

# WSDOT - Permeable Pavement Issues and Challenges

**Jeff Uhlmeyer**

State Pavement Engineer  
State Materials Laboratory

**Paula Hammond**

Secretary of Transportation

**Dave Dye**

Deputy Secretary

**Steve Reinmuth**

Chief of Staff

Stormwater Learning Cohort  
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**Washington State  
Department of Transportation**

# Senate Bill 5352 (2009)

## Sec. 307. FOR THE DEPARTMENT OF TRANSPORTATION— PRESERVATION—PROGRAM P

- (8) (b) Additionally, the department shall work with the department of ecology, the county road administration board, and the transportation improvement board to explore and explain the potential use of permeable asphalt and concrete pavement in state highway construction as an alternative method of storm water mitigation and the potential effects on highway pavement replacement needs.

# **Definition of a permeable pavement**

**“A special type of pavement that allows rain and snowmelt to pass through it” and “pavement with a void space” (EPA 1999)**

**The permeable pavement replaces conventional impermeable pavement allowing runoff to infiltrate directly into the soil and receive water quality treatment.**

# Types of Permeable Pavements

**Permeable Asphalt**



**Permeable Concrete**



# Permeable Asphalt

- Produced and placed the same as conventional HMA
- Gap graded – aggregate all similar in size - 3/8" maximum
- Asphalt content higher than conventional HMA 8-9%
- Air Voids 15-20%
- Thickness 2-4"





# Permeable Concrete

- Produced like conventional concrete in a ready-mix plant
- Single size aggregate (1" to 1/4 inch) , cement, and water
- Air Voids 14-31%
- Compressive strength 800-3,000 psi
- Permeability 36-364 inches per hour
- Placed by hand (very labor intensive)



