An Experimental Analysis on Strength of Pervious Concrete by Executing Partial Addition of Glass Fibre and Polypropylene Fibre

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Abstract- *Pervious Concrete is a concrete which is produced by omitting the fines aggregate from ordinary concrete. Pervious concrete is also referred as "Porous Concrete" Or "No Fine Concrete" The main aim of this investigation is to develop a strong pervious cement concrete using different types of fibres like Glass Fibre and Polypropylene Fibre .In addition, it is also aimed to compare the properties of these PCC mixes using proportion of Fibre content .The properties such as compressive strength were performed.*

Keywords- pervious Concrete, Fibres, Sandwiched Proportion, Glass and Polypropylene Fibre, Strength Characteristics.

I. INTRODUCTION

Pervious Concrete is a concrete which is produced by omitting the fines aggregate from ordinary concrete. Pervious concrete is also referred as "Porous Concrete" Or "No Fine Concrete". It can used for concrete flatwork applications which allows water from precipitation and other sources to directly pass through it, in that way reducing the runoff from a site and allowing ground water table recharge[6].Today in the present world we are very much fond of sustainable and eco-friendly means of construction.[1], Especially in a country like India where flooding and water logging problems are the major environmental issues sustainable development has become a necessity[2].Various sustainable and eco-friendly means are being put into use to overcome these problems where No-fine concrete hard road surfaces is one among them. Working on rain-drain idea No-fine concrete allows a big amount of storm water to percolate into the ground, thereby recharging the groundwater and reducing the storm water runoff [4],[6]. No-Fines Concrete is a light-weight concrete. The concrete paste then coats the aggregates and allows water to pass through the concrete slab. Pervious concrete is traditionally used in parking areas, areas for light traffic, residential streets, pedestrian walkways or pathways, and greenhouses [5]. It is an important application for sustainable construction. Its void content ranges from 18 to 35%, compressive strength from 4Mpa to 30Mpa. The infiltration rate is fall in range of 100 to 750 litter per m2. And due to high void content pervious Concrete is also lightweight with density 1600 Kg/m3 to 2100 Kg/m3 [9]

This concrete is made up from only coarse aggregate, cement, water and in sometimes cases addition of admixtures or Fibres. Generally only single sized coarse aggregate, of size passing through 20 mm retained on 10 mm is used[3]. No-fines concrete is becoming popular because of some of the advantages it possesses over the ordinary concrete. The single sized aggregates help to make a good no-fines concrete, which in addition to having large voids and because of this light in weight, also offers architecturally attractive look [3].

Objectives

1. To analyse different fibres for pervious concrete for identifying suitable fibres to partial addition.
2. To develop a strong pervious concrete mix with ACI reports

II. MATERIALS USED

Materials:

A. Cement:

Ordinary Portland cement (OPC) of M53 grade going along with IS: 10262-2009 was used for casting the pervious concrete.

B. Aggregate:

The coarse aggregate was natural gravel of 10mm-20mm maximum size was selected. For Experimentation work a single 20mm size aggregate are used.

C. Water:

Drinkable clean water that is good for making ordinary concrete should be used. For Mixing, Casting and Curing Purpose

D. Fibres:

Glass fibres: Glass fibres provide improvements in shrinkage characteristics, fatigue characteristics, impact, erosion resistance, serviceability, tensile strength, durability of concrete. In this study chopped strand mat glass fibre is used with properties- Type: Emulsion roded, Material: chopped strand MAT glass fibre, Density: 450/300 GSM (Grams per square meter), Length: 40 to 50 mm, Tensile strength: 108 Mpa, Flexural strength: 204 Mpa, Mechanical properties: good bonding.

Polypropylene fibres:

In the study Fibrillated 12 mm cut length fibres were used. These polypropylene fibres. Tensile strength 500-750 Mpa.

III. METHODOLOGY

The Methodology adopted and material characterization and design mix is carried out is presented in the form of flow chart After identification of problem and setting the objectives of the research, the research methodology has carefully design to achieve above mentioned objectives also the sequential activities involved in this study are presented in graphical form. Details of experimental study in materials in the sub sequent heading.

