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A Study on Retrofitted Hybrid Fibre Self Compacting Concrete

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Abstract - *Self-compacting concrete is a highly flowable type of concrete that spreads into the form without the need for mechanical vibration. It is highly workable concrete that can flow under its own weight through restricted sections without segregation and bleeding.*

In this project work the characteristics of SCC with the usage of Hybrid fibres –steel fibre, banana fibre, palm fibre are analysed. The compatibility of hybrid fibres with SCC has been found against mechanical properties of conventional self-compacting concrete. This experimental investigation was carried out to study the compressive strength, flexural strength and split tensile strength of hybrid fibre self compacting concrete . In addition to analyzing the mechanical properties it is supposed to check the behaviour of the same structural element after retrofitting with jacketing. The feasibility of this, in implementing our conventional building technology is analysed.

Key Words: Self Compacting Concrete, Hybrid fibre, Steel fibre, Palm fibre, Banana fibre, Retrofitting, Jacketting

1. INTRODUCTION

Self-Compacting Concrete(SCC) is a highly flowable concrete that spreads into the form without the need for mechanical vibration and is a non-segregating concrete that is placed by means of its own weight. SCC with a similar water cement or cement binder ratio will usually have a slightly higher strength compared with traditional vibrated concrete due to the lack of vibration giving an improved interface between the aggregate and hardened paste. . Hybrid fibre SCC consist of different fibres with different shape, strength, dimensions etc. Fibre is a small piece of reinforcing material possessing certain characteristics properties. The different fibres used were steel fibre, palm fibre and banana fibre. It increases elastic modulus, decrease brittleness control, crack initiation and its subsequent growth and propagation. The fibres were added in the ratio 0.1%,0.25%,0.5% and 0.75% respectively and the optimum value is obtained by the addition of 0.25% of fibre.

A Retrofitting an existing building can oftentimes be more cost effective than building a new facility. It is carried out to regain the strength of deteriorated structural concrete elements and to prevent further distress in concrete Strength deficiency of concrete structural members can be due to poor workmanship, design errors, and deterioration due to the aggression of harmful agents. The retrofitting process shall start with investigation and diagnosis of cracks and then applying suitable retrofitting technique and compatible materials.

Jacketting is the process in which a section of an existing structural member is restored to original dimensions by encasement using suitable materials. This method is applicable for protecting concrete, steel, and timber sections against further deterioration and for strengthening. If the material used for jacketing is cement mortar or concrete, the cement content must be exactly according to the requirements.

In this paper the mechanical properties of both conventional and HFSCC is determined. And the retrofitting of both conventional and HFSCC structural elements with jacketing has been done.

1.1 Objective

1. To develop and evaluate SCC with hybrid fibres.
2. To analyze the mechanical properties.
3. To compare it with the properties of conventional SCC.
4. Retrofitting of conventional and HFSCC structural elements using jacketing.
5. Comparison of both result.

2. Experimental Methodology

The material tests for cement, M-sand and coarse aggregate were conducted. The fresh concrete tests like L-Box test, V-funnel test and J-ring test were done. The mix of concrete used in this study is M40. Water cement ratio used is 0.5 .The fibres were added in the ratio 0.1%,0.25%,0.5% and 0.75% respectively. Tests were performed for compressive strength, flexural strength and spilt tensile strength of both conventional SCC and hybrid fibre SCC at different curing periods (7,14,21,28 days). The test results were used for the comparison study of both conventional and hybrid fibre SCC. And the structural elements were retrofitted by jacketing.

3. RESULT ANALYSIS OF CONVENTIONAL AND HFSCC CONCRETE

The following figures represent the result value of compressive strength of cube, split tensile strength of cylinder, flexural strength of beam of conventional SCC and HFSCC after 7, 14,21, 28 days curing.

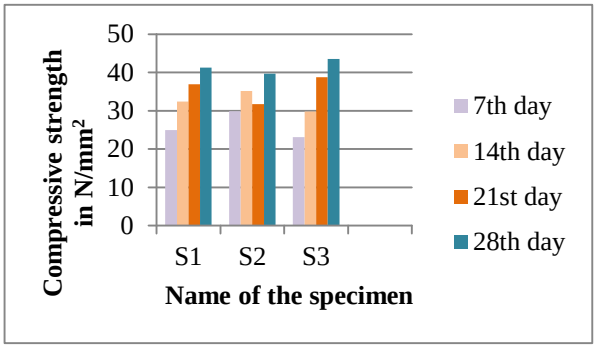

Fig 1: Compressive strength for conventional SCC after 7, 14, 21,28 days curing

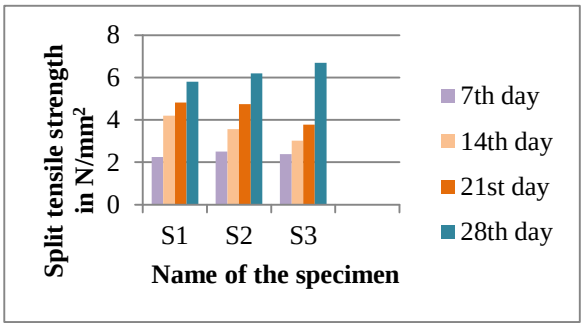

Fig 2: Split tensile strength for conventional SCC after 7, 14, 21,28 days curing

