e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:05/May-2023 Impact Factor- 7.868 www.irjmets.com

IMPROVEMENT IN COMPRESSIVE STRENGTH OF PERVIOUS CONCRETE

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ABSTRACT

Pervious concrete is a special type of concrete with high porosity. It is used for an application that allows the water to pass through it, thereby reducing the runoff from a site and allowing groundwater to recharge. The high porosity is attained by a higher interconnected void content. Typicaly pervious concrete has water to cement ratio of 0.28 to 0.4. The mixture is composed of cement materials, coarse aggregates, and water with little or no fine aggregate. The addition of a small amount of fine aggregate will generally reduce the void content and increase the strength. The present report Deal with the study and comparison of mechanical properties, workability density, and permeability of different grades of pervious concrete (M-20, M-25). The infiltration rate of previous concrete will fall into a range of 2 to 18 gallons per minute per square foot (80 to 720 liters per minute per square meter).

Keywords- Pervious Concrete, no fines, permeable, sustainable, stormwater, Water table, flooding, eco-friendly for environment.

I. INTRODUCTION

Pervious concrete can be used for several applications, but its primary use is in road pavement such as in rural areas. This report will focus on the pavement application of concrete, which also has been referred to as porous concrete, permeable concrete, no-fines concrete, and enhanced porosity concrete. Pervious concrete is a zero-slump, open-graded material consisting of cement, coarse aggregate, admixture, and water. Previous contains little or no fine aggregate. Pervious concrete compressive strength ranges from 2.8 MPa to 28MPa (ACI 522R, 2010). The combination of ingredients will produce a hardened material with connected pores ranging in size from 0.08 to 0.32 in.(2 to 8 mm). the void content range from 15 to 35%.

II. METHODOLOGY

Pervious concrete usually consists of normal Portland cement, uniform-sized coarse aggregate, and water. This combination forms an agglomeration of coarse aggregate surrounded by a thin layer of hardened cement paste at their points of contact. This configuration produces interconnected voids (typically of size in the range of 0.04 to 0.2 in.[1 to 5 mm]) between the coarse aggregate, which allows water to permeate at a much higher rate than conventional concrete. It consists high percentage (20 to 35%) of interconnected voids, which allows for the rapid passage of water through the body of concrete.

The following materials are:-

1. Aggregates

Aggregates gradings used in Pervious concrete are typically either single-sized coarse aggregate or grading between 3/4 and 3/8 in. (19 and 9.5 mm). Rounded and crushed aggregates, both normal and lightweight, have been used to make Pervious concrete. Fine aggregate content is limited in previous concrete mixtures because it tends to compromise the connectedness of the pore system. The addition of fine aggregate may increase compressive strengths and density but correspondingly reduce the flow rate of water through the previous concrete mass. Aggregate quality in pervious concrete is equally important as in conventional concrete. Flaky or elongated particles should be avoided. The narrow-graded coarse aggregate should be hard and clean, and free of coatings, such as dust or clay, or other absorbed chemicals that might detrimentally affect the paste/aggregate bond or cement hydration. Aggregate moisture at the time of mixing is important. The aggregate absorption should be satisfied by conditioning the stockpile as necessary to achieve saturated surface dry (SSD) conditions. Otherwise, a dry aggregate may result in a mixture that lacks adequate

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workability for placing and compaction. Overly wet aggregates can contribute to the draining of the paste, causing intermittent clogging of the intended void structure.

2. Cementitious materials

Portland cement conforming to ASTM C150/C150M, C595/C595M, or C1157/C1157M is used as the main binder. Supplementary cementitious materials such as fly ash, ground-granulated blast furnace slag, and silica fume can also be used in addition to Portland cement and should meet the requirements of ASTM C618, C989, and C1240, respectively. Testing materials in trial batching is strongly recommended to verify that cement-admixture compatibility is not a problem and that the setting time, rate of strength development, porosity, and permeability can be achieved to provide the characteristics needed for the anticipated placement and service conditions.

3. Water

Water requirement for pervious concrete is governed by the same requirements as those for conventional concrete. Pervious concrete should be proportioned with a relatively low water-cementitious material ratio (w/c) (typically 0.26 to 0..40) because an excessive amount of water will lead to drainage of the paste and subsequent clogging of the pore system. The addition of water, therefore, has to be monitored closely in the field. Further discussion of water quality is found in ACI 301. Recycled water from concrete operations may be usable but only if meets provisions of ASTM C94/C94M or AASHTO M-157.

