Investigation on Improving Compressive Strength of Pervious Concrete

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ABSTRACT:

Pervious concrete which is additionally referred to as the no-fines, porous, gap-graded, and permeable concrete and Enhance porosity concrete have been found to be a reliable storm water management tool.There is lot of research work goes within the field of pervious concrete. The compressive strength of pervious concrete is a smaller amount in comparison to the traditional concrete thanks to its porosity and voids. Typically pervious concrete has water to cementitious material ratio of 0.28 to 0.45.The mixture is composed of cementitious materials, coarse aggregates and water with little to no fine aggregates. The main theme of our project is to improve the strength characteristics of M40 grade of pervious concrete. But it are often noted that with increase in strength, the permeability of pervious concrete are going to be reduced. Hence, the development of strength should not affect the permeability property because it is the property which serves it purpose

KEYWORDS*: Pervious concrete, Permeability, High strength, Pavements*

I. INTRODUCTION

Pervious concrete was first utilized in the 1800s in Europe as pavement surfacing and cargo bearing walls. Cost efficiency was the main motive because decreased amount of cement.

It became popular within the 1920s for 2 storey homes in Scotland and England. It became increasingly viable in Europe after WWII mainly due to the scarcity of cement. It didn't become as popular within the US until the 1970s. In India it became popular in 2000. No Fine concrete could also be a surprising kind of concrete with a high porosity used for concrete flatwork applications that allows water from precipitation and other sources to leave behind in a straight line through, thereby reducing the runoff from a site and allowing groundwater recharge. Pervious concrete is formed using large aggregates with little to no or some amount of fine aggregates. It is a crucial application for sustainable construction and is one among many low impact development techniques employed by builders to guard water quality. The strength of pervious concrete is low when compared to conventional concrete due to absence of fine aggregate.

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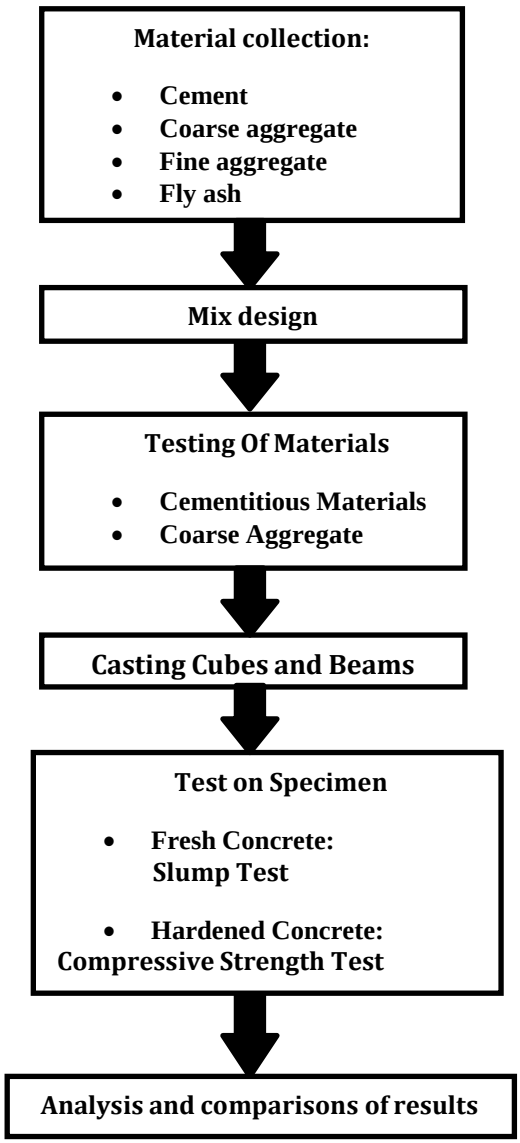
II. SCOPE OF THE PROJECT

- Scope of this project is to use pervious concrete in pavements, animal stalls and also in green buildings.
- To carry out the investigation of increasing compressive strength of pervious concrete by the addition of fine aggregates in the small quantities of total coarse aggregates and replacement of cementitious materials like fly ash and rice husk ash in our project
- To make and prove the concrete as Sustainable material.

