Indiana LTAP
Road Scholar Core Course #10
Porous Pavement

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Objectives

- Benefits of Porous Pavement
- Types of Porous Pavement
  - Pavers
  - Concrete
  - Asphalt
- Design Considerations
- Maintenance Considerations
  - Cold Weather Concerns
- Standards
- Example Projects
What is Porous Pavement?

Porous Pavement Surface

Aggregate Base Course
INDOT #5's/ IDOT CA-7

Underlying/Native Soils
Benefits of Porous Pavement
Benefits of Porous Pavement

- Porous pavements allow rainwater to infiltrate into and through the surface unlike traditional pavement

- Benefits of porous pavements
  - Increased stormwater infiltration
  - Decreased surface runoff
  - Improved water quality
  - Reduction in runoff velocity
Types of Porous Pavement
Porous asphalt is standard hot-mix asphalt with reduced sand or fines that permits water infiltration.
Pervious concrete is a concrete aggregate mixture that, when finished, has high permeability characteristics.
Permeable pavers consist of concrete paver bricks that have gaps that are filled with stone chips which allow for the infiltration of stormwater into the sub-base.
## Infiltration Rates of Porous Pavement

Infiltration rates of porous surfaces are crucial for managing stormwater and improving urban water quality. **Borst et al. (2010)** conducted research to determine the observed mean infiltration rates of various porous surfaces. The table below summarizes their findings:

<table>
<thead>
<tr>
<th>Surface</th>
<th>Observed Mean Infiltration Rates (inches/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pervious Concrete</td>
<td>1,575</td>
</tr>
<tr>
<td>Permeable Pavers</td>
<td>945</td>
</tr>
<tr>
<td>Porous Asphalt</td>
<td>80</td>
</tr>
</tbody>
</table>

*Borst et al. (2010)*

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Infiltration rates are typically measured in inches per hour (inches/hr) to understand how effectively water infiltrates through different porous materials, which is essential for urban planning and water management strategies.
Design Considerations

- Underlying soils should have an infiltration rate greater than 0.5 inches/hour

- 10’ setback from down-gradient building foundations

- 100’ setback from up-gradient building foundations

- 100’ setback from potable drinking water wells

- Easements should be considered to allow for future access
Maintenance Considerations

- Routine maintenance is necessary for the long term integrity of the porous pavement.

- Signage identifying the material as porous can help prevent irreversible damage from accidental sealing.

- Material providers can provide specific recommendations:
  - Power washing
  - Street sweeping
Cold Weather Maintenance

- **Snow Removal**
  - Rubber tipped blades
  - Raising blades up to 1”+

- **Deicing**
  - Do not use sand
  - Consult manufacturer before using salt

Source: Morton Arboretum
Morton Arboretum, Lisle, Illinois
Does Porous Pavement work in January?

- Recent studies completed in Toronto, Ontario, New Jersey have all showed that porous pavements still perform during cold weather conditions.

- The Iowa State – National Concrete Pavement Technology Center

  “Well-designed pervious concrete mixes can meet strength, permeability, and freeze-thaw resistance requirements for cold weather climates. Mix No. 4-RG-S7 with air entrainment showed the best freeze-thaw durability, with 2% mass loss after 300 freeze-thaw cycles.”

- Studies have shown a reduction in salt usage with porous pavements.
**Mix Standards**

- **Asphalt Pavement Association of Indiana (APAI)**

  “HMA mixtures for Porous Asphalt Pavements will be Open Graded mixtures designed and produced in accordance with current INDOT Standard Specifications Section 401 as modified by the following exceptions and additions to the specification.”
The curve number or runoff coefficient for permeable surfaces used in the hydrologic analysis is less than the curve number used for impermeable surfaces:

- CN for Impermeable Surfaces = 98
- CN for Porous Pavement can range between 80-98

Using permeable pavements rather than impermeable pavements, could reduce the required stormwater storage volume.

Permeable pavements would also reduce the amount of runoff that would have to be conveyed by the surface water collecting systems thereby reducing the size and cost of these collection systems.
Hydrologic Design Considerations

- If the aggregate base course is situated on permeable soils or have an underdrain that has been properly sized to meet release rate requirements, full credit for the storage can be recognized and credited towards the required stormwater storage volume.

- A porosity value of no greater than 0.36 is suggested when estimating the void space.
A third possible type of analysis is to treat the volume of voids below the permeable surface as a reservoir and evaluate it using a reservoir-routing modeling approach.

\[ I - O = \frac{\Delta S}{\Delta t} \]

- **I** = The inflow rate of water
- **O** = The outlet pipe’s capacity or the rate of water infiltrating into permeable native soils
- **S** = Storage in voids
Example Project- Village of Riverside

- Located in the Village’s Central Business District
- Reduced the volume of stormwater runoff entering the existing combined sewer system and complemented the Village’s historic character
Example Project - Village of Elmwood Park

- Replaced 4 residential alleys that were poorly draining and deteriorating with permeable pavers
Purdue University-West Lafayette Campus

- Porous Asphalt Installations
  - Horticulture Service Drive
  - Beering Drive
  - Black Cultural Center Parking Lot

- Pervious Concrete
  - Armory
  - Marriott Hall
  - Intersection at 3rd Street and Russell

- Permeable Pavers
  - Stadium Mall
  - Hilltop Apartments
  - Crossing the Tracks

Source: Purdue University News
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