Porous Pavements & ASCRL

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Asphalt Pavement Association of Michigan
www.apa-mi.org

HMA – Your Best Value
SMOOTH | DURABLE | SAFE | QUIET
Presentation Outline

• Porous Asphalt Pavements
  – What is a Porous Pavement
  – Design and Construction
  – Example Projects

• ASCRL
  – What is ASCRL
  – Design and Construction
  – Example Projects
What are Porous Pavements?

Open-Graded HMA ~ 2 ½ - 4”
½” Agg. (#57) ~ 1 – 2” Thick
Clean Uniformly Graded 2”-3” Crushed Agg. (#2) – 40% Voids
Non-Woven Geotextile
Uncompacted Subgrade

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Porous Applications

• Parking Lots

• Roads
  – on a limited basis

• Recreational Facilities
  – playgrounds, tennis courts, paths, etc.
Typical Porous Pavement

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Keys to Success – Site Conditions

- Soil permeability/infiltration rate
  - EPA recommends 0.5”/hour
  - 0.1”/hour still OK
- Depth to bedrock > 2’
- Depth to high water > 3’
- Fill – not recommended
- Frost
  - Pavement section should exceed frost depth
Soils Investigation

- Borings and/or test pits
  - Test permeability
  - Determine depth to high water table
  - Determine depth to bedrock
Keys to Success - Design

- Slope – limit surface slope to 5%
  - Terrace when necessary
  - Use conventional HMA for steeper slopes
- Avoid piping water long distances
- Spread infiltration over largest area possible
  - 5:1 Impervious: Infiltration
Keys to Success – HMA Design

• **Materials Selection**
  ▪ Aggregates
    ▪ Fine Aggregate Angularity
    ▪ Fractured Faces
    ▪ L.A. Abrasion
  ▪ Binder
    ▪ Stiffness
    ▪ Polymer Modified
    ▪ Fibers
## Keys to Success – HMA Design

### Gradation (APAM Guide)

<table>
<thead>
<tr>
<th>Aggregate Gradation:</th>
<th>Total Passing (% by weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve Size</td>
<td></td>
</tr>
<tr>
<td>(3/4”) 19 mm</td>
<td>100</td>
</tr>
<tr>
<td>(1/2”) 12.5 mm</td>
<td>85-100</td>
</tr>
<tr>
<td>(3/8”) 9.5 mm</td>
<td>55-75</td>
</tr>
<tr>
<td>(#4) 4.75 mm</td>
<td>10-25</td>
</tr>
<tr>
<td>(#8) 2.36 mm</td>
<td>5-10</td>
</tr>
<tr>
<td>(#200) 75 µm</td>
<td>2-4</td>
</tr>
</tbody>
</table>
Keys to Success – HMA Design

- Binder Content 5.0 - 6.5%
- Air Voids ≥ 18%
- Drain down ≤ 0.3%
- Evaluate for Moisture Susceptibility
- Mix Design is required!!!
Keys to Success – Construction

- Build porous pavement last
  - Protect from construction debris
  - Protect from soil laden runoff
- Protect site from heavy equipment
  - Don’t compact subgrade
- Excavate to subgrade (soft footprint)
- Place filter fabric
Keys to Success – Construction

- Place reservoir course 1.5 to 3 in. stone
- Place 1-2 in layer of ½ in stone to stabilize the surface of the reservoir course
- Place porous asphalt course (2 to 4 in.) usually compacted with 2-3 passes with 10 ton roller
Construction Guidelines

- Restrict traffic for 24 hrs.
- Protect porous pavement from contamination.
  - Runoff sediment
  - Construction debris
- Check Permeability
Construction Guidelines

Post Construction

- Inspect for design compliance during storm event.
- Confirm vegetation is established before removing temporary storm water measures
- Do not sand for snow or ice, liquid de-icing compounds may be used.
- Sign for maintenance.
Educational Sign

Permeable Asphalt

The Parking Lot is Full of Holes
The asphalt covering this section of the parking lot is permeable, allowing water to drain through it. Some of the particles usually mixed into asphalt were left out, so that small holes remain in the asphalt pavement. Rain and melting snow drain through these holes down into a layer of gravel.

