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An Experimental Study on Strength Characteristics of Pervious Concrete by Partial Addition of Glass Fiber and Polyester Fiber

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Abstract: The main objective of this investigation is to develop a strong and durable pervious cement concrete (PCC) mix using different types of admixtures like Glass Fiber and Polyester Fiber.In addition, it is also aimed to compare the properties of these PCC mixes to lay concrete pavers.The properties such as compressive strength, flexural strength, and Tensile strength tests were performed.

Keywords: pervious, pavement, porosity, skid resistance.

I. Introduction

No-Fines Concrete is a method of producing light concrete by omitting the fines from conventional concrete. No-fines concrete as the name itself implies, is a kind of concrete from which the fine aggregate fraction has been omitted. This concrete is made up of only coarse aggregate, cement and water. Very often only single sized coarse aggregate, of size passing through 20 mm retained on 10 mm is used. No-fines concrete is becoming popular because of some of the advantages it possesses over the conventional concrete.
The single sized aggregates make a good no-fines concrete, which in addition to having large voids and hence light in weight, also offers architecturally attractive look.
The advantages of this type of concrete are lower density (1600- 2000 kg/m3),lower cost due to lower cement content, lower thermal conductivity, relatively low drying shrinkage, no segregation .

II. Material and Methodology

Materials:
Cement:
Ordinary Portland cement (OPC) of M53 grade conforming to IS:12269-1999 was used for casting.
Aggregate:
The coarse aggregate was natural gravel of 20 mm maximum size was used.
Water:
Tap water that is suitable for making ordinary concrete should be used.

Mix proportions:

The cement: aggregate ratio by volume is in the range of 1:4 by volume. The water- cement ratio needs to be kept low, 0.31-0.5, to ensure the cement paste coats the aggregates and does not run off.

Methodology :

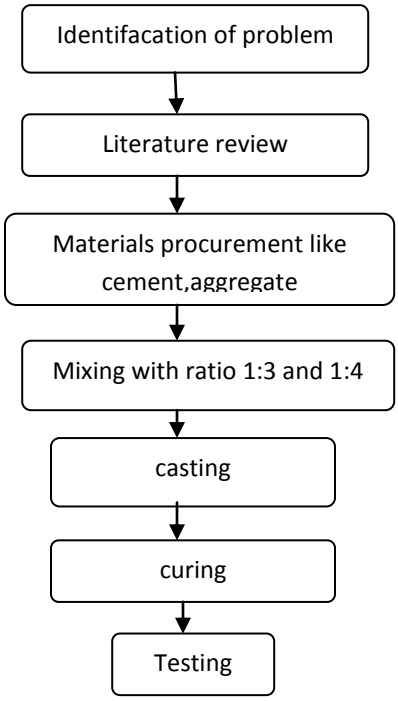

Fig: Methodology

Here the above figure shows the methodology adopted for the present experimental study.

Preparation, casting and curing of the test specimens:

The moulds were well cleaned and the internal faces were thoroughly oiled to avoid adhesion with the concrete after hardening. The casting was carried out in one layer without compaction. The specimens were demolded after 24 hours. After demolding, the specimens were completely immersed in tap water at temperature of 22 ±1°c and a relative humidity of about 95% for a period of testing.

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Figure 2.1: Mixing of materials

III. Results and Tables

Compressive strength on Cubes without additives for ratio 1:3:

Table:3.1: compressive strength without additives

Curing period (days)	Compressive Strength (N/mm^2)
7	9.5
14	12.7
28	16.4

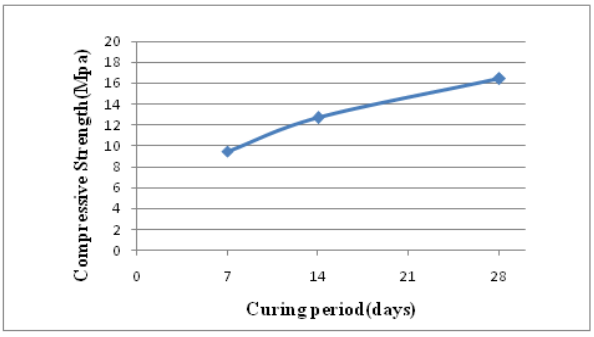

Figure:3.1: compressive strength without additives
The graph shows the compressive strength of the cubes without adding admixtures for 7, 14 and 28 days respectively

