Maine Mall Road Porous Pavement

85th NESMEA Conference
October 7, 2009
South Portland, Maine
Project location

- Maine Mall Road, South Portland
- Urban location
- Mixed commuter and commercial traffic
Project Information

- 0.35 miles in length
- AADT – 16,750 vehicles/day
- ESALs – 3,277,700 (20 years)
- Design Hourly Volume – 2412
- Percent Heavy Trucks – 5%
- Drains into South Branch of Long Creek
Why Porous Pavement?

- Long Creek is classified as an Urban Impaired Stream
- EPA Residual Designation Authority (2/09)
  - Require EXISTING development that contributes to the non attainment of water quality standards be regulated
  - Two affected waterways are Long Creek and Charles River in Boston
Long Creek Watershed

Watershed

Stream
Long Creek Watershed

- Total watershed is 2200 acres; 640 acres (28 percent) is impervious
- All landowners with more than 1 acre of impervious surfaces - roofs, parking lots, roads - are regulated
- MaineDOT owns 64 acres of impervious surface within the Watershed
Permit options

- **Individual Permit**
  - Apply water quality practices on all 64 acres regardless of impact on stream

- **General Permit**
  - Participate in Long Creek Watershed Management Plan with other landowners and collectively treat priority areas
Why now?

- American Recovery and Reinvestment Act
  - 100% Federal cost-sharing
- Satisfies part of MaineDOT Regulatory Requirements
- Opportunity to apply porous pavement to a urban highway
Porous pavement

- Proven technology
  - Over 20 years worldwide
  - Applications in colder climates
- Effective water quality treatment
  - UNH Stormwater Center
- Other DOTs – Arizona, Oregon, North Carolina, Minnesota
Water quality advantage

- 3 key criteria
  - Detains Peak Stormwater Flow Rate
  - Pollutant Filtration
  - Temperature Mitigation
Filter Material Layer

- Filters pollutants
- Help mitigate water temperature
- Includes 3 longitudinal runs of 6” perforated UD pipe, with laterals every 120’ (each traffic direction)
- Filter material meets gradation for MaineDOT Type B underdrain sand
Reservoir Stone Layer
<table>
<thead>
<tr>
<th>AGGREGATE REQUIREMENTS</th>
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<tbody>
<tr>
<td><strong>2-1/2”</strong></td>
</tr>
<tr>
<td><strong>2”</strong></td>
</tr>
<tr>
<td><strong>1”</strong></td>
</tr>
<tr>
<td><strong>3/4”</strong></td>
</tr>
<tr>
<td><strong>L.A. Abrasion</strong></td>
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Asphalt Treated Permeable Base
<table>
<thead>
<tr>
<th>GRADATION REQUIREMENTS</th>
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<tbody>
<tr>
<td>37.5 mm</td>
<td>100</td>
</tr>
<tr>
<td>25 mm</td>
<td>95 – 100</td>
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<tr>
<td>19 mm</td>
<td>80 – 95</td>
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<tr>
<td>12.5 mm</td>
<td>35 – 70</td>
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<tr>
<td>4.75 mm</td>
<td>2 – 10</td>
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<tr>
<td>2.36 mm</td>
<td>0 – 5</td>
</tr>
<tr>
<td>0.075 mm</td>
<td>0 – 2.0</td>
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<table>
<thead>
<tr>
<th>AGGREGATE QUALITIES</th>
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<tbody>
<tr>
<td>Micro-Deval</td>
<td>18.0 maximum</td>
</tr>
<tr>
<td>% Fractured</td>
<td>85/80</td>
</tr>
<tr>
<td>Flat/Elongated</td>
<td>10</td>
</tr>
</tbody>
</table>
Mix requirements

