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study and analysis on water absorbing roads

Raj.P.Kathale[1], Jay.S.Sahahde[2],Rohini.C.Sawane[3], Vaishnavi.P.Kinake[4], Rizwan MD Siraj[5]
Assistant Prof. H.D.Mishra, Department of Civil Engineering, Jagdambha College Of Engineering And Technology, Yavatmal, Maharashtra, India.

Student of B.E., Department of Civil Engineering, Jagdambha College Of Engineering And Technology, Yavatmal, Maharashtra, India.

Abstract - Roads are lifeline of our country as it is the best suitable method for all type of vehicles and most used by common people. The development of any country largely depends on the efficiency of its transportation system, because the transportation of a chain of activities related to economic development Human wants are satisfied by the production of good and its distribution. The road are ordinary type i.e concrete road, WBM road or bituminous road. If we replace these road by water absorbing road (WAR) we can save large quantity of water. Ordinary road constructed in cities majorly face the problem of flooding of road and because it's top layer is impervious. In urban areas larger amount of rainwater ends up falling on impervious surfaces such as parking lots, driveways, sidewalks, and streets rather than soaking into the soil and becomes stormwater.

1 INTRODUCTION

A water-absorbing road, also known as a permeable or porous pavement, is designed to allow rainwater to pass through its surface, preventing water from pooling and reducing runoff. These roads typically consist of materials that have gaps or pores which allow water to infiltrate into the ground below. This can help mitigate flooding, improve water quality by filtering pollutants, and replenish groundwater levels. These roads are often used in sustainable urban planning to manage stormwater effectively.

A water-absorbing road is an innovative infrastructure technology designed to manage rainwater and prevent flooding. These roads are constructed using permeable materials that allow water to pass through and be absorbed into the ground below.

Porous Concrete : Porous concrete also known as permeable concrete or pervious concrete, is a specialized type of concrete that has a high porosity, allowing water to pass through it easily. It is designed to help manage stormwater runoff and reduce flooding by allowing water to infiltrate into the ground, rather than pooling on the surface. Porous concrete is often used in applications such as parking lots, sidewalks, driveways, and other areas where water drainage is important.

Figure 1 Porous Concrete

2 LITERATURE REVIEW

(In 1976). VM Malhotra discussed concrete permeable, when it comes to applications and properties. Provided information on such features as proportions of the material, compatibility and hardening in an attempt to maximize the permeability and compressive strength in concrete permeable. It is believed that the resistance to compression and many other properties of the concrete permeable are dependent on the total ratio of cement and water-cement.

(In 1988), Richard Meininger published the results of laboratory experiments that had transported pervious concrete. The research was conducted on a number of samples is carried out with different material properties..

(In2010), Karthik H. Obla Pervious Concrete: An Overview. Pervious concrete is a special high porosity concrete used for flatwork applications that allows water from precipitation and ,pervious concrete has little or no fine aggregate and has just enough. cementitious paste to coat the coarse aggregate particles while preserving the interconnectivity of the voids.

(In2013), Jayeshkumar Pitroda & J. J. Bhavsar they have studied that on rural area. They said that, perforated concrete is a relatively new concept for Rural Road Pavement. With increase into the ground water level, agriculture problems.

(In 2015), Mr. Gaurav Uttam Shinde & Dr. S. S. Valunjkar, in this paper intentional on Cost and Time Control in Storm Water Management using Pervious Concrete. They study the pervious concrete in metro cities & the previous concrete has introduced in metro cities as a road pavement material. They said that, in metro city pavement pervious concrete is new concept because of problems in urban area related to low ground water table & storm water management.

3 METHODOLOGY

Water-absorbing roads, also known as permeable or porous pavements, are designed to allow water to pass through the surface and be absorbed into the ground, reducing surface runoff and helping manage stormwater. The methodology for creating such roads involves several key steps:

Figure 2 Water absorbing Road

Surface Preparation: The existing road surface is prepared by removing any debris, oil, or pollutants to create a clean and smooth base.

Permeable Material Selection: Permeable materials like porous asphalt, pervious concrete, or interlocking pavers are chosen for the road surface. These materials have gaps that allow water to pass through.

Base Layer: A layer of larger aggregate material is laid as the base to support the permeable surface. This layer provides structural stability and helps distribute the load from vehicles.

Joint Filling: In the case of interlocking pavers, the gaps between the pavers are filled with a permeable joint material like small stones or sand. This helps maintain the permeability of the surface.

Drainage Layer: Beneath the permeable surface, there's typically a layer of aggregate or gravel that serves as a reservoir for collected water before it infiltrates the ground.

Underlying Soil Preparation: The soil beneath the pavement is prepared to allow efficient water infiltration. This might involve loosening compacted soil or creating channels for water to flow.

Stormwater Management: The water that passes through the pavement is managed through a system that directs it into the ground or to storage areas where it can slowly infiltrate the soil.

Regular Maintenance: Regular maintenance is crucial to ensure the longevity and effectiveness of water-absorbing roads. This includes cleaning the surface t3o prevent clogging, repairing any damaged areas, and monitoring the drainage system.

Environmental Considerations: It's important to consider the local environment and hydrology when designing water-absorbing roads. Proper planning can help prevent flooding, erosion, and other issues.

