

# Pervious Concrete: A Future Road

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## Introduction:

- Flood Fury:** About 1100 people have died due to floods this year which has caused devastation in almost 16000 villages across the country.
- Possible Solution:** A Special type of concrete roads which is able to pass water through its pore whilst maintaining its possible strength and functional properties.
- Possible Applications:** Reduces Storm water runoff, reduces urban heat islands, walkways, Local roads, recharge ground water, pedestrians, low volume or village roads.
- Concrete containing little, if any, fine aggregate that results in sufficient voids to allow air and water to pass easily from the surface to underlying layers

## Basics Properties :

- The void content can range from 15 to 35%
- Typical compressive strengths of 2.8 to 28 MPa
- Percolation rate of 0.65 -1.2 cm/sec
- Pervious concrete consists of 15% to 25% interconnectivity between the voids



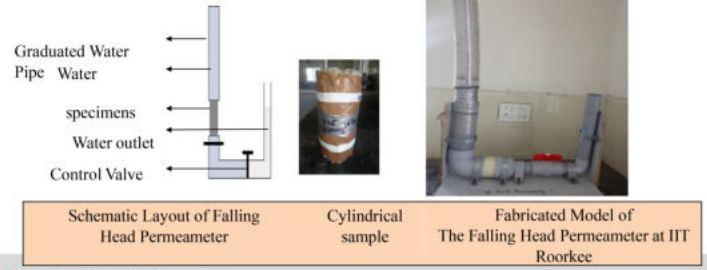
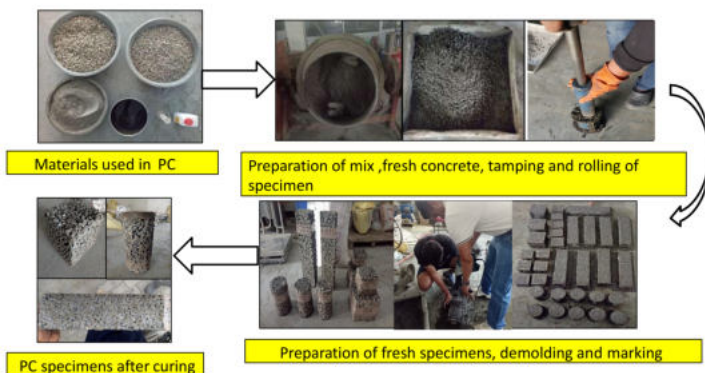
Figure 1. Sample Pervious concrete made in Lab IITR.

## Literature:

YEAR	STUDY PARAMETER	SIGNIFICANT FINDINGS	INVESTIGATORS
2004	Effect of Mix proportion and Aggregate properties on Density of Pervious Concrete	<ul style="list-style-type: none"> <li>Density of PC - 1600 – 2000 kg/m<sup>3</sup>.</li> <li>Compressive strength - 3.5 MPa to 28 Mpa</li> <li>Water Permeability - 0.25 to 4 mm/sec</li> </ul> Performance depends on material properties, its proportioning, porosity and compaction technique.	Tennis et al.
2014	Influence of binder material, aggregate size on the properties of pervious concrete.	<ul style="list-style-type: none"> <li>Water permeability coefficient } Decreased as the binder increased and increased with aggregate size</li> <li>Overall connected porosity } Increased as the amount of binder used increased and decreased with aggregate size.</li> <li>Compressive, splitting tensile and flexural strengths</li> </ul>	Fu et al.
2013	Investigate properties of pervious concrete based on compaction effort	Vertical porosity distribution due to surface compaction revealed greater porosity at the bottom of sample leading to decrease in tensile strength in the lower part of the pavement	Haselbach and Freeman.

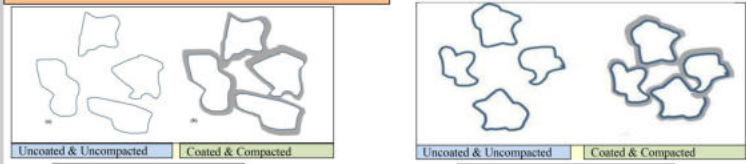
## Methods:

### PREPARATION OF MIX SPECIMENS



## Analysis of Results:

### PORE MORPHOLOGY Vs CEMENT PASTE



- Size of pores is smaller for smaller size aggregate
- 10mm aggregate required relatively less cement paste for coating balance used for filling the intergranular spaces
- Size of the aggregate is responsible for sphericity
- More spherical pores observed in larger size aggregate

## Durability Analysis

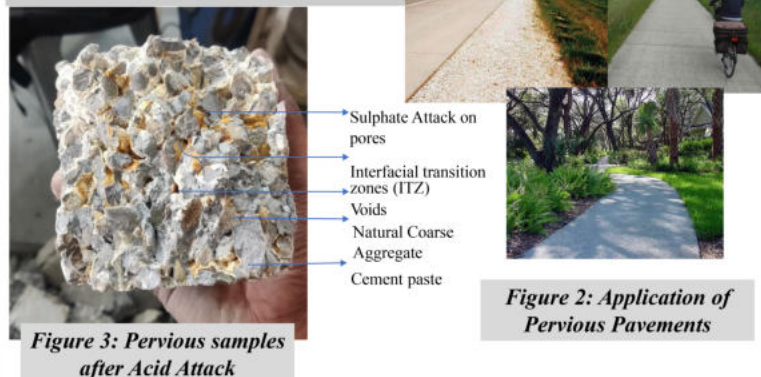


Figure 3: Pervious samples after Acid Attack

Figure 2: Application of Pervious Pavements

## Conclusions:

- Experimental study was aimed at arriving at a control mix having optimum strength and permissible permeability.
- Single size mixes with fines although displayed good strength properties but the pores were choked and led to poor permeability
- Well graded mixes, both large and small aggregate gradation displayed better porosity but lesser strength properties
- At lower w/c ratio, higher proportion of interconnected pores were observed corresponding to structurally weak PC samples
- Binary gradation mix and mixes with fines were less effected by acid attack and abrasion resistance test

Let's change to Pervious Pavements.....

## Paper Publications:

- Sahdeo, S.K., Ransinchung, G.D., Rahul, K.L. and Debbarma, S., 2020. Effect of mix proportion on the structural and functional properties of pervious concrete paving mixtures. Construction and Building Materials, 255, p.119260.
- Sahdeo, S.K., Ransinchung, G.D., Rahul, K.L. and Debbarma, S., 2020. Reclaimed Asphalt Pavement as a substitution for natural aggregates for the production of sustainable pervious concrete pavements. Journal of Material in Civil Engineering. (Under Production)
- Debbarma, S., Ransinchung, G.D., Singh, S. and Sahdeo, S.K., 2020. Utilization of industrial and agricultural wastes for productions of sustainable roller compacted concrete pavement mixes containing reclaimed asphalt pavement aggregates. Resources, Conservation and Recycling, 152, p.104504.

## References:

- Tennis, P., Leming, M., Akers, D., Pervious concrete pavements. Skokie, IL: Portland Cement Association; 2004.
- ACI 2010 Report on Pervious concrete
- Ghafoori, N., Dutta, S., Building And Non pavement Applications Of No-Fines Concrete. Journal of Materials in Civil Engineering, Vol. 7, No.4, November, 1995.

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