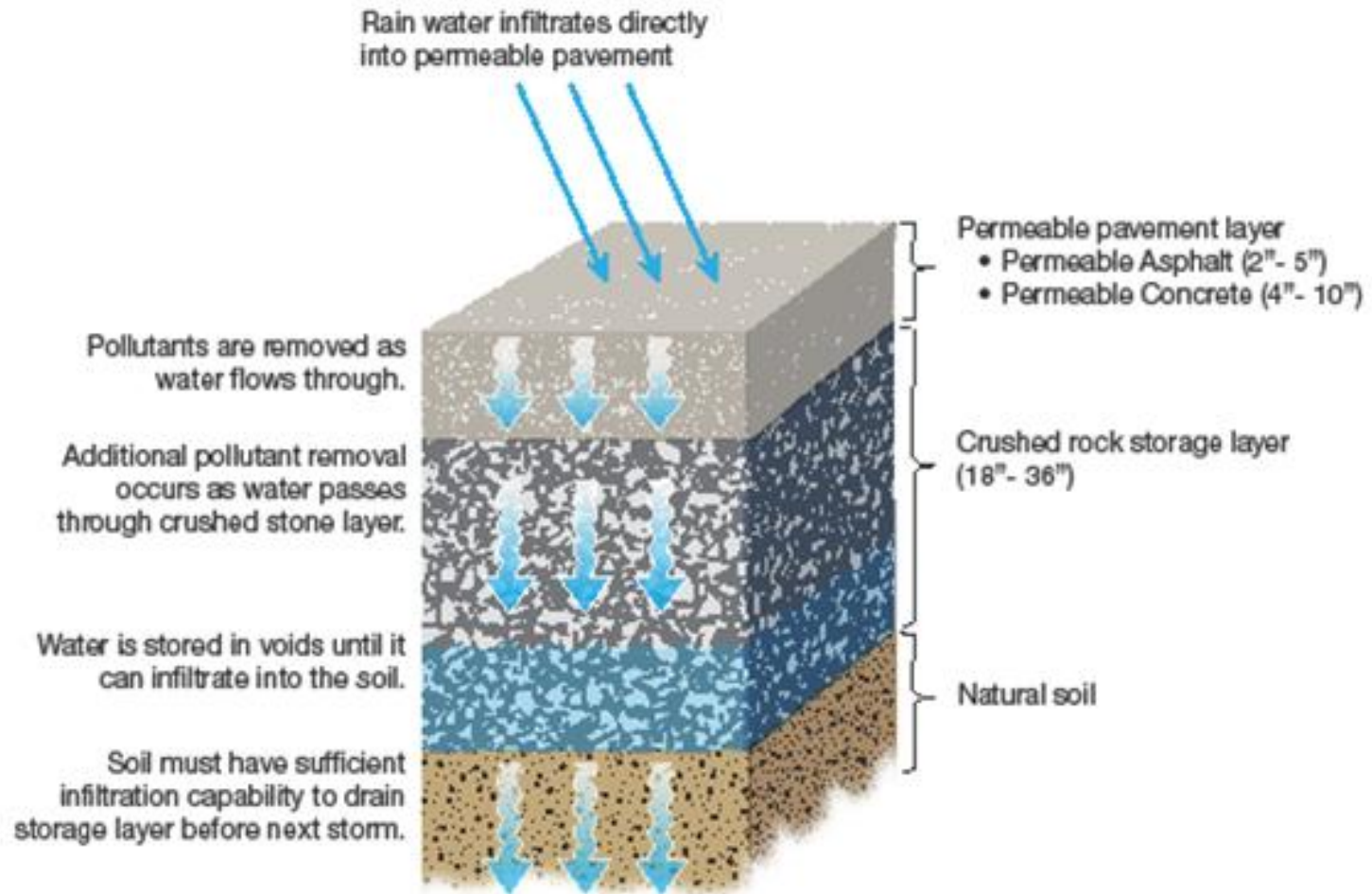
# Two Types of Installations

- Permeable pavement layer over an impermeable pavement
  - Pollutants are removed as water flows through the permeable pavement to the shoulder
  - Used to reduce splash and spray and for quieter pavement
  - Open graded friction courses
  - Permeable concrete overlays (experimental)
  
- Full depth installations
  - Water flows through pavement
  - Allows storage and infiltration of stormwater

