

# Aakruti...



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## **HOD MESSAGE**

I am Happy to interact with all stakeholders through this Technical Magazine “Aakruti “. This is outcome of all the research conducted by the civil engineering students and faculties. The editorial team has taken lot of efforts in collecting and nicely presenting it in the Technical Magazine. On behalf of Civil Engineering department, I am thankful to Exe. Director Shri Anil A. Bagane and Principal Dr. S.A.Khot for continuous motivation to bring all the activities at one level.

**Dr. Ashish Gurav**

## **EDITOR'S MESSAGE**

“Do not give up your “Dream”, because as you continue trying, you are becoming closer and closer to it. When others think it is impossible, it does not mean it is impossible for you.”

Many students may or may not understand or believe in the possibility of achieving the “Dreams” in their own live or in the lives of others. Many have given up their dreams early on in their lives might even laugh at statement! But each year, again and again, my students keep on proving the above statement correct. Impossible dreams can and DO become realities.

The journey of publication of this maiden issue of technical magazine is very much like making the dreams true. I am very glad that my students, colleagues and well-wishers have helped me and my department to achieve this mile stone. I hope that this will continue in coming future too and we will able to bring such issues.

I am very thankful to Dr. Ashish Gurav, Head of civil department for inspiring me to publish this magazine. His untiring efforts in compiling the issue has lions share in this publication. Also I am very much thankful to Dr. S.A. Khot, our beloved principle, and Hon. Shri. A. Bagane to support this activity.

Above all I am very thankful to all students of Civil Engineering Department while publishing this issue.

**Mr. Sandeep B. Chougule**

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# **USE OF RECYCLED PLASTIC WASTE IN FLEXIBLE PAVEMENT**

By

**Mr. Y.S. Patil**

Assistant Professor, SITCOE, Yadrav

## **INTRODUCTION:**

Human activities create waste, and it is the way these wastes are handled, stored, collected and disposed of, which can pose risks to the environment and to public health. In urban areas, especially in the rapid urbanizing cities of the developing world, problems and issues of Solid Waste Management (SWM) are of immediate importance. This has been acknowledged by most governments, however rapid population growth over-whelms the capacity of most municipal authorities to provide even the most basic services. Typically one two thirds of the solid waste generated is not collected. As a result, the uncollected waste, which is often also mixed with human and animal excreta, is dumped in-discriminately in the streets and in drains, so contributing to flooding, breeding of insect and rodent vectors and the spread of diseases. Looking to the global issue by plastic waste, and waste metal research efforts have been focused on consuming the waste on massive scale in efficient and environmental friendly manner. Plastic waste recycling is an excellent environmental friendly way as compared to disposal of waste plastic. On this outline of problem of disposal of plastic and metal waste, following proposal is based. It focuses on manufacturing green fencing post made up of 100% waste plastic. This can consume high amount of waste plastic along with reduction of the requirement of material for conventional construction, like cement and sand and aggregate. This will also lead to reduced carbon foot-print. These fencing posts are capable to withstand all quality parameters as per IS 4996-1984.

## **METHODOLOGY:**

Following test has to carry out in order to point out the property of the pure bitumen and rubberized bitumen:

1. Penetration test: It is the test to measure the hardness or the softness of bitumen by measuring the depth in millimetre. Also, it is calculated the consistency of bitumen

2. Flash and Fire Test: Generally, to focus on the safe mixing and the application of temperature value. The temperature at which spark generate is known as the flash point and the point at which bitumen start to ignite or fire is called as fire point.
3. Ductility Test: Ability of material to undergo plastic deformation before the break. It is as important test to measure the elongation of bitumen under the traffic load.
4. Viscosity Test: Is it the test to define the fluid property of material i.e. resistance to the flow. When apply the temperature it greatly influences the strength of resulting paving mixes.

**TESTING:**

1. Flash and Fire point test
2. Softening point test
3. Penetration test
4. Viscosity test
5. Ductility test

**COSTING AND EVALUATION :**

**For 10% of bitumen**

Cost of plastic – 60 Rs/Kg

Plastic replaced – 1.5 Kg

Total cost of plastic – 90 Rs

Cost of bitumen – 90 Rs/Kg

Bitumen replaced – 1.5 Kg

Total cost of bitumen – 135 Rs

$$\begin{aligned}
 \text{Cost saved due to replacement} &= \text{Amount of bitumen replaced} - \text{Amount of plastic} \\
 &= 135 - 90 \\
 &= 45 \text{ Rs.}
 \end{aligned}$$

**For 15% of bitumen**

Cost of plastic – 60 Rs/Kg

Plastic replaced – 3 Kg

Total cost of plastic – 180 Rs

Cost of bitumen – 90 Rs/Kg

Bitumen replaced – 3 Kg

Total cost of bitumen – 270 Rs

$$\begin{aligned}\text{Cost saved due to replacement} &= \text{Amount of bitumen replaced} - \text{Amount of plastic} \\ &= 270 - 180 \\ &= 90 \text{ Rs}\end{aligned}$$

#### **BENEFITS TO SOCIETY:**

1. Efficient waste management.
2. Helpful to aquatic life, as the dumping of plastic waste will be reduced.
3. Green belt development.
4. Longer working life.
5. Convenient operation.

#### **CONCLUSION:**

Plastic roads can withstand heavy traffic and are durable than flexible pavement roads. The use of plastic mixture reduces the bitumen content by 15% and improves the strength and performance of the road. This new technology is environmental friendly. The field trails have also been successful in pune, Bangalore and Jamshedpur. With combined efforts of contractors and government plastic bitumen roads will be able to curb the biggest waste disposal problem of the country. The plastic roads are also cost efficient and it is said that use of plastic in road constructions would help to resolve the problem in the world up to some extent. The use of plastic mix will reduce the bitumen content by 15% and increases the strength and performance of the road. The comparison study done between various parameters have also explained that utilization of waste plastic is the new saviour of mother land.

# CONCRETE SLUMP TEST

By

**Mr. Sandeep B. Chougule**

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## DEFINITION:

Concrete Slump Test is a measurement of concrete's workability, or fluidity. It's an indirect measurement of concrete consistency or stiffness. A slump test is a method used to determine the consistency of concrete. The consistency, or stiffness, indicates how much water has been used in the mix. The stiffness of the concrete mix should be matched to the requirements for the finished product quality

## CONCRETE SLUMP TEST:

The concrete slump test is used for the measurement of a property of fresh concrete. The test is an empirical test that measures the workability of fresh concrete. More specifically, it measures concrete consistency between batches. The test is popular due to the simplicity of apparatus used and simple procedure.