Compressive Strength on Cubes with glass fiber:

Table:3.2: compressive strength with Glass fiber

Curing period (days)	Compressive Strength (N/mm^2)
7	10.2
14	14.7
28	19.8

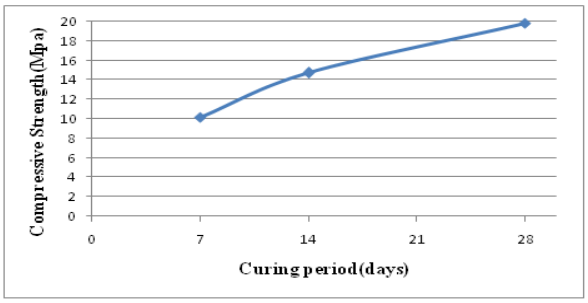

Figure:3.2: compressive strength with Glass fiber

The graph shows the compressive strength of the cubes by adding Glass fiber for 7, 14 and 28 days respectively

Compressive Strength on Cubes with polyester:

Table:3.3: compressive strength with Polyester

Curing period (days)	Compressive Strength (N/mm^2)
7	9.8
14	13.4
28	17.2

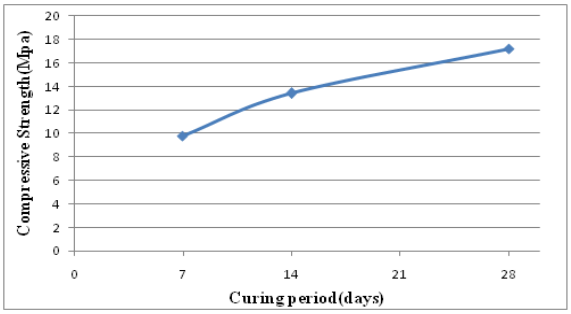

Figure:3.3: compressive strength with Polyester

The graph shows the compressive strength of the cubes by adding Polyester fiber for 7, 14 and 28 days respectively

Flexural strength for control specimen:

Table:3.4: Flexural strength without additives

Curing period (days)	Flexural Strength (N/mm^2)
7	1.9
14	2.4
28	2.9

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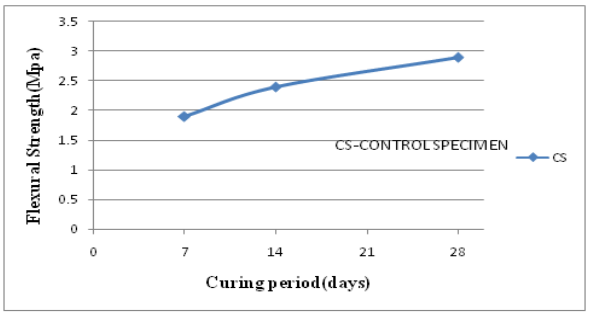

Figure:3.4: Flexural strength without additives

The graph represents the Flexural strength of the Prisms without adding admixtures for 7, 14 and 28 days respectively

Flexural strength test with Glass fiber:

Curing period (days)	Flexural Strength (N/mm^2)
7	2.2
14	2.9
28	3.3

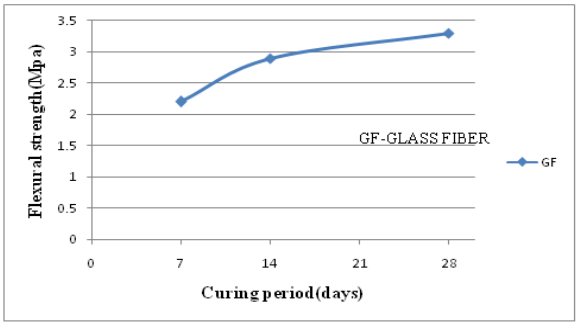

Figure:3.5: Flexural strength with Glass fiber

The graph represents the Flexural strength of the Prisms by adding Glass fiber for 7, 14 and 28 days respectively

Flexural strength test with polyester:

Table:3.6: Flexural strength with Polyester fiber

Curing period (days)	Flexural Strength (N/mm^2)
7	2.1
14	2.6
28	3.1

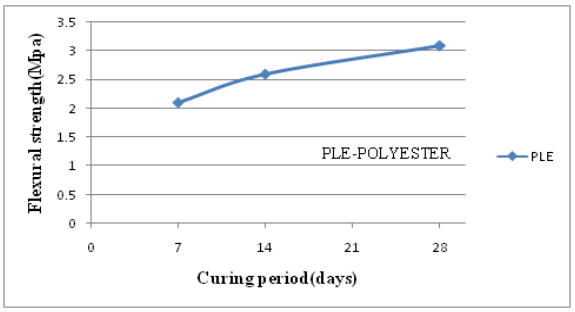

Figure:3.6: Flexural strength with Polyester fiber

The graph represents the Flexural strength of the Prisms by adding Polyester fiber for 7, 14 and 28 days respectively.

