Water Permeable Road Pavements

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Abstract— Considerable research has been conducted on environmentally sustainable development. This has leads to the use of pervious concrete in place of conventional concrete. Pervious concrete has been used as an effective method for handling and reducing negative environmental impacts. The voids are creates in the concrete for passing the water from concrete, also reducing the problem of water logging and make a road surface skid resistance. There is a analyzing the properties and characteristics of pervious concrete. The performance of pervious concrete was compared with the material used for the construction of concrete road pavements. The analysis was undertaken by comparing the characteristics of the pervious and normal concrete. The tests were conducted to determine the properties of concrete like compression strength, flexural strength and also permeability of concrete. It was found that pervious concrete pavements possesses some positive features like increased skid resistance and high permeability but most importantly it requires the high strength for highly trafficked areas. Pervious concrete has proven to have properties suitable for use in low volume traffic areas. If pervious concrete pavements can be implemented, it will have various positive effects on the environment.

KEYWORDS: Pervious concrete, storm water, urban road, retention ponds, cost.

I. INTRODUCTION

Considerable research has been conducted on environmentally sustainable development. This has leads to the use of pervious concrete in place of conventional concrete. Pervious concrete has been used as an effective method for handling and reducing negative environmental impacts. The voids are creates in the concrete for passing the water from concrete, also reducing the problem of water logging and make a road surface skid resistance.

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It was found that pervious concrete pavements possesses some positive features like increased skid resistance and high permeability but most importantly it requires the high strength for highly trafficked areas. Pervious concrete has proven to have properties suitable for use in low volume traffic areas. If pervious concrete pavements can be implemented, it will have various positive effects on the environment.

II. PROCEDURE FOR PAPER SUBMISSION

A. Review Stage

We are selected our project of water permeable road pavement and we study the details required for the project Like we collect all the information from various research paper and prepare the report.

B. Final Stage

We are casted the blocks and beams and taking various test on that blocks and beams. We are comparing the casted blocks with the conventional blocks. On the basis of that we are finding the advantages and disadvantages of our project in comparison with normal road pavement.

C. Figures

Following figure shows the permeability of water from casted slab.

Figure1: Water Absorbing Concrete.

III. MATERIALS AND METHODS

A. SIEVE ANALYSIS

Sieve analysis is a method of determining the grading of a particular aggregate or a mixture of aggregates. The sieve analysis is carried out in a hand operating sieves to provide a more consistent result and achieve much greater accuracy. The sieves used vary in size but consecutive sieves used are smaller in aperture as you move down the stack. The aggregate was dry sieved due to the large particle size. Before sieving starts the aggregate particles were air dried to ensure that no small particles contaminated the larger sieves and to prevent the smaller sieves from becoming clogged. The aggregate was collected in boxes at the bottom of the pan. Half was discharged and the other half was riffled again. This process was continued until the specifications for sampling were meet and an adequate quantity of material collected for the sieve analysis.

B. CONCRETE TESTS

The tests that we have conducted to provide a complete picture of all the properties of the concrete in both the wet and hardened state. For this reason, it was proposed that the testing incorporate aggregate testing to determine the effect of the aggregate shape on the performance of the previous concrete. This was followed by conducting workability tests like the slump, VEBE and compaction factor tests on the wet concrete sample. The hardened concrete tests proposed for the project were compressive strength and indirect tensile tests, modulus of rupture and elasticity and the skid resistance test. This testing includes determining the void ratio and calculating the permeability of the previous concrete.

C. COMPRESSIVE STRENGTH

The compressive strength tests are conducted to ensure a maximum strength is achieved by the concrete mix. Casted cylinder and cube testing are methods of determining the compressive strength of the prepared concrete. The cylinder testing is as per an Australian Standard for testing compressive strength, while cube testing is as per an British Standard. Both methods of determining compressive strength will be used as it may be easy to achieve a good result when using the cylinders and cubes.

The cube test, due to the method by which it is implemented, should give a more stable test specimen than the cylinders. This test will determine the strength of the concrete sample along the entire length of the sample and eliminate problems occurred with the edge aggregate dislodging or failing. The cube method usually determines a concrete strength increased by 10 and 40 percent in comparison to the equivalent cylinder test.

D. COMPACTION FACTOR TEST

The compaction factor test is used to determine the extent with which the fresh concrete compacts itself when allowed to fall without the application of any external compaction. The compaction obtained from the free falling is compared with the same sample under standard compaction practices (that is 3 layers, each tamped by 25 times). The sample falls from the initial cone and is captured in a second cone. It is then allowed to fall into a test cylinder with a diameter of 150 mm and height of 300 mm.

E. SLUMP TEST

The slump test is a method of testing the fresh concrete for calculating the workability of concrete which is prepared. It is a simple method of determining if different batches of concrete are the same. This is determined if the same constituents in the same proportions do not vary the characteristics of the concrete sample.

The slump is determined by filling concrete in a slump cone with fresh concrete in three layers. For each layer tamping is done 25 times by tamping rod. The slump cone is removed and the vertical subsidence of the fresh concrete sample is measured. Pervious concrete has very little cohesion due to its structure and may collapse on removal of the cone resulting in a poor result with little value.

IV. NON-PAVEMENT APPLICATIONS OF PERVIOUS CONCRETE

Pervious concrete has been used by European countries in many different building situations. It has been utilized for cast-in-situ load-bearing walls in houses, multi-storey and high-rise buildings, as prefabricated panels and steam-cured blocks.

A prominent use of pervious concrete in Europe is in tennis court applications. The only variation from a normal mix is the slightly smaller aggregate used to provide a smoother playing surface. The permeability of the pervious concrete reduces the time taken for water to drain and the surface to be playable.

Water and Power Resources Services in America successfully tested the use of drains and draintiles constructed from pervious concrete under the hydraulic structures. This application made it possible to reduce the uplift pressure on the structures and to drain ground water from beneath infrastructure like sewer pipes.

V. PAVEMENT APPLICATIONS OF PERVIOUS CONCRETE

Pervious concrete pavements were developed after some success with open graded asphalt and their applications in parking lots and service roads. Open graded asphalt is a mix of even graded coursed aggregate, small amounts of fines and a bituminous material. This road surfacing has a relatively high void ratio or porosity normally ranging between 18 and 25 percent.

Parking lots are another application for pervious concrete, made using a pervious concrete wearing course and several underlying permeable layers. The underlying permeable layers consist of three layers varying from a sandy material to a 37 mm aggregate. The primary task of all the permeable layers is to act as a reservoir for retaining water until it permeates into the soil. This is an effective method of controlling water runoff in situations where flash flooding frequently occurs. To eliminates the problems of downstream flooding caused by traditional impervious concrete surfaces and to reduce the runoff.

VI. CONCLUSION

A major difference found was that the pervious concrete deformation is more than the normal sample of concrete before failure. This shows that a pervious pavement has the ability to deform under the loading of traffic. The deformation should not affect the performance of the pavement providing its capacity is not exceeded.

Pervious concrete is a viable material that has the potential to replace the use of normal concrete pavements in situations where heavy traffic is limited, such as car parks, residential streets and driveways. More use may be possible if methods of reducing the raveling that occurs within the top aggregate are found.

The compressive strengths obtained from the different aggregate samples test shows that the shape of the aggregate particles used can significantly affect the strength of the concrete.

The increases skid resistance that the pervious concrete possesses is an extremely valuable characteristic that increases the safety of all road users. Pervious concrete has many positive shows that make its use applicable to society. However, it is in its early stages of development that requires more research before it is readily available and used more widely.

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