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An Experimental Study on Mechanical Properties of Bendable Concrete by Using Fly Ash and Recron 3S Fibers

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ABSTRACT- Diminishing the brittle idea of concrete has opened another universe of potential outcomes to upgrade the safety, strength and durability of the up and coming age of civil infrastructure . Small strands mostly represent its exhibition, and furthermore the materials are intended for greatest adaptability, on account of its long life, the Engineered Cement composites (ECC) is required to cost less over the long haul, too. The pliable or bendable cement is made of same fixings as in standard solid short the coarse aggregate. It looks precisely like normal concrete, yet under unreasonable strain, the ECC concrete permits, the uncommonly covered organization of fiber in the concrete to slide inside the concrete, accordingly evading the rigidity that causes weakness and breakage. The key factor is that ECC is designed, implies notwithstanding fortifying the solid with small size strands that go about as tendons to bond the solid all the more firmly.

An experimental has been carried out for M25 concrete using the optimum percentage of partial replacement of cement with fly ash and incorporating with different percentages of Recron fibers. Fly ash was partially replaced as cement by 10%, 20% and 30% and Recron fiber as 0.5%, 1.0% and 1.5% respectively. Conventional concrete cubes, cylinders and beams were casted and tested for 7 days and 28 days with water cement ratio of 0.45. The results are discussed in detailed. The compressive strength 15.15%, split tensile strength 50% and flexural strength 20.63% greater for replacement of cement with fly ash 30% and 1.5% of Recron fiber when compared with conventional concrete. Compared to the conventional concrete plate specimen the deflection value is high for replacement of cement with 30% fly ash and 1.5% of Recron fiber. Bendable concrete plate 30% of Fly ash and 1.5% of Recron fiber was found to be optimum replacement of cement. Plate size (700×150×30) mm &(700×150×45)mm shows the high flexural strength compared with the normal plate.

Keywords: ECC, Bendable Concrete, Recron fiber

I. INTRODUCTION

Concrete is brittle material when it subjected to tensile loads cracks are easily observed. Bendable concrete is ductile in nature this concrete is also known as Engineered cementious composite (ECC). This was created by victor Li at the college of Michigan.

Bendable concrete is a ultra ductile reinforced mixture is made to produce high ductility and more cracking control effect. In the present study the materials of cement, sand, fibers (Recron fibers), fly ash, water and admixture (Conplast SP 430) is used to make bendable concrete mixture. The concrete specimens were casted and cured for 7days, 28 days strength calculations. The slabs are casted for load deflection calculations. The main advantges of ECC are Increase tensile strength ,Greater impact resistance of fiber reinforced concrete, Reduce permeability , Arrest drying shrinkage, Controls cracking and Increases flexibility.

II. MATERIALS AND MIX PROPORTION

For making ECC the materials like cement, sand, fibers (Recron fibers), fly ash, water and super plasticizer (Conplast SP 430) are used the details of materials are dicussed below.

2.1 Cement

Cement is the fine material which is generally used for binding in concrete mix. In the present study cement of OPC 53 grade was used. The cement of OPC 53 grade is shown in the below figure 1.

Figure 1: OPC 53 Grade cement

2.2 Fine aggregates

Fine aggregates are the particles which are passing through IS 4.75mm sieve. These are used to fill the air voids in concrete mixture the fine aggregates which are used in the present study are shown in below figure 2.

Figure 2: Fine aggregates

2.3 Fibers (Recron fibers)

Fibers are generally used for making the high strength concrete. The fibers are mainly used to decrease the cracking effect of concrete. The recron 3S fiber which is used in this study is shown in below figure 3.

Figure 3: Recron fibers

2.4 Fly ash

Fly ash is a fine material it is the result of coal making process. The fly ash has some equal properties of cement, it is also used for making the concrete mixture in some cases. In this study class F fly ash is used to make concrete which is shown in the below figure 4.

Figure 4: Class F fly ash

2.5 Super plasticizer

Super plasticizer of Conplast SP 430 is utilized The primary advanatge of super plasticizer is to increte the strength and to reduce the water content in mix the SP430. The conplast SP430 is appeared in figure 5.

Figure 5: Conplast SP 430

2.6 Mix proportion

The mix proprotion is the quantity of materials which are used in the project. For the current study concrete mixture of M25 Grade is used the mix proportion is calculated as per the materials properties the quantities of materials is shown in the below Table 1

Table 1: Mix proportion of concrete

Binder	Cement	Fly ash	Fine aggregate	Recron fibers	Super plasticizer	Water
425.73	298.01	127.71	1582.42	0%, 0.5%, 1%, and 1.5%	2.98	192.58

III. EXPERIMENTAL WORK

3.1 Mixing the concrete

The trail mixes used in the study are 0%RF+0%FA+, 0.5%RF+10%FA, 1.0%RF+20%FA, 1.5%RF+30%FA. Initially select any mixture for M25 grade concrete. Measure the quantity of materials depending upon the mix design and mix the materials to make concrete mixture.