## PRINCIPLE OF SLUMP TEST:

The slump test result is a measure of the behavior of a compacted inverted cone of concrete under the action of gravity. It measures the consistency or the wetness of concrete which then gives an idea about the workability condition of concrete mix.

### **SLUMP TEST APPARATUS:**

1. Slump cone,
2. Scale for measurement,
3. Temping rod (steel)

### **PROCEDURE OF CONCRETE SLUMP TEST:**

1. The mold for the concrete slump test is a frustum of a cone, 300 mm (12 in) of height. The base is 200 mm (8in) in diameter and it has a smaller opening at the top of 100 mm (4 in).
2. The base is placed on a smooth surface and the container is filled with concrete in three layers, whose workability is to be tested .
3. Each layer is temped 25 times with a standard 16 mm (5/8 in) diameter steel rod, rounded at the end.
4. When the mold is completely filled with concrete, the top surface is struck off (leveled with mould top opening) by means of screening and rolling motion of the temping rod.
5. The mould must be firmly held against its base during the entire operation so that it could not move due to the pouring of concrete and this can be done by means of handles or foot - rests brazed to the mold.
6. Immediately after filling is completed and the concrete is leveled, the cone is slowly and carefully lifted vertically, an unsupported concrete will now slump.
7. The decrease in the height of the center of the slumped concrete is called slump.
8. The slump is measured by placing the cone just besides the slump concrete and the temping rod is placed over the cone so that it should also come over the area of slumped concrete.
9. The decrease in height of concrete to that of mold is noted with scale. (usually measured to the nearest 5 mm (1/4 in).

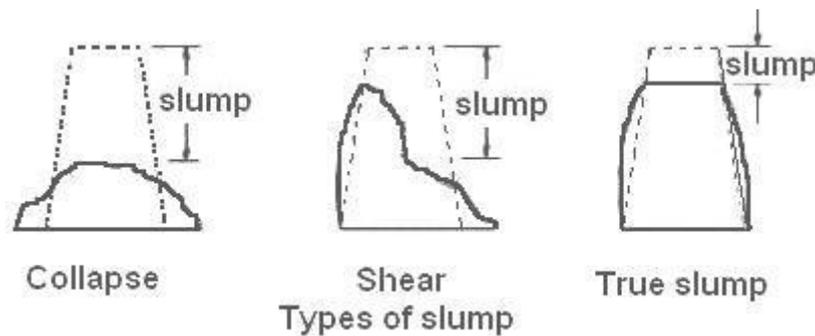
### **PRECAUTIONS IN SLUMP TEST**

In order to reduce the influence on slump of the variation in the surface friction, the inside of the mould and its base should be moistened at the beginning of every test, and prior to lifting of the mould the area immediately around the base of the cone should be cleaned from concrete which may have dropped accidentally.

## TYPES OF CONCRETE SLUMP

The slumped concrete takes various shapes, and according to the profile of slumped concrete, the slump is termed as;

1. Collapse Slump
2. Shear Slump
3. True Slump



### **Collapse Slump**

In a collapse slump the concrete collapses completely. A collapse slump will generally mean that the mix is too wet or that it is a high workability mix, for which slump test is not appropriate. It means the water-cement ratio is too high, i.e. concrete mix is too wet or it is a high workability mix, for which a slump test is not appropriate.

### **Shear Slump**

In a shear slump the top portion of the concrete shears off and slips sideways. OR

If one-half of the cone slides down an inclined plane, the slump is said to be a shear slump. The shear slump indicates that the result is incomplete, and concrete needs to be retested for valid results.

1. If a shear or collapse slump is achieved, a fresh sample should be taken and the test is repeated.
2. If the shear slump persists, as may the case with harsh mixes, this is an indication of lack of cohesion of the mix.

## **True Slump**

In a true slump the concrete simply subsides, keeping more or less to shape

1. This is the only slump which is used in various tests.
2. Mixes of stiff consistence have a Zero slump, so that in the rather dry range no variation can be detected between mixes of different workability.

However, in a lean mix with a tendency to harshness, a true slump can easily change to the shear slump type or even to collapse, and widely different values of slump can be obtained in different samples from the same mix; thus, the slump test is unreliable for lean mixes.

## **APPLICATIONS OF SLUMP TEST**

1. The slump test is used to ensure uniformity for different batches of similar concrete under field conditions and to ascertain the effects of plasticizers on their introduction.
2. This test is very useful on site as a check on the day-to-day or hour- to-hour variation in the materials being fed into the mixer. An increase in slump may mean, for instance, that the moisture content of aggregate has unexpectedly increases.
3. Other cause would be a change in the grading of the aggregate, such as a deficiency of sand.
4. Too high or too low a slump gives immediate warning and enables the mixer operator to remedy the situation.
5. This application of slump test as well as its simplicity, is responsible for its widespread use.

# **USE OF RUBBER TYRE WASTE AS AN EFFECTIVE CONSTRUCTION MATERIAL IN FLEXIBLE PAVEMENT**

**By**

**Mr. Y.S. Patil**

Assistant Professor, SITCOE, Yadrav

## **INTRODUCTION:**

In India top 7 large tire companies are responsible for 85% tire productions. The sale of automobile tires was 8.8 million units in 1982 which had increased to 17.7 million in the year of 1991, representing the growth rate of more than 100% in ten years. The disposal of these used tires has become a global problem. Developed and industrialized countries are facing a monumental problem in the disposal of used tire. Waste tire creates a suitable breeding place for vermin and insects and thus poses health risk. A more serious problem is that it is combustible. A huge volume of scrap tires has been stockpiled in many countries causing adverse impact on the environment in figure 1. The volume of waste tire generated is 1.5 billion per year owing to the increase in the number of vehicles worldwide (ET RMA2011).

Waste tire rubber is an important source of secondary raw materials. It is estimated that 1.2 billion of waste tire rubber produced globally in a year. 33 million vehicles manufactured in India. The disposal of these discarded tires is a major environmental concern worldwide. Tire landfilling a common method for disposing of waste tire rubber, is responsible for a serious ecological threat. The landfilling of waste tire creates soil and water pollution, because the waste tire rubber holds toxic and soluble components. It also provides a breeding habitat for various pests, burning of tires results in serious fire hazards. Therefore, it is necessary to find out the alternative for consumption disposal of the discarded rubber tires. Waste tire rubber can be used in construction industry. An attempt to use this waste tire rubber for improving the properties of bitumen by blending it with crumb rubber. It will improve the bitumen binder properties and cost effective.

Tire recycling, or rubber recycling, is the process of recycling waste tires that are no longer suitable for use on vehicles due to wear or irreparable damage. These tires are a challenging source of waste, due to the large volume produced, the durability of the tires, and

the components in the tire that are ecologically problematic. Because tires are highly durable and non-biodegradable, they can consume valued space in landfills.