- Binder: PG 76-28 with SBS polymer
- Minimum 2% binder
- Micro-Deval: 18.0 max. (composite blend)
- 95 percent coated particles (AASHTO T 195)
- 35 gyration design: looking for specimen that will be stable
<table>
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<tr>
<th>SIEVE SIZE</th>
<th>TARGET</th>
<th>SPEC RANGE</th>
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<tr>
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<tr>
<td>12.5 mm</td>
<td>48</td>
<td>35 – 70</td>
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<tr>
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<td>2.36 mm</td>
<td>3</td>
<td>0 – 5</td>
</tr>
<tr>
<td>0.075 mm</td>
<td>1.3</td>
<td>0 – 2.0</td>
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<tr>
<td>Binder content</td>
<td>2.0</td>
<td>2.0 minimum</td>
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Open-graded Friction Course
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</tr>
<tr>
<td>12.5 mm</td>
<td>85 - 100</td>
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</tr>
<tr>
<td>9.5 mm</td>
<td>55 - 75</td>
<td>85 – 100</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>10 - 25</td>
<td>20 – 40</td>
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<tr>
<td>2.36 mm</td>
<td>5 - 10</td>
<td>5 – 10</td>
</tr>
<tr>
<td>0.075 mm</td>
<td>2.0 – 4.0</td>
<td>2.0 – 4.0</td>
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<tr>
<td>AGGREGATE QUALITIES</td>
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<td></td>
</tr>
<tr>
<td>Micro-Deval</td>
<td>18.0 maximum</td>
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<tr>
<td>% Fractured</td>
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<tr>
<td>Flat/Elongated</td>
<td>5 max.</td>
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<tr>
<td>Sand equivalent</td>
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<td>FAA</td>
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## MIX DESIGN CRITERIA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Criteria</th>
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<tr>
<td>Binder Grade</td>
<td>PG 76 - 28 w/SBS</td>
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<tr>
<td>Binder content</td>
<td>6.0% minimum</td>
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<tr>
<td>Voids @ $N_{des}$</td>
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<tr>
<td>$VCA_{mix}$</td>
<td>Less than $VCA_{DRC}$</td>
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<tr>
<td>Draindown</td>
<td>0.3% max. (AASHTO T 305)</td>
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<tr>
<td>Cellulose fibers</td>
<td>0.3 percent</td>
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<tr>
<td>Gyrations @ $N_{des}$</td>
<td>50</td>
</tr>
<tr>
<td>SIEVE SIZE</td>
<td>TARGET</td>
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<td>------------</td>
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<td>2.3</td>
</tr>
<tr>
<td>Binder content</td>
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Construction specifications

- Track mounted paver
- Minimum air temperature:
  - 50°F - ATPB
  - 60°F - OGFC
- 12 ton static steel or 10 ton oscillatory roller – minimum 3 passes
- Offsite test strip required
- No traffic for 24 hours
Construction specifications

- PGAB 64-28 Asphalt “Tack coat”
- All Construction Joints
  - Must be saw cut or milled unless paved in echelon
- Minimum placement temp of 290 deg. F
- Limited construction activity on ATPB
Test strip

- Used to establish optimum laydown and compaction process
- Test strip supersedes specified equipment and techniques
- Completed strip provides opportunity to evaluate product
Something about white hats....
They make the crew nervous....
Maine Mall Road - Before

- Extremely flat in profile
- Project consisted of mill and overlay sections on each end of the project with porous pavement in the middle section
- Super-elevated turn lanes required carrying surface water to existing catchbasins several hundred feet away, or to the porous section
- Existing granite curb sections limited changes to roadway geometrics and drainage
ATPB Placement

- Track mounted paver caused minimal displacement to ballast stone surface

- Haul trucks displaced the ballast stone and required constant passes with a vibratory roller to keep stone locked

- Paver sonic trackers were erratic over the ballast stone, so were shut off after the first day of placement. Slope control was used to maintain cross slope
ATPB Placement

- Production and Placement Temperatures 290 – 340 deg. F.
- Breakdown roller temperature at approx. 200 – 210 deg. F to minimize lateral movement
- Mixture needed to “stiffen” enough to support compaction equipment
ATPB Placement

- ATPB placed at 7.5 inch and compacted to 6 inch finished depth
- ATPB mixture appeared to exhibit “tender” mix characteristics, with lateral movement if compacted at too high a temperature
- Placement was straightforward with few issues, with the exception of being extremely viscous (sticky)
ATPB Placement

- There was a requirement to keep business access open during the ATPB placement operation.

