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IMPROVEMENT OF COMPRESSIVE STRENGTH OF PERVIOUS CONCRETE

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ABSTRACT
Porous concrete is a unique type of concrete made of cement, solid aggregate, water and, if necessary, cement-based materials. As the concrete matrix does not usegood mixing, it has a high void content and allows water to flow throughout the body. Therefore, porous concrete is alsocalled flexible concrete and ventilated concrete. The compressive toughness of drainage concrete is lower thanthat of conventional concrete due to its porosity and voids. Therefore, the use of drainage concrete is limited, but there are significant benefits. the toughness and flexibility of Porous concrete increases, then it can be widely used. Currently, the use of porous concrete is restricted to narrowstreets only. If buildings are improved, they can also be used on solid roads for medium to heavy traffic. Along with that, Porous concrete laminates stormwater runoff, simplifiesgroundwater runoff and facilitates efficient use of available space. The main aim of our project is to improve the toughness characteristics of porous concrete. However, higher toughness may reduce the permeability of permeable concrete. Therefore, the increase in toughness is a property that serves its purpose and must not impair its permeability.

Keywords: Porous, permeability,compressive toughness, coarse aggregate, fine aggregate.

INTRODUCTION

Porous concrete is also known as fine grain, porous, gap grade, permeable concrete. By definition, porous concrete is a mixture of coarse aggregate, cement, water and a small to 0% fine aggregate [1-5].
15- 30% of the volume of permeable concrete consists of acoherent network of cavities that allow water to pass through. Permeable concrete allows 11.30 -18.9 L/min of water flow from open cells (0.093 m^2) of surface area. This is much larger than most rain events [6-10].
permeable concrete has a grainy texture and a honeycomb- like surface with moderate surface raveling that occurs on congested roads [11-15]. The workability of aerated concrete is low. The weight of drainage concrete is as light as about 1600 to 2000 kg / m^3. Permeable concrete systems have advantages over impermeable concrete [16-20]. Dealing with pavement runoff, preventing runoff pollution, replenishing aquifers, repelling saltwater ingress, controlling pollution caused by water infiltration for aquifer recharge. It absorbs less heat than conventional concrete and asphalt, reducing the need for air conditioning. compared to conventional concrete, porous concrete has lower compression toughness,higher accessibility, and light unit weight (approximately 65% of standard porous concrete [21-25].

OBJECTIVE

The main goal of our project is to improve the toughness ofdrainage concrete so that it can be used for a variety of purposes. Power improvement can be done by

- Addition of a small amount of fine aggregate
- Addition of a small amount of cement-based material
- Use of small coarse aggregate
- Using low w/c ratio.

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MATERIAL USED

Cement

ordinary Portland cement (53 grade) was used which had 28% consistency complied with IS: 12269-1987, cement has 3.15 specific gravity, bulk density (1120kg/m^3), and Fineness(225m^2/kg). initial setting time of cement 35 min and final setting time was 35 min.

Coarse aggregate

10-20 mm size of coarse aggregate was used throughout the experiment. Bulk density of coarse aggregate was found to be 1583.34kg/m^3 and specific gravity was found to be 2.65. After testing in laboratory as per the impact toughnessand Crushing toughness was 26.4% and 25.45% respectively.

Fine aggregate

Test was conducted by using of "river sand" as the fine aggregate, which confirmed to grading 'zone III'. For determination of quality of sand test was conducted in accordance with IS 2386(part- 1)-1963. The value of specific gravity was 2.62, fineness modulus of sand was 2.5and unit weight was 1720 kg/m^3.

Water

Water is used for chemical reaction with cement which imparts binding property and toughness under certain amount of water. The concrete mixture was made using clean potable water which is specified by IS 456-2000 standards.

Fly ash (FA)

FA is the waste by product of burning coal in electrical power plants. Fly ash is used because its resistance property against freezing and thawing. The specific gravity of fly ash is 2.36 and the quantity of fly ash is taken 10% replace with cement (by weight).

Rice husk ash

Rice husk ash (RHA) is used after burning as ash which is obtained from rice paddy mill industries. This was used in our experiment by replacing 10% of cement (by weight).

