EXPERIMENTAL STUDY ON CONCRETE WITH PLASTIC AGGREGATES

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ABSTRACT

Due to rapid industrialization and urbanization in the country lot of infrastructure developments are taking place. This process has in turn led questions to mankind to solve the problems generated by this growth. The problems defined are acute shortage of constructional materials, increased productivity of waste and other products. In this project M30 grade concrete is taken and waste plastic is used as modifier. Plastic waste was added in percentage such as 5%, 10% and 15% in order to replace the amount of sand. Tests were conducted on coarse aggregates, fine aggregates, cement and modifiers (plastic waste) to determine their physical properties. Cubes, cylinders and prisms were casted for 7 and 28day's strength. These tests revealed that the optimum modifier content was found to be 5% by the weight of the sand. The studies revealed that the optimum plastic waste content was 5% and the strength was found to be equal to the plain cement concrete. Using the optimum percentage rapid chloride penetration test and young's modulus test was performed. The concrete works using modifier can be used for construction.

Keywords – Plastic waste, optimum

1. INTRODUCTION

Plastic recycling is taking place on a significant scale in India. As much as 60% of both industrial and urban waste plastic is recycled. People in India have released plastic waste have immense economic value, as a result of this, recycling of waste plastics plays a major role in providing employment, resulting in economic development of the country. Indian construction industry creates lots of employment opportunities and accounts for major portion of the capital outlay in successive 5-year plans of our country. Plastic waste is bulky, heavy and unsuitable for disposal by incineration or composing which result in polluting the environment, posing number of problems for the well-being of human race and resulting in hazardous disease. Above all, the fast depleting reserves of conventional.

2. METHODOLOGY

2.1 COLLECTION OF MATERIALS

Plastic waste are mostly collected are plastic toys, buckets, mug, mixie body parts, grinder body parts which is reusable. Crushing the plastic waste to make powder form. Heat the plastic waste to attain melting point. Compress the material into hardened form using machine. Making smaller size using machine into size suitable for fine aggregate.

2.2 CASTING OF SPECIMENS

Casting of cube, cylinder and prism is done for both the conventional and modifier specimens. For each 3 specimens are casted and tested. In modifier 5%, 10% and 15% of plastic is replaced with coarse aggregate and each of the category is tested with 3 specimen.

2.3 TESTING OF SPECIMENS

Compressive strength, Tensile strength and Flexural strength test is conducted for both the conventional and modifier specimens

.2.4 MATERIAL PROPERTIES

Specific Gravity	Value
Sand	2.74
Coarse aggregate	2.74
Cement	3.15
Plastic waste	1.2

Table 2.1 Material properties

3. MIX DESIGN

The concrete used in this study was proportioned to attain strength of 30 MPa. The different type of mixes are obtained by adding plastic waste to 5%, 10% and 15% fine aggregate ratio. The mix shall be designed to produce M30 grade of concrete. The design is done as per IS 10262.

3.1 MIX PROPORTION

Water litre	Cement m^3	Fine Aggregate m^3	Coarse Aggregate m^3
208	462	640	1065
0.45	1	1.38	2.3

Table 3.1 Mix proportion

4. EXPERIMENTAL WORK

For the various mix proportion of plastic waste the concrete cubes, cylinder and prism have been prepared for 7days and 28days. The cube specimen were used for compressive strength whereas cylinder specimens were used for split tensile strength and prism specimens were used for flexural strength. Now, concrete cubes, cylinders, prisms are casted, which are of standard dimension of 0.15 m x 0.15 mx 0.15 m, 0.15 m x 0.3 m, 0.5 m x 0.1 m x 0.1 m. The specimens are kept for curing and tested for its compressive strength on different days (7days & 28days).

4.1 COMPRESSIVE STRENGTH

Compressive strength is the capacity of a material or structure to withstand loads tending to reduce size, as opposed to tensile strength, which withstands loads tending to elongate. It is often measured on a universal testing machine. Compressive strength is calculated using the formula = $\frac{load\ X\ 1000}{150\ X\ 150}$

4.2 SPLIT TENSILE STRENGTH

The split tensile strength of concrete cylinder was determined based on IS: 5816-1999. The load shall be applied nominal rate within the range 1.2 N/ (mm2/min) to 2.4 N/ (mm2/min).Formula for calculating the split tensile strength is = $\frac{2P}{\pi LD}$ N/mm2

Where, P = load in N, L = length in mm, D = diameter in mm

. 4.3 FLEXURAL STRENGTH

This test method is used to determine the modulus of rupture of specimens prepared and cured. The strength determined will vary where there are differences in specimen size, preparation, moisture condition or curing. This test method covers the determination of the flexural strength of concrete specimens by the use of the sample beam with centre-point

loading. Combining values from the two systems may result in non-conformance with the standard.