The reuse of a large amount of waste materials in civil engineering applications can positively contribute to a sustainable society. The current use waste tire in civil engineering applications includes landfills liners and caps, sub-grade fills an embankment, backfill for retaining walls and bridge abutments, aggregate in leach beds for septic systems, additives to asphalt, leachates collection stone in land-fills, sound barriers, admixtures in bituminous concrete and scrap tire pads as low cast seismic base isolation pads. Although waste tires having good engineering property, only a small amount of tire are currently reused in various civil engineering projects, i.e., 4.7% in the European Union in 2010 (ETRAM 2012) and 7.8% in the United States of America in 2011 (RMA 2013). This is not only minimizing the pollution occurred due to waste tire but also minimizes the use of conventional aggregate which is available in less quantity in our environment. It increases the durability of roads to reduce the problem of permanent deformations and thermal cracking. It is workable in higher temperature which is very beneficial for bituminous roads.

### **WHAT IS RUBBERIZED BITUMEN?**

1. Rubberized bitumen is a mixture of hot bitumen and crumb rubber are derived from waste tire.
2. Rubberized bitumen was invented by Charles McDonald in the mid 1960's.
3. It is extensively used in USA, particularly in the states of Arizona, California and Texas.
4. Difference between Asphalt pavement and Asphalt rubberized pavement.

<b>Asphalt pavement</b>	<b>Asphalt rubberized pavement</b>
Here only bitumen is used as a binding material	Here both crumb rubber and bitumen are used as a binding material

To find out the alternative solution of geo-materials which have good strength parameters as well as deformation parameters is a burning task for various geo-engineering applications. Several researchers are exploring the possibility of using different by products or waste materials like fly ash, fiber, rice husk ash and recycled tire materials as geo- materials. Waste tire have been used for reinforcing soft soil in road construction and retaining wall back fill.

## **WASTE TIRE**

Waste tire are categorized as solid or hazardous waste. Now- a-days it is used as an alternative source of construction material because its stockpiling creates lots of problems. Scrap-tire-derived materials are being used in civil engineering applications in three forms as per ASTM D6270 (ASTM 2008), namely tire crumbs (length < 10mm), tire chips (length = 10-50mm) and tire shreds (length >50mm). Typically value of thickness of tire chips (in figure 3) and shreds are 10-100mm. Sieves are used to grade the materials; generally, tire crumbs are avoided.

## **PROPERTIES OF TIRE**

<b>Sr. no.</b>	<b>Property</b>	<b>Value</b>
1	Specific gravity	1.08
2	Min. unit weight (KN/m <sup>3</sup> )	5.39
3	Compacted unit weight (KN/m <sup>3</sup> )	6.45
4	Friction angle	15-38°

## CONCLUSION:

The basic property that we tested for bitumen is in permissible limit. By Adding 0-3%,3%-5% and 5%-10% Crumb rubber in bitumen ductility and viscosity of bitumen are increasing and penetration, flash & fire point are decreasing. But up to 3% addition of crumb rubber obtain value are within the limit. Stability and flow of bitumen mix are within the limit up to 3% of crumb rubber. Ultimately, the use of waste tire in pavement materials improves the quality and performance of roads. In case of environment sustainability, it helps to reduce the amount of tire waste from environment and eventually helps to reduce environmental pollution. This technology also helps to reduce the load on solid waste management. In case of Economical aspect, use of waste tires in road pavement helps to decrease excess cost and to improve quality of road.

Sr. No.	Composition	% by weight
1	Zinc	1.52
2	Calcium	0.378
3	Iron	0.321
4	Chlorine	0.149
5	Chromium	0.0097
6	Fluoride	0.0010
7	Cadmium	0.0006
8	Lead	0.0065

# **INVESTIGATION OF DEEP BEAM BY IS CODE AND CIRIA GUIDE**

**By**

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## **INTRODUCTION**

Kore et.al (2013)[1] carried out Analysis and Design of R.C. Deep Beams Using Code Provisions of Different Countries and Their Comparison, This paper describes analysis and design of deep beams subjected to two equal point loads acting  $1/3$ rd of span with different L/D ratios and codes referred were INDIAN STANDERD CODE (I.S.-456-2000), NEWZEALAND (NDS-3101-2006), CANADIAN(CSA-A23.3-2004.), CIRIA GUIDE-2(1977) and APPENDIX-A of ACI -318 {STRUT and TIE METHOD) for design purpose. The parameters observed were Lever Arm, Theoretical steel required and strength of deep beam.

Kale et.al (2012)[2] done Analysis of Deep Beam Using Cast Software and Compression of Analytical Strain with Experimental Strain Results in that Analysis of deep beam by using CAST software based on strut and tie method. as per ACI 318-05(Appendix A).Design and casting of several deep beam using STM. Testing of deep beams in heavy structures laboratory for two point loading condition. Measurement of strain, load and deflection under controlled condition. Comparison of analytical flexure strain with experimental results.

Niranjan et.al (2012)[3] done Analysis of R.C Deep Beam by Finite Element Method in that the analytical study of reinforced concrete simply supported deep beams subjected to two point loads was carried out using finite element method to study the behavior of deep beam by considering flexural stress, flexural strain, and shear stress variations at different sections for various effective lengths to depth ratio and compared with Euler-Bernoulli Theory. The effective span to depth ratios of the beams considered were 1.25, 1.375 and 1.5.

Yang and Ashour (2008)[8] studied the effectiveness of web reinforcement around openings in continuous concrete deep beams. Twenty-two reinforced concrete continuous deep beams were tested to failure. The main variables investigated were the configuration of web reinforcement around opening, location of opening and shear span-to-overall depth ratio. Web opening located in either exterior or interior shear spans, the shear span-to-overall depth ratio was selected to be 0.6 and 1.0. The shear capacity of continuous beams having shear span-to-overall depth ratio of 0.6 is calculated using Kong et al formula, whereas the predicted shear capacity of beams having shear span to depth ratio of 1.0 is in good agreement with test results. The mechanism analysis based on the upper bound theorem also calculates the load capacity of continuous deep beams having openings within exterior shear spans but shows better agreement with that of continuous deep beams having openings within interior shear spans

Lu (2006) [9] proposed an analytical method for determining the shear strengths of steel reinforced concrete deep beams under the failure mode of concrete crushing originally based on the softened strut-and-tie model. The proposed method is a good physical model that can correlate well with the observed failure phenomenon of steel reinforced concrete deep beams. Based on the softened strut-and-tie model this paper proposes an analytical method for determining the shear strengths of Steel Reinforced concrete deep beams under the failure mode of concrete crushing. Based on the available experimental data, the applicability of the proposed strut-and-tie model to SRC deep beams for predicting the shear strength is examined. Also, a parametric study was performed to demonstrate the variation in the shear-carrying capacities of SRC deep beams caused by various parameters.

