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Experimental investigation of no fine concrete partially replaced with cement by silica fume as coarse aggregate by Ceramic tiles

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ABSTRACT:
No-fine concrete is one of the most promising sustainable materials. Nowadays, No-fine Concrete is a light-weight concrete produced by omitting the fines from conventional concrete also known as "No-fine Concrete" or "Porous Concrete" is a material comprised of narrowly graded coarse aggregates, cement materials, water and admixture and in some cases Ceramic Wastes are used. In this paper No-fine concrete the No fines concrete mix is designed without sand and adding silica fume and ceramic tiles as an admixture using ACI 522R-06 code, and analyse the property strength, permeability of pervious concrete. The mechanical strength of the concrete is increased to an extent. The aim of this project is to lay the No fines concrete in platform and car parking thus transmitting the water to the underground surface very easily for maintaining the ground water table even in all the places.The use of titanium di oxide is found to enhance the permeability in No Fine concrete by oxidizing the pollutants and helping in ashing down the clogged particles from the pores during rainy season.
Key words: No-fine, Permeability, Strength

I. INTRODUCTION

A larger amount of rainwater ends up falling on impervious surfaces such as parking lots, driveways, sidewalks, and streets rather than soaking into the soil. This creates an imbalance in the natural ecosystem and leads to a host of problems including erosion, floods, ground water level depletion and pollution of rivers, lakes, and coastal waters as rainwater rushing across pavement surfaces picks up everything from oil and grease spills to de-icing Salts and chemical fertilizers. Conventional normal weight Portland cement concrete is generally used for pavement construction. The impervious nature of the concrete pavements contributes to the increased water runoff into the drainage system, over-burdening the infrastructure and causing excessive flooding in built-up areas. Thus pervious concrete can play a vital role in filtration and rain water harvesting due to its porosity. This type of concrete has become significantly popular as a sustainable application during recent decades due to its potential contribution in solving environmental issues. Using sufficient paste to coat and bind the aggregate particles together creates a system of highly permeable, interconnected voids that drains quickly.

II. OBJECTIVE

- To strengthen the No Fine concrete using polypropylene fibre as admixture.
- To recharge the water table of soil beneath the construction.
- To increase life of structure.

III. MATERIALS

Cement:
Ordinary Portland cement (OPC) of M43 grade conforming to IS:12269-1999 was used for casting.
Coarse aggregate:
The coarse aggregate was natural gravel of 10mm to 20mm maximum size was used.
Ceramic Wastes:
In the study Fibrillated 12 mm cut length fibers were used. These polypropylene fibers.
Silica Fume**:**
In the study Fibrillated 12 mm cut length fibers were used. These polypropylene fibers.

IV. MIXING, CASTING AND CURING

All concrete samples (cubes, cylinders and prisms) are casted in steel moulds. They were cleaned and oiled before casting. The fresh concrete was placed inside the mould with approximately three equal layers and compacted by tamping rod. After 24 hours the specimens were demoulded and kept it in curing tank.

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V. RESULT AND DISCUSSION

Compressive Strength

The compressive strength development for all types of mixes is presented in Figure 3 & 4. Test results illustrate that in general, reference no fine concrete and partially replaced in no fine concrete specimens exhibited continuous development in strength up to 7 and 28 days of curing. There is a considerable improvement in strength for mixes containing silica fume & ceramic tiles. There was a slight increase in the compressive strength with increasing the silica fume volume fraction, unless the silica fume volume is so high leading the air voids content to become excessively high. The air voids tends to have a negative effect on the compressive strength.

While increasing the Particular percentage replacement of cement and coarse aggregate by silica fume and ceramic waste the compressive strength of pervious concrete is decreasing. Up to 5% replacement of silica fume the compressive strength is increasing gradually but the maximum compressive strength is replacement 15%.

Table 1: Compressive strength without replacement of silica fume and ceramic waste:

Curing days	**Compressive strength N/mm^2**
7	5.0
28	10.9

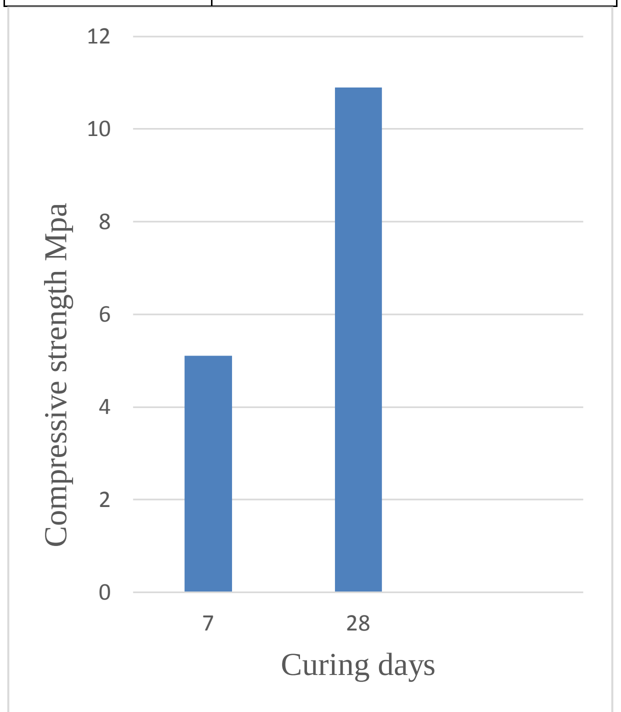

Figure No1: Compressive Strength for without replacement of silica fume and ceramic waste

