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Design and Estimation of Pervious Pavement Block for College Road

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Abstract:
Pervious concrete pavement is a unique and effective way to capture stormwater and allow it to seep into the ground thus recharging groundwater, reducing stormwater runoff, and meeting U.S. Environmental Protection Agency (EPA) stormwater regulations. This system has been recommended by EPA and geotechnical engineers as a Best Management Practices (BMPs) for the management of stormwater runoff. This pavement technology creates more efficient land use by eliminating the need for retention ponds, swales, and other stormwater management devices. Pervious surface treatments retain the water sub-surface as it gradually infiltrates into the soil; holding the storm water in multiple air voids or cells also assisting in water quality through degradation of hydrocarbons into carbon dioxide and water, and retaining metals in the structure keeps them from the groundwater table. Despite the use of pervious systems for nearly 30 years in the US, not a lot of research has been performed on the long term absorption of contaminants in the concrete microstructure. Several studies showcase the removal efficiency of these pavements in the first few years of service, stating it has shown above 75 percent efficiency in removal of contaminants. This investigation focused on various pervious concrete treatments determining optimum strength, voids, infiltration and voids. Additionally geochemical work on trace metal adsorption, major element adverse affects and water quality benefits was performed.

1.1 INTRODUCTION:

Pervious concrete is a composite material consisting of coarse aggregate Portland cement and water. It is different from conventional concrete in that contains no fines in the initial mixture, recognizing however, that fines are introduced during the compaction process. The Aggregate usually consist of a single size and is bonded together at its points of contact by a paste formed by the cement and water. The result is a concrete with a high percentage of interconnected voids that, when functioning correctly, permit the rapid percolation of water through the concrete. Unlike conventional concrete , which has a void ratio anywhere from 3 To 5% , pervious concrete can have void ratio from 15-40% depending on its application.Pervious concrete has lower compressive stress , higher permeability and a lower unit weight , approximately 70% of conventional concrete. Provides a photograph of in-situ pervious concrete and shows pervious concrete compared with conventional concrete.

1.2AIM:

- To design and estimate of pervious concrete block for college road

1.3 OBJECTIVE:

1. To drain out the surplus water from the surface of road pavement
2. For the filtration of water at some extent
3. To increase ground water table

2.1 MIXDESIGN AND PROPORTIONS:

The cement: aggregate ratio by volume is in the range of 1:4 to 1:6 by volume. The water- cement ratio needs to be kept low, 0.3- 0.5, to secure the cement paste coats the aggregates and does not run off.

Polypropylene fibres:
In the study Fibrillated 12 mm cut length fibres were used. These polypropylene fibres. Tensile strength 500-750 Mpa.

2.2 Mix Design by ACI 522R_10

- Assume percentage of voids by volume = 20 %
- Specific Gravity of coarse aggregate = 2.75
- Water cement ratio = w/c = 0.38
- Size of coarse aggregate = No. 67 (3/4'') as per C33/ C33m (i.e. 4.75 mm to 19 mm)
- Dry rodded density = 1741.2069 Kg /M3
- Water absorption of course aggregate = 1.2 %
- No fine aggregate.

2.3 The trial batch weights per M3 are as follows.

- Cement = 323.4 Kg/M3
- Water = 122.94 Kg/M3
- Aggregate = 1333.956 Kg/M3
- Proportion = Cement: Aggregate = 1: 4.1

2.4 Casting, Curing & Demoulding

The moulds of 150x150x150 Mm were well cleaned and the internal faces were completely oiled to avoid adhesion with the concrete after hardening. The casting was carried out in one layer without compaction. The specimens were demoulded after 24 hours. After demoulding, the specimens were completely immersed in water

3.1 METHODOLOGY

Step1. Identification of problem
In this step we have to 1st identify the problem actually occurring in the rainy season on actual college road

Step2. Data collection and literature review
In this step we collect the information through the internet and books available at the near store

Step3.Material procurement for the experiment
Then actual case study of our college road is made with respect with the actual experiment model for that purpose we have to collect the whatever materials required for the model making experiment

Step4. Mix design and calculations
In the next step we have to make the proper mix design for the college road project and all the calculations are made with the proper formulae and calculations

Step5. Mixing
Then for the experiment actual model making is started for that purpose the optimum amount of materials are taken and segregated in pure form.

Step6. Casting
Then the for the further process of testing process the casting of the all the materials and ingredients are properly mixed together.

Stpe7. Curing and testing
Then the curing of the block is made with the optimum amount of water and after the 28 days the testing of the casted cube is made

4.1 DESIGN

- If we take out all the sand, we need more coarse aggregate.
- To determine how much, take the "dry rodded weight" of the stone and multiply it by 27.
- DRW = 99.5 X 27 = 2686
- Aggregate size can range from:
- #67 (3/4 in. to No.4)
- #89 (3/8 in. to No. 50)
- Too coarse = texture too open
- Too fine = not enough voids
- Narrow gradation = maximum voids

5.1 RESULT ANALYSIS:

The basic permeable concrete pavement system consists of a top layer of porous concrete covering a layer of gravel that covers a layer of uniformly sized aggregate, which is placed on top of the existing soil sub-base. Storm water penetrates the porous concrete and is filtered through the first layer of gravel. The voids in the lower level of large aggregate are filled with runoff. The stored runoff gradually infiltrates into the underlying soil. The factors determining the design thickness of permeable concrete include its desired hydraulic (e.g. permeability and voids contents) and mechanical properties.

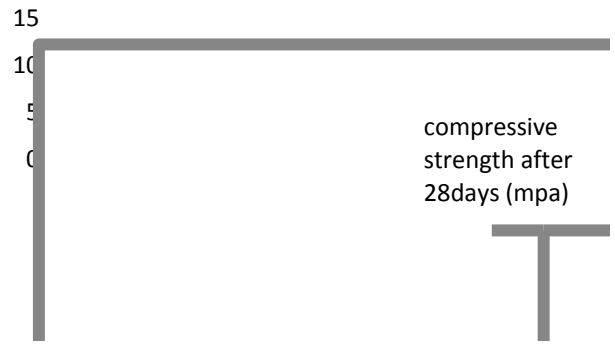

Figure.1. compressive strength on 28 day Curing

6.1 CONCLUSION:

Overall, through its ability to minimize risk to the natural environment on which roads are constructed, particularly in urban areas, permeable concrete has good potential to make a

positive contribution to sustainable road construction and life cycle management. It can meet stakeholder requirements through less impact on the environment on which roads are constructed, and therefore can assist the construction industry to move closer to sustainable construction management. The major issue that needs attention is the need to closely apply quality management to pavement and mix design, and concrete placement. More research is required to better manage its disadvantages, such as the possible potential to clog under certain circumstances and to minimize any leaching effects into the environment from binder material.

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