Aguilar et.al [14] Experimental Evaluation of Design Procedures for Shear Strength of Deep Reinforced Concrete Beams In this paper, results from the monotonic testing of four reinforced concrete deep beams is presented. The behavior of the deep beams is described in terms of cracking pattern, load-versus-deflection response, failure mode, and strains in steel reinforcement and concrete. Despite different failure modes, the failure loads and corresponding ultimate deflections were similar in all four specimens. Yielding of both longitudinal and transverse reinforcement occurred prior to failure. Based on the test results, the shear design procedures contained in the ACI 318-99 Code and Appendix A of the ACI 318-02 Code were evaluated. Both design procedures yielded conservative predictions of the shear strength of the single-span deep beams.

Salamy et.al [15] carry out Experimental and Analytical Study on RC deep beams, in that A study on RC deep beams behavior is conducted in this paper by means of finite element analysis along with experimental evaluation of analytical simulation. The beams have shear span to depth ratio between 0.5 and 1.5 and effective depth from 400 mm to 1400 mm. Lateral reinforcement ratio varies by 0.0%, 0.4% and 0.8% in shear span. A fracture type analysis is employed to simulate RC members through smeared rotating crack approach. The results showed reliability of analysis in predicting deep beams behavior in terms of failure load, failure mode as well as crack propagation. The objective of this study is to investigate capabilities of the finite element simulation for further study on deep beam behavior instead of conducting expensive time consuming experimental works. This includes particularly members with possibilities of failing in shear as well as size effect by means of large-scale structures numerical simulation.

In the present work, deep beams designed by using Codes of different countries such as IS 456-2000, (NDS-3101-2006), CRIIA GUIDE-2 of various Length to Span ratio under two point loading. The deflection, cracking, stress distribution (flexure, shear) parameters are investigated and results obtained experimentally are presented

## **1.1 Theoretical Formulation**

### **CODAL PROVISIONS:**

#### **1.1.1. IS CODE:**

As per the IS 456:2000, when the ratio of the effective span (L) to the overall depth (D) of a simply supported beam is less than or equal to 2.0, then the beam can be treated as a deep beam. The lever arm (Z) is given as

$$Z = 0.2 (L + 2D); 1 \leq L/D \leq 2$$

$$Z = 0.6L; L/D < 1$$

Where L is the effective span taken as centre to centre distance between the supports, or 1.15 times the clear span, whichever is smaller; and D is the overall depth. The tensile reinforcement required to resist the positive bending moment shall

Extend without curtailment between the supports;

Be embedded to a length not less than 0.8 times the development length beyond the face of the support; and

Be placed within a zone of depth equal to  $(0.25 D - 0.05 L)$  from the extreme tension fiber at mid-span.

The side face reinforcement is provided both in the vertical and horizontal directions at spacing limited to, smaller of three times the width of the beam or 450mm. the minimum areas of vertical and horizontal side face reinforcement are given below.

Side face reinforcement not only overcomes the effects of shrinkage and temperature but also acts as shear reinforcement. These specifications are,

Vertical steel shall be 0.15% for Fe 250 and 0.12% for Fe415. The bars shall not be more than 14mm diameter and spaced not more than 3 times the thickness of the beams or 450mm.

Horizontal steel shall be 0.25% for Fe250 and 0.20% for Fe415. The bars shall not be more than 16mm diameter and spaced not more than 3 times the thickness of the beams or 450mm.

A deep beam complying with the required of CL.29.2 and CL.29.3, IS 456-2000, page 51.

### **1.1.2. CIRIA GUIDE:**

The CIRIA Guide applies to beam having an effective span/depth ratio  $l/h$  of less than 2 for single-span beams and less than 2.5 for continuous beam. The CIRIA Guide was intended to be used in conjunction with the British Code CP 110: 1972; however, the authors have done some comparative calculations (Kong et.al. 1986).

The Guide defines the effective span  $l$  and active height  $h_a$  as follows

$$l = l_0 + [\text{lesser of } (c_1/2 \text{ and } 0.1 l_0)] + [\text{lesser of } (c_2/2) \text{ and } 0.1 l_0]$$

$$h = h \text{ or } l \text{ whichever is the lesser}$$

The lever arm ( $Z$ ) is given as

$$z = 0.2l + 0.4h_a \dots \dots \dots (\text{For s.s.beam})$$

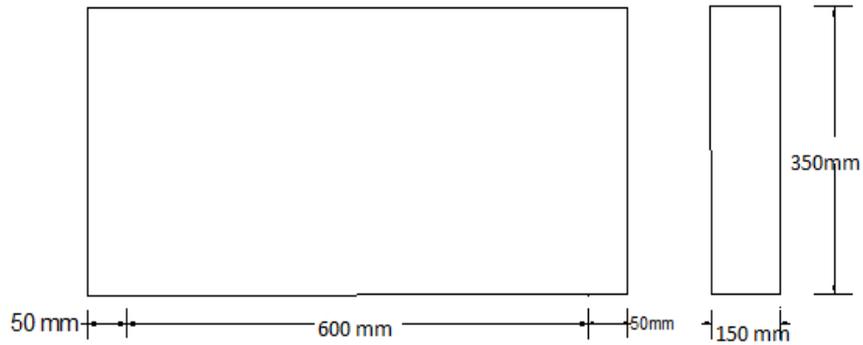
Where,  $l$  = effective span of beam and  $h_a$  = Depth of beam

## **2. Experimental Work**

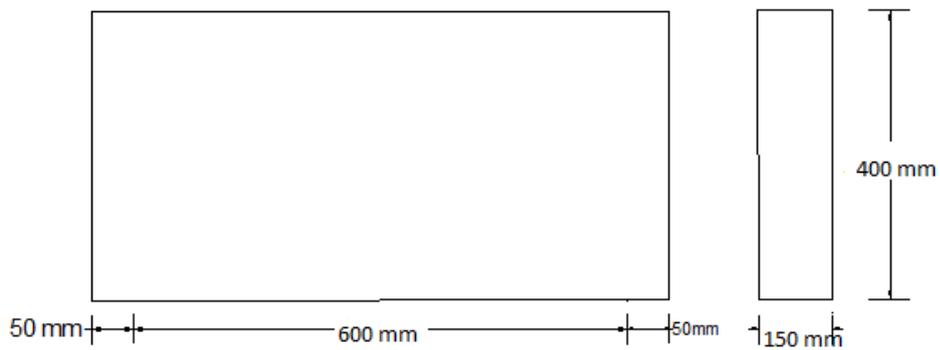
A mix is designed as per IS: 10262-1982 to achieve minimum target strength of 20 N/mm<sup>2</sup>. The mix proportion by weight is 1: 1.82: 3.8. a constant water cement ratio of 0.5 is used.

