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EXPERIMENTAL BEHAVIOUR OF COMPOSITE REINFORCED COLUMN BY AXIAL LOADING

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Abstract : The reinforcement in concrete plays a vital role in increasing its self – weight. In order to reduce that weight the reinforcement is replaced by hollow steel pipe filled with rubber cement mortar. The hollow steel pipe is taken of required dimension according to the structure. The scrap tyres are used as rubber crumbs. The replaced composite reinforcement is used in normal conventional concrete of M_{25} grade and tested for its strength.

Keywords—*conventional concrete, composite reinforcement, hollow steel pipe, scrap tyre.*

INTRODUCTION

Reinforced concrete (RC) is a composite material in which concrete's relatively low tensile strength and ductility are counteracted by the inclusion of reinforcement having higher tensile strength and/or ductility. The reinforcement is usually, though not necessarily, steel reinforcing bars (rebar) and is usually embedded passively in the concrete before the concrete sets. Rebar also known as reinforcing steel, reinforcement steel, is a steel bar or mesh of steel wires used as a tension device in reinforce concrete and reinforced masonry structures to strengthen and hold the concrete in tension. Rebar's surface is often patterned to form a better bond with the concrete. It is also employed to confer resistance to concentrated loads by providing enough localized resistance and stiffness for a load to spread through a wider area.

Rebar may also be used to hold other steel bars in the correct position to accommodate their loads or a strong, ductile and durable construction the reinforcement needs to have the following properties at least:

- High relative strength
- High toleration of tensile strain
- Good bond to the concrete, irrespective of pH, moisture, and similar factors
- Thermal compatibility, not causing unacceptable stresses in response to changing temperatures.
- Durability in the concrete environment, irrespective of corrosion or sustained stress for example.

MATERIALS AND METHOD

Mild steel hollow pipe and crumb rubber:

The rebar here is replaced by hollow steel pipe of the same dimension as like the reinforcement rod depending upon the structural need. The thickness of the hollow pipe varies from 1.5 to 2.5mm thickness. The more the thickness the more the strength since the pipe should not fail during bending. The hollow space is filled with rubber cement mortar of semi solid consistency. The rubber is extracted from scrap tyres. The rubber is powered by any of the following mechanical process: cracker mill, granulator, micro mill and shredding process. The crumb rubbers therefore can be mixed with cement slurry up to 70% to achieve strength. Mild steel consist of iron alloyed with less than 0.3% carbon most commonly between 0.1 – 0.25%. This type is widely used in construction industry for its ductility and malleability property.

Cement:

Cement plays the vital role in concrete as it acts as a binder that sets and hardens the other materials together. Ordinary Portland Cement (OPC) 53 grade is used for conventional concrete. For cement tests like soundness test, consistency test, etc., are done.

Fine aggregates:

The fine aggregates collected from the nearby river and locally available debris are used. They are sieved to the size below4.75mm. the specific gravity of fine aggregate is found to be 2.53 and the water absorption is found to be 1.24%.

Coarse aggregates:

The coarse aggregates of size 20mm and 15mm are used available locally. The specific gravity is found to be 2.27 and both the aggregates are confirming to IS 383.

testing methods

For determining the strength of concrete generally compression test of concrete cubes are done. Initially to determine the workability of concrete various test like: slump test, compaction factor test, vee – bee consist meter, flow test and Kelly ball test are done. In this project we have done the slump test.

Slump test:

The workability of fresh concrete plays an important role in controlling quality of hardened concrete, its measurement and control is of great significance. This test is used extensively at work sites and it is quite useful in detecting variations in water content and uniformity of a mix of given properties. Very dry mixes; having slump 0 – 25 mm are used in road making, low workability mixes; having slump 10 – 40 mm are used for foundations with light reinforcement, medium workability mixes; 50 - 90 for normal reinforced concrete placed with vibration, high workability concrete; > 100 mm.

The slump value achieved for the conventional concrete is 90mm which is medium workable conforming to IS 7320 (1974).

Compression test:

The usual primary requirement of good concrete is a satisfactory compressive strength in its hardened state. The compressive value is determined by testing the concrete cubes in the compression testing machine. The concrete cubes of size 15 x 15 x 15mm are widely used. After 28 days of curing the compressive strength of M_{25} grade concrete is found to be 25.2 N/mm^2.

For column specimen, the dimension used as per IS code is 700 x 150 x 150mm. The strength achieved for ordinary reinforced concrete column is 25.6MPa. the strength obtained from composite reinforced column is 33.28MPa after 28 days of curing.

Age	Strength per cent
1 day	16%
3 days	40%
7 days	65%
14 days	90%
28 days	99%

Table.1 age and strength of concrete after curing

Figure.1 Initial cracking occurred during compression test after 28 days of curing

Figure.2 hollow mild steel pipe filled with rubber cement slurry

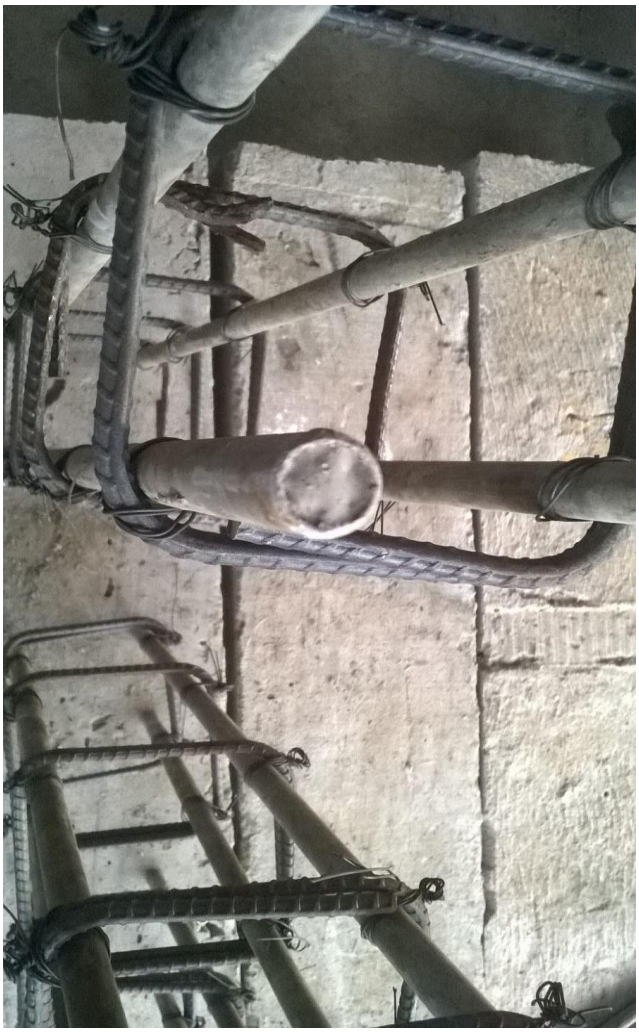

Figure.3 Column with composite reinforcement

Figure. 4 Comparison chart of conventional column with composite column

CONCLUSION

In order to find a replacement for reinforcement we done this project and got successful result. The strength of composite reinforced concrete increased by 30% compared to ordinary reinforced concrete column. Hence the project is successful.

Table.2 Compressive strength of different grades of concrete

Grade of Concrete	Minimum compressive strength N/mm² at 7 days	Specified characteristic compressive strength (N/mm²) at 28 days
M15	10	15
M20	13.5	20
M25	17	25
M30	20	30
M35	23.5	35
M40	27	40
M45	30	45

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