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"Evaluation of Concrete Strength with Enhanced Permeability Using Polystyrene Beads"

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Abstract - Pervious concrete, also known as permeable or porous concrete, is an innovative construction material designed to facilitate water drainage and reduce surface runoff. Unlike traditional concrete, which is dense and impervious, pervious concrete features a high void content, allowing water to flow through its surface and into the underlying soil. This unique property makes pervious concrete an effective solution for managing stormwater, reducing flooding risks, and improving groundwater recharge. It is commonly used in applications such as parking lots, sidewalks, driveways, and roadways, where it helps mitigate issues related to water accumulation and erosion.

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Key Words*: *Pervious concrete, permeable concrete, porous concrete, water drainage, surface runoff, void content

1. INTRODUCTION

Pervious concrete, also known as permeable or porous concrete, is a specialized type of concrete that allows water to pass through its structure due to its high void content. Unlike conventional concrete, which is dense and impermeable, pervious concrete is designed to facilitate water infiltration, reducing surface runoff and promoting groundwater recharge.

This material is composed of cement, coarse aggregates, water, and little to no fine aggregates, resulting in a porous structure. Its permeability makes it an effective solution for stormwater management, mitigating urban flooding, and minimizing the risk of erosion. Common applications include parking lots, sidewalks, driveways, road shoulders, and low- traffic pavements, where it supports sustainable construction practices and helps address water-related environmental challenges.

2. Experimental Study

First Trail: -

In first trial we casted 3 cube of M15 grade. The curing duration of these cube were 7 days. Our initial aim before casting these blocks was to see if the polystyrene beans get's burn or not, and also check if these blocks were permeable or not. We casted these beans according to 1:2:4 ratio. Which means 1 part cement, 2 part polystyrene, and 4 part aggregate. In our first trial we used 10-12.5mm sized aggregate

Table No. 1

Type of cement	Grade of concrete	Size of Aggregate used	Size of cube	Curing period
OPC43	M15	10-12.5mm	150x150x60mm	7 Days

Second Trail

In second trial we casted 7 blocks of different grade of concrete. 2 blocks of M15 grade, 2 blocks of M20 grade, 2 blocks of M25 grade, and 1 block of 1:7 ratio block. The curing duration for these blocks was for 7 days. Every block was prepared by using different size of aggregate. For ex. first block was made of 10-12.5mm aggregate of M15 grade and second block was made of 16-20mm aggregate of M15 grade.

Compression Test:-

Table No. 2

Garde of Concrete	Size of Aggregate used	Compressive Strength
M15	• 10-12.5mm	7kN
	• 16-20mm	12kN
M20	• 10-12.5mm	12kN
	• Mix size of Coarse aggregate	19kN
M25	• 10-12.5mm	20kN
	• 16-20mm	17kN
1:7 Ratio	• 10-12.5mm	7kN

Permeability Test :-

Permeability test was conducted by keeping time constant i.e., for 1min

Table No. 3

Garde of Concrete	Size of Aggregate used	Permeability
M15	• 10-12.5mm	776.67ml
M20	• 10-12.5mm	946.67ml
	• Mix size of Coarse aggregate	1016.67ml
1:7	• 10-12.5mm	696.67ml

3. CONCLUSIONS

These are following expected outcome of our project:

Increase in compressive strength of concrete.

The use of polystyrene beans in pervious concrete without burning is to check the increase in its compressive strength.

Durability and Longevity

With proper design and maintenance, pervious concrete can achieve a long service life, comparable to traditional concrete, even in varying environmental conditions.

By conducting the above tests it is suggested that M20 grade concrete can give adequate rate of permeability as well as strength.

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