



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



CIVIL PLUS

Technical Magazine
2020-21



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 (Pe0s):

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 (Ps0s): 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

MAGAZINE CO-ORDINATORS



Mr. Amar Shitole
Incharge



Mr. Soham Mancharkar
Editor



Ms. Aishwarya Taru
Member

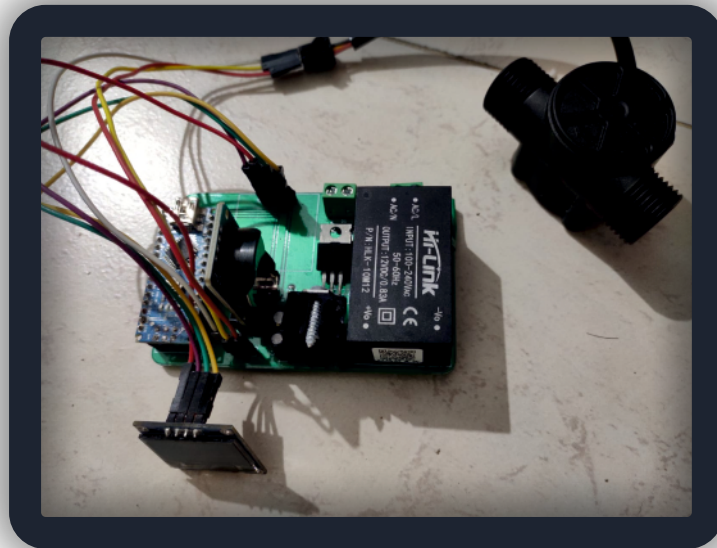


Mr. Sushant Balgude
Member



Department of Civil Engineering

Automatic Water Distribution For Smart Cities



Product Name : Automatic Water Distribution For Smart Cities

Product Developed By :

Soham Mancharkar | Kartikey More | Nikhil More | Sanket Badwaik

Name of Guide : Mr. Rahul Patil

Objective : Uniform distribution of water to every consumer
in the cities.

Outcome : Large number of water can be saved in the reservoirs.
Accurate revenue of water supply will be generated.

Academic Year

2020-21

Summary of Copyrights: AY 2020-21

Sr. No.	Full Name	Title of Copyrights	Copyright Registration Number	Date of Copyright Registration
1	SAHIL SANJEEV SALVI	MORPHOMETRIC ANALYSIS AND PRIORITIZATION OF VASHISHTHI WATERSHED	L-103583/2021	24/05/2021
2	SAHIL SANJEEV SALVI	OPTIMIZATION OF RESERVOIR OPERATION FOR IRRIGATION USING FUZZY LOGIC	L-104439/2021	14/06/2021
3	SAHIL SANJEEV SALVI	EXPERIMENTAL INVESTIGATION OF BOND STRENGTH IN STEELFIBRE REINFORCED CONCRETE	L-104616/2021	18/06/2021
4	SAHIL SANJEEV SALVI, SRINATH AVINASH CHAVAN, AKASH RAJESH DANGAT, SIDDHART SHITAL KORE, SWAPNIL MARUTI LONDHE	EXPERIMENTAL INVESTIGATION BY USE OF GRANITE FINE WASTE IN CONCRETE	L-105315/2021	12/07/2021
5	SAHIL SANJEEV SALVI, KOMAL MANTUTE, RUTUJA SABALE, SIDDHI LANDE, AKASH KADLAG	A STUDY OF WASTE PLASTIC USED IN PAVING BLOCK	L-105278/2021	09/07/2021
6	MAYURA YEOLE	ROAD TRAFFIC ACCIDENT PREDICTION FOR MIXED TRAFFIC FLOW- A CASE STUDY	L-105194/2021	07/07/2021
7	AKSHAY RAHANE	FERROCRETE ROOF SLAB SYSTEM	L-104542/2021	17/06/2021
8	AKSHAY BHARAT RAHANE, JAGTAP VRUSHALI SHIVAJI, WADE PAPIHA RAJU, ISMAIL MOHAMMAD SHABIR, KHAN SARWARADIL FAHIM	TO ENHANCE THE STRENGTH OF CONCRETE BY PARTIAL REPLACEMENT OF COARSE AGGREGATE WITH TILE WASTE	L-105094/2021	06/07/2021

Summary of Copyrights: AY 2020-21

9	MRS. MAYURA MILIND YEOLE, NAYAN BELDAR, SHUBHAM NIMKAR, AKSHAY DHANIVALE, AMIT MADAGE	TRAFFI SIMULATION USING VISSIM SOFTWARE- A CASE STUDY	L-104622/2021	21/06/2021
10	RAHUL PATIL SOHAM MANCHARKAR NIKHIL MORE KARTIKEY MORE SANKET BADWIK	AUTOMATIC WATER DISTRIBUTION FOR SMART CITIES	L-107203/2021	02/09/2021



Dated : 24/05/2021

1. Registration Number : **L-103583/2021**
2. Name, address and nationality of the applicant : SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG,
MARUTI MANDIR, RATNAGIRI.
MARUTI MANDIR, RATNAGIRI-415612
INDIAN
3. Nature of the applicant's interest in the copyright of the work : AUTHOR
4. Class and description of the work : LITERARY/ DRAMATIC WORK
5. Title of the work : MORPHOMETRIC ANALYSIS AND PRIORITIZATION OF
VASHISHTHI WATERSHED
6. Language of the work : ENGLISH
7. Name, address and nationality of the author and if the author is deceased, date of his decease : SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG,
MARUTI MANDIR, RATNAGIRI.
MARUTI MANDIR, RATNAGIRI-415612
INDIAN
8. Whether the work is published or unpublished : UNPUBLISHED
9. Year and country of first publication and name, address and nationality of the publisher : N.A.
10. Years and countries of subsequent publications, if any, and names, addresses and nationalities of the publishers : N.A.
11. Names, addresses and nationalities of the owners of various rights comprising the copyright in the work and the extent of rights held by each, together with particulars of assignments and licences, if any : SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG,
MARUTI MANDIR, RATNAGIRI.
MARUTI MANDIR, RATNAGIRI-415612
INDIAN
12. Names, addresses and nationalities of other persons, if any, authorised to assign or licence of rights comprising the copyright : N.A.
13. If the work is an 'Artistic work', the location of the original work, including name, address and nationality of the person in possession of the work. (In the case of an architectural work, the year of completion of the work should also be shown). : N.A.
14. If the work is an 'Artistic work' which is used or capable of being used in relation to any goods or services, the application should include a certification from the Registrar of Trade Marks in terms of the provision to Sub-Section (i) of Section 45 of the Copyright Act, 1957. : N.A.
15. If the work is an 'Artistic work', whether it is registered under the Designs Act 2000 if yes give details. : N.A.
16. If the work is an 'Artistic work', capable of being registered as a design under the Designs Act 2000. whether it has been applied to an article though an industrial process and ,if yes ,the number of times it is reproduced. : N.A.
17. Remarks, if any :

Diary Number : 9548/2021-CO/L

Date of Application : 19/04/2021

Date of Receipt : 19/04/2021



DEPUTY REGISTRAR OF COPYRIGHTS



Dated : 14/06/2021

1. Registration Number : **L-104439/2021**
2. Name, address and nationality of the applicant : SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG, MARUTI MANDIR, RATNAGIRI-415612 INDIAN
3. Nature of the applicant's interest in the copyright of the work : AUTHOR
4. Class and description of the work : LITERARY/ DRAMATIC WORK
5. Title of the work : OPTIMIZATION OF RESERVOIR OPERATION FOR IRRIGATION USING FUZZY LOGIC
6. Language of the work : ENGLISH
7. Name, address and nationality of the author and if the author is deceased, date of his decease : SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG, MARUTI MANDIR, RATNAGIRI-415612 INDIAN
8. Whether the work is published or unpublished : PUBLISHED
9. Year and country of first publication and name, address and nationality of the publisher : 2017 INDIA
SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG, MARUTI MANDIR, RATNAGIRI-415612 INDIAN
10. Years and countries of subsequent publications, if any, and names, addresses and nationalities of the publishers : N.A.
11. Names, addresses and nationalities of the owners of various rights comprising the copyright in the work and the extent of rights held by each, together with particulars of assignments and licences, if any : SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG, MARUTI MANDIR, RATNAGIRI-415612 INDIAN
12. Names, addresses and nationalities of other persons, if any, authorised to assign or licence of rights comprising the copyright : N.A.
13. If the work is an 'Artistic work', the location of the original work, including name, address and nationality of the person in possession of the work. (In the case of an architectural work, the year of completion of the work should also be shown). : N.A.
14. If the work is an 'Artistic work' which is used or capable of being used in relation to any goods or services, the application should include a certification from the Registrar of Trade Marks in terms of the provision to Sub-Section (i) of Section 45 of the Copyright Act, 1957. : N.A.
15. If the work is an 'Artistic work', whether it is registered under the Designs Act 2000 if yes give details. : N.A.
16. If the work is an 'Artistic work', capable of being registered as a design under the Designs Act 2000. whether it has been applied to an article though an industrial process and ,if yes ,the number of times it is reproduced. : N.A.
17. Remarks, if any :

Diary Number : 11050/2021-CO/L
Date of Application : 12/05/2021
Date of Receipt : 12/05/2021



DEPUTY REGISTRAR OF COPYRIGHTS



Dated : 18/06/2021

1. Registration Number : **L-104616/2021**
2. Name, address and nationality of the applicant : SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG, MARUTI MANDIR, RATNAGIRI-415612 INDIAN
3. Nature of the applicant's interest in the copyright of the work : AUTHOR
4. Class and description of the work : LITERARY/ DRAMATIC WORK
5. Title of the work : EXPERIMENTAL INVESTIGATION OF BOND STRENGTH IN STEEL FIBRE REINFORCED CONCRETE
6. Language of the work : ENGLISH
7. Name, address and nationality of the author and if the author is deceased, date of his decease : SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG, MARUTI MANDIR, RATNAGIRI-415612 INDIAN
8. Whether the work is published or unpublished : PUBLISHED
9. Year and country of first publication and name, address and nationality of the publisher : 2017 INDIA
SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG, MARUTI MANDIR, RATNAGIRI-415612 INDIAN
10. Years and countries of subsequent publications, if any, and names, addresses and nationalities of the publishers : N.A.
11. Names, addresses and nationalities of the owners of various rights comprising the copyright in the work and the extent of rights held by each, together with particulars of assignments and licences, if any : SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG, MARUTI MANDIR, RATNAGIRI-415612 INDIAN
12. Names, addresses and nationalities of other persons, if any, authorised to assign or licence of rights comprising the copyright : N.A.
13. If the work is an 'Artistic work', the location of the original work, including name, address and nationality of the person in possession of the work. (In the case of an architectural work, the year of completion of the work should also be shown). : N.A.
14. If the work is an 'Artistic work' which is used or capable of being used in relation to any goods or services, the application should include a certification from the Registrar of Trade Marks in terms of the provision to Sub-Section (i) of Section 45 of the Copyright Act, 1957. : N.A.
15. If the work is an 'Artistic work', whether it is registered under the Designs Act 2000 if yes give details. : N.A.
16. If the work is an 'Artistic work', capable of being registered as a design under the Designs Act 2000. whether it has been applied to an article though an industrial process and ,if yes ,the number of times it is reproduced. : N.A.
17. Remarks, if any :

Diary Number : 11196/2021-CO/L
Date of Application : 16/05/2021
Date of Receipt : 16/05/2021



DEPUTY REGISTRAR OF COPYRIGHTS



Dated : 12/07/2021

1. Registration Number : **L-105315/2021**
2. Name, address and nationality of the applicant :
SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG,
MARUTI MANDIR, RATNAGIRI-415612
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SRINATH AVINASH CHAVAN , FLAT NO.B- 904 KOHINOOR
GRANDUERE , MUKAI CHOWK , RAVET , PUNE-412101
INDIAN
SIDDHARTH SHITAL KORE , GURUWAR PETH, SHIVAJI
CORNER, TASGAON.
DIST-SANGLI-416312
INDIAN
AKASH RAJESH DANGAT , BEHIND DHANSHREE HOTEL,
VIKASNAGAR KIWALE, DEHU ROAD, PUNE-412101
INDIAN
SWAPNIL MARUTI LONDHE , MAHADEVNAGAR,
CHIKHALI, PUNE-411062
INDIAN
3. Nature of the applicant's interest in the copyright of the work : AUTHOR
4. Class and description of the work : LITERARY/ DRAMATIC WORK
5. Title of the work : EXPERIMENTAL INVESTIGATION BY USE OF GRANITE
FINE WASTE IN CONCRETE
6. Language of the work : ENGLISH
7. Name, address and nationality of the author and if the author is
deceased, date of his decease :
SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG,
MARUTI MANDIR, RATNAGIRI-415612
INDIAN

SRINATH AVINASH CHAVAN , FLAT NO.B- 904 KOHINOOR
GRANDUERE , MUKAI CHOWK , RAVET , PUNE-412101
INDIAN

SIDDHARTH SHITAL KORE , GURUWAR PETH, SHIVAJI
CORNER, TASGAON.
DIST-SANGLI-416312
INDIAN

AKASH RAJESH DANGAT , BEHIND DHANSHREE HOTEL,
VIKASNAGAR KIWALE, DEHU ROAD, PUNE-412101
INDIAN

SWAPNIL MARUTI LONDHE , MAHADEVNAGAR,
CHIKHALI, PUNE-411062
INDIAN
8. Whether the work is published or unpublished : UNPUBLISHED
9. Year and country of first publication and name, address and
nationality of the publisher : N.A.
10. Years and countries of subsequent publications, if any, and names,
addresses and nationalities of the publishers : N.A.
11. Names, addresses and nationalities of the owners of various rights
comprising the copyright in the work and the extent of rights held
by each, together with particulars of assignments and licences, if
any :
SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG,
MARUTI MANDIR, RATNAGIRI-415612
INDIAN
SRINATH AVINASH CHAVAN , FLAT NO.B- 904 KOHINOOR
GRANDUERE , MUKAI CHOWK , RAVET , PUNE-412101
INDIAN
SIDDHARTH SHITAL KORE , GURUWAR PETH, SHIVAJI
CORNER, TASGAON.
DIST-SANGLI-416312
INDIAN
AKASH RAJESH DANGAT , BEHIND DHANSHREE HOTEL,
VIKASNAGAR KIWALE, DEHU ROAD, PUNE-412101
INDIAN
SWAPNIL MARUTI LONDHE , MAHADEVNAGAR,
CHIKHALI, PUNE-411062
INDIAN

DEPUTY REGISTRAR OF COPYRIGHTS
12. Names, addresses and nationalities of other persons, if any,
authorised to assign or licence of rights comprising the copyright : N.A.
13. If the work is an 'Artistic work', the location of the original work,
including name, address and nationality of the person in possession
of the work. (In the case of an architectural work, the year of
completion of the work should also be shown). : N.A.



14.

If the work is an 'Artistic work' which is used or capable of being used in relation to any goods or services, the application should include a certification from the Registrar of Trade Marks in terms of the provision to Sub-Section (i) of Section 45 of the Copyright Act, 1957.

:

N.A.
15.

If the work is an 'Artistic work', whether it is registered under the Designs Act 2000 if yes give details.

:

N.A.
16.

If the work is an 'Artistic work', capable of being registered as a design under the Designs Act 2000.whether it has been applied to an article though an industrial process and ,if yes ,the number of times it is reproduced.

:

N.A.
17.

Remarks, if any

:
- Diary Number :

11476/2021-CO/L
- Date of Application :

21/05/2021
- Date of Receipt :

21/05/2021





DEPUTY REGISTRAR OF COPYRIGHTS



Dated : 09/07/2021

1. Registration Number : **L-105278/2021**
2. Name, address and nationality of the applicant :

SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG,
MARUTI MANDIR, RATNAGIRI-415612
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KOMAL GANESH MANTUTE , HIVPURI COLONY, OMERGA
DIS: OSMANBAD-413606
INDIAN
SABALE RUTUJA VITTHAL , AT ADMAPUR TEMPLE NEAR
VODAFONE TOWER NIPANI BANGALORE ROAD-416210
INDIAN
SIDDHI ARUN LANDE , C/1, PERDESHI RECIDENCY, NEAR
SAI CHOWK , NEW SANGVI, PUNE-411027
INDIAN
AKASH CHANDRASHEKHAR KADLAG , SHIV SHAMBHO
HOUSING SOCIETY, NEAR GHARJAI MATA MANDIR,
RUPEENAGAR, TALAWADE ,PUNE-411062
INDIAN
3. Nature of the applicant's interest in the copyright of the work : AUTHOR
4. Class and description of the work : LITERARY/ DRAMATIC WORK
5. Title of the work : A STUDY OF WASTE PLASTIC USED IN PAVING BLOCKS
6. Language of the work : ENGLISH
7. Name, address and nationality of the author and if the author is deceased, date of his decease :

SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG,
MARUTI MANDIR, RATNAGIRI-415612
INDIAN

KOMAL GANESH MANTUTE , HIVPURI COLONY, OMERGA
DIS: OSMANBAD-413606
INDIAN

SABALE RUTUJA VITTHAL , AT ADMAPUR TEMPLE NEAR
VODAFONE TOWER NIPANI BANGALORE ROAD-416210
INDIAN

SIDDHI ARUN LANDE , C/1, PERDESHI RECIDENCY, NEAR
SAI CHOWK , NEW SANGVI, PUNE-411027
INDIAN

AKASH CHANDRASHEKHAR KADLAG , SHIV SHAMBHO
HOUSING SOCIETY, NEAR GHARJAI MATA MANDIR,
RUPEENAGAR, TALAWADE ,PUNE-411062
INDIAN
8. Whether the work is published or unpublished : UNPUBLISHED
9. Year and country of first publication and name, address and nationality of the publisher : N.A.
10. Years and countries of subsequent publications, if any, and names, addresses and nationalities of the publishers : N.A.
11. Names, addresses and nationalities of the owners of various rights comprising the copyright in the work and the extent of rights held by each, together with particulars of assignments and licences, if any :

SAHIL SANJEEV SALVI , 785 G, SHRIKUL, EKATA MARG,
MARUTI MANDIR, RATNAGIRI-415612
INDIAN
KOMAL GANESH MANTUTE , HIVPURI COLONY, OMERGA
DIS: OSMANBAD-413606
INDIAN
SABALE RUTUJA VITTHAL , AT ADMAPUR TEMPLE NEAR
VODAFONE TOWER NIPANI BANGALORE ROAD-416210
INDIAN
SIDDHI ARUN LANDE , C/1, PERDESHI RECIDENCY, NEAR
SAI CHOWK , NEW SANGVI, PUNE-411027
INDIAN
AKASH CHANDRASHEKHAR KADLAG , SHIV SHAMBHO
HOUSING SOCIETY, NEAR GHARJAI MATA MANDIR,
RUPEENAGAR, TALAWADE ,PUNE-411062
INDIAN
12. Name, address and nationalities of other persons, if any, authorized to assign or licence of rights comprising the copyright : N.A. **DEPUTY REGISTRAR OF COPYRIGHTS**
13. If the work is an 'Artistic work', the location of the original work, including name, address and nationality of the person in possession of the work. (In the case of an architectural work, the year of completion of the work should also be shown). : N.A.



14. If the work is an 'Artistic work' which is used or capable of being used in relation to any goods or services, the application should include a certification from the Registrar of Trade Marks in terms of the provision to Sub-Section (i) of Section 45 of the Copyright Act, 1957.

:

N.A.
15. If the work is an 'Artistic work', whether it is registered under the Designs Act 2000 if yes give details.

:

N.A.
16. If the work is an 'Artistic work', capable of being registered as a design under the Designs Act 2000.whether it has been applied to an article though an industrial process and ,if yes ,the number of times it is reproduced.

:

N.A.
17. Remarks, if any

:
- Diary Number :

11475/2021-CO/L
- Date of Application :

21/05/2021
- Date of Receipt :

21/05/2021





DEPUTY REGISTRAR OF COPYRIGHTS



Dated : 07/07/2021

1. Registration Number : **L-105194/2021**
2. Name, address and nationality of the applicant : MAYURA M YEOLE , D-301, GOYAL-GARIMA,
KESHAVNAGAR, CHINCHWAD,PUNE, MAHARASHTRA-411033-411033
INDIAN
DR.R.K.JAIN , QUEENSTOWN
SOCIETY,CHINCHWAD,PUNE,MAHARSHTRA-411033
INDIAN
DR.RADHIKA MENON , FLAT NO 15. DEVI LOTUS SOCIETY
BHAU PATIL ROAD KIRKE, PUNE-411020
INDIAN
3. Nature of the applicant's interest in the copyright of the work : AUTHOR
4. Class and description of the work : LITERARY/ DRAMATIC WORK
5. Title of the work : ROAD TRAFFIC ACCIDENT PREDICTION FOR MIXED
TRAFFIC FLOW- A CASE STUDY
6. Language of the work : ENGLISH
7. Name, address and nationality of the author and if the author is deceased, date of his decease : MAYURA M YEOLE , D-301, GOYAL-GARIMA,
KESHAVNAGAR, CHINCHWAD,PUNE, MAHARASHTRA-411033-411033
INDIAN

DR.R.K.JAIN , QUEENSTOWN
SOCIETY,CHINCHWAD,PUNE,MAHARSHTRA-411033
INDIAN

DR.RADHIKA MENON , FLAT NO 15. DEVI LOTUS SOCIETY
BHAU PATIL ROAD KIRKE, PUNE-411020
INDIAN
8. Whether the work is published or unpublished : UNPUBLISHED
9. Year and country of first publication and name, address and nationality of the publisher : N.A.
10. Years and countries of subsequent publications, if any, and names, addresses and nationalities of the publishers : N.A.
11. Names, addresses and nationalities of the owners of various rights comprising the copyright in the work and the extent of rights held by each, together with particulars of assignments and licences, if any : MAYURA M YEOLE , D-301, GOYAL-GARIMA,
KESHAVNAGAR, CHINCHWAD,PUNE, MAHARASHTRA-411033-411033
INDIAN
DR.R.K.JAIN , QUEENSTOWN
SOCIETY,CHINCHWAD,PUNE,MAHARSHTRA-411033
INDIAN
DR.RADHIKA MENON , FLAT NO 15. DEVI LOTUS SOCIETY
BHAU PATIL ROAD KIRKE, PUNE-411020
INDIAN
12. Names, addresses and nationalities of other persons, if any, authorised to assign or licence of rights comprising the copyright : N.A.
13. If the work is an 'Artistic work', the location of the original work, including name, address and nationality of the person in possession of the work. (In the case of an architectural work, the year of completion of the work should also be shown). : N.A.
14. If the work is an 'Artistic work' which is used or capable of being used in connection to any goods or services, the application should include information from the Registrar of Trade Marks in terms of the Section (i) of Section 45 of the Copyright Act, : N.A.
15. If the work is an 'Artistic work', whether it is registered under the : N.A.
16. If the work is an 'Artistic work', capable of being registered as a : N.A.
17. Remarks, if any :



Handwritten signature

DEPUTY REGISTRAR OF COPYRIGHTS

Diary Number : 11789/2021-CO/L
Date of Application : 27/05/2021
Date of Receipt : 27/05/2021



Dated : 17/06/2021

1. Registration Number : **L-104542/2021**
2. Name, address and nationality of the applicant : AKSHAY RAHANE , SHARADNAGAR,LANE 8
SPINE ROAD,CHIKHALI-412114
INDIAN
3. Nature of the applicant's interest in the copyright of the work : AUTHOR
4. Class and description of the work : LITERARY/ DRAMATIC WORK
5. Title of the work : FERROCRETE ROOF SLAB SYSTEM
6. Language of the work : ENGLISH
7. Name, address and nationality of the author and if the author is deceased, date of his decease : AKSHAY RAHANE , SHARADNAGAR,LANE 8
SPINE ROAD,CHIKHALI-412114
INDIAN
8. Whether the work is published or unpublished : PUBLISHED
9. Year and country of first publication and name, address and nationality of the publisher : 2021 INDIA
AKSHAY RAHANE , SHARADNAGAR,LANE 8
SPINE ROAD,CHIKHALI-412114
INDIAN
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5. Title of the work : TO ENHANCE THE STRENGTH OF CONCRETE BY PARTIAL
REPLACEMENT OF COARSE AGGREGATE WITH TILE
WASTE
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4. Class and description of the work : LITERARY/ DRAMATIC WORK
5. Title of the work : TRAFFI SIMULATION USING VISSIM SOFTWARE- A CASE STUDY
6. Language of the work : ENGLISH
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9. Year and country of first publication and name, address and nationality of the publisher : N.A.
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10. Years and countries of subsequent publications, if any, and names, addresses and nationalities of the publishers : N.A.
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Table B 4.6.3.i.: Student Paper Publications

