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Experimental Studies on Pervious Concrete by Varying the Size of Aggregate and Sand Content

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Abstract Pervious concrete is a mixture of cement, water, coarse aggregate and little to no sand. It is also called as porous concrete and no fines concrete. This paper deals with the experimental results of pervious concrete based on three different sizes of aggregates with three sand contents. A mix design of Grade M25 was developed. The sizes of aggregate taken are 10, 12.5 and 16mm and the sand content is reduced to 5%, 10% and 15%. Three cubes and three cylinders were casted for each size and sand content respectively. A total of 27 cubes and 27 cylinders are

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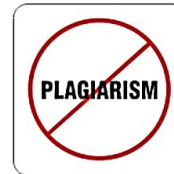


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Abstract— Pervious concrete is a mixture of cement, water, coarse aggregate and little to no sand. It is also called as porous concrete and no fines concrete. This paper deals with the experimental results of pervious concrete based on three different sizes of aggregates with three sand contents. A mix design of Grade M25 was developed. The sizes of aggregate taken are 10, 12.5 and 16mm and the sand content is reduced to 5%, 10% and 15%. Three cubes and three cylinders were casted for each size and sand content respectively. A total of 27 cubes and 27 cylinders are casted which are tested for compressive strength and infiltration rate. Based on the analysis of the results obtained, applications of pervious concrete will be recommended.

Keywords—Pervious Concrete, Mix Design, Fine Aggregate Reduction, Compressive strength, Infiltration Rate.

I. INTRODUCTION

Pervious concrete is a mixture of cement, water, coarse aggregate and little to no sand. It is a special type of concrete with a high level of porosity that allows water from precipitation and other sources to pass directly through the sub grade. It helps to reduce the run off thereby allowing ground water discharge. It is used for concrete flatwork applications. It is an open graded structure with interconnected voids which gives this concrete its high level of porosity. Generally, Pervious concrete has water to cement ratio of 0.3 to 0.45 and the void ratio ranges from 0.2 to 0.38.

Pervious concrete is sensitive to changes in water content which makes the field modifications vital for a proper concrete mixture. Excess water may result in segregation and bleeding while less water may affect the curing of the solid. The high porosity achieved also results in the reduction of strength as compared to conventional concrete mixtures but sufficient strength for many different applications is readily achieved.

It represents a near zero-slump. Permeability to water depicted by pervious concrete generally ranges from 1.2 mm/s to 13.2 mm/s. While its compressive strength generally ranges from 2.5 MPa to 30 MPa. Pervious concrete is rapidly becoming popular in many countries due to its use in sustainable construction.

II. NEED FOR PERVIOUS CONCRETE

A. Environmental effects of conventional concrete

Cement production is one the top ranking producers of anthropogenic carbon dioxide in the world after transport and energy generation. Around 5% of the worldwide total of carbon dioxide emissions is caused by cement production. Concrete causes damage to the topsoil which is the most fertile layer of the earth. The hard surfaces created by concrete result in surface runoff causing soil erosion, flooding and water pollution.

B. Environmental benefits of pervious concrete

Pervious concrete helps to solve the problems of conventional concrete by reducing the surface run off volume, rate and pollutants. It helps to collect and fill the retention ponds which is collected beneath the pavement itself, allowing filtration thereby reducing the need for retention ponds themselves. Pervious concrete reduces the heat island effect, as it stores less heat allowing the growth of trees for shade.

C. Applications of pervious concrete

Pervious concrete can be used in parking areas with light traffic, residential streets, greenhouse and pedestrian walkways. It is application of environment friendly construction. It is a type of low impact development technique used to protect the quality of water. Other applications are drainage media for hydraulic structures and