
- The diverted water of Godavari river will irrigate 95000 ha of land in Marathwada region.
- Lack of surface water due to erratic rainfall results in excess stress on ground water. Due to excess use, the level of ground water is declining. This project will help to reduce the stress on ground water and will effectively increase the ground water level.
- The water scarcity in Marathwada region results in suicide of farmers due to crop failure and economic losses. This project will meet the water requirement for irrigation purposes and will help to stop the suicide of farmers.
- The availability of ample water will increase the irrigation potential of the drought prone area and will ultimately increase the productivity of land.
- The crops in the Marathwada region are mainly rain fed crops. The farmers depend upon rain water for the crop production. This project will inspire farmers to take cash crops and their annual income will increase considerably.
- This project will help to enhance the life of people in this area in social and economical aspects.
- The execution of this project will transform the Dry Hell of Marathwada region into Nandanvan.



CONCLUSION

- This paper presents a brief overall review on the Godavari-Manjara Interlink project. In this project, emphasis has been placed on improving the productivity of agriculture, Water use and water resource management. Our project focuses on system and understanding of water availability, its productivity, allocation, management, and recharge or conservation in Marathwada region. Successful implementation of this project will help to transfer the surplus water of Godavari river towards water deficit areas of Marathwada region.
- Our analysis shows that due to uneven distribution of rainfall there are drought prone conditions in some regions of Godavari basin while there is availability of surplus water in other regions having heavy rainfall values. By studying the hydrology of Godavari basin and Marathwada region it can be concluded that the execution of this project will solve all the water related problems of Marathwada region and we can transfer sufficient amount of water from Godavari river towards Manjara river to tackle with the water scarcity of Beed, Latur and Osmanabad district which suffer through drought conditions almost every year. If water transferred from water abundant region to water deficit region, there would be adequate supply of water for everyone in all parts of the country. It also appears to promote national integration and a fair sharing of the country's natural water wealth.
- The barriers before the interlinking projects are massive estimated cost of the project, issues related to environmental and ecological impact such as deforestation and soil erosion, rehabilitation of the project-affected people and the interstate river water distribution issues. If all this barriers are overcome by the State and the Central Government, then the Interlinking of rivers will bring the water revolution in India.

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Partial Replacement of Concrete Ingredients by Marble Waste and Industrial Waste Water

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ABSTRACT The aim of this study is to assess the possibility of utilizing marble waste and industrial waste water as a partial Replacement of Concrete. Marble industry produces a large amount of waste during mining and its processing stage. It has been studied that around 70% of marble waste is produced during marble cutting, which creates a lot of environmental problems when dumped on open land. Our main objective of this study is to effective utilization of marble waste (marble powder and marble as a fine aggregate) by replacement of concrete ingredients (cement and fine aggregate). We also worked on the effect on strength when industrial waste water is mixed into concrete. In this work we have compared strength achieved by the Concrete blocks by addition of waste marble in various proportions. We studied the compressive strength and the behaviour of concrete block under stress. The obtained results of this study indicate that replacing marble waste & industrial waste water found cost reduction in concrete making and compressive strength is also as per IS requirements.

INDEX TERMS Marble Fines, Marble waste Replacement, Concrete, Industrial waste water

7) INTRODUCTION

There are more than 50 different types of minerals and rocks in India and most of it comes from Rajasthan. The state has large deposits of natural rocks which include granite, marbles, sandstone, limestone, slate, quartzite, etc. However it is seen that the process of marble quarrying and its processing generates a large amount of waste in the form of marble powder or as fines. These wastes are then dumped in the open land which creates a lot of environmental as well as health problems. This project contains an experimental investigation of suitability of effective utilization of marble waste by replacing partially with concrete ingredients as well as utilization of industrial waste water into the concrete.

With the ever increasing popularity of the marbles of Rajasthan, growing demand for finished and unfinished products, discovery of new marble deposits and growing private and public supports have led to a significant growth in Marble Industry of this State. As a result, number of marble quarries as well as marble processing units has significantly gone up mainly during last one decade. However, whereas there is significant growth in production of finished and unfinished marble products, there is also simultaneous rise in waste generation as well; thereby causing concern towards the deteriorating environmental quality. A wide spread need is being felt to make this industry environmentally sustainable.

Previously, studies were carried out in the context of utilization of the marble waste in concrete. In the paper 'Behaviour of Concrete Using Marble Waste as Coarse

Aggregate' by Sudarshan D. Kore and Ashok Vyas concluded that the workability, compressive strength and permeability increased with increase in substitution of marble aggregate by replacing natural coarse aggregate by marble aggregate in different percentages by weight of the concrete. In the paper 'Impact of marble waste as coarse aggregate on properties of lean cement concrete' they concluded that The workability of all the concrete mix increases with increased percentage of replacement of natural coarse aggregate by marble aggregates. Compressive strength of the concrete shows upward trend till 80% marble used as coarse aggregate in concrete. The permeability of the concrete increases with increase in percentage of replacement of natural coarse aggregate by marble aggregate this is mainly due to presence pores in the concrete.

In this project an investigation is carried out for effective utilization of waste marble powder and fines in the concrete and observes its behavior in the compressive strength. The scope of the project includes cost optimization of concrete and also minimization of cement content used in concrete making. This investigation also checks the effect of using industrial waste water in concrete.

8) Experimental Study

2.1 Materials

An experimental study was performed by prepare of M20 grade concrete mix using partial replacement of cement by marble powder and complete replacement of natural

crushed sand by marble fines. The cement used is 43 Grade Portland Pozzolona Cement. The naturally available coursed aggregate with nominal size 20mm was used and crushed sand as fine aggregate.

TABLE 2.1
PHYSICAL PROPERTIES OF MATERIALS

MATERIALS	SPECIFIC GRAVITY	WATER ABSORPTION	GRADING
COURSE AGGREGATE	2.61	0.54	AS PER TABLE 2 OF IS 383
CRUSHED SAND	2.66	2.0	ZONE 2 AS PER TABLE 4 OF IS 383
MARBLE FINES	2.70	0.05	AS PER TABLE 2 OF IS 383

TABLE 2.2.
PHYSICAL PROPERTIES OF MATERIALS

DESCRIPTION	MARBLE POWDER	MARBLE FINES
SIEVE ANALYSIS	<90 MICRON SIEVE	< 75MM SIEVE
PICTURE		

a. METHODOLOGY

For this experiment, M20 grade concrete mix was prepared with water cement ratio 0.42 and cement content 403.5 Kg/m³. Five sets of mix design were prepared with the trail of using different substituents such as follows:

27. Cement + fine aggregate + course aggregate + water
28. [Cement(85%)+Marble Powder(15%)] + fine aggregate + course aggregate + water
29. Cement + Marble Fines + course aggregate + water
30. Cement + Fine Aggregate + Course aggregate + Industrial Waste Water
31. [Cement(85%)+marble powder(15%)] + Marble Fines + Course Aggregate + Industrial Waste Water

These concrete were prepared and casted in 150mm concrete mould to take compressive test. After 24 hours these moulds were De-moulded and set for curing in a water tank. The compressive tests were taken in 3days, 7days, 28 days respectively to check the results.

TABLE 2.3.
MIX PROPORTION TABLE OF M20 GRADE CONCRETE

Mix	Cement (kg)	Marble Powder (kg)	Crushed Sand (kg)	Marble Fines (kg)	Course Aggregate (kg)
1	3.63	-	6.1	-	11.72
2	5.61	0.9	9	-	11.72
3	3.63	-	-	6.1	11.72
4	3.63	-	6.1	-	11.72
5	3.1	0.54	-	6.1	11.72

9) RESULTS & DISCUSSIONS

3.1. RESULTS

As per above procedure concrete testing done and observed result which is given in following table.

TABLE 3.1.
COMPRESSIVE STRENGTH OF CONCRETE

SAMPLE	3 DAYS (MPA)	7 DAYS (MPA)	28 DAYS (MPA)
REQUIRED STRENGTH (MPA)	8 →	13	20
MIX 1	10.93	16.26	30.71
MIX 2	7.64	15.77	22.82
MIX 3	11.33	17.82	22.84
MIX 4	10.93	16.26	30.71
MIX 5	8.97	10.67	20.05

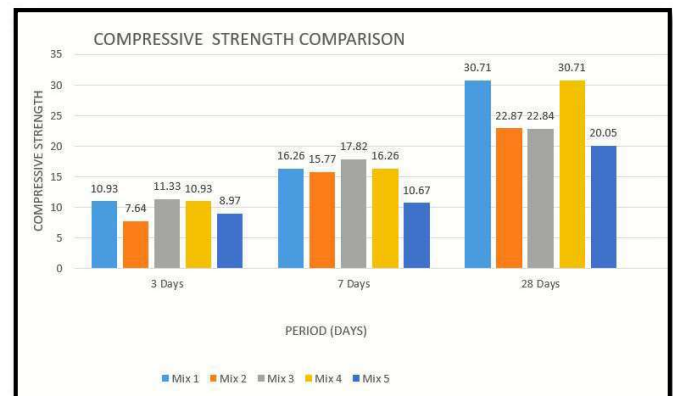


Figure 1. Comparison of Compressive Strength of all Mixes



Figure 2. Performance on Compression Test Machine

a. DISCUSSIONS

From the above results it is observed that by adding all the three ingredients (waste marble powder, marble fines and industrial waste water) at the fixed proportion, we were able to achieve positive compression test results and the this marble waste utilization become cost reduction in in concrete making.

ACKNOWLEDGMENT

It gives us a delight for completing our final year civil engineering project ‘An Experimental Investigation on Partial Replacement of Concrete Ingredient by Marble Waste & Industrial Waste Water.’ This Project gave us an insight of the concrete behaviour with the various ingredients and utilization of industrial waste into concrete. This project would not have been possible without our teachers and guide Prof. Satish Pitake. We would also like to thank our Head of Civil Department Dr. Sameer Sawarkar for their encourage words and support in completion of our project. Special thanks to the Principal of Pimpri Chinchwad College of Engineering and Research. Dr. Harish Tiwari for his valuable suggestions and feedbacks. Lastly we like to appreciate my group members who worked together as a team and their contribution for completion of this work

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Sustainable Solution for Disposal of Waste Product (May 2019)

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ABSTRACT Waste materials have become a threat to the environment. These materials should be reused and treated before they are disposed off. Phosphogypsum, one such waste by-product of fertilizers industries possess huge landfill problems all over the world. India produces approximately 25 million phosphogypsum per annum, only a small quantity of which is utilized by famers or cement industries. This research focuses on the maximum use of raw phosphogypsum in cement concrete mixes and analyses the futuristic scope of phosphogypsum in construction industry. Untreated phosphogypsum was used in the preparation of concrete mixes by partially replacing it with cement in 0%, 5%, 10%, 15%, 20% and 25% by weight and finding its compressive strength. The results have been evaluated and it was found that raw phosphogypsum gave unsatisfactory results in compression and thus needs treatment before using them in concrete. The future scope of phosphogypsum in construction industries is huge if the waste is treated and used effectively.

INDEX TERMS phosphogypsum, cement concrete, compressive strength, waste

INTRODUCTION

Waste Materials are a major threat to the environment when not disposed of properly. It is important to reuse and treat such materials which possess certain characteristics and then dispose them off. One of the methods is incorporating wastes in the construction industries by finding their potential strength and utilizing them. This will reduce the burden on nation's land filling. Phosphogypsum is one such waste by-product obtained from Fertilizer Industries which is then dumped on lands and in seas. Approximately 4.5-5 tons of phosphogypsum is generated per ton of phosphoric acid production (P_2O_5) using wet process [1]. In India, approximately 4.9 million tons of phosphoric acid was produced in the year 2018-19 which accounts for 24.5 million tons of phosphogypsum produced per annum. Commercially, Phosphoric Acid is produced by two methods namely 'The Wet Process' and 'The Thermal Process'. In India, wet process is mostly used for the production of phosphoric acid for making phosphatic fertilizers [2].

The phosphogypsum is mainly calcium sulphate in dihydrate form which also contains impurities such as fluorides, hydroxides, heavy metals, carbonic acids, etc. The general reaction showing production of phosphoric acid and phosphogypsum by wet process is as follows [3]

$$\text{Ca}_5\text{F}(\text{PO}_4)_3 + 5\text{H}_2\text{SO}_4 + 10\text{H}_2\text{O} \rightarrow 3\text{H}_3\text{PO}_4 + 5\text{CaSO}_4 \cdot 2\text{H}_2\text{O} + \text{HF} \quad (1)$$

The weathered phosphogypsum can be used as a retarder in place of natural phosphogypsum for Portland cement [4]. Up to 75% of waste phosphogypsum is simply prepared into non fired bricks only with small quantities

of river sand which is a cost effective way to recycle the waste [5]. The influence of phosphogypsum impurities is studied and its effect on setting time and compressive strength of mortar and concrete are presented along with various methods to beneficiate the PG has been postulated [6]. Phosphogypsum based slag aggregate was substituted for coarse aggregate in Portland cement and was tested for compressive, splitting tensile and flexural strength by using in concrete. The results indicated that slag aggregate performed well as a coarse aggregate in Portland cement concrete and should perform satisfactorily in highway pavement system [7]. This research mainly investigated the effect on compressive strength of the concrete in presence of waste phosphogypsum when added with different percent by weight of cement. Only raw phosphogypsum was used to find the maximum percentage of the phosphogypsum that can be used in cement concrete and thus possess less risk on landfills. The concrete strength was designed for 20 MPa and 40 MPa and the calculated quantity of cement was replaced by phosphogypsum at 0%, 5%, 10%, 15%, 20%, and 25% in terms of weight.

MATERIALS AND PREPARATION OF SPECIMEN

A. Physical Properties of Phosphogypsum

Phosphogypsum is a grey coloured, damp, fine grained powder with a maximum size range between 0.5 mm to 1 mm [2]. Phosphogypsum has properties similar to natural gypsum. The density of particles ranges from 2.27 to 2.40 g cm⁻³. The free water content of phosphogypsum mainly depends on nature of rock, draining time of the stack and local meteorological conditions [8]. Usually free moisture

content between 25-30% exists in the gypsum cake after drying [1].



Fig. 1. Raw phosphogypsum

B. Chemical Properties of Phosphogypsum

Calcium and SO_4^{2-} are major constituents of phosphogypsum. Phosphogypsum is acidic in nature due to presence of various residual acids such as Phosphoric, Sulphuric and Fluoride acids [8]. Primary phosphogypsum may consist of calcium sulphate dihydrate with small amounts of silica, usually as quartz and unreacted phosphate rock, radioactive material (like radium, uranium), heavy metals namely arsenic, cadmium, chromium, mercury and fluoride. The concentration of the metals depends on the composition of the phosphate rock [2].

10) PREPARATION OF SPECIMEN

Ordinary Portland cement, raw phosphogypsum, crushed stone (fine and coarse) was used to prepare concrete specimens in this research. The fineness modulus of sand and coarse aggregate was 2.9 and 6.9 respectively. The aggregate was washed and dried to remove any dust, clay or organic materials. Potable water was used for mixing of concrete.

The phosphogypsum sample was collected from Paradeep Phosphates Ltd, Paradeep, Odisha. The industry is one of the huge producers of Phosphatic fertilizers in India and eventually of phosphogypsum. Cement concrete blocks of strength 20 MPa and 40 MPa were prepared to check the effects of phosphogypsum compressive strength of concrete.

The quantities of ingredients for concrete mix was calculated as per IS 10262:2009 (Guidelines for Concrete Mix Design Proportioning) and IS 456:2000 (Workability, Durability and Concrete Mix Proportioning). The specimens are tested for compressive strength according to IS 516:1959.

RESULTS AND DISCUSSION

A. Compressive Strength of Concrete (20 MPa)

The test results of 7 days and 28 days compressive strength for 20 MPa are given in Figs. 2 & 3 respectively. The result shows that the compressive strength obtained does not decrease below 50% of the expected when the percentage of phosphogypsum is kept between 5-15%. Adding more than 15% phosphogypsum reduces the

strength of concrete significantly. In any case the compressive strength does not seem to increase with the addition of waste phosphogypsum directly into the concrete.