4. Admixture

The water-reducing admixture should meet the requirements of ASTM C494/C494M. Water-reducing admixtures (high-range or medium-range) are used depending on the w/c. Retarding admixtures are used to stabilize and control cement hydration. Retarding admixtures is frequently preferred when dealing with stiff mixtures, such as Pervious concrete. They are especially useful in hot weather applications. Retarding admixture can act as a lubricant to help discharge concrete from a mixer and can improve handling and in-place performance characteristics. Accelerators can be used when Pervious concrete is placed in cold weather. studies report the use of cement hydration stabilizers as an aid in extending the working time of the mixture and viscosity-modifying admixtures(VMAs) to enhance workability. Air-entraining admixtures should meet the requirements of ASTM C260. Air-entraining admixtures are not commonly used in Pervious concretes but can be used in environments susceptible to freezing and thawing. No reliable method exists, however, to quantify the entrained air volume in these materials.

FIG 1. Mixing And Casting Of Pervious Concrete

III. RESULTS AND DISCUSSION

To improve the compressive strength we perform different test to get the desired result. There are several test performed on material that is :-

1- Fineness test of cement :-

- We pass the 100g (w1) cement through 90 micron sieve .

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- Weight (w2) cement retained on 90 micron.
- That is according to my reading w2=5g.
- Therefore, fineness of cement= (w2/w1)*100=5%.
- Hence, for PPC it should never be greater than 5%.

2- Consistency test of cement:-

- Take 400 g of cement and mixed with 33% of water i.e.132g.
- Then make the paste and filled in vicat apparatus.
- Then placed under needle (10mm dia.) which is allowed to free fall on cement paste.
- Then according to reading it should be penetrate 33mm to 35mm from top or 5mm to 7mm from bottom.

FIG 2. Consistency test of cement

3- Specific gravity and Water absorption test of coarse aggregate:-

1.	Weight of vessel + water + Coarse aggregate (A)	2260.5g
2.	Weight of vessel + water (B)	1626.5g
3.	Weight of SSD aggregate in air (C)	1019g
4.	Weight of oven dried aggregate (D)	1000g

- Specific gravity = (D/C-(A-B))=2.59 .
- Water Absorption = (C-D/D)*100=1.9%

FIG 3. Weight of vessel + coarse aggregate + water (for specific gravity and water absorption test)

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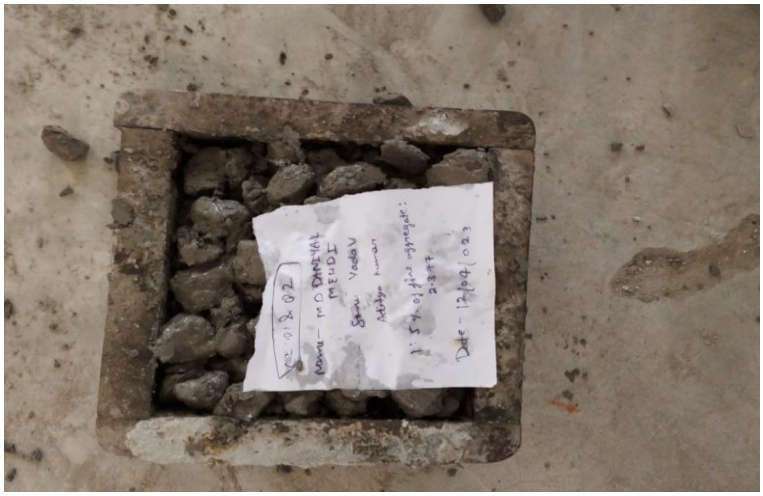

FIG 4. Casting of pervious concrete

IV. CONCLUSION

We made the M30 mix design Pervious concrete as (1:0:2.377).

- We make the 6 cube at 0% addition of aggregate.
- We make the 6 cube at addition of 5% of fine aggregate.
- We make the 6 cube at addition of 10% of fine aggregate.
- We check the compressive strength of pervious concrete at 7 days and 28 days.
- By this we know that as the increase in addition of fine aggregate the compressive strength increases but at the cost of decrease in permeability of pervious concrete.
- Since, we should be aware when we add the fine aggregate in pervious concrete. So that we also get desired permeability.

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