A Laboratory Assessment of Fibrous Concrete with Waste Rural Materials

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Abstract— In this thesis, commercially available synthetic fibers namely, nylon, coconut and steel fiber are used to study the effects of fiber used for reinforcing concrete mixes and to obtain basic strength. The compressive strength tests were performed by changing fiber weight content from 0% to 1.25% of the cement weight content. As a result, it was found that the use of nylon fiber considerably increases the tensile strength as the fiber content is increased.

Key words: Fiber Reinforced Concrete; Steel Fiber, Nylon Fiber and Coconut Fibers; Fiber Concrete Testing; Compressive

I. INTRODUCTION

A. General

Concrete is acknowledged to be a comparatively brittle material when subjected to traditional stresses and impact loads, wherever tensile strength is around just one tenth of its compressive strength. As a result for these characteristics, concrete flexural members couldn't support such loads that usually take place throughout their service life. Traditionally, concrete member reinforced with continuous reinforcing bars to resist tensile stresses and compensate for the dearth of malleability and strength. What is more, steel reinforcement is adopted to beat high potentially tensile stresses and shear stresses at vital location in concrete member. Even supposing the addition of steel reinforcement considerably will increase the strength of concrete, the event of small cracks should be controlled to supply concrete with solid tensile properties.

1) SFRC – Steel Fiber Reinforced Concrete
2) NFRC – Nylon Fiber Reinforced Concrete
3) CFRC – Coconut Fiber Reinforced Concrete

The weakness in tension can be overcome by the use of primary reinforcement rods and to some extend by the inclusion of a sufficient volume of certain fibers. Moreover the use of fibers alters the behavior of fiber-matrix composite after concrete has cracked, thereby improving its Ductility Since the conventional fibers like steel, polypropylene and glass fibers have some limitations, focus on some other alternative materials which are easy to find in the locality is important.

II. LITERATURE REVIEW

Jong-HanLee etal (2017) was concluded that "An experimental study was performed to examine the effects of concrete strength and fiber content ratio on the flexural capacity of steel fiber-reinforced concrete. Three fiber volume fractions, 0.25, 0.375, and 0.5%, and three concrete compressive strengths, 25, 35, and 45 MPa, were designed for the experiments. The stress and deflection relationship, first peak and post-cracking strength, and energy absorption capacity were evaluated with respect to the variance in the fiber volume fraction and concrete strength. The results showed that the equivalent flexural strength ratio, which is determined from the first peak strength and energy absorption capacity, increased with the increase in the fiber volume fraction but decreased with the increase in the concrete strength. Furthermore, the effects of the concrete strength and fiber content ratio are discussed in a steel fiber-reinforced concrete floor slab. The ultimate flexural capacity also required a consideration of the influence of the content ratio of steel fiber as well as the strength of cement composite matrix."

MohsenAhmadi etal (2017) were concluded that "Mixed Recycled Aggregates (MRA) is a mixture of recycled concrete and masonry materials. These kinds of aggregates have lower strength and higher water absorption than natural aggregates. Therefore, the concrete with recycled aggregates has lower strength than the concrete with natural aggregates. Using the steel fibers recovered from waste tires within the concrete with recycled aggregates improves the mechanical properties of this concrete further as determination the environmental drawback of that waste steel bar. During this study, the impact of recycled steel fibers on the mechanical properties of traditional concrete and also the concrete with recycled combination."

T. Simoes et al (2017) were concluded that "The main objective of the research described in this paper was to evaluate how the concrete compressive strength and the geometry of the steel fibers influence the behavior of the fiber/matrix interface. A numerical model was calibrated and used to expand the scope of results obtained from the experimental tests. It can be concluded that the concrete compressive strength strongly influences the fiber/matrix strength."

III. RESULTS & CONCLUSION

The strength characteristics of waste material in concrete mixtures have been computed in the present work by replacing with the steel fibers, Glass fiber and Polypropylene Fiber for different percentage.

Compressive Strength

Mix	% of fibers added	7 days (N/mm2)	14 days (N/mm2)	28 days (N/mm2)
Normal mix	CC	25.56	30.67	38.52
Steel fiber	0.25	31.7	36.89	44.3
	0.5	32.3	37.93	45.63
	0.75	33.48	39.7	46.96
	1	34.67	41.63	48.15
	1.25	35.85	43.26	49.19
Nylon fiber	0.25	28.15	32.59	40.3
	0.5	28.89	33.48	41.19
	0.75	29.33	33.93	42.22
	1	29.93	34.52	42.96
	1.25	30.67	34.96	41.7

Coconut Fiber	0.25	26.37	31.7	38.96
	0.5	26.67	32.3	39.26
	0.75	27.26	32.59	39.85
	1	27.85	33.04	40.15
	1.25	28.59	33.48	39.74

Table 1: Comparison of Compressive Strength of Concrete using Steel Fibers, Glass Fiber and Polypropylene Fiber

IV. Future Scope of the Study

Below are some of the recommendations for further studies:

- If additional research supports the use of concrete buildings then existing specification should be revised to permit and encourage the use of other waste material.
- More trials with different percentage of steel fiber, coconut fiber and coconut fibers of replacement.
- More investigations and laboratory tests should be done on the durability of steel fiber, coconut fiber and coconut fibers material in new concrete, and its creep and shrinkage characteristics.

References

[1] Lee, J.H., 2017. Influence of concrete strength combined with fiber content in the residual flexural strengths of fiber reinforced concrete. Composite Structures, 168, pp.216-225.
[2] Ahmadi, M., Farzin, S., Hassani, A. and Motamedi, M., 2017. Mechanical properties of the concrete containing recycled fibers and aggregates. Construction and Building Materials, 144, pp.392-398.
[3] Simões, T., Octávio, C., Valença, J., Costa, H., Dias-da-Costa, D. and Júlio, E., 2017. Influence of concrete strength and steel fibre geometry on the fibre/matrix interface. Composites Part B: Engineering, 122, pp.156-164.
[4] Nehdi, M.L., Najjar, M.F., Soliman, A.M. and Azabi, T.M., 2017. Novel steel fibre-reinforced preplaced aggregate concrete with superior mechanical performance. Cement and Concrete Composites, 82, pp.242-251.
[5] Rao, K.M.M. and Rao, K.M., 2007. Extraction and tensile properties of natural fibers: Vakka, date and bamboo. Composite structures, 77(3), pp.288-295.
[6] Bilba, K. et al 2003. Sugar cane bagasse fibre reinforced cement composites. Part I. Influence of the botanical components of bagasse on the setting of bagasse/cement composite. Cement and concrete composites, 25(1), pp.91-96.