

STUDY OF PERVIOUS CONCRETE

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Abstract –Pervious concrete is a very special type of concrete with high porosity used for flat work application basically that's allow water from precipitation and other sources to pass directly through thereby reducing the runoff from the site and allowing ground water recharge. And in this concrete porosity is attain by a highly interconnected void content. Also in permeable or pervious concrete has no fine aggregate and has just enough cementing paste to coarse aggregate particles while preserving the interconnectivity of the voids .permeable or pervious concrete is traditionally used in parking area with lo traffic ,walkways in park and garden residential , green house, basketball court, volleyball house.

Main objective of pervious concrete are :-

- To help restore ground water supply.
- Reduce pollution of coastal water;
- To pave parking.
- Recharge ground water table.
- Reduces runoff water.
- Reduces risk of flooding and topsoil wash away.

Key Words: No fine aggregates , permeable, runoff ,pave parking, ground water, interconnectivity etc

1.INTRODUCTION

Portland cement pervious concrete (PCPC) is very popular and continuously gaining a lot of attention in construction industry. Pervious concrete is typically design with high void content(15-25%).There is no fine aggregates in pervious concrete.

1.1 Benefits of pervious concrete

- It reduces the storm water runoff.
- Allow more efficient land development.
- Prevent water from entering into the stream and also prevents it from being polluted.
- Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

1.2 BASIC PRINCIPLE

In pervious concrete the most important and basic principal which turns out to be different from other types of concrete like PCC and RCC because, it has no fine aggregates in it.

pervious concrete also has interconnected voids and because of that water will percolate and spread in all direction which is not possible if those joints are not interconnected.

2. EXPERIMENTAL PROGRAM AND APPROACH

2.1 MATERIAL PROPERTIES

2.1.1 AGRREGATES:- In pervious concrete generally singular size of coarse aggregates are used. For design of pervious concrete we used 16 mm of coarse aggregates as per the IS code 10262:2009 for mix design and also if coarse aggregate size decreases compressive strength increases.

2.1.2 CEMENTITIOUS MATERIAL:- we used portland pozzolana cement of o.p.c grade-53(birla cement) as per the is code IS code 1489:1991

2.1.3 ADMIXTURE:- water reducing agent for the pervious concrete generally styrenebutadien is used as a water reducing agent in pervious concrete.

3. FORMATION OF CUBES AND CYLINDER

Volume of cylinder = $300 \times 150 \times 150 \times 3.14$

No. of cylinder= 9

Total volume of all cylinder= 0.3817 cubic meter

Volume of cubes= $150 \times 150 \times 150$

No. of cubes= 6

Total volume of all cubes= 0.02025 cubic meter

Total volume of cube and cylinder=0.40195

4. MIX DESIGN

For design of pervious concrete we concluded IS code method :-

Water: cement : fine aggregates : coarse aggregates = 0.36:1:0:4 (as per the IS code 10262:2009)

5. EXPERIMENTATIN AND TESTING

5.1 SIEVE ANALYSIS TEST:- For the design of pervious concrete we tested the 3 different size of aggregate

- 10mm to 12.5mm
- 12.5 to 16mm
- 16mm to 20mm

After the testing of cubes for above aggregate sizes, we extracted that higher compressive strength gain on 12.5 to 16 mm size of aggregates

5.2 COMPRESSIVE TEST: -compressive strength is dependent on size of coarse aggregate, void ratio, bond between mortar and coarse aggregate. In 7 days cubes of permeable concrete gain 30% of its strength, in 21 days of permeable concrete gain 70% of its strength, and for 28 days it gains 95% strength.

5.3 TENSILE STRENGTH:-In this project we conducted the split tensile test for cylinder. In pervious concrete tensile strength vary from 1 to 3.5 Mpa

5.4 PERMEABILITY TEST:- permeability of the pervious concrete is determined by special arrangement of cylindrical shape bucket or specific container which should be open from both the side and has to arranged in such a way so that one side could be used for pouring of water and other resting on pervious concrete as shown in figure below.