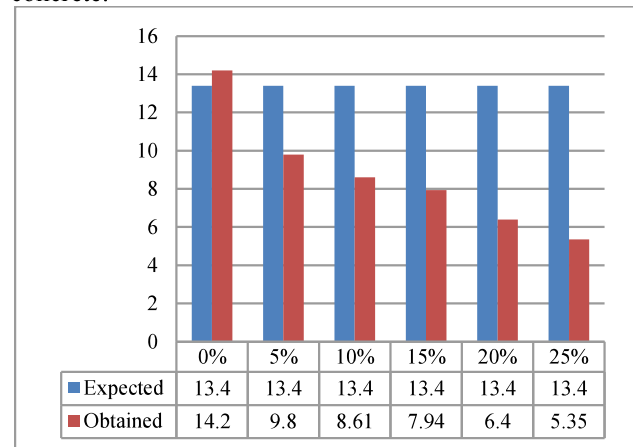


Fig. 2. Compressive Strength of Concrete at 7 days

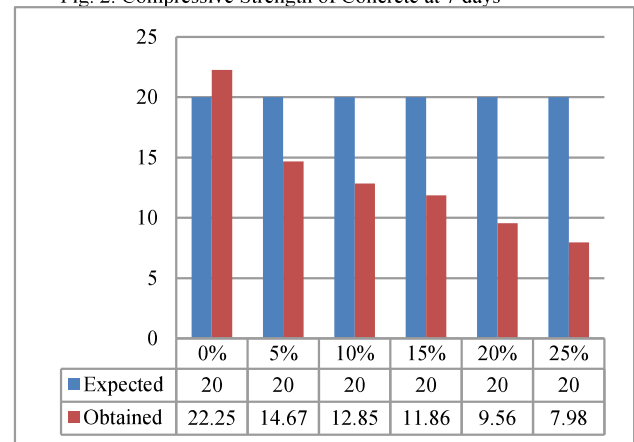


Fig. 3. Compressive Strength of Concrete at 28 days

B. Compressive Strength of Concrete (40 MPa)

The test results of 7 days and 28 days compressive strength for 40 MPa are given in Figs. 4 & 5 respectively. The result of M20 and M40 gives almost similar interpretations. The strength of concrete decreases with addition of waste phosphogypsum but the results are more drastic when percentage exceeds 15%.

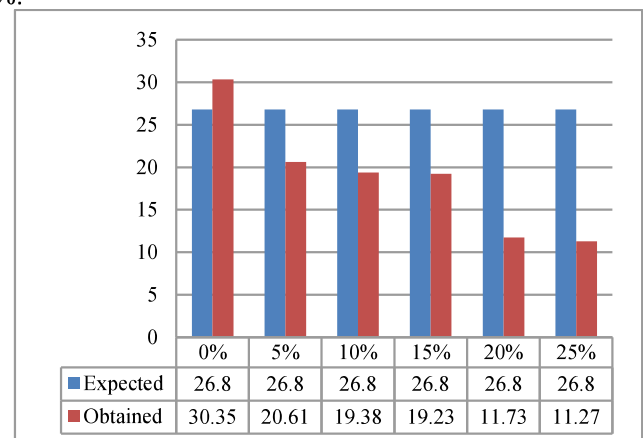


Fig. 4. Compressive Strength of Concrete at 7 days

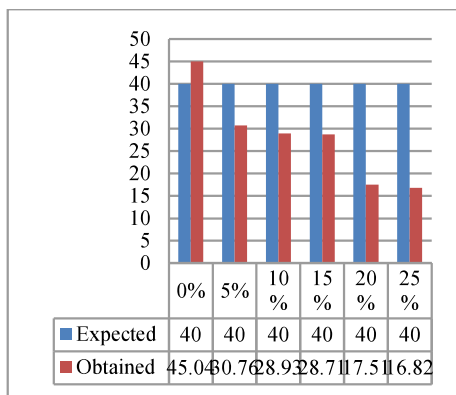


Fig. 5. Compressive Strength of Concrete at 28 days

SCOPE OF PHOSPHOGYPSUM IN CONSTRUCTION INDUSTRY

These Concrete paving blocks are also the ideal materials on the footpaths for easy laying, better look and finish. Within a span of 3 years these block become unserviceable due to rapid deterioration occurred on new pavers[9].

The paving blocks can become a potential source of utilizing the waste phosphogypsum in its manufacturing. The minimum strength requirement of paving blocks are 30 MPa, which can be obtained if the phosphogypsum based concrete is designed for strength of 40 MPa. The waste gets utilized and the cement content is reduced which makes it an economical product, hence posing less burden on landfills.

CONCLUSION

PPL at Odisha is one of the leading sources of phosphogypsum production in India. The industry occasionally sells the waste product at low prices to the local farmers who use it in soil amendment. However, the waste phosphogypsum which is in the form of slurry is mainly stored in surge tanks as per the guidelines of Central Pollution Control Board, India. The addition of 5-15% of raw phosphogypsum in concrete is an acceptable approach if the concrete is used in manufacturing of paver blocks, bricks, etc. To obtain better results, phosphogypsum needs to be treated chemically and use it as a substitute of cement in concrete works. A lot of research work has been carried on the use of phosphogypsum and from this research, it can be concluded that raw phosphogypsum should be treated before it is used as a replacement of cement. Phosphogypsum when used effectively provides an economical approach to the construction industry while carrying the benefit of sustainable utilization of industrial waste product.

ACKNOWLEDGMENT

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EFFECT OF DEM RESOLUTION ON ESTIMATION OF UNIVERSAL SOIL LOSS EQUATION LS FACTOR (May 2020)

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ABSTRACT Better life and human development leads to exploration of a vast amount of forest area and thus environmental degradation becomes common. Changes in land uses contribute to soil erosion. LS factor plays an important role in estimating soil erosion risk using empirical models such as RUSLE (Revised Universal Soil Loss Equation). The study was carried out in Raigad district of Maharashtra, India to estimate the impact of varying DEM resolutions on LS factor values. The aim to study was to estimate the impact of various computational flow accumulation as well as varying slope exponents on LS factor values. Slope Gradient and Slope Length factors are the commonly used parameters of USLE (Universal Soil Loss Equation) to predict soil erosion. These factors are pluck out from the Digital Elevation Model (DEM). Thus the DEM grid size will influence topographic factors and therefore soil loss calculation. Different DEM resolutions such as SRTM (30m), SRTM (90m), and GTOPO (900m) were used for comparison.

INDEX TERMS LS factor, DEM resolution, QGIS, ArcGIS, SRTM, GTOPO

1. INTRODUCTION

Cutting down the forest areas for development of new areas of housing, agriculture, recreation, mining and industrial activities has increased. Extensive deforestation for development of new areas has resulted in disturbance of the ecological environment. It has been acknowledged that the harmful effects of widespread soil erosion such as soil degradation, agricultural production, water quality, hydrological systems, and environments are serious problems for human sustainability (Lal, 1998). In this constantly changing environment, the availability and distribution of water varies with space and time. It is necessary to collect the data with high accuracy but practically it is not possible. So in such cases, remote sensing and GIS plays an important role for collecting accurate and correctly formatted data. The study carried out by Shuttle Radar Topography Mission (SRTM) in February 2000 has delivered near global topographic data that has been used for multipurpose and by many fields of Earth Science (Mukul Manas et al., 2015). Terrain analysis is defined as the process of describing the terrain with respect to roughness, altitude, slope, etc. This type of analysis is useful in determining land suitability for agriculture, construction of roads, designing irrigation schemes, and other land use. And also plays an important role while selecting a site. The terrain parameters such as slope steepness and slope gradient will be computed from DEM data using QGIS (Quantum Geographic Information System). QGIS is a free and open source platform desktop that supports viewing, editing, and analysis of geospatial data. The objective is to capture the geomorphological changes with greater precision and estimate soil erosion with high resolution DEM. DEM is

a 3D computer graphic representation of the terrain surface. DEMs are generally used in the Geographic Information System (GIS). Various DEMs such as SRTM (30m), SRTM (90m), and GTOPO (900m) are used to compare the difference in computing the topographical LS factors. Hence, the aim of this study was to determine soil erosion using Revised Universal Soil Loss Equation (RUSLE). In flow accumulation, the accumulated flow is calculated as the accumulated weights of all cells flowing into each downslope cell in the output raster. Output cells with a high flow accumulation are areas of concerned flows and can be used to identify stream channel. Calculation of flow accumulation is very important measure for many hydrological and topographical analyses.

MATERIALS AND METHODS:

2.1 STUDY AREA:

Study area is Raigad District in the state of Maharashtra, India. Total area of the composed region is 7152 sq. m. Raigad district is one of the four districts which lies along the western coast of the Maharashtra state. It is located between north latitude $17^{\circ}51'00''$ and $19^{\circ}08'00''$ and east longitudes $72^{\circ}50'00''$ and $73^{\circ}40'00''$ and is bounded by Thane in the north, Ratnagiri in the south, Pune in the east and Arabian sea at the west having a boundary of length 250km.

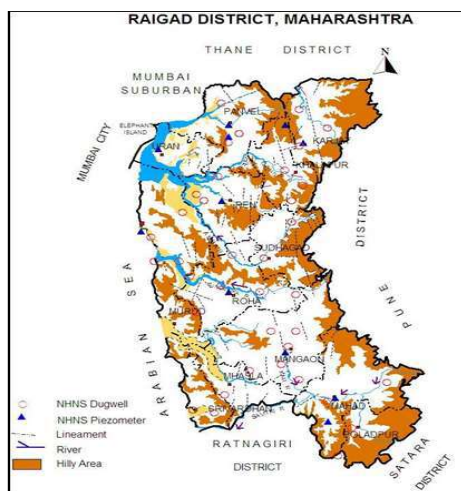


Fig 2.1.1 Map of Raigad district

Acquisition of the DEM depends upon the resolution or the grid size. The data required for DEM resolutions such as SRTM 30m and GTOPO 900m are obtained from USGS Earth Explorer and for SRTM 90m data is obtained from Open Topography through internet explorer. The concerned area is plotted using the coordinates creating the polygon. Then this is downloaded in the form of tiff format as Shape File. Then the data is processed through QGIS or ArcGIS software to obtain required DEM resolutions.

2.2. DEM DATA ACQUISITION:

DEM	Source
SRTM 30m	USGS
SRTM 90m	Open Topography
GTOPO 900m	USGS

Table 2.2.1 Sources of DEM

2.3. METHODOLOGY:

The software used for the processing of the acquired data from earth explorer is QGIS or ArcGIS. The software contains a toolbox for performing and processing of the image. The fill operation is performed in order to fill the sinks. The L factor is calculated using the flow accumulation tool in the software whereas slope exponent is calculated separately. LS factor is calculated with help of raster calculator, this uses the two layers created earlier. Now the mean values, deviation values are compared for the analysis purpose and variations are studied.

The Length and slope factor was calculated through a series of equation. The slope length (L) is calculated as given by (Wischmeier & smith, 1978)

$$L = (X / 22.13)^m \quad \dots (1)$$

Where,

22.13 is the RUSLE plot length (metres),

X = slope length (m)

S = slope gradient (%)

m = variable slope exponent

m value	Slope (%)
0.50	>5
0.40	3-5
0.30	1-3
0.20	<1
Source: Ministry of Natural Resources and Environment, Malaysia(2010)	

Table 2.3.1 Values of Slope Exponent

The slope steepness (S) factor is calculated as given by (McCool et al., 1989)

$$S = 10.8 \sin \alpha + 0.03 \quad \alpha < 9\% \quad \dots (2)$$

$$S = 16.8 \sin \alpha - 0.5 \quad \alpha \geq 9\% \quad \dots (3)$$

LS factor is also compared by values of constant slope exponent (m) and also spatially distributed slope exponent. Also by analysis two algorithms to determine the flow direction i.e. single flow direction and multiple flow direction. The LS factors of these two algorithm are compared which are given by (McCool et al., 1989) and (Desmet & Govers, 1996).

3. RESULTS AND DISCUSSION:

For each DEM, LS factor are calculated using Slope Length (L) factor and Slope Steepness (S) factor equation. LS factor is calculated on the basis of variable slope exponent (m) which varies from 0.2 to 0.5 in steep terrain. Calculation of slope length (L) factor and slope steepness (S) factor showed that the LS factor in each DEM varied from 0 to 100. The L and S factors in RUSLE showed the effect of topography on erosion. The L factor, S factor and flow accumulation helps to make better comparison of DEM resolutions.

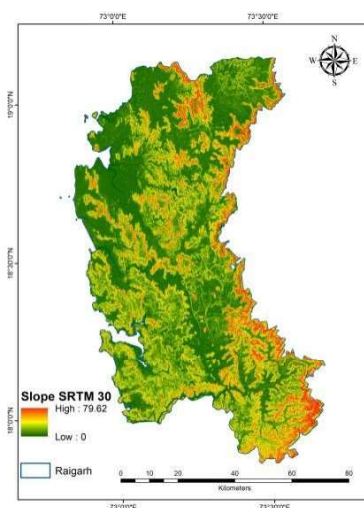


Fig 3.1 Slope of SRTM 30m

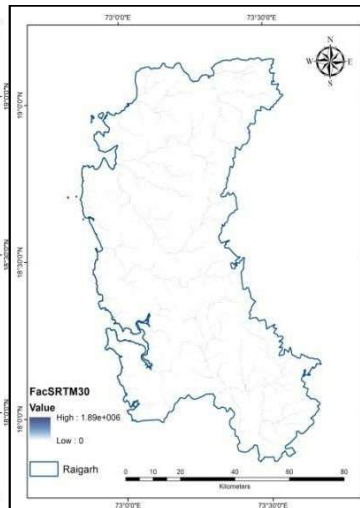


Fig 3.2 Flow Accumulation of SRTM 30m

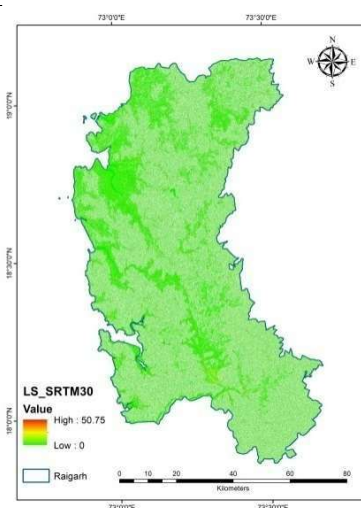


Fig 3.3 LS Factor of SRTM 30m

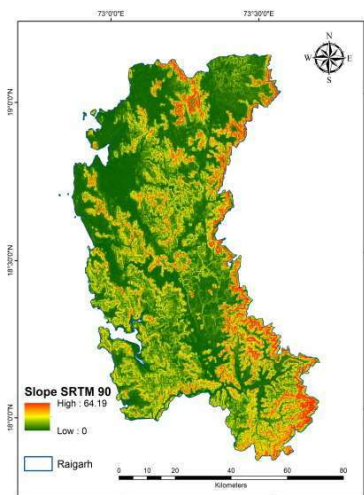


Fig 3.4 Slope of SRTM 90m

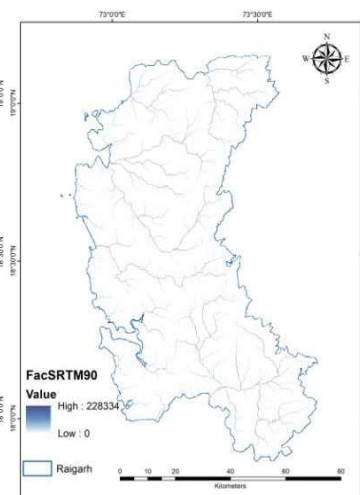


Fig 3.5 Flow Accumulation of SRTM 90m

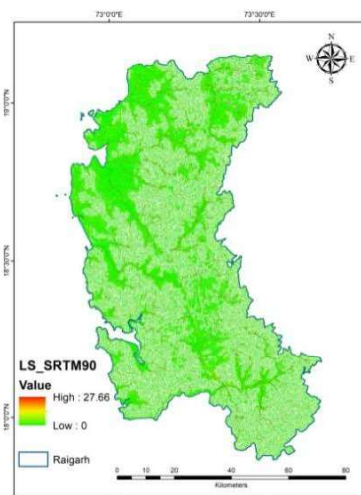


Fig 3.6 LS Factor of SRTM 90m

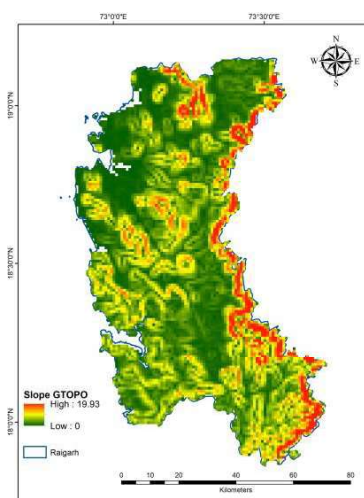


Fig 3.7 SRTM of GTOPO900m

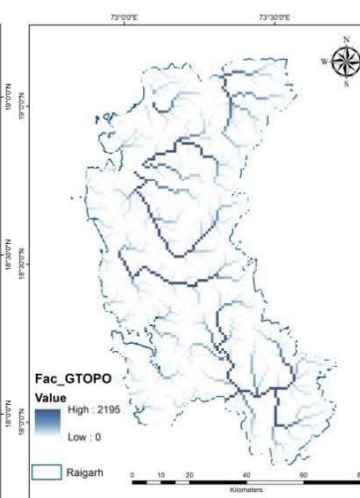


Fig 3.8 Flow Accumulation of GTOPO900m

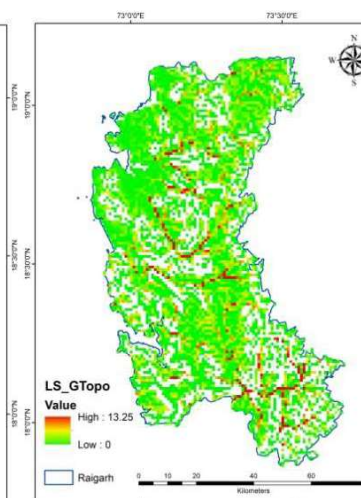


Fig 3.9 LS Factor GTOPO900m

Parameter	SRTM 30m	SRTM 90m	GTOPO 900 m
Min	0	0	0
Max	50.75	27.66	13.25
Mean	25.375	13.83	6.625
SD	50.75	27.66	13.25
Coefficient of variation	2	2	2