Sr. No	Student name	Paper Title	Guide name	Journal Name	Academic Year	Vol./Issue , Page no.
1	Twinkal Thakur	Behaviour of Geo Textile in Flexible Pavement	M M Yeole	International Journal of Innovative Research In Technology	2017-18	Vol.4, Issue 11 Page no 1879-1881
2	Yogita Gurav					
3	Yash Agrawal					
4	Shyam Yesane	Rainwater Harvesting - A Case Study at Pimpri Chinchwad College of Engineering and Research, Ravet	Amar Shitole	International Journal of Advanced Research in Science and Engineering,	2017-18	Volume 9, Issue 5
5	Yogesh Birajdar					
6	Gourav Taras					
7	Jayant Shinde					
8	Gayatri Chaskar	Analysis of Compressive Strength of Hardened Concrete: Replacing Natural Sand by Steel Slag	M M Yeole	International Journal of Engineering Trends and Applications	2018-19	Vol.5, Issue 3 Page no. 54-56
9	Mohini Koli					
10	Jyoti Mishra					
11	Sumeet Sonawane					
12	Mayur Khadke	Plastic Embedded Concrete	M M Yeole	International Journal of Innovative Research In Technology	2018-19	Vol.5, Issue 1 Page no. 392 - 395
13	Sagar Pagar					
14	Mahesh Khandbor					
15	Ajinkya V Bagul	Determination of Loss in Strength of Steel Due To Stacking on Construction Site	A.B. Kudoli	Iconic Research And Engineering Journals	2018-19	APR 2019 Volume 2 Issue 10 ISSN: 2456-8880
16	Nishant P Kharche					
17	Vijay A Khedkar					
18	Shubham S Palkar					
19	Kumar Awni	Automated Drip Irrigation System Using Soil Moisture Sensors	A.B. Kudoli	Iconic Research And Engineering Journals	2018-19	Volume 2 Issue 11 ISSN: 2456-8880
20	Ashish Valvi					
21	Krishna Wadle					
22	Tushar Yelmar	An Experimental Investigation on Partial Replacement of Concrete Ingredient by Marble Waste & Industrial Waste Water	Satish Pitake	AEGAEUM Journals Volume 8, Issue 5	2019-20	Volume 8, Issue 5
23	Jayraj Choordia					
24	Akash Gaware					
25	Suraj Bhosale					
26	Akash Totre	Utilization of plastic waste for manufacturing of paver block	Satish Pitake	AEGAEUM Journals	2019-20	Volume 8, Issue 5
27	Apurva Kedar					
28	Rutuja Birjdar					
29	Pratibha Kumbhar					
30	Nutan Mahajan	Accident cause model for Talawade	M M Yeole	ISOR JMCE Journals	2019-20	Vol.16, Issue 3 Page no. 76-83
31	Godavari Mane					
32	Mukta Nisal					
33	Prajakta Sawant					
34	Simarn Shaikh					
35	Akshada Kadam					
36	Suraj S Alhat ,		A.B. Kudoli		2019-20	

37	Rohit S Borhade	Economical and Eco-Feasible Method of Slab Curing Using Curing Pad		AEGAEUM Journals		ISSN NO: 0776-3808, Volume 8, Issue 3, Page No: 699
38	Rohit B Jawale					
39	Shubham V Mali					
40	Kunal L Malwade	A System for Recycling of Water in Drinking Water Units	A.B. Kudoli	AEGAEUM Journals	2019-20	Volume 8, Issue 4, ISSN NO: 0776-3808 Page No: 2422
41	Ajinkya A Puranik					
42	Nachiket B Patil					
43	Nishant L Gavhane					
44	Rushikesh K. Jadhav	Experimental Study Comparison of Performance of Concrete with Waste Paper, Steel Fiber and Carbon Fibers	M M Yeole	International Journal of Engineering Research in Mechanical and Civil Engineering	2020-21	Vol.5 Issue 7 Page no. 23-28
45	Saurabh G. Rakshe					
46	Harshal M. Shinde					
47	Kaustubh S. Chougule					
48	Prachi R. Deshpande	Application of Artificial Neural Networks in predicting sub-base CBR values	M M Yeole	AEGAEUM JOURNAL	2020-21	Volume 8, Issue 11, Page no.452-457
49	Omkar S. Birajdar					
50	Nikesh G. Padvi					
51	Sayali G. Pawar					
52	Srinath Avinash Chavan	EXPERIMENTAL INVESTIGATION BY USE OF GRANITE FINE WASTE IN CONCRETE	S.S.Salvi	International Journal of Creative Research Thoughts (IJCRT)	2020-21	Volume 9, Issue 5 Page No. 694-700
53	Akash Rajesh Dangat					
54	Siddhart Shital Kore					
55	Swapnil Maruti Londhe					
56	Komal Mantute	A STUDY OF WASTE PLASTIC USED IN PAVING BLOCK	S.S.Salvi	International Journal of Creative Research Thoughts (IJCRT)	2020-21	Volume 9, Issue 5 Page No. 701-706
57	Rutuja Sabale					
58	Siddhi Lande					
59	Akash Kadlag					
60	Jayraj S Chordiya	Application of Value Engineering System to a Residential Building –Case Study	Prof. Satish A. Pitake	International Journal of Scientific Research in Engineering and Management (IJSREM)	2020-21	Volume 5, Issue 5 Page No. 1-4
61	Tushar Panpaliya	Physical & Mechanical Properties of Mees Bamboo for replacement with Steel in Concrete Structure	Prof. Satish A. Pitake	International Journal of Scientific Research in Engineering and Management (IJSREM)	2020-21	Volume 5, Issue 5 Page No. 1-4
62	Priyvrat Meena					
63	Akash Naikare					
64	Ankush Nomulwar					

65	Vrushali S. Jagtap	To Enhance the Strength of Concrete by Partial Replacement of Coarse Aggregate with Tile Waste	Prof. Akshay B. Rahane	International Journal of Creative Research Thoughts (IJCRT)	2020-21	Volume 9, Issue 5 Page No. 134-139
66	Papiha R. Wade					
67	Mohammad Ismail					
68	Mr. Omkar Shelar	Strength Assessment of Concrete Structures Due to Various Chemical Attacks	Prof. Akshay B. Rahane	International Journal of Creative Research Thoughts (IJCRT)	2020-21	Volume 9, Issue 5 Page No. 152-154
69	Mr. Varun Salgaonkar					
70	Mr. Sanket Oswal					
71	Mr. Mohanesh Tamboli					
72	Akshay Dhanivale	Traffic Simulation using VISSIMs Software: A Case Study	Prof. Mayura Yeole	International Journal of All Research Education and Scientific Methods (IJARESM)	2020-21	Volume 9, Issue 5 Page No. 3963-3971
73	Nayan Beldar					
74	Shubham Nimkar					
75	Amit Madage					
76	Sanket Chaudhari	WATER BALANCE – A HYDRO MATHEMATICAL APPROACH TOWARDS WATER MANAGEMENT AT VILLAGE LEVEL	Prof. Gajanan N. Supe,	International Journal of Creative Research Thoughts (IJCRT)	2020-21	Volume 9, Issue 5 Page No. 4-7
77	Sudarshan Devshatwar					
78	Sneha Birajdar					
79	Ashwini Chopade					
80	Kiran kshirsagar	Municipal Solid Waste Management System For Pune City	Prof. Gajanan N. Supe,	International Journal of Creative Research Thoughts (IJCRT)	2020-21	Volume 9, Issue 5 Page No. 841-846
81	Pranali Mahind					
82	Shravani Thobde					
83	Ashwini Yalangphale					
84	Soham Mancharkar	AUTOMATIC WATER DISTRIBUTION FOR SMART CITIES	Rahul Patil	Journal of Emerging Technologies and Innovative Research (JETIR)	2020-21	Volume 8, Issue 7 Page No. D46 – D51
85	Kartikey More					
86	Nikhil More					
87	Sanket Badwaik					



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

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A STUDY OF WASTE PLASTIC USED IN PAVING BLOCK

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Abstract: A large number of plastic wastes have been collected from several places such as tourist and public places etc., High density polyethylene bags are collected, cleaned, and used as a replacement for cement in the manufacturing of Paver Blocks. Plastic waste is available in large quantity and hence the cost factor comes down. when we having waste plastic then we can use as reuse, recycle and reduce. Be mindful of what you do, pay attention to the items you buy, and always check yourself to see if you need it or if it comes in a package with less waste.

Index Terms - Paver block, Plastic waste, Ceramic Waste, Compressive Strength

I. INTRODUCTION

Plastic is evil. You can hardly do away with it. Every day we use plastic in daily lifestyle that is Garbage, coffee cup, electronic material, plastic bags Etc. so plastic is very harmful to humans, animals, marine and as well as to environment. But where is all the plastic going? It would be startling to note that billions of tons of plastic are ending up in the world's oceans. Pollution caused by plastic is not only harmful to marine life but is also affecting the health of humans. The harmful chemicals like PCBs, DDT, and PAH, which get absorbed in the plastic debris that floats in the seawater, have a varied and harmful range of chronic effects like endocrine disorders. The toxins are transferred in the food chain as they get absorbed in the animals' bodies after they eat the plastic pieces. Human beings consume these contaminated fish and mammals. Plastic pollution is affecting the global economy. It is destroying the fishing and aquaculture industries. Plastic is mostly produced by household, tourism and trekking etc. In many countries, the composition of Waste is different, that it is affected by the socioeconomic characters, waste management programs, and consumption patterns, but generally, the level of plastic in the waste composition is high. One of the largest components of plastic waste is polyethylene which is followed by polypropylene.

Definition of Plastic-Looking to the global issue of environmental pollution by post-consumer plastic waste, research efforts have been focused on consuming this waste on a massive scale in an efficient and environmentally friendly manner. Plastic contains in solid as well as in finished state.

Need of recycling the Plastic-Recycling plastic is very important because of this material is used in the manufacturing of various products, Recycling is important if we want to leave this planet for our future generations. when we having waste plastic then we can use as reuse, recycle and reduce. Be mindful of what you do, pay attention to the items you buy, and always check yourself to see if you need it or if it comes in a package with less waste.

II. AIM

The aim of this project is to replace cement with plastic waste in paver block and to reduce the cost of paver block when compared to that of convention concrete paver blocks.

II. OBJECTIVES

- 1.To determine the suitability of waste plastic in the development of pavement blocks.
- 2.To evaluate compressive strength and durability of ordinary concrete paver blocks and plastic paver blocks.
- 3.To produce cost-effective paver blocks and eco-friendly. Which a common person can afford easily.

IV. LITERATURE REVIEW

Pooja Bhatia Most of the developing nations lack a proper solid waste management system owing to the difficulties faced during the sample collection and treatment phases. Low-density polyethylene (LDPE) contributes as a major source of such pollution due to the widespread use of its products which include water sachets, thin bags, wrapping paper, etc. The waste plastic which is disposal in landfilling that will affect the ground water table as well as surrounding soil. A relatively simple technology has been proposed in this paper that produces LDPE-bonded sand blocks and pavers. The density and compressive strength were found to be increased as the particle size of the sand were decreased. The samples also exhibited far superior impact resistance as compared to traditional clay paver blocks.

Aarti Ghude Plastic is a non-biodegradable material. The plastic waste in municipal solid waste is increased rapidly day by day. When we need to use of plastic that time is very important to use of plastic after using of plastic they can use as a reuse. Plastic is of many different types such as High-Density Poly-ethylene (HDPE), This project aims to replace the bonding given by cement in paver blocks with the melted plastic waste. The degradation of plastic is a very long process; it may take thousands of years. Hence, a project helps reduce plastic waste. In this project, we have used plastic waste in different ratios with fine and coarse aggregate. The paver blocks were prepared and tested. The water absorption capacity of the plastic paver block is less.

S. Arjun Kumar S. Ganesh Babu in addition, with waste plastic waste lime sludge from the paper industry replaces fine aggregate. In project, we have to use lime sludge, waste plastic in different proportion with sand. The paver block is tested and we discussed about all test. Because of population increment the production of plastic waste is also increased. We will be using the method of landfilling for disposal of plastic which is very important. so, we can use the plastic in paver block.

Avinash G B, Roja A P, Santosh M R the Plastic Pavers are prepared by utilizing waste plastics. A large amount of plastic is being brought into the separation regions are discarded or burned which leads to the contamination of the environment and air. The heated waste plastic and then added sand in it which is manually carried out as well as mechanically. In this present work, the Plastic paver is made by adding 40%, 50%, 60%, and 70% of plastic waste by weight of sand required to fill the mold of pavers. In that four-trial works, it is found that a minimum of 60% waste additive is required to get the desired shape of the mold and 70% waste additive.

Avinash Gb, Rosa Ap, Santosh M R, Puneetha kumari H M In this project we can use a waste plastic as cement, and we will do instead of plastic disposal we can use the plastic in pavement block, then it is economical as well as easily available. as compare to concrete pavement block the plastic pavement block is light in weight. Also, it has a small procedure to making a block. The use of plastic waste which is non-biodegradable is rapidly growing in the surrounding and becoming a threat to the environment in many aspects.

V. METHODOLOGY AND INVESTIGATION

5.1 Methodology

This study has the following methodology for using recycled plastic used in the paving block

1. List out material required for the study
2. Check the properties of the collected material.
3. Prepare a mix design for the recycled plastic used in the paving block.
4. Making the paving block using proper mix and guidelines.
5. Check the properties of the recycled plastic used in the paving block

5.2 Experimental Investigation

In the project use sand and plastic for the paving block in proper shape. In convention concrete paving block use cement, sand, and aggregate with water. Cement is used for the binding material in the paving block, But the recycled plastic paving block required only sand and plastic. Where the plastic is used as a binder in the paving block.

5.3 Materials used for plastic used paving block

The wastes of plastic in the household are large and increase with time. The largest component of plastic waste is polyethylene, followed by polypropylene, polyethylene terephthalate, and polystyrene. Looking to the global issue of environmental pollution by post-consumer plastic waste, the use of post-consumer plastic waste in concrete will not only be its safe disposal method but may also improve concrete properties like tensile strength, chemical resistance, drying shrinkage, and creep on a short and long-term basis.

1. Good Insulation for cold, heat, and sound-saving energy.
2. As compare to concrete block it is economical.
3. Hygienic and clean
4. Ease of processing/installation
5. Lightweight
6. Maintenance-free (such as painting is minimized)

5.4. Mix Design (1:3)

In this process of manufacturing plastic paving block mix design is not given proper calculation. This mix design depends on the trial-and-error method while during the manufacturing process.

5.5. Collect the Plastic Waste

The manufacturing of plastic paving blocks requires a huge plastic. The weight of the plastic is very small so the quantity of the plastic is required a huge quantity. The 1 kg plastic requires 4 kg sand. Sand is another material used in the plastic paving block. The quantity of the sand depends on the plastic used for blocks.

5.6. Preparation of The Mixture

Plastic bag collected and not need to clean but stored and roughly cleaned. Weight the plastic and sand with a proportion of the 1 part of and 2 part of the plastic. The rate of the sand and plastic are depending on the type of the product The quantity of the mixture is determined to enable easy handling and transportation.

5.7. Heating the Mixture

The mixture is progressively heated in a recycled half-barrel with continuous and strong mixing. Taking a barrel and heat at constant temperature and placed the plastic at a proper weight. After melting the plastic add slowly sand in good proportion. stir this mixture constantly. During the mixing take care of proper mixing. The composition of the gas and vapor produced during the melting is essentially CO₂ and H₂O₂ nevertheless it is recommended that the operator wears an appropriate facial mask.

5.8. Moulding

The plastic paste still very hot and fluid is poured into the mold and firmly leveled with a trowel. Then it is compressed with a dedicated tool which is designed as per paving block shape.

5.9. Unmolding

When plastic is cool enough, the extraction of the paving block out of the mold is immediate. It is only requiring a gentle pulling off of the mould. Paving block on their metallic support is immersed in a tank with cold water.

VI.RESULT AND DISCUSSION

Result:

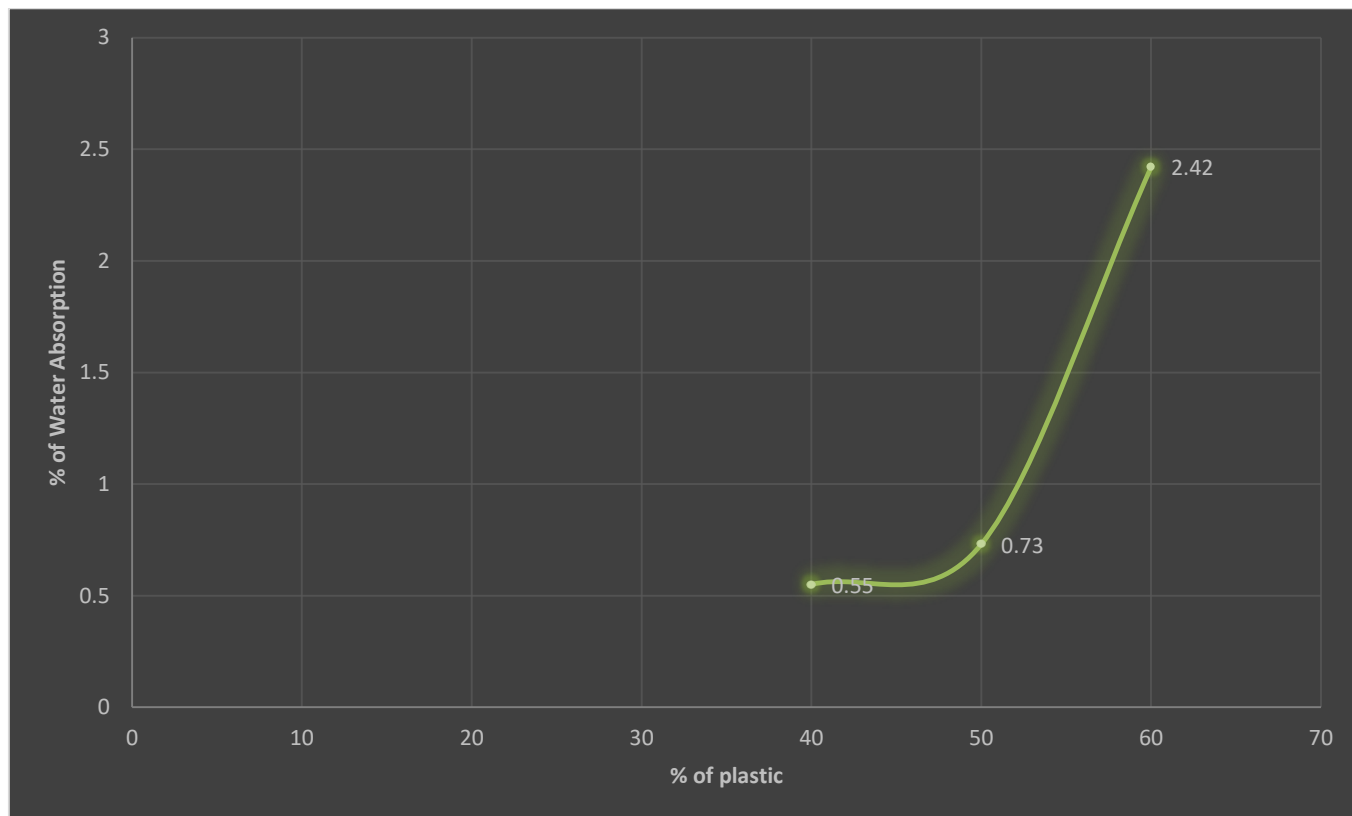
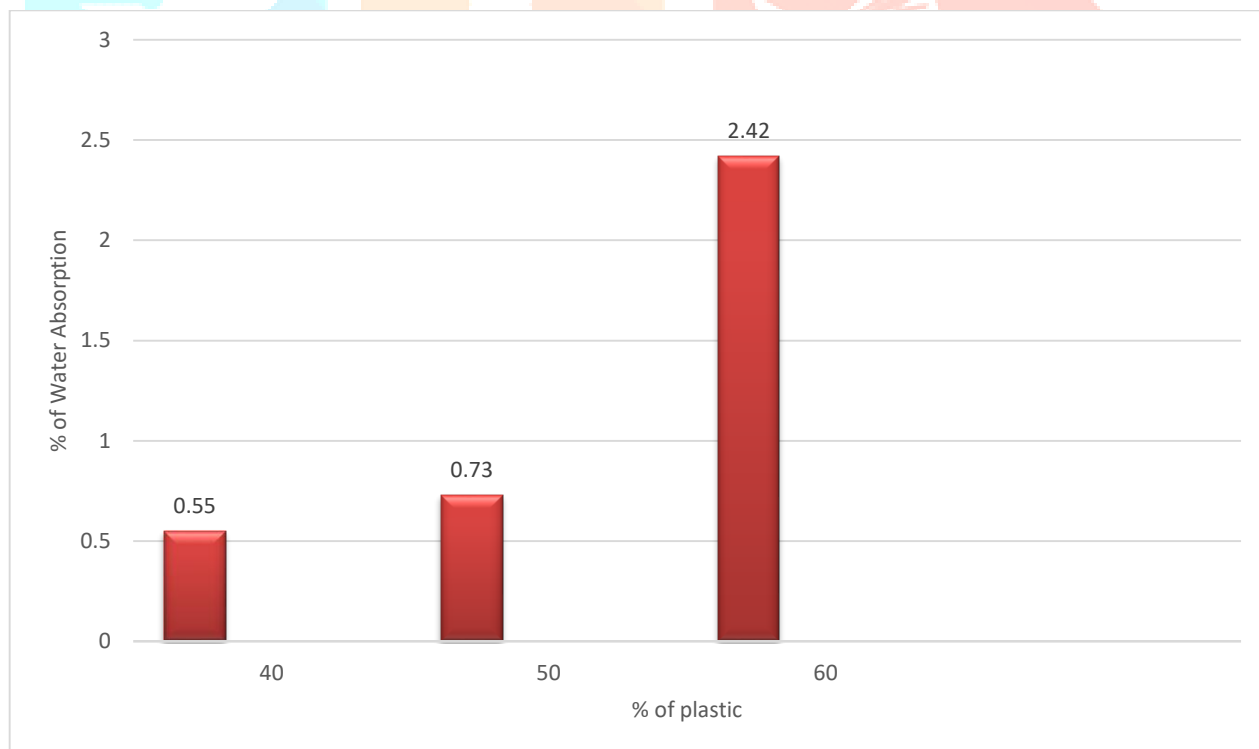
In this study we made 3 blocks the paver block was prepared and tested the result when the discussed. We performed the Water Absorption Test and Compressive strength test.

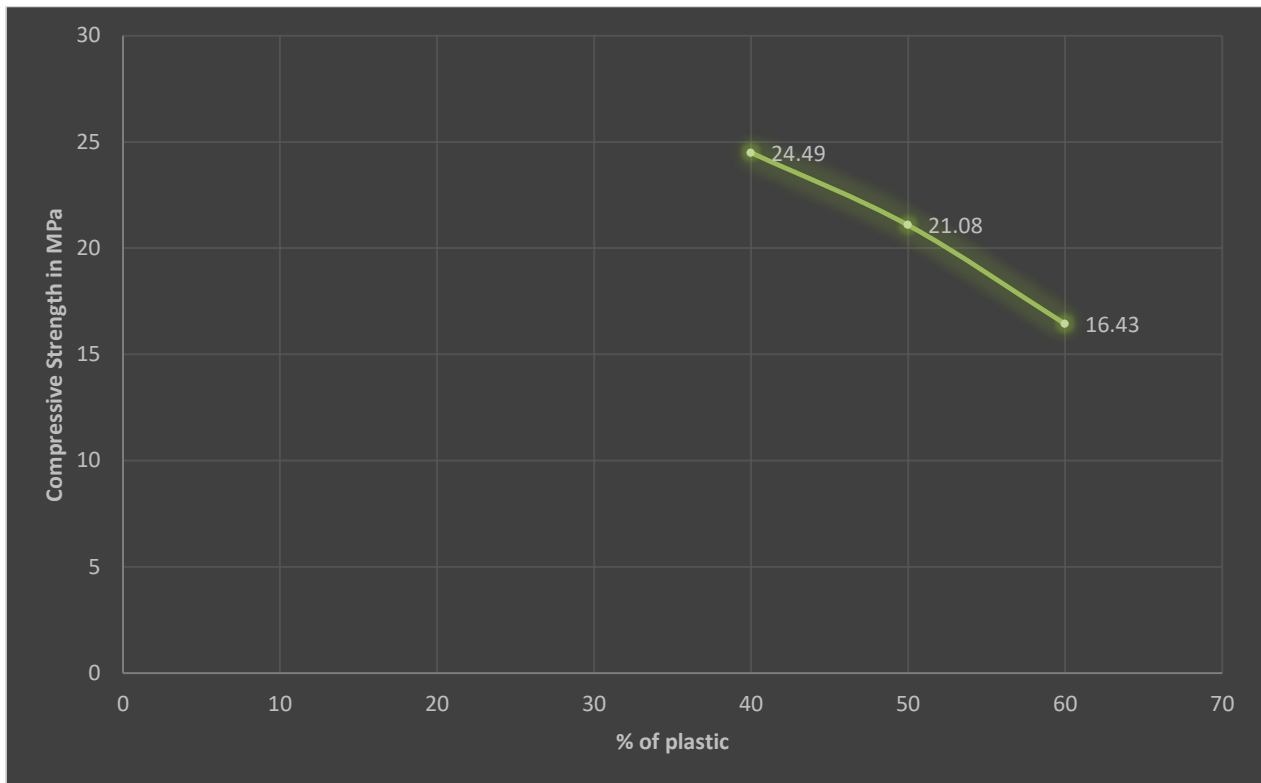
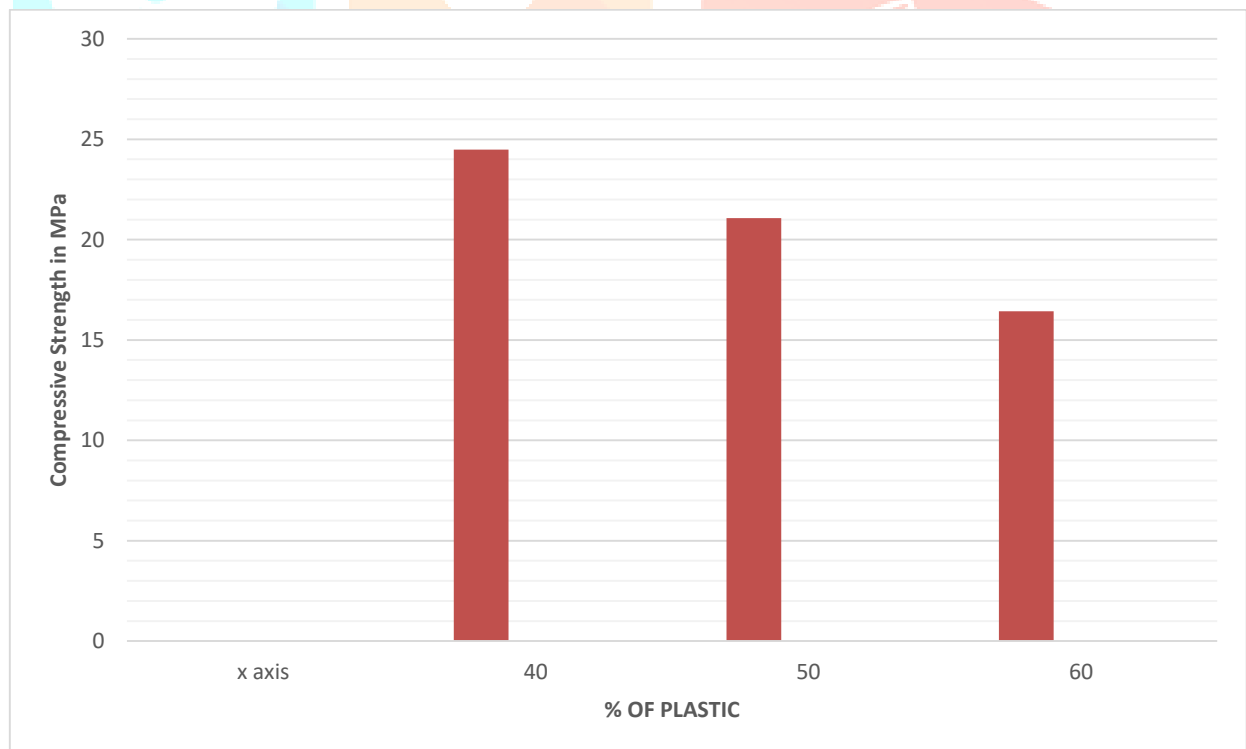
Table:5.1 Table showing water absorption

Sr. No.	Description (%)	Weight Before Test (Kg)	Weight After Test (Kg)
1	B1 (40)	3.59	3.61
2	B2 (50)	2.72	2.74
3	B3 (60)	3.30	3.38

Table 5.2 Table Showing Compressive Strength

Sr no	Description (%)	Load (KN)	Compressive strength in MPa
1	B1(40)	79	24.49
2	B2(50)	68	21.08
3	B3(60)	53	16.43

Graph 5.1 Percentage of Water Absorption v/s Percentage of Plastic**Bar Graph 5.2 Percentage of Water Absorption v/s Percentage of Plastic**

Graph 5.3 Compressive Strength v/s Percentage of Plastic**Bar Graph 5.4 Compressive Strength v/s Percentage of Plastic**

VII.CONCLUSION

1. Plastic is very hard polluted ingredient in the nature so used in the paving block to reduce the pollution in the area.
2. The finishing, shape, interlocking and appearance of the plastic paving block are good as conventional concrete paving block.
3. The strength of the block is very less than the concrete block, so these blocks are not used in the heavy traffic.
4. These blocks are used in the park and, on foot path of the road. It also used in the making mile stone, side guard in the road construction.
5. When we conducted water absorption test on plastic paver block, we observed that plastic content is more than 50% then capacity of water absorption of block is i.e., more than 2% compare to other blocks.
6. The Water absorption value is less 2% material is suited for construction
7. As percentages of plastic content increases, compressive strength of 40%, 50% and 60% content of plastic decreases gradually respectively.