MIX DESIGN PROPORTION

- Part of the mixture is calculated at a thickness of 20mm as rough as Porous concrete.
- According to mix design, the quantity of cement calculated per cubic meter of porous concrete is 390 kgs based on NRMCA, USA.
- The process of mixing the mixture provided the amount of cement in the mixing scale as 1: 4 in compound sizes exceeding 20mm and stored in a 10mm IS filter.
- The W/C ratio of Porous concrete should be between 0.25 to 0.30. For optimal performance was selected a W/C rating of 0.3 and adjusted after making water samples in cement averaged 0.25, 0.30 and 0.35.
- The average design void ratio of Porous concrete is 20% and the unit weight ranges from (1600 to 2000) kg/m3.

CASTING AND TESTING

The tests are performed as per IS 516 (1959).
In this we have made concrete blocks by using different percentage of fine aggregate (0,5,6,7,8,9,10) and also by using FA and RHA (10%) as replacement to fine aggregate. The toughness of concrete is found at 7, 14 & 28 days. To find the permeability of concrete we have performed the permeability head test. here also we have used fine aggregate of different proportion (0,8,10) % and fly ash andrice husk ash (10%) as replacement to fine aggregate. The toughness and permeability values are calculated and explained in the final result.

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Figure 2: porous concrete block

RESULT AND DISCUSSION

Compressive toughness

Table1: Compressive toughness value of Porous Concrete

S. No	Age Of Concrete	Standard porous Concrete With0% Fines, MPA	Porous Concrete With 5% Fines, MPA	Porous Concrete With 6% Fines, MPA	Porous Concrete With 7% Fines, MPA	Porous Concrete With 8% Fines, MPA
1	7	16.72	17.36	17.75	18.32	18.98
2	14	19.26	19.60	19.73	19.93	21.47
3	28	21.06	21.98	22.47	23.79	24.13

Table2: Compressive toughness value of Porous Concrete

Age Of Concrete	Porous Concrete With 9%Fines, MPA	Porous Concrete With 10%Fines, MPA	Porous Concrete With 10% Fly Ash asCement Substitute, MPA	Porous Concrete With 10% Rha as Cement, Substitute, MPA	Porous Concrete With 10% Fly Ash and Rha as Cement, Substitute, MPA
7	18.76	18.28	17.26	19.92	17.79
14	21.23	20.23	19.92	21.13	20.33
28	23.47	22.87	22.87	23.93	23.12

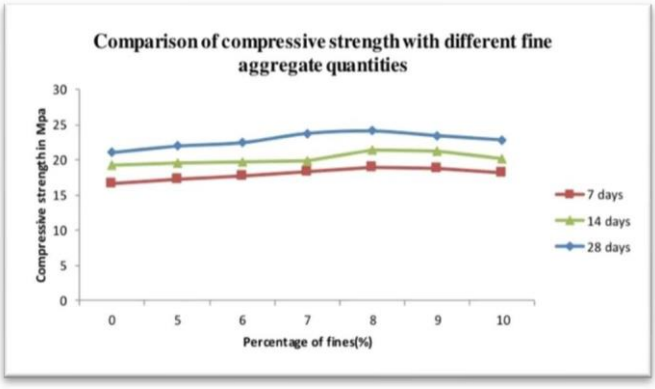

Figure 2: a comparison of compressive toughness withdifferent amounts of fine aggregates.

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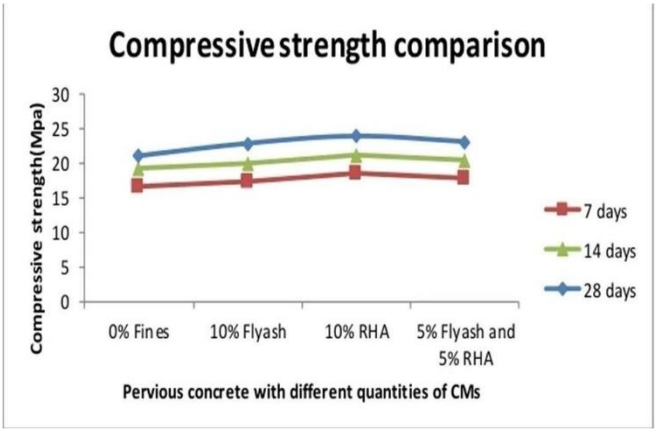

Figure 3: a comparison of compressive toughness with adifferent amount of cement material.

