International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 03 | Mar 2021 www.irjet.net p-ISSN: 2395-0072

Experimental Study on Pervious Concrete

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Abstract - *Increases in impermeable surfaces with traditional drainage systems, kerbs, and gutters linked on to surface drainage networks, may result in high instantaneous water flows which will inundate existing infrastructure leading to increased risks of flash flooding. Pervious concrete may be a special high porosity concrete used for flatwork applications that permits water from precipitation and other sources to undergo, thereby reducing the runoff from a site and recharging groundwater levels. Typically, pervious concrete has little or no one aggregate and has just enough cementations paste to coat the coarse aggregate particles while preserving the interconnectivity of the voids. Pervious pavement is traditionally utilized in parking areas, areas with light traffic, pedestrian walkways, and greenhouses and contributes to sustainable construction. Permeable pavement is defined as a type of pavement that can store stormwater until it infiltrates through the subgrade soil and can function as a conventional pavement to carry specific traffic load and speed. To improve the strength suitable mix design should be adopted. In the present study, the design criteria for permeable concrete are explained in the Indian context. The analysis was undertaken by conducting several standard concrete tests and comparing the characteristics of the pervious concrete and conventional concrete samples.*

Key Words: **pervious concrete, increase in ground water, pervious pavement, rain water collection, reduction in runoff.**

1. INTRODUCTION

Pervious concrete is one among the leading materials employed by the concrete industry as GREEN industry practices for providing pollution control, storm water management and sustainable design with population growth; continual urbanisation hassled to a rise of impervious surface areas, which block the percolation of precipitation from rainfall and snow down through the bottom . This increases the potential for excess surface runoff, which may cause downstream flooding, bank erosion and possibly transport of pollutants into potable water supplies. On the opposite hand, permeable pavements have the power to scale back runoff volume and improve water quality. Indeed, they will store storm water runoff until infiltrating into soil or conveyed downstream within the storm water management system by a drain. This paper will provide technical information on application, mixture design of pervious concrete. Permeable Pavement Systems are designed to realize water quality and quantity benefits by allowing movement of storm water through the pavement surface and into a base/sub base reservoir. The water passes through the voids within the pavement materials and provides the structural support as conventional pavement. That's why permeable pavements are often served as an alternate to standard road and parking lots. These pavements have ability to scale back urban runoff and trap pollutants; also it provides the opportunities to scale back the impacts of urbanization on receiving water systems by providing at source treatment and management of storm water. Permeable pavement design has been shown in present study to manage rain water. General Applications of permeable pavement systems are as follows:

- Low volume residential roads
- Pavements, bike and pedestrian pathways
- Patios
- Tennis courts
- Road shoulders
- Swimming pool decks
- Greenhouse floors
- Pavement edge drains and gutters
- Underneath permeable blocks for
- Ground stabilisation.
- Parking lots
- Driveways
- Hard standing for sports facilities

1.1 Objective of study

- To study material used for pervious pavement
- To carryout laboratory testing of pervious pavement material
- To mix design of pervious concrete
- To study the effects of admixtures in pervious concrete
- To carryout laboratory testing for the different design mix of concrete including admixtures

1.2 METHDOLOGY

For present study we had studied on amount of literature for finalizing the materials. Then we have tested materials in laboratory. for pervious concrete we tried some mix design and calculated the quantities and we have performed that mix design in laboratory. list of tests which performed in laboratory are Sieve analysis, aggregate impact value test, aggregate crushing value test, specific gravity and aggregate, compressive strength of concrete -cube test water absorption test, shape tests on coarse aggregates, abrasion value of road

2. MATERIAL USED

- Pozzolonic Portland Cement
- Ordinary Portland Cement
- Coarse Aggregate & Fine Aggregate
- Super plasticizer
- Portable Water

In the present work, Ordinary Portland Cement (OPC) of 53 grade conforming IS 12269-1987 was used and the pozzolonic Portland cement conforming IS 1489 (Part 2) 1991. The use of super plasticizer was also used in experiments. The coarse aggregate used was crushed, angular blue granite stones of uniform size namely 6.3 mm, 8 mm, 10 mm and 12.5 mm. It has specific gravity of 2.48, 1% water absorption 17.41% impact value, 27.47% crushing value and 12.0% abrasion value. The Potable water available in laboratory conforming to IS 456-2000 was used in this study for casting and curing of specimens. Material which is used in experimental work are found eligible as per Indian standards and results of various experiments are as below.

