IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 7.105 ⁜ Vol. 9, Issue 4, April 2022

DOI: 10.17148/IARJSET.2022.9436

Water Absorbing Pavements by Using Pervious Concrete

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Abstract: Pervious concrete is a special type of concrete with high porosity used for concrete flatwork applications that allows water for precipitation and other sources to pass directly through, thereby reducing the runoff from the site and allowing groundwater recharge. It is also called as porous concrete, permeable concrete and no fines concrete. Pervious concrete is made using coarse aggregates with little or no fine aggregates. Pervious concrete can be introduced in low loading intensity parking pavements, walk ways, sub base for concrete pavements, Footpaths and highways. Different properties of pervious concrete e.g. workability, compressive strength, flexural strength test at 7, 14 and 28 days have been studied experimentally. However porosity was the most consider shrewd potency of porous concrete in calculating efficiency of porous concrete which was affected by addition of certain percentage of fiber.

Keywords: Pervious Concrete, Permeable, Compressive Strength, Porosity

I. INTRODUCTION

Pervious pavement is a storm water drainage system that allows rain water and runoff to move through the pavements surface to storage layer below, with the eventually seeping into the underlying soil. Permeable pavement is beneficial to the environment because it can reduce storm water volume, treat the storm water quality, and replenish the ground water supply and lower air temperatures on hot days. Storm water leads to the water logging problem. Because of the growing urbanization there is shortage of the pervious lands which lead to the water logging problem. Increasing water logging problem can be solved by using the pervious concrete or porous pavement. Porous concrete is a mixture of cement, coarse aggregate, water and any other additive or mixture. Porous concrete contains almost 20-30% or up to 30% of the voids. The voids present in the concrete will allow the water to penetrate through it. Penetration of water through voids will lead to increase in the level of ground water table and also the storm water gets filtered through it so that the amount of the contamination is less. Filtered water can be reuse especially in the dry region it plays an important role to increase the ground water level .But as compared to the conventional concrete the strength of the porous concrete is less .So that the porous concrete should be use on low traffic volume i.e. at parking slots, shoulders, etc. Pervious concrete is typically designed for a void content in the range of 15% to 30%. Generally as the void content decreases, the strength increases and permeability decreases. The high water permeability of pervious concrete makes it to be considered as an environmentally friendly concrete.

II. OBJECTIVES

Foremost objective of this paper is listed as:

1. To achieve maximum compressive strength without inhibiting the permeability characteristics of the pervious concrete.
2. To study the strength properties of conventional concrete with pervious concrete.
3. To study the influence of fine aggregate, w/c ratio, admixture on the properties of pervious concrete.

III. BENEFITS OF PERVIOUS CONCRETE

- Reduce the quantity of runoff water.
- Improve water quality.
- Enhance pavement skid resistance, especially during storm events by rapidly drainage rainwater.
- Although high-traffic pavements are not a typical use for pervious concrete, concrete surfaces also improve safety during rainstorms by eliminating ponding.

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IV. MATERIALS

Cement

53 Grade OPC provides high strength and durability to structure because of its optimum particle size distribution and superior crystalized structure. Being a high strength cement, it provides numerous advantages wherever concrete for special high strength application is required, such as in the construction of skyscrapers, bridges, flyovers, chimneys, runways, concrete roads and other heavy load bearing structures. The various tests conducted on cements are initial and final setting time, specific gravity, fineness and compressive strength.

Aggregate:

Aggregate constitute the bulk of the concrete mixture and give dimensional stability to concrete. The most important function of the fine aggregate is to assist in producing workability and uniformity in mixture. They should therefore meet certain requirement if the concrete is to be workable, strong, durable and economical.

Water:

Water is a very important ingredient of environmental-friendly paver blocks. Potable water ought to be used for mixing the cement, sand and Aggregates.

Admixtures:

Super-plasticizer:

Chemical admixtures are used in pervious concrete to obtain special properties, as in conventional concrete. Because of the rapid setting time associated with pervious concrete, retarders or hydration-stabilizing admixtures are used commonly. Here we used conplast sp 430. Dosage of super plasticizer was 1% to that of cement

Fibers:

Polypropylene fiber of size 12 mm was used in order to gain strength.

V. METHODOLOGY AND MIX DESIGN

Methodology:

Although pervious concrete contains the same basic ingredients as the conventional concrete, the proportions of the ingredients can vary. One major difference is the requirement of increased void content within pervious concrete. The amount of void space is directly correlated to the permeability of the pavement. The need for void space within the mix design correlates with using little to no fine aggregates. The porous concrete mix design adopted for this study were based on materials that we were used.

Mix Design:

A laboratory study evaluating strength and infiltration, concrete mix was performed. The experiments included compressive strength tests, infiltration rate test on clean specimens. For experimentation M-25 controlled concrete using locally available building materials and OPC cement was used with aggregate size of 6mm to10mm and 20mm. A table vibrator was used for compacting the concrete. Mix designing of M-25 controlled concrete is done and results are validated by casting 7 cube samples (150mmx150mmx150mm) and subsequently testing infiltration rate and compressive strength after 7 days and 28 days.

CUBES AND CYLINDER FORMATION

- Volume of cube = 15cmx15cmx15cm
- No. of cubes = 7
- Total volume of all cubes = 23265 cubic.cm

VI. SCOPE

1. Pervious Concrete pavement system can offer a valuable storm water management tool.
2. Storm water retention areas could also be reduced or eliminated.
3. Ground water level & aquifer recharge can be increase by allowing the rainfall to infiltrate. So, in future to tackle aforesaid problems and to protect people from flood prone areas pervious concrete is one effective solution.

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VII. CONCLUSION

From the experimental results of investigation, the following conclusions can be made. Pervious concrete allows water passes through it. Due to voids in pervious concrete it is difficult obtained required compressive strength. The ideal pervious concrete is expected to provide the maximum compressive strength, and the optimal infiltration rate. Especially for pervious concrete used on roadways, there is the need for it to be able to withstand various traffic loadings while providing adequate infiltration to reduce surface runoffs. From the analysis the control mix is recommended. Using smaller size aggregate can enhance the compressive strength of pervious concrete than bigger size aggregate. Compressive strength can be increase by using proper admixtures also. Fiber content has high effect on compressive strength where as it shows an average flexural & split tensile strength. Pervious concrete with fibers is more flexible than without fiber. It is an eco-friendly concrete material. Water absorption, abrasion resistance are good property of pervious concrete.

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