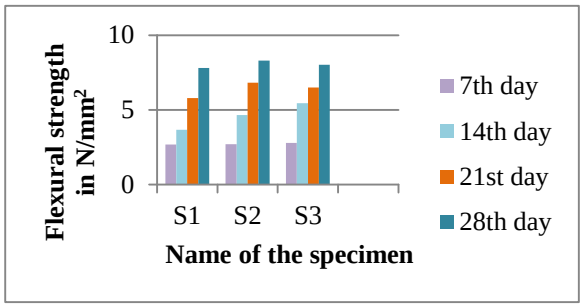

Fig 3: Flexural strength for conventional SCC after 7, 14,21, 28 days curing

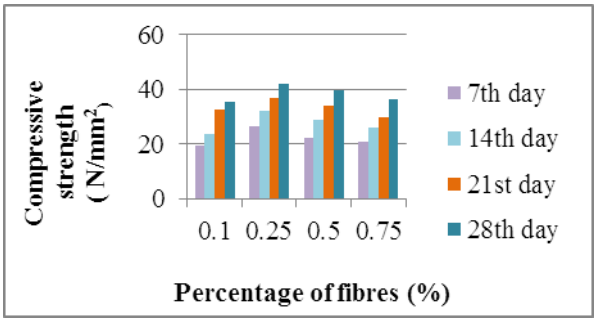

Fig 4: Compressive strength for Hybrid fibre SCC after 7,14,21,28 days curing

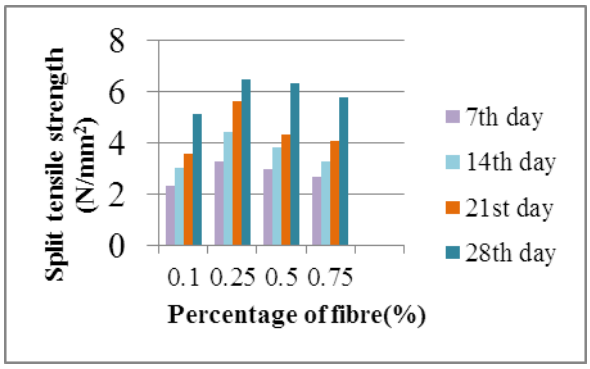

Fig 5: Split tensile strength for Hybrid fibre SCC after 7, 14, 21,28 days curing

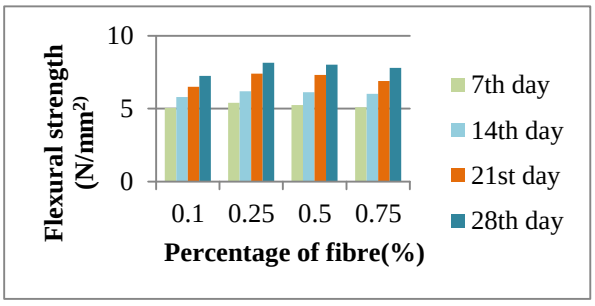

Fig 6: Flexural strength for Hybrid fibre SCC after 7, 14,21, 28 days curing

4. RETROFITTING OF CONVENTIONAL AND HFSCC STRUCTURES

Retrofitting is the seismic strengthening of existing damaged or undamaged structures. It gives unity to the structure by providing a proper connection between its resisting elements. In this paper the structure is retrofitted by jacketing. For this square meshes were used.
The following figures shows the retrofitting of conventional and HFSCC structures.

Fig 7: Retrofitting of cubes

Fig 8: Retrofitting of cylinder

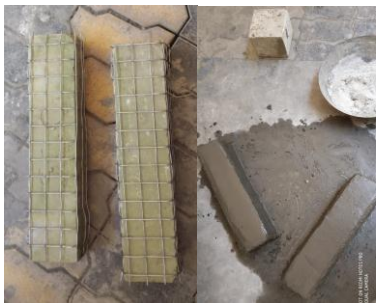

Fig 9: Retrofitting of beams

5. RESULT

The following table shows the mechanical properties of retrofitted structural elements.

Mechanical properties	Retrofitted conventional SCC	Retrofitted Hybrid fibre SCC
Compressive strength	45.8 N/mm^2	49.6 N/mm^2
Split tensile strength	7.4 N/mm^2	7.82 N/mm^2
Flexural strength	9.2 N/mm^2	9.74 N/mm^2

6. CONCLUSIONS

- The optimum value is obtained by the addition of 0.25% of fibre.
- All mechanical properties were increased by the addition of hybrid fibre.
- All mechanical properties of structural elements were increased by jacketing.
- Compared to retrofitted conventional SCC, there is an increase in the mechanical properties of retrofitted HFSCC.

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