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Review of Applications andproperties of Pervious concrete

Mr. Gaurav R. Desai

Department of Civil Engineering,D.Y.Patil Pratishthan's College of Engineering, Salokhenagar,Shivaji University, Kolhapur,(India)

ABSTRACT

The use of conventional concrete for almost all the construction and other related activities as like a tradition continues from many decades and still continues the same. Pavement systems constituting about 30-40 per cent of the total urban roads have converted pervious natural ground into impervious systems, which have created a negative impact on the environment. The use of Pervious concrete as an alternative can be adopted in specific works with added advantages. In other words pervious concrete is known as No-fines concrete or concrete with low water-cement ratio. The pervious concrete is a homogeneous mixture of cement, coarse aggregate and water with use admixtures or fibres as if needed to modify certain properties of concrete.

Keywords:flexural strength, no-fines, Pervious concrete, permeable, split tensile

I.INTRODUCTION

In this Twenty First Century era where the world is facing number of problems due to natural calamities like drought, floods etc. the need for an alternative technique rises on the top. The most important need of mankind is need of water mainly for drinking purpose and without which there will be no survival any kind of life on earth.

II.OBJECTIVES

The objective of this research paper is to study what is pervious concrete, properties governing it. The application of pervious concrete in variety of fields, its success and failure rates etc. The paper also reflects the different use of various admixtures and fibres which affect the strength and permeability properties of pervious concrete.

As in today rainwater harvesting has become the top priority for all the developed as well as the developing countries, pervious concrete asconstruction material can also help to achieve this water requirement at lowest cost and eco-friendly way. This concrete is used in decks of swimming pool, tennis courts, patios and drains, retaining walls. Pervious concrete decreases the overflow of rainwater from the paved areas. The major contribution of pervious concrete is recharging of groundwater storage andthereby reduce runoff and also supports sustainable construction.

Compressive strength of pervious concrete depends primarily on the porosity of concrete. Compressive strength of pervious concrete varies inversely with the porosity of concrete

Composition of Pervious concrete.

Cement:

Cement of locally available grade OPC 43, 53 may be used which conforms according to IS Specifications.

Coarse Aggregate

Coarse aggregate with small angularity provides highstrength and less permeability. Aggregate passing through 20 mm and retained on 10 mm is used.

Water

Organic matter free eater should be used for manufacture of pervious concrete.

Admixtures:

Use of superplasticizerspolymers as dispersants to avoid particle aggregation andto improve the flow characteristics of suspensions such as in concrete applications. Use of silica fume as sand replacements gives out considerable increase in mechanicals strength of pervious concrete.

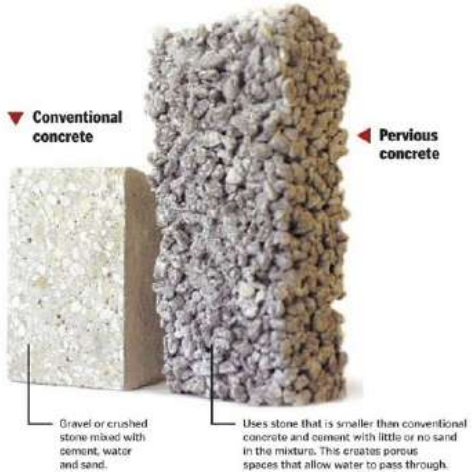

Fig.1.1 Samples of Conventional and pervious concrete

III.MIX PROPORTION

No fines concrete is made with a water-cement ratio from 6:1 to 10:1 i.e. 0.28 to 0.40. Aggregates used are normally passing through 20 mm and retained on 10 mm. The binder to aggregate ratio should be below 0.25.

Aggregate-cement ratio, water-cement ratio and unit weight of concrete govern the strength of pervious or no-fines concrete.

Voids content should be in the range of 15% to 30%

When pervious concrete is made using conventional aggregates, their density should be in the range of 1600 to 1900 kg/m3, but when light weight aggregates are used their density should be about 360 kg/m^3.

Feasibility of Pervious concrete in Indian climatic conditions:

India is a country having three major climatic conditions i.e. Summer season, Rainy season, Winter season, so the pervious concrete has to sustain all these conditions and function in the right manner to serve its purpose. India is facing a typical problem of ground water table falling at a fast rate due to reduced recharge of rainwater into subsoil and unplanned water withdrawal for agriculture and industry by pumping. The Government of

India is propagating the rainwater harvesting schemes on a priority basis and thus pervious concrete can be major role player to achieve this mission.

IV.TESTS ANALYSIS

Permeability test:

The constant head permeability test can be used to test the permeability of pervious concrete. The flow rate through pervious concrete depends on the materials and placing operations. Typical flow rates for water through pervious concrete are 0.2 cm/s to 0.54 cm/s, with rates of up to 1.2 cm/s. Even higher rates have been measured in the laboratory.