Stiffness is obtained using the formula = $\frac{y1-y2}{x1-x2}$

Fig 4.1 Specimen for Compression

Fig 4.2 Specimen for Split tensile

Fig 4.3 Specimen for Flexural test

5. COMPARITIVE RESULTS OF CONVENTIONAL AND MODIFIER CONCRETE

5.1 COMPRESSIVE STRENGTH FOR 28 DAYS

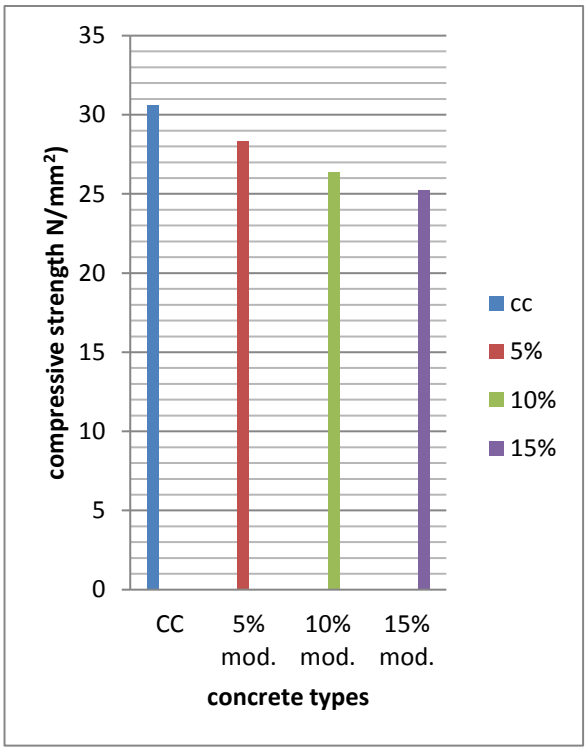

Fig 5.1 Compressive strength

5.2 SPLIT TENSILE STRENGTH FOR 28 DAYS

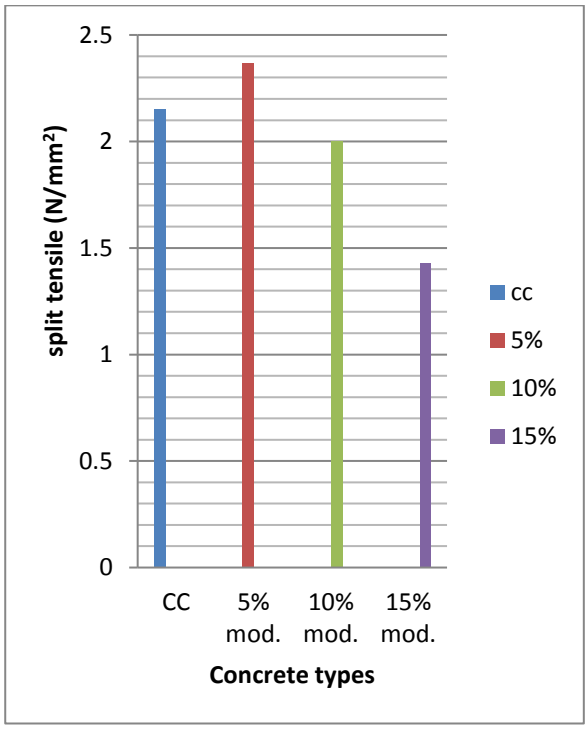

Fig 5.2 Split tensile strength

5.3 FLEXURAL STRENGTH FOR 28 DAYS

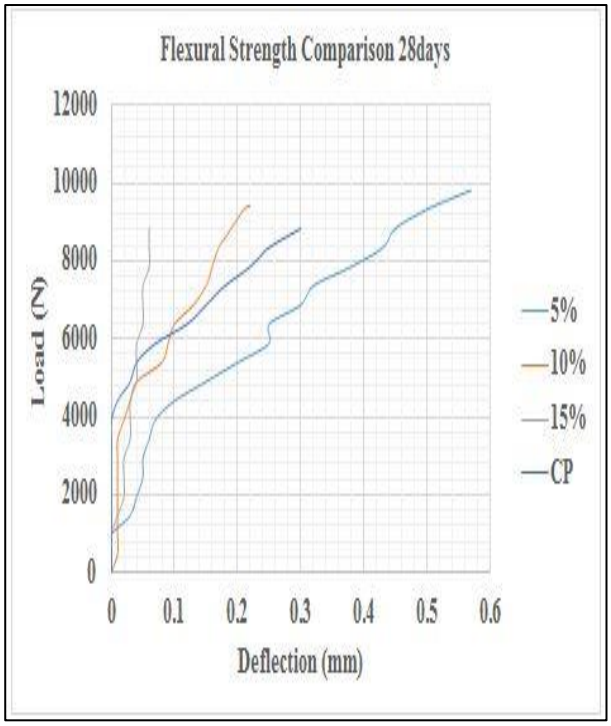

Fig 5.3 Flexural strength

5.4 STIFFNESS COMPARISON FOR 28DAYS

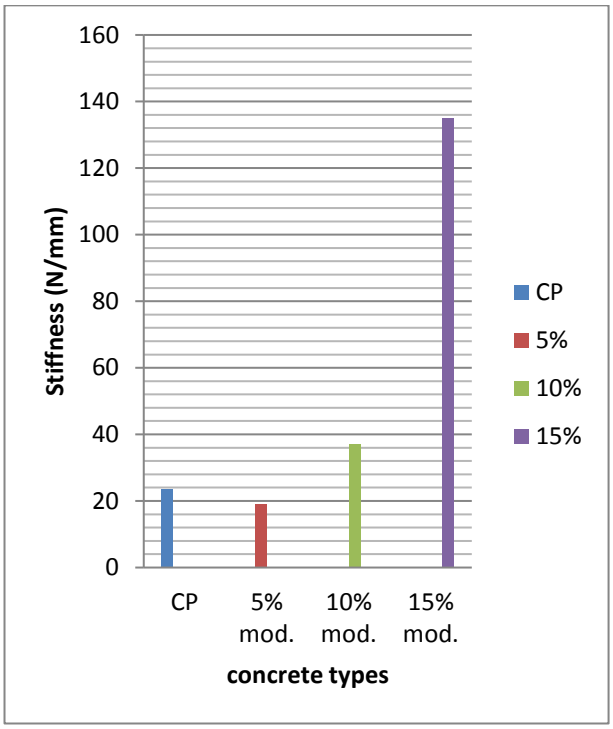

Fig 5.4 Stiffness comparison

6. RAPID CHLORIDE PENETRATION TEST

Corrosion of reinforcing steel due to chloride ingress is one of the most common environmental attacks that lead to the deterioration of concrete structures. Corrosion-related damage to bridge deck overlays, parking garages, marine structures, and manufacturing plants results in millions of dollars spent annually on repairs. This durability problem has received widespread attention in recent years because of its frequent occurrence and the associated high cost of repairs.

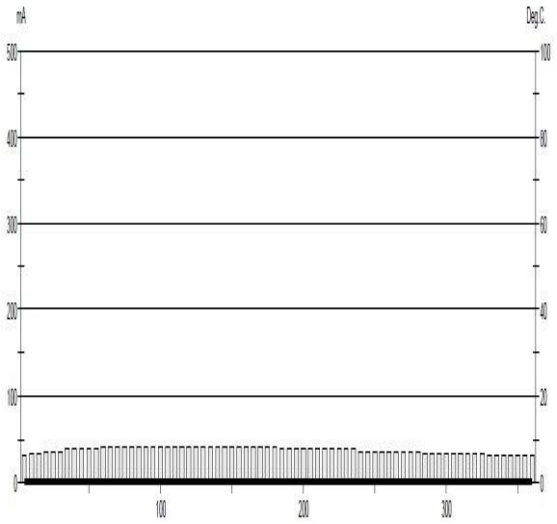

Fig 6.1 Penetration Chart

Test report

Voltage Used:	60
Testing time:	06:00 hour
Charge passed:	797
Adjusted Charge passed:	691
Permeability class:	Very Low
Instrument number:	053708
