AN EXPERIMENTAL STUDY ON INDUSTRIAL WASTE MATERIALS IN CONCRETE

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ABSTRACT

To overcome the stress and demand for Construction Materials, some alternatives namely Fly ash, Granite Fines and Recycled Coarse Aggregate have been identified. In this Project the concrete ingredients namely Cement, Sand and Coarse Aggregate is partially replaced by Fly ash, Granite Fines and Recycled Coarse Aggregate and Steel Fibers. The Compressive Strength, Split Tensile Strength and Flexural Strength of Concrete were found out at 7 days, 14 days and 28 days in hardened state. Then the strength and performance of industrial waste materials (Fly ash, Granite Fines, and Recycled Aggregate) can be found out by comparing with the conventional concrete.Atotalof93cubes,cylindersand beams specimenswere castwiththepartially replacementof concrete ingredients namely Cement, Sand and Coarse Aggregatebyindustrial waste materials (Fly ash, Granite Fines, and Recycled Aggregate)withtheproportionof30% &40% with and without 3% of steel fiberandcompared with19conventionalspecimens.Freshandhard ened properties of concretesuch as compressive strength, tensile strength and flexural strength were identified and finally itis recommended 30% replacement findustrial waste with 3% of steel fiber gives optimaland safest replacement in concrete composites.

INTRODUCTION

Concrete is the most widely used building materials. It has the distinction of being formed into desired shape most conveniently. It is an artificial material consisting of ingredients such as cement, fine aggregate, coarse aggregate and water. Aggregates are the major ingredients of concrete. Any construction activity requires several materials such as, concrete, steel, brick, stone, glass, clay, mud, wood, and so on. For its sustainability and adaptability with respect to the changing environment, the concrete must be such that it can conserve resources, protect environment, economize and lead to proper utilization of energy.Plain concrete possess a very low tensile strength, limited ductility, and little resistance to cracking. Internal micro cracks are inherently present in the concrete and its poor tensile strength is due to the propagation of such micro cracks, eventually leading to brittle failure of the concrete. The most widely accepted remedy to this flexural weakness of concrete is the conventional reinforcement with high strength steel. Also the reinforcement placing and efficient compaction of RCC is very difficult. In plain concrete and similar brittle materials, structural cracks (micro-cracks) develop even before loading, particularly due to drying shrinkage or other causes of volume change. It has been that the addition of small, closely spaced and uniformly dispersed fibers to concrete would act as crack arrester and would substantially improve its static and dynamic properties.

MATERIALS USED IN CONCRETE

- Cement
- Aggregate
- Fine Aggregate
- Coarse Aggregate
- Water
- Fly Ash
- Granite Fine Slurry
- Recycled Concrete Aggregates

- Recycling and Reuse of Construction& Demolition Wastes in Concrete

(i)

- Steel Fibers

(ii)

Fig 1: (i)Recycled Concrete Aggregate (ii)Steel Fibers.

MIXDESIGN

Design of concrete mixes involves determination of the proportions of the given constituents namely, cement, water, coarse aggregate and fine aggregate with admixtures if any. Workability is specified as the important property of concrete in the fresh state.

Table 1: Mix Ratio

Water (ℓ)	Cement (Kg)	Fine Aggregate (Kg)	Coarse Aggregate (Kg)
186	372	591.41	1145.30
W/C=**0.5**	Ratio = **1 : 1.50 : 3.00**		

COMPRESSIVE STRENGTH OF CONCRETE

The test was carried out conforming to IS 516-1959 to obtain compressive strength of concrete at the age of 7, 14 and 28 days for M20 grade concrete.The size of cubes is 150 X 150 X 150 mm. The cubes were tested using Compression Testing Machine (CTM) of capacity 400KN. This concrete is poured in the mould and tempered properly so as not to have any voids. After 24 hours these moulds are removed and test specimens are put in water for curing. The results are presented shows the variation of compressive strength with fly ash, granite fine, recycled aggregate, steel fibrereplacement percentage.

SPLIT TENSILE STRENGTH OF CONCRETE

. The size of cylinders 150mm diameter and 300mm height. The cylinders were tested using Compression Testing Machine (CTM) of capacity 400KN. After 24 hours these moulds are removed and test specimens are put in water for curing. The top surface of these specimen should be made even and smooth.The variation of split tensile strength at the age of 7, 14 and 28 days with 30% and 40% percentage of fly ash, granite fine, recycled aggregate, with and without steel fiber, from the testresults, it was observed that the maximum split tensile strength was obtained for mixes with 30 % replacement of cement by fly ash, granite fine, recycled aggregate, steel fiber. For fly ash concrete split tensile strength increases 30 % replacement and 40% replacement it is gradually decreases.