This approach works the best in guidance of fellow researchers

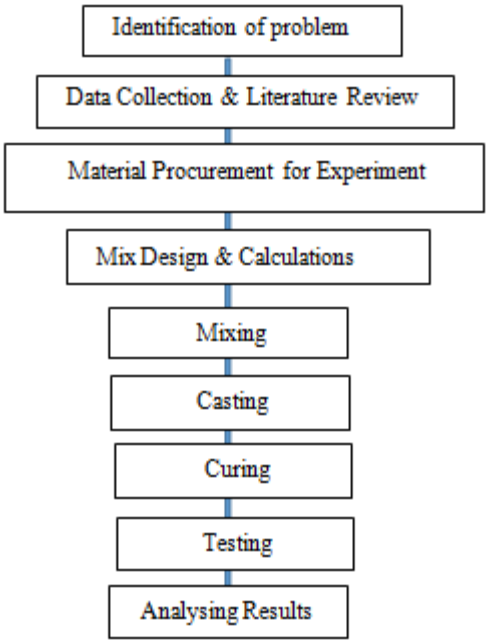

Figure 1 Methodology

Figure shows the methodology adopted for experimental study.

IV. PREPARATION, CASTING AND CURING OF THE TEST SPECIMENS

A. Mix Design and proportions:

The cement: aggregate ratio by volume is in the range of 1:4 to 1:6 by volume [8]. The water- cement ratio needs to be kept low, 0.3- 0.5, to secure the cement paste coats the aggregates and does not run off [3].

B. Mix Design by ACI 522R_10

- Assume percentage of voids by volume = 20 %
- Specific Gravity of coarse aggregate = 2.75
- Water cement ratio = w/c = 0.38
- Size of coarse aggregate = No. 67 (3/4'') as per C33/ C33m (i.e. 4.75 mm to 19 mm)
- Dry rodded density = 1741.2069 Kg /M3
- Water absorption of course aggregate = 1.2 %
- No fine aggregate.

The trial batch weights per M3 are as follows.
Cement = 323.4 Kg/M3
Water = 122.94 Kg/M3
Aggregate = 1333.956 Kg/M3
Proportion = Cement: Aggregate = 1: 4.1

C. Percentage Variation of fibre in mix:-

The proportions of two fibre (Glass & Polypropylene) used in concrete mix were at volume of 0%, 0.1%, 0.15% and 0.2% and 0.25%for each proportion equal amount of fibre are added to the mix by the weight of cement.

D. Casting, Curing & Demoulding

The moulds of 150x150x150 Mm were well cleaned and the internal faces were completely oiled to avoid adhesion with the concrete after hardening. The casting was carried out in one layer without compaction. The specimens were demoulded after 24 hours. After demoulding, the specimens were completely immersed in water.

Figure 2 Mixing of materials

Figure 3 Concrete Specimens

Figure 4 Concrete Specimens Weighting

Figure 5 Concrete Specimens Testing

The graph shows the compressive strength of the cubes with different % of Fibres for 3, 7, 14 and 28 days respectively .

Results are the averages of 3cubes for each Proportions of Specimen (A0, A.1, A.15, and A.2and A.25)

V. EXPERIMENTAL RESULTS AND TABLES

3 Days Compressive strength on Cubes

Table 2: compressive strength

Sr No	%of Addition of Fibre (GF+PPF)	Compressive Strength (mpa)
1	0 % Fibres	3.18
2	0.1% Fibres	3.2
3	0.15% Fibres	3.26
4	0.2 % Fibres	3.34
5	0.25 % Fibres	3.31

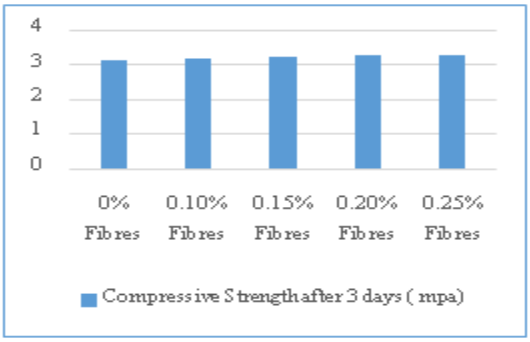

Figure 6: Concrete compressive Strengths on 3 days curing

7 Days Compressive strength on Cubes

Table 3: compressive strength

Sr No	% of Addition of Fibre (GF+PPF)	Compressive Strength (mpa)
1	0 % Fibres	5.61
2	0.1 % Fibres	5.68
3	0.15% Fibres	5.7
4	0.2 % Fibres	6.03
5	0.25 % Fibres	5.86