III. METHODOLOGY



IV MATERIAL PROPERTIES

Table 1 Results of Cement

Name of the test	Result
Fineness of Cement (by sieve analysis)	9%
Specific Gravity of Cement	3.15
Consistency of Cement	32%
Setting Time • Initial Setting Time • Final Setting Time	 35 mins 132 mins
Soundness of Cement	5mm

Table 2 Results of Coarse Aggregate

Name of the Test	As per IS code	Result
Specific Gravity of CA	2.5-3.0	2.81
Aggregate Impact Test	<30%	22%
Aggregate Crushing Test	<30%	21.5%
Los Angel's Abrasion Test	<50%	27%

Table 3 Results of Fine Aggregate

Property	Value
Specific gravity	2.62
Fineness modulus	2.5
Dry rodded unit weight	1720 kg/m^3
Water absorption	0.6%

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V EXPERIMENTAL INVESTIGATION

Table 4 Compressive Strength of Pervious Concrete with Different Proportions of Fine Aggregate

Age of concrete in days	Standard pervious concrete (0% fines), MPa	Pervious concrete with 7% fines, MPa	Pervious concrete with 8% fines, MPa	Pervious concrete with 9% fines, MPa	Pervious concrete with 10%fines,MPa
7	16.72	18.32	18.98	18.76	18.28
14	19.26	19.93	21.47	21.23	20.23
28	21.06	23.79	24.13	23.47	22.87

Table 5 Compressive Strength of Pervious Concrete with Cement Replacement

Age of concrete in days	Standard pervious concrete with 0% fines, MPa	Pervious concrete with 10% FA as Cement replacement, MPa	Pervious concrete with 10% RHA as cement replacement, MPa	Pervious concrete with 10% FA and RHA as, MPa
7	16.72	17.26	19.92	17.79
14	19.26	19.92	21.13	20.33
28	21.06	22.87	23.93	23.12

Table 6 Co-efficient of Permeability of Pervious Concrete with Addition of Different Proportions of Fine Aggregates and Cementitious Materials

Standard pervious concrete with 0% fines (cm/sec)	Pervious concrete with 8% fine aggregates (cm/sec)	Pervious concrete with 10% fine aggregates (cm/sec)	Pervious concrete with 10% fly ash as cement replacement (cm/sec)	Pervious concrete with 10% rice husk ash as cement replacement (cm/sec)
1.02	0.76	0.49	0.59	0.53
1.08	0.83	0.54	0.62	0.58
1.24	0.92	0.69	0.74	0.73

VI CONCLUSION

- The dimensions of coarse aggregates, water to cement ratio and aggregate to cement ratio plays an important role in strength of pervious concrete.
- The void ratio and unit weight are two important parameters of pervious concrete in the context of mix design.
- The compressive strength and co-efficient of permeability of pervious concrete are inversely proportional to each other up to addition of 8% of fines.
- Among the two methods of increasing compressive strength of pervious concrete, the addition of fines has gave more value when compared to replacement of cementitious

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materials.

- The compressive strength of pervious concrete is increased by 12.96% when 7% fine aggregates were added to the standard pervious concrete.
- The compressive strength of pervious concrete is increased by a maximum of 14.57% when 8% fines were added to standard pervious concrete.
- The compressive strength of pervious concrete is increased by 11.44% when 9% fine aggregates were added to the standard pervious concrete.
- The compressive strength of pervious concrete is increased by 8.59% when 10% fine aggregates were added to the standard pervious concrete.
- The compressive strength of pervious concrete is increased by 8.59% when 10% fly ash was replaced in the place of cement.
- The compressive strength of pervious concrete is increased by 9.78% when 5% fly ash and 5% Rice Husk Ash was replaced in the place ofcement.
- The coefficient of permeability is decreased by 22.54% when 8% fines are added to standard pervious concrete.
- The coefficient of permeability is decreased by 51.96% when 10% fines are added to standard pervious concrete.
- The coefficient of permeability is decreased by 42.15% when 10% cement is replaced by Fly ash in standard pervious concrete.
- The coefficient of permeability is decreased by 48.03% when 10% cement is replaced by Rice Husk ash in standard pervious concrete.
- Hence it is recommended that addition of 8% fine aggregates to the pervious concrete will satisfy both the compressive strength and permeability of pervious concrete.

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