formula used $I=(KM)/(D^2 \times T)$

I- Infiltration rate

M- mass of water

K- constant

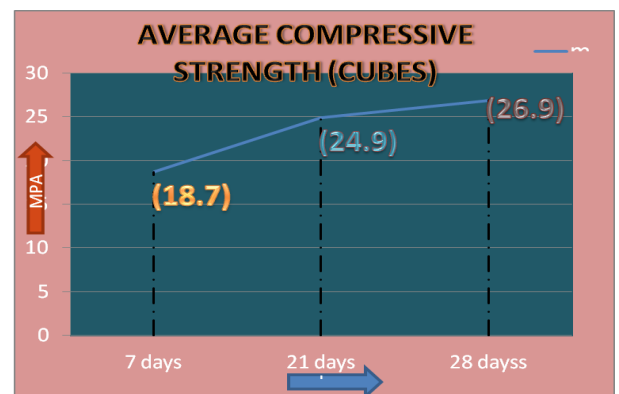
D- diameter

T- time

6. METHODOLOGY

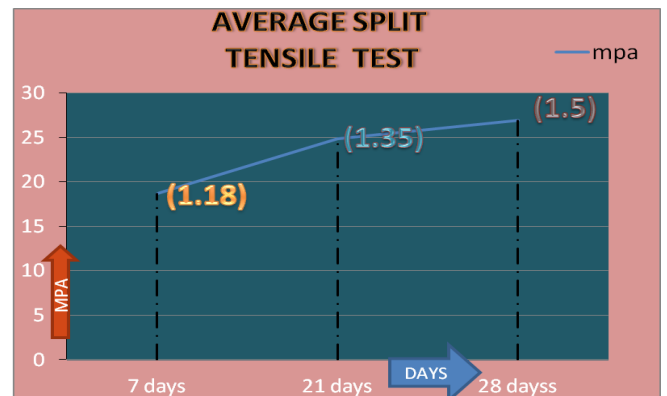
6.1 COMPRESSIVE STRENGTH:-

After the testing of pervious concrete we found the compressive strength in 7 days as 18.69 mpa, 21 days as 24.89 mpa and for 28 days as 26.90 mpa.



6.2 TENSILE STRENGTH:-

After the testing of pervious concrete we found the compressive strength in 7 days as 1.18 mpa, 21 days as 1.35 mpa and for 28 days as 1.5 mpa.



7. FINAL RESULT:-

- 12.5 to 16 mm AGGREGATES HAVE MUCH HIGHER COMPRESSIVE STRENGTH
- COMPRESSIVE STRENGTH :- 26.89 mpa
- SPLIT TENSILE TEST :- 1.56 mpa
- PERMEABILITY :- 6.9mm/sec

8. FUTURE SCOPE:-

- Pervious concrete can be used in building for rainwater harvesting as well as for cooling purpose by providing permeable wall.
- In the presence of clayey soil, water can be percolated through providing borehole at every 1-2km with the help of drainage system.

- Flaky aggregate can be used to provide easy passages of water without any extra drainage system provided. (flaky aggregate has more strength).
- Water can be filtered and stored as fresh water below the ground.
- We can also give direction to water specifically according to need. By providing certain angle to the flaky aggregate, water which gets drained will make its way to the slope going down towards the sewer line or any other drainage arrangement. This could be useful where soil strata have less water absorption capacity.

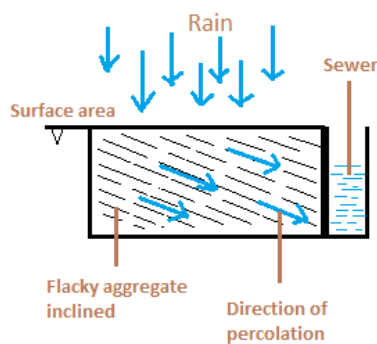


Fig-1

9. MAINTANANCE:-

- Prevent the surface from becoming clogged which reduce permeability. most site function well without regular maintenance if protected from sand.
Vacuuming or power blowing may be necessary if the site become clogged
- Pressure washing has shown to improve permeability of clogged pavement to 80% to 90% of the original permeability.
- The chance of clogging is highest during and just after construction and the site must be protected by an erosion control until vegetation has been established on the adjacent ground.
- However pervious concrete work good in little or no maintenance but the main reason being debris and residue lodging on top of void structure maintenance is required.
- Maintenance requirement cannot be determined because it changes with conditions and place to place and also on traffic condition.
- Landscaping material such as mulch ,sand ,and topsoil should not be on the concrete, even temporarily.
- One of the important aspect of pervious concrete is that in case of logging of any kind of cementing

material or weathered rock could be extremely hard to remove.

- Pressure washing pervious concrete 1-2 time a year would be necessary.

10. CONCLUSION:-

- Compressive strength of pervious concrete depend upon the porosity of concrete ,age, binder material (type of cement),test specimen shape and size ,showed huge influence on the strength of pervious concrete .
- Compressive strength is inversely proportional to porosity hence, when compressive strength increases porosity decreases
- We also concluded that Reduction in the aggregate size decreases the porosity because of its inter relation with no fine aggregate property.
- Porous concrete is unsuitable for heavy duty roads.
- Extra amount of water exceeding the specific requirement make the wet cement settle at the bottom because due to porosity wet cement makes its way to the bottom.
- More the required tamping decreases porosity .
- Vibrations also decrease pervious concrete porosity.
- Permeability of porous concrete is influence by the porosity
- Friction is more on pervious concrete than other material roads.

Small size of coarse aggregates (12.5 to 16mm) should be able to give the high compressive strength and at the same time produce higher permeability rate.

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