Figure No 2: Compressive test on cube

Table 2: Result of pervious concrete with replacement of silica fume and ceramic waste

Curing days	**Compressive strength N/mm^2**		
	5 % &15%	**10%&15%**	**15%&15%**
7	5.3	5.4	6.11
28	11.6	13.5	14.3

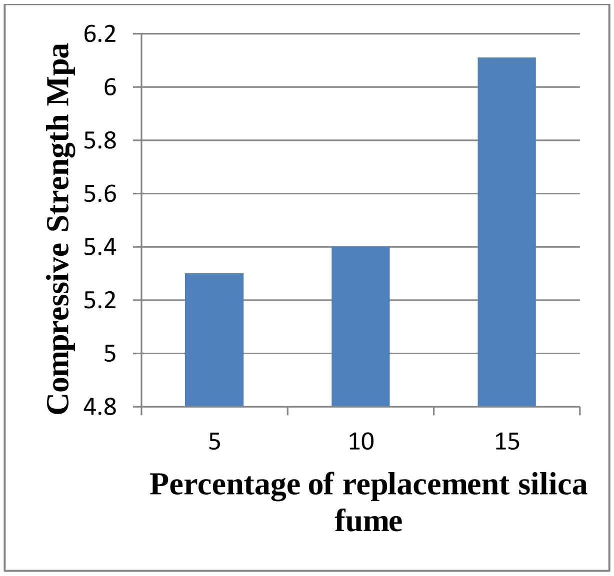

Figure No3: Compressive strength in 7days with replacement of silica fume and ceramic waste

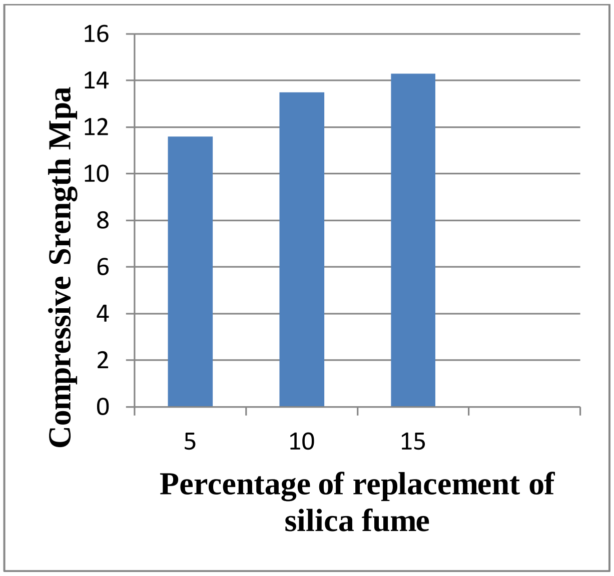

Figure No 4: Compressive strength in 28days with replacement of silica fume and ceramic waste

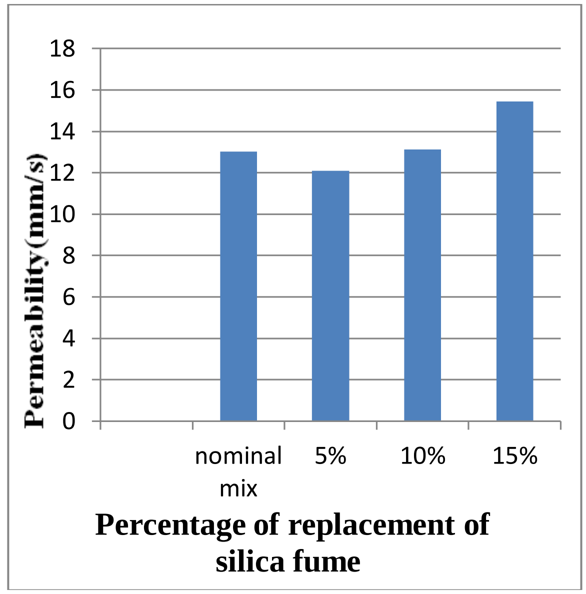

Figure No 5: Result of nominal mix and pervious concrete with replacement of silica fume and ceramic waste.

PERMIALITY

The primary goal of any porous concrete system is to achieve adequate porosity so that Water can readily pass through the system and into the sub base. The creation of air voids is Achieved by limiting or completely eliminating fine aggregates (FA) such as sand from the mix design, and using a well-sorted coarse aggregate (CA). With no fines in the mix, the CA is bound together only by a thin layer of cement creating air voids.

Table 3: Result of conventional concrete

No fine concrete	Permeability(mm/s)
Conventional mix	13.02

Table 4: Result of pervious concrete with replacement of silica fume and ceramic waste

Replacement percentage	Permeability (mm/s)
5 % &15%	12.10
10%&15%	13.12
15%&15%	15.44

VI. RESULT AND DISCUSSION

From the experimental study following conclusions were obtained:

1. Compressive strength of specimens for 1:4 ratio increased by 38.53% at 28 days when compared with control specimens.
2. Permeability of specimens for 1:4 ratio with replacement of silica fume and ceramic waste increased by 18.58% at 28 days when compared with control specimen.

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