PROJECT PHASE- I REPORT

On

DESIGN OF PERVIOUS FLEXIBLE PAVEMENT

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ABSTRACT

The purpose of this project is to study and analyse the application of porous pavements in regions afflicted with heavy rainfall and in-adequate drainage facilities. This caters to the rising issue of Urban Storm water Discharge Management, especially at places in metropolitan cities like parking lots, low volume roadways and infiltration systems.

This study deals in design, construction, hydrological benefits and environmental consideration of full depth asphalt pavement.

Porous Pavements are in demand because they offer site planners and public work officials to manage storm water by using natural water absorption capacity of soil. Its construction neither requires heavy machinery nor skilled labourers which in turn makes a premium cost cut making its implementation a go-to in mega projects like 100 smart cities initiated by the union government.

In India, the monsoon months of June to September account for more than 80% of annual rainfall. Recently, Mumbai – The Financial Capital of our Country experienced over 200mm of rainfall in a matter of 12 hours, which is over 10 days of regular monsoon. This not only disrupted public transport but also became the cause of many deaths. Similar situation arose in the IT capital, Bengaluru, which received record breaking rain in a span of 24 hours. Many parts of city were inundated and vehicles were found floating in the waters.

The integral reason for such a massacre in both the above mentioned cities was found to be poor Urban planning. These cities have developed naturally without the benefit of planned drainage and waste management systems. The drains used to remove rain water are often the same that carries sewage away from the cities. This makes recycling, prevention of floods and quick removal of flood waters impossible.

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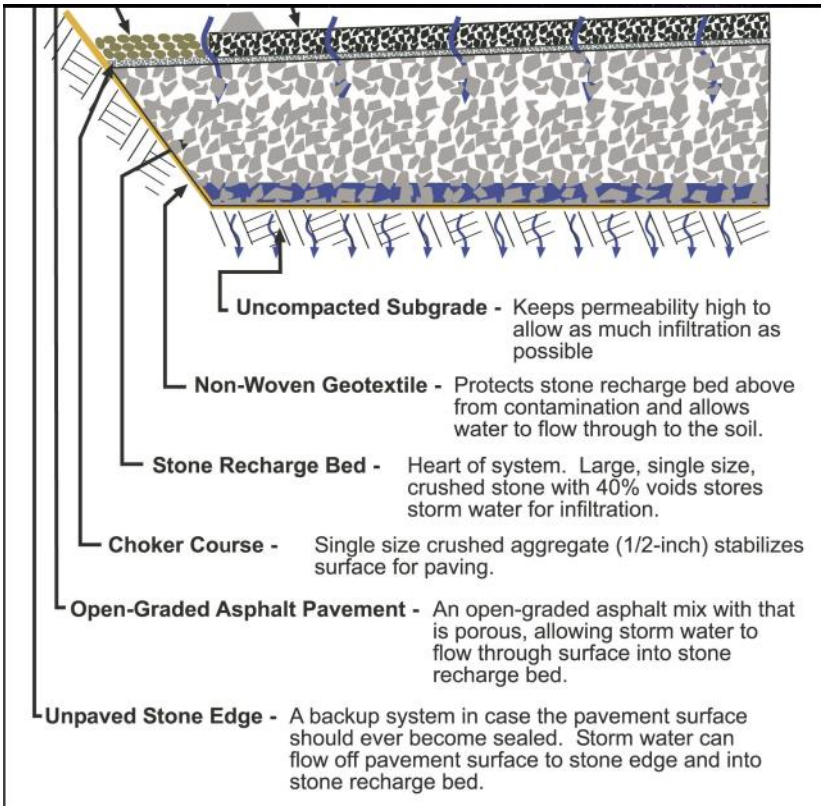
INTRODUCTION

Porous asphalt (PA) is one type of flexible mixture that is design to solve the problem of storm water and rainfall especially at the parking lot and other low traffic density areas. Pervious pavements are sustainable urban drainage systems able to greatly improve storm-water management. These devices allow rainwater to infiltrate through the surface into a storage layer.

Pervious pavements (PP) have normally a somewhat similar structure, consisting of a surface pavement layer, an underlying reservoir layer composed normally of stone aggregates, and usually also a filter layer or fabric installed on the bottom. Besides there are several modifications which can include for instance different kinds of pervious subbase materials, and also water collection pipes, tanks or other systems in connection with more or less impervious layers. PP materials and structures need to be selected and dimensioned for each case taking into consideration all local demands and circumstances.

These pavements permits incipient rainfall and local runoff to flow through the pavement surface course of open graded asphalt mix. Then, it tends to accumulate in a porous base consisting of large open graded gravel from which the water would percolate into the natural ground below.