### **2.1 Specimen Details**

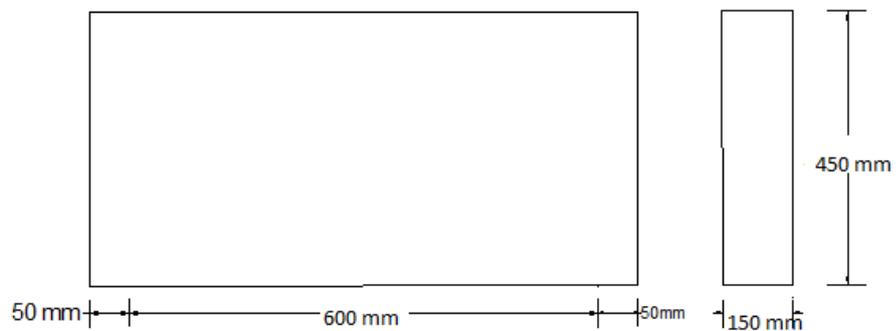
The experimental program to be consists of casting and testing of 36 numbers of 700 mm and 600 mm long reinforced concrete deep beams with variable cross section. All the beams tested over a simply supported span. The beam designed by using IS 456:2000 and CIRIA guide as under reinforced section to sustain minimum two point loads of 50kN. The details of reinforcement present in the test beam are shown below. Testing of deep beams and cubes was done after 28 days curing. The details of specimens are as follows:



**Figure 1.** The Dimensions of the Deep Beam Specimen B1 & B7



**Figure 2.** The Dimensions of the Deep Beam Specimen B2 & B8



**Figure 3.** The Dimensions of the Deep Beam Specimen B3 & B9

**Table 1. Reinforcement Details of Test Specimen**

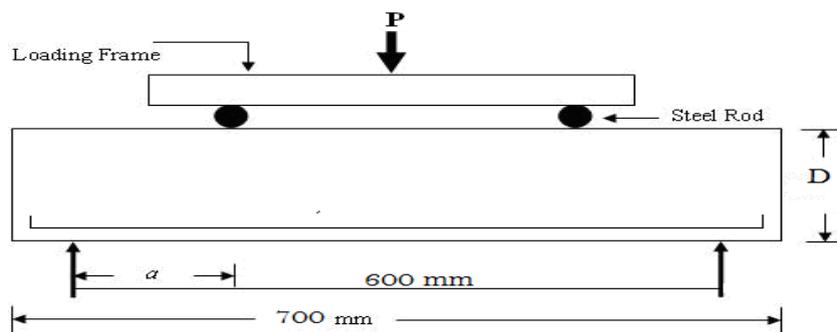
<b>AS per IS-456-2000</b>						
Beam no.	B1	B2	B3	B4	B5	B6
Depth (mm)	350	400	450	350	400	450
Length (mm)	700	700	700	600	600	600
l/d ratio	1.71	1.5	1.33	1.43	1.25	1.11
Lever arm (Z) (mm)	260	280	300	240	260	280
Steel (mm <sup>2</sup> )	133.41	123.98	115.82	144.27	133.24	123.80
Steel provided (mm <sup>2</sup> )	157 2-10mm $\phi$	157 2-10mm $\phi$	157 2- 10mm $\phi$	157 2- 10mm $\phi$	157 2- 10mm $\phi$	157 2- 10mm $\phi$
Min shear Vertical	63	72	81	63	72	81
Min shear Horizontal	105	120	135	105	120	135
Vertical	4-8mm $\phi$	4-8mm $\phi$	4- 8mm $\phi$	4- 8mm $\phi$	4- 8mm $\phi$	4- 8mm $\phi$
Horizontal	2-8mm $\phi$	2-8mm $\phi$	2- 8mm $\phi$	2- 8mm $\phi$	2- 8mm $\phi$	2- 8mm $\phi$
Zone of placement	57.5mm	70mm	82.5mm	62.5mm	75mm	87.5mm
<b>CIRIA GUIDE</b>						
Beam no.	B7	B8	B9	B10	B11	B12
Steel (mm <sup>2</sup> )	389.92	475.36	558.62	422.41	509.28	598.52
Steel prov. (mm <sup>2</sup> )	402.12 2-16mm $\phi$	603.18 3-16mm $\phi$	603.18 3- 16mm $\phi$	603.18 3- 16mm $\phi$	603.18 3- 16mm $\phi$	603.18 3- 16mm $\phi$
Distribute rein. Overdepth (mm)	70mm	80mm	90mm	70mm	80mm	90mm

**Table 2. Specimen Schedule**

Size in mm	No. of Deep Beam			
	As per IS Code		CIRIA GUIDE	
	Beam Name	No. of Deep Beam	Beam Name	No. of Deep Beam
700X150X350	B1	3	B7	3
700X150X400	B2	3	B8	3
700X150X450	B3	3	B9	3
600X150X350	B4	3	B10	3
600X150X400	B5	3	B11	3
600X150X450	B6	3	B12	3

## 2.1 Test Setup

Tests was carried out at room temperature and as per the Indian standards. The testing arrangement is shown in fig no. 4 two point loads were applied on reinforced concrete deep beams of span 0.6m through hydraulic jack of capacity 1000kN. The specimens were placed on a simply supported arrangement of 100 T loading frame. The beams were suitably instrumented for measuring of middle strain including the mid span deflection with dial gauges and strain gauges. Demountable mechanical stain gauge was used to measure the concrete strain readings at mid-section of the beam.