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APPLICATION OF ARTIFICIAL NEURAL NETWORKS IN PREDICTING SUB-BASE CBR VALUES

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Abstract: Establishing a realistic working profile of soil properties has been, and is still, one of the most challenging problems facing Geo-technical engineers, especially for CBR results. In the present study a neural-network approach is used to tackle this problem. Source data of a series of California Bearing Ratio Tests (CBR) performed at the Laboratory and Geo-technical Experimental Site.

This will be useful for training and testing an artificial neural network. The developed neural network will be showing the prediction of CBR values of the site studied. Data are then generated for constructing the profiles of the CBR values using the trained neural network. This study might be useful for the future as this process will reduce the work on procedure and graphical calculations.

Keywords: ANN, CBR, Neural power, GEP, SVM, Soil index, SPSS, Sub-base.

1. INTRODUCTION

1.1 California Bearing Ratio:

The California Bearing Ratio (CBR) test is a penetration test used to evaluate the subgrade strength of roads and pavements. The results of these tests are used with the empirical curves to determine the thickness of pavement and its component layers. The CBR test is one of the most commonly used methods to evaluate the strength of a sub grade soil, sub base, and base course material for design of thickness for highways and airfield pavement. The California bearing ratio test is penetration test meant for the evaluation of subgrade strength of roads and pavements

Soaked CBR values represent the strength of an aggregate in a fully saturated condition. Unsoaked CBR values represent the strength of an aggregate in an unsaturated state. It is more time-consuming to perform a soaked CBR test than an unsoaked one, because each sample needs to be soaked for 4 days

It is a penetration test wherein a standard piston, having an area of 3 in (or 50 mm diameter), is used to penetrate the soil at a standard rate of 1.25 mm/minute. The pressure up to a penetration of 12.5 mm and its ratio to the bearing value of a standard crushed rock is termed as the CBR.

The sub grade strength characteristics is one of the most important component in permanent design. The CBR is most common test used for characterizing sub grade pavement materials, being the ratio (Expressed as a percentage) of stress needed to penetrate a soil mass with a 50mm dig, plunger at a rate of 1.25mm/min to the stress needed for correspondent penetration of a standard material (normally defined as crushed stone) generally, the ratio of is calculated penetrations of 2.5mm & 5mm while normally

the ratio at 2.5mm is considered, when at 5mm is reliably greater, the ratio at 5mm is considered. The correct load values (at 2.5mm & 5mm penetration) are then extracted from load penetration curve, & the CBR is determined using the formula;

$$\text{CBR} = (\text{Applied load} / \text{Standard load}) * 100$$

1.2 Artificial Neural Network:

ANN represents a simplified model of human brain, consisting complex communications network that consists of hundreds of simple processing units wired together. Neural network works as simple as human brain. It consists of numerous interconnected neurons which works simultaneously to solve the problems.

ANN works on almost every aspects of Civil Engineering works, but the limited number of studies have been made on predicting the CBR values of soil. Taskiran developed the ANN & Gene Expression Programming (GEP) model for predicting the CBR values of soil. ANN predict the relationship between the soil data & their respective CBR values. Most attempts are made on sub grade soil. However, few research attempts have been made on using ANN to predict CBR from soil indices for local sub-base soil.

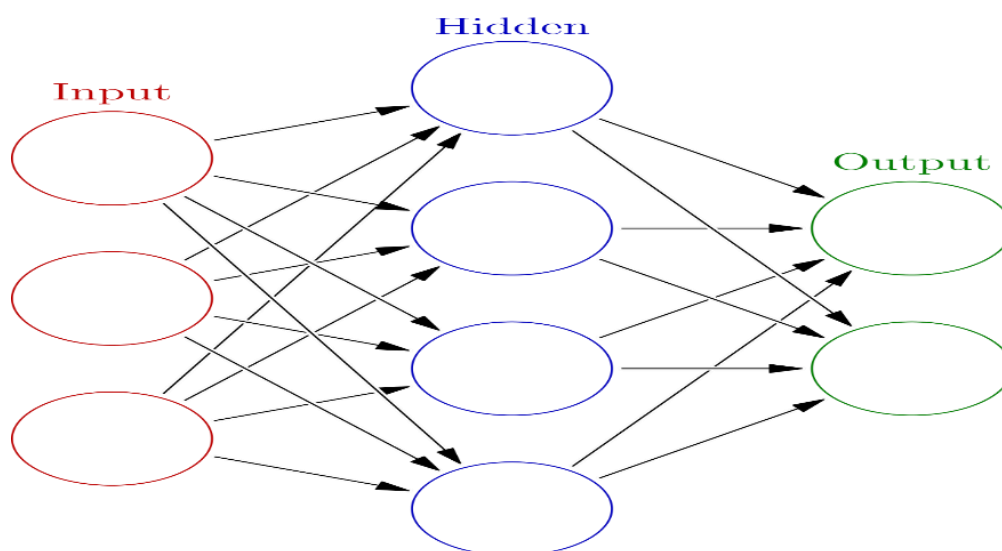


Fig.1 structure of ANN

1.3 MATLAB

What Is MATLAB?

MATLAB, short for MATrix LABoratory is a programming package specifically designed for quick and easy scientific calculations and I/O. It has literally hundreds of built-in functions for a wide variety of computations and many toolboxes designed for specific research disciplines, including statistics, optimization, solution of partial differential equations, data analysis.

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include:

- Math and computation
- Algorithm development
- Modeling, simulation, and prototyping
- Data analysis, exploration, and visualization
- Scientific and engineering graphics
- Application development, including Graphical User Interface building

MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar noninteractive language such as C or Fortran.

The name MATLAB stands for matrix laboratory. MATLAB was originally written to provide easy access to matrix software developed by the LINPACK and EISPACK projects, which together represent the state-of-the-art in software for matrix computation.

MATLAB has evolved over a period of years with input from many users. In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry, MATLAB is the tool of choice for high-productivity research, development, and analysis.

MATLAB features a family of application-specific solutions called toolboxes. Very important to most users of MATLAB, toolboxes allow you to *learn* and *apply* specialized technology. Toolboxes are comprehensive collections of MATLAB functions (M-files) that extend the MATLAB environment to solve particular classes of problems. Areas in which toolboxes are available include signal processing, control systems, neural networks, fuzzy logic, wavelets, simulation, and many others.

The MATLAB System

The MATLAB system consists of five main parts:

The MATLAB language.

This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features. It allows both "programming in the small" to rapidly create quick and dirty throw-away programs, and "programming in the large" to create complete large and complex application programs.

2. RESEARCH METHODOLOGY

When we were looking for problem statements for this project, we came across various loop holes in investigation of soil properties. We found that civil engineering field lack in use of new technologies. So, we did research especially on CBR tests and its correlated properties. We are in the process in learning artificial neural network software.

3. OBJECTIVES

1. Application of ANN by preparing optimized model.
2. Reduce the time for actual performance of ANN
3. It is alternative to statistical and traditional methods as well as in combination with numerical simulation systems.
4. Simplicity, the positive aspects and the reliable results of the usage of neural networks for solving engineering problems.

4. DESCRIPTION OF PROJECT WORK / EXPERIMENTATION

The software used for the processing of acquired data from the laboratory is MATLAB. The software contains a toolbox for performing & processing of the data but before this we have to give inputs that we have decided these are MDD, OMC, LL, PL, PI, MC, etc. it works as same as human brain.

4.1 we can derive the methodology in following steps:

1. collection of data: we have visited a laboratory where the in-situ testing had been conducted. We had brief discussion with the technicians & lab assistance. They made us clear about the CBR concept & the correlated parameters. They have provided us a bunch of recorded data of their laboratory results, which we will be using as our input data.
2. We have learnt the basic programming which is used for building of ANN. Also, we trained on MATLAB software which is one of the basic tool for ANN programming.

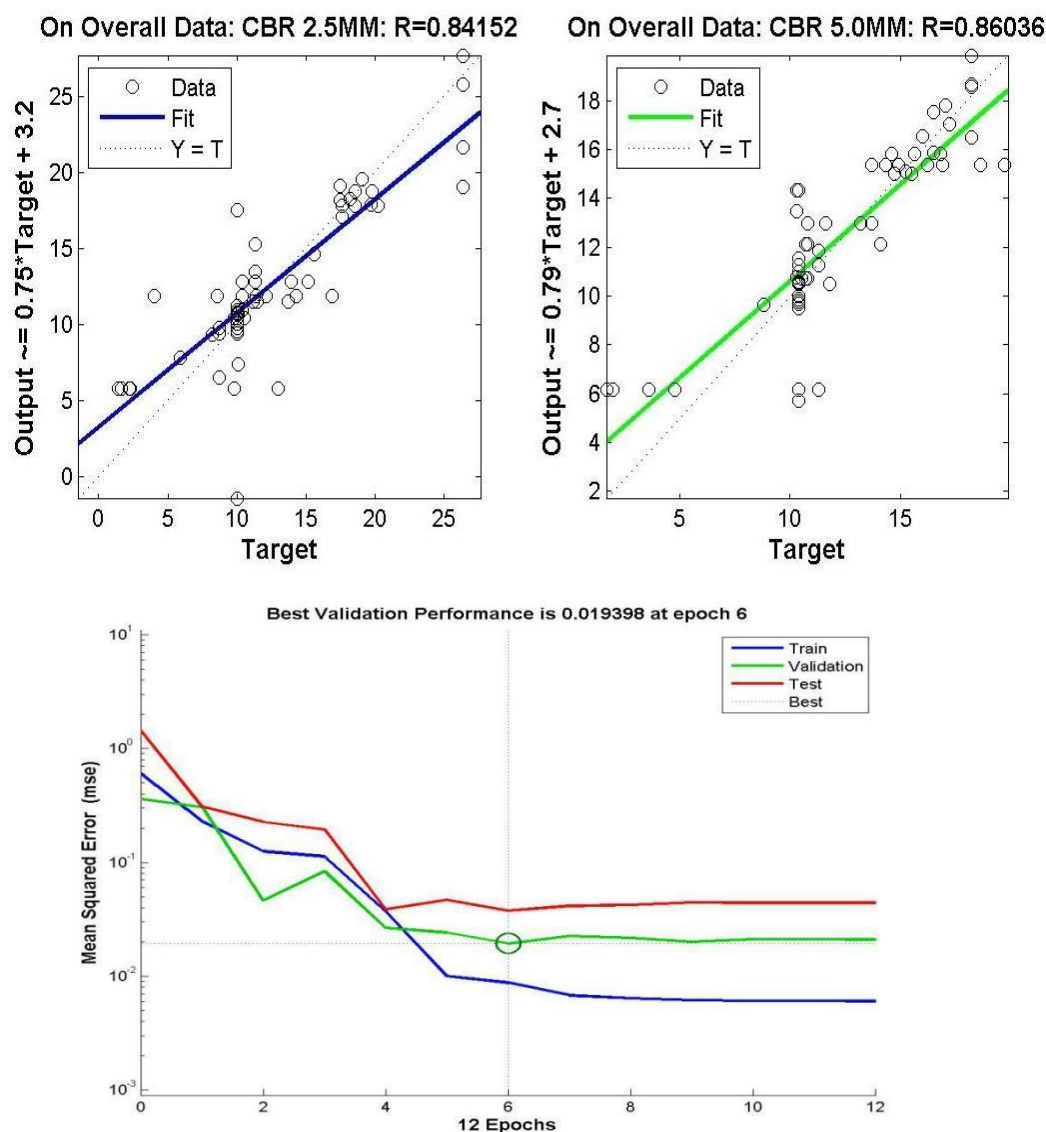
By following these two above mentioned steps, we achieved our finalized program for testing & results.

5. DATA ACQUISITION

In order to correlation between sub-base physical properties & CBR, multiple soil samples (100 samples) were collected. The data was collected from soil samples acquired by Constrologist testing pvt. Ltd. laboratory, which were tested for gradation, Optimum Moisture Content (OMC), Maximum Dry Density (MDD), Liquid Limit (LL), Plastic Limit (PL), Plasticity Index (PI). Sub-base samples are tested according to American standards for testing of materials.

6. RESULTS

1. The ANN models are successful in predicting CBR values as determined by actual CBR tests with the accuracy of 92.27%.
2. The developed ANN model is more accurate than the mathematical method. The prediction error percentage of ANN model ranged from 0.58 to 2.78%, while the mathematical method was 8.83 to 53.73%.



7. CONCLUSIONS

The main objectives of this study were the examination of ANN in terms of predicting CBR values based on basic soil tests. To establish this goal, soil samples were collected & tested in the constrologist laboratory to obtain the input parameters for the ANN model.

1. The neural network is power full tool and is easy to use.
2. The developed ANN model can be used reliably, successfully and very accurately for the prediction of sub-base CBR values.
3. The input parameters ranges play a significant role in model making. Sub-base data parameters were trained to achieve the best correlation between CBR & such soil parameters.

ACKNOWLEDGMENT

It gives me an immense pleasure to submit this project report on **“APPLICATION OF ARTIFICIAL NEURAL NETWORK FOR PREDICTION OF SOIL PROPERTIES”**. We tried our level best to represent this topic into compact & to the point framework.

We express our sincere thanks with profound gratitude to our project guide **Prof. Mayura Yeole** for her valuable guidance & constant encouragement without which it would have been impossible for us to present and complete this project successful. We are also indebted to **Prof. Sameer Sawarkar**, Head of Department who was constant source of inspiration to us during completion of this research work.

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We thank full to all teaching and non-teaching staff members of Civil Engineering Department for inspiring us the best of their knowledge and guidance and help.

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Application of Value Engineering System to a Residential Building –Case Study

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Abstract - Value engineering is one of the effective tools for reducing cost, time and to improve quality. It is also used as effective technique in problem solving. In current situation of construction industry there is need of such techniques which can not only influence project cost, time and quality but also to have positive impact on environment. This project analyzed the current practice of Construction activity and applied value engineering concept in case study taken for selected activity of construction. Construction coupler and conventional lap splice is compared. Dado tiles are provided without cutting the tiles to avoid wastage of time and cost. Compared Ecopro Door frames with regular wooden door frames. This study has attempted cost saving in selected activity after considering value engineering. Based on the research findings we can expect by applying value engineering concept we can reduce cost, time and improvement in functionality of construction work.

- Improve organizational performance.
- Identify problems.

Value engineering is being a very effective approach, must be appreciated and understood at all level of the project management and must be accepted worldwide. This is one of the tools available for the engineer, and its application on projects and products guides the engineer's imagination, creativity, and synthesis of knowledge such that whole- life value is achieved for the project or product. Essentially, the project or product is viewed from its purpose and functions through to its conception, actualization or manufacture and usage. And simultaneously in a reverse order from its usage back to its purpose and functions. Although value engineering has its origin in the manufacturing industry, its methodology has been well developed for use in the construction industry. The realization of whole- life value for a building project involves finding optimum combinations of initial project costs, maintenance cost, and cost associated with the time for completion of the project. Value engineering is technique directed towards analyzing the functions of an item or process to determine "best value" or the best relation between the cost and value.

Key Words: Value engineering, Cost, Time, Quality

1. INTRODUCTION

Value engineering is a powerful approach for cost saving and quality improvement. Especially since the construction industry holds a significant weight with respect to the worldwide economy. Value engineering not only considers project costs and quality, but also it proved to have optimistic impacts on the environment and contributing in the green construction all over world. Value engineering takes into consideration from the initial its life-cycle costs. This study includes three actual site problems solving using value engineering approach. Value Analysis was developed in the late 1940s by Lawrence D. Miles. He worked in the purchasing department of General Electric Company in USA. Value Analysis was a response to the question: How had companies managed to innovate during World War II despite of rationed materials and war time shortages Miles presented a model on the idea that "All cost is for function". Customers buy functions experienced through products and services Miles named his approach Value Analysis and later Value Engineering. Today it is also called Value Management.

Importance of Value Engineering

- Reduce cost.
- Improve quality.
- Increase reliability and availability.
- Enhance customer satisfaction.

1.1 Objective and scope

Applying value engineering concept in selected construction activity and investigating performance aiming following

1. Determine the best design in minimum cost.
2. Improve quality work.
3. Easily availability of material.
4. Improve customer satisfaction.

2. LITERATURE REVIEW

2.1 General

Various technical papers on value engineering in design and construction of building have been presented at research from which we referred many papers for study. Reviews of these papers are given below.

[1] **Mohamed Abdelghany**: He summarizes research undertaken at the American University in Cairo, Egypt. With application of value engineering use of acrylic paint with ceramic tiles in the walls of wet areas in residential compounds can improve value in residential projects.

[2] **Singh R, Himanshu S. K.** : They summarize research undertaken at the Department of Civil Engineering, Graphic Era University, Dehradun, Uttarakhand, INDIA. They show that couplers are an effective and an economic replacement to lap splice. On the topic of Reinforcement Couplers as an

Alternative to Lap Splices they also did a case study on use of couplers in reinforced steel over a conventional lap splice.

[3] **Andy Stratton, P.E.:** This paper describes on Encouragement of the further economic growth in the corridor by providing more efficient transportation system. This research is under taken at the Colorado Department of Transportation, Denver on the topic of Value Engineering study in transport. Concept of value engineering understood.

[4] **V. Gowrisankar Kongu :** The paper is on the Value Engineering in Residential House Construction where they Used aesthetically pleasing and more durable materials without increasing cost. The cost is one of the important factors in the construction industry so this research paper suggests the use of the aesthetically pleasing and durable materials without any effect on the economy of the construction. So quality and even function might be sacrificed in the process. While on the other hand, the goal of VE studies is to increase value without sacrificing the function or the quality.

2.2 Concluding remark from literature survey:

In the present study, a number of papers published so far have been surveyed, reviewed and analyzed. A substantial amount of work has been conducted on value engineering in building construction to save money, time and improving quality of the construction. Current approach of value engineering is seen in the generals and research paper.

- The scope for the value engineering in building construction and design by using basic value engineering principles.
- Rates of construction of coupler and conventional lap splice in construction are not compared.
- The dado tiles are provided without cutting the tiles to avoid wastage of time and cost is not been discussed.
- Use of aesthetic, pleasing & more durable material without increasing cost.

3. METHODOLOGY

Under this research work various work are planned to execute selected activity for application of value engineering. Activity selected after observation on actual site. Selected activity under three different case studies is presented below.

3.1 Case Study 1: Study of Dado Tiles

Dado means tiles which are provided in surface and lower area of wall for prevention of wet and disturbance. Dado is used along the sides of the wall of bathrooms to avoid damage in walls due to water.

- A case study was conducted by our group of a City Pride School project in Ravet
- Size of one toilet 1.25X1.05X3m
- Number of toilet in one floor 16

Table -1: Rates of Dado Tiles

Standard Size of Tiles (mm)	Rate Per SQFT(Rs)
300 X 600	30
200 X 200	25
600 X 600	30

- Size of Room: 1.25X1.05X3m
- Size of tile taken 300X600mm
- No. of toilet in 1 floor-16
- No. of floors - 4
- Total Wastage in sq. ft.- 1280
- Total Wastage Cost of the tile (Rs30/sq. ft.) – 38,400/-
- Suggested Size 1.3X1X3m
- Total saving after recommendation= Rs.38,400/-

3.2 Case Study 2: Use of coupler in reinforcement

A case study was carried out at an undergoing School construction site (City Pride School) in Ravet. Performed estimations of the total lapping length for various diameters of bar (16, 20, 25mm) for columns for an entire site and calculated the total cost of the lapping length of steel. After value analysis, suggested a better alternative for lapping i.e. use of couplers.

We also made the estimation of coupler and compared its cost. During Value analysis we studied the use of couplers instead of lapping and its strength.

- The coupler system is designed to connect two pieces of rebar together in the field quickly and easily.
- The building consists of a basement, first floor and second floor.
- Building is constructed by using 16mm, 20mm and 25mm bars, so we have calculated the total cost of lap length and compared with the cost of coupler.



Fig-1: Coupler

Generally couplers are manufactured from Mild Steel, but in some cases alloys of different metals can also be used.

- During manufacturing of couplers different basic steps such as cutting, boring, threading, finishing are consider.
- Based on Grade of concrete site method adopted for lap splices.

a) By Site Method:

The lap splice was selected as per the concrete grade used in the site work.

M30: 46d

M35: 40d

M25: 39d

Where d is the diameter of the bar.

b) By IS-456 Method

As a standard method IS 456 specifies a formula for

determining the lap length in any structural member. As per IS code lap splice is given by the formula;

$$L_s = 48d$$

(Where d is the diameter of the bar.)

The reinforcement couplers not only provide strength to the joints but are they are also an cost-effective means of connections of two bars.



Fig -2: Coupler on site

The total savings after the using coupler instead of lapping are given below:

Table -2:. Estimation of Splices

Dia. of bar	No. of bar	Unit weight	Total lap Length	Total weight	Steel rate per Kg	Total Cost(Rs)
16	804	1.58	643.2	1016.256	48	48780.288
20	1470	2.469	1270.4	3136.618	48	150557.645
25	2218	3.858	2335.5	9010.359	48	432497.232
					Total	631835

Table -3: Estimation of Coupler

Diameter of bar	Number of coupler	Cost of coupler per head	Total cost of coupler(Rs)
16	804	46	36984
20	1470	66	97020
25	2218	96	212928
		Total	346932

Total Savings In Rupees: **2,84,930/-** i.e around. 45% savings.

3.3 Case study 3: Study on Door Frames

Door frames are the jambs and upper transverse member enclosing the sides and top of doorways and usually supporting a door. Features of wooden door frames

- Robustness
- Termite resistance
- Optimum strength

- Crack resistance
- Simple to fit
- Immaculate finish

Features of Ecopro Door Frames (WPC Boards)

- Innovative composition
- Seamless workability
- Strong and durable
- Efficient product
- Environmental friendly
- Economical than Wooden Boards

WPC Boards: Now day's people are turning for such product which can eco-friendly with require output. WPC boards in India show as a green solution and environment-friendly in comparison to the substitutes used. The WPC boards consist of 70% virgin polymer, 15% wood powder and 15% additives. There is no use of wood in these products, hence being a remarkable step towards following the sustainable development goals. As a matter of fact, a tree is saved with the usage of 10 WPC in India.



Fig -3: Wooden & Ecopro Board

Proposed Wooden Door Frame

- Running Length -18 ft.
- Cost of frame -Rs.100/running feet
- Number of doors in each floor 35
- Number of floor -4
- Total cost of frame -Rs.2,52,000/-

Ecopro Door Frames

- Running Length -18 ft.
- Cost of frame - Rs.80/running feet
- Number of doors in each floor 35
- Number of floor -4
- Total cost of frame-Rs.2,01,600/-
- Total savings in door frames – Rs.50,400/-i.e. 20% savings.

4. RESULT

Under selected activities after using vale engineering techniques following result observed.

- Case study 1 –Reduced dado tiles wastage and Total saving after recommendation= Rs.38,400/-

- Case study 2 – Use of coupler instead of splices in reinforcement. Total saving after recommendation = Rs. 2,84,930/-
- Case study 3 – Using Ecopro Board for door frames
Total saving = Rs. 50,400/-

5. CONCLUSIONS

1. The Value engineering is a dominant approach for cost saving by selecting appropriate alternative.
2. Value engineering is not just reducing the costs but also increases the design standards easy to build the project and saving time.
3. We can use value engineering techniques for optimizing other construction activities with use of eco-friendly material and method.