The compressive toughness of common concrete increases with age and the percentage of fines up to 8% of the combined fines. 7-day pressure toughness of 5% standard porous concrete is less than ordinary standard porous concrete with 0% concentration. It may be due to a slight increase in initial toughness due to mixing. Flow concrete with a good 8% consistency provides very high compression toughness when the compressive toughness begins to fall. Using 10% of the rice husk instead of cement, Drained Concrete offers very high-pressure pressures compared to high-grade concrete and other methods of jet ash. Hollow concrete, a mixture of fly ash and rice husk ash, hasa very low compression toughness. This may be due to inhomogeneity between two attachment elements.

Permeability

Table3*: permeability values of Porous Concrete*

S No	Standard Porous concrete with 0% fines (cm/second)	Porous concretewith 8% fine Aggregate (cm/second)	Porous concrete with10% fine aggregates (cm/second)	Porous concrete with 10% fly ash ascement substitute (cm/second)	Porous concrete with10% RHA as cement substitute (cm/second)
1	1.02	0.76	0.49	0.59	0.53

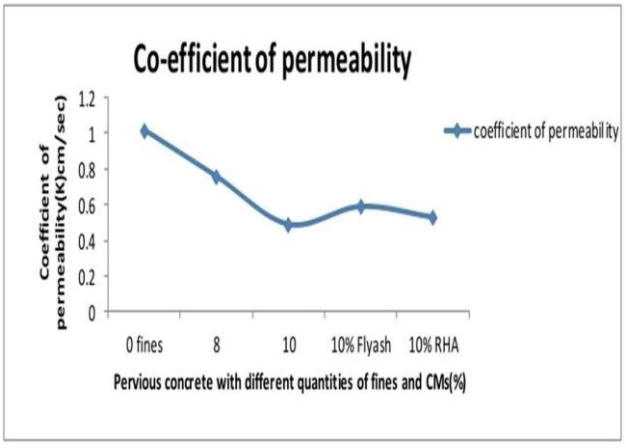

Figure 4: Coefficient of permeability of porous concretewith different quantities of fines & cement substitutes.

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Table 3 shows the permeability values of fine aggregate and the different ratios of fly ash and rice husk ash.

Effective joint accessibility is a limit of 1.02 cm / second onstandard porous concrete with a good mix of 0% and a minimum of 0.49 cm / second on porous concrete a good concentration of 10%. Flexible concrete with 10% fly ash has a minimum access coefficient of 0.59 cm / sec and rice ash of 0.53 cm / sec. The reason for the small amounts of water infiltration is due to the corrosion of cement material

CONCLUSION

- Aggregate wage size, water level in cement and aggregate rate in cement play an important role in the toughness of the concrete. A compressive toughness and cohesiveness of the concrete sliding access are parallel to up to 8% of the fine.
- From the two methods of increasing the compressive toughness of conventional concrete, the adding of good concentrations provided a greater value compared to the replacement of cement materials.
- Increased fines and Cementitious replacement will reduce the penetration capacity of flowing concrete.
- The compressive toughness of substantial sections expanded by 4.36% while 5% fine totals are added to standard porous cement. The compressive toughness of the porous cement expanded by 6.69% while a funding total of 6% was added to the ordinary cement. The compressive toughness of the porous cement expanded by 12.96% while a supporting total of 7% was added to the standard porous concrete.
- The compressive toughness of cement is expanded by a high of 14.57% when 8% fines are added to the standard porous concrete.
- The compressive toughness increases by 11.44% when a better total of 9% is added to the standard porous concrete. The compressive toughness of the Porous cement expanded by 8.59% when 10% of the fine part was added to the standard Porous concrete.
- The compressive toughness of Porous concrete increases by 8.59% when 10% of fly ash is replaced by cement.
- The compressive toughness of moving concrete increased by 13.62% when 10% of Rice Husk Ash is replaced by cement.
- The compressive toughness of cement mortar increases by 9.78% when 5% flies to ashes and 5% of Rice Husk Ash is replaced by cement.
- The coefficient of permeability is decreased by 42.15% when 10% cement was replaced by Fly ash in standard concrete.
- The coefficient of permeability is decreased by 48.03% when 10% cement was replaced by Rice Husk ash in standard Porous concrete.
- It is therefore recommended that the addition of an 8% fine on Porous concrete will satisfy both the pressure forces and the penetration of Porous concrete.

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