POROUS ASPHALT: DESIGN AND CONSTRUCTION CHALLENGES & OPPORTUNITIES

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POROUS ASPHALT:
DESIGN AND PERFORMANCE GOALS

1. Properly integrated into site design
2. Permeable wearing course
3. Flexible Pavement Section designed for saturated subgrade conditions
4. Pavement designed to infiltrate 100% of rainfall
5. Pavement depth sufficient to eliminate frost heave
6. *Durable, long lasting wearing course*
7. Constructible Design (materials, sequencing)
8. Prevents or accounts for surface water run-on
9. Provides drainage redundancy (inlet, outlet)
10. Addresses potential storm water flows in subgrade/trenches

November 6, 2014
## POROUS ASPHALT: CONSIDERATION FOR USE

<table>
<thead>
<tr>
<th>Design Consideration</th>
<th>Porous Asphalt</th>
<th>Pervious Concrete</th>
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</thead>
<tbody>
<tr>
<td>Does not require certified installer</td>
<td>X</td>
<td></td>
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<tr>
<td>Can be made in small batches</td>
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<td>X</td>
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<tr>
<td>Cost Effective (initial and life cycle) for High Load/Volume Roads</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Can be used almost immediately</td>
<td></td>
<td>X</td>
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<td>More sensitive to traffic volume/soils</td>
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COKER COURSE GRADATION MISCUES

- Watch for too much aggregate of one size (poorly graded)
- Not enough fracture face
- Too little voids (too much fines)

Nearly 50% of material between $\frac{1}{2}$” and 3/8”
COKER COURSE GRADATION MISCUES

- Result of gradation miscue (poorly graded) on choker course
- Rutting, lack of interlocking
GRADATION CORRECTION

- Correction-added correctly graded material to existing poorly graded material.
- Rutting greatly reduced
- Subsequent areas with strictly correct rock were even better.
AGGREGATE SPECIFICATION-CHART

- Good way to see visually how gradation should look
- Original, poorly graded aggregate is near vertical line
- Replacement material has curve that emulates specification curve
• Check manufacturer's recommendations for placement-middle to top of reservoir course to maximize load spreading
• Can reduce overall section thickness-important for arterials
• Section shown is proposed WSU Puyallup LID Frontage Phase 1 section
• Porous asphalt treated base also helps reduce section thickness
CITY OF PUYALLUP
PROJECTS
8th Ave NW LID Retrofit

- Converted 100% impervious=>100% Pervious
- Porous Asphalt Street
- Pervious concrete sidewalk (south side)
- Permeable Paver sidewalk (north side)
- ROW rain gardens

Design Consideration:
- Edge Constraint?
  - 1' flush curb for 8th Ave NW
  - Porous gravel shoulder for 6th Ave SW & Wilson Loop
  - Barrier curb could be used as well
  - Don’t recommend curb and gutter for new
- Crown?
  - 1% crown on 8th vs. 3% City standard
  - No Crown or 1% cross slope 6th Ave & Wilson Loop
CITY OF PUYALLUP PROJECTS

Wilson Loop (Porous Alley Initiative)

- Replaced HMA section with pervious asphalt section
- Street had failed, frequent complaints
- Frequent ponding on roadway
- Utilized pervious rock shoulders
- Wilson Loop and 6th both holding up well with traffic crossing edge frequently
CITY OF PUYALLUP PROJECTS

6th Ave SW (Porous Alley Initiative)

- Water main replacement drove project
- Frequent street flooding events, adverse grade, no storm drainage
- Replaced HMA section with pervious asphalt section
- Utilized pervious rock shoulders
• Mix used by City of Puyallup is blend developed by PW Streets. Uses a standard 1-1/4” CSBC rock blended with #57 rock.
• CSBC had void content of 12.5%
• #57 rock had void content of 41.3%
• Staff mixes the rock manually at 1:1 ratio
• Used as reservoir course and for porous gravel alleys, shoulders
• Can be used as single rock under porous asphalt, no choker course required—workable surface for pavers
• Creates drivable, firm but porous surface
CONSTRUCTION OBSERVATION KEYS

- Make sure compaction starts within the compaction range specified by the mix design
  - Too Early (too hot) - final mat may not have desired porosity
  - Too Late (too cold) – final mat will not compact to desired density, surface may be uneven, likely candidate for raveling and eventual rutting
- Have some device for measuring asphalt temperature during placement AND know your mix’s compaction temperature range.
CONSTRUCTION TESTING KEYS

• Working on compaction/density specification
• Just now comparing data between Tacoma and Puyallup projects
• Stay tuned for more information
Similar results for voids and density on Puyallup projects

Little less variability, may be due to vibratory compacting on Puyallup projects
CONSTRUCTION TESTING-AHA!

- Air voids is calculated directly from % compaction and RICE of design mix (maximum mix density)
- Target air voids is 16-22%, therefore target density is 78-84% compaction
- To increase pavement durability, suggest that 80-85% compaction be established for field acceptance.
Several owners later, porous asphalt driveway is seal coated.
POST CONSTRUCTION

• Consider installing signage advising unique nature of pavement
• Covenants or other instruments tied to land/title for private developments
MAINTENANCE

- Sweep regularly with regenerative air or vacuum sweepers
  - TOP: Tymco Model 600 Regenerative Sweeper also available with Alternative Fuel option
  - Bottom: Elgin Crosswind Regenerative Sweeper also available with Alternative Fuel option
POST CONSTRUCTION

- Other Concerns/Issues
  - Protection of pavement during building construction.
  - Homeowner/End User care of pavement.
  - Education of maintenance personnel.
  - Utility installations and road way repairs.
CONTACT INFORMATION:

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Questions???
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CITY OF PUYALLUP
PROJECTS
Riverwalk Trail-JEB III Link

• Porous asphalt trail
• Connects to Foothills Trail
• Allows East Pioneer Way storm flows to pass laterally
CITY OF PUYALLUP PROJECTS

Corporate Yards South Entrance

- Pervious concrete entrance, 24’ wide
- Heavy equipment access needed because of sight distance restriction on 39th Ave SE
- Utilized porous alley mix of 1-1/4” blended with #57 rock for reservoir course
- Conservative 12” thick section
POROUS GRAVEL ALLEYS

• Using mix of 1-1/4 and #57 rock

• Allows 2-3 years between maintenance vs. one –two times/year with dense graded

• Inexpensively addresses ponding issues
CITY OF PUYALLUP PROJECTS
39TH AVE SW, 11TH ST SW TO 17TH ST SW

- Pervious concrete roadway & sidewalks
- Standard concrete for intersections
- Overall less cost than HMA
- Construction 2015
CITY OF PUYALLUP PROJECTS
WSU LID FRONTAGE IMPROVEMENT

- Pervious concrete and porous asphalt roadways
- Testing built into design
- Standard concrete for intersections
- Phased Construction starting 2015
CITY OF PUYALLUP PROJECTS
SHAW ROAD, 23RD AVE SE TO MANORWOOD DRIVE

- Pervious concrete roadways and bike track, sidewalks
- Construction projected for 2016