"A REVIEW ON DEVELOPMENT OF CEMENT COMPOSITE ROOFING TILES"

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ABSTRACT

The usefulness of fiber reinforced concrete (FRC) in various civil engineering applications is indisputable. Fiber reinforced concrete has so far been successfully used in slabs on grade, architectural panels, precast products, offshore structures, structures in seismic regions, thin and thick repairs, crash barriers, footings, hydraulic structures and many other applications. Fiber Reinforced Concrete (FRC) is gaining attention as an effective way to improve the performance of concrete. Fibers are currently being specified in tunneling, bridge decks, pavements, loading docks, thin unbonded overlays, concrete pads, and concretes slabs. These applications of fiber reinforced concrete are becoming increasingly popular and are exhibiting excellent performance. Fiber-reinforced concrete (FRC) is concrete containing fibrous material which increases its structural integrity. It contains short discrete fibers that are uniformly distributed and randomly oriented. Fibers include steel fibers, glass fibers , synthetic fibers and natural fibers This study presents understanding srength of fibre reinforced conceret. Mechanical properties and durability of fiber reinforced concrete.

KEYWORDS: Steel Fibre Reinforced Concrete, tensile strength, compressive strength

I. INTRODUCTION

A. Background

In almost all developing countries, there is a great shortage of roofing material. Local materials are often used, like soil, stone, grass and palm leaves. These roofs require a lot of maintenance and are not always resistant to heavy rain. Materials like Corrugated Iron Sheets (CIS) and asbestos cement sheets have replaced traditional materials.

Cement mortar tiles have partially replaced ceramic tiles for purely economic reasons , Cement mortar tiles have partially replaced ceramic tiles for purely economic reasons but what limits the use of cement mortar tiles is their weight on the roof, which requires a strong load bearing structure. Therefore, changing an existing system of roof also requires strengthening of the roof framework. Cement mortar tile can be made lightweight by incorporating natural fibres into its composite matrix. Bamboo is one of the natural fibrous materials abundantly available in tropical regions , The main objectives of the study are to develop fibre reinforced cement concrete roof tiles and to seek its pros and cons as a roofing material based on standard specifications.

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In this study we will be dealing with the problems faced in the cement mortar tiles like poor tensile strength, poor resistance to impact low ductility and durability and study the impact of fiber reinforcement on these problems faced.

B. OBJECTIVES

1.To develop lightweight concrete roofing tiles with fibre reinforced cement mortar composite.

2.To study the strength and behaviour of these tiles relative to the Cement mortar roofing tile.

3.To study material properties related to the development of composite roofing tiles.

4.To study different parameters related to the behaviour of the composite roofing tiles with experimental investigations.

II. METHODOLOGY

A. SELECTION OF MATERIALS

1. NATURAL FIBRE :- We chose bamboo fibers as the natural fibers in our project , Bamboo is easy to cut, handle, repair, reposition and maintain, without the need for sophisticated tools or equipment. advantage of building with bamboo is that it can be used in combination with other types of construction materials, like reinforcing materials for foundations.
2. STEEL FIBRES :- Hooked end steel wire cut in a zigzag manner or s-shape were used as steel fiber. These hooke end steel fiber was made by making cuts as hooked ends of a straight 20 gauge (0.914 mm in diameter) and around 8-10 cm in length each.
3. SAND :- Grade I, II,III and IV sand was prepared using sieve analysis as specified in IS 650 for sand. All the 4 grades of sand were mixed in proper proportions so as to ensure proper strength and compact matrix with suitable void ratio in cement mortar used in casting of tiles.
4. WATER :- As per IS 2250 recommendations, potable water was used for mixing of cement mortar as per the IS code the water that is suitable for drinking purpose held itself suitable for use in mortar mix as well

B.PREPARATION OF MATERIAL

1. SAND :- we have used three grades of sand I, II, III for the cement mortar mix. For the preparation of sand we have used the sieve analysis procedure as specified in the IS code.