- Geotextile fabric and temporary mix was placed over the ballast stone and ATPB to maintain business access.
ATPB Placement

- Surface and internal mixture temperatures monitored to determine compaction start

- 12 ton static roller was used as breakdown (approx. 200 – 210 deg.)
- 3-5 ton used as intermediate (approx 140 deg.)

- 10 ton static roller used as finish roller, with 3-5 to iron out any marks left behind
ATPB Placement

- Adjoining lanes placed the same day eliminated the requirement to mill or saw cut transverse or longitudinal construction joints.
- Any construction joints left open were saw cut before continuing the placement of ATPB.
OGFC Placement

- Like the ATPB, the surface and internal mixture temperatures monitored to determine compaction start
  - 12 ton static roller was used as breakdown (approx. 180-210 deg. F)
  - 3-5 ton used as intermediate (approx 140 deg. F)
  - 10 ton static roller used as finish roller, with 3-5 and 1 ton rollers to iron out any marks left behind
OGFC Placement

- Most in road structures raised and paved around with OGFC mixture
- Some structures were set with concrete fill
- Granite curb set and concrete fill placed along the gutter
OGFC Placement

- There was some damage to the ATPB surface due to the granite curb installation operation.
- Damage was not considered severe enough to warrant remedial action, but illustrated the need to keep construction activity to a minimum.
OGFC Placement

- RS-1 emulsified tack coat used around all structures and curbline rather than PGAB 64-28

- All concrete surfaces primed with approx. 0.05 gal/sq yard prior to OGFC placement
OGFC Placement

- OGFC was placed at a 3.75 inch depth, and compacted to 3 inch depth.

- ATPB surface primed with approx. 0.01 gal/sq yard prior to OGFC placement
OGFC Placement

- The mat was uniform, and free of any visual segregation

- The mixture did not exhibit the same “tender” characteristics as the ATPB

- Adjustments were made to the roller pattern and temperature range as the project progressed
OGFC Placement

- Joints were trimmed to a vertical edge while hot, to minimize trimming later.

- All construction joints were tacked with a heavy application of RS-1 emulsion.

- Curb areas and utility structures took extra effort due to the coarse mixture.
OGFC Placement

- As with the ATPB, there was a requirement to keep business access open during the OGFC placement operation.

- This gave the crew the opportunity to “field test” the OGFC and ATPB layers.
Mill and Overlay Sections
12.5mm w/ PGAB 76-28 SBS

- The project was reviewed for drainage issues, and elevations were taken prior to and after the project was milled.
- The project was milled at night. The old surface layer(s) varied in depth from 1.5 to 2.5 inches.
- Areas of delamination were minimal.
Mill and Overlay Sections

12.5mm w/ PGAB 76-28 SBS

- A 9.5mm leveling course using PGAB 64-28 was placed over the milled surface to correct any surface irregularities and drainage concerns.
- Structures were reset to the level course.
- Due to the pavement removal depth being greater than estimated, the surface was changed to a 12.5mm PGAB 76-28 mixture, placed at a 1.5 inch depth.
Overlay Sections

12.5mm w/ PGAB 76-28 SBS

- Production and Placement Temperatures
  290 – 350 deg. F.

- Compaction Temperatures approx. 290+ for breakdown roller

- Pneumatic roller left off until 190+/- surface temp due to tire pick-up issues

- Finish rolled when Pneumatic was off
South Portland - Maine Mall Road
Porous Pavement Field Testing
Questions ?