Why is it Better Than Regular Asphalt?
In a regular parking lot, rainwater runs off the pavement, empties into storm sewers, and ends up in creeks, carrying impurities along with it. Permeable asphalt allows that rainwater to drain directly below the parking lot. This filters particles and slows the flow of water, reducing the flooding of sewers and creeks. Another benefit of permeable asphalt is that it lessens the amount of standing water and ice on a parking lot, making it safer for drivers.

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Maintenance

- Inspect several times first few months & during storm events.
- Inspect annually thereafter.
- Pavement surface may be flushed or vacuumed.
- Damaged pavement can be repaired using dense hot mix (provided <10% area).
Morris Arboretum
Philadelphia, PA
1983
Diagram of infiltration bed at Morris Arboretum
Morris Arboretum
Morris Arboretum

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Ford Rouge Center
Dearborn, MI
2002
Strategy for Water Quality at Ford Rouge Center
Longacre House
Farmington Hills, MI
2007
Farmington Hills

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Washtenaw Community College
Ypsilanti, MI
2007
Washtenaw Community College

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Michigan State University
East Lansing, MI
2009
Michigan State University
Meijer Store
Manistee, MI
2014
Manistee Meijer

Project Location – Manistee

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Manistee Meijer

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Manistee Meijer

Design Focus: Stormwater Quality

- Porous paving
- Catch basin sediment sumps
- Mechanical sediment removal
- Infiltration basins
- Low-velocity discharge
- Maintenance plan
Sylvan Avenue – Ann Arbor

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porous streets !!
Sylvan Avenue – Ann Arbor

Maintenance is Important!

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Willard Street – Ann Arbor

porous streets !!

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Willard Street – Ann Arbor

2016 – 6 years old
Conclusions

- Porous pavements offer good alternative to conventional storm water mitigation
- Site Conditions must be right
- Need to protect pavement from contamination during and after construction
- Properly designed constructed and maintained, will last more than 20 years
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• ASCRL
  – What is ASCRL
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Asphalt Stabilized Crack-Relief Layer (ASCRL)

HMA Overlay

ASCRL
High voids

Old pavement

Subgrade

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Asphalt Stabilized Crack-Relief Layer (ASCRL)
Asphalt Stabilized Crack-Relief Layer (ASCRL)

Subgrade

Old pavement

HMA Overlay, 3.5” – 4”

ASCRL 3” – 3.5”
Asphalt Stabilized Crack-Relief Layer (ASCRL)

MIDHIGAN
DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION
FOR
ASPHALT STABILIZED CRACK RELIEF LAYER

1. Description. Furnish, place and compact an asphalt stabilized crack relief layer (ASCRL) on a prepared pavement base according to the details shown on the plans or as directed by the Engineer. The HMA mixture will be provided according to the requirements of the 2003 Standard Specifications for Construction, except as modified herein.

2. Materials. The aggregate materials used to prepare the ASCRL shall meet the following requirements.

The coarse aggregate shall originate geologically only from natural sources. Crushed concrete or crushed asphalt pavement cannot be used in the ASCRL mixture.

Table 1 Aggregate Specifications

<table>
<thead>
<tr>
<th>Gravel Size (inch)</th>
<th>1 1/2</th>
<th>1</th>
<th>1/2</th>
<th>No. 4</th>
<th>No. 30</th>
<th>No. 200 (LOF) (a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Passing</td>
<td>100</td>
<td>20-100</td>
<td>30-60</td>
<td>10-25</td>
<td>5-15</td>
<td>2-5</td>
</tr>
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</table>