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Our gratitude to Almighty, my colleague, family members, friends, Project manager from site and also acknowledges the support and help of all others who all contributed in this work.

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EXPERIMENTAL INVESTIGATION BY USE OF GRANITE FINE WASTE IN CONCRETE

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Abstract: In the world of the construction industrial era, the waste generated from the stone industries cause environmental problems. At the same time, Construction industries face many problems not only at the end of the life cycle of the products but also at the beginning of it. It is also significant to develop low-cost building material by the waste produced by stone industry. Therefore, the reuse of Granite fine waste material in the construction industry can be emphasized to produce low-cost concrete. This Project aims at innovative use of Granite Fine waste in concrete by replacing the fine aggregate which is the other alternative that can be used in conventional concrete. The proposed work is investigated for a concrete mix of M20 grade with 0%, 10%, 20%, and 30% of Granite Fine waste used as the replacement of fine aggregate. A series of 12 cubes are cast and tested after 28 days for the compressive strength. The result appears that the compressive strength of concrete increases up to 10% after the replacement of fine aggregate with Granite fine waste and further, it decreases as the percentage of granite increases.

Index Terms - Granite Fine Waste, Compressive Strength, Grade of Concrete.

I. INTRODUCTION

Granite is an important structural and ornamental stone and it also has high compressive strength and durability, it is used extensively for massive structural work. Fine-grained granite that takes and preserves good polish is employed for ornamental and monumental works and also for inscription purposes. The word granite is derived from the Latin word 'granum', which is a grain. Solid waste is produced mainly from industrial processing, mining, and agriculture, and is disposed of inefficiently. The waste produced at the time of mining, processing, and finishing of rocks such as granite, marble, sandstones, consists of a large quantum of the total solid waste. Since there is an increase in population day by day is resulting in demand for building of infrastructure has increased constantly. Concrete is the most widely used manmade construction material in the world whereas the most ingredient in concrete is cement, fine aggregate, and coarse aggregate. For construction purposes river sand is used as fine aggregate in concrete. Recently in India many states like Rajasthan, Tamil Nadu have imposed restrictions on sand removal from the river beds due to unsafe impacts threatening and has forced the search of feasible alternative materials. The complete and proper disposal of this waste is not possible, and the only way to minimize the damages caused by it is its complete utilization. This waste, although with no proper method of disposal, has a potential for usage as a partial or complete replacement of aggregates in cement mortar, or can be used as a Fine aggregate substitute in concrete.

II. AIM

To Investigate experimentally compressive strength by use of Granite Fine waste in Concrete with varying proportion of Granite Fines for M 20 Grade of concrete.

III. OBJECTIVES

The main objective is to study the influence of Granite fine waste in concrete.

- To evaluate the potential use of granite powder in concrete as a replacement for natural sand.
- To examine the degree of strength improvement in concrete obtained with the addition of granite powder.
- To analyse the result of compressive strength with different proportion of granite fines with that of conventional concrete.

IV. LITERATURE REVIEW

Anandhu Ramesh, Sravanan.S, Kanesh Pandian.M, and Charles Raja P investigated the grade of concrete and the percentage of substitution of granite powder with various percentage. The cubes are prepared by 0%, 10%, 15%, 20% of fine/natural aggregate substitution Granite Powder by-product on the behavior of concrete, compressive strength on cubes is performed. Experimental results revealed that compressive strength and axial stress strain behavior of the substitution rate up to 20% is fairly greater than values obtained with natural aggregates and it is suggested that substitution of natural aggregates by GP by-product up to 20% is favorable for the concrete resistance.

G. Ganesh Naidu, M Sri Durga Vara Prasad, N. Narendra investigated to discover the combined effect of granite cutting waste and recycled concrete on the workability and mechanical properties of self-compacting concrete. In this experiment the granite cutting waste is replaced with fine aggregate at 0%, 20%, 40%, 60%, 80%, and 100% proportions. Recycled concrete is replaced with coarse aggregate starting from 20 to 100%. Total 36 mixes of cubes were designed to check the fresh and hardened properties. Slump flow and T500, funnel, and Lbox tests are conducted to know the flow ability and passing ability of concrete. The result obtained is that the Granite Cutting Waste and Recycled Concrete values are increasing, Slump flow values are gradually decreasing. The reason behind this is, increasing viscosity and nonbonding behavior of recycled concrete and granite cutting waste. As the GC waste and RC values are increasing, Slump flow values are gradually decreasing. The reason behind this is, increasing viscosity and nonbonding behavior of recycled concrete and granite cutting waste.

Dr.G. Prince Arulraj, Mr. Adin and Mr. Suresh Khanna obtained the test result that replacement of fine aggregate with granite powder is found to improve the strength of concrete after the replacement of 15% of Fine Aggregate with Granite powder. The utilization of granite powder will avoid disposal problems and related environmental issues. The utilization of granite powder will reduce the usage of river sand and conserve natural resources. The Various percentages of granite powder are added by weight to replace sand by weight which are 0%, 5%, 10%, 15%, 20%, and 25%. To improve the workability of concrete 0.5% Superplasticizer was added. 54 cubes and 36 cylinders were cast. Compressive strength and split tensile strength were found. The test results represent that granite fine as replacement sand has a beneficial effect on the mechanical properties such as compressive strength and split tensile strength of concrete.

Manasseb Joel determined the suitability of Crushed granite fine to replace river sand in concrete production for use in rigid pavement. Various tests like Slump, compressive and indirect tensile strength tests were performed on concrete. 40.70N/mm² and 2.30N/mm² are the values obtained as high compressive and indirect tensile strength respectively with the partial replacement of river sand with 20% Crushed Granite Fine, as against values of 35.00N/mm² and 1.75N/mm², obtained with the use of river sand as fine aggregate after 28 days of curing the. Based on the results of tests obtained, river sand can be replaced with 20% Crushed Granite fine and is recommended for use in the production of concrete for use in the rigid pavement. Conservation of river sand in addition to better ways of disposing wastes from the quarry sites are some of the merits of using Crushed Granite Fines.

Kanamalai Williams C, Partheeban P, Felix Kala T. investigated the high-performance concrete made with replacement of fine aggregate with granite powder. The various percentage of granite powder was added by weight. 0%, 25%, 50%, 75%, and 100% as a replacement of fine aggregate used in concrete and cement was replaced with 7.5% Silica fume, 10% fly ash, 10% slag, and 1% superplasticizer. The effects of curing temperature at 32 0.40 Celsius water binder (w/b) ratio were there for 1, 7, 14, 28, 56, and 90 days which is shown on various test like compressive strength, split tensile strength, modulus of elasticity, drying shrinkage, and water penetration of concrete were studied. Experimental results show that there is an increase in the proportions of granite powder resulted in a decrease in the compressive strength of concrete. After the replacement of 25% granite powder concrete, the highest compressive strength was shown which was 47.35 kPa after 90 days. The overall conclusion revealed that granite powder can be utilized as a partial replacement of fine aggregate in high-performance concrete.

V Methodology and Investigation

5.1 Methodology:

A series of 9 cubes specimens and 3 conventional concrete cubes are cast and tested for compressive strength.

To achieve the aim and objectives, a methodology developed is as follows:

1. Casting of the cube and check for Compressive Strength with conventional concrete for mix M20 is carried out.
2. The Casting of the cube with replacement of Fine Aggregate with Granite fines for mix M20 with varying percentage is done.
3. Testing of the above said cube at 28 days for compressive strength is done respectively.
4. Compressive Strength result tests are compared with that of the conventional concrete strength.

5.2 Experiment and Investigation

The experimental program is designed to study the bond strength of Granite Fines wastes with varying percentages replacing Fine Aggregate in concrete. The replacement of Fine Aggregate is done at 0%, 10%, 20%, and 30% in M20 concrete mix which is later used in the casting of the cubes. Cube specimens of 150 mm x 150 mm x 150 mm are cast and are kept in water for curing to 28 days for testing the compressive strength of concrete

5.3 Material to be Used

1. Cement: Ordinary Portland cement of 53 grade is used in this experimentation conforming to I.S- 8112- 1989.
2. Fine Aggregate: Fine aggregates are the second ingredient of the aggregate phase in concrete. Sand is the most commonly used fine aggregate in concrete. Fine aggregates that pass from 4.75 mm (No.4) sieve but are retained on 75um (No.200) sieve.
3. Coarse Aggregate: The coarse aggregates used for the concrete are 20 mm passing and retained on a 4.75mm.
4. Water: Potable water is used for the experimentation.
5. Granite: Granite belongs to the igneous rock family. The density of the granite is between 2.65 to 2.75 g/cm³. The material is ordered from Granite Powder Company named Rajendra R Raibagi situated in Gajendragad, Karnataka, India. The type of Granite used is a Mixture of Himalayan Blue and Mudgal Grey.

Table 1 Material Testing

Materials	Specific Gravity	Water Absorption	Grading
Coarse Aggregate	2.61	0.54	As per table 2 of IS383
Crushed Sand	2.66	2.0	Zone 2 as per Table 4 of IS 383
Granite Fines	2.7	0.5 to 1.5%	---

Table 2 Chemical Compound of Granite Powder

Chemical Compound	Chemical Formula	Weight in %
Silica	SiO ₂	70.86
Alumina	Al ₂ O ₃	01.89
Ferric Oxide	Fe ₂ O ₃	02.39
Calcium Oxide	CaO	00.80
Magnesium Oxide	MgO	02.02
Sodium Oxide	Na ₂ O	09.34
Potassium Oxide	K ₂ O	04.71
Loss on Ignition	LOI	02.06

5.4 Material Testing

Fine aggregate and coarse aggregates are tested before the experiments and checked for conformity with relevant Indian standards. Specific gravity test and water absorption test of coarse aggregate are conducted as per IS: 2386 (Part III) 1963. Specific gravity test of fine aggregate is done as per IS: 2720 (Part II) 1973.

5.5 Concrete Mix Proportions

Concrete for M20 grade is prepared. A mixed proportion of 1: 1.5: 3 with 0.5 water-cement ratio to get a characteristic strength of M20 which are considered for this experimental study. The exact quantity of materials for each mix is calculated for one cube.

5.6 Preparation of Mix Design

Four sets of mix design were prepared with the use of different substituents such as follows:

1. Cement + fine aggregate + 20 mm coarse aggregate + water
2. Cement + (Granite Fines 10% + Fine aggregate 90%) + coarse aggregate + water
3. Cement + (Granite Fines 20% + Fine aggregate 80%) + coarse aggregate + Water
4. Cement + (Granite Fines 30% + Fine Aggregate 70%) + Coarse aggregate + Water

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

Table 3 Material Required For 1 Cube

Sr. No	% Of Granite Powder	Coarse Aggregate in Kg	Fine Aggregate in Kg	Cement in Kg	Granite Powder in Kg
1	0%	5	2.5	1.7	0
2	10%	5	2.25	1.7	0.25
3	20%	5	2	1.7	0.5
4	30%	5	1.75	1.7	0.75

5.7 Mixing and Casting

Thorough mixing of the materials is essential for the production of uniform concrete. The mixing should ensure that the mass becomes homogenous, uniform in colour, and consistency. There are two methods adopted for mixing concrete:

- (i) Hand mixing (ii) Machine mixing

From two methods, hand mixing is efficient and also economical for small concreting work.

An in-house casting setup is done in the Laboratory of Civil department using Cubes of 150mm x 150mm x 150mm.

5.8 Curing

The process of providing adequate temperature, moisture and time to allow concrete achieve to the desired properties for it is termed as 'Curing'. The cubes are stored in the moist air of at least 90% relative humidity a place free from vibration, and at a

temperature of 27°C for 24 hours. After this period, the cubes are marked and removed from the mold and unless required for the test within 24 hours, immediately submerged in clean fresh water and kept there until taken out just before to the test for 28 days.

5.8 Testing:

Compression test is to be conducted on cubes on proposed experimentation work.

5.9 Compression Test:

The Compression test is the most common test conducted on concrete. The test is easy to perform and gets most of the desirable characteristics properties of concrete which is related to its compressive strength. The compression test is carried out in the cube of the size 150 x 150 x 150 mm. The cubes are filled with 0%, 10%, 20%, and 30% with Granite Fines. Each layer is compacted by hand compaction. After the top layer has been compacted the surface of the concrete is brought to the finished level with the top of the mold, using a trowel. After 24 hours the cubes are remoulded and are shifted to a curing tank wherein, they are allowed to cure for 28 days. After 28 days of curing the cubes, are tested on a digital compression testing machine as per I.S. 5161959. The failure load is noted. The compressive strength is calculated as follows:

$$\text{Compressive strength (MPa)} = \text{Failure load divided by cross-sectional area.}$$

VI Result and Discussion

In this study, the different percentages of Granite Fine as 0%, 10%, 20%, and 30% were replaced by Fine Aggregate in concrete. Results obtained in this research have been given in subtitles as 'compressive strength'.

Compressive Strength:

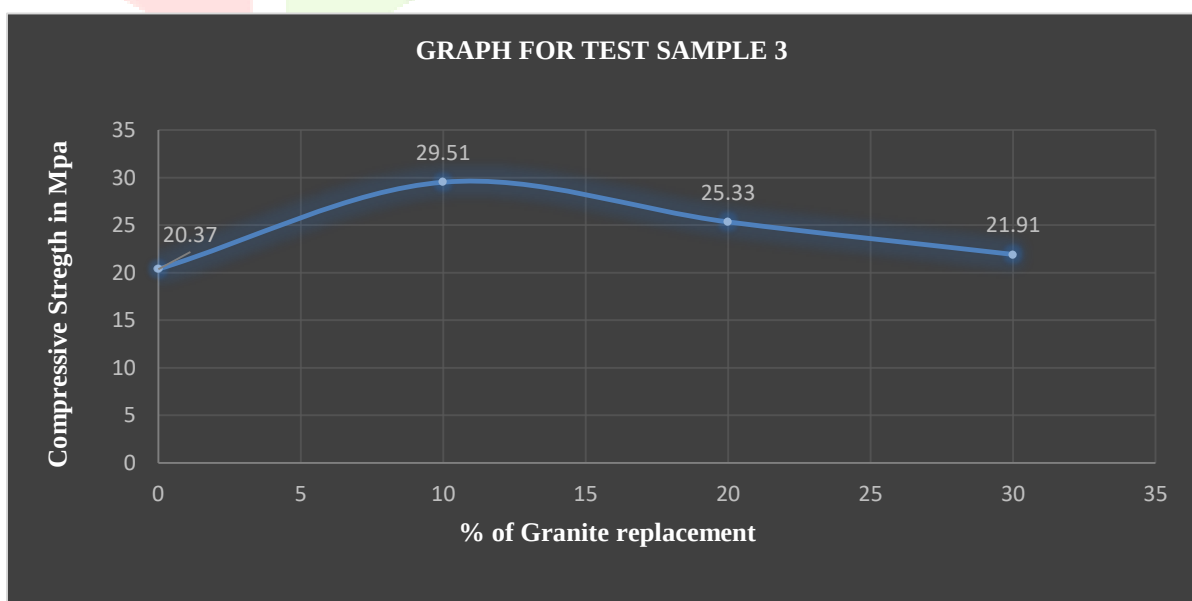
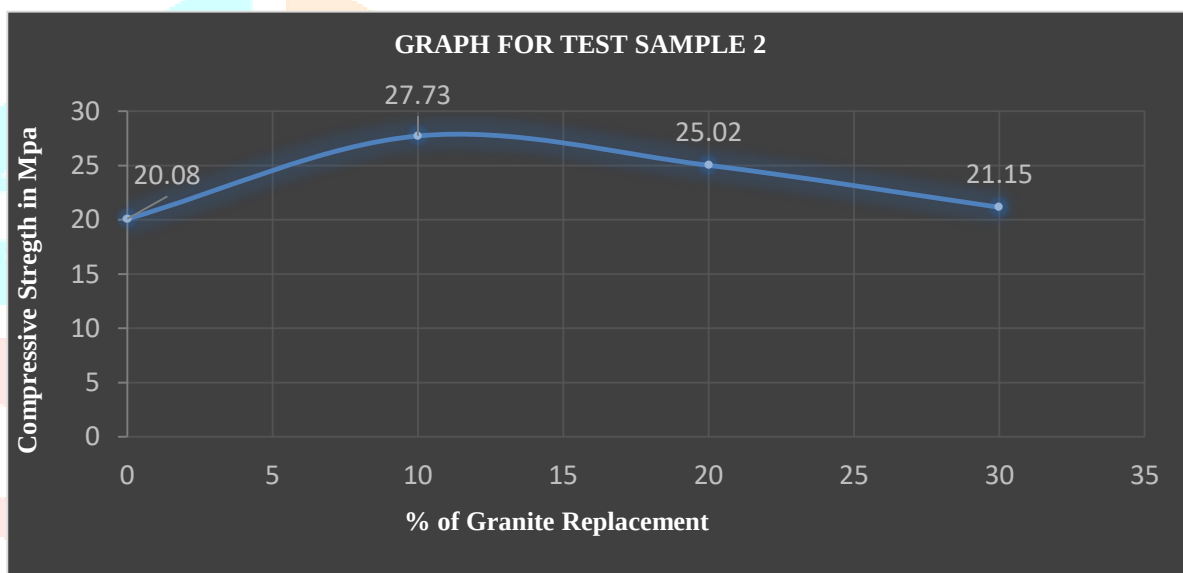
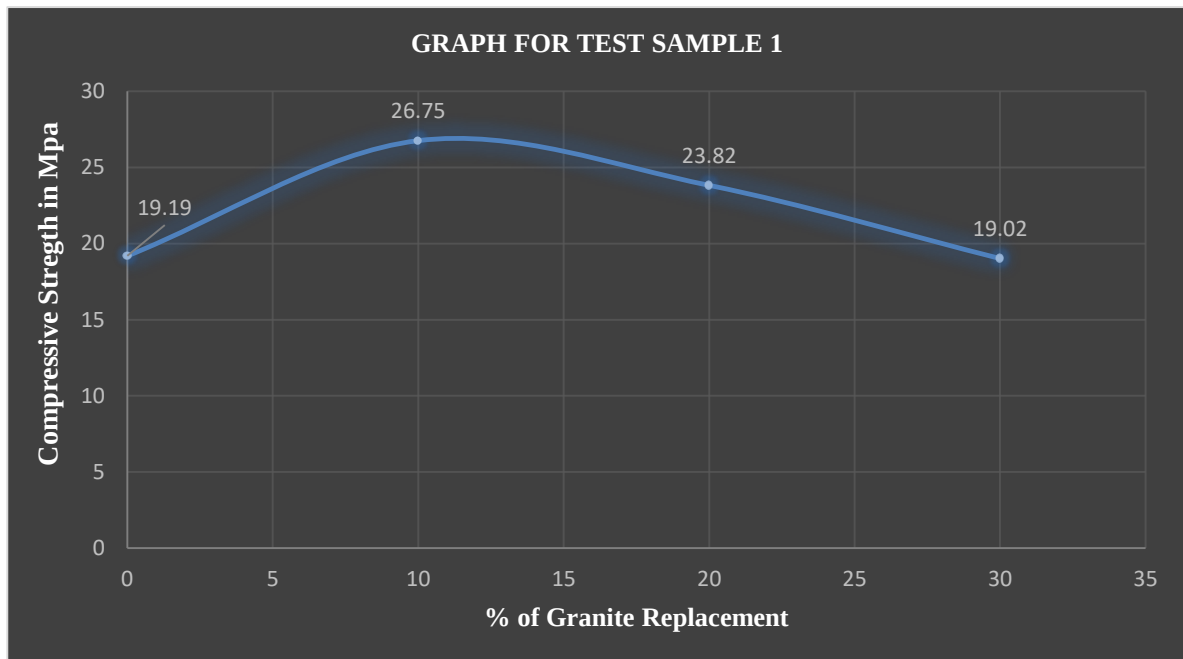
Results of Compressive strength for M20 grade of concrete on cube specimen with 0%, 10%, 20%, and 30% with Granite Fine replacement of Fine aggregate in concrete are shown in the table.

Table 3 Material Required For 1 Cube

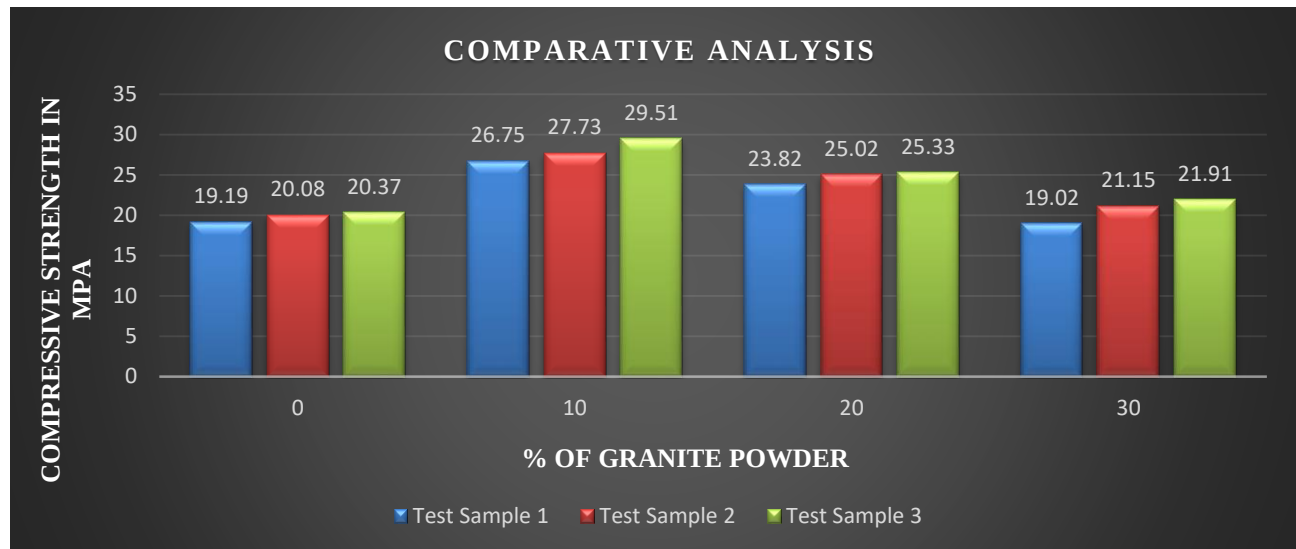
COMPRESSIVE STRENGTH In (KN)					
Sr. No	%Of Granite Powder	Test Sample 1 in KN	Test Sample 2 in KN	Test Sample 3 in KN	Average of all 3 samples In KN
1	0	448	452	457	452
2	10	602	624	664	630
3	20	536	563	570	556
4	30	428	476	796	465

Table 3 Material Required For 1 Cube

COMPRESSIVE STRENGTH In (Mpa)				
Sr. No	%Of Granite Powder	Test Sample 1 in N/mm ²	Test Sample 2 in N/mm ²	Test Sample 3 in N/mm ²
1	0	19.19	20.08	20.37
2	10	26.75	27.73	29.51
3	20	23.82	25.02	25.33
4	30	19.02	21.15	21.91

GRAPH 1 COMPRESSIVE STRENGTH V/s PERCENTAGE OF GRANITE REPLACEMENT FOR SAMPLE 1, 2 & 3

GRAPH 2 COMPARATIVE ANALYSIS FOR ALL 3 SAMPLES



VII Conclusion

Following conclusions can be obtained from the present experimental work on the effects of the varying percentage of Granite Fines Compressive strength.

1. The use of Granite Fine waste in partial replacement of Fine Aggregate in concrete showed an increase in Compressive strength.
2. Compressive Strength shows an increasing trend till 10% of replacement of Granite and further, it decreases which is nearly equal to the strength of conventional concrete.
3. The use of Granite Fine waste in the replacement of fine aggregate shows a 40% increase in Compressive Strength when it is replaced by 10% as compared to conventional concrete.
4. The comparative increase in compressive strength as compared with conventional concrete at 20% and 30% of Granite fine waste content are 24% and 4% Respectively for M20 mix of concrete.
5. All the Specimens with Granite Fine Waste failed in Crushing Mode.

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Experimental Study Comparison of Performance of Concrete with Waste Paper, Steel Fiber and Carbon Fibers

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Abstract: The compressive, tensile and flexural performance of reinforced concrete structures is investigated with inclusion of waste paper, steel fibers and carbon fibers. The mass content of the additives used are 10%, 15% and 20% of total mix proportion. Twenty-seven cubes were tested under uniaxial compression and nine beams are tested under four-point bending. Also, 27 cylinders are tested for determination of tensile strength. The size of the cubes considered are 150 x 150 mm. Test results for all the three additives for axial compressive strength, tensile strength and ultimate strain of concrete significantly, will be presented in this project with the detail study of the material flexural behaviour. In flexure, the fibers increase the lateral load bearing capacity and the deflection several times larger than the concrete cubes. In flexure, fiber inclusion can affect the failure mode of the composite structure significantly. This experimental investigation is carried out under mix proportions i.e. M20 and the results of the durability tests are compared with the same mix proportionated concrete cubes. The beams for flexure made of Papercrete, steel fibres and carbon fibers are compared with the conventional concrete beams under four-point bending test. The size of beams under compression loading considered are 2000 x 100 x 200 mm. The main aim of this project is to increase the awareness of the use of natural and waste fibers as construction materials in the construction industry.

Index Terms: Carbon fibres, Steel fibres, Waste paper, four-point bending test, durability tests, mix proportions, concrete, cement, deflection.

1. INTRODUCTION

a) Papercrete-

The necessity of providing low-cost, sustainable housing has led to greater interest in alternative construction materials. A term has been coined for a relatively new material basically made of waste paper, cement, and water. It is called "papercrete." Papercrete is a slightly misleading name. It implies a mix of paper and concrete, hence papercrete. But more accurately, only the Portland cement part of concrete is used in the mix – along with other admixtures. Although some people add sand and other additives to improve its behaviour under compressive load, the basic components are still the same. The combination of these materials produces a new construction material, which may provide a way to produce affordable housing on a large scale.

b) Steel Fibers-

Also, Steel fibers are added with concrete to increase the structural properties, particularly tensile and flexural strength. The extent of improvement in the mechanical properties achieved with SFRC over those of plain concrete depends on several factors, such as shape, size, volume, percentage and distribution of fibers.