Table 3.1 LS factor statistics with slope exponent constant

Parameter	SRTM 30m	SRTM 90m	GTOPO 900 m
Min	0	0	0
Max	79.62	64.19	19.93
Mean	39.81	32.09	9.96
SD	79.62	64.19	19.93
Coefficient of variation	2	2	2

Table 3.2 LS factor statistic with distributed Slope value

Parameter	SRTM 30m	SRTM 90m	GTOPO 900 m
Min	0	0	0
Max	18000000	228334	2195
Mean	900000	114167	1097
SD	18000000	228334	2195
Coefficient of variation	2	2	2

Table 3.3 LS factor statistic with flow accumulation

4. CONCLUSIONS:

The study methodically explores the effect of DEM grid size on determining slope length, slope steepness, flow algorithms and LS factor. DEM of SRTM 30m gives high resolution as compared to resolutions of SRTM 90m and GTOPO 900m. The slope length increases with increase in DEM grid size whereas slope steepness decreases with increase in DEM grid size. The LS factor computed using L factor, S factor and flow accumulation helps in determining

the level of soil loss through RUSLE model. The potential erosion in the study depends upon the topographic LS factor as the major factor. This study can be used as baseline information for decision makers to develop regional planning for the study area.

ACKNOWLEDGMENT

It gives me an immense pleasure to submit this project report on "EFFECT OF DEM RESOLUTION OF UNIVERSAL LOSS EQUATION ON LS FACTOR." We tried our level best to represent this topic into compact and to the point framework.



Wish to express our sincere thanks with profound gratitude to our project guide **Prof. S.S. BOBADE** for his valuable guidance and constant encouragement without which it would have been impossible for us to present and complete this project successfully.

We would like to extend our sincere and true thanks to our Head of Department **Dr. Sameer Sawarkar** and principal **Dr. H.U. Tiwari** as well as all the staff members for imparting us the best of their knowledge and guidance.

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ECONOMICAL AND ECO- FEASIBLE METHOD OF SLAB CURING USING CURING PAD

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ABSTRACT:

Efficient uninterrupted curing is a key to quality concrete. Proper curing of concrete is crucial to obtain design strength and maximum durability considering the cost of curing. Curing is designed primarily to keep the concrete moist, by preventing the loss of moisture from the concrete during the period in which it gains strength. Due to rising problems of scarcity of water and expensive conventional methods of curing, it had become necessary to build-up a new method for concrete curing. This paper represents the experimental work related to a newly developed, effective and economical method of slab curing. This method consists of a technology namely 'Curing Pad' that not only absorbs and retains water for an extended period of time but also reduces evaporation losses. Concrete pad consists of 3 layers. The top layer is of a reflector material that reduces evaporation losses. The middle layer comprises of an absorbent material that stores and transmits water to the concrete slab. Bottom layer is binding or packing layer that holds all three layers together. Various tests are performed to check the durability of Curing Pad as well as its performance on concrete slab. These test results are compared to those of ponding method of slab curing.

INDEX TERMS : strength, scarcity of water.

1. INTRODUCTION

Cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Raw materials used in cement are heated to a temperature up to 1450 °C and then cooled. This heat gets stored in the cement and on the addition of water it reacts with the water forming an exothermic reaction which evolves heat.

Heat of hydration induces thermal gradient due to higher rate of loss of heat from outer surface than from inner core. This thermal gradient causes cracking in concrete due to non-uniform expansion of concrete within the body.

Curing is the process of controlling the rate and extent of moisture loss from concrete during cement hydration. It may be either after it has been placed in position (or during the manufacture of concrete products), thereby providing time for the hydration of the cement to occur. Since the hydration of cement does take time – days, and even weeks rather than hours – curing must be undertaken for a reasonable period of time if the concrete is to achieve its potential strength and durability. Curing may also encompass the control of temperature since this affects the rate at which cement hydrates. The curing period may depend on the properties required of the concrete, the purpose for which it is to be used, and the ambient conditions, i.e. the temperature and relative humidity of the surrounding atmosphere. Curing is designed primarily to keep the concrete moist, by preventing the loss of moisture from the concrete during the period in which it is gaining strength. Curing may be applied in a number of ways and the most appropriate means of curing may be dictated by the site or the construction method.

2. RESEARCH METHODOLOGY

Various construction sites were visited to inspect the traditional way of curing used for column and slabs. We found that gunny bags and ponding method used for column and slabs respectively. This type of curing method which is used since last years. Data was collected pertaining to available methodologies and applications of ponding method for curing of slab.

The collected data were used for separation of traditional and new method of curing. On the basis of data we have decided to make curing pad of three layers.

Based on collected data analysis was made to find out the most suitable materials for: -

- Upper Layer: - To prevent evaporation losses
- Middle Layer: - Material having capacity to absorb and hold water
- Bottom Layer: - Durable material to transmit water from middle layer to concrete slab below. This three layers in one pad which will help to keep the surface moist for long time.

3. ANALYSIS

1. Compressive strength test for m20 cubes in which 18 blocks were casted to check against 3, 7, 28days. 9 blocks Immersed in curing tank and others cured by using curing pads. Test results are in following table:

Table 1.Strength Results

Readings	3 Days (mpa)	7 Days (mpa)	28 Days (mpa)
Type-I PAD	9.5	12.24	23.22
Type-II PAD	11.45	17.45	24.35
Immersed in water	13.72	18.45	26.4



2. Workability of curing pad to check against wear and tear of pads when come in contact with rough surface of slab.

3. This pads are cost effective method of curing .it requires 5 rupees cost per sq.ft.

4. Curing pad absorb the water 3 liters (size 2x3 ft.) and holds the water up to 7 days for normal surface. For freshly cured slab, pad holds the water 1 day and surface keeps wet. For fresh slab first 7 days we need to sprinkled water daily after that alternately curing can be done.

Test results of absorption of water:

Table 2. Water absorption results

Readings	Type-I PAD	Type-II PAD
Dry Weight	1090	960
Weight after adding water	4820	4760
Weight after 1 day	3760	3650
Weight after 3 Day	2830	2610
Weight after 7 Day	1120	990

4. CONCLUSION

Based on the research results presented, the following conclusions were drawn:

1. The concrete cubes cured in water tank and those cured by curing pads showed similarity in their relative compressive strength development.
2. The use of the following curing methods: Immersion in lime water; covering with curing pads; and immersion in water, should be limited to the 28-day curing period.
3. Strength of concrete by using curing pads is more than the conventional ponding method.
4. It is a one type investment that is only buying cost of pads which is useful for different floors.
5. Curing pads helps to reduce amount of water for curing.
6. It is effective, environmental friendly and economical method of curing of slab.

5. ACKNOWLEDGMENT

It gives us an immense pleasure in submitting our research paper on "Economical and eco- feasible method of slab curing using curing pad". We take this opportunity to show panegyrics and thanks to our guide Prof. A. B. Kudoli and Coordinator Prof. S. Pitke whose suggestions helps us a lot throughout the duration of our efforts on research. We are also indebted to Dr. S. S. Sawarkar, Head of the Department who was constant source of inspiration to us during completion of this research work.

We would like to extend my special thanks to the Principal, Dr. H. U. Tiwari for his assistance and providing helpful suggestion.

We are thankful to all teaching and non-teaching staff members of Civil

Engineering Department for their help and co-operation during the course of this work.

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Faster than Speed of light: time travel to the future and the past(based on Special Relativity)

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ABSTRACT:

In this paper the time dilation topic and further more analysis on time travel is discussed. As we know, that special relativity (time dilation) provides us a way to travel to the future. But as we can see that time dilation and special relativity provides us the speed less than the speed of light. In this paper the effects on time after exceeding the speed of light is discussed that how we can get speed more than the speed of light in special relativity and can theoretically travel to past also. (these are the effects and an approach to see what happens to time after travelling at a speed more than the speed of light.)

INDEX TERMS : speed of light, time travel

1.INTRODUCTION

As we can see from special relativity, a paper published by Albert Einstein in 1905, the time dilation provides us the effects on time after approaching a speed close to speed of light. The special relativity is based on two postulates:

- I. The laws of physics are invariant in all inertial frames of reference, and
- II. The speed of light in vacuum is the same for all observers, regardless of the motion of the light source or observer.

$$t' = \gamma (t - vx/c^2)$$

$$x' = \gamma (x - vt)$$

$$y' = y$$

$$z' = z,$$

The equations above are the equations of Lorentz Transformation for moving bodies. It shows how time and position changes if the reference point changes i.e. two observers seeing an event from different reference frames.

The first equation tells us about the effect on time for a moving observer with respect to the observer on the ground.

But if we see that special relativity allows us to travel at a speed less than the speed of light. By solving these equations further, we can see that special relativity's time dilation can be used to travel more than the speed of light and also a modified version can lead us to the past travel.

We will solve this by taking the help of twin paradox experiment based on time dilation effect.

(Reference: Wikipedia-twin paradox)

Consider a space ship traveling from Earth to the nearest star system: a distance $d = 4$ light years away, at a speed $v = 0.8c$ (i.e., 80 percent of the speed of light).

To make the numbers easy, the ship is assumed to attain full speed in a negligible time upon departure (even though it would actually take close to a year accelerating at $1g$ to get up to speed). Similarly, at the end of the outgoing trip, the change in direction needed to start the return trip is assumed to occur in a negligible time.

The parties will observe the situation as follows
Earth perspective

The Earth-based mission control reasons about the journey this way: the round trip will take $t = 2d/v = 10$ years in Earth time (i.e. everybody on Earth will be 10 years older when the ship returns). The amount of time as measured on the ship's clocks and the aging of the travelers during their trip will be reduced by the factor $= \sqrt{1-v^2/c^2}$, the reciprocal of the Lorentz factor (time dilation). In this case $\epsilon = 0.6$ and the travelers will have aged only $0.6 \times 10 = 6$ years when they return.

Travelers' perspective

The ship's crew members also calculate the particulars of their trip from their perspective. They know that the distant star system and the Earth are moving relative to the ship at speed v during the trip. In their rest frame the distance between the Earth and the star system is $\epsilon d = 0.6 \times 4 = 2.4$ light years (length contraction), for both the outward and return journeys. Each half of the journey takes $\epsilon d / v = 2.4 / 0.8 = 3$ years, and the round trip takes twice as long (6 years).

Their calculations show that they will arrive home having aged 6 years. The travelers' final calculation about their aging is in complete agreement with the

calculations of those on Earth, though they experience the trip quite differently from those who stay at home.

Conclusion[edit]

Readings on Earth's and spaceship's clocks		
Event	Earth (years)	Spaceship (years)
Departure	0	0
End of outgoing trip = Beginning of ingoing trip	5	3
Arrival	10	6

No matter what method they use to predict the clock readings, everybody will agree about them. If twins are born on the day the ship leaves, and one goes on the journey while the other stays on Earth, they will meet again when the traveler is 6 years old and the stay-at-home twin is 10 years old.

No matter what method they use to predict the clock readings, everybody will agree about them. If twins are born on the day the ship leaves, and one goes on the journey while the other stays on Earth, they will meet again when the traveler is 6 years old and the stay-at-home twin is 10 years old.

2. SOLUTIONS FOR SPEED MORE THAN THE SPEED OF LIGHT

In the Lorentz factor $\varepsilon = \sqrt{1 - v^2/c^2}$ if we solve further then we will get a new modified equation

as $\varepsilon = \sqrt{\frac{c^2 - v^2}{c^2}}$ which can be further solved as =

$\sqrt{\frac{(c+v)(v')}{c^2}}$, where we can see that the term $(c + v)$ is the speed more than the speed of light.

And if we take the above example data and solve it at a speed of $4 \times 10^8 \text{ m/s}$, here $v=1.333c$. Now the time for the traveler to return from the space trip at the same distance of $d=4$ light years will be

$t_m = t_s \sqrt{\frac{(c+v)(v')}{c^2}}$, and thus $t_m = 5.6\text{yrs}$ and $t_s = 6\text{yrs}$

Now we can see that the $t_m < t_s$, therefore even after travelling at a speed more than the speed of light, the traveler will still be doing future travel.

But if we go at higher speed till twice the speed of light i.e. $2c$

Where the time of the moving observer becomes zero and at a speed more than $2c$ i.e. $2c+v$, the moving clock's time will be ticking fast than the clock on the ground and this will allow us for past travel.

2.3. SOLUTIONS FOR SPEED MORE THAN TWICE THE SPEED OF LIGHT

As we can see in the 'II', that past travel can be done at a speed more than the speed = twice the speed of light i.e. $2c$.

$$t_s = 3.42$$

Now if we take the speed as $2c+v=7 \times 10^8 \text{ m/s}$ where $v=2.333c$. so the time for the traveler to return from space trip for the same distance $d=4$ light yrs will be $t_m=t_s \sqrt{\frac{(2c+v)(v')}{c^2}}$, and thus $t_m = 6.7$ which is greater than the time for the observer on the ground and hence the past travel is possible but at a speed more than $2c$.

And the general equation of the factor now termed as

$$\alpha = \sqrt{\frac{(2^n c + v)(v')}{c^2}}$$

Where c = speed of light

v =traveling speed

$v'=2^n c - v$

$n=0,1,2,3,\dots,n$

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Assessment of Compressive strength of conventional concrete by using Self healing agent

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ABSTRACT:

Crack formation is very common phenomenon in concrete structure which allows the water and different type of chemical into the concrete through the cracks and decreases durability and strength. Self-healing mechanism in the concrete which helps to repair the cracks by producing calcium carbonate crystals which block the micro cracks and pores in the concrete. *Bacillus pasteurii*, *Bacillus subtilis* and *B. sphaericus*, *Bacillus megaterium* which are mainly used for the experiments by different researchers for their study. The selection of the bacteria was according to their survival in the alkaline environment. The condition of growth is different for different types of bacteria. For the growth, bacteria were put in a medium containing different chemical at a particular temperature and for a particular time period. In this study Self-Healing agents such as *Bacillus Sphaericus* used Bacteria is mixed in concrete with calcium lactate. Bacteria used in proportion of 10, 20, 30 ml/liter and calcium lactate 10g/liter water. A Comparison study is made with this concrete subjected to compressive strength of normal concrete and Bacterial concrete.

INDEX TERMS : *Bacillus sphaericus*, Bacterial Concrete, Calcium lactate, Self healing agents.

