

Compressive Strength Study of Pervious Concrete By Using Fibres And Hybrid Fibres

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Abstract—Pervious concrete is made using coarse aggregate without fine aggregates. This type of concrete with a high porosity allows rainwater to pass directly through, thereby helps to reduce runoff and improve ground water recharge. Generally pervious concrete has less strength and used for concrete pavements. Addition of fibres in pervious concrete gaining importance day by day. Crimped steel fibres with 60 mm length and 0.5 mm diameter and polypropylene fibres 6mm length and diameter were used. Fibre inclusion improved strength of pervious concrete. In this experimental research fibres added in varying percentage(0.5%, 1% and 1.5%) of cement weight to pervious concrete. Concrete casted with a mix ratio of 1:4 and effect of these fibres on strength of pervious concrete are studied.

Keywords—Steel Fibre; Polypropylene Fibre; Strength.

I. INTRODUCTION

Pervious concrete is a special type of concrete with a high porosity used for various applications such as pedestrian walkway, parking areas with light traffic, ground water recharge etc. It is made using coarse aggregates (no fine aggregate) with cement and fibre mix.

Compared to conventional concrete, pervious concrete has a low strength, and high permeability characteristics. Addition of fibres in concrete is a new trend for increasing the strength. In this paper addition of fibres and hybrid fibers and its effect on pervious concrete is studied

II. MIX DESIGN

| Ingredient | Quantity (Kg/m ³) |
|------------------|-------------------------------|
| Cement | 1440 |
| Coarse Aggregate | 1600 |

Mix proportions

Cement : CA = 1:4

III. OBJECTIVE OF WORK

This study aims to determine compressive strength of series of pervious concrete mixes.

IV. EXPERIMENTAL PROGRAMME

A. Materials

53 grade ordinary Portland cement, aggregates with combined grading, fibres (steel and polypropylene) were used.

Table (1): Physical properties of crimped fibres and polypropylene fibres

| Type of fiber | Shape of fibre | Length L (mm) | Diameter d (mm) | Aspect ratio L/d | Density (Kg/m ³) |
|---------------|----------------|---------------|-----------------|------------------|------------------------------|
| Steel | Crimped | 60 | 0.8 | 75 | 7850 |
| Polypropylene | Straight | 6 | 0.018 | 333.33 | 910 |

B. Specimens

Cubes of size 150mm were casted and tested for compressive strength at the age of 7, 14 and 28 days.

V. METHODOLOGY

A. Testing of materials

Cement test conducted for determining specific gravity and setting time. Coarse aggregate specific gravity is determined.

B. Preparation and concrete testing

Concrete of mix proportion 1:4 is fixed and casted a series of test specimens like Normal Pervious Concrete, Steel Fibre Reinforced concrete, Polypropylene Fibre Reinforced Concrete and Hybrid Reinforced Concrete specimens with varying percentage of fibres (0.5%,1%,1.5%)

VI. RESULTS AND DISCUSSION

The results obtained from compressive strength test conducted on the hardened normal pervious concrete, steel fibre reinforced pervious concrete and hybrid fibre reinforced pervious concrete are reported.

Table (2):Result of compressive strength of Normal Pervious Concrete

| COMPRESSIVE STRENGTH (MPa) | | | | | | |
|----------------------------|-----------------|---------------------|---------|----------------------|---------|----------------------|
| SL No | Mix designation | 7 th day | Average | 14 th day | Average | 28 th day |
| 1 | NPC1 | 8.22 | | 9.47 | | 10.35 |
| 2 | NPC2 | 8.36 | 24.96 | 9.48 | | 10.37 |
| 3 | NPC3 | 8.38 | | 9.50 | | 10.39 |

Table (3):Result of compressive strength of Steel Fibre Reinforced Concrete

| COMPRESSIVE STRENGTH (MPa) | | | | | | |
|----------------------------|------------------|-----------------|---------------------|---------|----------------------|----------|
| SL No | % of steel fibre | Mix designation | 7 th day | Average | 14 th day | Aver age |
| 1 | 0.5 | PSC11 | 16.31 | | 20.13 | |
| 2 | 0.5 | PSC12 | 16.35 | | 20.14 | |
| 3 | 0.5 | PSC13 | 16.40 | 16.35 | 20.18 | |
| 4 | 1 | PSC21 | 20.4 | | 24.1 | |
| 5 | 1 | PSC22 | 20.35 | 20.35 | 24 | |
| 6 | 1 | PSC23 | 20.3 | | 24.2 | |
| 7 | 1.5 | PSC31 | 19.43 | | 23.21 | |
| 8 | 1.5 | PSC32 | 19.45 | 19.45 | 23.33 | |
| 9 | 1.5 | PSC33 | 19.47 | | 23.44 | |