Tensile Strength Test on Cylinders without admixtures :

Table:3.7: Flexural strength without additives

	Tensile strength (N/mm^2)
7	0.95
14	1.75
28	1.42

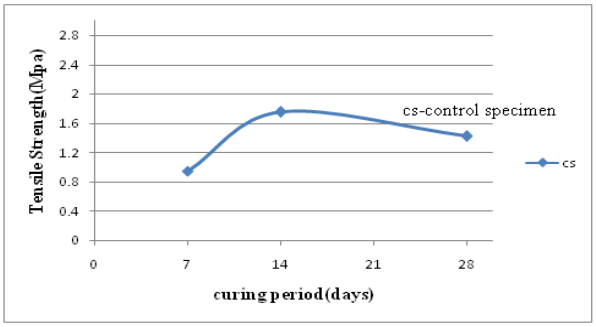

Figure:3.7: Flexural strength without additives

The graph represents the Tensile strength of the Cylinders without adding admixtures for 7, 14 and 28 days respectively.

Tensile Strength Test with Glass fiber:

Table:3.8: Tensile strength with Glass Fiber

Curing period (days)	Flexural Strength (N/mm^2)
7	1.2
14	1.5
28	1.7

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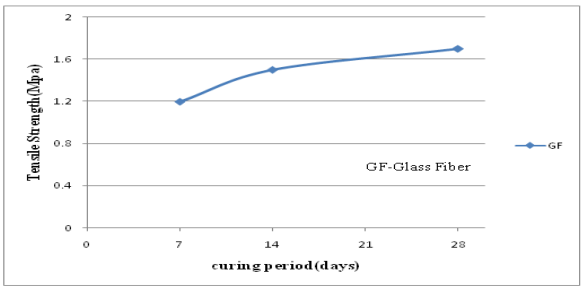

Figure:3.7: Flexural strength without additives

The graph represents the Tensile strength of the Cylinders by adding Glass fiber for 7, 14 and 28 days respectively

Tensile strength Test with polyester:

Table:3.9: Tensile strength with Polyester

Curing period (days)	Tensile Strength (N/mm^2)
7	1.07
14	1.3
28	1.56

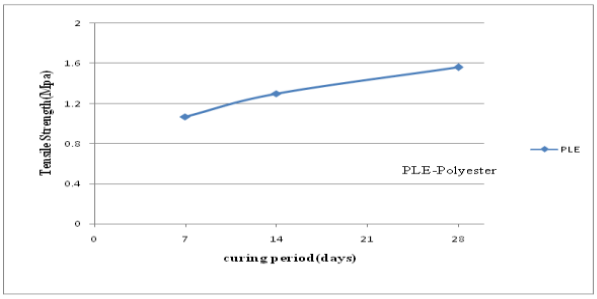

Figure:3.9:Tensile strength with Polyester

The graph represents the Tensile strength of the Cylinders by adding Polyester fiber for 7, 14 and 28 days respectively

COMPARISON OF COMPRESSIVE STRENGTH OF CUBES FOR 1:3 RATIO:

Table:3.10: Comparision of Compressive strength

Curin Period (Days)	Control specimens (MPa)	Control specimens+Glass fiber (Mpa)	Control specimens+Polyester (Mpa)
7	9.5	10.2	9.8
14	12.7	14.7	13.4
28	16.4	19.8	17.2