Physical Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Crushed Material, Min. (MTM 117) % (b)</td>
<td>95</td>
</tr>
<tr>
<td>Loss, max., Los Angeles Abrasion (AASHTO T264) %</td>
<td>95</td>
</tr>
<tr>
<td>Soft Particle (max) % (c)</td>
<td>5.0</td>
</tr>
</tbody>
</table>

a. Loss by Washing shall be by MTM 108. Mineral filler may be used to meet the required percentage.
b. The percentage of crushed material will be determined on that portion of the sample retained on all screens down to and including the No. 4 screen.
c. The sum of aggregate particles retained on the No. 4 sieve identified as shale, siltstone, clay minerals, and particles which are structurally weak or are found to be unsatisfactory in service.

d. Mix Design. The Contractor shall provide a mix design in accordance with the criteria herein. The following are the requirements for the testing, documentation, and material samples for a mix design verification. Submittal of the Mix Design and samples shall be made to MDOT.
Asphalt Stabilized Crack-Relief Layer (ASCRL)

Table 1 Aggregate Specifications

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</thead>
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<tr>
<td>Crushed Material, Min. (MTM 117) % (b)                 95</td>
</tr>
<tr>
<td>Loss, max., Los Angeles Abrasion (AASHTO T96) %          35</td>
</tr>
<tr>
<td>Soft Particle (max) % (c)                                5.0</td>
</tr>
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</table>

a. Loss by Washing shall be by MTM 108. Mineral filler may used to meet the required percentage.
b. The percentage of crushed material will be determined on that portion of the sample retained on all sieves down to and including the No. 4 sieve.
c. The sum of aggregate particles retain on the No. 4 sieve identified as shale, siltstone, clay ironstone and particles which are structurally weak or are found to non-durable in service.
Asphalt Stabilized Crack-Relief Layer (ASCRL)

Mix Design

- Asphalt Binder – PG 64-28 with 0.5% liquid antistrip additive
- Asphalt content – 3 to 4%
- Surface Coating – 100% without excessive draindown (max 0.30%)
- Minimum Asphalt film thickness - 9.0 microns
- Moisture sensitivity (AASHTO T283)
Asphalt Stabilized Crack-Relief Layer (ASCRL)

Construction

- Placed in a single layer
- Compaction – steel – wheeled tandem roller (1.0 ton per foot of drum length)
  - Static mode only
  - Minimum of three passes (down and back)
  - Compaction test strip may be required (minimize breakage of Agg.)
Asphalt Stabilized Crack-Relief Layer (ASCRL)

MDOT Projects to Date

<table>
<thead>
<tr>
<th>Project</th>
<th># of Jobs</th>
<th>Length (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCRL</td>
<td>30</td>
<td>148</td>
</tr>
</tbody>
</table>

Started in 1999
- All are performing very well
Asphalt Stabilized Crack-Relief Layer (ASCRL)

MDOT Projects to Date

<table>
<thead>
<tr>
<th>Region</th>
<th># of Jobs</th>
<th>Length (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superior</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>North</td>
<td>10</td>
<td>31</td>
</tr>
<tr>
<td>Grand</td>
<td>8</td>
<td>27</td>
</tr>
<tr>
<td>Bay</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td>University</td>
<td>4</td>
<td>38</td>
</tr>
<tr>
<td>Metro</td>
<td>3</td>
<td>23</td>
</tr>
</tbody>
</table>
Asphalt Stabilized Crack-Relief Layer (ASCRL)

M-21, Before Construction
Asphalt Stabilized Crack-Relief Layer (ASCRL)

M-21, 5 years old
Asphalt Stabilized Crack-Relief Layer (ASCRL)

I-69, 4 years old
Asphalt Stabilized Crack-Relief Layer (ASCRL)

I-69, 10 years old
Asphalt Stabilized Crack-Relief Layer (ASCRL)

I-69BL, 5 years old

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Asphalt Stabilized Crack-Relief Layer (ASCRL)

I-69BL, 11 years old
Asphalt Stabilized Crack-Relief Layer (ASCRL)

M-43, 13 years old
Asphalt Stabilized Crack-Relief Layer (ASCRL)

M-43, 13 years old
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Questions?