(a) straight

(b) end-hooked

Fig 1.1: Various steel fibre profile

c) Carbon Fibres-

Carbon Fiber cement-matrix composites are structural materials that are gaining in importance quite rapidly due to the decrease in carbon Fiber cost and the increasing demand of superior structural and functional properties. These composites contain short carbon Fiber typically 5 mm in length, as the short Fiber can be used as an admixture in concrete (whereas continuous Fiber cannot be simply added to the concrete mix) and short Fiber are less expensive than continuous Fiber. However, due to the weak bond between carbon Fiber and the cement matrix, continuous Fiber [2±4] are much more effective than short Fiber in reinforcing concrete. Surface treatment of carbon Fiber (e.g. by heating

or by using ozone, silane, SiO₂ particles or hot NaOH solution) is useful for improving the bond between Fiber and matrix, thereby improving the properties of the composite. In the case of surface treatment by ozone or silane, the improved bond is due to the enhanced wettability by water. Admixtures such as latex methylcellulose and silica fume also help the bond.

I. AIM

The main aim of this project is to increase the awareness of the use of natural and waste fibers as construction materials in the construction industry.

II. OBJECTIVES OF THE STUDY

- To study the physical properties of concrete mixed with waste paper, steel fibers and carbon fibers by conducting durability tests
- To study the flexural behaviour of concrete mixed with waste paper, steel fibers and carbon fibers by experimental investigations conducting four point bending tests.
- To conduct split tensile strength test on of concrete mixed with waste paper, steel fibers and carbon fibers
- To compare the flexural performance of concrete mixed with waste paper, steel fibers and carbon fibers composite beam with conventional steel reinforced concrete (SRC) beams.

III. LITERATURE REVIEW

1]ClaudiuAciu, Dana Adriana Ilutiu-Varvara, NicoletaCobirzan, AncaBalog ^[1]The paper presents a study on the recycling of paper waste, which is frequently found in almost all activity areas, in order to obtain an ecological plastering mortar. The materials used, in four mortar recipes, as well as the methods for their preparation are presented. The research leads to the conclusion that the method for the preparation of plastering mortars with paper waste allows for the use of non-polluting technology with low energy consumption.

2] Barry J. Fuller, ApostolosFafitis, Ph.D., F.ASCE, and Jorge L. Santamaria ^[2] For decades intrepid environmentalists have been building and other structures with a material that recycles wastepaper into an alternative construction material made with cement and other ingredients. They have claimed these “papercrete” structures are strong, durable, and insulating. One solution that has seen increased use in recent years is called as papercrete, which is somewhat of a misnomer in that it is created from waste

paper, cement and such other ingredients as sand, fly ash, and Styrofoam, to name a few.

3] H. Yun1, H. Jung1, C. Choi ^[3] These days CO₂ emission which made from construction sites because of cement using is globally issued. On the other hand, people’s desire to live eco-environment is continuously increasing. In order to resolve these kinds of matters, this study carried out. Papercrete is a new composite material using waste paper as a partial replacement of Portland cement. By using the waste paper, papercrete is not only reducing the amount of cement using but also making environmentally friendly building materials. This study aimed to evaluate the fundamental mechanical properties such as compressive and splitting tensile strength of papercrete containing waste papers as a partial replacement of Portland cement. And it also analyses the stress-strain relation of papercrete to evaluate the ductile behaviour of papercrete.

4] Matthew West, Ryan Hansanuwat, Mark Lyles, Pablo La Roche Ph.D. ^[4] This paper describes the development of a low cost, energy efficient prototype house designed for informal settlements of Tijuana constructed from a variety of local manufacturing waste materials. The 35 m² prototype demonstrates construction techniques using waste car tires and gabion rock cages as a retaining wall system, wood pallets as a roof truss system, waste newspaper blended with Portland cement as a “papercrete” wall system, waste rice sacks integrated into a vegetated roof system, windows made of sewer pipes and dinner plates, and a simple radiant floor heating system using agricultural irrigation tubing. This project is extremely relevant given the increasing number of worldwide urban dwellers with inadequate housing, depleting natural resources for building materials, and greenhouse gas contributions associated with energy intensive building materials travelling great distances. We hope the knowledge attained from this project will ultimately be disseminated into other communities with similar need

5] Fuller, B., and Fafitis, A., Santamaria, J. ^[5] Papercrete is a new construction material made most often with waste paper, cement and water. People have been using papercrete to build low cost homes without a clear understanding of its structural properties. The purpose of this study is to obtain some mechanical and physical parameters of papercrete by doing several laboratory tests. The samples tested were made following the most common mixes that papercrete makers are using currently. The experimental setup used to test the samples is briefly described and some test results are tabulated in tables. This will allow us to reach some conclusions and make several recommendations for using papercrete to build homes.

6] P H Bischoff ^[6]This paper investigates the post cracking response of reinforced concrete tension members made with both plain and steel fiber-reinforced concrete (SFRC). Loading was either monotonic or cyclic, and shrinkage effects are included in analysis of the member response. Tension-stiffening results are used to determine the average tensile response of concrete after cracking, and an expression is developed to predict this smeared behavior as a material property for cracked SFRC, as well as to estimate crack spacing. Specimens with steel fibers exhibited increased tension stiffening and smaller crack spacing's, which both contributed to a reduction in crack widths. The post cracking tensile strength of fiber concrete at the cracks is the determining factor affecting behavior and is a fundamental material property used to predict tension stiffening and crack behavior for conventionally reinforced SFRC. The uniaxial strength of SFRC immediately after cracking governs serviceability behavior, while the post cracking strength at larger deformations governs strength design and is responsible for tension stiffening after yielding of the reinforcement. Cyclic loading did not have a significant effect on either tension stiffening or crack width control for the specimens tested.

7] Joshua A. McMahon Anna C. Birely ^[7]The authors studied that Fiber-reinforced concrete (FRC), particularly steel FRC (SFRC). The stated that it offers the potential to improve the service level performance of structures by controlling the width of cracks and potentially allowing for a reduction in the amount of traditional reinforcing steel. Full-scale tests of hybrid reinforced concrete (continuous reinforcement with SFRC) one-way slab strips were conducted to investigate the interaction of rebar with SFRC. Parameters varied were slab depth, amount of reinforcement, and location of reinforcement. Readings from strain gages on the rebar were used to investigate the impact of SFRC on the service stresses. Crack width measurements were made at regular intervals and compared to strain readings. In SFRC slabs, service stress limits were reached at larger demands than in RC slabs. When service stress limits were reached in SFRC slabs, crack widths were much smaller than common crack width limits, suggesting design for crack widths may be an appropriate method for addressing serviceability in SFRC slabs. Applying the results of the tests to sample bridges, it was demonstrated that SFRC can be used to either decrease the amount of steel in a bridge deck to satisfy service performance requirements or to increase the slab span without the need for additional reinforcement.

8] J. Carrillo, J. Cárdenas Pulido, W. Aperador ^[8]

The study conducted by the author's points out the influence of two corrosive environments at a short term and the fiber dosage on the flexural performance of steel fiber reinforced concrete, SFRC. The experimental program comprised the tests of 54 SFRC specimens having steel fibers characterized by a length/diameter ratio of 65 and fiber dosages of 30 and 60 kg/m³. Regarding the corrosive environments, cylinders and beams were subjected to the action of a watery environment and to an environment of 3.5% NaCl solution (chloride ion) during a period of 60 days. The results were compared with those of cylinders and beams kept in unaltered conditions. For this exposure time that is equivalent to the corrosion initiation phase, it was observed that chloride ions of 3.5% NaCl solution cause degradation in mechanical performance of SFRC; for instance, loss of flexural strength of roughly 10% and reduction of flexural toughness equal to 11%. However, saline exposure caused an increase of the deflection capacity of SFRC for the initiation phase of corrosion, which can improve its ductility and bond capacity between the matrix and embedded steel fibers. Finally, equations have been proposed to describe the effect of watery and saline environments in the initiation phase of corrosion on CRFA subjected to bending stresses.

9] Martin Herbrand, Viviane Adam, Martin Classen, Dominik Kueres and Josef Hegger ^[1]. In this paper, the strengthening method and the experimental results obtained at RWTH Aachen University are presented. The authors stated that due to Increasing traffic loads and changes in code provisions lead to deficits in shear and flexural capacity of many existing highway bridges. Therefore, a large number of structures are expected to require refurbishment and strengthening in the future. This projection is based on the current condition of many older road bridges. Different strengthening methods for bridges exist to extend their service life, all having specific advantages and disadvantages. By applying a thin layer of carbon textile-reinforced mortar (CCTFS) to bridge deck slabs and the webs of pre-stressed concrete bridges, the fatigue and ultimate strength of these members can be increased significantly. The CCTFS layer is a combination of a corrosion resistant carbon fiber reinforced polymer (CFRP) fabric and an efficient mortar.

10] Zoi C. Tetta, Lampros N. Koutas, Dionysios A. Bournas ^[3]This paper presents an experimental study on shear strengthening of rectangular reinforced concrete (RC) beams with advanced composite materials. Key parameters of this study include: (a) the strengthening system, namely textile-reinforced mortar (CTFS) jacketing and fiber-reinforced polymer (FRP) jacketing, (b) the strengthening configuration, namely side-bonding, U-wrapping and full wrapping, and (c) the number of the strengthening layers. In

total, 14 RC beams were constructed and tested under bending loading. One of the beams did not receive any strengthening and served as control beam, eight received CTFS jacketing, whereas the rest five received FRP jacketing. It is concluded that the CTFS is generally less effective than FRP in increasing the shear capacity of concrete, however the effectiveness depends on both the strengthening configuration and the number of layers. U-wrapping strengthening configuration is much more effective than side-bonding in case of CTFS jackets and the effectiveness of CTFS jackets increases considerably with increasing the number of layers.

IV. PROBLEM STATEMENT

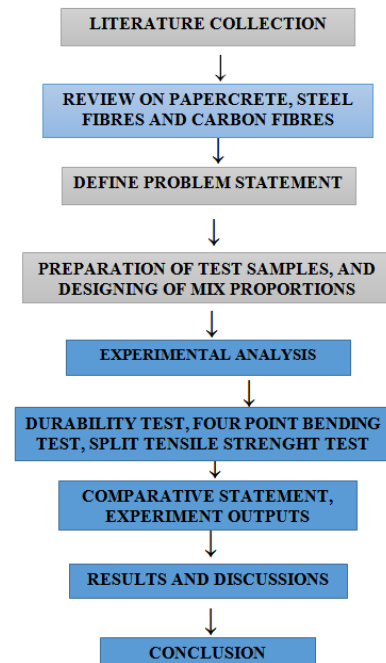
Ecological concerns have resulted in a renewed interest in natural materials, and such issues as recyclability and environmental safety have become increasingly important for the introduction of new materials and products. Structural polymer composites are traditionally utilizing man-made fibres (such as glass or carbon fibres) as reinforcement, but environmental issues have generated a considerable interest in natural fibres. Plant fibres such as flax, hemp, sisal and kenaf are under consideration as environmentally friendly and relatively low-cost alternatives for glass fibres in structural engineering composites. Many researches have carried out work on steel fibers and their results have shown that steel fiber reinforced concrete is more effective than conventional concrete and the steel fibers are very effective in decreasing or eliminating the early plastic shrinkage occurring. Hence this project aims to combine the products as additive in concrete gradually by 10%, 15% and 20% and observe the physical as well as strength characteristics.

V. SCOPE

The scope of the research is focused on determining the accuracy of anecdotal evidence obtained from papercrete makers and from examination of existing structures as well as studying the compressive properties of this new material made of waste paper, cement, and water and additionally with steel fibers and carbon fibers. In addition to the compressive properties, a limited number of additional tests are performed. The objective of these tests is to gain some insight on performance of concrete with the inclusion of different materials such as waste paper, steel fibers, and carbon fibers.

VI. METHODOLOGY

The project study involved two stages. The primary data was gathered through a Literature survey targeted by web searches and review of ebooks, manuals, codes and journal papers. After review the problem statement is defined and sample preparation is taken up for detail study and analysis purposes. This project execution follows the flow chart given below -



Flow Chart

VII. MATERIALS PROPERTIES

Materials used in Concrete -

M-Sand :

Getting good quality of M-sand which should be free from organic impurities. While adding the M-sand to the mix, it should be in uniform size i.e. all the M-sand particles should be fine. The M-sand obtained from local resource is used in production of fly ash based geopolymer bricks. The physical and chemical properties of M-sand obtained by testing the samples as per Indian Standards.



Fig. M-Sand

Cement:

A cement is a binder substance used in construction that say and harden and can bind other material together. The most important type of cement is used as a component in the production of mortar in masonry, and of concrete which is a combination of cement and aggregate to form a strong building material. Cement used in construction can be characterized has being hydraulic or non-hydraulic, depending upon ability of cement to set in the presence of water. Non-hydraulic cement will not set in wet condition under water, rather, it set as it dries and react with carbon dioxide in the air. It can be attack by some aggressive chemical after setting.



Fig.Cement

Coarse aggregate:

IS 383-1970 defines coarse aggregates as Aggregates most of which is retained on 4.75 mm IS Sieve and containing only so much finer material as is permitted for the various types described in this standard

Coarse aggregates may be described as:

1. Uncrushed gravel or stone which results from natural disintegration of rock,

2. Crushed gravel or stone when it results from crushing of gravel or hard stone, and

3. Partially crushed gravel or stone when it is a product of the blending of uncrushed gravel stone and crushed gravel or stone.



Fig Coarse aggregate

Water:

According to IS 456 : 2000, water used for mixing and curing shall be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel. Potable water is generally considered satisfactory for mixing concrete. The pH value of water shall be not less than 6

Steel Fibre:

The amount of fibres added in the concrete mix is expressed as a percentage of total volume of the composite (concrete and fibres), termed volume fraction (V_f). V_f typically ranges from 0.1 to 3%. Aspect ratio is defines as fibre length (l) by its diameter (d). The aspect ratio of Fibres of a non circular shape can be determines by using an equivalent diameter for the calculation of aspect ratio. However, fibres which are too long tend to ballZ in the mix and create workability problems. Some recent research indicated that using fibres in concrete has limited effect on the impact resistance of the materials. The result of fiber reinforcement concrete indicates that the use of micro fibres offers better impact resistance compared with the longer fibres.

VIII. TESTS ON CEMENT:

1) Standard Consistency -

The standard consistency of a cement paste is defined as that consistency which will permit the Vicat plunger of 10 mm diameter and 50 mm length to penetrate to a point to 7 mm from the bottom of the Vicatmould Figure 3.1. The experiment was done as per IS 4031-Part IV.

2) Initial Setting Time

Initial setting time is regarded as the time elapsed between the moments that the water is added to the cement to the time that the paste starts losing its plasticity. Experiment was done as per IS -269:1989, clause 6.3

3) Final setting time

Final setting time is the time elapsed between the moments that the water is added to the cement and when the paste has completely lost its plasticity. Experiment was done as per IS -269:1989, clause 6.3

4) Fineness of Cement

Fineness is a measure of total surface area of cement. For finer cements surface area will be more. Fineness influences the rate of hydration, rate of strength development, shrinkage and rate of evolution of heat. Experiment was done as per IS 4031-Part I-1996.

5) Density of Cement

Le Chatelier's flask is used to determine density of cement. Kerosene which does not react with cement is used. Experiment is done in Le Chatelier's flask.

6) Soundness of Cement

The testing of soundness of cement is to ensure that the cement does not show any applicable subsequent expansion. Unsoundness in cement is due to excess of lime, magnesia or excessive proportion of sulphates. Experiment is done by Le Chatelier method. And the value of soundness is 1mm.



Mixing of concrete

of total mix proportion. In this chapter test conducted on materials, beams, cubes, cylinder will be presented. This experimental investigation is carried out under mix proportions i.e. M20 and the results of the durability tests are compared with the same mix proportionated concrete cubes.

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IX. RESULTS AND DISCUSSIONS

The results of material testings, compressive strength, split tensile strength test and flexural performance of concrete structures included with fibers are presented in this chapter. The mass content of fibres considered is 10%, 15% and 20%



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Municipal Solid Waste Management System For Pune City

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Abstract -

The growing population create problem of solid waste management (SWM) is a major challenge for Indian cities and villages. We are thinking about to keeping our Pune city clean but have we ever thought about the wastes in the land filling area of the city. Our aim is reduction, recycling and reuse of the waste; to make cities clean. The study is all about the growth of solid waste management (SWM) in different part of the Pune city. Pune city have some policy and program to be adopted by the municipal corporation in managing solid wastes. There are cities which are successfully converting the solid waste into compost, vermicomposting, Biogas, RDF (Refused Derived Fuel), etc., we need to learn their process to be replicated in each cities of India. Solid waste management includes all the activities and actions which required to manage waste from its collection to it's final disposal. This includes the collection, transport, treatment and disposal of waste. The main and important aim of waste management is to minimize the effect of waste product and hazards to the environment. Effective waste management is quite expensive, usually comprising 20%-50% of municipal budget. With rapid urbanisation, industrialization and an explosion of population in Pune, solid waste management will be a key challenge for governments and local municipal bodies in future. The "SWACHH BHARAT ABHIYAAN" (clean India mission) was created to tackle theses issue's which are mainly related to waste management, cleanliness and sanitation on a national level.

Index Terms – Pune, Solid Waste Management, RDF, Swachh Bharat Abhiyaan.

1. Introduction –

In Pune city, solid waste management has become a top superiority. Day by day population increases with increasing waste. According to increasing number of population, management face challenge to manage all those things. Management of Solid Waste(MSW), may be defined as the control of generation, segregation, storage, collection, transfer and transport, processing and disposal of waste based on technical principles. This includes all technological, financial, institutional and legal and policy aspects involved for solving the whole spread of issues related with solid waste. In India, Pune is 13th cleanest city, according to Swachh Survekshan. Term 'waste' relates to materials which is produced by human activities and the process is generally undertaken to shorten their effect on environment and human health. Poor waste management can create serious health and social problems in a nation. With increasing population, management of Municipal Solid Waste (MSW) in the country has emerged as a severe problems not only because of the environment and artistic troubles but also because of the sheer quantities generated every day. Segregation at source, collection, transportation, treatment and scientific disposal of waste was largely insufficient leading to degradation of the environment and poor quality of life. In Pune city due to growth of population solid waste is increases. Due to improper management of solid waste most common problems associated it includes odour nuisance, diseases, atmospheric and water pollution (Jilani 2002). And also improper disposal on the landfill site's may causes the diseases like asthma, jaundice also reduces the quality of the drinking water (Bean, et al. 1995). In Pune city solid waste comprises, discarded and unwanted materials from commercial, industrial, from houses, hospital, hotels, establishment market changing life style and increase in urban population lead to the generation of

solid waste. If solid waste disposed off in open area on land, then it causes environmental causes, negative impact on health. Large amount of waste poorly disposed and untreated. PMC (Pune municipal corporation) is responsible for collection, storage, segregation, transportation and disposal of MSW. So there is immediate need for designed scientific Integrated SW management system using GIS, Remote sensing to control and minimize negative effects on environments. Covid-19 in India shows that the peak is yet to come and India has a long way to go to control the virus. Because of coronavirus the biomedical waste is generated from the hospitals and laboratories not all the waste is hazardous but even the smaller amount of hazardous waste is enough to spread the virus and hinder our fight against corona. Biomedical waste required handled consciously and it should be treated carefully and properly in way that it does not affects anyone before it gets treated. Solid waste management is crucial and essential job in response to coronavirus after seeing all condition that amount of biomedical waste has been increased to 15 times more than amount of the waste generated from the general patients.

2. Objectives -

The main objective of this research work is to decide the most suitable disposal method of "Municipal Solid Waste Management for Pune city" for future forecast in year 2050

3. Study Area -

Pune is the second largest quick developing urban city in Maharashtra and ranks eight at national level. It is now quickly changing from an education-administrative center to an important industrial centres and the IT Center. Pune is a plateau or upland city which is situated near the western margin of the Deccan Plateau or upland. Pune is situated at an elevation of 560 m above the mean sea level. PMC lies between latitudes 18° 25'N and 18° 37'N and longitudes between 73° 44'E and 73° 57'E and the geographical area is around 243.84 Sq. Km with a population of 3.12 million. The area in the central part of the PMC is slowly populated than the marginal regions.

4. Methodology -

The purpose of the study is find out the total solid waste by population at 2050 year. For the work, first we calculate population projection for 2050 year using geometrical increase method. Population projection is calculated using the equation:

$$P_b = P_a(1+r)^t;$$

P_b = is population of the for which projection is to be made

P_a = is population of the base year

r = is the rate of growth divided by 100

t = is the number of years between 'a' and 'b'

Ex: If present population (2020) of a Pune city is 6629 with a growth rate of 2.74%, then project the population for the year 2050.

$$\begin{aligned} P(2050) &= P(2020) * (1+2.74/100)^{30} \\ &= 6629 * 2.250 \end{aligned}$$

$$P(2050) = 14915.25 \text{ Thousands}$$

4.1 Determination of waste generation rate:-

- Small Town-100g/p/day
- Medium Town-300-400g/p/day
- Large Town-500g/p/day

For Pune city waste generation rate is more than 500g/p/day because Pune is rapid growth city.

Future waste generation = per capita waste generation* projected population

We calculate area required for sanitary landfill:-

- Location - Pune
- Waste generation - 2677 tons per day (current)
- Design life - Active period (30 year)
- Topography - Hilly area
- Water table - Below 3m ground surface
- Average total precipitation - 722mm per year
- Current waste generation per year = 2677 t
- Estimated waste generation after 30 yr =7458t
- Total waste generation in 30 yr = $0.5(2677+7458) * 365 * 30$
 $= 55,489,125$
 $= 56 \text{ MT}$
- Total waste volume (assumed density 0.85 t/cu. m) = $56 * 10^6 / 0.85$
 $= 65.88 * 10^6 \text{ cu. m}$
- Volume of daily cover = $0.1 * 65.88 * 10^6$
 $= 6.5 * 10^6 \text{ cu. m}$
- Volume of linear and cover systems:- $= 0.125 * 65.88 * 10^6$
 $= 8.23 * 10^6 \text{ cu. m}$
- First estimate of landfill volume = $(65.88 + 6.5 + 8.23 - 6.5) * 10^6$
 $= 74.11 * 10^6 \text{ cu. m}$

4.2 Area Calculation-

- Area required for infrastructure facility:- $= 0.15 * A = 0.15 * 37.05 * 10^5$
 $= 55.57 * 10^5 \text{ sq. m}$
- Area available for landfill Area required for landfill separation
 $= 0.85 * A_r$
 $= 0.85 * 37.05 * 10^5$
 $= 31.49 * 10^5 \text{ sq. m}$
- Area required for landfill separation $A_i = (74.11 * 10^6) / 20$
 $= 37.05 * 10^5 \text{ sq. m}$
- Total area required for landfill separation = $1.15 * A_i$
 $= 1.15 * 37.05 * 10^5$
 $= 42.60 * 10^5 \text{ sq. m}$

4.3 Functional Element-

Various functional elements associated with the management of solid wastes such as generation, storage, collection, transportation, processing and disposal which are given below-

•Waste generation-

Waste generated at the start of any process, and at every stage as raw materials are converted into goods for consumption. The source of waste generation determines composition, quantity and waste characteristics.

•Waste storage-

Storage of Municipal solid waste (MSW) after collection and prior to transportation to the transform Or disposal site . It is an relevant practical component. Storage time depends on the type of Municipal solid waste.

For example,

the ecological or biodegradable waste cannot be stored for long in a storage holder because of it's decomposable nature. There are so many choices for storage like plastic containers, conventional dustbins (of households), used oil drums, large storage bins (for institutions and commercial area's Or servicing depots), etc.

•**Waste collection**-Collection refers two features: collection from the origin or source of generation to the upcoming collection point and collection from that point to the wide vehicles for transportation or to the transfer stations and then finally go to the processing plant / disposal area. Collections based on the number of containers, frequency of collection, types of collection services and track.

•**Transfer and transport-**

This involves transfer of waste from minor collection vehicle to major ones at transfer stations.

• **Processing**-It is very important functional component of Solid Waste Management system, which leads to many types of resource recovery, recycling, energy generation, production of organic manure, etc.

•**Disposal of final projects-**

Engineering principles are followed to intern the waste to the little possible area, reduce them to lowest particle volume by compaction at area or site and cover them after each day's operation to shorten exposure to ant/vermin.

4.4 Waste Treatment Methods

1) Windrow Composting- This method is useful for disposal for the disposal of biodegradable waste. This method is not expensive composting method. It improves the fertility of soil. eg. Yard waste.

2) Sanitary Landfill- It involve the dumping of waste into a land fill. A low-laying open area out of the city where solid waste/ Garbage is collected and dumped. e.g. Food Waste

3) Incineration Method- It is mainly used to dispose of the medical waste hazardous and toxic wastes. Waste can be easily be rid by using this method. It features combustion of waste to transform them into base component with the generated heat being trapped for Deriving energy. eg. E-waste

4) Recycling- It is the process of convert waste material to useful product. This is done to reduce the use of raw materials and minimize the quantity of waste generation.

5) Integrated System- Integrated waste management system all inclusive waste prohibition, recycling, composting and disposal program. An efficient integrated system considers how to prohibit, reuse, recycle, manage solid waste in ways that most efficiently. and it protect environment and human health.

6) Vermiculture-It is a technique based on utilizing earthworms to convert organic waste into vermicomposting, the product of decomposition by various worms. Harvesting worms that take part in decomposing organic waste and convert it into nutrient rich fertilizer.