Compressive strength:

The laboratory compressive strength tests of pervious concrete shows results in the range of 3.5 Mpa to 28 Mpa which is suitable for wide range of applications. Average values are 17 Mpa. The concrete cubes of size 150 mm x 150 mm x 150 mm are prepared for each mix.The average compressive strength of three cubes is taken as a result for consideration. Cube concrete cylinders are also

Split tensile strength:

The split tensile strength is performed on cylindrical cubes of 150 mm diameter and 300 mm long as per ASTM standards.

Flexural Strength:

Flexural strength in pervious concretes generally ranges between about 1 MPa and 3.7 MPa. The factors influencing the flexural strength, particularly degree of compaction, porosity, and the aggregate-to-cement ratio. However, the typical application constructed with pervious concrete does not require the measurement of flexural strength for design.

Workability:

The workability can be measured by using slump test as per IS :1199-1959. The test results shows poor slump. Also this category of concrete falls under the category of no slump concrete, there is no correlation of this concrete with workability.

Porosity:

It is the ratio of volume of voids to the total volume of specimen.

The porosity can be calculated using following equation:

$p = [1- (W_1 – W_2) / \rho_w V] \times 100\%$

where,

ρ_w= Density of water (kg/mm^2)

V = pervious concrete volume (mm^2)

W_1 = weight of a sample of pervious concrete air-dried for 24 hours (kg)

W_2 = weight of sample of pervious concrete submerged in water (kg)

p = total porosity of pervious concrete (%)

Shrinkage:

The drying shrinkage of pervious concrete is considerably higher than conventional concrete. As there is only thin layer of paste existing between aggregates and they have only point to point contact, the value of drying shrinkage becomes low. The rate of drying shrinkage of pervious concrete is 50 to 80% of total drying shrinkage that takes place in 10 days which is 20 to 30% for conventional concrete.

Advantages of pervious concrete:

Low cost: The cost of construction/installation of pervious concrete pavements is very low as compared to conventional concrete. It also reduces the cost of underground pipes and stormwater piping etc.

Safety for vehicles: As all the water on roads due to rains will be immediately filtered up in the ground, hence there will be no cases of skidding of vehicles and hence the accident rate will get decreased in the rainy season.

Ground water recharge: To overcome the problem of water crisis all over the world, pervious concrete can be used to increase ground water table by its perviousness etc.

V.APPLICATIONS

1. Parking lots
2. Walkways, Pathways
3. Low traffic roads
4. Compound walls
5. Swimming pool decks
6. Road pavement
7. Hydraulic structures

VI.CONCLUSION

Pervious concrete is receiving great attention by the construction industry because of its several advantages, specially high flow rate of water through its body-allowing rain fall to be captured and to percolate into ground and recharge the falling down ground water table, providing a solution to environment–friendly sensitive construction. This is vital for Indian conditions where Govt. is putting lot of efforts to implement ground water recharging techniques.

The research paper reflects the following points:

a) Review of the various materials used of manufacture of pervious concrete.
b) Various type of tests performed on pervious concrete.
c) Applications of pervious concrete in a variety of fields.
d) The study of various research papers reflect that permeability is the important property of pervious concrete.

VII.FUTURE SCOPE

This paper focuses on various applications and tests on pervious concrete, but it was noticed that there is no specific Mix Design for pervious concrete to be set as standard in any working conditions or any country. The design has been used in various applications have been subjected to remodifications; restructuring based on the usage of concrete its functioning, serviceability etc. Although some tests like permeability, compressive strength have been found in common in all of the applications. The addition of various fibres have been found to influence many properties and strength of pervious concrete in many of the cases. However there needs to be more research work to be done to examine that how this pervious concrete can be widely used to increase the ground water table by studying the soil nature, properties etc. which can help to meet the water demand and overcome water crisis which is troubling all over the world.

REFERENCES

[1.] *I.S. 12269-1989*- Specifications for 53 grade ordinary Portland cement

[2.] *I.S. 383-1970*- Specifications for Coarse and Fine aggregate from Natural source of concrete

[3.] *I.S.456-2000*- Indian Standard Plain Reinforced Concrete- Code of Practice

[4.] *I.S. 10262-1982*- Recommended concrete Mix Design

[5.] Charles Mitchell, P.E.Introduction to Durability and In-Place Infiltration of Pervious Concrete

[6.] Darshan S. Shah, Prof. JayeshkumarPitroda, Prof.J.J.Bhavsar,Pervious Concrete: New Era For Rural Road Pavement

[7.] K. Rajasekhar, K. Spandana, Strength properties of pervious concrete compared with conventional concrete, IOSR-JMCE Volume 13,Issue 4 Ver, III (Jul-Aug 2016)

[8.] Karthik H. Obla,Pervious concrete-An overview

[9.] Rama Mahalingam, Shanti Mahalingam, Analysis of pervious concrete properties

[10.] ShaikNiyazuddinGuntakaland SenthilSelvan, Application Of Pervious Concrete For Pavements:A Review, RJC,Vol. 10,No. 1,32-36,January - March,2017

[11.] Vikram, Mahla R.P., Experimental Study of Pervious Concrete Pavement Volume 3 Issue VII, July 2015 page 41-48