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Experimental Study on Bendable concrete

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Abstract:

Engineered Cementitious Composite (ECC), also referred to as bendable concrete, is a type of ultra-ductile concrete that exhibits numerous cracking and strain-hardening under tension and flexure. In the past ten years, significant progress has been achieved in the development of bendable concrete with extremely high tensile ductility. In the current experiment, additional cementitious ingredients including super plasticisers and Poly Propylene fibre are used to test the strength qualities of various bendable concrete compositions. The flexural strength of bendable concrete in the current work is higher than that of conventional concrete. Concrete flexure is weak. By partially substituting Super Plascticers and Poly propylene fibre for cement, bendable concrete exhibits beneficial effects on flexural values of 0.5 percent, 1% percent, and 2% percent, respectively. The mixture displays varying strengths depending on the amounts of Poly Propylene fibre andSuper Plascticers used .

Keywords **—Concrete, Bendable Concrete, Polypropylene fibers and Super Plascticers**

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I. INTRODUCTION

Concrete has always been a fragile substance that easily fractures when put under tensile pressure.

In recent years, scientists have developed a new kind of concrete that is more ductile than regular concrete. Ordinary concrete tends to break when under tensile pressure. Because of this, scientists have long been interested in developing concrete that is more ductile, or more likely to bend than to break when subjected to force. Engineered Cementitious Composite (ECC) has been shown to be 40 times lighter and 50 times more flexible than regular concrete. Additionally, ECC is particularly ideal for crucial components in seismic zones due to its superior energy absorbing qualities.

II. OBJECTIVES:

- To compare the compressive strength between bendable concrete and conventional concrete.
- To compare the weight and cost of bendable concrete with the conventional concrete.
- To compare the flexural strength between bendable concrete and conventional concrete.

Behavioural Analysis The material characterization of bendable concrete is investigated in the current work. By substituting various percentages of Super Plascticers and various percentages of fibres, an experimental analysis was done to compare the mechanical properties of bendable concrete's compressive strength, flexural strength, splitting tensile strength, and other properties. Keeping the Poly propylene fibre volume fraction at 0.5 percent to 3 percent, the Super plasticizer at 2 percent, the water/cement ratio fixed at 0.5, and replacing fibres with cement all ways to determine a better proportion for workability.

Polypropylene fibre (PPF) is **a kind of linear polymer synthetic fibre obtained from propylene polymerization**. It has some advantages such as light weight, high strength, high toughness, and corrosion resistance.

Super plasticizer Super plasticizer used is Conmix SP 1030. It is used to control rheological properties of fresh concrete. Super plasticizers are additives to fresh concrete which help in dispersing the cement uniformly in the mix. When used to achieve reduction in mixing water they can reduce water up to 15-20% and hence decrease W/C ratio by same amount. This results in increase in strength and other properties like density, water tightness

Nominal mix design for Bendable concrete

As we are not using coarse aggregate in the Bendable Concrete, there is no separate mix design for the Bendable concrete. For this research we have to estimate the different mixes having different constituents which are Fibers and Fine aggregate Super Plasticizer

Casting and curing of test specimen In the detailed study about the Bendable Concrete or ECC to achieve workability and to know mechanical properties various trials have done as shown above. For each nominal mix, standard cubes 36 No's of size (150mmx150mmx150mm), 12No's of standard Beams of size (100mmx100mmx100mm) and 12 No's of Cylinders (150mm diax300mm height) casted and cured using the accelerated curing tank & tested to know the strength.

For all mixtures with varying Super Plasctizer proportions and volumes of fibres of 1% and 1.5 %, a total of 60 specimens were cast. Mixing Making a mix is crucial to the creation of concrete. A crucial step in the creation of ECC is mixing. Before it is cast, it must be well mixed. Since concrete lacks coarse aggregate, the interaction between fibres and other cementitious elements depends on the proportion of each component in the concrete mix.

As the Bendable Concrete is different from normal concrete the mixing should be done in proper order to get a good workable mix. In mixing we fallow a procedure for adding constituents to get a good workable mix all the dry material i.e. cements, Fly ash, aggregates, were added into drum and mixed thoroughly for 2- 3 minutes. After that Water and super plasticizer was next added into dry material and mixed for 2-3 minutes. Poly propylene fibre was added in last and mixed for an additional three

Flexural strength: Flexural strength is expressed in terms of modulus of rupture, which is the maximum stress at the extreme fibers in bending. It is calculated by flexure formula. After removal of the beam specimen from the curing tank, they are tested on the load frame of 20kN capacity in accordance with IS 9399:1679

Splitting tensile strength, The specimens were tested in accordance with IS 5816:1999. Specimens when received dry shall be kept in water for 24 h before they are taken for testing. Unless other conditions are required for specific laboratory investigation specimen shall be tested immediately on removal from the water whilst they are still wet. Surface water and grit shall be wiped off the specimens and any projecting fins removed from the surfaces which are to be in contact with the packing strips