7) RDF- RDF (Refuse Derived Fuel). This fuel is produced from fundamental which are explosive or combustible that the industry calls Municipal Solid Waste (MSW) for short. This waste, which is from industrial or commercial areas or sites is burned to produce electricity power. Refuse Derived Fuel (RDF) is a renewable energy source. That make sure waste isn't thrown into a landfill area and instead, put to sustainable use.

5. Result and Discussion

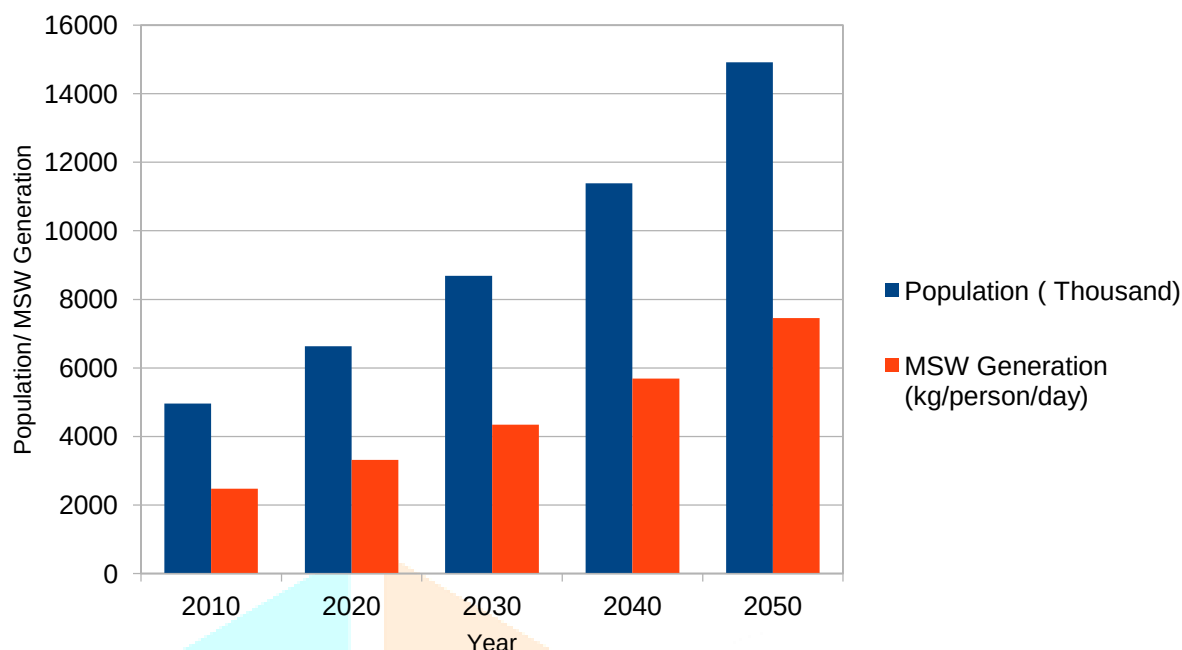


Fig 1. Bar chart OF MSW generation, Population projected form 2010 to 2050.

Total population of Pune city and waste generated from population, Rapidly Increasing from 2010 to 2050.

According to climate change, seasonal variations from wet to dry season, which cause significant changes in the moisture content of solid waste, varying from less than 50% in dry season to greater than 65% in wet season. In wet months, collection and disposal of wastes are often more problematic. High temperature and humidity cause solid wastes decomposes for more rapidly than in colder climates. In India usually a community storage system is practised where individuals deposit their waste in bins located at street corners and at specific intervals. The containers generally are constructed of metal, concrete or a combination of the two.

6. Conclusion

From the study is concluded municipal solid waste disposal at urali devachi depot at Pune, in India. MSW creates many problems to human health as well as to environment. Open Dumping of solid waste affects on the aesthetic view of surroundings area and produce bad smell in nature. At the time of decomposition of waste released many gases like SO₂, CO₂ which affect on human health. From this process land and air also get polluted. It also causes harmful effects on human health. Leach-ate is a corrosive activity, which is very harmful to human beings. From the land pollution the water table get polluted. It is not safe, most important for drinking, commercial and industrial purposes. In Pune city it is observed that there is enough provisions for recycling the waste, but plants are unable to operating at full capacity, as a result waste is getting piled up. Municipal corporation should understand the commercial cost and benefit aspects of creating capacity to recycle is not enough. The main problem is that in most of the cases, for recycling of waste municipal corporation does not have its own plant, so it has to depend on the private companies. These private companies have an edge in case of investment, efficiency, effectiveness and technology. These private companies are driven by the market dynamism or energy of supply and demand, investment and output and cost and profit. The moment they realize that the operation is not profit-making they surrender the operation. Therefore it is Mandatory that the authority understands the existing commercial aspects and market competition. Municipal corporation should understand the pros and can of consensus with the private players. PPP (public private partnership) is good, but needs enough defence measures for sustainable and stable operation. There should be proper section and provision for fine and also against breach of contract. The contact with NGO's and private players should be comprehensible. Corporation or local municipalities are spending immense amount on keeping the city clean. There is vast cost attached with the collection and conversion of waste. The complete process is cumbersome and needs effective handling at each and every step. It is inappropriate to see litter all around in a promising city such as Pune. Everyone likes cleanliness. Commitment from citizen, government and the corporation is crucial to keep city

garbage free. The study determines the capacity to use GIS , GPS and remote sensing technology for the effective assessment of solid waste management system will reduce the human health problems and environment risk. The study is useful in planning for the city in future. It highlights on the importance of the requirement of solid waste system.

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To Enhance the Strength of Concrete by Partial Replacement of Coarse Aggregate with Tile Waste

Prof.Akshay B. Rahane, Vrushali S. Jagtap, Papiha R. Wade, Mohammad Ismail

Abstract:

Growth in construction industry is linked to the growth of infrastructure sector and the building industry. Construction industry has been growth @10-12% per annum. Concrete is widely used as a construction material due to inherent advantages. The demand for granite aggregates only expected to grow as the demand for infrastructure is ever increasing. Hence, there is a pertinent need to look for alternate materials to granite aggregates. This study explores use of ceramic tile waste as an option to the replacement of granite aggregates in terms of suitability. In this study the ceramic tile waste is being used to replace the granite aggregate i.e., coarse aggregate (CA). The ceramic coarse aggregate (CCA) is used in concrete by replacing CA by 25%, 35% and 45%. To compare the results of conventional concrete (CC) with CCA concrete a concrete design mix of M20 is produced with various proportion of CCA material. Due to the good bounding nature of ceramic material with cement it increases the strength of concrete. From the study it is found that the percentage of replacement of CA with CCA material is 45%, within which the performance of concrete is better, and all the results attained within the designed limit.

1. Introduction:

The ceramic waste will help to increase the high compressive strength of the concrete when compared to the other materials. Considering the environmental factors, we can recycle the construction and debris waste used in the concrete. Concrete is an essential element in the construction material which is usually associated with coarse aggregate henceforth coarse aggregate acts as an essential element in the construction field. In the present condition the demand of coarse aggregate is going increased, and it leads to the gradual cost increment of aggregates. Thus, the introducing new ceramic tiles from waste ceramic tiles by crushing it to get the required size. The 30% of ceramic products are being waste daily so there is a small cost of this waste or sometimes it has no cost because the ceramic products are not recycled and reused. The utilization of concrete in Indian construction is the rate of about 400 million tons per year and if this continues it may reach a billion tons in less than a decade. Concrete is made up of various aggregates present in the earth's crust, in this manner its assets are consistently drained causing ecological strain. Environment deliver solid has also been affected by various human actions which deliver solid waste in significant amounts i.e., more than 2500 million tons per year, inclusive of all the industrial, medical, agricultural, and other forms of waste from the rural and urban areas. Clearance of all these solid wastes causes various issues and complication there by affecting ecology.

The utilization of concrete in Indian construction is the rate of about 400 million tons per year and if this continues it may reach a billion tons in less than a decade. Concrete is made up of various aggregates present in the earth's crust, in this manner its assets are consistently drained causing ecological strain. Environment deliver solid has also been affected by various human actions which deliver solid waste in significant amounts i.e., more than 2500 million tons per year, inclusive of all the industrial, medical, agricultural, and other forms of waste from the rural and urban areas. Clearance of all these solid wastes causes various issues and complication there by affecting ecology. Presently large amounts of ceramic wastes are generated in ceramic industry which would have an important impact on environment and humans. But now a days the awareness regarding the use of ceramic waste in construction field has increased. Even this type of usage products solid waste but the disposal of them is not much complicated compared to the waste and pollution by the source industries. The non-biodegradable ceramic materials used for floor tiles, wall tiles and weather course tiles, sanitary ceramic products, electrical ceramic insulators, and ceramic utensils etc. can be conveniently recycled into concrete elements for various services and locations. This replacement has numerous advantages such as the economy using as sustainable material and reduction solid waste disposal and minimize the environmental hazardous.

Keywords: Infrastructure sector, Granite, Ceramic material, Conventional concrete, Mix design, Compressive strength, solid waste, ecology, sustainable material, construction industry, Coarse aggregate.

2. Objective of study:

- 1) To analyze the potential application of tile waste in concrete production which would reduce the usage of coarse aggregate in concrete and preserve the clean environment.
- 2) To reduce the cost of construction and evaluate the significance of waste material for manufacturing of sustainable concrete for construction.

3. LITERATURE REVIEW

1. “The effect of ceramic waste aggregate on strength properties of concrete”, E.E. Ikponwosa and S.O Ehikhuenmen, Nigerian Journal of Technology (NIJOTECH) July 2017:

This paper states that the use of ceramic waste in concrete mix resulted in considerable reduction in the workability as replacement level increased. The use of ceramic waste (CW) in concrete resulted in the decrease of its density but was still within the normal concrete range values. If used, this also could result in reduced dead weight of concrete structures. The strength of ceramic waste concrete decreased. Due to higher flakiness value, weaker bonding of the aggregate with cement pastes due to porcelain surface and higher water absorption of the ceramic waste aggregate. Hence, the substitution of coarse aggregate with ceramic waste beyond the 75% replacement level is not recommended for use in structural concrete. The use of ceramic waste in concrete is an effective way to reducing the costs of concrete and keeping the environment clean through efficient management of waste and decrease in the use of normal coarse aggregate in concrete production.

2. “An Experimental analysis of partial replacement of coarse aggregate by waste ceramic tiles in concrete”, N. Sivachandiran, A. Magesh, International Journal of pure and applied mathematics, 2015:

The purpose of this investigation was the utilization of tiles collected from the demolished buildings and the wastes obtained from the tile industries. The use of these tile aggregates as partial replacement in aggregate in concrete has positive effect on the environment and obtaining lower costs since the tile aggregates are easy to obtain. Their cost is cheaper than the natural aggregates. The ceramic tile aggregates are partial replaced with coarse aggregate because the tile aggregate is easy to obtain, and their cost is cheaper than the natural aggregate. After completions of all experimental, programs are conducted that ceramic tile aggregate can be used in place of coarse aggregate with certain percentage. of replacement, based on the compression strength test, split tensile strength test.

3. “Effect of Partial replacement of fine and coarse aggregate with ceramic waste on the properties of concrete”, Vikas Rajora¹, Gurtej Singh Sidhu, International Journal of science and research (IJSR), August 2016:

According to this paper ceramic waste initially there is decrease of 23.32% in compressive strength of 7days when partially replacement of 10%, but after that while replacing 20% there is increase of 5.48% and with 30% there is increase of 14.56% increases respectively in initial compressive strength with respect to normal concrete mix. The reason behind this is that the ceramic waste (sand) behaves as micro filler in concrete. When the ceramic waste replaced as 10% the amount of micro filler is not enough to exhibit required strength but further increase in amount of ceramic waste (sand) fill more voids in concrete mix due to which the compressive strength increased. Ceramic waste initially there is decrease 16.20% in compressive strength of 28days when partially replacement of 10%, but after that while replacing 20% there is increase of 4.2% and with 30% there is increase of 14.42% increases respectively in final compressive strength with respect to normal concrete. Initially there is decrease by 39.49% in flexural strength (28days) when partially replacement of 10%, but after that while replacing 20% there is increase of 8.57% and with 30% there is increase of 33.40% increases respectively in flexural strength with respect to normal concrete.

4. Material and methodology:

4.1) Material:

- A. Ceramic Tile waste
- B. Coarse Aggregate - Size 10 mm.
- C. Fine Aggregate
- D. Cement – OPC 43 grade
- E. Water

4.2) Methodology:

The Methodology starts with the procedure of carrying out test on the broken tile waste around 10mm size. The result of all the tests taken on the broken tile waste and coarse aggregate were compared to the standard given in texts. The test includes specific gravity, water absorption, sieve analysis. Cubes of size (150mm×150mm×150mm) with mix proportion 1:1:5:3 were casted with constant water cement ratio of 0.50.

The coarse aggregate was partially replaced with tile waste by 25%, 35% and 45%. The cubes were casted and after 24 hours, they were remoulded and cured in water.

4.2.1) Water absorption Test:

From the previous research paper, we have found that tile waste absorbs water. We have dried the tile waste in an oven at the temperature of about 105°C to 110°C and then cool and weigh. After cooling, we have immersed the dry specimens in clean water at 27° + 2° for 24 hours.



Fig.1: Water absorption Test

4.2.2) Specific Gravity Test:

We have used pycnometer method for this test and results obtained are as follows:

- ✓ Specific gravity of Coarse-grained aggregate = 3
- ✓ Specific gravity of Fine-grained aggregate = 2.61
- ✓ Specific gravity of waste ceramic tiles = 2.76
- ✓ Specific gravity of cement = 3

4.2.3) Sieve analysis:

a. Test result of sieve analysis of cement:

Sieve size=90 μ m.

Weight of cement:1000gm

Weight retained on 90 μ m sieve =38gm.

Percentage of fineness = $\{(1000-38)/1000\} * 100$
= 96.2%.

b. Results for sieve analysis of coarse aggregate:

Total weight = 3000gm.

Average size of coarse aggregate = 10mm.

c. Result of sieve analysis of fine aggregate:

Fineness modulus =3.05.

d. Sieve Analysis for tile waste:

For partial replacement of coarse aggregate by ceramic tile wastes we are using average size of tile waste i.e., 10 mm Because average size of aggregate is 10 mm.

4.2.4) Compressive strength:

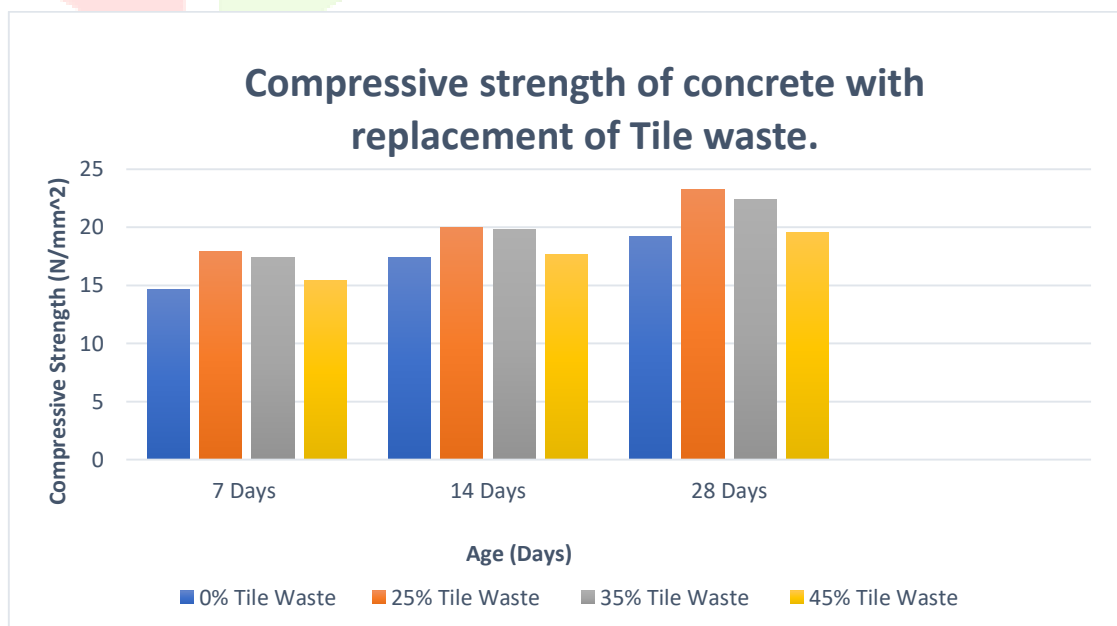
The compressive strength test was conducted on UTM (Universal Testing Machine). The test was conducted on concrete cubes for different percentage of waste tiles. The cubes were crushed under UTM and its strength was recorded.



Fig 2: Compression test on UTM

5. Conclusion:

From the experimental study on plain cement concrete and the ceramic coarse aggregate concrete, the compressive strength of concrete with the addition of tile waste increases with the increase in percentage up to 25% and it gives 23.26 N/mm^2 beyond which strength to decrease with further addition of tile waste.



Graph no 1: Compressive strength of concrete with replacement of tile waste.

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Strength Assessment of Concrete Structures Due to Various Chemical Attacks

Prof. Akshay Rahane, Mr. Omkar Shelar, Mr. Varun Salgaonkar, Mr. Sanket Oswal, Mr. Mohanesh Tamboli.

Abstract: The strength and durability of concrete after casting changes at variance factors regarding physical and chemical damages. Concrete structures with steel-reinforcement are in a continuous and losing life with corrosiveness that naturally occurs from long-term exposure to an aggressive environment. The concrete structure like dams, canals, bridges which have the influence of water forms various types of chemical reactions which include carbonation attack, sulphate attack, chloride attack, alkali aggregate reaction etc. Chemical reactions, either intrinsic or extrinsic, are one of the main reasons for concrete's deterioration. The present dissertation consists on an analysis of the chemical expansive reactions in concrete element, the alkalis aggregate reaction, and the internal sulphuric reaction. During the carbonation process the fundamental element identified in the concrete microstructure is calcite which comes out at the surface of concrete structure, in the form of cracks. When carbon dioxide causes by environment come contact into the concrete structure and effect with calcium hydroxide to create calcium carbonate this phenomenon is called as carbonation. Carbonation usually describe by pH value which indicate the depth of reaction in the structure. The depth of carbonation directly affects the life of structure in year. Through the years to overcome this problem the solution is being discovered by performing various experiments on Concrete after and before the casting. Which gave us the Chemical test like by increasing the CO₂ binding capacity, improving CaO Value and physical tests such as applying epoxy coating, etc.? After all, performing the various types of test for particular outcome finally check for durability tests for concrete structure is take place for better result. There are many of them but in this case it will be pH indicator, UTM and CTM is being discussed. This project addresses the study of chemical reaction which is taking place on various type of concrete structures and affect the durability and strength of it.

Keywords: Strength Assessment, Concrete Structure, Chemical Attack, Epoxy, Chlorine, Sulphur.

I. INTRODUCTION

What is chemical attack?? When we are dealing with durability of concrete chemical attack which result in volume change, cracking of concrete and the consequent deterioration of concrete become an important part of discussion. Chemical attack is the reaction of chemical element from exposure and moisture present in the concrete which results into deterioration of RCC structures.

Ordinary Portland Cement (OPC) is highly alkaline in nature with pH values above 12. When the cement paste comes into contact with the acids its components break down, this phenomenon is known as acid attack. If pH decreases to values lower than stability limits of cement hydrates, then the corresponding hydrate loses calcium and decomposes to amorphous hydrogel. The final reaction products of acid attack are the corresponding calcium salts of the acid as well as hydrogels of siliceous, aluminium, and ferric oxides.



Fig 1: Hydrochloric Acid Attack on Concrete

II. OBJECTIVE

1. To study about attacks of the chemical.
2. To study the effect of various acid attacks on concrete.
3. To study preventive methods of concrete deterioration caused by chemicals and acid attacks.

III. LITERATURE REVIEW

1. Durability of Concrete Exposed to Sulphuric Acid Attack, Seyed Mahmoodreza Joorabchian.

This thesis investigates the effects of aggressive sulfuric acid attack on the concrete mixtures prepared with metakaolin (MK) and limestone filler (LF) at various replacement levels. In addition, rapid chloride permeability (RCPT), water sorptivity, water porosity and rapid freezing and thawing tests were also performed on the concrete samples. Three sulfuric acid solutions with concentrations of 3%, 5% and 7% were used for examining the resistance of concrete specimens for a total exposure period of eight weeks. The performance of the degraded specimens was evaluated by measuring the weight loss, change in strength and visual assessment

2. Concrete Deterioration Caused by Sulfuric Acid Attack, Sept2018, K. Kawai, S. Yamaji, T. Shinmi

Biological deterioration of concrete in sewage and wastewater treatment plants has been reported. This deterioration is caused by sulfuric acid attack and is dependent on the concentration of sulfuric acid, this in turn being a function of both the specific location within the plant and also the time over which the concrete is exposed to elevated concentrations of acid. Given that concrete may often be exposed to very strong acid solutions, resin coatings are applied to the concrete to protect them

3. Concrete against acid attack: Preventive measures, Oct19, Dr. Anwar Khatab, ²Dr. Mohsin Usman Qureshi, ³Mr. Muhammad Nadeem

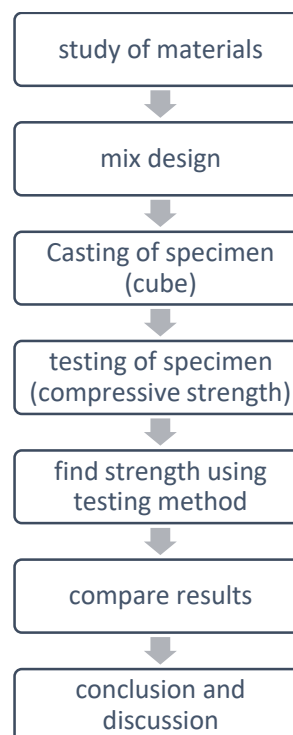
This paper addresses the measures taken to prevent or minimize the

deterioration of concrete, which confronts an acidic environment. Primarily, the mechanism of reaction between alkaline concrete and acid is clearly demonstrated. The mechanism of reaction clearly sets guidelines as to how the chances of this disastrous reaction should be minimized or eliminated at all. The suggested preventive measures are two-fold i.e. the improvement of the basic microstructure of concrete and the provision of barriers against acids. Concrete can be made acid resistant using classical as well as novel techniques like nanotechnology.

4. Response of Concrete to Sulfuric Acid Attack, Emmanuel K. Attiogbe and Sami H. Rizkalla

The study shows that all three indicators of deterioration are effective measures of concrete response to the acid attack. However, the study suggests that the increase in thickness (expansion) of small specimens (with large surface area-to-volume ratios) may be a more consistent measure than the weight loss of larger specimens when comparing the effects of different sulfuric acid concentrations on concrete.

IV. METHODOLOGY



V. MATERIALS USED

1. **Cement:** -
Ordinary Portland Cement (53 grade)
2. **Sand**
3. **Coarse Aggregate:** -
Size of aggregate 20mm
4. **Water**
5. **Chemicals:** -
Chlorine Solution
Sulphur Powder
6. **Epoxy Resin Solution**

VI. CONCLUSION

1. Performed 7/14/28 days Compressive strength on cube and results shown.
2. After 7/14/28 day compressive strength when 0.35% of Sulphur is added decreases and by using epoxy coating compressive strength of concrete increases.
3. After 7/14/28 day compressive strength when 0.35% of Chlorine is added decreases and by using epoxy coating compressive strength of concrete increases

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INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

WATER BALANCE – A HYDRO MATHEMATICAL APPROACH TOWARDS WATER MANAGEMENT AT VILLAGE LEVEL

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Abstract - India is one of the few countries having erratic and unevenly distributed rainfall and hence many parts of the country face severe drought conditions which adversely affects the agricultural crop cultivation and ultimately results in the poor socio-economic condition of farmers. Water is a very basic and most valuable resource on this earth which provides life to all living beings and plants hence proper management of water should be our priority, especially in the water-scarce region. Micro watershed management plays a very crucial role in proper water management at the village level but it's not possible without having a proper knowledge regarding water availability, water requirement, and correct data regarding Runoff, Evapotranspiration, Infiltration, and other basic factors. In this paper, we have determined a hydro mathematical approach for water balance at the village level and we have applied this approach to water-scarce Nimkhedi kh. micro watershed region which is situated in the Jalgaon district in Maharashtra. This approach more focused on appropriate monthly calculation of water availability, demand, Runoff, Evapotranspiration, Infiltration, Vapour diffusion and other parameters which gives us detailed dataset for proper water management, after calculation of different factors involved in water balance we come to know that the Nimkhedi kh micro watershed region is a water-stressed region and available rainfall water and groundwater are not sufficient to fulfil the requirement of this region so changes in the cropping pattern and other development is necessary to make this region water sufficient.

Index Terms – Water balance, Runoff, Evapotranspiration, Infiltration, Water requirement

1. Introduction –

Water balance estimation is required for proper micro watershed management and planning related to the use of water but this water balance estimation is not an easy task because we have to consider a lot of factors in calculation. In water balance, runoff plays a very important role in water balance as the decision regarding the new structure for storage in the water-scarce region is mainly dependent on the runoff parameter. There are many empirical formulae to calculate runoff like strange table, Barlow method, SCS curve number method, and Irrigation department method these methods are simple for calculation and also, they are reliable but in village areas, there is a problem of unavailability of data so to overcome this challenge and to get reliable runoff calculation SCS curve method used for calculation which is most widely accepted method for calculation of runoff. Soil Conservation Service Curve Number (SCS-CN) method documented in Section 4 of the National Engineering Handbook (NEH-4) of the US Department of Agriculture in 1956. Evapotranspiration calculation is important to determine crop water requirement, as in village areas, 95% of water demand comes from agriculture, therefore, its calculation plays a crucial role in water balance. There are so many techniques available for calculation of reference evapotranspiration and potential evapotranspiration like Penman Monteith equation, Blaney-Criddle equation, Hargreaves equation, Jensen Haise equation which are widely accepted and reliable among these equations we have used Blaney-Criddle equation for ETo calculation because this method is suitable for missing meteorological data. This method is documented in chapter 3 (Crop Water need) of FAO 56.

