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# Effect of Clogging Material on Pervious Concrete

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**Abstract** - *One of the aim of the paper is to illustrate permeable behaviour of pervious or porous concrete(PC). Pervious concrete (porous concrete), a kind of porous concrete with continuous pores as the important species of ecological concrete, is made by specifically graded aggregate, cement, water, additives and admixtures through a certain proportion and special processes. However, permeable concrete exhibits reduction in permeability due to clogging by particulates, which severely limits service life. The pore structure of permeable concrete and characteristics of flowing particulates influence clogging, which occurs when particles build-up and block connected porosity. Permeable concrete requires regular maintenance by vacuum sweeping and pressure washing, but the effectiveness and viability of these methods is questionable. The permeability of the various pervious concrete mixtures determined using the falling-head permeability test apparatus*

***Key Words***: **Pervious concrete, Porous concrete, Permeability test, Clogging, Compressive strength**

## 1. PERVIOUS CONCRETE

Pervious concrete (also called porous concrete, permeable concrete, no fines concrete and porous pavement) it is a type of concrete with a high porosity used for concrete, flat allows for the use of its water from precipitation, and the other sources to pass through directly , thereby reducing the runoff from a site and allowing groundwater recharge. PC is made using large aggregates with little to no fine aggregates. This produces a highly porous material with typically 15-35% volume of interconnected voids that allow very rapid water percolation. Despite the fact that the permeable concrete, obviously, has a lot of benefits, it is, exposed to the blockage, which leads to problems with operation and premature degradation. The Design goal of the permeable concrete mixing is to achieve a balance between the voids, strength, and paste it into the content, and user experience. Fine aggregate content is significantly reduced. Different mix proportioning methods have been recommended, and its most important requirement is to allow the cement paste, in order to bind to aggregate in order to achieve the required strength and high-severability. The purpose of this paper is to critically review the existing research on clogging is to summarise current understanding of the problem and mitigating strategies. The main problem is that this kind of research requires a broad knowledge range including cement and concrete materials science, pavement design, mass transport phenomena, structural, environmental and water resources engineering. The structure of this paper is as follows. For the first time, the properties of permeable concrete, and the factors that have an impact on its operating characteristics are taken into account. When the research is related to understanding, clogging, and methods for clean-permeable concrete is considered. Finally, the future research needs are discussed The significance of this research is to investigate the effect of clogging of pores with clayey materials on the water permeability of pervious concrete and efficiency of cleaning process. In addition, the effects of compaction on the density, strength and water permeability of pervious concrete were investigated.

### 1.1 Pervious concrete – Functions

The porous concrete has been extensively applied road works, landscaping works, environmental engineering and other fields achieving good social, environmental and ecological effects . From the technical performance point of view, in addition to reducing the surface water, the performances of the permeable concrete on purifying water reducing road traffic noise, regulating the humidity and temperature of urban space and other aspects are equally obvious, compared with the impervious concrete pavement. Pervious concrete can remove stormwater more quickly than traditional concrete which results in improved skid resistance.

### 1.2 Pervious concrete – problem

The clogging failure is regarded as one of the primary reasons that cause the decrease of functionality and even the thorough failures of pervious concrete pavement eventually. Solving clogging relevant problems will make the contributions to the sustainable urbanization and environmental issues. Pervious concrete does not handle the heavy traffic loadings and vehicles due to its low compressive and flexural strength. The cost of maintenance and cleaning is high. The clogging effects on pervious concrete pavement decrease the initial drainage ability significantly in the short period. The drainage function may lose thoroughly if without the effective and timely cleaning. There are installation problems also.

## 2. Properties of pervious concrete

Within the permeable concrete, the material is the same as that of ordinary concrete, but the mix proportions are different. The Design goal of the permeable concrete mixing is to achieve a balance between voids, strength, paste content and workability. Fine aggregate content is significantly reduced.