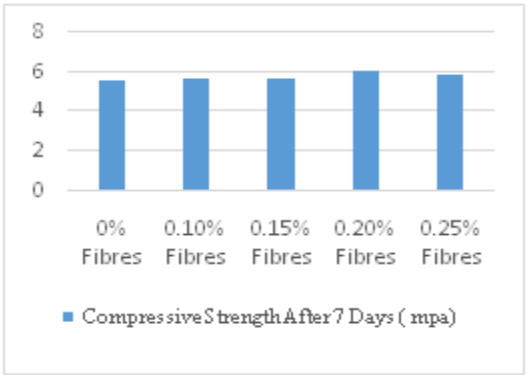

Figure 7: compressive strength on 7 day Curing

14 Days Compressive strength on Cubes

Table 4: compressive strength

Sr No	%of Addition of Fibre (GF+PPF)	Compressive Strength (mpa)
1	0 % Fibres	8.3
2	0.1 % Fibres	8.54
3	0.15% Fibres	8.71
4	0.2 % Fibres	8.84
5	0.25 % Fibres	8.22

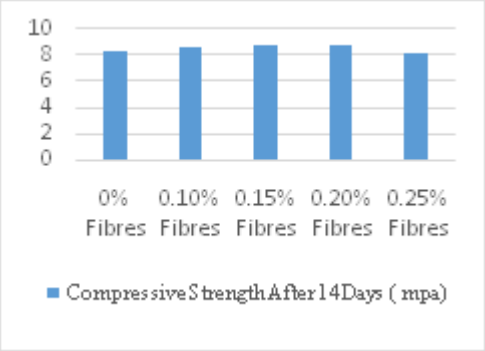

Figure 8: compressive strength on 14 day Curing

28 Days Compressive strength on Cubes

Table 5: compressive strength

Sr No	%of Addition of Fibre (GF+PPF)	Compressive Strength (mpa)
1	0 % Fibres	11.43
2	0.1 % Fibres	11.67
3	0.15% Fibres	12.8
4	0.2 % Fibres	14.15
5	0.25 % Fibres	13.61

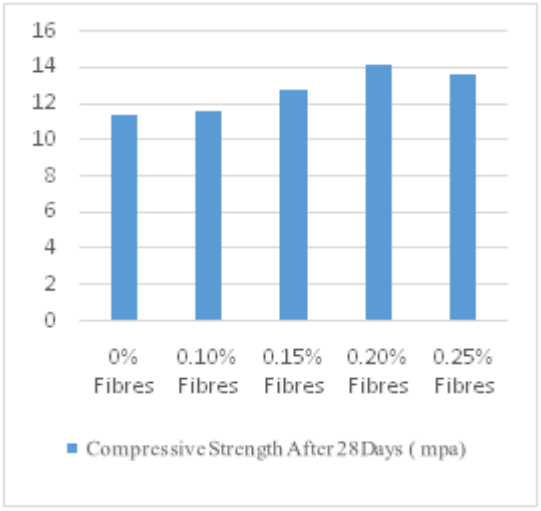

Figure 9: compressive strength on 28 day Curing

Compressive strengths on Cubes Comparisons with Variation in Percentages of Fibres and Days of Curing