IS Sieve	Percentage passing for			
	Grading Zone I	Grading Zone II	Grading Zone III	Grading Zone IV
10mm	100	100	100	100
4.75mm	90 – 100	90 – 100	90 – 100	90 – 100
2.36mm	60 – 95	75 – 100	85 – 100	95 – 100
1.18 mm	30 – 70	55 – 90	75 – 100	90 – 100
600 micron	15 – 34	35 – 59	60 – 79	80 – 100
300 microns	5 – 20	8 – 30	12 – 40	15 – 50
150 microns	0 – 10	0 – 10	0 – 10	0 – 15

2. **BOOMBO FIBRES:-** Firstly the bamboo fibres dipped in blue coloured Asian Paint. After the bamboo fibres were dipped into the blue coloured Asian paint the fibres were rolled in silica powder, These fibres were then dried in open atmosphere for around 24 hrs. Finally these fibres were cut in length of 60 mm and width of 4 mm.

- **3. STEEL FIBRES :-** A 20 gauge steel binding wire was taken and was tied in zigzag manner on specially designed nailed-box such that it would provide cut length of each steel fibre around 5cm. Once the required length of binding wire was wound aroundthe nails then with the help of a cutter we cut that wire in 'S .

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C . PREPARATION OF MOULD

1. Tile mould of 300mm*300mm*25mm was prepared
2. Base plate of 300*300mm was cut
3. On this plate 25*300mm rectangular plates were welded

D. CASTING OF TILES

1. Firstly the tile mould was cleaned properly and then oiled. 2. Mortar Mix Were Prepared. 3. bottom layer was laid and steel fibres were placed over this layer . 4. Middle layer was laid and bamboo fibres were laid in grid pattern over this layer . 5. Top layer was laid.

E. CURING OF TILES

After casting the tiles it was allowed to dry for 24 hrs. After 24 hrs the tile is then submerged in clean water for curing for 28 Days.

F. TESTING OF TILES

After the curing of tiles for 28 days the tile were now taken for the testing. The tiles so prepared were tested with following tests:-

1. Water absorption test
2. Water permeability test
3. Flexure test

III. RESULTS AND DISCUSSION

1. **WATERABSORPTIONTESTRESULTS** :- From the experimental results of water absorption test we conclude that the water absorption of non-reinforced cement mortar tiles was less as compared to that of fibre reinforced cement mortar tile. The reason can be linked with the use of bamboo fibre which has the ability to soak water.

TILETYPE	AVERAGE%WATERABSORPTION
NON-REINFORCEDTIL	1.033
FIBREREINFORCEDTIL	1.496

2. WATER PERMEABILITY TEST RESULTS :- As per our observations for water permeability test results we did not find any damp spots under any of the tiles that was supported on both ends and applied with water as per the procedure which denoted that the tiles that were casted by us were

3. **FLEXURE TEST RESULTS** :- From the experimental results on the tiles we can conclude that fibre reinforced cement mortar tiles show better flexure performance as compared to non-fibre reinforced cement mortar tiles. So on the base of these experimental results we can conclude that the flexural strength fibre reinforced tiles is more than that of non-reinforced tiles. Hence fibre reinforcement in cement mortar tiles improves the flexural strength of cement mortar tiles considerably.

TILETYPE	AVERAGEFLEXURE STRENGTH	RATIO (STRENGTH/ WEIGHT)
NON-REINFORCED TILE	5.288	1.05
FIBREREINFORCED TILE	6.15	1.268

IV. CONCLUSION

1. The average flexure strength of conventional or non-fibre reinforced cement mortar tile was observed to be around 5.288 MPa on the other hand the average flexural strength of fibre reinforced cement mortar tiles was 6.155 MPa.
2. Comparing the weight of fibre reinforced tiles and non-reinforced tile we can observe that the fibre reinforced tiles for 1% replacement with fibre as compared to nonreinforced show around 5-10% weight reduction.
3. The strength to weight ratio was also observed to increase from 1.05 for non-reinforced tiles to 1.268 for fibre reinforced tiles.

Thus fibre reinforced tiles were observed to have following advantages

1.Light weight

2.Improved flexural strength

3.Higher strength to weight ratio

4.Lower water permeability as compared to non-reinforced cement mortar tiles.

Owing to these advantages, the use of fibre reinforced cement mortar tiles with bamboo fibres (0.25% by weight) in compression region and steel fibre (0.75% by weight) in tension region should be promoted to be used in place of conventional tiles.

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