### 2.1 Compressive Strength Porosity, void ratio and water absorption test

Pervious concrete is a type of lightweight concrete that is porous, obtained by detaching sand from the normal concrete mix. Though pervious concrete can be used for various applications, its primary drawback is low compressive strength. Since the paste layer between aggregates is thin, it can not provide sufficient compressive strength compared with traditional concrete. The compressive strength of pervious concrete is related to several factors such as void ratio, unit weight, water-cement ratio, supplementary cementing materials, aggregate size, and aggregate to cement ratio. The compressive strength of permeable concrete decreases linearly with increasing void ratio. The compressive strength is linearly proportional to unit weight while inversely proportional to void ratio. In order to know the compressive strength of the pervious concrete for each mix case the cylinder specimens of diameter 100 mm X 200 mm size were cured for 28 days and then tested according to the test method of cylindrical concrete specimens.

### 2.2 Permeability

The most distinguished feature of pervious concrete is its high permeability, which is a measure of the ease by which fluid may flow through the material under a pressure gradient. Void ratio of typical pervious concrete ranges from 14% to 31. The general trend is an increase in permeability with an increase in porosity, with a wide distribution and only a weak correlation was observed. Permeability depends upon the characteristics such as size distribution, shape, degree of connectivity and tortuosity of the pores. Most permeability measurements are based on the theory of Darcy's Law and the assumption of laminar flow inside the permeable concrete with the use of falling head permeability test adopted from soil mechanics. The average coefficient of permeability (k) is calculated using Equation 2-4 established based on Darcy's law:

$$K= ( A X L / A X T ) X \ln(h1/h2)$$

Where

K = coefficient of permeability, in/s or cm/s, (or L/T)

a = cross-sectional area of the pipe, in2 or cm 2 , (or L)

L = length of the sample, (in or cm)

A = cross-section area of the sample specimens, in cm 2 t = time for water to drop from h1 to h2, sec,

h1 = initial water level, in or cm,

h2 = final water level, in or cm

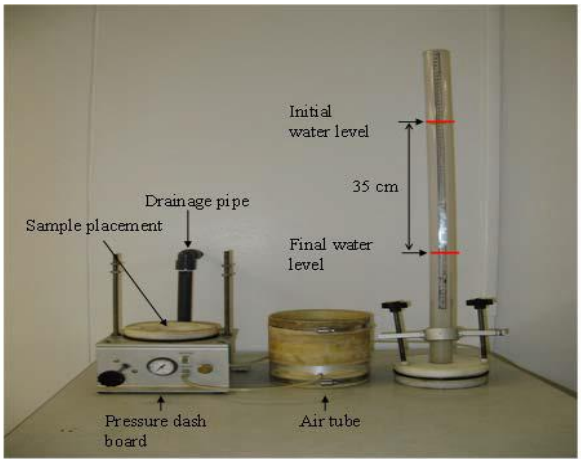


**Fig -1: Falling-head permeameter used to measure coefficient of permeability of pervious concrete**

### 3. Methods to unclog permeable concrete

Permeable concrete pavements require regular maintenance to preserve performance and effectiveness. The main focus of maintenance is removing particles causing clogging to recover infiltration capacity. Pressure/power washing with water and vacuum sweeping. The most highly recommended methods to rehabilitate clogged permeable concrete. Pressure washing uses high-pressure cleaner, and it makes use of a conical nozzle to break the bond between clogging particles and the substrate in order to provide for its removal. In vacuum sweeping, clogging particles are sucked out to open blocked pores. The recommended frequency of maintenance ranges from at least once per year to two to four times per year depending on the site and weather conditions.

The effectiveness of pressure-washing, vacuum cleaning, washing, and use a combination of these methods, in order to restore the infiltration capacity of the water-permeable concrete has been investigated in many studies. The results varied among the different studies, and, yes, sometimes even within a single study. These differences can be explained by the differences in the permeability of the concrete. In general, results reveal that the maintenance methods offer the recovery of the mobility, at least in part, although it is economically and practically feasible viability are questionable . The vacuum machines are faster than the pressure in the wash, but only those molecules that are very close to the surface of the ground are extracted. It is also found that vacuum sweeping could partially restore the infiltration capacity of permeable concrete.

### 4. CONCLUSIONS

The effects of compaction and clogging of pervious concrete were investigated. The following conclusions are made from this study: The pores clogging has been proved a serious problem in maintaining its water permeability in service. High pressure water cleaning is found to be a reasonable

maintenance approach to restore the water permeability of pervious concrete.

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