**Figure 4. Loading Setup**

### 3 Results and Conclusion

**Table 3.** Central Deflection

Specimen No.	Load (kN)	Deflection (mm)	Specimen No.	Load (kN)	Deflection(mm)
B 1	332	0.79	B 7	279	1.05
B2	372	1.16	B 8	310	1.35
B 3	390	1.58	B 9	323	1.65
B 4	318	1.15	B 10	263	1.47
B 6	369	1.32	B 12	300	1.67

**Table 4.** Flexural Stresses in N/mm<sup>2</sup>

250 kN			300 kN			300 kN		
Depth	B1	B7	Depth	B2	B8	Depth	B3	B9
300 mm	4.55	5.96	350 mm	5.75	6.50	400 mm	7.91	8.36
250 mm	1.86	2.53	300 mm	4.33	4.18	350 mm	6.57	6.72
200 mm	1.49	1.64	250 mm	1.64	1.93	300 mm	2.30	2.84
150 mm	1.79	2.01	200 mm	1.50	1.61	250 mm	1.94	1.95
100 mm	1.34	1.64	150 mm	1.72	1.78	200 mm	1.63	1.72
50 mm	4.55	7.45	100 mm	1.49	1.58	150 mm	1.48	1.50
			50 mm	5.82	7.32	100 mm	1.18	1.20
						50 mm	5.75	6.57

250 kN			300 kN			300 kN		
Depth	B4	B10	Depth	B5	B11	Depth	B6	B12
300 mm	6.94	8.14	350 mm	6.50	7.39	400 mm	8.49	9.11
250 mm	2.99	5.08	300 mm	4.41	5.45	350 mm	7.32	8.06
200 mm	1.78	2.02	250 mm	2.23	2.91	300 mm	2.99	5.23
150 mm	1.57	1.87	200 mm	1.87	2.06	250 mm	2.19	2.31
100 mm	1.50	1.91	150 mm	2.00	2.02	200 mm	1.85	1.95
50 mm	6.65	8.06	100 mm	1.72	1.79	150 mm	1.66	1.74
			50 mm	5.82	6.72	100 mm	1.34	1.46
						50 mm	6.57	6.87

**Table 5.** Shear Stresses in N/mm<sup>2</sup>

Specimen No.	Failure Load (kN)	Ultimate Shear Stress (N/mm <sup>2</sup> )	Specimen No.	Failure Load (kN)	Ultimate Shear Stress (N/mm <sup>2</sup> )
B1	174	2.369	B7	157	1.753
B2	205	2.118	B8	197	2.019
B3	237	2.705	B9	230	2.576
B4	169	2.315	B10	139	1.716
B5	199	2.318	B11	178	2.069
B6	228	2.968	B12	217	2.739

#### STRENGTH:

- As per the code provisions it was observed that, as L/D ratio decreases there is an increase in the strength of deep beams

#### DEFLECTION:

- It was observed that deflection of specimen designed as per provisions of CIRIA Guide is more than the specimen designed as per IS Code.
- Deflection of deep beam designed as per IS Code is more than analytical deflection.
- Deflection of deep beam designed as per CIRIA Guide is more than analytical deflection.
- It was observed that, as depth of deep beam increases deflection of beam decreases.

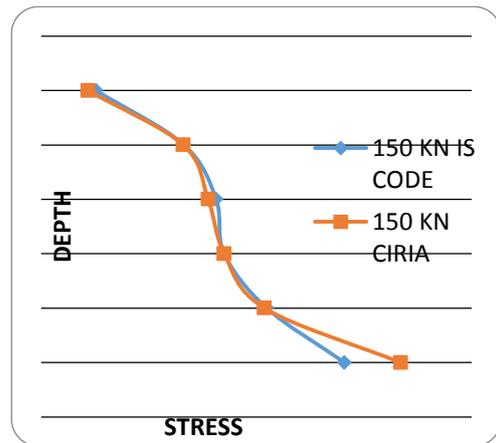
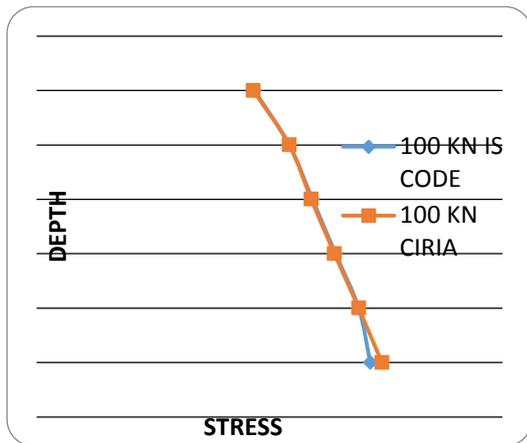
#### FLEXURAL STRESS:

- From the flexural stress graphs it was observed that as load increases the neutral axis shifted towards bottom of the deep beam.
- As L/D ratio of the deep beam decreases the flexural stress of beam decreases.
- Flexural stress of deep beam designed as per CIRIA Guide is more than the beam designed as per IS Code.
- Flexural stress of deep beam designed as per IS Code is more than analytical stress.
- Flexural stress of deep beam designed as per CIRIA Guide is more than analytical stress.

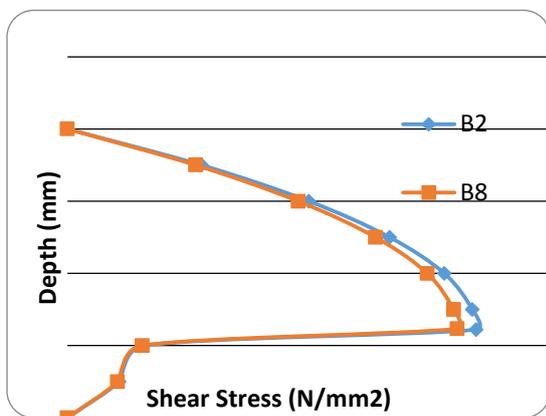
#### SHEAR STRESS:

- From the shear stress distribution graphs it was observed that maximum shear stress is at neutral axis and neutral axis of deep beam shifted towards bottom of the beam.
- Shear stress of deep beam designed as per IS Code is more than beam designed as per CIRIA Guide.
- Shear stress of deep beam designed as per IS Code is less than analytical stress.
- Shear stress of deep beam designed as per CIRIA Guide is less than analytical stress.

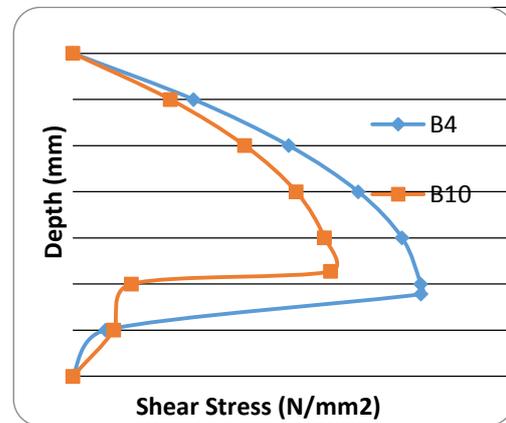
### Sample Flexural Stress and Shear Distribution Graphs



**Figure 5 and 6.** Flexural Stress Distribution for Specimens B1 and B7



**Figure 7** Shear Stress Distribution for Specimens B2 and B8



**Figure 8** Shear Stress Distribution for Specimens B4 and B10

## Figures of Specimen Failure

Following are the modes of failure of beam specimens:



**Figure 9** Failure mode of B1



**Figure 10** Failure mode of B4



**Figure 11** Failure mode of B7

# **BASIC CIVIL SERVICES – PIXEL SERVICES**

**By**

Mrs.A.R.Kothale

Assistant Prof. SITCOE, Yadrav.

