

Storm Water Runoff Management by Using Pervious Concrete Pavement

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Abstract— Our topic name is pervious concrete. Pervious concrete is a precise kind of concrete with high shrinkable used for concrete uniform work depletion that allow water from precipitation and thereby reducing the runoff from a site and allowing ground water recharge. At bountiful projects water logging at parking and walkways is the major arise uncommonly during monsoon as pavements and floors are normally impermeable. This results in decent amount of outlay in repairs and providing storm water drain systems, which may get clogged during peak over flow. Besides, there are abundant other problems that arise due to the above. In such situations, it is very crucial to think about an economical solution, which helps in getting rid of all above problems. The best solvent to above problem is pervious concrete. Pervious concrete is habitually used in parking areas, areas with high traffic, walk way in a parks and gardens, residential streets, pedestrian walkways and basketball and volley ball courts etc. Pervious concrete is an important for the viable construction and is one of many low impact growth techniques used by builders to protect water quality.

Keywords: Storm Water, water quality

I. INTRODUCTION

Pervious concrete, which is also called as the no-fines, porous, gap-graded, and permeable concrete. Pervious concrete is a composite material consisting of coarse aggregate, Portland cement, Super - Plasticizer and water. It is separate from conventional concrete in that it contains no fines in the initial mixture, recognizing however, that fines are introduced during the compaction process. The aggregate to be composed of a single size and is bonded together at its points of contact by a paste formed by the cement and water.

In fact, the use of pervious concrete is among the Best Management Practices recommended by the Environmental Protection Agency (EPA) and by other agencies and geotechnical engineers across the country for the management of storm-water runoff on a zonal basis. This pavement technology makes more proficient land use by abolish the demand for retention ponds, swales, and other storm-water management tool.

In execution so, pervious concrete has the potential to lower overall project costs on a first-cost basis. In pervious concrete, delicately restrained amounts of water and cementitious materials are used to make a paste that forms a thick layer on every side aggregate particle. A pervious concrete mixture contains tiny or no sand, creating a substantial void content. Using sufficient paste to layer and tie up the aggregate particles together creates a technique of highly permeable, interdependence voids that drains quickly. Seldom, in the middle of 15% and 25% voids are bring out in the hardened concrete, and flow rates for water through pervious concrete are mostly throughout 480 in./hr. (0.34

cm/s, which is 5 gal/ft²/ min or 200 L/m²/min), even if they can be much higher. Both the low mortar content and high porosity also reduce strength compared to conventional concrete mixtures, but adequate strength for many applications is readily achieved. While pervious concrete can be used for a astonish number of applications, its essential use is in pavement. This details will focus on the pavement function of the material, which also has been bring up to as porous concrete, permeable concrete, no-fines concrete, gap-graded concrete, and enhanced-porosity concrete. Pervious concrete can remove storm water more quickly than traditional concrete such that pervious concrete is a potential solution for eliminating storm water runoff.

However, pervious concrete has diver's restriction preventing widespread application to normal roadways. The Curb of pervious concrete are linked to strength, durability, and maintenance. The forming, placement, and curing of concrete are all done on-site, rather than in a factory under invariable conditions. Even if pervious concrete can be mixed by the identical suppliers and delivered by the identical trucks as dense concrete, its outlandish physical characteristics require a contractor with specified experience. The structural diversity between pervious and impervious concrete call for unlike installation processes, neither of which is more difficult or time-consuming than the other.

II. OBJECTIVES

- 1) Investigate the properties of pervious concrete with 10MM Coarse aggregate and by using plasticizers.
- 2) To help restore ground water supply.
- 3) Reduce pollution of coastal water.
- 4) To pave parking.
- 5) Reduces runoff water.
- 6) Recharge ground water table.
- 7) Reduces risk of flooding and topsoil wash away.
- 8) Optimizing the Compressive Strength.
- 9) Develop pervious concrete suitable for Path Slab application.
- 10) Determine porosity. Studying the properties of Pervious concrete.

III. SCOPE OF THE PROJECT WORK

The design of pervious concrete pavement parking lots is just emerging from the experimental phase. Most pervious concrete pavement users and designers would agree that further research and test demonstration pavement areas must be installed.

- Investigate mix design variants resulting in optimum job mix formula of pervious concrete.
- Conduct permeability tests to investigate porous characteristics.

- Perform acoustical tests to investigate noise-damping characteristics.
- Construct demonstration pilot test sections using pervious concrete mix designs in Kolkata, Kharagpur, and IIT campus to assess for the field performance characteristics.
- Investigate the properties of pervious concrete with 10MM coarse aggregate, and by using plasticizers.
- Optimizing the compressive strength.
- Develop pervious concrete suitable for Path slab application.
- Determine porosity and flow rate.
- Laying procedure for pervious concrete.
- Studying the properties of pervious concrete.
- Study of economic feasibility and benefits of pervious concrete mix designs.
- Organize workshops / short-term courses on pervious concrete pavement designs.
- Review of the pervious concrete mix designs & standards currently being used worldwide.

