

A REVIEW ON ACCESSIBILITY OF PERVIOUS CONCRETE AS RUNOFF REDUCING ELEMENT

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ABSTRACT

Due to impermeable elements like asphalt roads, impervious paving blocks, PCC beddings etc. the runoff of surface water becomes a critical issue. Rainwater does not pass into the underground because of the lack of water permeability and air permeability in concrete pavements. Moreover, these elements reduce the percolation or infiltration of water into ground, which is affecting the ground water. This paper aims to review on accessibility of pervious concrete as eco friendly solution and its use as provision of effective method for ground water recharge. The pervious concrete is open graded mixture of cement coarse aggregate forming concrete with pores. As the pores are incorporated, the impermeable concrete acts as permeable surface that allows water to percolate through it and infiltrates into ground. This further meets with ground water and reduces ground water deficiency. This type of concrete has used for sustainable drainage system from many years. In this paper, the study made for effectiveness of pervious concrete as runoff reducing element.

Keywords—*infiltration, porous concrete, runoff, sustainable.*

I. INTRODUCTION

As the urbanization and infrastructure developments are increasing, the impervious surface produced for human being is influencing the ground water levels. In addition, this ground water is considered as a major source used for living. To survive this battle for water, the firm solutions are required and pervious concrete provides the effective solution to this. In India groundwater accounts for 65% of irrigation water and 85% of drinking water supplies. It is estimated that 60% of ground water will be in a critical state of degradation within next 20 years. [ACI 211.3R-02, 'Guide for selecting proportion for no-slump concrete'].

It is observed that the use of PC may reduce flooding risk, recharge ground water, reduce storm water runoff, reduce noise when in contact with vehicle tires, and prevent glare and skidding during rainy season by allowing water to infiltrate freely through its pores. ^[2]

Pervious concrete provides cost effective, sustainable solution to impervious area like open parking lots, concrete pavement where moderate loading is expected, and where massive concrete work is required with proper drainage. The major lacunae of this concrete are blockage of voids due to residue and green vegetation over pervious area. So preventive treatments and maintenance is required and pervious concrete cannot be provided with reinforcement due to high risk of corrosion because of the open pores in its structure.

II. LITERATURE STUDY ON PERVIOUS CONCRETE

Mohammed Sonebi, Mohamed Bassuoni, Ammar Yahia (2016)^[1] 'Pervious Concrete: Mix Design, Properties and Applications' in this research the Portland cement pervious concrete (PCPC) is defined as a special type of concrete characterized by an interconnected pore structure and high void content/porosity typically in the range of 15 to 35% by volume. This article gives idea on PCPC including its mix ingredients/proportions, key properties, durability and applications. Well-graded single sized coarse aggregate grading between 9.5 and 19mm are used for preparation of PCPC. The small amount of sand incorporated to provide strength to PCPC.

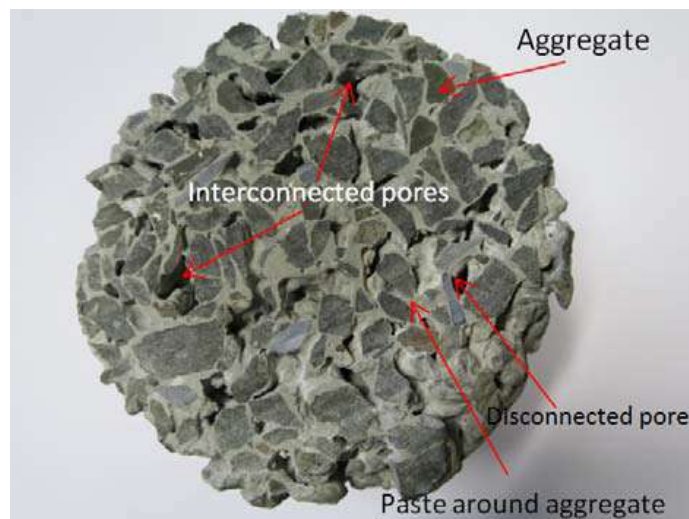


Fig.1: Cross section of PCPC, illustrating porous structure ^[1]

The paper studied the mix proportions for PCPC from literature available. In addition, the study illustrated key properties of PCPC. Author has carried a typical relationship between the void ratio and fresh density of PCPC. This paper concludes that the density of PCPC reduces up to 15-35% than normal Concrete. Density ranges from 1600 to 2000 kg/m³. In addition, permeability of PCPC can range between 81 to 730 L/min/m², with a typical rate of 120-320 L/min/m², which is depending on compaction, void content, materials and sub base infiltration rates.

Himanshu Chaudhary, Sangeeta Dhyani (2016)^[2] 'Analysis of pervious concrete on various parameters' in this review The study for pervious concrete, its porosity characteristics and strength properties are made. According to this paper, pervious concrete is a mixture, which has high porosity and strength. This paper includes literature of methodology of preparation of pervious concrete. In which they have stated that using Gait Motion and Embedded Force plates, tracking videography and electromyography, can analyze the subject mobility of wet pervious. Moreover, use of Latex polymer improves the strength of pervious concrete.