## **INTRODUCTION**

In this project, we will build a web-based application named as “Pixel Services”. In this project a user can view the availability of the technical employees such as Masson, Electrician, and Carpenter etc. On the availability of the person, the user can book that resource for his/her construction work. In the booking process, the user will provide all the details about the working he/she is going to plan. The main purpose of this project is to facilitate the end users to online book a technical person for his/her construction work according to the end user convenience.

## **WORKING STEPS OF PIXEL SERVICES**

### **User panel -**

- The user can login
- The user can book a specific service according to his/her convenience on the availability of the service/resource
- For booking the user must be a registered user. If the user is not login already then there must be a “Registration” option available for the user.
- In the booking process, the user will provide complete details about the work and can provide the pictures of the working
- The user can see the appropriate expense report after booking the appropriate
- The user can download the service dues voucher. Pay the dues in the bank and upload the paid voucher on his/her
- The user can see the approximate deadline of the selected

### **Admin panel -**

- The admin can login and
- The admin can add different information about their services and create profile for their employees such as Masson, Electrician, carpenters
- The admin can also add all the information about their employees such as information about the available dates, their per day cost /service charges etc.



# ANALYSIS OF KRISHNA SUB-BASIN FLOOD 2019

By

Shreya R. Gangdhar<sup>1</sup>, Pragati S. Dabade<sup>2</sup>, Shivani L. Powar<sup>3</sup>, Seema S. Swami<sup>4</sup>

<sup>1234</sup>B.Tech Student, SITCOE, Yadrav, Ichalkranji, Kolhapur

The present research work includes the details of Krishna sub basin also the study of flood events of Krishna basin 2019. The capacity of reservoir & rainfall pattern of Krishna basin was studied. The data of flood prone area was collected & Analysis of flood 2019 in Sangli District was done by various Organizations like Indian Metrological Department (IMD) & IITM Pune, Water Resources Department (WRD), Central Water Commission New Delhi (CWC) & Maharashtra Remote Sensing Application Centre & also suggested existing floods mitigation in infrastructure in Krishna basin. The solutions were suggested from the reasons studied.

<b>Sr. No.</b>	<b>Reasons</b>	<b>Solution</b>
1	There is steady increase in the water table of Krishna river, so it accumulates in the soil and does not infiltrate but increases the volume of water which causes flood sometimes.	Permeable soil & rocks are suggested to Improve soil conditions because it allows water to infiltrate into them for reduce flood risk.
2	Reduction in the height of all the bridges.	While constructing new bridges according to HFL height should be consider.
3	Houses and huts have been illegally constructed in between demarcated river flood line area.	Awareness among the people about to avoid illegal construction.
4	Heavy rains in the catchment area of the dam and excess water released in the river basin which was lead to an increase flood levels.	The water should be discharged from dam before the monsoon season.
5	Deforestation plays important role in flooding.	More tree plantation.
6	The poor project planning of reservoir	Proper project management.

	impacts on flood absorption capacity.	
7	Other reasons	By removing dumped debris, siltation, and vegetation developed in between cross sections of river including its tributaries nallas and local drains. Should clean this as routine by local authorities.

# **ANALYSIS OF SOIL FOR THE GROUND IMPROVEMENT OF ROAD CONSTRUCTION**

**By**

Aditya Potdar , Bhanase Vikrant , Gudase Tushar , Mane Manoj , Prof. Ravindra M. Garud

Abstract: Construction of embankment fill on soft cohesive soils with low permeability will generally induce consolidation settlement to take place. Depending on the thickness of the compressible stratum and its engineering characteristics, consolidation settlement may take a few weeks to years to cease. It is necessary to analyse both the magnitude and time-rate of settlement of the subsoil supporting the embankment so that the settlement in the long run will not influence the Serviceability of the embankment. For the construction of Rural Roads, Indian Roads Congress has brought out Rural Road Manual IRC SP: 20-2002 for design and construction. The design is based on the CBR value of the soil sub-grade and the 10 years projected cumulative traffic with an assumed 6% traffic growth per year. Based on this concept, normally two layers of WBM with 75 mm thickness is laid over the granular sub-base with suitable material having minimum 15% CBR. If the locally available materials, including marginal and industrial waste materials are utilized, it could be possible to reduce the cost of road construction. Several types of new materials are tried to establish the efficacy of new materials in road construction. Adoption of such technique may also result in the conservation of natural resources, energy Environment .It includes Stabilization with lime; Stabilization with cement; Stabilization with a combination of lime and cement.

## **A. Road Details**

- Type of road- Urban road
- Distance – 2Km
- Width of road – 10m
- Road – Bituminous road.
- Type of soil- Red and black mix soil
- Location of sample Collected- At Market yard -Vishrambag Sangli-Miraj road, Sangli.

### **Significance of Road :**

This Urban road is necessary to ensure that even the many parts of the country have access to basic products and services that a country's citizens are entitled to. These urban parts of the country have faster access to outside products, information, services and social linkages.

### **Description of Study Area**

The common soil test for road construction includes classification of soil particle size distribution, moisture content determination, specific gravity, CBR test. The laboratory tests should be carried out on every sample taken for the determination of particle size and moisture content.

### **Preparation of Soil Samples**

In this project minimum 2 samples are collected. The different tests are conducted on these samples and obtained the result. After that to determinate the suitable ground improvement techniques for the improvement of soil properties like strength, bearing capacity etc. No. of samples/Km taken – 1 Sample/Km. The material are used for the project work is collected from college labs and other materials are purchased by the group members like measuring tape.

### **Test Conducted**

Different soil tests for a road construction project require the site investigation to be carried out to understand the soil profile, Moisture content, particle size, and specific gravity tests on soils are used for the calculation of soil properties such as degree of saturation.

## **RESULTS AND DISCUSSION**

Sub grade soil is an integral part of the road pavement structure as it provides the support to the pavement from beneath. The sub grade soil and its properties are important in the design of pavement structure. Therefore it is very essential to evaluate the sub grade by conducting tests.