IV. APPLICATION OF THE PERVIOUS CONCRETE

- 1) Low-Volume Pavements
- 2) Residential roads, alleys and driveways
- 3) Sidewalks and Pathways
- 4) Parking Lots
- 5) Low water crossings
- 6) Tennis courts
- 7) Sub-base for Conventional concrete Pavements
- 8) Patios
- 9) Artificial reefs
- 10) Well linings
- 11) Tree grates in sidewalks
- 12) Swimming pool decks
- 13) Pavement edge drains
- 14) Noise Barriers

V. ADVANTAGES

- 1) Helps in keeping earth below wetter, greener and cooler
- 2) It reduces the rainfall run off
- 3) Eliminates the need of gutters, storm, drains and other rain wetter management practices
- 4) replenishes the aquifers and water table
- 5) Conserve water which otherwise goes to drains
- 6) It is a durable material
- 7) Reduced environmental pollutants
- 8) Rough texture thus avoiding skidding of vehicles
- 9) Stronger and durable for light traffic loads
- 10) Reduced flash flooding

VI. DIS-ADVANTAGES

- 1) Under drain systems needed for low permeability soils
- 2) Increased maintenance requirements over standard PCC
- 3) Non – conventional construction practices
- 4) Use of skilled labour
- 5) Potential of higher failure rate if not adequately

VII. LITERATURE REVIEW

R. Patil researched on Strong and durable pervious concrete mixes for low – volume roads. The effects of two types of fine aggregates, i.e. Crushed stone and river sand, on various properties of pervious concrete were studied. In total 10 different pervious concrete mixes were prepared considering each level of cement content and each type of fine aggregate. In addition steel fiber was used to increase the strength parameter. The effects of such variation on the properties of pervious concrete mixes were studied.

S. O. Ajamul concluded that smaller the size of coarse aggregate should be able to produce a higher compressive strength and at the same time produce a higher permeability rate. The mixtures with higher aggregate / cement ratio 8:1 and 10:1 are considered to be useful for a pavement that requires low compressive strength and high permeability rate. Finally, further study should be conducted on the pervious concrete pavement produced with these material proportions to meet the condition of increased abrasion and compressive stresses due to high vehicular loading and traffic volumes.

Prof J. J. Bhavasar came with the study of the previous concrete pavement in rural areas becomes more suitable to meet the rural are requirement such as to reduce the storm water runoff, to increase the groundwater level, to eliminate the costly storm water management practices. Previous concrete is the relatively new concrete for the pavement construction in rural areas having cost benefits and previous concrete extensively used worldwide because of their environmental benefits, hydraulic and durability properties, this study found that previous concrete mixtures proportions can be optimized for strength, permeability, porosity and freeze-thaw resistance with sand, or sand and fibers.

William Gunter Geode investigated into structural performance and evaluation of the applicability of existing thickness design methods. In this paper he attempts to accomplish two main purposes. The first purpose of this thesis is to examine the structural performance of pervious concrete. This structural performance examination is performed with the goal of showing that pervious concrete may be successfully used as a roadway paving material. After the structural performance characteristics of pervious concrete have been thoroughly investigated, the second purpose of this thesis is to evaluate current thickness design methods for their applicability to pervious concrete.

VIII. RESEARCH METHODOLOGY

After identification of problem and setting the objectives of the research, the research methodology has carefully design to achieve these objectives.

- Collection and study of literature belong to the thesis work.
- Determine the engineering properties of pervious concrete and differentiate them with conventional concrete.
- Cast various trial mixes with varying percentages of pervious concrete and differentiate for the compressive strength.

- Get-ready test samples with the percentage value and test these samples for the various pavements properties.
- To comment on the suitability and curb of pervious concrete with conventional concrete in construction of pavements.

IX. MAINTENANCE OF PERVIOUS CONCRETE

- Vacuuming is the most successful way of cleaning pervious concrete. The fines that accumulate usually stay within the top 1 inch or so of the surface. So pulling them out the top is easier than pushing them further into the pavement.
- Wet is a combination of wetting the surface to loosen the debris and vacuuming at the same time and has been very successful.
- Power washing can be helpful to loosen packed in clay and massive debris. A high psi is not recommended as it can loosen the aggregate on the surface. A low psi will dislodge the packed in material. A thorough vacuuming will need to follow.
- Collect leaves/pinecones etc. after they have fallen. This keeps them from decomposing into the surface.
- Vacuuming the pavement once or twice a year will prevent build up below the surface that is not visible to the eye.
- Manage the immediate landscaping before, during and after pervious paving to prevent soils and mulch from contaminating the pervious pavement after a rain storm.

X. CONCLUSION

The use of pervious concrete in low-capacity road applications has been induce urban developers and contractors due to its various benefits. This paper reviewed the current state-of-the-art correlate to key mechanical and hydro logical characteristics of pervious concrete pavement material. The main objective of this paper was to present the reader with the importance of pervious concrete and its benefits in the context of urbanization. The paper has discussed various characteristics of pervious concrete such as mechanical, hydro logical, durability, field performance, environmental and cost-benefits aspects. Based on the previous studies, it was found that there exist several research gaps in the subject area, as preferable in the future scope of research. These gaps if considered and studied can help in the overall enhancement of the understanding of the material and lead to the development and implementation of design standards for pervious concrete pavements. Overall, the past studies shows that pervious concrete mix is a very reassuring candidate to be used as a pavement material in low-volume roads such as local streets, pedestrian walkways and driveways, and maybe in arterials and highways in future if mechanistic-based design procedures are developed.

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