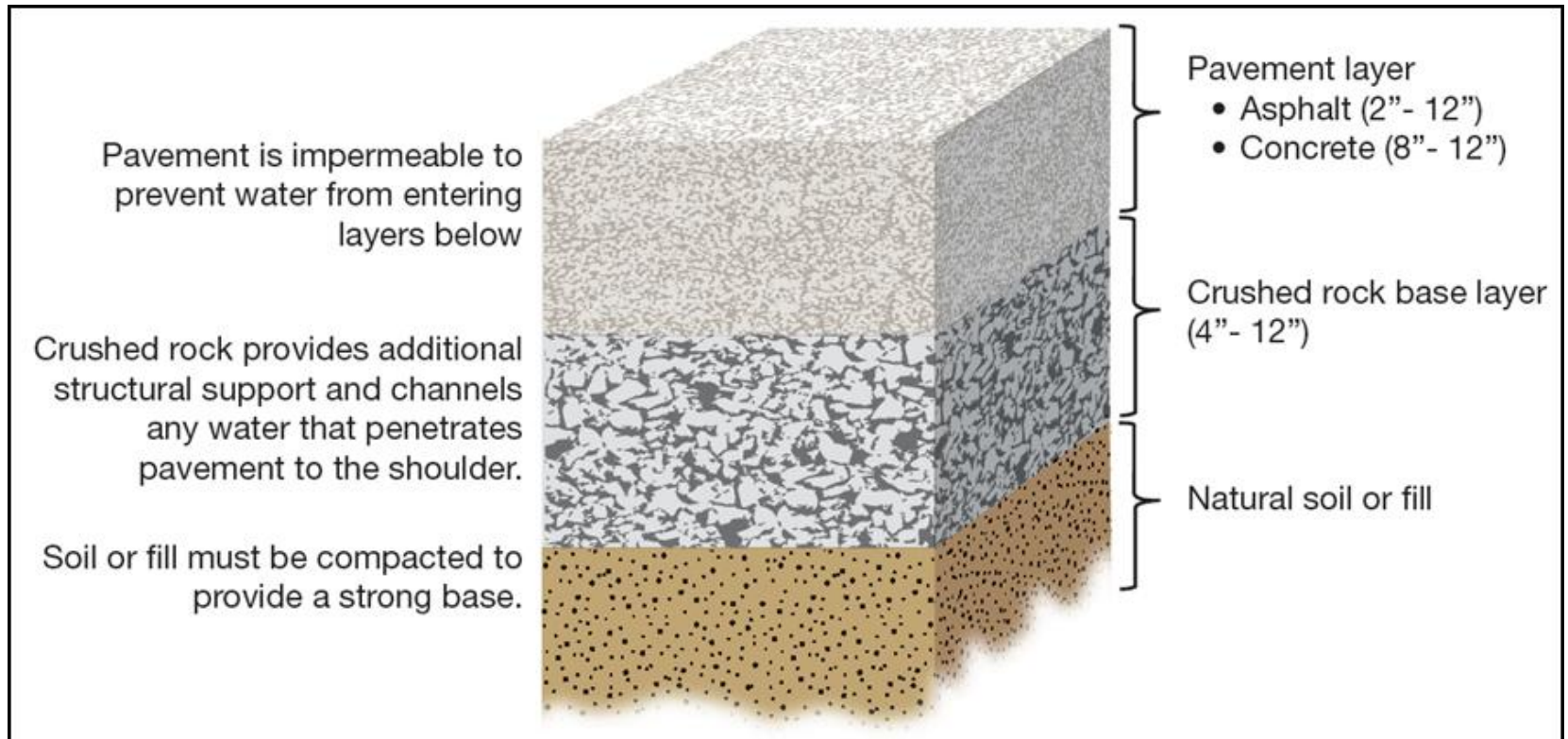




# Permeable Asphalt Cross Section



# Permeable Concrete Cross Section



# **WSDOT Applications**

- Pedestrian sidewalks and trails
- Car parking
- Truck parking
- Light vehicle access areas

# WSDOT Permeable Pavement Layer Thicknesses

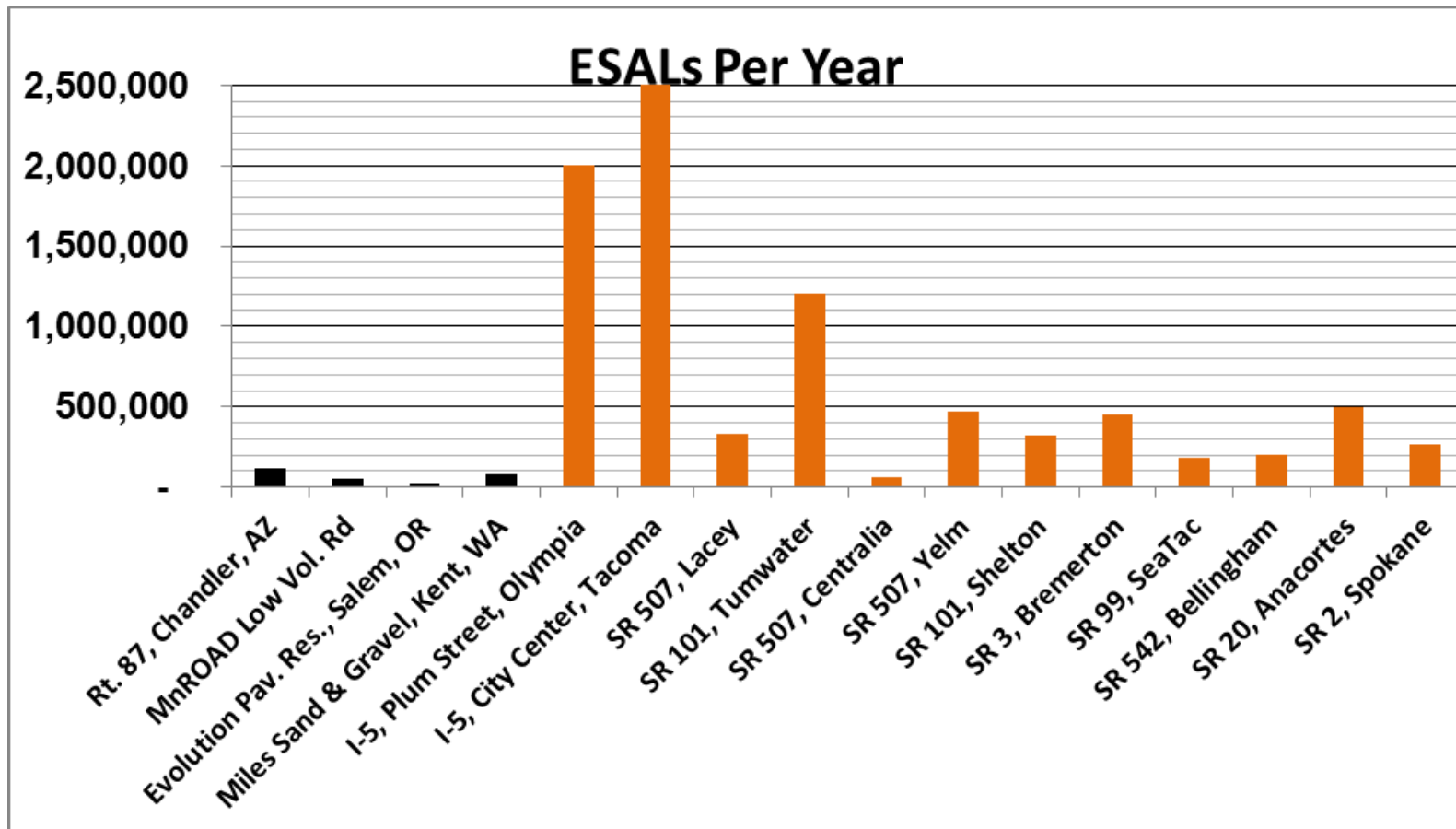
Facility	Flexible	Rigid
• Light Vehicle Access Areas	0.50 ft HMA 0.50 ft (permeable base)	0.75 ft PCC (undoweled) 0.50 ft (permeable base)
• Truck Parking	0.50 ft HMA 0.50 ft (permeable base)	0.75 ft PCC (undoweled) 0.50 ft (permeable base)
• Car Parking	0.35 ft HMA 0.50 ft (permeable base)	0.67 ft PCC (undoweled) 0.50 ft (permeable base)
• Pedestrian Sidewalks and Trails	0.25 ft HMA 0.35 ft (permeable base)	0.35 ft PCC (undoweled) 0.35 ft (permeable base)