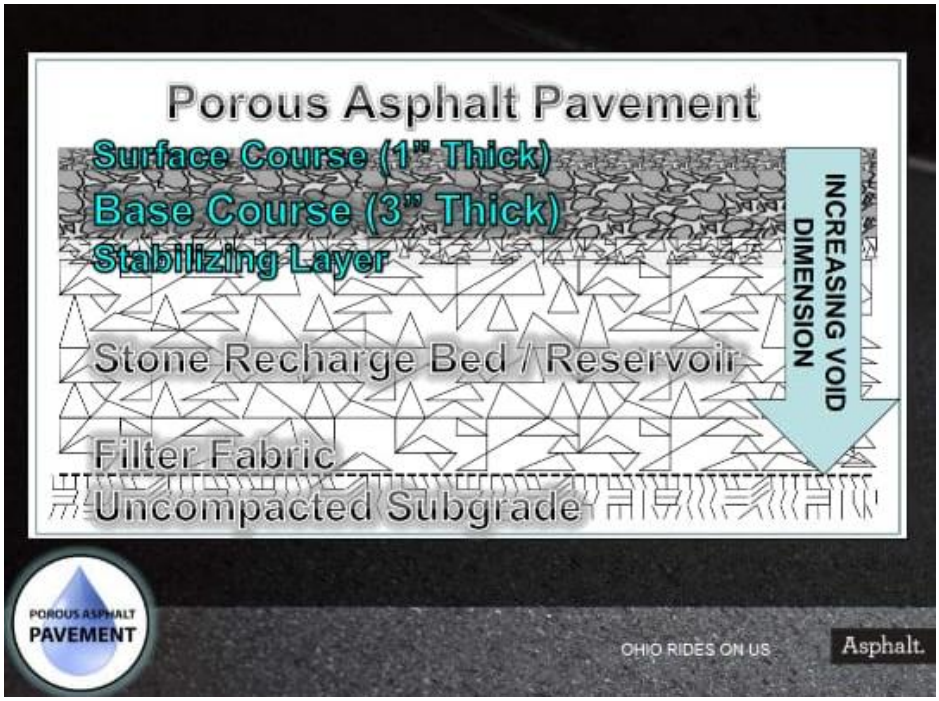
Porous flexible pavement is first created in the 1970s at the Franklin Institute in Philadelphia, Pennsylvania. PP is consisting of the standard bituminous asphalt in which the usage of fine aggregate have been reduced, which allow the water to flow through the asphalt.


Uncompacted Subgrade - Keeps permeability high to allow as much infiltration as possible
Non-Woven Geotextile - Protects stone recharge bed above from contamination and allows water to flow through to the soil.
Stone Recharge Bed - Heart of system. Large, single size, crushed stone with 40% voids stores storm water for infiltration.
Choker Course - Single size crushed aggregate (1/2-inch) stabilizes surface for paving.
Open-Graded Asphalt Pavement - An open-graded asphalt mix with that is porous, allowing storm water to flow through surface into stone recharge bed.
Unpaved Stone Edge - A backup system in case the pavement surface should ever become sealed. Storm water can flow off pavement surface to stone edge and into stone recharge bed.

METHODOLOGY

For the successful development and design of Porous flexible pavement we have decided to follow the following steps:

1. Procurement of Aggregates, Binders, Admixtures and other related equipment and tools.
2. Testing of specific grades of bitumen samples for in depth understanding of its nature and behaviour when subjected to adverse environmental conditions.
3. Selection of various grades and shapes of aggregate suitable for our project.
4. Testing of bitumen samples and aggregates will be according to the “test to be carried” as mentioned.
5. Appropriate grades of bitumen and aggregates are selected for further design procedures.
6. Casting of specimens will be based upon appropriate mix design methods such as Marshall Method.
7. Tests results are analysed to obtain design values such as OBC, VFA, VMA etc.
8. Tests for Strength and permeability are conducted and results are compared with standard results to obtain proper design.
9. Practical application via miniature modelling will be constructed for demonstration purpose.
10. Analysis of various properties of porous pavement is to be conducted.
11. Documentation is prepared.


Porous Asphalt Pavement
Surface Course (1" Thick)
Base Course (3" Thick)
Stabilizing Layer
Stone Recharge Bed / Reservoir
Filter Fabric
Uncompacted Subgrade
INCREASING VOID DIMENSION
POROUS ASPHALT PAVEMENT
OHIO RIDES ON US
Asphalt.

TEST TO BE CARRIED

Binder Tests

1. Penetration Test
2. Softening Point Test
3. Ductility Test
4. Dynamic Shear Rheometer Test
5. Short and Long term ageing Test
6. Direct Tensile Test

Aggregates Tests

1. Percentage Void Content
2. Water Absorption Test
3. Density Test
4. Abrasion Test

Mixture Tests

1. CBR Test
2. Permeability Test
3. Stability Test
4. Indirect Tensile Strength Test (ITS)
5. Binder Drain down Test
6. Repeated Load Indirect Tensile Test (RLITT)
7. Rutting Resistance
8. Compression Test
9. Aging Effects Test
10. Image Analysis

FEASIBILITY STUDIES

1. Urban Storm Water Discharge Management.
2. Ground water Recharge.
3. Integrated Rain Water Harvesting.
4. Prevention from flash flooding.
5. Prevention of coagulation of drainage pipes.
6. Eco Friendly
7. Reduce in Noise levels.
8. Purifies water that penetrates and removes total sediments from water and Also removes pollutants.
9. Faster construction
10. Better loading capacity than porous concrete.
11. Less repair and maintenance required.
12. Reusable up to large extent.

DEMOSTRATION PROJECTS

PROJECT:	Driveway 139ft by 9ft
	(This is the first application of porous pavement Known to us)
AREA	139 ft. by 9 ft.
OWNER:	Frank A. Kutowicz
LOCATION:	Arden, Delaware
INSTALLATION DATE:	Early Summer, 1973(Reported 8/23/73)
SOIL:	Standard Dellaware Clay
AGGREGATE:	9” to 18” of ¾” to 2” stone
PAVING:	2”
FEATURES:	Broken Rubble (Crushed bricks) as a sub base.

PROJECT:	Parking Lot
	(This is the first application of porous pavement in India)
AREA:	85m by 4m
OWNER:	Jaipur Development Authority (JDA)
LOCATION:	Gandhi Nagar Railway Station in Jaipur
INSTALLATION DATE:	October 2012

References

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