Channel number:	1
Report date:	3/18/2017
Testing by:	PK
Reference:	Plastic (5%)
Sample diameter:	102
Comment:	Nil

Fig 6.2 Test Report

7. YOUNG'S MODULUS TEST

Young's modulus, also known as the elastic modulus, is a measure of the stiffness of a solid material. It is a mechanical property of linear elastic solid materials. It defines the relationship between stress (force per unit area) and strain (proportional deformation) in a material.

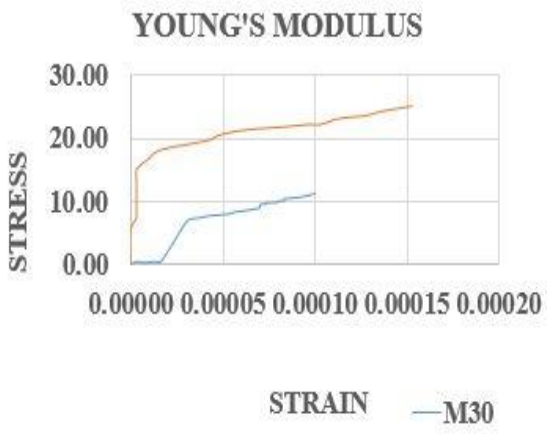

Fig 7.1 Stress Strain Comparison

Young's Modulus for M30 grade concrete = 0.27 x 105 MPa

Young's Modulus for Modifier concrete = 0.97 x 105 MPa

8. CONCLUSION

From the experimental study on concrete with plastic aggregates, the following observations are made,

The compressive strengths of modified (plastic added) cement concrete equals the compressive strength of plain cement concrete. The optimum modifier content is found to be 5% by weight of sand for the fine aggregate. The addition of plastic aggregates have not produced any significant change in the Compressive strength, Split tensile Strength and Flexural strength. Therefore the 5% of the natural fine aggregate can be replaced to prepare the concrete. Plastic waste can be effectively used in the concrete and thus provide a solution for the disposal problem of the plastic wastes.

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