Permeable Pavement for Stormwater

MIDS Group, May 18, 2012

Minnesota Pollution Control Agency
• Permeable Pavement Tech Team prepared two drafts of Design Guidance
• Core team members reviewed and commented, out to full team for review shortly
• Wenck team working with Tech Team, MPCA, and Barr to review and comment on guidance and calculator
• Collecting cost data and case studies
• Finalize package for discussion at June meeting
Review of Permeable Pavement Design Guidance

• Developed by Permeable Pavement Tech Team
• Based on guidance from State of Virginia
• Has been initially reviewed by industry leaders
• Comments incorporated into Draft 2
• Today: review key parts of the Guidance
Permeable Pavement

- Porous asphalt
- Permeable interlocking concrete pavement (PICP)
- Pervious concrete
Performance

• Full infiltration – 100% of the runoff volume to 1.1 inch depth is retained; 100% pollutant reduction for that volume

• Partial infiltration – less than 100% is retained; some part is collected and discharged; pollutant reduction depends on volume retained

• Overflow volume from larger events directed into overflow system with no pollutant reduction for that volume
Pervious Concrete Typical Section

- **Pervious Concrete**: Typ. 5 to 8 in. (125 to 200 mm) thick
- **Typ. No. 57 stone reservoir**: thickness varies with design
- **Optional geotextile**: on bottom and sides of open-graded base
- **Soil subgrade**
Porous Asphalt Typical Section

- Optional 3 to 6 in. stone for overflow drainage
- Porous asphalt
  - Min. 3 in. (75 mm) thick
- Choker course
  - 1 in. (25 mm) thick
  - (Typ. No. 57 stone)
- Reservoir layer – thickness varies with design
- Geotextile on bottom and sides of open-graded base
- Soil subgrade
PICP Typical Section

Typ. No. 8 aggregate in openings
Curb/edge restraint with cut-outs for overflow drainage
Concrete pavers min. 3 1/8 in. (80 mm) thick
Bedding course 1 1/2 to 2 in. (40 to 50 mm) thick (typ. No. 8 aggregate)

4 in. (100 mm) thick No. 57 stone open-graded base
No. 2 stone subbase – thickness varies with design
Optional geotextile on bottom and sides of open-graded base

Soil subgrade

MIDS Permeable Pavement Design Specification
Permeable Pavement Volume Retention Calculator

**Pervious Pavement**

\[ V = A_s \times D_o \times n \]

### Required treatment volume (RV) [ft³]

- **Top surface area (A_s) [ft²]**
- **Outflow depth (D_o) [ft]**
- **Media porosity (n) [ft²/ft³]**
- **Volume reduction capacity of BMP (V) [ft³]**

<table>
<thead>
<tr>
<th>Required treatment volume (RV) [ft³]</th>
<th>92</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top surface area (A_s) [ft²]</td>
<td>100</td>
</tr>
<tr>
<td>Outflow depth (D_o) [ft]</td>
<td>7</td>
</tr>
<tr>
<td>Media porosity (n) [ft²/ft³]</td>
<td>0.4</td>
</tr>
<tr>
<td>Volume reduction capacity of BMP (V) [ft³]</td>
<td>80</td>
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</tbody>
</table>

**Volume of retention provided by BMP (BMPV) [ft³]**

- **Volume of retention provided by BMP (BMPV) [ft³]**

| Volume of retention provided by BMP (BMPV) [ft³] | 80 |

**Legend**

- **User input cells**
- **Calculation cells**
- **Constant values**
- **Value obtained from upstream value**
- **Value obtained from another sheet**
- **No data needed**
Site Selection

- **Best candidates:**
  - Low volume residential
  - Alleys
  - Parking lots

- **Best performance with HSG A or B soils**

- **Less successful candidates:**
  - High volume streets, highways
  - Pavement with heavy truck traffic
  - Areas with short turning radius
# Stormwater Management Functions

<table>
<thead>
<tr>
<th>Stormwater Management Function</th>
<th>Full Infiltration</th>
<th>Partial Infiltration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Runoff Volume Retained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Phosphorus (TP) Removal</td>
<td>Composite: 100% for infiltrated volume, minimal for bypassed large event volume</td>
<td>Composite: 100% for infiltrated volume, minimal for bypassed volume</td>
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<tr>
<td>Total Suspended Solids (TSS) Removal</td>
<td>Composite: 100% for infiltrated volume, minimal for bypassed large event volume</td>
<td>Composite: 100% for infiltrated volume, minimal for bypassed volume</td>
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<tr>
<td>Winter Maintenance Impacts</td>
<td>Potential reduction in chloride application for ice control</td>
<td></td>
</tr>
<tr>
<td>Channel Protection</td>
<td>Design additional (optional, as needed) storage in reservoir layer to accommodate larger storm volumes</td>
<td></td>
</tr>
<tr>
<td>Flood Mitigation</td>
<td>Partial. May be able to design additional storage into the reservoir layer by adding base depth storage or by using underground storage chambers.</td>
<td></td>
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</tbody>
</table>
Ongoing Issues

- Agreement on scientific basis of annual volume and pollutant load removal numbers for calculator

- Technical issues:
  - Consistency with wellhead protection guidance
  - Use in sensitive karst areas
  - Post-construction acceptance criteria
  - De-icer use and other maintenance issues
  - Mn/DOT specification development
  - Definitions and language consistency