3.2 Workability of concrete (Slump cone test)

For four trial mixes the slump cone test values are studies to check the workability of concrete mix.

3.3 Casting of the specimens

The specimens of cubes, cylinder and prisms are used to check the strength. The slab plates were casted to check the ultimate load values for the trails.

3.4 Curing of the test samples

The test samples are cured for 7days, 28 days in curing tank to check the strength values for cubes, cylinders, prisms and ultimate load for slab plates

3.5 Compressive strength

Compressive strength of concrete is measured for 0%RF+0%FA+, 0.5%RF+10%FA, 1.0%RF+20%FA, 1.5%RF+30%FA. Initially select any mixture for M25 grade concrete at 7days and 28 days curing for this study. The compressive strength is measured by using UTM machine

3.6 Split tensile strength

The split tensile strength of concrete is measured for 0%RF+0%FA+, 0.5%RF+10%FA, 1.0%RF+20%FA, 1.5%RF+30%FA. Initially select any mixture for M25 grade concrete at 7 days and 28 days curing this test is done for cylindrical specimens in UTM for 4 trials.

3.7 Flexural strength

The flexural strength of concrete is measured for 0%RF+0%FA+, 0.5%RF+10%FA, 1.0%RF+20%FA, 1.5%RF+30%FA. Initially select any mixture for M25 grade concrete prism specimens which are cured at 7 days and 28 days age. This test is also measured for four trial mixes.

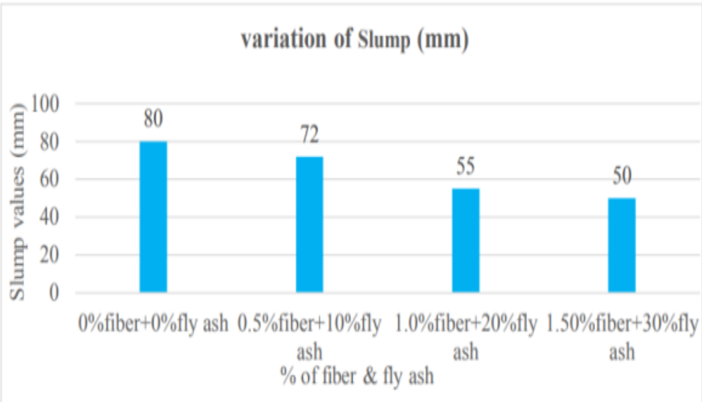
3.8 Ultimate load test

This test is measured for slab specimens of size 0.7X0.15X0.03 and 0.7X0.15X0.045 sizes. The load vs diflection values are studied for four trials the comparison of ultimate load values are mesured for all 8 plate specimens

IV. RESULTS AND ANALYSIS

4.1 Slump cone test

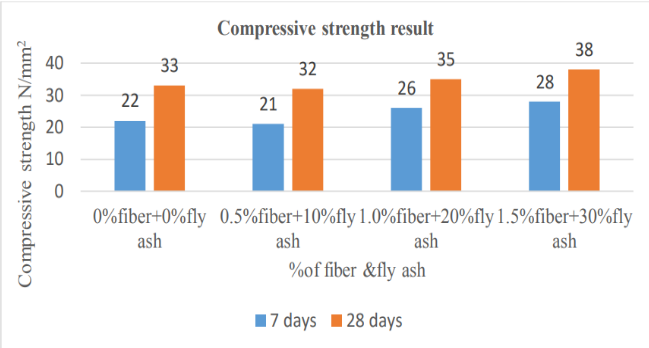
From the below chart it was seen that the expanding the level of recron fiber structure 0% to 1.5% and fly ash from 0% to 30% the slump cone decreases



Graph 1: Comparison of slump cone test

4.2 Compressive strength

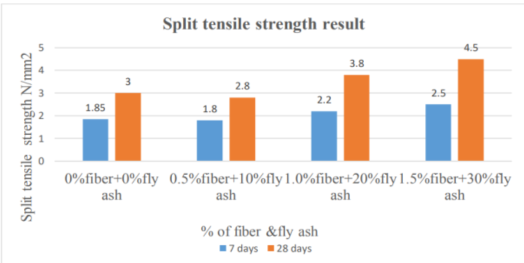
From the below diagram it was seen that the most extreme estimation of compressive strength is seen at 1.5% of fiber and 30% of fly ash and least value is seen at 0.5% fibers and 10% fly ash blend for both 7 days and 28 days.



