International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 6 Issue 5, July-August 2022 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Experimental Investigation on Behavior of Pervious Concrete in Strength and Permeability by using RHA, SCBA, Nylon and Polypropylene Fiber

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ABSTRACT

During hydration and hardening, concrete needs to develop certain physical and chemical properties, among others, mechanical strength, low permeability to ingress of moisture, and chemical and volume stability. Concrete has relatively high compressive strength, but significantly lower tensile strength (about 10% of the compressive strength). As a result, concrete always fails from tensile stresses even when loaded in compression. The practical implication of these facts is that concrete elements that are subjected to tensile stresses must be reinforced. Concrete is most often constructed with the addition of steel bar or fiber reinforcement. The reinforcement can be by bars (rebar), mesh, or fibres to produce reinforced concrete. Concrete can also be pre-stressed (reducing tensile stress) using steel cables, allowing for beams or slabs with a longer span than is practical with reinforced concrete.

KEYWORDS: *hydration, concrete, permeability, compressive strength, tensile stresses*

How to cite this paper: Tanushree Sharma | Vijay Meshram | Dr. Abhay Kumar Jha "Experimental Investigation on Behavior of Pervious Concrete in Strength and Permeability by using RHA, SCBA, Nylon and Polypropylene Fiber" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-6 | Issue-5, August 2022, pp.1420-1422, URL: www.ijtsrd.com/papers/ijtsrd50668.pdf

IJTSRD50668

INTRODUCTION

The proper utilization of pervious concrete is a recognized best management practice by the U.S. Environmental Protection Agency (EPA) for providing first flush pollution control and storm-water management. As regulations further limit storm-water runoff, it is becoming more expensive for property owners to develop real estate, due to the size and expense of the necessary drainage systems.

Pervious concrete reduces the runoff from paved areas, which reduces the need for separate storm-water retention ponds and allows the use of smaller capacity storm sewers. This allows property owners to develop a larger area of available property at a lower cost. Pervious concrete also naturally filters storm water and can reduce pollutant loads entering into streams, ponds and rivers.

Pervious concrete functions like a storm water infiltration basin and allows the storm water to infiltrate the soil over a large area, thus facilitating recharge of precious groundwater supplies locally. All of these benefits lead to more effective land use. Pervious concrete can also reduce the impact of development on trees. A pervious concrete pavement allows the transfer of both water and air to root systems allowing trees to flourish even in highly developed areas.

OBJECTIVES

1. To study the properties of Pervious Concrete with RHA, SCBA and polypropylene fibre.
2. To study the Permeability testing of plain pervious concrete cube.
3. To study the Permeability testing of SCBA, RHA and fibre mixed pervious concrete cube.
4. Loadings on pervious concrete are also an area of concern. Existing pervious concrete pavements are studied.

5. Data drawn from these pavements are utilized along with the results of the compression tests to determine vehicular loadings and volumes that the pervious concrete can sustain over time.
6. Additionally, pavement thickness design will be conducted on varying soil types and loadings.
7. As with any research, the experiments performed are subject to limitations. These limitations are in regards to the type and size of aggregate used and the curing process. These restrictions are discussed further in more detail.

LITERATURE SURVEY

Nawkhare et al. (2018) Nowadays, the main focus of research is to reduce industrial and agricultural waste for ecofriendly environment. This experimental study investigates the strength performance of concrete using Portland pozzolana Cement and Sugarcane Bagasse Ash. Initially, bagasse ash samples were collected and its properties were investigated. Normal consistency and setting time of the pastes containing Portland pozzolana cement and sugarcane bagasse ash at 5%, 10%, 15% & 20% replacement were investigated. The compressive strength of concrete block containing Portland pozzolana cement with bagasse ash at 5%, 10%, 15% & 20% replacementswere also investigated. The Compressive strength was evaluated for 7, 14, and 28 days of curing period. The effect of SCBA %, curing period, mix ratio on concrete block compressive strength, were studied and results are incorporated in the paper. The test result shows that sugarcane bagasse ash (SCBA) can be used as a partial replacement of cement upto 10% by weight of cement without any major loss in strength. Compressive strength was calculated for7, 14 and 28 days.