## CONCLUSION

From the research carried out, following conclusions are made:

- Application of Ground Improvement is not only cheaper but reduce the construction time significantly.
- Soil treated with lime and exposed to wetting and drying cycle's results in loss of cohesion between the grains of soil and lime, which leads to increase in soil volume.
- Ground Improvement Techniques is a technically viable and cost effective solution for soils which are weak in strength and treatment is to be done in order to make them suitable for road construction.
- Soil modification is changing the characteristics of soil by adding soil amendments to strengthen physical and chemical condition to improve the bearing capacity of soil.
- Improvement of poor subgrade soil by increasing CBR value of soil using Cement kiln dust.
- The shear strength of the subsoil within a depth of 9m varies from 2 kPa to 6.6 kPa, depending on the water content and in-situ bulk density.
- Road embankment without any improvement fails in bearing capacity as well as overall stability.

# **PHYTORID TECHNOLOGY FOR TREATMENT OF SEWAGE**

**By**

Chougule Manasi S., Madwana Rutuja J., Patil Srushti N., Pardeshi Shrunkhala S., Patil Sachin B., Prof. Chougule Sandeep B.

Water supply and sanitation are the two basic needs that affect people's standard of living. When sewage is exposed to an open environment without any treatment, there are chances of health hazards. Conveying the sewage to the central treatment facility and its safe disposal is the major concern of wastewater management authorities. Cost and resources are the major constraints to maintain this huge infrastructure tackle this, a decentralized wastewater treatment system (DWTS) is evolved. DWTS consists of a combination of the septic tank, Anaerobic Baffled Reactor (ABR), Constructed Wetland(CW), activated sludge process (ASP), moving-bed biofilm reactor (MBBR), etc Wastewater treatment plants can never be a revenue-generating model as the product is treated water and small fraction of sludge. To make it economically feasible, recycling and reusing wastewater at the point of generation can solve water issues to a great extent. When one or more-unit operations incorporated into a single system for wastewater treatment is known as the package wastewater treatment system. The commercially available package systems in the market are energy-intensive and have high capital costs. Hence there is a need for a package treatment system incorporated with less energy-intensive and natural treatment. The present study is focused on the development of a highly efficient, compact, user-friendly and economical system incorporated with natural treatment in order to serve the needs of developing countries.

## **CONCLUSION:**

The present study conducted on the field scale hybrid bio-rack packaged treatment system. The conclusion is derived from the results obtained during the study.

- The growth of vegetation and development of the system during the study is the main reason behind the higher organic matter and nutrient removal.
- The hybrid bio-rack package treatment system for household wastewater can be the feasible, economic and user-friendly option in the Indian context.
- Modification done in the modified bio-rack wetland system by changing the flow

pattern and introducing media resulted in maximum COD, BOD<sub>3</sub> and TKN removal efficiency obtained during study at HRT of 16 hr are 71%, 76% and 61% respectively. For the modified bio-rack system at HRT of 24 hr, COD, BOD<sub>3</sub> and TKN removal efficiency were 68%, 66 % and 58%.

- The hybrid bio-rack package treatment system for household wastewater can be the feasible, economic and user-friendly option in the Indian context.



**Experimental Setup**

# **SUSTAINABLE BRICKS MADE BY WASTE**

**By**

Asif Makhamalla, Namrta Londhe , Vaibhav Petkar, Dhiraj Choudhari ,  
Harshal Chavan

## **INTRODUCTION**

Bio-based materials are one of the most sustainable choices when it comes to CO<sub>2</sub> emissions, since they act as a carbon sink throughout the building's life. In any building the indoor temperature relies on various elements of the building such as walls, roofs, windows, and doors. Major surface area of the wall is exposed to solar radiation, to reduce the heat gain through the wall the perfect insulation substances have to be chosen. It is feasible to reduce heat loss in the wall to reduce the thermal conductivity of the bricks.

In the execution of this study, these agricultural wastes were mixed together with clay soil in different percentages by weight. Physical and mechanical properties including soil physical properties, density, shrinkage, water absorption, compressive strength as well as thermal conductivity were measured, reported and discussed. The construction of buildings and production of materials will lead to 40% of all pollution emissions and around one-third of black carbon emissions. In the building, construction materials are the most important part and directly exposed to people. Wall materials and thermal insulation materials are the main components of the building and cost a large number of resources. In this project we are mainly focus on by product of corncob waste .Project mainly accommodate the formation of insulating bricks using agricultural by product. Requirement for economic and environmental friendly material has extended an interest in natural fiber from the previous researcher natural sugarcane bagasse has been successfully incorporated into fire clay bricks. Therefore in this study corncob waste has been utilized for similar studies. So, the motto of this experimental study shall to develop a sustainable green product that can be made by utilizing two waste products Agriculture waste and discarded plastic, rubber waste in shredded form. In our country more Availability of Agriculture waste and plastic, rubber waste but not proper utilization is done so it's ill effect will be it has hazardous to environment and human life also. Agriculture waste will be mixed with Clay to manufacture the bricks. The suitable tests are compressive strength test, water absorption test, hardness test, fire resistance test.

## METHDOLOY

- **Material-** corncob, rubber waste, metal waste



**Rubber waste**

**corncob**

**metal waste**

### **Visit to bricks manufacturing unit to understand the methodology used in manufacturing**

- Collect Agriculture waste, Rubber, metal waste from existing industry.
- Refer IS 2117:1991 for Manufacturing handmade insulation Burnt Brick.
- Prepare proportion of casting Eco brick.

## CASTING

1. For Manufactured Eco brick, mould will made from fabrication shop with use of galvanized steel
2. Taken out following proportion for casting
  - 1: - 15kg soil +1.5kg corn cob+0.5 kg cement+0.5kg Iron waste
  - 2: -12.5 kg soil+1.5kg corn cob +0.5 kg cement+0.5kg Iron waste
  - 3: -10kg soil +1.5kg corn cob +0.5 kg cement+0.5kg Iron waste
3. After that, Add Water  $\frac{1}{4}$  to  $\frac{1}{3}$  by mass of soil (refer IS 2117:1991)
4. Prepare proper mixing of Corn cob, soil, Rubber and water. Before casting mould will be properly oiling is needed and then material will fill up into that mould.
5. Handmade bricks are need to dry in sunlight minimum 3-4 days and then brick for heating in collage oven or

## CONCLUSION

1. The load bearing capacity was found of oven dried brick to be 6.38 KN/m<sup>2</sup>
2. Water absorption test was found of oven dried brick to be 48.51%

3. The load bearing capacity was found of kiln bricks to be 1.22 KN/m<sup>2</sup>
4. The brick performance of kiln dried brick in drop test was fail.
5. Water absorption test was found of kiln brick to be 63.81 %
6. The society can be benefited as large amount of agriculture waste will be improved.
7. Good amount of natural resource soil conservation.