Graph 2: Comparison of Compressive strength

4.3 Split tensile strength

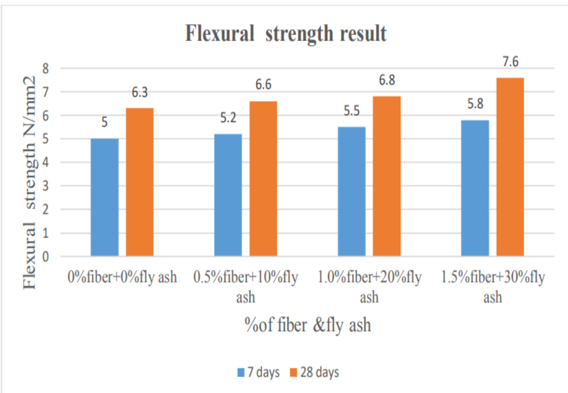
From the below chart it was seen that the greatest estimation of split elasticity is seen at 1.5% of fiber and 30% of fly debris and least qualities are seen at 0.5% filaments and 10% fly debris blend for both 7 days and 28 days.



Graph 3: Comparison of split tensile strength

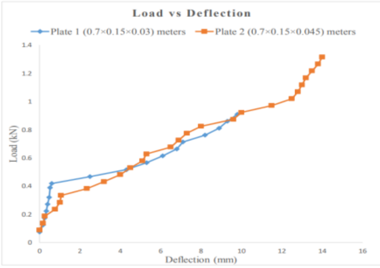
4.4 Flexural strength

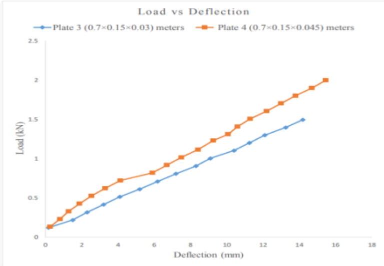
From the below diagram it was seen that the most extreme estimation of flexural strength is seen at 1.5% of fiber and 30% of fly debris and least qualities are seen at 0% strands and 0% fly debris blend for both 7 days and 28 days.



Graph 4: Comparison of flexural strength

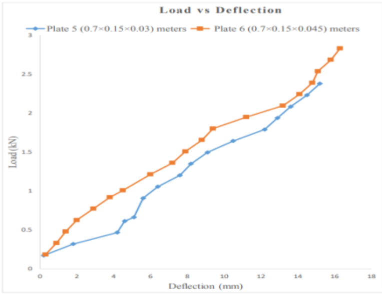
4.5 Ultimate load VS deflection

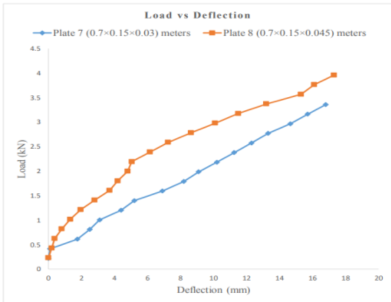




Graph 5: Normal Mix

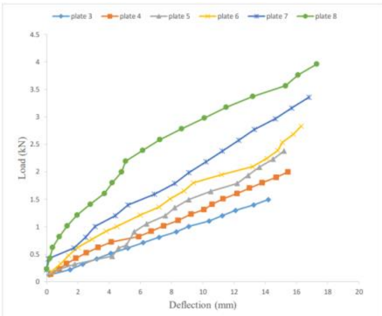
Graph 6: 0.5%RF+10%FA





Graph 7: 1.0%RF+30%FA

Graph 8: 1.5%RF+30%FA



Graph 9: Comparison of Load VS deflection for different percentages of fly ash and Recron fiber

V. CONCLUSIONS

The advancement of concrete with the adding combination of expansion in level of fractional supplanting of concrete with fly ash and consolidating with different rates of Recron fiber has been successfully completed and the results were presented and the analyzed in the previous chapter. Based on the experimental work on M25 grade concrete the following conclusions were given below.

1. Replacement of fly ash at 10, 20, & 30% with Recron fiber 0.5, 1.0, & 1.5% the workability increases when compared with controlled concrete.
2. At 30% of fly ash with 1.5% of fiber it can observed that there is an increment of 15.15% compressive strength when compared with controlled concrete.
3. At 30% of fly ash with 1.5% of fiber it can observed that there is an increment of 50.50% tensile strength when compared with controlled concrete.
4. At 30% of fly ash with 1.5% of fiber it can observed that there is an increment of 20.63% flexural strength when compared with controlled concrete.
5. Maximum deflection for plates with size 700×150×30 & 700×150×45mm was found to be 9.80 & 14.00 mm at load 0.9091 &1.315 kN for Normal concrete.

6. Maximum deflection for plates with size 700×150×30 & 700×150×45mm was found to be 16.80 & 17.30 mm at load 3.358 & 3.959 kN for Bendable concrete.

7. Hence from the test results it was demonetized that at 30% fly ash & 1.5% fiber strength improvement is high when compared with other contributions.

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