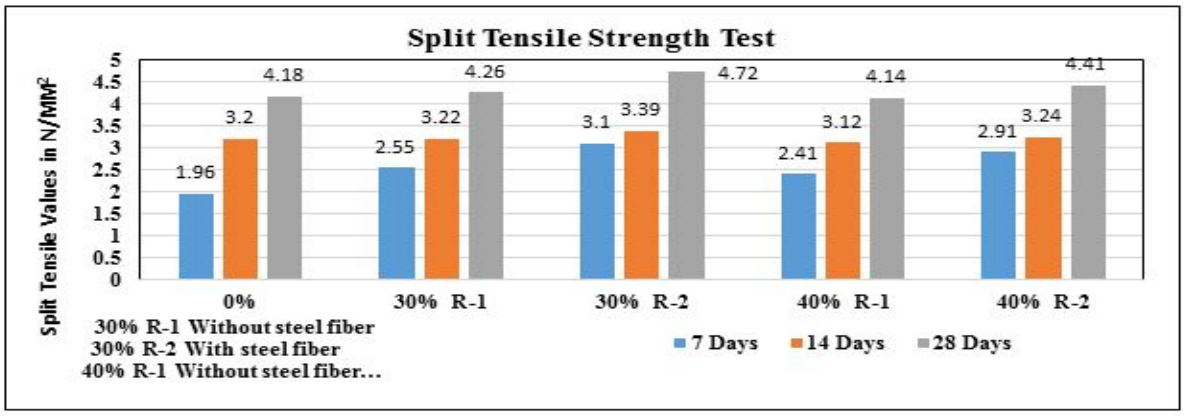

Fig 2: Split tensile Strength test

FLEXURALSTRENGTH TEST

The test was carried out conforming to IS 516-1959 to obtain Flexural strength of concrete at the age of 28 days. The size of the beam was 1200mm X 150mm X 100 mm. The reinforcement at 2 Nos of 10mm dia at top and 2 Nos 8mm dia at bottom. The beams were tested using Flexure Testing Machine (FTM) of capacity 100KN. The flexure strength at the age of 28 days of with and without steel fiber concrete continuously increased with respect to controlled concrete and reached a maximum value of 30 % replacement level for M20 grades of concrete.

Table2: Flexural strength test results

Sl.No	28 days specimen	Flexural Strength in N/MM^2
1	Conventional beam specimen	5.33
2	30% without steel fiber	6.67
3	30% with steel Fiber	8.67

The results of flexural strength of concrete at the age of 28 days are presented in Table 2.The variations in flexural strength at the age of 28 days with different percentage of fly ash Granite Fine and Recycled Aggregate with 3% steel fiber. From the test results, it was observed that the minimum flexural strength was obtained for mixes with conventional beam, for fly ash, Granite Fine and Recycled Aggregate with 3% steel fiber concrete the flexural strength increases 30% replacements.

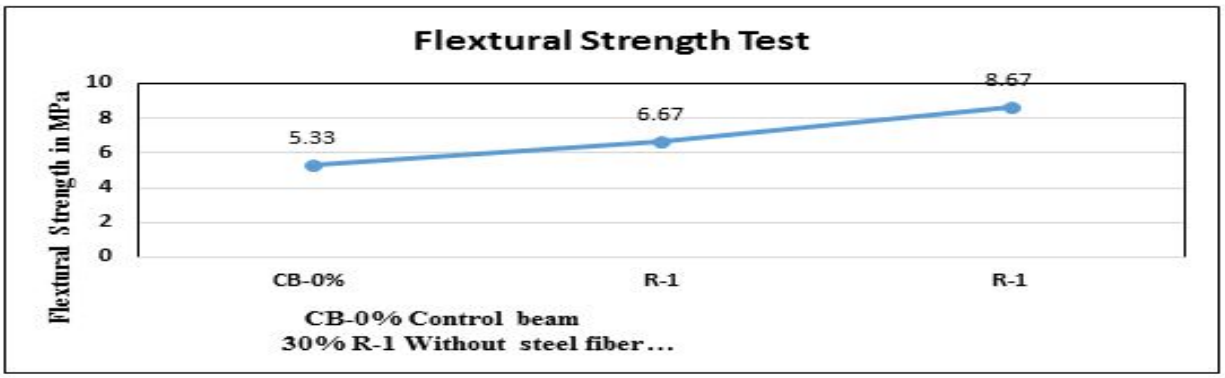

Fig 2: Flexural strength test results

CONCLUSION

Based on the findings of this project work, the following conclusions can be drawn

- This study was conducted to evaluate the effect of using Industrial waste materials as ingredients of concrete composites and also gives an idea for

using waste materials within the specified range. The result obtained in this project shows that is of great potential for the utilization of industrial waste in concrete.

- The compressive strength increases when the percentage of 30% and 40% with adding 3% of steel fiber (30.03 MPa and 28.82 MPa), and without steel fiber (28.62 MPa and 28.04 MPa)increases the strength attain the limit of 30% replacement with steel fiber (30.03 MPa).However, the gain in strength compared with reference concrete remains high.
- The split tensile strength increases when the percentage of
- 30% and 40% with adding 3% of steel fiber (4.72 MPa and 4.41 MPa), and without steel fiber (4.26 MPa and 4.14 MPa) increases the strength attain the limit of 30% replacementwith steel fiber (4.72 MPa).
- The maximum strength achieved in the 30% replacement of industrial wastes in concrete. Then casting beams in 30% replacement with and without steel fibers only. The Flexural strength is 6.67 MPa and 8.67 MPa. Compare to the conventional beam (5.33MPa).
- The industrial waste materials can be used in concrete composites without affecting the mechanical properties up to the specified range.

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