1) Introduction

concrete is the most widely used man made construction material. Some of major forms of environmental attack are chlorides and sulphate that lead to corrosion of reinforcement and subsequent reduction in strength, serviceability and aesthetics of the structure. Crack formation is a typical phenomenon related to durability. Percolation of crack may lead to leakage problems, causing deterioration of the concrete matrix or corrosion of embedded steel reinforcement. [17]. So to find solution for this recent years a bacteria-based self-healing concrete is being developed in order to extend the service life this called Self healing concrete or Bacterial concrete. [11]

II. Background of Self Healing concrete

Bacteria are added to the concrete mix to enhance the strength and also it acts as an excellent self-healing agent. It consists of cement, aggregate, sand, Bacteria, Calcium lactate. Self-healing concrete is a bacterial remediation technique surpasses other techniques it is bio-based, eco-friendly, cost-effective and durable.



Fig 1. Self Healing Concrete

A. Mechanism Self healing concrete

Self-healing concrete is a result of biological reaction of non-reacted limestone and a calcium-based nutrient with the help of bacteria to heal the cracks appeared on the building.

Special type of bacteria's known as *Bacillus* is used along with calcium nutrient known as Calcium Lactate [14]. When the cracks appear in the concrete, the water seeps in the cracks. The spores of the bacteria germinate and start feeding on the calcium lactate consuming oxygen. The soluble calcium

lactate is converted to insoluble limestone. The insoluble limestone starts to harden.

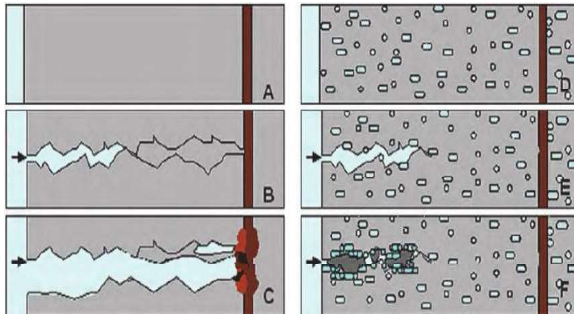
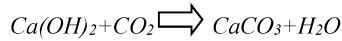
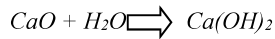


Fig 2. Chemical process of Self healing

Bacteria are microscopic, single-celled organisms that thrive in diverse environments. These organisms can live in soil, the ocean and inside the human gut.

B. Bacteria used in Self-healing concrete

From various Researches carried on self healing concrete researchers concluded that Bacillus family bacteria is used to make self healing concrete. Following are the Bacteria used in Self healing concrete are Bacillus sphaericus, Bacillus pasteurii, Bacillus megaterium, Bacillus subtilis, Bacillus aerius, Sporosarcina pasteurii, AKKR5, Shewanella Species, Bacillus flexus, etc.

C. Preparation of Bacterial Concrete

Bacterial concrete can be prepared in two ways-

- By direct application

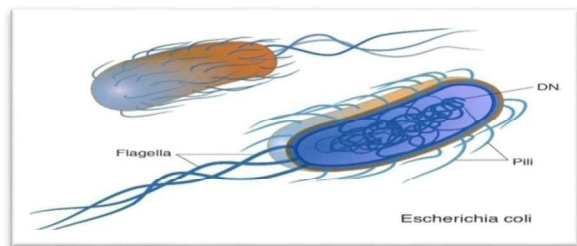
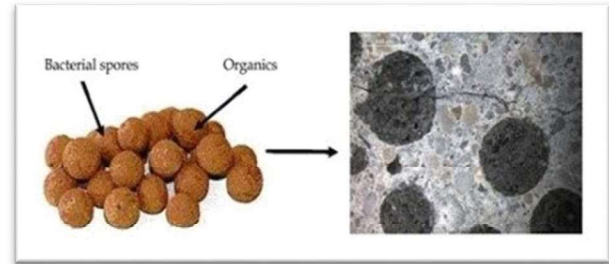
Bacterial spores and calcium lactate is added into concrete directly when mixing of concrete is done. When Crack occurred water comes in contact with this bacterium, they germinate and feed on calcium lactate and produces limestone. Thus sealing the cracks.

2) By encapsulation in lightweight concrete

By encapsulation method the bacteria and its food i.e. calcium lactate, are placed inside treated clay pellets and concrete is prepared. About 6% of the clay pellets are added for making bacterial concrete. [8]

When concrete structures are made with Bacterial concrete, when the crack occurs in the structure and clay pellets are broken and the bacteria germinate and eat down the calcium lactate and

produce limestone, which hardens and thus sealing the crack. Minor cracks about 0.5mm width can be treated by using bacterial concrete.



Bacillus sphaericus

Bacillus sphaericus is an obligate aerobic bacterium, gram-positive bacteria, rod-shaped used as a larvicide for mosquito control. It forms spherical endospores. Rods, 0.6 to 1.0 by 1.0 to 7.0 microns, with ends rounded or pointed, occurring singly or in short chains. Motile. Gram-variable, often Gram-negative with Gram-positive granules. Spores, 0.7 to 1.2 microns in diameter, round, terminal to sub terminal. Spore wall usually thick and easily stained. Remnants of the sporangium often adhere making the surface rough and spiny. Immature spores sometimes ellipsoidal, becoming round. Found mainly in soil. Maintaining medium- nutrient agar, nutrient broth. Bacillus Sphaericus possesses maximum urease activity and increases the strength of concrete. therefore, is suitable to be used for bacterial calcite precipitation in concrete. [1,5,6,7]

III. Methodology

In this Research paper initial investigation on Self-healing concrete is done on M20 grade of concrete. The main aim in this project is to compare the hardened properties of normal water concrete, Bacterial concrete. The material tests required to obtain the mix design of concrete were carried out in the laboratory. The mix design for M20 concrete is obtained using the IS Standard method of design. The material used are: Cement used is Birla super OPC 53

grade, River Sand and 20mm Coarse aggregates, Bacillus sphaericus Bacteria with 10,20,30 ml/liter, Calcium lactate 10gm/liter. The experimental investigations carried out on normal and bacterial concrete are: Cubic compressive strength. The strengths of Bacterial concrete are compared with the strengths of normal water concrete. The cubic compressive strengths are compared for 7 days, 14 days and 28 days curing period. In this research work 36 cubes were casted.

IV. Experimental procedure

A. Materials

1. Cement

Cement is a binder material, ordinary Portland cement (OPC) of 53 grade (Birla super brand) was used. The physical and chemical properties of cement are as per IS12269:1987[21].

2. Fine aggregate

River sand passing through 4.75mm IS sieve and confirming to zone-2 of IS383:1987[22] was used. The specific gravity was found to be 2.78.

3. Coarse aggregate

The coarse aggregate used in this work was of 20 mm down nominal size. The crushed angular shaped coarse aggregate was obtained from the local crushing plants. It has specific gravity of 2.94.

4. Water

Potable water is used for conventional and bacterial concrete.[23]

5. Bacillus sphaericus

The Microbial culture of Bacillus sphaericus was obtained in Freeze dried form in ampoules under the code **NCIM 2478 (ATCC14557, DSM28)** from National Collection of Industrial Microorganisms. Prescribed medium by NCIM is Nutrient agar (solid), Nutrient broth (Liquid).



Fig 5. Microbial Culture

Preparation of Bacterial culture:-

- 1) For 1000ml of distilled water 13g of nutrient broth was taken in a conical flask. Then the conical flask should be cotton plugged.
- 2) Then the broth is kept in an autoclave for 20 mi at 120 deg centigrade.
- 3) Then the flask was taken out and it should be cooled to room temperature.
- 4) Use laminar air flow chamber for inoculating the broth without any contamination.
- 5) Before using the laminar air flow chamber clean the chamber with ethanol.
- 6) Then after revived culture was taken and it is mixed with the broth.
- 7) Then keep the conical flask in the incubator at 30 deg centigrade for 24 hrs.



Fig 6. Bacterial culture

6. Calcium Lactate

Calcium lactate is a white crystalline salt made by the action of lactic acid on calcium carbonate. It is created by the reaction of lactic acid with calcium carbonate or calcium hydroxide. The chemical formula of Calcium lactate is $C_6H_{10}CaO_6 \cdot 5H_2O$. Manufactured by Analab fine chemicals, Mumbai. We have used calcium lactate in our research in the Quantity 10 gram/liter.

B. Mix Design

For this Research, the concrete M20 Grade for the samples was used. The M20 grade mix design of concrete is taken as per IS10262-2009 [24]. it shown in table 1.

Table 1 Mix Design

Cement (kg)	FA(kg)	Coarse aggregate(kg)	Water
426	700	1260	191.58

The proportion of mix design is 1:1.64:3.

C. Tests conducted on Concrete

1) Compressive strength test

This test was conducted as per IS 516-1959 [25]. The cube mould of size 150mm × 150mm × 150mm, conforming to IS: 10086 – 1982 were used to find the compressive strength of concrete. Specimens were placed on the bearing surface of CTM with the capacity of 200 kN without the eccentricity and a uniform rate on loading is 140 kg/cm² per minute was applied until the failure of the cube. The maximum load was noted and the compressive strength was calculated. The compression strength in N/mm²=P/A. The tests were performed at a curing age of 7, 14 and 28 days. Total 36 cubes, with three specimens for four different batches were made for testing at each selected age.

V. Result and Discussions

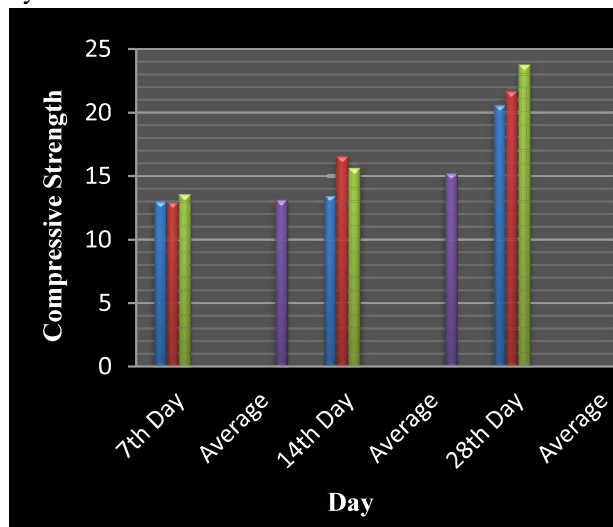
A. Compressive test results

In the compressive strength test, three cubes constituted of one sample. Total 36 cubes were tested the compressive strength test is performed as described in section. The Table show the 7th, 14th and 28th day Compressive strength test results.

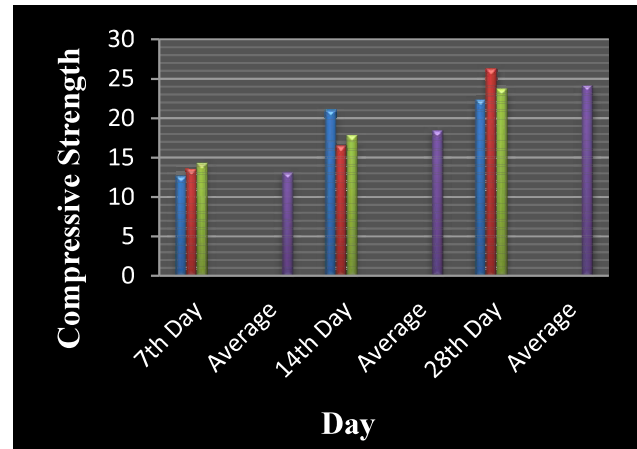
Table 2 Compressive strength Results

INDEX	7 th Day	14 th Day	28 th Day
Normal concrete	13.15	15.2	22
BCNW 10	13.52	18.42	24.12
BCNW 20	18.82	24.12	31.4
BCNW 30	18.36	25.8	32.44

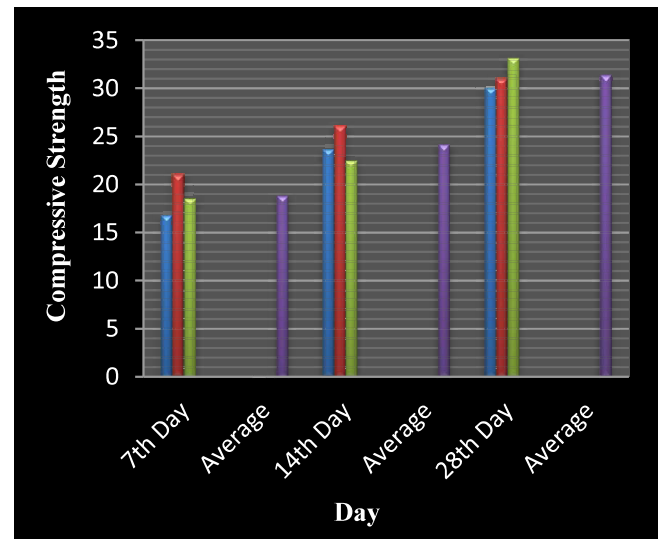
The following Graphs show the Compressive strength results for M20 concrete for 7th, 14th and 28th days



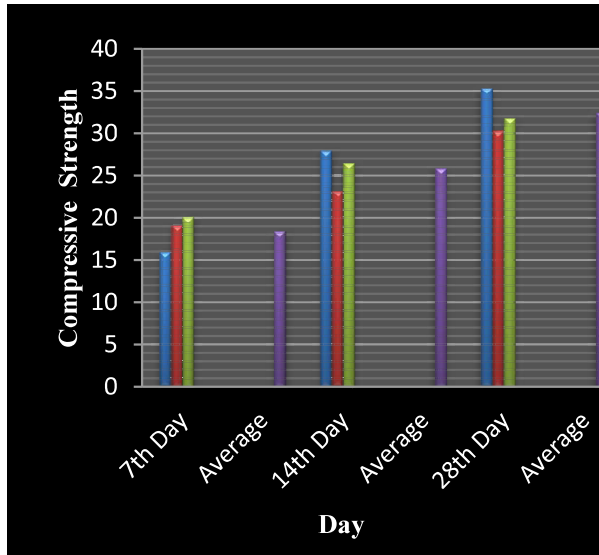
Graph 1-Compressive strength of M20 Normal concrete



Graph 2.Compressive strength of BCNW 10ML

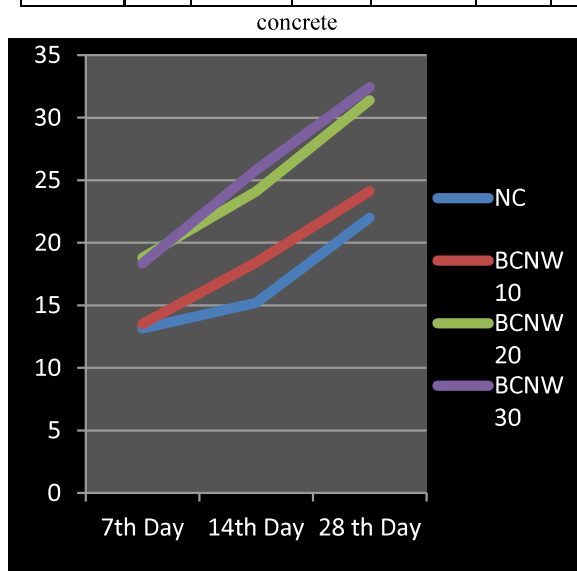


Graph 3.Compressive strength of BCNW 20ML



Graph 4.Compressive strength of M20 BCNW 30 ML
Table 2Comparison of compressive strength in % normal

INDEX	7 th Day	% Increase	14 th Day	% Increase	28 th Day	% Increase
Normal Concrete	13.15	-	15.2	-	22	-
BCNW 10	13.52	2.81%	18.42	21.1%	24.12	9.6%
BCNW 20	18.82	43.1%	24.12	58.6%	31.4	42.4%
BCNW 30	18.36	39.6%	25.8	69.7%	32.44	47.4%



Graph 5.Comparison of compressive strength in % normal concrete

VI Conclusion

1. The importance of work is to introduce the *Bacillus sphaericus* bacteria to understand the change in hardened properties of concrete.
2. The bacteria to be proved efficient in enhancing the properties of the concrete strength increase thus we can conclude the produced calcium carbonate has filled so percentage of void volume thereby making the texture compact and resistive to seepage.
3. The addition of bacteria with tap water is added in the concrete in proportion 10 ml/litre, 20 ml/litre. The result obtained at 7, 14, 28 days the compressive strength increased in the range of 9% to 48% when compared to normal concrete.
4. The Mix with Bacterial concentration of 30 ml/liter attained maximum increase in strength.
5. Bacterial concrete it may become yet another alternative method to replace OPC and hazardous effect on environment pollution.