Patidar (2018) Pervious solid water penetrability and compressive quality for the most part rely upon admixtures, extent of the materials and total sizes. This paper examines different mix of pervious cement with admixture (polypropylene fiber), water concrete proportion and distinctive total sizes. Three total sizes 6mm-10mm, 10mm-20mm and 6mm-10mm-20mm sizes are taken. For each total size, W/C proportion of 0.30, 0.35, and 0.40 were utilized. The goal of this exploration is to examine the impact of polypropylene fiber, variety in total sizes and W/C proportion on pervious cement. For trial of water penetrability, we utilized falling head technique. The trial research has been done to figure void proportion, water porousness, thickness and compressive quality. In the event that we increment in W/C proportion found in compressive quality pervious cement. Compressive quality of ordinary cement is more prominent than pervious cement. The void proportion that must be found in scope of 25% to 32% of pervious cement is adequate. Thus on the off chance that we utilize little size of total, porousness of pervious solid will diminishes. As indicated by examination it was seen that with utilizing blend (half) total and 0.30 W/C proportion gives better outcome for pervious cement. In this examination utilized of polypropylene fiber gives better outcome for compressive quality of pervious cement and does not impact on water penetrability of pervious cement.

METHODOLOGY

Synthetic Fibres:-Synthetic fibres are man-made fibres resulting from research and development in the petrochemical and textile industries. There are two different physical fibre forms: monofilament fibres, and fibres produced from fibrillated tape. Currently, there are two different synthetic fibre volumes used in application, namely low-volume percentage (0.1 to 0.3% by volume) and high-volume percentage (0.4 to 0.8% by volume). Most synthetic fibre applications are at the 0.1% by volume level. At this level, the strength of the concrete is considered unaffected and crack control characteristics are sought. Fibre types that have been tried in cement concrete matrices include: acrylic, aramid, carbon, nylon, polyester, polyethylene and polypropylene.

Figure. 1 Synthetic Fibres

Table: 1 Comparison of Ordinary Portland cement and Portland Pozzolona Cement

Pervious concrete	7 Days Strength	28 Days Strength
OPC	5.49 N/mm^2	12.05 N/mm^2
PPC	3.48N/mm^2	7.18N/mm^2

Table 2 Pervious concrete with 6% RHA + 6% SCBA and %age of Nylon fibre

Strength of Pervious concrete	Pervious concrete with 6% RHA + 6% SCBA and 0.1% Nylon fibre	Pervious concrete with 6% RHA + 6% SCBA and 0.15% Nylon fibre	Pervious concretewith 6% RHA + 6% SCBA and 0.2% Nylon fibre	Pervious concretewith 6% RHA + 6% SCBA and 0.25% Nylon fibre	Pervious concrete with 6% RHA + 6% SCBA and 0.3% Nylonfibre
Average 7 Days (N/mm^2)	3.51	3.83	3.71	3.1	3.7
Average 28 Days(N/mm^2)	7.19	7.15	8.1	7.75	7.73

CONCLUSION

- The compressive strength of pervious concrete mix with RHA, SCBA and nylon fibre and pervious concrete mix with RHA, SCBA and polypropylene fibre is increased as comparison to the plain pervious concrete.
- When we used the 6 % RHA and 6 % SCBA with nylon fibre and polypropylene fibre in pervious concrete in various proportion of 0.1%, 0.15%, 0.2%, 0.25% and 0.3% of the weight of concrete, the result obtained by the compressive strength of nylon fibre with 6 % RHA and 6 % SCBA and polypropylene fibre 6 % RHA and 6 % SCBA is up-to 0.2 % of used result get increased

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