MarshConeTest

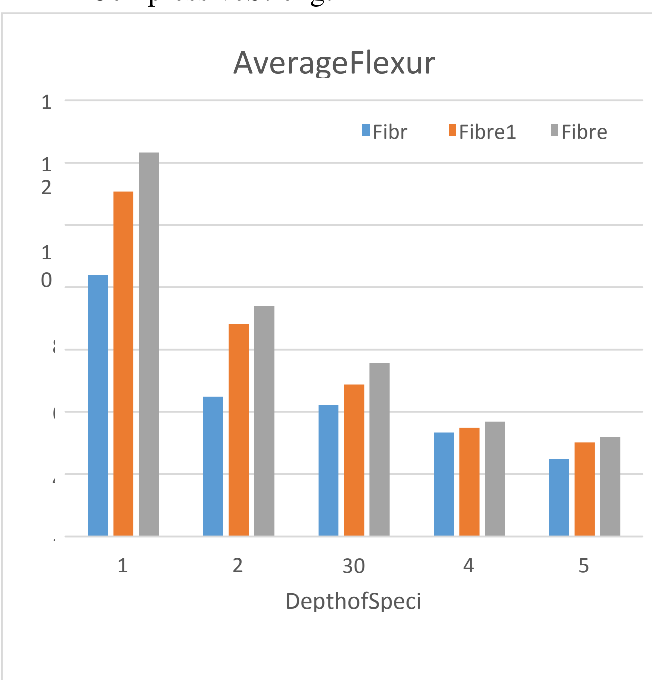
Super plasticizer (Supercon-100) dosage was decided by this test. Table shows the dataacquired after performing test using 400gm of cement with varying plasticizer dosage. w/cratiowas kept as 0.4

Cement(gm)	Water(ml)	Dosage(ml)	Marshconetime(s)
400	160	10	30
400	160	11	27
400	160	12	26
400	160	13	24
400	160	14	22
400	160	15	17

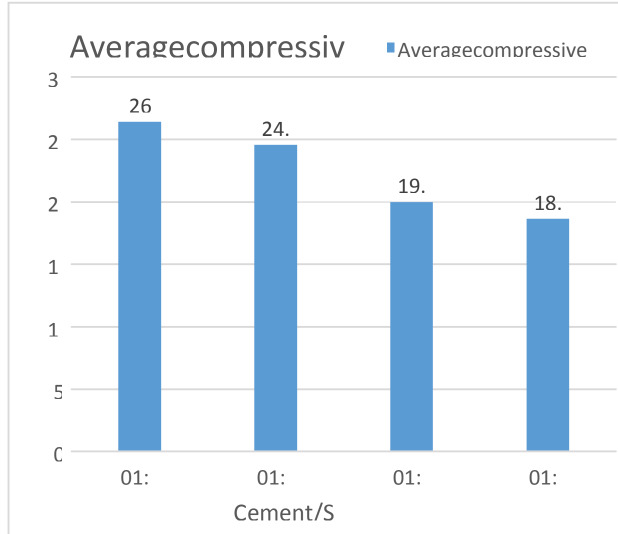
AverageSlump

Typeofmix	Slump(mm)	Percentagedifference(%)
Plane(0%)	120	-
1.0%Fiber	70	50
1.25%Fiber	60	60
1.5%Fiber	45	75

CompressiveStrength



Average Flexural Strength



Results and Discussion:
Multipletestswereconductedandafterdetailedstudyofthetestresultsfollowingconclusionscanbemade
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1. 1When the cement to sand ratio was 1:0.6, the concrete's compressive strength was found to be at its highest. The compressive strength decreased by roughly 7% as the sand content was raised to 1:0.8.
2. A specimen with a 10mm depth and a 1.5 percent fibre content was determined to have the maximum flexural strength of concrete. The flexural strength is at its maximum for length: breadth: depth ratios of 70:15:1 and 1.5 percent fibre content, according to the findings of the test for flexural strength..
3. . As the depth of the concrete specimen is increased, the flexural strength of the concrete falls. When the depth was increased from 10mm to 20mm, there was an about 40% drop in flexural strength for fibre content = 1.5%..

DiscussionofResults:

It is clear from the findings in chapter 5 and the research that followed that ECC possesses the advantages listed below over regular concrete:

1. Based on the results, it can be inferred that the flexural strength was at its highest for a L:B:D ratio of 70:15:1 and a fibre content of 1.5 percent. Because it can resist cracking, this ECC will last longer than regular concrete.

2. It has been discovered that ECC is incredibly flexible (strain=0.007) and can bend like a metal.

3. The ECC weighs 32.8 percent less than regular concrete. It has been noted that the weight can be lowered by roughly 32.8 percent for the same piece. As a result, steel reinforcing can be cut back.

4. The ECC has excellent self-healing qualities since the surplus free cement component that was not reacted during initial hydration allows it to repair small cracks on its own.

5. The cost of the material components is higher, but because there are fewer structural members, the structure's dead load is lower and its usable area is higher, lowering the project's overall cost.

6. If standard concrete is used to build a road project, especially one where a large number of cars will be using it, the life cycle will be quite short. However, because to its flexibility, ECC can significantly extend service life. The cost of replacing the roads is therefore avoided. Additionally, the expense of operation and upkeep is decreased.

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