ACKNOWLEDGMENT

We wish to express our immeasurable appreciation and deepest gratitude for the help and support by our project guide Prof. Rahul patil in making this study possible. We are also grateful to all our faculty and staff members of department of civil engineering and our collage for their assistance in the completion of this work.

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Utilization of waste material in civil construction (May 2020)

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ABSTRACT There is a growing awareness in India about extensive damage being caused to the environment due to accumulation of waste materials from industrial plants, power houses, colliery pits and demolition sites and it has become of the major environmental, economic and social issues. Waste material is the material unused, unwanted and rejected as worthless into the environment in our society as whole. Waste materials coming out of industry now a days is posing a great environmental problem in disposing them into the air, water and the land. But, with proper utilization of these materials in construction industry as well as in making road pavements will greatly help the society to have a better and pleasant environment. Substitutions of waste material will conserve dwindling resources and will avoid the environmental and ecological damages caused by quarrying and exploitation of the raw materials for making cement. These waste material can partly be used, or processed, to produce materials suitable as aggregates or fillers in concrete. Use of waste products is not only a partial solution to environmental & ecological problems and it significantly improves the micro structure and consequently the properties of concrete. The output of these waste materials in India are more than double the production of cement and other

construction material used in all the civil engineering activities. So, use of waste materials not only to make the cement concrete (generally used in all the construction activities) less expensive, but to provide a blend of tailored properties of waste materials and Portland cements suitable for specified purpose. These paper outlines regarding the optimum utilization use of waste materials in some construction activities as a green concept, which ultimately reduces the environmental pollution.

INDEX TERMSwaste material, construction, environment, concrete

INTRODUCTION

The Waste materials that are commonly known are blast furnace slag, fly-ash, silica fume (from power plants) recycled aggregates (from demolition sites), solid waste, plastic waste (domestic waste) and rubber waste (commercial waste). Partial replacement of Portland cement with waste materials like blast furnace slag, fly ash, silica fume (from power plants), recycled aggregates (from demolitions site) solid waste, plastic waste (domestic waste) and rubber waste (commercial waste) will be a great help in reducing environmental pollution and also in reduction in manufacturing of cement and other material that required for the construction

activities. One of the major challenges of our present society in the protection of environment. Any construction requires several material such as concrete, steel, brick, stone, glass, clay, mud, wood and so on. However, the cement concrete remains the main construction material used. In construction industries for its suitability and adaptability with respect to the changing environment, the concrete must be such that

it can conserve resources, protect the environment, economize and lead to proper utilization of energy. To achieve this, major emphasis must be laid on the use of waste and byproducts in cement and concrete used for new construction. The utilization of recycled aggregates is particularly very promising as 75% of concrete is made of aggregates. The enormous quantities of demolished concrete are available at various construction site, which are now posing a serious problem of disposal in urban areas. This can easily be recycled as aggregate and used in concrete. As the problem of disposing these waste materials became a big environmental problem, the proper utilization of these big materials again in construction activities will be a great relief to the society. Some of the important elements in this respect are the reduction of the composition of energy and natural raw materials, systematic composition and use of waste materials to a great extent. Research and development activities have been taken up even in India for proving its feasibility, and economic viability and cost effectiveness for the use of waste materials in all the construction activities.

POINTS TO BE CONSIDERED WHILE UTILIZING WASTE MATERIAL IN CONSTRUCTION:-

1. Build It Back Into the New Building

The smartest way to recycle construction waste is to integrate it back into the new building or the new building site. Some of this may happen naturally. In remodeling projects, walls are not necessarily demolished. They may simply be redecorated, moved, or reconfigured. Lumber cut-offs in woodframed constructions may be useful for fire blocking or as spacers.

2. Build to Standard Dimensions

Building projects may offer the chance to use building materials supplied in standard measurements. The less you have to adapt or cut, the less wastage you will incur – not to mention the time and effort saved. Framing layouts can be planned to use standard wood lengths, for instance. Standard dimensions also make it easier to reuse any materials you have left over.

3. Locate Your Local Recycling Center

The key word here is local. If it takes too much time, effort, and gas to transport construction waste for recycling, look for another solution (like avoiding waste instead). If the recycling center is close enough, find out what they take and when they open. Then add necessary trips to your overall construction schedule and planning to minimize overall impact. Take waste to the recycling center on the way out when you go to fetch new building materials, for instance.

4. Practice Deconstruction Instead of Demolition

Organizations exist in some areas to remove reusable items without damage for reuse in social housing projects. There may also be tax advantages to the customer who is paying for the overall project. If this is not possible, an alternative is a front yard sale of such items during the construction project. Radiators, grates, piping, appliances, and fittings in sufficiently good condition can all qualify.

5. Calculate the Savings

In case you had any doubts about it, recycling construction waste is not only a way of helping the planet, but also an opportunity for higher profitability, better prices to customers, or both. In buying fewer new materials, recycling waste without having to transport it, or reselling it where it has market value, there are positive economic as well as environmental consequences. Good construction accounting tools will help you to manage the savings to be made through recycling.

3 TYPES OF WASTE MATERIAL CAN BE REUSED IN CONSTRUCTION:-

Asphalt Paving

- Land Clearing Residuals
- Wood
- Sanitary ware

- Buildings
- Metals
- Concrete
- Brick

• Asphalt Paving:-

Due to heavy traffic loads and environmental conditions that are not considered in the design of asphalt pavements, more and more asphalt pavements are failing prematurely, as a result overlaying or replacing failing pavements become a necessity. Overlaying a pavement is a simple process, where a new asphalt layer is added, the problem with overlaying is the nature of the asphalt mix materials, which will take the form of the lower layer and most distress will be reflected on it after opening road for traffic. The best solution is to mill the surface of the old pavement to remove the affected part of the pavement, then the question is what to do with the removed materials, either dump it in landfill or reuse it as construction materials, hence the use of reclaimed asphalt pavement (RAP) came into the picture with a promise of many economic and environmental benefits. Currently, almost all RAP is recycled back into pavements, for example it is estimated that a 30,000 ton pile of RAP with an average 6% liquid asphalt binder content is the equivalent of about 28,200 tons of clean aggregate plus 10,000 Barrels of liquid asphalt, which could replace virgin materials. The most recycled materials in the is asphalt pavement materials. Over 80% of asphalt pavement materials milled from roadways is reused. It can be mixed into new pavement or used as a sub-base or fill material.

• Land Clearing Residuals:-

Mulch is any material that is spread or laid over the surface of the soil as a covering. It is used to retain moisture in the soil, suppress weeds, keep the soil cool, and make the garden bed look more attractive. Organic mulches also help improve the soil's fertility, as they decompose. Organic mulch will decompose and have to be replaced, but in the process, it will also improve your soil's fertility and its organic content. The dryer and woodier the mulch, the slower it will decompose and the fewer nutrients it will give to the soil.

It pays to know the origin of manure, compost, and straw since these materials can contain viable weed seeds. The last thing you want is to spread a mulch that is going to start sprouting and make more work for you. Each type of organic mulch has its own use.

• Wood:-

Wood cement composites (WCC) are a new opportunity for recycling post-consumer wood and chemically treated wood fiber in the manufacture of building and sound absorbing products. The technology is employed throughout the world to produce stay-in-place insulated wall forms, structural panels, acoustical treatments, and highway sound

barriers. However there is no evidence that WCC technology has been applied to C&D wood waste. Our study examines the use of "mulched" wood fiber prepared by harmer mills typically found in C&D recycling systems. We are demonstrating that sufficient strength and durability can be achieved to satisfy established building codes and standards.

.Sanitary ware:-

Ceramic wastes are classified as non-recyclable wastes in South Africa, except for the normal use as filling material. Based on research regarding recyclable Construction and Demolition (C&D) wastes, ceramic wastes have the potential to be used in concrete production. However, there are no guidelines and standards to the usage of these wastes in concrete. In addition, the local construction industry does not have knowledge and experience to utilize the material.

• Metals:-

Recycled steel metal scraps can be made into higher quality tools through a process using an electric arc furnace. Stainless steel can also be made in this way. Copper scrap is made into products using some of the same processes as steel, which also include blast and reverberator furnace processes. Aluminum scrap metal can also be melted at a much lower temperature than virgin aluminum, so the process consumes much less energy. This is generally true of all recycled metals, which not only saves on energy but Co2 emissions as well. This protects our environment, as well as providing an economic savings in the manufacturing process, which is then hopefully passed on to the consumer.

• Concrete:-

In the process of urban development, with the reconstruction of old city, a lot of waste concrete will be generated. At the same time, civil engineering construction, earthquakes and wars also can generate a large number of waste concrete. The existence of waste concrete will directly pollute environment and occupy the land resources. The recycling utilization of waste concrete is benefit to environmental protection and saving resources, and is also benefit to realize the sustainable development of building materials. Waste concrete research situations in and abroad were introduced. The crushing and regeneration technology of waste concrete were studied. The material properties of recycled concrete were analyzed and some advices about development of recycled concrete were presented. By screening the waste concrete to particular sizes it can be used as a replacement for aggregates.

4.BENEFITS:-

• You effectively save the need to procure and consume natural raw materials • You in turn save energy, decreasing harmful emissions, and reducing space needed for landfills. • You reduce the cost of

construction, extending your budget, meaning you spend it on other living requirements. • Creates employment opportunities and economic activities in recycling industries. • It becomes economical for new building works.

5. CONCLUSION:-

• It has been established that materials & components from demolished buildings are being reused for new construction works as well as renovation projects, especially by low- income communities in developing countries. • As sorting and recycling facilities become more wide spread and better developed it will be easier to redirect our waste from landfill. • In order to reduce the construction waste, during the time of construction order only the correct amount of raw materials.

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Smart Construction Material

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ABSTRACT Asbestos cement sheets and galvanized iron sheets in corrugated forms are being extensively used for roofing in housing, industrial sheds, godowns and other structures. Asbestos cement sheets fail under impact load. The material 'asbestos' used for the manufacturing of sheets is a hazardous to human health. It causes diseases like asbestosis and lung cancer to the people working for the manufacturing of the sheets. Due to this reason it has been banned in many countries such as USA, Russia, France, Canada, etc. In India also asbestos sheets are banned but due to economy most of our citizens prefer it taking risk of health so, we thought of given our people a better alternative within their limits.

INDEX TERMS :

Introduction

1. PROPERTIES OF NYLON ROPES-

1. Know your Nylon rope requirements-

The correct size is important. Using undersized rope causes undue strain on the rope. Proper selection of the right rope size is the greatest factor in getting full use and long life from your rope. In addition to size, other factors such as type of lay and special fiber treatment will determine the selection of rope. Most industries making regular use of rope have selected certain types as best suited to perform specific jobs. In some cases, special purpose ropes have been developed to meet particular needs. Generally, the proper size and type of rope can be specified from your past experience and the recommendations of your supplier.

2. Rope construction-

Manufacture can make 3- Strand, 4- Strand, or 8- Strand Plaited Ropes as per requirements.

3-Strand ropes are preferred on most applications because of its flexibility, knot ability, and easy in handling. They come in an easy to splice medium lay; however can be ordered to conform to specific lay requirements either softer or harder. 4-Strand ropes have a slightly firmer lay and provide a rounder rope with more outside surface and more traction on sheaves and objects to be turned or gripped. It is available in various core constructions depending on the rope's application. 4-Strand Manila ropes is approximately 7% heavier than 3- Strand and has a breaking strength approximately 5% less. 8-Strand plaited ropes have four left-hand laid strands and four right-hand laid strands, paired off parallel and woven together. Used mostly for marine applications, its neutral (or balanced) construction provides excellent hock ling resistance. It is available in 5" to 15" circumference (or 1-5/8" to 5" diameter). 3.

3. Treatment-

All Natural Fiber Ropes are lubricated with a water repellent treatment that resists moisture, mildew, and rot. The lubrication also guards against internal chaffing and wear. Upon request, ropes may be treated with Copper Quinolinolate, Copper Napthanate, Tar, Graphite impregnated, or Tallow treated. These treatments are generally for the added protection of fibers against rot and mildew.

4. Proper use of net-

New rope should be thoroughly inspected throughout its entire length before it is placed in service to determine that no part of it is damaged or defective. After it is placed in service, rope should be inspected at least every thirty days under ordinary circumstances; more often if it is used to support scaffolding or other supports upon which men work. If it is exposed to acids or caustics, it should be inspected daily. Inspection should include examination of the entire length of rope for wear, abrasion, broken or cut fibers, displacement of yarns or strands, discoloration or rotting. To inspect the inner fibers, the rope should be untwisted in several places to make sure the inside yarns are bright, clear and unspotted. The specification tables show breaking strengths and safe working loads. Rope loaded to over 75% of its breaking strength will be permanently injured. Damage from this cause may be detected by examining the inside threads which will be broken to an extent governed by the amount of the overload. Such damage may also be determined by the reduced diameter of the weakened section of the rope. Care should be taken to prevent kinking a rope. Even a moderate strain may over-stress the fibers at the point of the bend, producing a serious defect and one that may be difficult to locate.

5. Rope care and safety-

Good rope care - better rope service or the service that should be expected from good rope and for the safety of men and materials, rope should be handled and used with care. By following these points in rope selection,

handling and storage, it will remain dependable and safe over long periods. Keep rope clean. Dragging rope on the ground or over rough, gritty surfaces allows abrasive particles to work into the rope and weaken the fibers. If rope becomes muddy or dirty, it should be washed and dried thoroughly before storing.

6. Kinks cause rope failure

Prevent kinks which cause permanent damage and weakening of the rope. If kinks should form, or if rope is continually twisted in one direction, as over a winch, remove kinks or restore balance in the rope by throwing in twist in opposite direction.

2. CONSTRUCTION PROCEDURE FOR MANUFACTURING OF NYLON CEMENT SHEET –

1. Proportioning of material Initially we decided the material to be used for casting of sheet, and accordingly we decided the proportion. The sand cement mortar ratio was decided as 1:2 and water cement ratio was also decided as 0.35. Then the size of Nylon was decided according to member size. The nylon of cut size was weighted by weighing equipment; it was 110 gm for 1.5 sq.m.

2. Preparation of formwork-

For casting corrugated sheet we used Asbestos cement fully corrugated sheet as formwork from both the sides. The water was sprinkled on asbestos sheet to prevent the water absorption from the sheet. The polythene paper was laid on the asbestos sheet for easy removal of casted sheet and also for providing good finishing.

3. Mixing of material

All the material which was thoroughly weighed batched was transported by us to mixing area. Sand and cement was dry mixed thoroughly. Then the water was added slowly while mixing the mortar. Mortar mixed with help of shovel.

4. Placing of mortar

Firstly we placed Nylon net of 0.75mm dia. on Asbestos sheet, net was placed very loosely on to the sheet so to prevent tensioning of net after placing of concrete. Then we placed the mortar on corrugated sheet with uniform thickness of 8mm. Care was taken that the net under the mortar doesn't come out.

5. Vibration of sheet

The sheet was kept on table vibrator the polythene paper was laid on mortar and then another sheet was laid on it. Then the vibration started and continued for 1min. Then the sheet at top was removed and thickness was measured with the help of gauge marker and finishing was also checked. The thickness was nearly 8mm. Again the sheet was laid and vibration was continued for 2min. Again the sheet was removed and thickness was checked it was 8mm and was ok.

6. Finishing of casted sheet

By using table vibrator and polythene paper the smooth finish was obtained on the surface, but the voids were seen at some part of sheet so we finished the voids with the help of trowel. The sheet was cut in size when the mortar was green with the help of trowel.

7. Curing of sheet

We carried out Curing of sheet after 24 hours of casting the sheet. Spreading gunny bags on the sheets. By these the curing was done with less water and soil remained moist for long time.

3. SOME COMMON MISTAKE TESTS CARRIED ON NYLON REINFORCED SHEETS:

The (Reference code-is 5913:1970)

1. Visual inspection test
2. Water absorption test
3. Test for impermeability
4. Acid resistance test
5. Load bearing capacity test

Visual inspection test: p

The sheets casted are inspected visually to check the following

1. Uniformity of texture:- The texture on the both side of the formwork was uniform.

2. Neatness and straightness of the trimmed edges:-

The trimmed edges were uniform and straight after some cutting in the fresh condition

3. Squareness of the corners:-

The corners were square by cutting sheet in green condition.