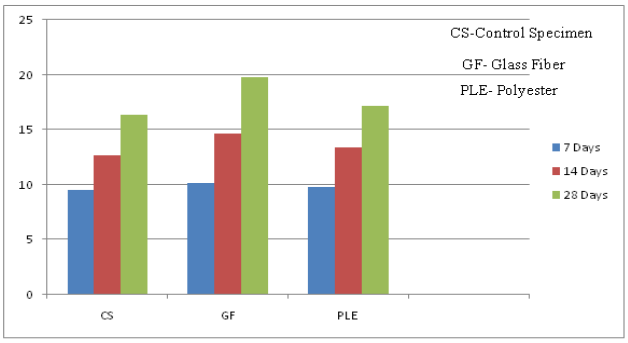

Figure:3.10: Comparision of Compressive strength

The above graph represents the comparision of Compressive strengths for control specimen, control specimen with glass fiber and control specimen with polyester fiber.The graph indicates that the Compressive strength increases by the addition of admixtures for 7,14 and 28 days respectively.It also indicates that the strength of control specimen with glass fiber is more when compared with the strength of control specimen with polyester fiber.

COMPARISON OF FLEXURAL STRENGTH OF PRISMS FOR 1:3 RATIO:

Table:3.11: Comparision of Compressive strength

Curing Period (Days)	Control specimens (MPa)	Control specimens+Glass fiber (Mpa)	Control specimens+Polyester (Mpa)
7	1.9	2.2	2.1
14	2.4	2.9	2.6
28	2.9	3.3	3.1

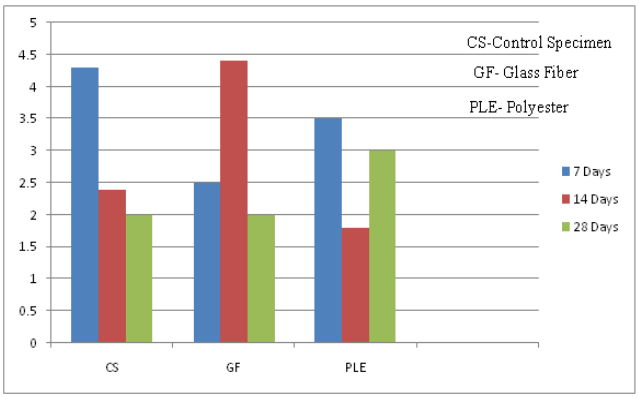

Figure:3.11: Comparision of Flexural strength

The above graph represents the comparision of Flexural strengths for control specimen, control specimen with glass fiber and control specimen with polyester fiber.The graph

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indicates that the Flexural strength increases by the addition of admixtures for 7,14 and 28 days respectively.It also indicates that the strength of control specimen with glass fiber is more when compared with the strength of control specimen with polyester fiber.

Comparison of Tensile strength of Cylinders for 1:3 ratio:

Table:3.12: Comparision of Tensile strength

Curing Period (Days)	Control specimens (MPa)	Control specimens +Glass fiber (Mpa)	Control specimens +Polyester (Mpa)
7	0.8	1.1	0.9
14	1.0	1.4	1.2
28	1.15	1.6	1.4

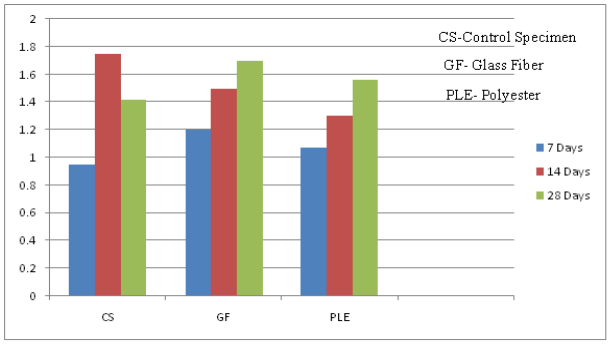

Figure:3.11: Comparision of Tensile strength

The above graph represents the comparision of Tensile Strength for control specimen, control specimen with glass fiber and control specimen with Polyester fiber.The graph indicates that the strength increases by the addition of admixtures for 7,14,and 28 days respectively.

Conclusions

From the experimental study following conclusions were obtained:

1. Compressive strength of specimens for 1:3 ratio with Glass fiber and polyester fiber increased by 17.17% & 4.65% at 28 days when compared with control specimens.
2. Tensile strength of specimens for 1:3 ratio with Glass fiber and Polyester fiber increased by 16.47% & 8.97% at 28 days when compared with control specimens.
3. Flexural strength of specimens for 1:3 ratio with Glass fiber and Polyester fiber increased by 12.12% & 6.45% at 28 days when compared with control specimens.
4. compressive strength,tensile strength and Flexural strength of specimens with glass fiber increased when compared with specimens with polyester fiber.

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