Groundwater recharge is an important component of water budget which is very difficult to calculate directly due to uncertainties and complexities in the subsurface. Numerical modeling gives us information regarding indirect estimation of groundwater recharge but its application is limited due to data scarcity. Data scarcity is a major concern at village level for the calculation of hydrological parameters as so many uncertainties are there in meteorological data. There are some numerical formulas which can be used for the calculation of groundwater recharge but these are applicable to the specific region for which it is created. Such methods usually estimate GR through a regression equation with precipitation and they offer a reasonable alternative for GR estimation especially in the United States and in India, such as Anderson's formula (1992), Sehgal Method (1973), Waltermayer approach (2001), and Eakin Method (1949) from above approaches Sehgal approach is suitable for India. Soil moisture calculation is also done separately in this study which has significant importance in an area having more agricultural land. After calculating all

parameters related to water balance like water demand, availability, and components of water balance equation we can determine the status of a particular village related to water availability and also can give suggestions to reduce water scarcity in that village.

2. Objectives -

1. To determine the monthly total water demand and water availability in selected regions.
2. Planning for water security and balancing.
3. To give suggestions to the village to tackle the problem of water scarcity.

3. Study Area -

Nimkhedi kh, Dhormal, Satod micro watershed region is situated in Muktainagar Taluka, Jalgaon district, India with latitude 20.980 N and 76.0530 E. According to census data this region has a total population of 4833 in which male population is 2465 and the female population is 2368. Average annual rainfall of the region is 577.07mm with a total geographic area of 2146 hect. This region depends on two lakes and some farm ponds having a total combined capacity of 262000 cum and number of wells available in the region.

4. Methodology -

For Water Balance of Nimkhedi kh. micro watershed, we have to collect the data required for the water balance approach in selected regions. The required data for the village is obtained from the Government Authority. By consideration factors required to compute the water balance and formulas to calculate.

Government authority has provided us data regarding rainfall, Cropping pattern, average monthly temperature, and soil type. Selected regions received an average of 585 mm of rainfall yearly.

A simple equation for water balance is given by hydrologist is as follows,

$$P = R + ET + F + SM$$

Where,

P is precipitation

R is runoff

ET is evapotranspiration

SM is soil moisture

4.1 Runoff (R):

Runoff is a very important factor in water balance because it plays a crucial role in determining the potential of the water storage. In this study we have decided to use the Soil Conservation Service Curve Number (SCS-CN) method for runoff calculation. The formulas used to calculate are (Equation is valid for $P > i$ for $= 0.2$)

$$R = (P - 0.2S)2P + 0.8S$$

Where $S = 25400 / CN - 254$

S = potential maximum retention or Infiltration

CN = curve number

Total runoff value for this region is 1662920 cum which is nearly 12% of total rainfall, from runoff generated only 565968 cum of runoff available for further storage.

4.2 Infiltration (F):

Infiltration is the downward movement of water into the land surface, which helps to enhance the groundwater recharge condition of the zone, more the infiltration rate of the soil more the groundwater recharge. As the soil in the zone is mostly clayey the rate of infiltration is found out to be lesser than the sandy soil. Here we done the calculation for the infiltration by Philip Method (Cumulative method)

$$F(t) = St^{0.5} + kt$$

Where, S = Sorptivity (cm/hr)

K = the hydraulic conductivity (cm/hr)

T = time from the beginning of rainfall (hr)

Total infiltration is found out to be 8.19% of the total rainfall, which is less to increase the ground water recharge for the zone.

4.3 Crop water requirement:

Crop water requirement calculation can be done in two ways, first by considering delta for a particular crop and second by considering the evapotranspiration approach. In evapotranspiration approach we have to calculate reference evapotranspiration which depends on various environmental factors for calculation of evapotranspiration we have decided to use Blaney-Criddle formula which is easy and accurate as some other methods available but these methods are not suitable for rural areas having less environmental data available. Blaney- Criddle formula is given below,

$$ET_o = p(0.46T_{mean} + 8.13)$$

Where, T_{mean} = mean daily temperature (c)

P = mean daily percentage of annual daytime hours

After calculation of reference evapotranspiration, we can determine potential evapotranspiration by simply multiplying it by crop factor which changes according to crop and its age, with the help of potential evapotranspiration we can determine monthly crop water demand. Average yearly crop water demand is 15250580 cum which is around 97.34% of total water requirement therefore calculation of crop water requirement is very important in water balance at village level.

4.4 Soil Moisture (SM):

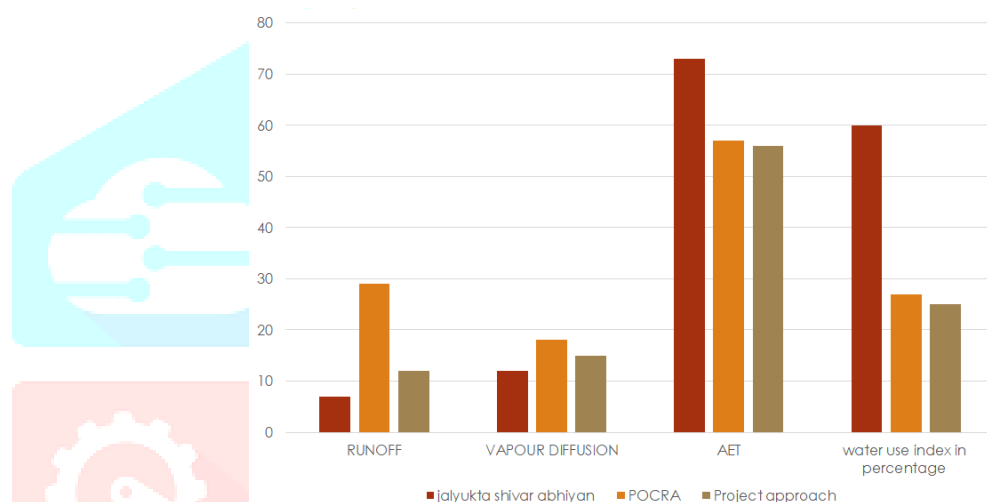
Soil Moisture is the volume of water held by soil in its active layer typically for 1-2 m. Soil moisture is important for crop growth as this will help in plant growth and reduces the external water requirement by irrigation. Soil moisture depends on the amount of precipitation (rainfall), water consumption by crops, air temperature, etc. Adequate moisture levels are of high importance to yield, soil moisture available after kharif will be used by rabi crops and therefore calculation of soil moisture is important in computation of accurate water balance. According to calculation 15% of total rainfall gets converted into soil moisture in this region.

4.5 Water Requirement:

Domestic water requirement in villages is calculated by considering water demand for humans, livestock and schools. As standard values are given as per the Central Public Health and Environmental Engineering Organisation. per day water requirement of humans and different livestock therefore by simple calculation, we can determine domestic water requirement and by adding above crop water requirement we get total water requirement for a particular region. Most of the water requirement in rural areas comes from agriculture hence water demand in April and May is very low because of less activities in agriculture. For calculation of water requirement, we have considered monthly variation in consumption of water which gives us more accurate data to analyse results and for further improvements.

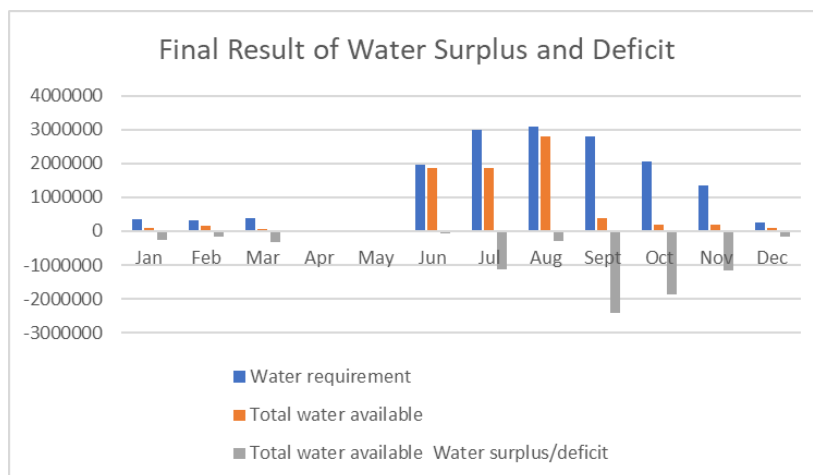
5. Results -

Jalyukta shivar abhiyan and POCRA approach are two important approaches in water balance calculation and they are widely used in Maharashtra for water budgeting. In graph no. 1 We have compared our study and important parameters of the hydrological cycle with the above approaches. Some changes in result arise due to utilization of different formulas and assumptions in the micro watershed region in different approaches. In this study our focus was on more accuracy, simplicity and reliability because less data is available in villages for computing different parameters in hydrology.



Graph no. 1 Water balance parameter comparison with other method

In Nimkhedi kh micro watershed region Rainfall is observed in June, July, August and September, October month and about 12661400 cum volume of water generated by rainfall. This region mostly depends on groundwater for irrigation and domestic water requirement, Total existing groundwater draft for all purposes is 801747 cum, and only 15 % of agricultural land is irrigated. According to the study and calculation we made, we found this region has water deficiency every month except April, as the water requirement for crops in April month is very less. In Nimkhedi kh micro watershed region Rainfall is observed in June, July, August and September, October month and about 12661400 cum volume of water generated by rainfall. This region mostly depends on groundwater for irrigation and domestic water requirement, Total existing groundwater draft for all purposes is 801747 cum, and only 15 % of agricultural land is irrigated. According to the study and calculation we made, we found this region has water deficiency every month except April, as the water requirement for crops in April month.



Graph no.2 Final result of water balance

In Nimkhedi kh micro watershed region is a water deficit region having a total yearly water deficit of 7836153 cum which is about 50% deficiency. Therefore, some steps are required to achieve water security in this region. Available runoff for storage is less because of intermittent rainfall and availability of black cotton soil which has more water holding capacity, therefore available runoff is insufficient to fulfil the water requirement, hence some changes in cropping pattern and structural changes are required to achieve water security in the micro watershed region is very less.

6. Conclusion:

In this current study we had an approach towards meeting the water requirement of Nimkhedi Kh micro watershed. This is a simple way of approach by using various methods and previously developed hydrological empirical formulae for calculating water balance parameters which will give amount of requirement and availability of water at small scale. The proposed calculation approach is for monthly water balance components which helps to plan uses of water correctly and this approach is most suitable at village level as the dataset required for this approach is less and it is also accurate and reliable.

In this region Rainfall is less which gives Runoff value after calculation is 12% of rainfall which is quite less to fulfil the storage requirement. Infiltration is about 8.19% of rainfall, the maximum water requirement is from agricultural areas. To meet this requirement, we have to take correct decisions and action in the form of structural changes in storage as well as cropping patterns. We found that there is good improvement in irrigation methodology as drip irrigation is used in 70 to 75% of agricultural areas which will save ample amounts of water. Nimkhedi kh micro watershed region is a water deficit region having a total yearly water deficit of 7836153 cum. We have 296646 m³ of groundwater available for future scope but it is also not sufficient to solve the problem of water scarcity of this region hence some structural changes and proper micro watershed planning required for this region to solve the problem of water scarcity.

As groundwater and available storage is not sufficient to tackle the problem of water scarcity we have to consider some other options. Purna River is near to this micro watershed region so there is scope of studying water availability in this river; We can take decisions about transfer of water in the lake, so that water availability can be increased. With this method we can easily calculate water balance parameters and find the solutions to tackle water scarcity problems. This method can be applied to any other micro watershed to find out different hydrological parameters.

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Physical & Mechanical Properties of Mees Bamboo for replacement with Steel in Concrete Structure

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Abstract - Bamboos in India show a great diversity in both their habitats and species. There is need of research work for investigating feasible properties of bamboo for construction purpose. Indian Bamboo is a fast-growing wood tree as compared it with other trees. It achieves its optimum strength within four years and full maturity in five years. It is a low-cost sustainable material which is locally available. Due to lack in understanding in properties of bamboo, its utilization is limited in the industry. This paper presents an investigation through various tests on bamboo to know its physical and mechanical properties. To know properties of the bamboo species which were locally available were Mees Bamboo (*Dendrocalamus strictus* (Roxb.)), Assam Bamboo (*Bambusa balcooa*), Manga Bamboo. This bamboo was locally available in Pune, India. Among this bamboo we selected Mees Bamboo and performed various test such as tensile test, water absorption test, compression/bending test. The test resulted that, if we treat bamboo and then use it, results for good physical properties and bamboo has very good mechanical properties.

Key Words: Mees Bamboo, Tensile strength

1. INTRODUCTION

Bamboo is a fast-growing giant grass as compared it with other trees. It achieves its optimum strength within four years and full maturity in five years. As fast-growing plant bamboo reach 15 to 30m of height within two to four months of its plantation. It is a low-cost sustainable material which is locally available. Due to lack in understanding in properties of bamboo, its utilization is limited in industry. Generally, steel is used to reinforce the concrete. Though steel has a high tensile strength to complement the low tensile strength of concrete, use of steel should be limited since it is costly and also it takes so much energy in its manufacturing process. Thus, a suitable substitute of this with a low cost, environmentally friendly and also a less energy consuming one, is a global concern; especially for developing country. Addressing all these problems, bamboo is one of the suitable replacements of reinforcing bar in concrete for low cost constructions. Bamboo is natural, cheap, widely available and most importantly strong in both tension and compression. The tensile strength of bamboo is relatively high, which makes bamboo an attractive substitute to steel in tensile loading applications.

There are 1500 identified species of bamboo found around the world. As every bamboo species has similar anatomy, which includes nodes, internodes and diaphragm.

To differ the species of bamboo its root is checked which includes sympodial, monopodial and amphodial. In India, there are a total of 148 species are found in which there are 29 genera (both wild and cultivated). The maximum concentration species is found in the deciduous and semi-evergreen regions of North-east and semi-evergreen regions of north-east and the tropical moist deciduous forests of north and south India. The annual production of bamboo in India is 4.6 Million tones, about which 1.9 Million tones is used by the pulp industry. In Maharashtra, 90% of bamboo is grown in Vidarbha area and in konkan region only manga species of bamboo is grown.

In this paper, tensile property of bamboo is observed and evaluation of the use of bamboo as reinforcing bar in concrete with replace of steel is done. The aim of this research is to investigate the mechanical and physical properties of different species of local bamboos. This research is a part of an experimental work which focuses on the possibility of utilizing bamboo as reinforcement for beam

2. OBJECTIVE OF STUDY

The aim of this paper is to determine the practicability of bamboo reinforcement for concrete beams. The mechanical properties and behavior of steel reinforced concrete have been studied and due to current increasing demand of steel and problem during its manufacturing there is need of research for sustainable material.

We selected bamboo as an alternative because it is ecofriendly and having similar properties of steel. Therefore, the aim of this work is to provide a preliminary contribution toward the collection of the mechanical and physical properties with behaviors of bamboo reinforced beams. Following tests selected for determining properties as per IS code.

- Density Determination
- Water Absorption
- Static Bending
- Tensile Strength
- Compression Strength

3. MATERIAL & METHOD

• Bamboo

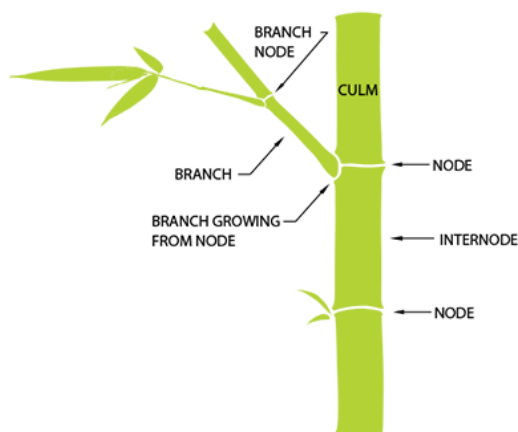


Fig -1: Bamboo Anatomy

Bamboo Culm –Culm means bamboo shoot which is hollow for some species and some species have solid culms. Stem have important job in this plant which is responsible for shape and size of plant and it support leaves, produce food. Various structures on stem like

- Node- where leaf and bud attach to stem and culm segment begins and end with joint.
- Internode-Distance between two nodes is known as internode which tells how much tree grew in one season.

The nodes in bamboo culms were an important factor in the uniform distribution of mechanical properties. The locally available species of bamboo in Pune are Mees bamboo (*Bambusa Vulgaris*), Assam bamboo (*Bambusa Balcooa*) & Manga Bamboo (*Qxytenanthera Ritcheyi*). From the species available, we choose Mees bamboo and conducted some test (as per IS-6874:2008) on the species of bamboo.

Physical Test:

It includes two tests, which are:

1) Density Determination:

The test specimens for determining basic mass per volume taken from freshly felled culms at different positions of the culm (base, middle and top) about 25 mm in length and 25 mm in width with full wall thickness. In this test a sample of calculated dimension was taken from bamboo and its volume and its weight was measured. Density of bamboo species was determined as per procedure mentioned in IS code.

2) Water Absorption Test:

During our research from previous research papers we found that bamboo absorbs water. To stop bamboo from absorbing water we used oil paint as an agent. In this test 8 samples of different size and different bamboo strips were taken. Out of which 4 samples were untreated and 4 samples were treated with oil paint to stop bamboo from absorbing water. The

weight of this sample was recorded and then samples were placed in water tank for 24 hours and weight of this sample was recorded again. The test specimen was weighed with an accuracy of 0.01 g. Percentage water content in treated and untreated samples was calculated.



Fig -2: Treated and Untreated bamboo for water absorption test

Mechanical Test:

It includes three test. These tests were conducted on UTM (Universal testing Machine), which are:

1) Static Bending test:

A beam of suitable length to support the test specimen was kept at right angle to the platform of the Universal testing machine. The test specimen was placed on supports with saddles and a wooden beam was placed over the specimen using saddles in such a way that load is applied through the loading head of the testing machine. The test specimen was then allowed to find its own position; the specimen, saddles, load and supports was aligned visually in one vertical plane. The loading of the test specimen was carried out uniformly at constant speed. The loading head of testing machine was moved at the rate of 0.5 mm/s. Deflection at the middle of the span was recorded at the points of sudden changes in deflection, at the time of failure and at maximum level. Crack development and the form of failure were noted.



Fig -3: Bamboo Strip Bending Test



Fig -4: Hollow Cylindrical Bending Test

2) Tensile Strength Test:

This test was conducted on UTM. The grips were pressing the test specimen perpendicular to the fibers and in radial direction. The load was applied continuously and the movable head of the testing machine shall travel at a constant rate of 0.01 mm/s. The maximum load was recorded.



Fig -5: Bamboo Strip Tensile Test



Fig -6: Bamboo Cylindrical Strip Tensile Test

3) Compression Strength Test:

This test was conducted on Digital compression testing machine until crushing and the crushing loads were recorded. The length of bamboo we took to perform test was 50 mm. The inner and outer diameters at top and bottom portion of the samples were measured. The average diameter was considered for calculating crushing strength.

4. RESULT & DISCUSSION

4.1 Physical Properties Test Result: -

$$\text{Density of Bamboo} = 752.4 \frac{kg}{m^3} = 0.7524 \frac{g}{cc}$$

Water Absorption Test Result and Observation: -

The water content of each test specimen calculated as the loss in mass, expressed as a percentage of the oven dry mass.

Formula: -

$$w\% = \left(\frac{W_f - W_i}{W_i} \right) * 100$$

Wi = Initial weight of specimen

Wf = Final weight of specimen

w% = percentage water content absorbed in 24 hrs.

Observation Table:

Table -1: Water Absorption Test Table

Sr. No.	Specimen & Size (in mm)	Wi (g)	Wf (g)	w%
1)	Untreated Sample-1 (100*35*7.5)	20.9	30.67	19.92
2)	Treated Sample-1 (100*35*7.5)	21.98	26.36	46.74
3)	Untreated Sample-2 (50*28*10)	7.42	8.98	21.13
4)	Treated Sample-2 (50*28*10)	7.94	11.32	42.64
5)	Untreated Sample-3 (100*26*9)	16.45	19.98	21.46
6)	Treated Sample-3 (100*26*9)	17.55	24.84	41.64

7)	Untreated Sample-4 (100*27*10)	17.68	21.31	20.56
8)	Treated Sample-4 (100*27*10)	18.72	26.68	42.54

Average water content for untreated samples after 24hrs is 43.36%. Average water content for Treated samples after 24hrs is 20.76%. Water content decrease by 52.12% after treating bamboo with oil paint.

4.2 Mechanical Properties

I) Static Bending test: In this test deflection in the bamboo strip and hollow bamboo were measured. The maximum deflection allowed in UTM machine and in bamboo was recorded as 100 mm. But the bamboo strip didn't break. Therefore, the load at which bamboo would break in 2 parts was not determined in single point loading test.

II) Tensile Test Result:

Table -2: Tensile Test Table

Specimen	Cross sectional area (mm ²)	Tensile load (kN)	Tensile strength (N/mm ²)
Hollow Cylindrical Bamboo Strip	94.25	11.46	121.59
Bamboo strip	100	12.48	124.8

III) Compression Test Result

Table -3: Compression Test Table

Sr No	Length (mm)	Diameter (mm)		Area (mm ²)	Crushing load(kN)	Crushing Strength (N/mm ²)
		inner	outer			
1)	50	20	38.5	849.99	64	75.29
2)	45	21	38	787.75	62	78.7

5. CONCLUSIONS

The study in this paper indicates that bamboo has a promising potential to be used as a construction material. In the study, we performed some physical test and Mechanical tests which include compression, tensile, bending test were conducted to test two bamboo samples from selected species. Ability and capability of Mees bamboo which was locally available was

determined. Mees bamboo (*Dendrocalamus strictus*) exhibited a good performance in tensile strength test and compression strength test. The water absorption capacity of bamboo was reduced by moisture resistant material i.e., oil paint. It reduced the water absorption by 52.12%. Thus, the experimental results discovered that bamboo has a good performance in strength properties.

ACKNOWLEDGMENTS

It gives us a delight for completing our final year Civil engineering project "Performance evaluation of bamboo reinforced concrete beam". This Project gave us an insight of the Bamboo properties and behavior. 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 and Prof. Sudarshan Bobade 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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AUTOMATIC WATER DISTRIBUTION FOR SMART CITIES

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Abstract : In a Smart city, there are many houses. Water is an essential thing. The usage of water in each house is different depends on their user's need. According the season, water usage is varying. Particularly, the water usage is increasing on Sundays like washing clothes, cleaning houses etc., where female partners also going for work. Similarly, in summer season, water necessity is more. In winter and rainy season, water is used in lesser. Based on these reasons, user should be take control over water management. So, the proposed model has been developed for water management, it was controlled by sensor devices. This system should be such that any user would not be without water during repair of any portion of the system. For example, each house needs 300 litres of water approximately. Generally, the Corporation will supply a sufficient amount of water for a smart city, it is regulated by a sensor device. The sensor device is controlled 300 litre waters for one house. The volume of the water tank is 500 litres. After reaching the level of 300 litres of the tank, automatically, it should be directed to a next house. Each 100 litre can be marked in the water tank. There are 100 litre water is there, it if filled in the first line. In each water tank, there was the sensor chip, which used to sense the water level in the tank. If already 100 litre of water is remaining in the tank, then balance 200 litre must be filled in to the tank. This can be controlled by the sensor chip. Such as on weekend days, the amount of litre must be increased for each house as 400 litres. Because, the usage of water is high for those particular days. As like that, if a particular house needs a large amount of water due to their personal occasion, then the particular house must be filled with extra water as they required. But the extra amount of water also supplies by the same pipe; it is maintained by a sensor chip. Similarly, there is no change in the water level in the tank of smart city houses after three days, a total amount of water in the tank is redirected to the corporation. It is slightly complicated, because of this process is reversible.

IndexTerms - Sensors, Water management, Valve, Distribution.

I. INTRODUCTION

There are many challenges in the Smart city. One of them is water management. To overcome the water problem, the proposed model has been developed for the water management. Water is most important for our life and man cannot live without water. Already, the water management system exists for finding the leakage of water in the pipelines and also the pH level of water. The monitoring system has been designed with sensors. Readings from the sensor are processed with microcontroller and communicate through computers or wireless networks.

Smart city has been developed for human life for comfort and convenient. In foreign countries used such as Europe, America and Asia, Smart city is a well-established and world class technology has been used. It is based on advanced urban cities with civic amenities. Smart City may vary based on the countries, cultures, life styles, technology, environment and also needs of society. Smart city is an enhanced city with smart designs in method of housing, infrastructure, mobility, technology, security system, transportation etc. A Smart City would have a different meaning in India than in Europe. Even in India, there is no clear way of defining a Smart City.

Smart city era brings different ideas and innovations through information and communication areas. The present scenario, it is used in various fields like networking, energy platforms, decision making system, service architectures, power grids etc to establish the full equipped cities for the future. Not only in these fields, but also used in conversion of traffic system to energy management system, e-governance and emergency management.

In cities, the population is very high and also industry, schools etc, which are affected by the services. Cities have a many infrastructures, services and group of peoples both public and private. They share their ideas. A smart city has complex structure that shares space and buildings with stakeholders and service providers. It is an extension of city to allow the use of resources to improve the quality of human life in urban areas and to overcome the issue of water management in smart cities.

1.1 PROBLEM STATEMENT

- To avoid water theft and to overcome the problem of water scarcity.
- Current water distribution solutions are based on centralized management systems.
- These systems offer limited control and are filled with inefficiencies.
- Water losses, high contamination levels, and difficulty in maintenance are some of the common problems faced by the current system.

1.2 OBJECTIVE

- Uniform distribution of water to every consumer in the cities.
- Creating greater customer awareness of water consumption habits, leading to conservation improvement.
- Consideration of new metering system including improving the cities meter reading.
- Enhancing new services to the customers.

1.3 SCOPE OF PROJECT

- The main scope of our project is to provide safe and clean, reliable water supply to the cities.
- We are considering a new metering system including improving the cities meter reading.