4. Rectangularity:- The rectangular shape was maintained.

Water absorption test : Specimen:- From each of the sheets casted in accordance with the sampling, a specimen of 175mm x 175mm was taken. Procedure:-

The specimens were completely immersed in water at 1520°C for a period of 18 hours. These were taken out and weighed after removing surplus moisture with a damp cloth (M1). The specimen shall then be placed in an air oven capable of being set to 150°C, and then maintained at that temperature constantly. The heating was commenced with ventilator wide open, raising the temperature from about 105-150°C to the specimens to constant mass. The test pieces shall then be cooled for at least one hour in a desiccators containing anhydrous calcium chloride and weighed (M2).

Results:- The absorption was calculated as follows:-

$$\text{Absorption \%} = \frac{M1 - M2}{M2} \times 100$$

Where, M1 = mass in grams of specimen after absorption. M2 = mass in grams of specimen heating.

Test for impermeability : Specimen:- A piece of nylon sheet 100mmx100mm was cut.

Procedure:-

A transparent metallic tube 35+5mm diameter & 300mm long was sealed to the test piece and held vertically. The test piece was supported on a suitable arrangement, which provides the bottom surface to be inspected. The sealing of the tube was done for corrugated sheet at the center of the valley and for semi-corrugated sheets in the flat portion between corrugations. The tubes may be suitable shaped at the bottom for these purpose, as necessary, The tube was filled up with water carefully to about 250mm height, if necessary by providing overflow liner to maintained the required constant height, and it was ensured that water does not leak through the sealing. Arrangement was provided in the test equipment to evacuate entrapped air.

The test was conducted at 15 to 35 degree centigrade and at a relative humidity of 45 to 75 percent.

4 Acid resistance test:

Specimen:-

Take a piece of 65mm x 65mm measured along the center of the curved section.

Procedure:-

Each specimen was placed upright for 24 hours in 270ml of 5% acetic acid solution at 15 to 35 degree centigrade contained in a vessel of such a size that the specimen is entirely immersed. Separate vessels and solutions were used for each specimen. The concentration of the acetic acid was determined before & after immersion of the specimen by titration against a solution of sodium hydroxide of known concentration (app. 0.5N), using thymol blue as indicator. For titration, 10ml of the acid solution (0.040g in 100ml 95% alcohol) added to it.

The end-point to be taken is that of the color change from yellow to blue corresponding to pH value 8.0 to 9.5; the small amount of gelatinous precipitate formed does not interfere.

Result:-

The result was reported in terms of grams of acetic acid per square meter of area of the specimen & this value was calculated from the fall in concentration, assuming that 1ml of 0.5N sodium hydroxide solution hydroxide solution is equivalent to 0.030g of acetic acid as follows:

Mass in g of acetic acid used per m² = $\frac{0.030 \times 370 (x-y)}{10A}$

$$= \frac{1.11(x-y)}{A}$$

A

Where,

X = volume in ml of 0.5N sodium hydroxide use at the initial titration,

Y = volume in ml of 0.5N sodium hydroxide used at the final titration, and

A = area in m² of unprotected nylon cement sheet.

Load bearing capacity test:

Specimen:-

The specimen for the test shall consist of full sheets or 1.25m long cut from full sheet and was selected in accordance with the method of sampling given in the relevant specification.

Procedure:-

Immediately prior to test, the specimen was completely immersed in water at 15 to 35 degree centigrade for a period of 24 hours. Each specimen was freely and evenly supported with its smooth side up on parallel rigid hardwood, cast iron or steel bearers 50mm wide and of a length at least as great as the width of the specimen, and set at right angles to the corrugations. The bearers were placed 1m from center to center.

The sheet was loaded at the mid span by means of selfaligning rigid flat beam 230 + 5mm wide, parallel to the supports. Strips of felt or soft fiber about 10mm thick were interposed between the test piece and the supports and under the beam by which the load is applied. The load was applied at a rate not greater than 2000N/min.

4. ADVANTAGES OF N.R.C. SHEETS

1. Nylon cement sheet is economical than other roofing
2. Substitutes.
3. It is non hazardous for human health as well as for environment.
4. Material available in local market can be used for manufacturing of sheet.
5. Skilled labours are not required for manufacture of sheet.
6. it gives better strength.
7. No heavy machinery is required forcastingsheet.
8. When it obsolete it can be recycled.
9. It creates employment opportunity.

CONCLUSION-

The use of nylon nets in combination with cement mortar is a feasible concept. It was an attempt to replace the conventional asbestos cement sheets. Nylon Cement Sheets can be locally manufactured on sites and can used for low cost housing, small cattle shades, industrial shades, godowns, storage houses etc. where Load Bearing Capacity of roofing isn't the significant factor. The cost of Nylon Sheet is Rs.146/- for 1m² and that of the A.C.Sheet is Rs.175/- for 1m² in market.

Nylon Cement Sheet can replace A.C. Sheets where loading isn't the prime factor over economy. 2) Nylon Cement Sheets can be locally manufactured on sites and can use for low cost housing, small cattle shades, industrial shades, godowns, storage houses etc. 3) Recommended spacing of the purlins for placing the sheets is up to 1.4m.

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ECONOMICAL AND ECO- FEASIBLE METHOD OF SLAB CURING USING CURING PAD

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Abstract: Efficient uninterrupted curing is a key to quality concrete. Proper curing of concrete is crucial to obtain design strength and maximum durability considering the cost of curing. Curing is designed primarily to keep the concrete moist, by preventing the loss of moisture from the concrete during the period in which it gains strength. Due to rising problems of scarcity of water and expensive conventional methods of curing, it had become necessary to build-up a new method for concrete curing. This paper represents the experimental work related to a newly developed, effective and economical method of slab curing. This method consists of a technology namely 'Curing Pad' that not only absorbs and retains water for an extended period of time but also reduces evaporation losses. Concrete pad consists of 3 layers. The top layer is of a reflector material that reduces evaporation losses. The middle layer comprises of an absorbent material that stores and transmits water to the concrete slab. Bottom layer is binding or packing layer that holds all three layers together. Various tests are performed to check the durability of Curing Pad as well as its performance on concrete slab. These test results are compared to those of ponding method of slab curing.

Keywords: strength, scarcity of water.

1. INTRODUCTION

Cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Raw materials used in cement are heated to a temperature up to 1450 °C and then cooled. This heat gets stored in the cement and on the addition of water it reacts with the water forming an exothermic reaction which evolves heat.

Heat of hydration induces thermal gradient due to higher rate of loss of heat from outer surface than from inner core. This thermal gradient causes cracking in concrete due to non-uniform expansion of concrete within the body.

Curing is the process of controlling the rate and extent of moisture loss from concrete during cement hydration. It may be either after it has been placed in position (or during the manufacture of concrete products), thereby providing time for the hydration of the cement to occur. Since the hydration of cement does take time – days, and even weeks rather than hours – curing must be undertaken for a reasonable period of time if the concrete is to achieve its potential strength and durability. Curing may also encompass the control of temperature since this affects the rate at which cement hydrates. The curing period may depend on the properties required of the concrete, the purpose for which it is to be used, and the ambient conditions, i.e. the temperature and relative humidity of the surrounding atmosphere. Curing is designed primarily to keep the concrete moist, by preventing the loss of moisture from the concrete during the period in which it is gaining

strength. Curing may be applied in a number of ways and the most appropriate means of curing may be dictated by the site or the construction method.

2. RESEARCH METHODOLOGY

Various construction sites were visited to inspect the traditional way of curing used for column and slabs. We found that gunny bags and ponding method used for column and slabs respectively. This type of curing method which is used since last years. Data was collected pertaining to available methodologies and applications of ponding method for curing of slab.

The collected data were used for separation of traditional and new method of curing. On the basis of data we have decided to make curing pad of three layers.

Based on collected data analysis was made to find out the most suitable materials for: -

- Upper Layer: - To prevent evaporation losses
- Middle Layer: - Material having capacity to absorb and hold water
- Bottom Layer: - Durable material to transmit water from middle layer to concrete slab below.

This three layers in one pad which will help to keep the surface moist for long time.

3. ANALYSIS

1. Compressive strength test for m20 cubes in which 18 blocks were casted to check against 3, 7, 28days. 9 blocks Immersed in curing tank and others cured by using curing pads.

Test results are in following table:

Table 1.Strength Results

Readings	3 Days (mpa)	7 Days (mpa)	28 Days (mpa)
Type – I Pad	9.5	12.24	23.22
Type – II Pad	11.45	17.45	24.35
Immersed in Water	13.72	18.45	26.40

2. Workability of curing pad to check against wear and tear of pads when come in contact with rough surface of slab.

3. This pads are cost effective method of curing .it requires 5 rupees cost per sq.ft.

4. Curing pad absorb the water 3 liters (size 2x3 ft.) and holds the water up to 7 days for normal surface. For freshly cured slab, pad holds the water 1 day and surface keeps wet. For fresh slab first 7 days we need to sprinkled water daily after that alternately curing can be done.

Test results of absorption of water:

Table 2. Water absorption results

Readings (gm)	Type – I Pad	Type – II Pad
Dry Weight	1090	960
Weight after adding water	4820	4760
Weight after 1 Day	3760	3650
Weight after 3 Days	2830	2610
Weight after 7 Days	1120	990

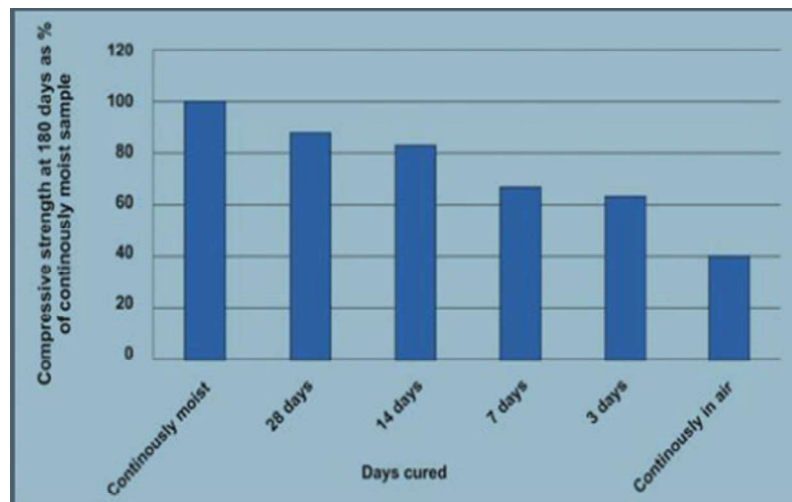


Figure 1. Graphical strength

4. CONCLUSION

Based on the research results presented, the following conclusions were drawn:

1. The concrete cubes cured in water tank and those cured by curing pads showed similarity in their relative compressive strength development.
2. The use of the following curing methods:

Immersion in lime water; covering with curing pads; and immersion in water, should be limited to the 28-day curing period.

3. Strength of concrete by using curing pads is more than the conventional ponding method.

4. It is a one type investment that is only buying cost of pads which is useful for different floors.

5. Curing pads helps to reduce amount of water for curing.

6. It is effective, environmental friendly and economical method of curing of slab.

ACKNOWLEDGMENT

It gives us an immense pleasure in submitting our research paper on **“Economical and eco- feasible method of slab curing using curing pad”**. We take this opportunity to show panegyrics and thanks to our guide **Prof. A. B. Kudoli** and Coordinator **Prof. S. Pitke** whose suggestions helps us a lot throughout the duration of our efforts on research. We are also indebted to **Dr. S. S. Sawarkar**, Head of the Department who was constant source of inspiration to us during completion of this research work.

We would like to extend my special thanks to the **Principal, Dr. H. U. Tiwari** for his assistance and providing helpful suggestion.

We are thankful to all teaching and non-teaching staff members of Civil Engineering Department for their help and co-operation during the course of this work.

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A System for Recycling of Water in Drinking Water Units

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Abstract: Water covers 70% of our planet, but not total 70% of water is get utilized as only 3% of the world's water is fresh water, out of which two-thirds of that is tucked away in frozen glaciers or otherwise unavailable for our use which in short means only 1% of total world's water is available for use which is far lesser than 70% of total water. It has been observed from past, lot of amount of pure water is wasted just due to human psychology for cleaning of glass and also by throwing previous left water in the water bottle. In our current invention, this malpractices is totally get avoided and the arrangement of the system is made in such a way that purified water can be only and only utilized for the drinking purpose and not a single drop of water is wasted as mention in above purposes.

Keywords: recycle, saving, reuse of water.

1. INTRODUCTION

At public places drinking water utensils are available and mostly these units are used with water purifiers of a specific type depending upon the quality of water available. The purifiers are selected as per availability of water as well as on the desired quality of water for drinking.

It is observed that in drinking water unit a huge amount of purified and chilled water is going to drainage as waste. The cost involved to purify the water as well as for cooling the water is considerable. Water conservation is an important issue.

It has been observed from past, lot of amount of pure water is wasted just due to human psychology also for cleaning of glass as people normally wash pot before using it. When people consume water the glass or pot touches mouth and or lips. So every time or mostly people wash the pot or glass before using it. Also in case of filling of water bottles people throw previous left water in the water bottle due to tendency. According to the survey, around 15 to 25% of pure water is wasted from purification unit. In our current subject matter, this practices is totally get avoided and the arrangement of the system is made in such a way that purified water can be only and only utilized for the drinking purpose and not a single drop of water is wasted as mention in above purposes.

2. RESEARCH METHODOLOGY

According to this paper, the purified waste water generated gets easily and effectively recycled for drinking purpose by not wasting water. The present paper relates reuse of the purified waste water generated due to unwanted cleaning of glass and the remaining water thrown away after drinking due to human tendency of not taking the partaken water of someone else. The available system has been critically reviewed. By considering the limitations of general system, the water which is purified gets directly wasted in the sewer pipe which will make this purified water polluted. The present system considers this point and makes the use of this purified water by not allowing it to get drained which is shown in figure.

Outlet water tank is located just below the cooler connected by outlet pipe which is shown in figure . Outlet water tank consist of two sensors along with one submerged electric motor connected to it. The two sensors of which one is located in the upper layer of the water tank and another one is located in the bottom layer of the tank. Sensors will command the motor to get started and will also turn off the motor and the motor will help to pump the water in overhead water tank. With the help of connecting pipe the water coming from outlet water tank will directly get transferred to overhead water tank.

Overhead tank located above the Purification Unit as shown in figure has two inlet pipe one coming from outlet water tank and another one coming from main water supply pipe. The water supply pipe is located at such a position so that it should maintain some vacant space above the pipe in such a way that it will occupy the water coming from the outlet tank. The Float is fitted to this inlet pipe which functions in such a way that whenever the float will go down automatically the water supply will get started and as soon as the float comes exactly at horizontal level the water supply will stop which will maintain the above portion free.

The overhead water tank is then connected to pre sediment filter tank and the ahead to the Water Purification Unit, then it will purify the water coming from overhead water tank which will then supply the water to the cooler or pure water storage unit to complete the water cycle. Special shape of glass is provided with this system, which will automatically avoid the direct contact of lips to the glass which is shown in figure.