# Limitations

- Not suitable for slopes greater than 5%
- Soils must be suitable for infiltration
- High water tables
- Drinking water well setback
- Risk of fuel from vehicles and other toxic chemicals leaching into aquifers
- Risk of clogging over time due to build-up of sediments even if properly designed, installed and maintained
- High volume traffic or heavy loads – unknown performance

# ESAL Comparison – Permeable Installations vs. WSDOT Roadways



# Maintenance

- Periodic inspection and cleaning required
- High-efficiency vacuum sweepers and pressure washers are necessary to remove clogging (street sweepers will not work)
- Runoff carrying sediments or other pollutants must be prevented from flowing onto the permeable pavement
- Potholes and cracks can be filled with patching mixes unless more than 10 percent of the surface area needs repair
- No fog sealing of permeable asphalt allowed

# Use of Permeable Pavement on Shoulders?

- Ongoing discussion within WSDOT . . .
- Caution due to unknown performance
- Need to study structural capacity – fatigue, permeability vs. stiffness and strength
- Soils must be suitable for infiltration
- UC California Davis study currently investigating use of permeable shoulders
- Study consists of open graded concrete on subgrade over membrane, base drainage material, different permeable pavement types
- \$150 to \$200K needed for accelerated pavement testing



# Costs

- Permeable asphalt cost is similar to conventional HMA when the avoided costs of not have to build stormwater systems is added
- Cost for permeable concrete were not found in the literature
- Life cycle cost depends upon initial cost, maintenance cost and pavement life, the later two largely unknown.

# Anacortes Ferry Terminal

- 3000 square feet (20 ft by 150 ft ) of holding lanes 9 and 10
- 8 inches of permeable concrete over 8 inches of shoulder ballast
- Geotextile between subgrade and shoulder ballast
- Bid price for 80 cy of permeable concrete \$23,000 (\$550/cy)



# Olympia North Street sidewalk 1999 & 2008





# Olympia High School parking lot 2008





# Olympia Decatur Street

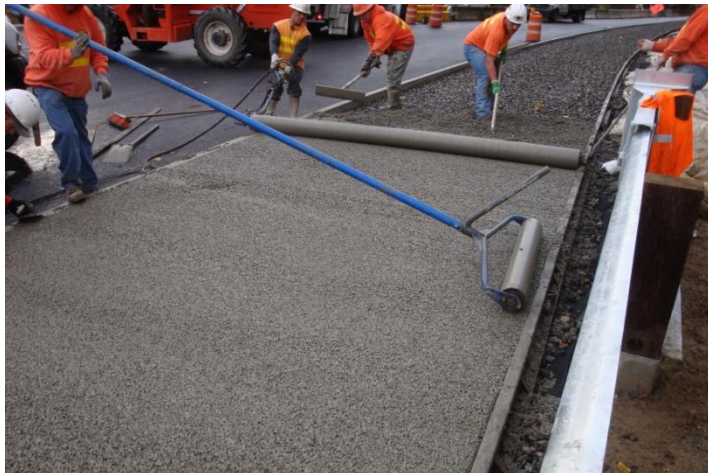


# Port of Portland Auto Parking Lot





# SR-900 south of Issaquah sidewalk 2009



# Pringle Creek Community Salem 2006