Vikrant P. Kothari, Sharvari M. Rath (2016)^[3] 'Experimental Study on Pervious Concrete by Varying Size and Shape of Aggregate'. In this review the need of pervious concrete, Experimental study of materials such as Cement, Aggregates and Effect of Sizes of aggregates on the pervious concrete, Water, Mix proportions, Test to determine properties of aggregates. This article gives Methodology to do the test of permeability, To determine the permeability of the pervious concrete mixes, cylinders of 100mm diameter and 150mm long were casted. The

samples were cured for 7 days and tested there after using constant head parameter designed and assembled . To determine compressive strength of cubes different mixes were casted and tested for 3,14,28 days.

From the tests it is observed that permeability varies with W/C ratio and aggregates size, increase in W/C ratio reduce porosity, Smaller size of aggregates gives less permeability, So that the use of larger size of aggregates for higher permeability is preferable.

Rama Mahalingam, Shanthi Vaithiyalingam Mahalingam(2016)^[4]: 'Analysis of pervious concrete properties'. This research paper gives the basic idea of previous concrete, and appropriate amounts of water and cementation material is to be used to make a paste that forms a thin coat around aggregate particles, but leaves free space between aggregates. A complete elimination or drastic reduction of fine aggregates creates large and continuous voids. Pervious concrete is also known as a no-fines concrete, porous concrete, and permeable concrete. Paper also gives the benefits of pervious concrete; it is the effective storm water management tool to reduce volume storm water runoff and pollutants. The article provides overview on materials used for preparation of pervious concrete. The aggregate passing through the 9.5 mm sieve and retained on the 4.75 mm sieve, and the aggregate passing through the 12.5 mm sieve and retained on the 9.5 mm sieve were used in this research. The pH of water conformed to IS 456-2000. The material properties obtained from test result are studied as well as mix proportions and test methodologies are given. The coarse aggregate content is varied to achieve the proper thickness of paste surrounding the aggregate by trial and error, based on mix proportion of no-fines concrete. The W/C ratio is kept to 0.33. All pervious concrete specimens used in the tests were prepared according to the ASTM C192 guidelines, "Standard Practice for Making and Curing Concrete test Specimens in the Laboratory". Tests to find compressive strength, flexural strength, split tensile strength, porosity, permeability. For permeability setup designed on constant head permeability method. Results of tests are discussed in this article. The compressive strength, split tensile strength and flexural strength values varied from 5 N/mm² to 16 N/mm², 1.15 N/mm² to 1.7 N/mm², and 1.88 N/mm² to 3.21 N/mm², respectively. Porosity is between 20.95% to 28.26%, permeability between 8.60 mm/sec to 19.80 mm/sec. Based on experimental results, it can be concluded that, when runoff collection is of primary concern and strength is not a governing issue, the use of pervious concrete can be regarded as a suitable and sustainable choice in various storm water management applications

Shaik Niyazuddin Guntakal, and Senthil Selvan (2017) [5] 'Application of pervious concrete for pavements: a review' in this review paper the study of importance of pervious concrete, pavements, strength, permeability, durability, environment. the main purpose of this review paper is to provide knowledge to the researcher about the pervious concrete material and its advantages. there is a lot of scope for research in this area, which helps to protect our environment and ground water resources.

this paper gives information of researchers conducted different experimental investigations like aggregate investigation, the effect of aggregate properties, the effect of aggregate size and gradation, optimal mix, admixture investigation, optimum water to cement ratio, failure analysis with admixtures and without admixtures. water-reducing admixtures are used to increase the workability without increasing the water content. according to this article to increase the strength of pavement it is necessary to decrease the size of

aggregate, dolomite is best suitable aggregate, which provides higher compressive strength. typically, higher strengths are achieved with angular aggregates. the little amount of water added cause lack of bonding between aggregates which reduces compressive strength, the optimum amount of water is added which produces the right mix and the bondage between the aggregates is the good and compressive strength of this mix is good. excessive amount of water gives less compressive strength. w/c ratio between 0.27 to 0.30 is an ideal ratio. in this article, the mix proportions used by various researchers is given. dolomite is providing good dry strength when compare to quartzite and limestone. dolomite is preferable to aggregate to produce a concrete which has more compressive strength. cement used is ordinary portland cement to produce pervious concrete. cement or cementing material provides good durability and strength to the concrete. pervious concrete usually has zero slumps when compare to conventional concrete.

this review gives idea about admixtures, mineral additives could lead to the improvement of concrete properties such as mechanical strength and durability[1]. air entraining admixtures can reduce freeze-thaw damage in pervious concrete.the sample preparation is also given in this paper.

strength properties such as compressive, flexural and fatigue strength have been investigated by various researchers in the past. researches shows that strength properties are depend more on aggregate-cement ratio than water-cement ratio.

III. CONCLUSION

The pervious concrete is cost effective a mean to reduce surface runoff. It can be helpful for storm water drainage, flood management etc.The more study is required for making this as a water management tool.Pervious concrete can be used efficiently as building material.

IV. FUTURE SCOPE

The in depth mix design is not yet available for preparation of pervious concrete. The study of percolation proprieties with different sizes of aggregate can be possible. The study of pervious concrete as a sustainable resource for ground water recharge is possible.

V. ACKNOWLEDGEMENT

We the authors gratefully acknowledge to all the authors mentioned in references for their great contribution on study of pervious concrete. The references were very useful in the preparation of this review paper.

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