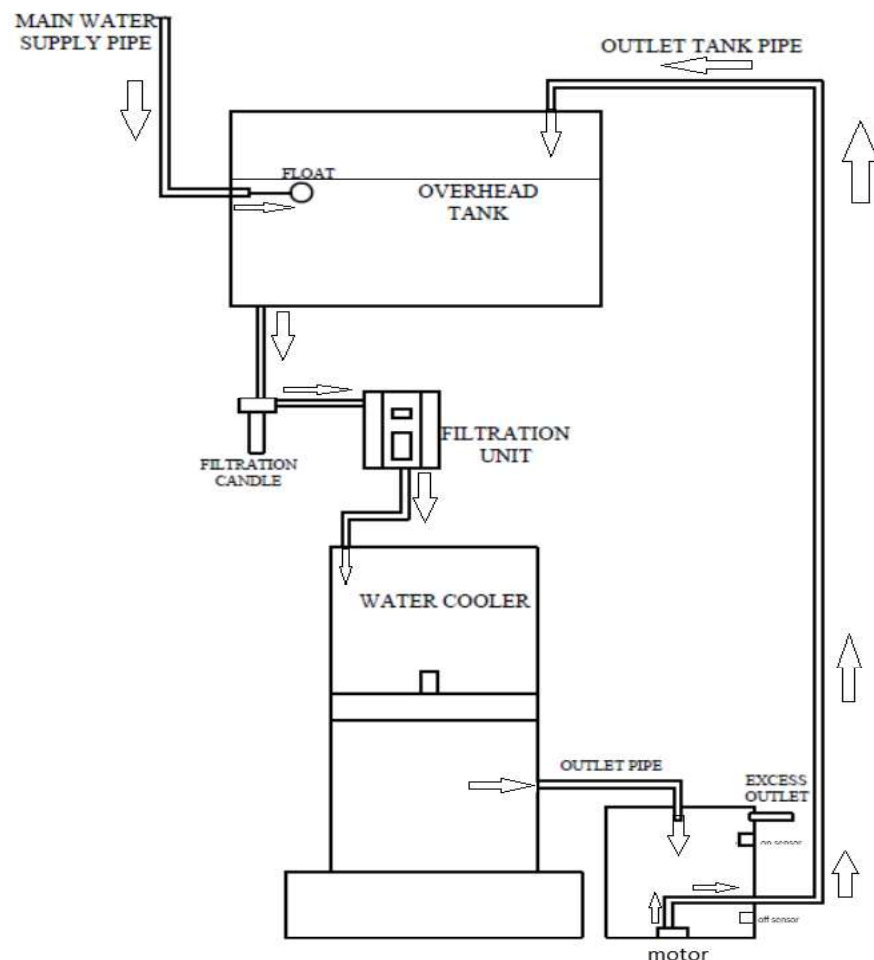


Fig. Complete Schematic Diagram

3. CONCLUSION

This study helps us to understand the need and benefits of the water in our society. By taking into consideration of the above research paper, we conclude that the system can save tremendous amount of water which is just wasted by throwing it into basin without making no use. The system is not only economical but can also be fitted perfectly in any small area. This system can be implemented in any public areas where cleanliness is maintained example college, schools, hospitals, etc and also it is environmental friendly system.

ACKNOWLEDGMENT

It gives us an immense pleasure in submitting our research paper on “**A System for Recycling of Water in Drinking Water Units**”. We take this opportunity to show panegyrics and thanks to our guide **Prof. A. B. Kudoli** and Coordinator **Prof. S. Pitke** whose suggestions helps us a lot throughout the duration of our efforts on research. We are also indebted to **Dr. S. S. Bobade**, Head of the Department who was constant source of inspiration to us during completion of this research work.

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An Experimental Investigation on Partial Replacement of Concrete Ingredient by Marble Waste & Industrial Waste Water

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Abstract: *The aim of this study is to assess the possibility of utilizing marble waste and industrial waste water as a partial Replacement of Concrete. Marble industry produces a large amount of waste during mining and its processing stage. It has been studied that around 70% of marble waste is produced during marble cutting, which creates a lot of environmental problems when dumped on open land. Our main objective of this study is to effective utilization of marble waste (marble powder and marble as a fine aggregate) by replacement of concrete ingredients (cement and fine aggregate). We also worked on the effect on strength when industrial waste water is mixed into concrete. In this work we have compared strength achieved by the Concrete blocks by addition of waste marble in various proportions. We studied the compressive strength and the behaviour of concrete block under stress. The obtained results of this study indicate that replacing marble waste & industrial waste water found cost reduction in concrete making and compressive strength is also as per IS requirements.*

Keywords: Marble waste Replacement, Concrete, Industrial waste water

1. INTRODUCTION

There are more than 50 different types of minerals and rocks in India and most of it comes from Rajasthan. The state has large deposits of natural rocks which include granite, marbles, sandstone, limestone, slate, quartzite, etc. However it is seen that the process of marble quarrying and its processing generates a large amount of waste in the form of marble powder or as fines. These wastes are then dumped in the open land which creates a lot of environmental as well as health problems. This project contains an experimental investigation of suitability of effective utilization of marble waste by replacing partially with concrete ingredients as well as utilization of industrial waste water into the concrete.

With the ever increasing popularity of the marbles of Rajasthan, growing demand for finished and unfinished products, discovery of new marble deposits and growing private and public supports have led to a significant growth in Marble Industry of this State. As a result, number of marble quarries as well as marble processing units has significantly gone up mainly during last one decade. However, whereas there is significant growth in production of finished and unfinished marble products, there is also simultaneous rise in waste generation as well; thereby causing concern towards the deteriorating environmental quality. A wide spread need is being felt to make this industry environmentally sustainable.

Previously, studies were carried out in the context of utilization of the marble waste in concrete. In the paper 'Behaviour of Concrete Using Marble Waste as Coarse Aggregate' by Sudarshan D. Kore and Ashok Vyas concluded that the workability, compressive strength and permeability increased with increase in substitution of marble aggregate by replacing natural

course aggregate by marble aggregate in different percentages by weight of the concrete. In the paper ‘Impact of marble waste as coarse aggregate on properties of lean cement concrete’ they concluded that The workability of all the concrete mix increases with increased percentage of replacement of natural coarse aggregate by marble aggregates. Compressive strength of the concrete shows upward trend till 80% marble used as coarse aggregate in concrete. The permeability of the concrete increases with increase in percentage of replacement of natural coarse aggregate by marble aggregate this is mainly due to presence pores in the concrete.

In this project an investigation is carried out for effective utilization of waste marble powder and fines in the concrete and observes its behaviour in the compressive strength. The scope of the project includes cost optimization of concrete and also minimization of cement content used in concrete making. This investigation also checks the effect of using industrial waste water in concrete.

2. EXPERIMENTAL STUDY

2.1. MATERIALS

An experimental study was performed by prepare of M20 grade concrete mix using partial replacement of cement by marble powder and complete replacement of natural crushed sand by marble fines. The cement used is 43 Grade Portland Pozzolona Cement. The naturally available coursed aggregate with nominal size 20mm was used and crushed sand as fine aggregate.

Table 2.1 Physical Properties of Materials

Materials	Specific Gravity	Water Absorption	Grading
Course Aggregate	2.61	0.54	As per table 2 of IS 383
Crushed Sand	2.66	2.0	Zone 2 as per Table 4 of IS 383
Marble Fines	2.70	0.05	As per Table 2 of IS 383

Table 2.2. Difference between Marble Powder and Marble Fines

Description	Marble Powder	Marble Fines
Sieve Analysis	<90 micron sieve	< 75mm sieve
Picture		

2.2. METHODOLOGY

For this experiment, M20 grade concrete mix was prepared with water cement ratio 0.42 and cement content 403.5 Kg/m³. Five sets of mix design were prepared with the trail of using different substituents such as follows:

1. Cement + fine aggregate + course aggregate + water
2. [Cement(85%)+Marble Powder(15%)] + fine aggregate + course aggregate + water
3. Cement + Marble Fines + course aggregate + water
4. Cement + Fine Aggregate + Course aggregate + Industrial Waste Water
5. [Cement(85%)+marble powder(15%)] + Marble Fines + Course Aggregate + Industrial Waste Water

These concrete were prepared and casted in 150mm concrete mould to take compressive test. After 24 hours these moulds were De-moulded and set for curing in a water tank. The compressive tests were taken in 3days, 7days, 28 days respectively to check the results.

Table 2.2. Mix Proportion Table of M20 Grade Concrete

Mix	Cement (kg)	Marble Powder (kg)	Crushed Sand (kg)	Marble Fines (kg)	Course Aggregate (kg)
1	3.63	-	6.1	-	11.72
2	5.61	0.9	9	-	11.72
3	3.63	-	-	6.1	11.72
4	3.63	-	6.1	-	11.72
5	3.1	0.54	-	6.1	11.72

3. RESULTS & DISCUSSIONS

3.1. RESULTS

As per above procedure concrete testing done and observed result which is given in following table.

Table 3.1 Compressive Strength of Concrete

Sample	3 Days (Mpa)	7 Days (Mpa)	28 Days (Mpa)
Required Strength (Mpa) →	8	13	20
Mix 1	10.93	16.26	30.71
Mix 2	7.64	15.77	22.82

Mix 3	11.33	17.82	22.84
Mix 4	10.93	16.26	30.71
Mix 5	8.97	10.67	20.05

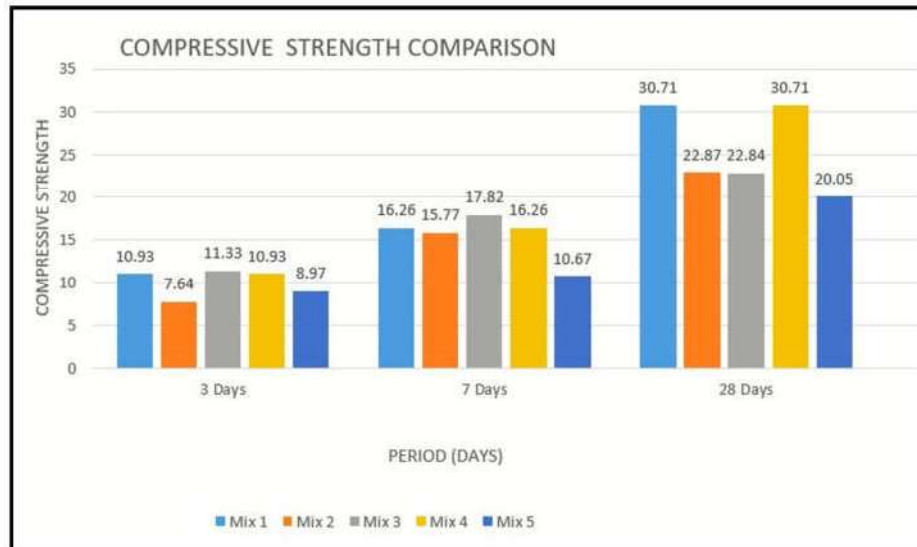


Figure 1. Comparison of Compressive Strength of all Mixes



Figure 2. Performance on Compression Test Machine

3.2. DISCUSSIONS

From the above results it is observed that by adding all the three ingredients (waste marble powder, marble fines and industrial waste water) at the fixed proportion, we were able to achieve positive compression test results and the this marble waste utilization become cost reduction in in concrete making.

ACKNOWLEDGMENTS

It gives us a delight for completing our final year civil engineering project ‘An Experimental Investigation on Partial Replacement of Concrete Ingredient by Marble Waste & Industrial Waste Water.’ This Project gave us an insight of the concrete behaviour with the various ingredients and utilization of industrial waste into concrete. This project would not have been possible without our teachers and guide Prof. Satish Pitake and Prof. Sandeep Wani. We would also like to thank our Head of Civil Department Dr. Sameer Sawarkar for their encourage words and support in completion of our project. Special thanks to the Principal of Pimpri Chinchwad College of Engineering and Research. Dr. Harish Tiwari for his valuable suggestions and feedbacks. Lastly we like to appreciate my group members who worked together as a team and their contribution for completion of this work.

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Accident Cause Model for Talawade, Pune, Maharashtra.

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Sawant⁴, Simran Shaikh⁵ and Akshada Kadam⁶

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

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

Date of Submission: 08-06-2019

Date of acceptance: 25-06-2019

I. Introduction

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

II. Literature Review

Road condition :-

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

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

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

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

The paper reveals and concludes that the majority of the drivers does not follow rules and traffic signs while driving. A very small chunk doesn't believe in following traffic signal which causes accidents and other traffic problems. Failing to keep lane. Failing to yield right of the way. Driving in excess of speed.

B. Vehicle condition:-

Traffic Analysis and Road Accidents: A Case Study of Hyderabad using GIS by M. Bhagyaiah¹, B. Shrinagesh.

This Paper addresses to increase of vehicle the major accidents are happened. The increase of vehicle has lot of pressure on the existing roads and ultimately resulting in road accidents. From 2001 there is an increase of 202 percent of two wheeler and 286 percent of four wheeler vehicles with no road expansion. Motor vehicle crashes are a common cause of death. GIS helps to locate the accident hotspot.

C. Age of Driver : -

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

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

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

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

D.Human Behaviour : -

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

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

E. Provide Safety & Prevention Measures:-

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

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

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

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

Methodology

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

CASE STUDY [Talawade] :

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



CHARACTERISTICS OF ROAD

Location of site :Ganeshnagar, near MSCB

officeTalawade road, Pune 411062

Width of road : 15m

Length of road(A) : 86.4 m

Length of road (B) : 100 m

Average speed: 40 km/hr

Side Margin : 3.6 m

B opposite side : 4.3 m (Right)

MSCB side : 5.6 m

TECHNICAL TERMS

Stopping sight distance:

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

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

Super elevation:

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

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

Here, V= 40kmph

t= 2.5 sec

g= 9.81

f= 0.15

R = 300m

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

$$= 1187.32m$$

$$e = 40^2 / 127 \times 300$$

$$= 4.19\%$$

Condition of Road



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

Perpet (Shopkeeper)
Questioner for road accident
→ 6-7 months high traffic route.

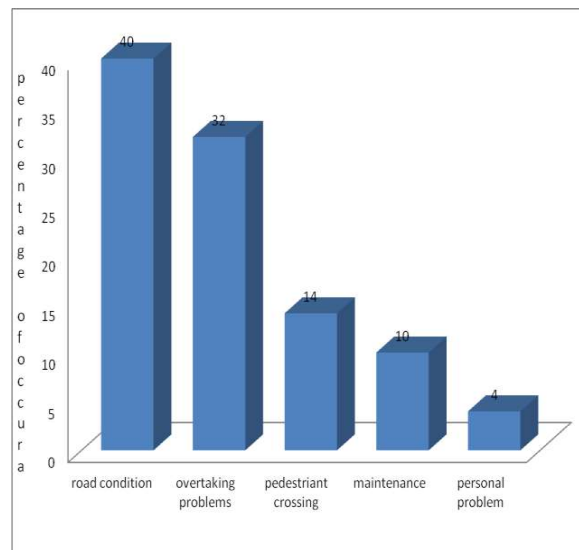
- Area :
- Area of travel (location): Ganeshnagar -
- Time of travel :
- Type of Road:

1) Any accident witnessed : YES (✓) NO ()
Description: Road crossing, pedestrian.
Buses & trucks (from 4 traffic).
2

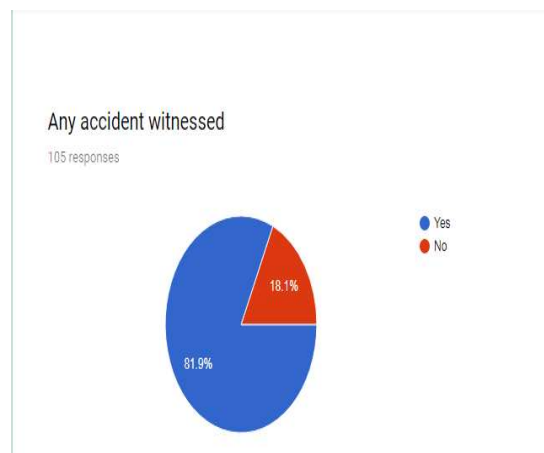
2) Causes :

- I. Personal : Driving problem ✓
Vehicle problem
- II. Road conditions ✓ → 10-15 days. road is bad
- III. Improper signal
- IV. Overtaking ✓
- V. Overturning
- VI. lack of maintenance
- VII. Not following lane
- VIII. Any other

3) Any suggestions regarding preventive measures for mentioned causes:
Speed breaker, Divider, Circle.

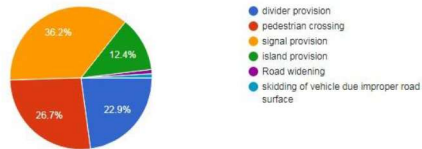


DATA GENERATED BY CREATING GOOGLE FORM



Any suggestions

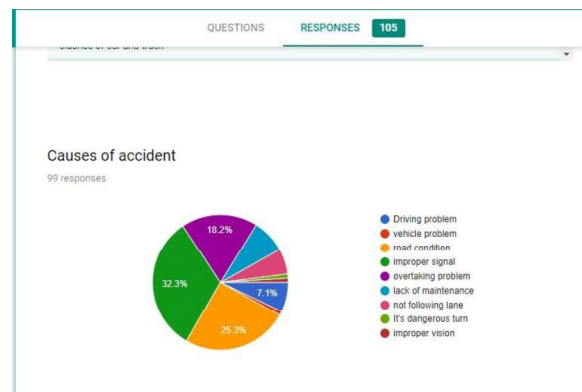
105 responses



Description of accident witnessed

7 responses

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



ACCIDENT CAUSE MODEL

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

The equation is,

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

Where,

IS = Improper Signal

RC = Road Condition

DP = Driving Problem

OP = Overtaking Problem

VP = Vehicle Problem

For example:

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

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

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

$$= [1/3(40-13.33)] / [1/3(40^2 - 13.33^2)]$$

$$= 8.89/21.77$$

$$= 0.40$$

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

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

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

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

Substituting values in the formula

$$\begin{aligned} \text{ACM} &= 0.4*42+0.387*45+0.408*13+0.365*60+0.258*5 \\ &= 63 \text{ no. of accidents in a week} \end{aligned}$$

III. Conclusion

The following model concludes that huge number of accidents occur weekly.
The model consist of various causes by which accidents may occurs in that area.