1) aggregate impact value test: - experimental results of aggregate impact value test is 17.41% , according to IRC the aggregate which lies in the range of 10-20% classify as the strong aggregate.
2) Aggregate crushing value test: -experimental results of aggregate crushing value test is 27.41% , according to IRC aggregate crushing value should not more than 45%
3) Abrasion value test - experimental results of abrasion value test is 12 %, the minimum abrasion value is 30 % for road construction.
4) Abrasion value test - experimental results of abrasion value test is 12 5%, the minimum abrasion value is 30% for road construction.
5) Water absorption and specific gravity - Experimental results of this test is 0.006, according to Indian standard it should not more than 0.6 unit by weight and specific gravity 2.48, According to Indian standard in road construction range of specific gravity is 2 to 3

TABLE 1 EXPERIMENTAL RESULT OF COMPRESSIVE STRENGTH TEST

Days	Cement	Admixtures	Compressive Strength [N/mm²]	Reading on CTM Load in KN
7	Ordinary Portland Cement		3.11	120
7	Portland Pozzolana Cement		2.40	184
7	Ordinary Portland Cement	Super plasticizer	5.70	258
14	Ordinary Portland Cement		3.91	218
14	Portland Pozzolana Cement		5.42	250
14	Ordinary Portland Cement	Super plasticizer	6.57	278
28	Ordinary Portland Cement		5.95	264
28	Portland Pozzolana Cement		8.26	316
28	Ordinary Portland Cement	Super plasticizer	9.95	354

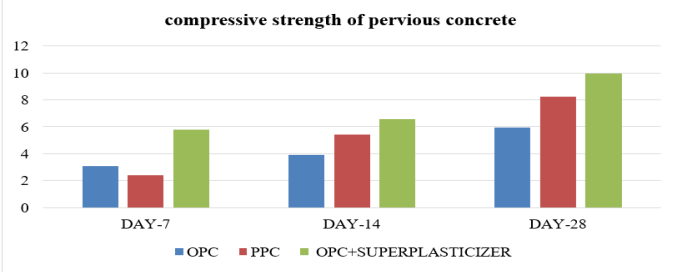

FIGURE 1 COMPRESSIVE STRENGTH OF PERVIOUS CONCRETE

3. CONCLUSIONS

This study is concluded based on the results from this experimental research on pervious concrete; the following conclusions have been drawn: Compressive strength of concrete mainly depends on porosity of concrete , age of binding material and type of admixtures.

- The results of 7 days, 14 days, 28days the compressive strength of concrete has been observed that the strength of OPC cement cubes are very less in compare to PPC cement and OPC cement with admixtures.
- The compressive strength of concrete is increase in 1.5% to 2% in PPC cement than OPC cement. And it adding superplasticizer compressive strength 2 to 2.5 % as adding 2% superplasticizer by concrete volume.
- The compressive, splitting-tensile, and flexural strength are inversely related to the permeability. As permeability increases, the strength of pervious concrete mixtures decreases.
- From particularly in this study, we can conclude that amount of fine aggregate is required less than 10%
- The water content is required 0.27% to 0.34% when mix design does not contain admixtures and when admixtures are used than water content should be 0.34% to 0.40%.
- The proportion of aggregate to cement by mass should be 4:1, 4.5:1 and valid up to 7:1.
- The ratio of fine aggregate to coarse aggregate ratio should be 0:1 to 1:1.

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