1.4 RESEARCH

The related research was done through research papers published at national and international level. Various data and provisions were studied from “Hydrology and Water Resource Engineering” - S. K. Garg, Khanna Publisher.

1.5 ADVANTAGES OF SYSTEM

- Equal water supply for each consumer according to number of members.
- Least wastage of water.
- Least electric power consumed.
- Accurate readings.

1.6 LIMITATIONS

- Continuous electric supply needed.
- Expert installation needed.

1.7 EXPECTED OUTCOMES

- Large number of water can be saved in the reservoirs.
- Accurate revenue of water supply will be generated.

II. LITERATURE REVIEW

A) Water Anti-Theft and quality monitoring system by using PLC and SCADA

Gaikwad Sonali Ashok (2013) has planned this strategy as a model for water circulation framework involving a control framework, communication means, funnelling, actuators, sensors and valves. This paper concentrates especially to a control framework for controlling and checking segments inside a water dispersion framework. To transmit or receive the control and status information man machine and electrical interfaces are incorporated to PLC (Programmable Logic Controller)

B) Design of a PI controller for a computerized building water distribution system with PLC system

Hassaan Th. H. Thabet (2011) has considered and built up the framework for water supply framework's energy conservation guideline of a pump with flow control as indicated by unsettling influences. The framework can distribute the water with steady weight and spare energy effectiveness. The framework was tried for every whole day for 21 days with limit of (20 - 120) litre/minute of water, and around ten meters building elevation. The weight of the supply system is around 1.2 Bar. The test results of the simulated and actualized framework demonstrate enhanced proficiency and expanded precision in the variable heaps of the water devoured in a multi-story working with a constant pressure controlled operation. The PLC connects and controls the operational parameters to the speed asked for by the framework and screen the framework amid typical and anomalous conditions (over-loading and dry running)

C) PLC based automatic corporation water distribution system using solar energy

P. Mukesh Aravind (2013) has implemented the strategy to depict about the PLC based programmed enterprise water circulation framework, which encourages to disseminate the water naturally as per the requirement of the particular region. In conventional framework there is no legitimate strategy took after for the dissemination of water. To defeat the trouble in the regular framework, the PLC based automated framework utilizing embedded controller is used for disseminating the water to the general population similarly as indicated by their usage. The embedded controller is as of now pre-modified to do the tasks and results are appeared in ladder diagram utilizing Pico software. So as to make the framework more effective and contamination free, solar based energy is utilized as an elective hotspot for control supply activity of the PLC unit.

D) Wireless Sensor Networks for monitoring and controlling of water distribution systems

A. J. Whittle (2013) has built up the technique for in-situ, on-line checking of water dissemination frameworks with a precise target to support effective administration and task. Specifically, it is critical to recognize and restrict pipe failures not long after they happen, and pre-emptively, distinguish 'hotspots', or zones of the circulation arrange that will probably be helpless to basic failures. These capacities are indispensable for diminishing the time taken to recognize and repair failures and thus, alleviating impacts on water supply. This paper depicts the Waterwise venture in Singapore, concentrating on the utilization of Water Wise as a tool for observing, recognizing and foreseeing unusual occasions that might be demonstrative of auxiliary pipe failures, for example, blasts or breaks

E) Automated drinking water system and theft detection using embedded technology

Sagar Khole (2015) has exhibited the technique to implement the proposed water supply framework, every purchaser ought to be furnished with an embedded based water flow observing framework comprising of a microcontroller to record the flow rate

utilizing a flow sensor and to transmit the same to a remote checking station utilizing wireless transmitter and it is likewise furnished with an electrically worked solenoid valve to supply water to the buyers. The valve turns on/off to stop the water supply at whatever point the flow rate surpasses a predefined restrict. The solenoid valves are likewise controlled utilizing continuous clock to control flow of water appropriately for a settled span of time. It is proposed to utilize a GSM modem for wireless communication so the data can be passed to specific capable officer's PDA for quick activity.

F) Controlling and Monitoring of Automation of Water Supply scheme based on IOT with theft detection

Ahmad T. Jaiad (2017) has proposed the strategy to concentrate on persistent and constant supervision of water supply in IOT scheme. Water distribution with constant supervising formulates a legitimate dispersion so quantity of water in tanks, flow rate, variation from the norm in supply line can be made. Internet of things is only the method of substantial items embedded with electronics, sensors, programming, and system network. Monitoring should be possible from any place as central server. Utilizing Ada natural product as free disjoin information constantly pushed on cloud so information can be seen continuously. Utilizing typical sensors with controller and raspberry pi as Minicomputer can supervise information and moreover control task from cloud with skilled customer server communication. This framework is centred on, Internet of things which is new state of affairs to make city as a smart city with various applications. Principle target to implement this scheme is to sketch out and make up a negligible effort dependable and productive system to make appropriate water conveyance by consistent checking and furthermore controlling it from a central server with the goal that water related problems will be taken care. Arduino collects the data from sensors and forward it raspberry pi. The important issues of water distribution process which includes overflow, over utilization and water quality are solved.

III. METHODOLOGY

The proposed name 'Automated Water Distribution System' consists of various enhanced components. It is created and assembled in a package which is advancement of current water distribution system which will play a part in future technologies to come.

Initially, the water distributaries are fitted with the new introduced system. Data such as amount of water to be discharge, time of discharge, etc is embedded into it before use. When the water distribution is started from any corporation it travels through distributary lines and reaches sub-tanks situated in buildings. The system attached to the distributary water line consists of solenoidal valve.

Once the main solenoid valve gets opened, the water flows through the pipe into the sub-tank. The sensor attached to the solenoid valve will measure the amount of water discharged into water tank. The flow rate is measured with the help of pulse output from the flow sensor. Once the given amount of water discharged is achieved into water tank, the solenoid valve will shut off and stop the flow of water. A RTC (Real Time Clock) is also combined in this system which will automatically open the solenoid valve after 24 hours and allow the flow of water. Monthly routine checks can be conducted on this system to check any malfunction occurs. This will also help to solve any circumstance which may occur in coming future.

This automatic process of shutting on and off of water supply can continue on daily basis without any man power or human assistance. This will definitely help us to avoid misuse as well as theft of water on large scale.

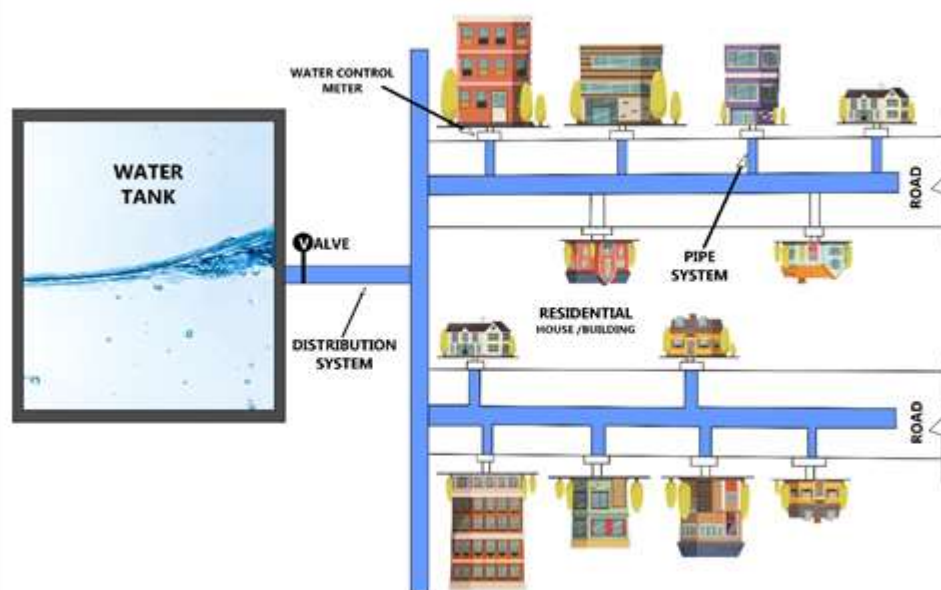


Fig 1.1 Flow Chart of Proposed System

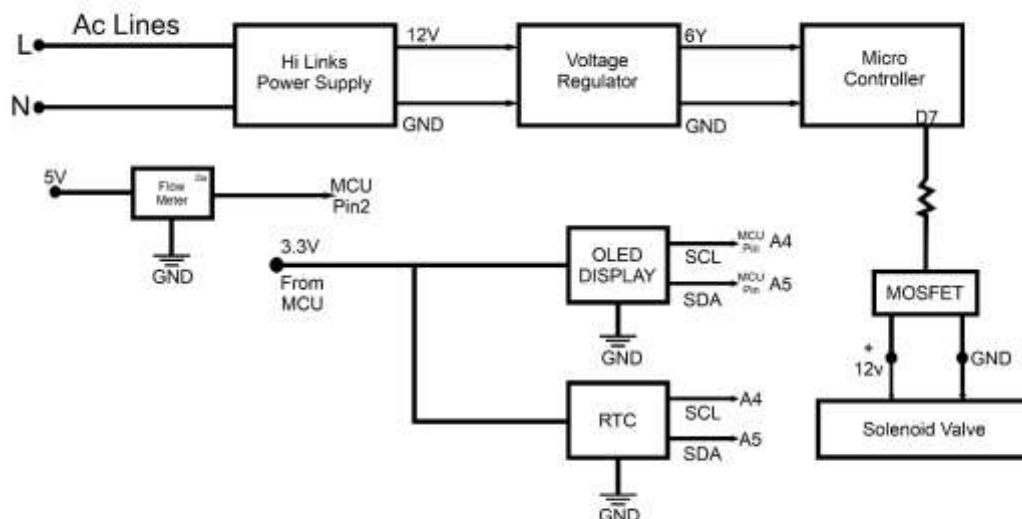


Fig 1.1 Flow Chart Diagram of AWDS Device.

3.1 COMPONENTS AND THEIR PARTS

- Solenoidal Valve
- Flowmeter
- Real Time Clock (RTC)
- Microcontroller
- Hi-Link Power Supply
- MOSFET (IRF540N)
- OLED Display
- Diode
- Capacitor
- Screw terminal
- PCB



Fig. 3 AWDS System

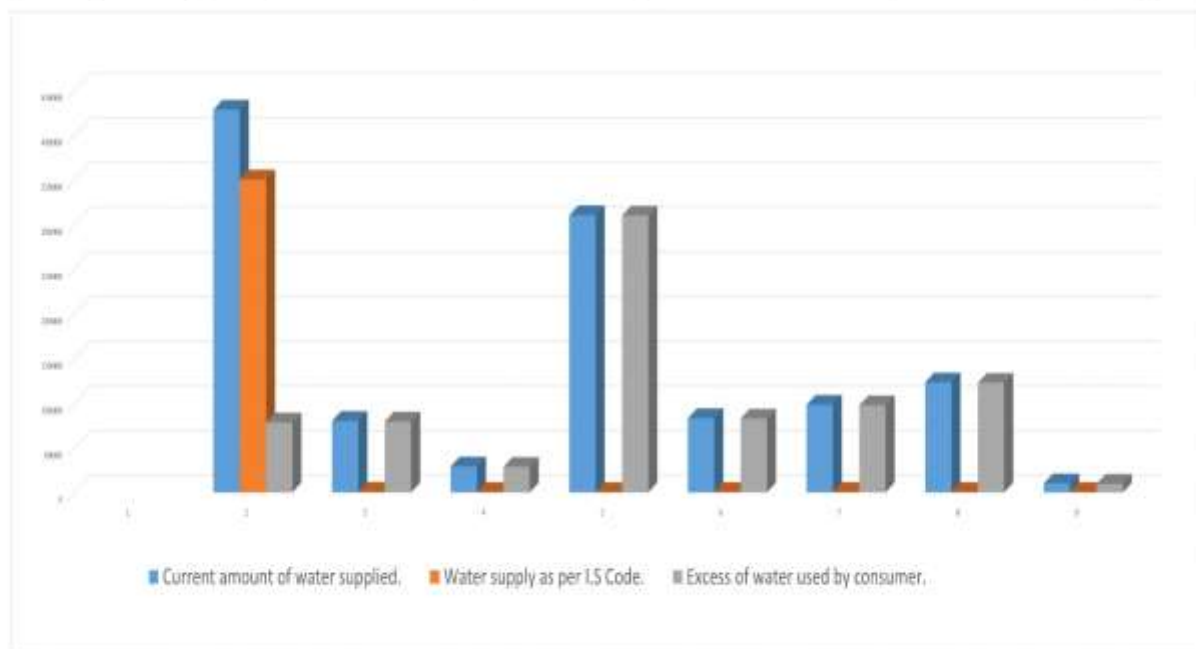
3.2 TABLES AND CHARTS

A.)Following Is The Collective Data of Water Consumption By Consumers of Pimpri Chinchwad Municipal Corporation (PCMC):

Consumers	19th	20th	20th	No. Of Members	Current date of water reading	Preceding date of meter reading	Duration in days	Meter reading before month	Meter reading after month	Reading difference	Current amount of water supplied	Water supply as per I.S Code	Excess of water used by consumer	Season (1/2/3)
1	1			3	19-10-2020	01-04-2020	864	849	877	438	438000	348000	88000	1
2	1			5	07-04-2021	09-05-2021	33	468	588	120	80000	470	79530	1
3	1			3	07-04-2021	08-05-2021	32	2088	2090	2	20880	400	20480	1
4	1			3	08-10-2020	11-10-2020	34	2520	2520	0	22000	400	21600	3
5	1			3	08-04-2021	07-05-2021	31	9900	1140	88	90000	400	89600	3
6	1			4	08-10-2020	08-10-2020	0	4400	4610	210	38000	500	37500	3
7	1			3	07-04-2021	09-05-2021	33	718	887	169	120000	400	119600	1
8	1			3	08-05-2021	17-05-2021	10	8500	8500	0	38000	400	37600	1
9	1			3	07-04-2021	09-05-2021	33	3864	3900	36	42000	400	41600	1
10	1			3	08-10-2020	08-10-2020	0	1400	1641	241	260000	400	259600	3
11	1			3	08-05-2021	07-06-2021	32	1800	1884	84	7000	400	6600	1
12	1			3	08-10-2020	07-04-2021	63	2100	220	1900	5000	400	4600	1
13	1			5	08-04-2021	15-05-2021	37	1400	2000	600	38000	670	37330	1
14	1			3	08-10-2020	08-04-2021	181	5000	8000	3000	70000	400	69600	1
15	1			3	08-10-2020	08-05-2021	123	2800	1140	1660	10000	400	9600	1
16	1			5	08-10-2020	08-10-2020	0	11000	11000	0	80000	670	79330	1
17	1			3	08-04-2021	15-05-2021	37	1400	8000	6600	38000	400	37600	1
18	1			3	05-04-2021	08-05-2021	37	340	411	71	60000	400	59600	1
19	1			3	08-04-2021	15-05-2021	37	1800	1800	0	80000	400	79600	1
20	1			3	08-05-2021	08-04-2021	34	80	91	11	4000	400	3600	1
21	1			3	08-10-2020	08-10-2020	0	40	77	37	20000	400	19600	3
22	1			3	08-05-2021	08-04-2021	32	3000	3900	900	28000	400	27600	1
23	1			4	07-10-2020	08-10-2020	238	8000	8000	0	380000	500	379500	1
24	1			4	07-10-2020	12-10-2020	208	3400	1400	2000	70000	500	69500	3
25	1			4	11-10-2021	01-04-2021	79	1800	3000	1200	30000	500	29500	1
26	1			3	18-10-2020	19-05-2020	61	2700	3800	1100	90000	400	89600	1
27	1			4	11-10-2021	19-04-2021	99	130	180	50	50000	3800	46200	1
28	1			3	08-04-2021	15-05-2021	37	118	220	102	7000	1000	6000	1
29	1			3	05-04-2021	08-04-2021	30	3800	1000	2800	67000	14000	53000	1
30	1			4	02-04-2021	08-05-2021	37	770	980	210	38000	3800	34200	1

Table – 1 Calculation on Excel sheet of random 30 Consumers

B.)Following Is The Graphical Representation Of Consumption of Water By Random 4 Consumers of Pimpri Chinchwad Municipal Corporation:



Graph – 1 Graphical Representation of random 30 Consumers

IV. CONCLUSION

The project has given a solution for real time water management and data generation. The data calculated from these systems can be gathered and stored digitally. So as in future, local and higher authorities such as WRD, Jal Sansadhan Mantri can collect this data and plan more efficiently on water resources and generate water resources if in need.

In this project a major module in Water Controlling in AWDS is successfully implemented using which water misuses are detected in different parts of the system by processing the data collected from module to the server and hence analysing the water wastage in different parts of any area.

The final outcome of the project is a novel smart system that monitors the water discharge in distribution system and prevents wastage of water and also records the data regarding flow rate and total water flow. AWDS is the future of the water distribution system which will operate without zero human assistance.

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Summary of Patents: AY 2020-21

Sr. No.	Name of Inventors	Title of Patent	Patent Number/Application No.	Date of Patent Filing/Registered
1	Mr. S.S. Bobade	ISUAV-Woman Security: Intelligent Woman Security Using Streetlight and Auto Run Unmanned Aerial Vehicle Using IOT- Based Technology	2020102989	09/12/2020
2	Mr. S.S. Bobade	Movements/shifts/displacements monitoring SMART box of Earth Retaining Structures in Landslides Mitigation	2020103096	16/12/2020
3	Mr. S.S. Bobade	Precast Karmaveer Bandhara	202021050661	20/11/2020
4	Mr. S.S. Bobade	Storm Drain Grate to Prevent Entry of Floating Debris/ Trash/Material /	202011046925	28/10/2020
5	Mr. S.S. Bobade	Efficient Reuse Of Grey Water To Flush The Toilets Without Pumping In G+1 Or Multi-Storey Building	202121023530	27/05/2021



Australian Government

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CERTIFICATE OF GRANT INNOVATION PATENT

Patent number: 2020102989

The Commissioner of Patents has granted the above patent on 9 December 2020, and certifies that the below particulars have been registered in the Register of Patents.

Name and address of patentee(s):

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Vipin Jain of Teerthanker Mahaveer Institute of Management and Technology Teerthanker Mahaveer University Moradabad, Uttar Pradesh 244001 India

Title of invention:

ISUAV-Woman Security: Intelligent Woman Security Using Streetlight and Auto Run Unmanned Aerial Vehicle Using IOT- Based Technology

Name of inventor(s):

Gaurang Tiwari, Raj; Srikanth, V.; Murali, A.; Meenakshi, T.; JD, Sunitha.; Reddy Allugunti, Viswanatha; Venkateswara Reddy, L.; Sampatrao Bobade, Sudarshan; Metre, Vishakha A. and Jain, Vipin

Term of Patent:

Eight years from 23 October 2020

NOTE: This Innovation Patent cannot be enforced unless and until it has been examined by the Commissioner of Patents and a Certificate of Examination has been issued. See sections 120(1A) and 129A of the Patents Act 1990, set out on the reverse of this document.



Dated this 9th day of December 2020

Commissioner of Patents

PATENTS ACT 1990

The Australian Patents Register is the official record and should be referred to for the full details pertaining to this IP Right.

Sect 120(1A) Infringement proceedings in respect of an innovation patent cannot be started unless the patent has been certified.

- (1) Where a person, by means of circulars, advertisements or otherwise, threatens a person with infringement proceedings or other similar proceedings a person aggrieved may apply to a prescribed court, or to another court having jurisdiction to hear and determine the application, for:
 - (a) a declaration that the threats are unjustifiable; and
 - (b) an injunction against the continuance of the threats; and
 - (c) the recovery of any damages sustained by the applicant as a result of the threats.
- (2) Subsection (1) applies whether or not the person who made the threats is entitled to, or interested in, the patent or a patent application.

Certain threats of infringement proceedings are always unjustifiable.

- (1) If:
- (a) a person:
 - (i) has applied for an innovation patent, but the application has not been determined; or
 - (ii) has an innovation patent that has not been certified; and
 - (b) the person, by means of circulars, advertisements or otherwise, threatens a person with infringement proceedings or other similar proceedings in respect of the patent applied for, or the patent, as the case may be;
- then, for the purposes of an application for relief under section 128 by the person threatened, the threats are unjustifiable.

(2) If an application under section 128 for relief relates to threats made in respect of an innovation patent that has not been certified or an application for an innovation patent, the court may grant the application the relief applied for.

(3) If an application under section 128 for relief relates to threats made in respect of a certified innovation patent, the court may grant the applicant the relief applied for unless the respondent satisfies the court that the acts about which the threats were made infringed, or would infringe, a claim that is not shown by the applicant to be invalid.

certified, in respect of an innovation patent other than in section 19, means a certificate of examination issued by the Commissioner under paragraph 101E(e) in respect of the patent



Australian Government

IP Australia

CERTIFICATE OF GRANT INNOVATION PATENT

Patent number: 2020103096

The Commissioner of Patents has granted the above patent on 16 December 2020, and certifies that the below particulars have been registered in the Register of Patents.

Name and address of patentee(s):

Sudarshan Sampatrao Bobade of Civil Engineering Department, TSSM's BSCOER Narhe, Pune Maharashtra 411041 India

Arun Wamanrao Dhawale of Civil Engineering Department, TSSM's BSCOER, Narhe Pune Maharashtra 411041 India

Vaibhav Garg of Civil Engineering Department, TSSM's BSCOER, Narhe Pune Maharashtra 411041 India

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Aviraj Jitendra Bobade of Krupasindhu, Opposite Jotiba Temple, At – Belwadi Post- Kalgaon Tal- Karad, Dist- Satara Maharashtra 415109 India

Saish Sharad Bobade of Krupasindhu, Opposite Jotiba Temple, At – Belwadi Post- Kalgaon Tal- Karad, Dist- Satara Maharashtra 415109 India

Yogesh Mohanrao Nigade of Gulunche, Tal: Purandar Dist: Pune MH 412102 India

Anand Bajrang Tapase of Civil Engineering Department, KBPCOE, CTS No: 453 Sadar Bazar, Satara Maharashtra 415001 India

Title of invention:

Movements/shifts/displacements monitoring SMART box of Earth Retaining Structures in Landslides Mitigation

Name of inventor(s):

Sampatrao Bobade, Sudarshan; Wamanrao Dhawale, Arun; Garg, Vaibhav; Mohan Patil, Rupali; Sudarshan Bobade, Shravani; Mohan Patil, Mangesh; Jitendra Bobade, Aviraj; Sharad Bobade, Saish; Mohanrao Nigade, Yogesh and Bajrang Tapase, Anand

Term of Patent:

Eight years from 29 October 2020

NOTE: This Innovation Patent cannot be enforced unless and until it has been examined by the Commissioner of Patents and a Certificate of Examination has been issued. See sections 120(1A) and 129A of the Patents Act 1990, set out on the reverse of this document.



Dated this 16th day of December 2020

Commissioner of Patents

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The Australian Patents Register is the official record and should be referred to for the full details pertaining to this IP Right.

Sect 120(1A) Infringement proceedings in respect of an innovation patent cannot be started unless the patent has been certified.

- (1) Where a person, by means of circulars, advertisements or otherwise, threatens a person with infringement proceedings or other similar proceedings a person aggrieved may apply to a prescribed court, or to another court having jurisdiction to hear and determine the application, for:
 - (a) a declaration that the threats are unjustifiable; and
 - (b) an injunction against the continuance of the threats; and
 - (c) the recovery of any damages sustained by the applicant as a result of the threats.
- (2) Subsection (1) applies whether or not the person who made the threats is entitled to, or interested in, the patent or a patent application.

Certain threats of infringement proceedings are always unjustifiable.

- (1) If:
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 - (i) has applied for an innovation patent, but the application has not been determined; or
 - (ii) has an innovation patent that has not been certified; and
 - (b) the person, by means of circulars, advertisements or otherwise, threatens a person with infringement proceedings or other similar proceedings in respect of the patent applied for, or the patent, as the case may be;
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(3) If an application under section 128 for relief relates to threats made in respect of a certified innovation patent, the court may grant the applicant the relief applied for unless the respondent satisfies the court that the acts about which the threats were made infringed, or would infringe, a claim that is not shown by the applicant to be invalid.

certified, in respect of an innovation patent other than in section 19, means a certificate of examination issued by the Commissioner under paragraph 101E(e) in respect of the patent

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G.A.R.6
[See Rule 22(1)]
RECEIPT



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104, SAI GLAMOUR RESIDENCY,
LAXMINAGAR, RAVET, PUNE 412101

CBR Detail:

Sr. No.	Ref. No./Application No.	App. Number	Amount Paid	C.B.R. No.	Form Name	Remarks
1	202021050661	TEMP/E-1/56346/2020-MUM	1600	29394	FORM 1	PRECAST KARMAVEER BANDHARA (PKB)

TransactionID	Payment Mode	Challan Identification Number	Amount Paid	Head of A/C No
N-0000727513	Online Bank Transfer	2011200012568	1600.00	1475001020000001

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RECEIPT



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Sr. No.	Ref. No./Application No.	App. Number	Amount Paid	C.B.R. No.	Form Name	Remarks
1	202011046925	TEMP/E-1/52015/2020-DEL	1600	35707	FORM 1	STORM DRAIN GRATE TO PREVENT ENTRY OF FLOATING DEBRIS/TRASH/MATERIAL/LITTER

TransactionID	Payment Mode	Challan Identification Number	Amount Paid	Head of A/C No
N-0000718202	Online Bank Transfer	2810200003351	1600.00	1475001020000001

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Sr. No.	Ref. No./Application No.	App. Number	Amount Paid	C.B.R. No.	Form Name	Remarks
1	202121023530	TEMP/E-1/25456/2021-MUM	1600	12082	FORM 1	EFFICIENT REUSE OF GREY WATER TO FLUSH THE TOILETS WITHOUT PUMPING IN G+1 OR MULTI-STOREY BUILDING

TransactionID	Payment Mode	Challan Identification Number	Amount Paid	Head of A/C No
N-0000806882	Online Bank Transfer	2705210001530	1600.00	1475001020000001

Total Amount : ₹ 1600

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Queen Elizabeth II