IV. Results

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

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

Substituting values in the formula

$$\begin{aligned} \text{ACM} &= 0.4*42+0.387*45+0.408*13+0.365*60+0.258*5 \\ &= 63 \text{ no. of accidents in a week} \end{aligned}$$

V. Discussion

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

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UTILIZATION OF PLASTIC WASTE FOR MANUFACTURING OF PAVER BLOCK

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Abstract: *At present nearly tones of plastic waste is used in India every year. The degradation rate of plastic waste is also very slow. Our aim of this research work is to use plastic waste in combination with the fine aggregates to reduce the cost of paver blocks when compared to the conventional concrete blocks & also used for good interlocking with respect to the other paver blocks. Hence this work is helpful in reducing plastic waste which leads to protect environment from pollution.*

We used plastic waste in different proportion with the HDPE granules, coarse aggregates, cement, water and fine aggregates. The paver blocks were prepared and tested with reference of IS code. Result of this work indicate that prepared paver block can be used for area varying from non-traffic to light traffic road.

Index Terms- *HDPE [high density polyethylene], plastic waste.*

1. INTRODUCTION

As the world population grows, wastes of various types are being generated. The creation of non-decaying and low biodegradable waste materials, combined with a growing consumer population has resulted in waste disposal crisis. One solution to this crisis is recycling wastes into useful products. Many Government agencies, private organizations and individuals have completed or in the process of completing a wide variety of studies and research projects concerning the feasibility, environmental suitability and performance of using waste plastics in construction field which needs better and cost-effective construction material and reuse of waste plastics and save our world from environmental Pollution. With the increase in development, there is an increase in cost of construction and the maintenance of pavements. So, the Engineers and Designers have been looking for new concept of using waste building materials Such as plastic, quarry dust, wood, paper, metals, glass in cement concrete Paver Blocks. This pavement is less susceptible to rutting. In this investigation various properties Such as Compressive strength, split tensile strength and water absorption of paver blocks consisting of plastic wastes, non- conventional materials such as quarry dust and fine aggregate of various percentage replacements are used Cement concrete tiles and paving blocks are precast solid products made out of cement concrete. The product is made in various sizes and shapes viz rectangular, square and round blocks of different dimensions with designs for interlocking of adjacent tiles blocks. The raw materials required for manufacture of the product are plastics and aggregates which are available locally in every part of the country. This pavement is less susceptible to rutting. Minimum fatigue or thermal cracking, low stripping due to moisture and offers great durability, little or no impact on processing and also produces eco-friendly construction and costs less.

A lot of face-lift is being given to roads, footpaths along the roadside. These paving blocks are ideal materials on the footpaths for easy laying better look and finish Paver block paving is versatile, aesthetically attractive, functional, and cost effective and requires little maintenance if correctly manufactured and laid. Most concrete paving block constructed in India also has performed satisfactorily but two main areas of concern are occasional failure due to excessive surface wear, and Variability in the strength of block. The sustainable development for construction involves the use of Non-conventional and innovative materials, and recycling of waste materials in order to compensate the lack of natural resources and to find alternative ways conserving the environment.

2. RESEARCH METHODOLOGY

A.Properties of materials

Plastic waste [HDPE Granules]

Plastic waste used for making paver blocks was collected from surrounding locality. HDPE Granules is indicated by resin no 2. High density polyethylene or polyethylene high density [PHD] is thermoplastic polymer produced from monomer ethylene. It is sometimes called alkethene or polythene.

Table1. Properties of HDPE

Sr no.	Properties	Values
1.	Density	0.95-0.97 g/cm ³
2.	Flexibility	High crystallinity
3	Heat resistance	>100°C
4	Melting point	135°C
5.	Maximum allowable stress at 20°C	14.32Mpa
6.	Thermal coefficient of expansion	6.7 x 10 ⁻⁶ °F
7.	Tensile strength	0.2-0.4N/mm ²



Figure 1. Sample HDPE

Coarse aggregates

Locally available aggregates were used in this work. Aggregate passing through 12.5mm sieve and retained on 10 mm sieve are taken and tested as per IS:383-1970.

Table 2. Properties of coarse aggregates

Sr no	Properties	Values
1.	Specific gravity	2.65
2.	Water absorption	0.8%
3.	Loose bulk density	1.412kg/lit
4.	Rodded bulk density	1.532kg/lit

Cement

Cement used in this work is OPC 43 grade. Cement tested as per Is 8112:1989 for 43 grade ordinary Portland cement.

Table3. Properties of cement

Sr no.	Properties	Values
1.	Tricalcium silicate[c ₃ s]	40%
2.	Dicalcium silicate[c ₂ s]	30%
3.	Tricalcium aluminate[c ₃ a]	11%
4.	Tetra calcium alumina ferrite[c ₄ af]	11%

Fine aggregates

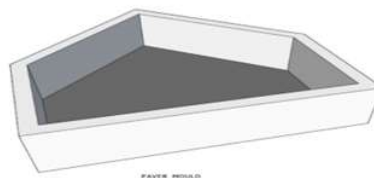
Crushed sand is used as a fine aggregate. Crushed sand is manufactured by crushing larger stones of quarry to particular size of sand. Its chemical and physical properties such as color, size and shape, surface texture depends upon types of stones and its source. The artificial sand produce by machine can be a better substitute to natural river sand.

Table4. Properties of crushed sand

Sr no.	Properties	Values
1.	Specific weight	2.76
2.	Bulk density	1.82
3.	Water absorption	1.85%
4.	Crushing value	14.3%
5.	Clay and fine dust contents	0.55%

B. Preparation of mold

As this is a research work, so we prepared the pentagon type paver blocks.

**Figure 2 a 3D view of paver block**

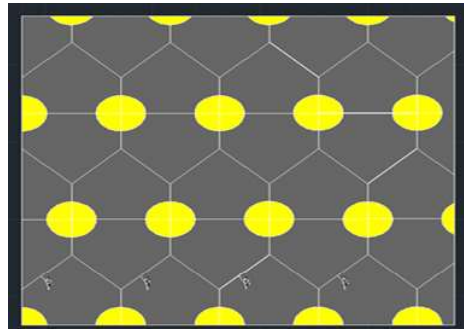


Figure 2 b Interlocking Pattern of paver blocks

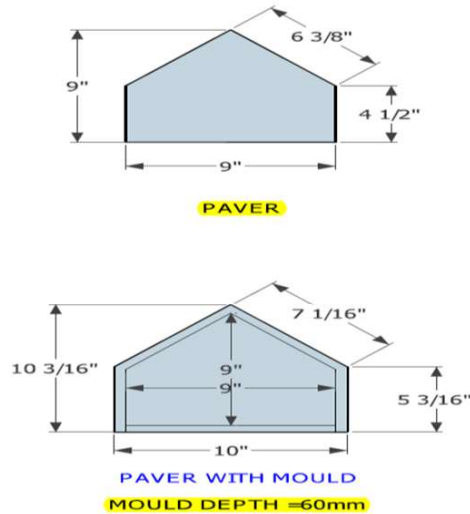


Figure 2 c Dimension Details of paver block

C.Mix Ratio

For volume of- $2.332 \times 10^{-3} \text{m}^3$

Water required is 0.45 lit for each sample and the other constituents of mix are as follows:-

Mix ratio 1

Coarse aggregates-2.59kg

HDPE granules-0.0492kg [3% of F.A]

Fine aggregates-1.590kg

Cement-1.02kg

Mix ratio 2

Coarse aggregates-2.59kg

HDPE granules-0.082kg [5% of F.A]

Fine aggregates-1.560kg

Cement-1.02kg

Mix ratio 3

Coarse aggregates-2.59kg

HDPE granules-0.164kg [10% of F.A]

Fine aggregates-1.470kg

Cement-1.02kg

D. Preparation of Test Specimen

Table4. Limit as per IS 15658.2006

Sr no	Description	Permissible limit	Clause no
1.	Pigments	9% by weight of concrete	4.4
2.	Grade of concrete	M-35 for 60mm thickness	5

**Figure3. Concrete paver blocks****3. ANALYSIS**

All concrete paving blocks was prepared by using standard mix design and vibration until proper compaction is obtained from the machine.

1. Water absorption test

The water absorption test is carried out in accordance with the Annex c of IS 15658: 2006. The permissible limit for water absorption is <6% by mass of paver block.

The percent water absorption is to be calculated.

2. Compressive strength

The compressive test is carried out in accordance with the Annex D of IS 15658:2006. For each mix ratio 2 blocks are prepared and the average is shown in the table.

**Figure4. Compressive Testing machine**

3. Abrasion resistance test

The abrasion resistance is carried out in accordance with the Annex E of IS 15658:2006.

After testing specimen of paver block of different mix design for compressive strength and water absorption following result are obtained and identified the use of this product for suitable application.

Table 5. Results of Compressive strength and Water absorption

Mix Ratio no	Average product compressive strength[N/mm ²]			Water absorption [%]
	7days	14days	28days	3days
0% waste	22.49	31.01	34.01	3.26
Mix 1 [3% waste]	21.89	31	34.25	1.19
Mix 2 [5% waste]	24.25	33.03	37.46	1.10
Mix 3 [10% waste]	25.13	34.17	38.09	0.89

Table 6. Abrasion resistance test results

Grade	Specimen no	side	Initial readin g	Abrasion after no's of revolution [mm]			
				525	1050	1575	2100
35	1	A	0.47	0.56	0.63	0.67	0.73
35	1	B	0.16	0.27	0.33	0.47	0.65
35	2	A	0.36	0.65	0.84	1.03	1.10
35	2	B	0.38	0.44	0.57	0.64	0.70
	Average		0.34	0.48	0.59	0.70	0.79

4.CONCLUSION

1. As per result of compressive strength it is efficient to use for footway, waiting sheds ramps, car parking's, and pedestrian roads.
2. It can be used in the area varying from non-traffic to light traffic road.
3. The utilization of waste plastics in production of such paver blocks can reduce the pollution and it is the productive way of disposal of plastic waste.
4. Water absorption values are in limits as suggested by IS code.

ACKNOWLEDGMENT

It gives us an immense pleasure in submitting our research paper on “Utilization of plastic waste for manufacturing of paver block”. We take this opportunity to show panegyrics and thanks to our guide **Prof. S. A. Pitake** whose suggestions helps us a lot throughout the duration of our efforts on research. We are also indebted to **Dr. S. S. Sawarkar**, Head of the Department who was constant source of inspiration to us during completion of this research work.

We would like to extend my special thanks to the **Principal, Dr. H. U. Tiwari** for his assistance and providing helpful suggestion.

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INNOVATIONS & STARTUPS (CIPCIS 2020)**



CIPCIS 2020: P-2866

Innovative System To Improve The Settling Of Sediments In The Water Storage Tank

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ABSTRACT-

Many times the crushing industries or construction industries may be located in the area of water sources which deposits huge particles in water, and such water is responsible for blockage of taps, showers and water sprayers connected to water supply system of the building, leaving the layers of sediments on the floors of bathrooms and toilets, which needs regular cleaning, with the wastage of the huge quantity of water.

IPR APPLICATION / PATENT NO. – 331/MUM/2015A

CIPCIS 2020: P-287

SOLID FUEL DIESEL ENGINE WITH INDUCTION OF SOLID FUEL

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ABSTRACT-

The present invention is related to use of solid fuel as an alternative form of energy in a modified internal combustion engine. The fuel injector of the conventional diesel engine has been replaced with coal carburetor (Coal Power). It has a hopper in which the coal powder of volatile coal is filled with size of 30-75 micron by granulating it from large size coal. The coal pump in the system is working as coal carburetor which is controlled by DC series motor whose speed can be controlled and the rotor of the carburetor is rotated using DC series motor. The metered quantity of coal is taken by carburetor Docket from bonnet and supplied to the suction manifold. When the pocket goes to intake manifold. The coal is inducted to the engine cylinder manifold in the flowing air. The coal enters the engine cylinder through the intake valve of engine. The mixture of coal and air is heated to very high temperature due to compression of air. The diesel fuel is injected at the end of compression stroke which self ignites and burns because of which the coal particle is ignited. The flame is generated in the engine due to which the coal particle burns at faster rate producing power at the engine crank shaft. The present system provides use of solid fuel as coal and has an additional feature of coal carburetor to supply coal intake manifold. This system has payback cost of the system and is at par with the liquid fuel engine. It has wide range of applications due to availability of low cost fuel.

CIPCIS2020, February 18-20, 2021



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CIPCIS 2020: P-288

Innovative And Efficient Logistic System For Sugar Industries

Anand B. Kudoli, Sudarshan S. Bobade

Assistant Professor, PCCER, Pune, Maharashtra, India, anand.kudoli@pccoer.in.

ABSTRACT- Innovative logistic system for sugar industry through which there will be hike in profit of farmers raw material without compromising profit of the sugar industries, and will increase GDP of the nation against less fuel consumption with sense of environmental impact assessment, permanent solution to road traffic with decrement and control over the accidents, use of speedy transportation vehicles related to the sugar industries will cause less maintenance for existing road infrastructure, and farmers are able to have another crop due to in time response from sugar industries.

IPR APPLICATION / PATENT NO. – 201621030821

CIPCIS 2020: P-289

Innovative And Efficient Smart Calculator With Unit-System

Anand B. Kudoli, Sudarshan S. Bobade

Assistant Professor, Maharashtra, India, anand.kudoli@pccoer.in.

ABSTRACT- Smart Calculator in which input data in any unit-system (SI,MKS,CGS) entered is shown directly on display with numerical value along with its unit, is processed through inbuilt transformation system at the time of entry itself, and solve the problems of millions of users in finding final answer as per their choice in any of above said unit-system, that saves the time of user as a main resource, build confidence of solving the mathematical problems, required less time to convert final answer in various unit, as in every field calculations are required to be carried out with various unit-system, users will enjoy calculations with ease and accuracy

IPR APPLICATION / PATENT NO. – 201621032482

CIPCIS 2020: P-290

An Alteration In Screwdriver To Make It Easy To Grip And Apply More Torque

Suraj Balasaheb Satav

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ABSTRACT-

Tip of screwdriver is kept on target screw, wings are pulled outside so that they will be perpendicular to the cylindrical shaft, for tightening purpose handle is moved in clockwise direction and for removing purpose, it is moved in anticlockwise direction, action of wings is used whenever the grip is required and screws are tight.

CIPCIS2020, February 18-20, 2021



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CIPCIS 2020: P-251

Innovative And Efficient Smart Calculator With Unit-System

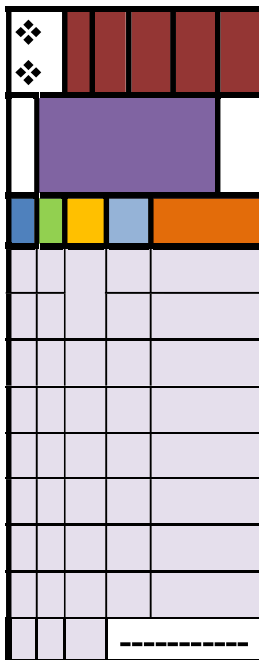
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ABSTRACT-

Smart Calculator in which input data in any unit-system (SI, MKS, CGS) entered is shown directly on display with numerical value along with its unit, is processed through inbuilt transformation system at the time of entry itself, and solve the problems of millions of users in finding final answer as per their choice in any of above said unit-system, that saves the time of user as a main resource, build confidence of solving the mathematical problems, required less time to convert final answer in various unit, as in every field calculations are required to be carried out with various unit-system, users will enjoy calculations with ease and accuracy.

DIAGRAM / SCHEMATIC –



IPR APPLICATION / PATENT NO. – 201621032482

"Every man-made structure in this world is conceived, designed, constructed, maintained and eventually, even demolished by a Civil Engineer."

Dr. Sameer Sawarkar