Table (4):Result of compressive strength of polypropylene Fibre Reinforced Concret

| COMPRESSIVE STRENGTH (MPa) | | | | | | | | | |
|----------------------------|-------------------------------|------------------|---------------------|----------|----------------------|----------|----------|----------|--------|
| S L | % of poly prop ylen e fibre s | Mix designati on | 7 th day | Avera ge | 14 th day | Aver age | 28th day | Aver age | |
| 1 | 0.5 | PPC11 | 12.47 | | 12.50 | 14.44 | | 19.27 | 19.4 3 |
| 2 | 0.5 | PPC12 | 12.50 | | | 14.50 | | 19.50 | |
| 3 | 0.5 | PPC13 | 12.52 | | | 14.51 | 14.4 8 | 19.51 | |
| 4 | 1 | PPC21 | 13.13 | | | 15.19 | | 20.23 | |
| 5 | 1 | PPC22 | 13.33 | | 3.20 | 15.20 | | 20.25 | 20.2 5 |
| 6 | 1 | PPC23 | 13.14 | | | 15.21 | | 20.26 | |
| 7 | 1.5 | PPC31 | 13.11 | | | 15.10 | 15.1 5 | 20.14 | 2015 |
| 8 | 1.5 | PPC32 | 13.21 | | 3.18 | 15.17 | | 20.15 | |
| 9 | 1.5 | PPC33 | 13.23 | | | 15.18 | | 20.17 | |

Table (5): Result of Hybrid Fibre Reinforced Concrete

| COMPRESSIVE STRENGTH (MPa) | | | | | | | | | |
|----------------------------|---|------------------|---------------------|----------|----------------------|----------|----------|----------|--------|
| S L | % of steel and poly prop ylen e fibre s | Mix designati on | 7 th day | Avera ge | 14 th day | Aver age | 28th day | Aver age | |
| 1 | 0.5 | HFPC11 | 15.32 | | 12.50 | 14.44 | | 19.27 | 19.4 3 |
| 2 | 0.5 | HFPC12 | 15.45 | | | 14.50 | | 19.50 | |
| 3 | 0.5 | HFPC13 | 12.52 | | | 14.51 | 14.4 8 | 19.51 | |
| 4 | 1 | HFPC21 | 13.13 | | | 15.19 | | 20.23 | |
| 5 | 1 | HFPC22 | 13.33 | | 13.2 0 | 15.20 | | 20.25 | 20.2 5 |
| 6 | 1 | HFPC23 | 13.14 | | | 15.21 | | 20.26 | |
| 7 | 1.5 | HFPC31 | 13.11 | | | 15.10 | 15.1 5 | 20.14 | 2015 |
| 8 | 1.5 | HFPC32 | 13.21 | | 3.18 | 15.17 | | 20.15 | |
| 9 | 1.5 | HFPC33 | 13.23 | | | 15.18 | | 20.17 | |

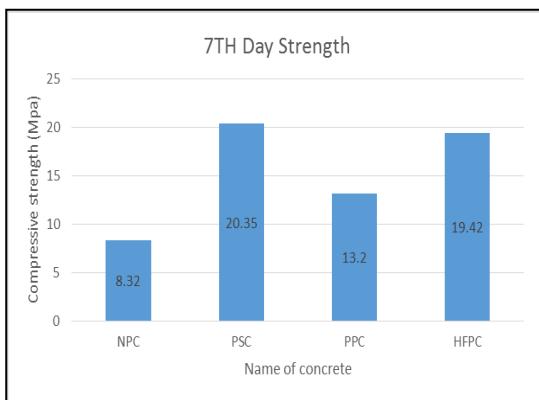
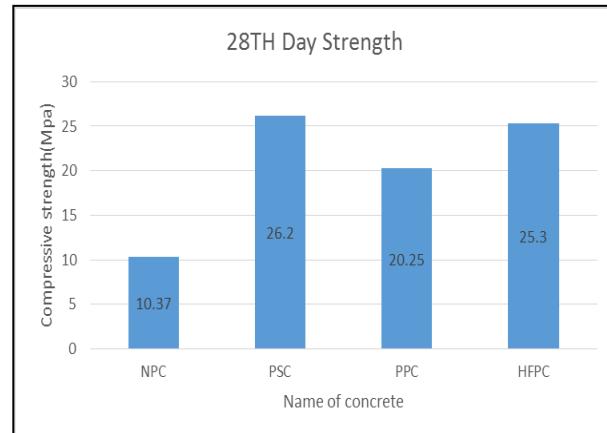
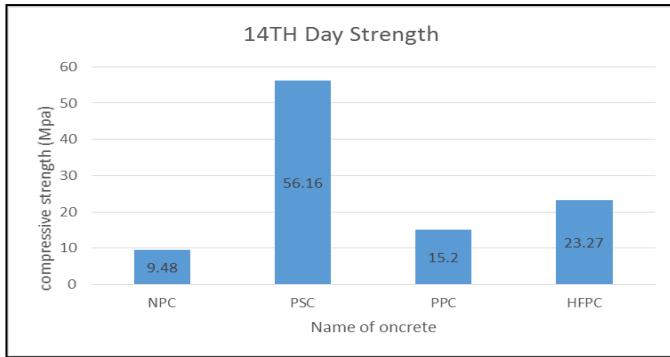


FIG (1) : 7TH DAY COMPRESSIVE STRENGTH

Fig (3) : 28TH DAY COMPRESSIVE STRENGTHFIG (2) 14TH DAY COMPRESSIVE STRENGTH

VII. CONCLUSION

The test results showed that greater compressive strength achieved in Steel Fibre Reinforced Concrete than Hybrid Fibre Reinforced concrete ,Polypropylene reinforced concrete and Normal Pervious Concrete.

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