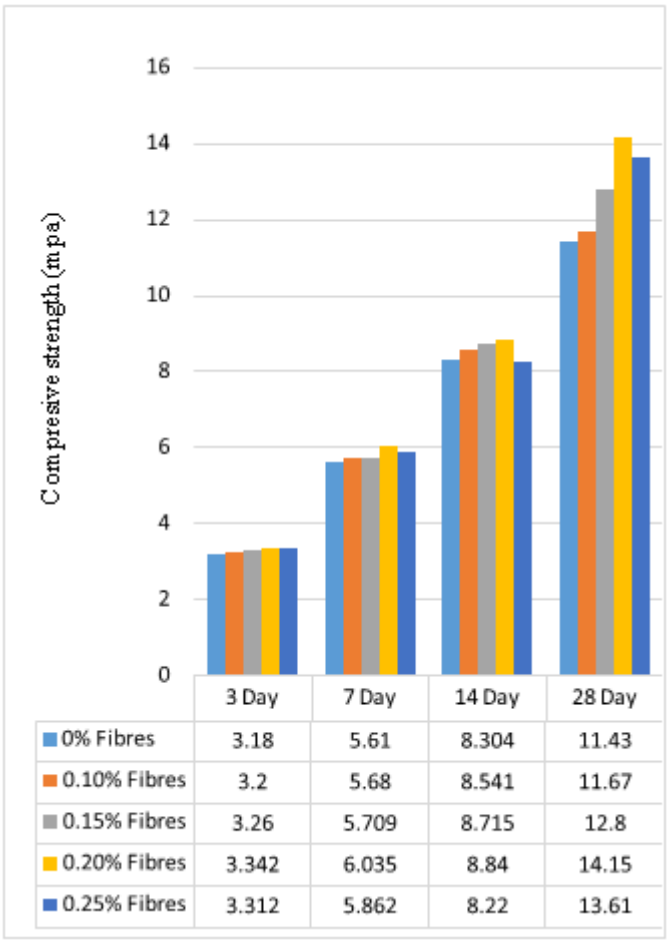

Figure 10: Concrete compressive Strengths

Figure 10 shows summarized results on relation between percentage fibres addition in concrete mix and compressive strength after 3days,7days,14days,28day curing.

Compressive strength shows better results for 0.20% fibres addition mix 3.34 mpa,6.03mpa,8.84mpa,14.15mpa then it may falls .

Table 7: Compressive strength Comparison 0% and 0.20% Fibre

Days	Compressive Strength (mpa)	
	0% of Addition of Fibre (GF+PPF)	0.2% of Addition of Fibre (GF+PPF)
3	3.18	3.342
7	5.61	6.035
14	8.304	8.84
28	11.43	14.15

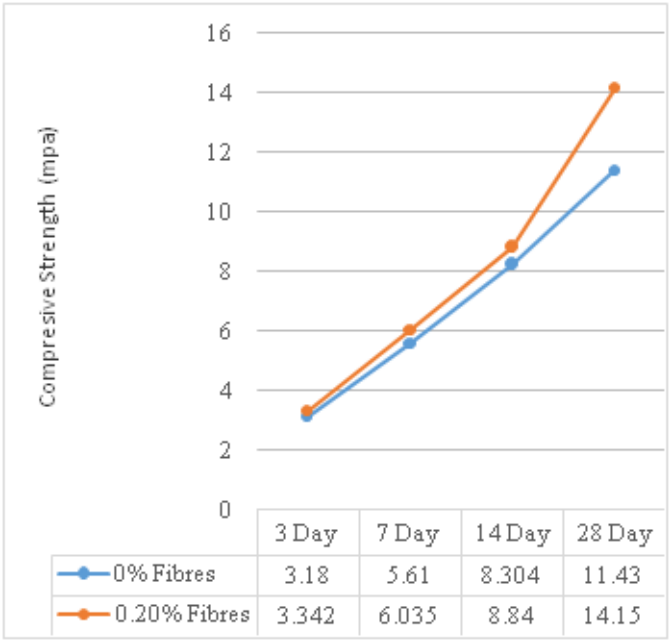

Figure 11: Comparisons of compressive strength with 0% and 0.2% Fibre

Figure 11 shows comparative results on relation between percentage 0% and 0.20% fibres addition in concrete mix and compressive strength after 3days,7days,14days,28day curing.

VI. CONCLUSION

The test carried out at 3 days , 7 days, 14 days and 28 days, the comparison is made between the plain pervious concrete, pervious concrete with Glass fibre and polypropylene fibre .

- The compressive strength of Glass fibre and Polypropylene fibre mixed with pervious concrete is increased as comparison to the % fibre pervious concrete.
- When we used the Glass fibre and polypropylenefibre in pervious concrete in different proportion0.1%, 0.15%,0.2% and 0.25% of volume of concrete the result Received by the compressive strength of Glass fibre and polypropylene fibre up-to0.2 % of used resultget increased.
- Compressive strength of specimens for 1:4.1 ratio with Glass fibre and polypropylene fibre increased by 22.15% at 28 days when compared with control.

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