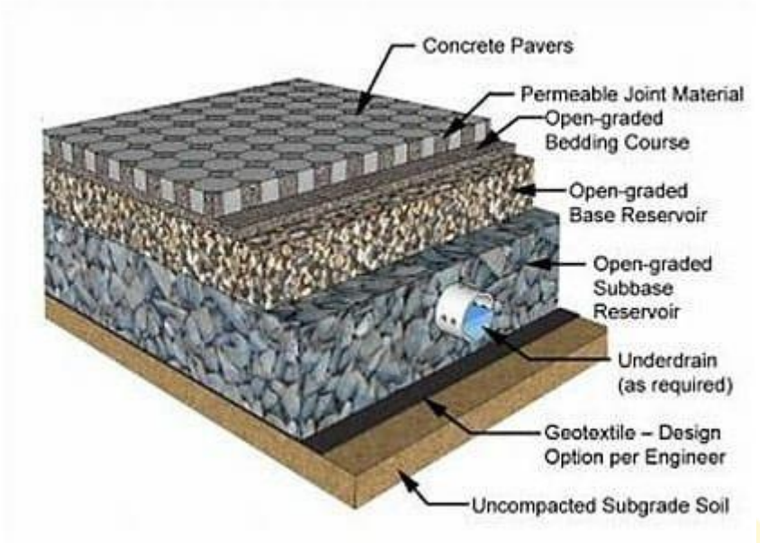

Figure 3 Permeable Paving

Maintenance:

Drain Maintenance: Ensure that any underlying drainage systems remain clear and functional. Remember to follow manufacturer guidelines and local regulations when performing maintenance on permeable concrete surfaces.

Pressure Washing: Periodically use a pressure washer to clean out deeper contaminants from the pores. Keep weeds under control by using a weed killer or pulling them out by hand. Fill cracks with suitable filler to prevent water from seeping in and causing further damage.

Inspect for Damage: Check for cracks or damage and repair them promptly to maintain proper water permeability. The overall maintenance goal for a permeable paving system is to prevent clogging of the voids paces within the surface material.

Annual Maintenance: The exact maintenance schedule can vary based on factors like climate, usage, and local regulations. It's best to consult with a local expert or the manufacturer for specific guidance on annual maintenance for permeable concrete.

4 OBJECTIVE

Water-absorbing roads, also known as permeable or porous pavements, offer several important objectives.

Groundwater Recharge: Permeable pavements enable water to percolate into the soil, replenishing groundwater reserves. This is particularly valuable in regions facing water scarcity or lowered water tables.

Limited Load-Bearing Capacity: While they are designed to handle regular traffic loads, they might not be suitable for high-traffic areas or heavy vehicles.

Improved Water Quality: Water-absorbing roads filter pollutants from stormwater before it reaches groundwater or water bodies. The permeable surfaces and underlying layers trap and degrade contaminants, leading to improved water quality.

Heat Island Reduction: Water-absorbing pavements can reduce the heat island effect in urban areas by evaporative cooling, making the surroundings more comfortable.

Durability: Permeable pavements are designed to withstand heavy loads and can have a longer lifespan compared to traditional asphalt surfaces.

Reduced Effect: These Heat Island pavements can mitigate the urban heat island effect by allowing water to cool the pavement and the surrounding area as it evaporates.

Sustainable Urban Design: Incorporating water-absorbing roads into urban planning aligns with sustainability goals, promoting environmentally friendly and resilient infrastructure.

Longevity and Reduced Maintenance: Properly designed and maintained water-absorbing roads can have longer lifespans compared to traditional pavements, as they are less prone to cracking and deterioration caused by freeze-thaw cycles.

Design Complexity: Proper design and installation are essential to ensure effective performance. Improper installation can lead to reduced permeability and other issues.

5 MATERIALS

Water-absorbing Road materials and steps are innovations aimed at addressing issues related to flooding, water runoff, and surface water accumulation. These materials are designed to absorb excess water, reducing the risk of flooding and improving overall road safety. The steps involved in implementing such materials typically include:

Cement

Being a high strength cement, it provides numerous advantages wherever concrete for special high strength application is required, such as in the construction of skyscrapers, bridges, flyovers, chimneys, runways, concrete roads and other heavy load bearing structures.

Coarse Aggregate

Coarse aggregate was used as a primary ingredient in making the permeable concrete. Larger aggregates provide a rougher surface. Recent uses for pervious concrete have focused on parking lots, low-traffic pavements, and pedestrian walkways. For these applications, the smallest sized aggregate feasible is used for aesthetic reasons. Coarse Aggregates are those that are retained on the sieve of mesh size 4.75 mm. Their upper size is generally around 7.5 mm.

Water

Water to cementitious materials ratios between 0.34 and 0.40 are used routinely with proper inclusion of chemical admixtures, and those as high as 0.45 and 0.52 have been used successfully. The relation between strength and water to cementitious materials ratio is not clear for pervious concrete because unlike conventional concrete, the total paste content is less than the voids content between the aggregates.

Admixture

To create permeable concrete, you can add a variety of admixtures that enhance its permeability. Common additives include water-reducing agents, pozzolans like fly ash, and special aggregates. These components help maintain structural integrity while allowing water to pass through the material. It's important to consult with a concrete professional to determine the right combination of admixtures for your specific project

6 CONCLUSIONS

- Permeable pavement contributes a lot in to ground water recharge. From the experimental results of investigation, the following conclusions can be made.
- Though the pervious concrete has low compressive, tensile and flexural strength it has high coefficient of permeability hence the environmental effects and economical aspects.
- It is evident from the project that no fines concrete has more coefficient of permeability. Hence, it is capable of capturing storm water and recharging the ground water.
- Permeable concrete offers several benefits, such as improved stormwater management, reduced runoff, and decreased flooding risk.
- As a result, it can be ideally used at parking areas and at residential areas where the movement of vehicles is very moderate.

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