

## 7.1 Permeable Pavements

### 7.1.1 Credits

#### 7.1.1.1 Porous Asphalt or Concrete

##### Description of Public Road or Public Parking lot

##### Model Surface as

#### 1. Base material laid above surrounding grade:

a) Without underlying perforated drain pipes to collect stormwater

Grass over underlying soil type (till or outwash)

b) With underlying perforated drain pipes for stormwater collection:

at or below bottom of base layer

Impervious surface

elevated within the base course

Impervious surface

#### 2. Base material laid partially or completely below surrounding grade:

a) Without underlying perforated drain pipes

Option 1: Grass over underlying soil type

Option 2: Impervious surface routed to an infiltrationbasin<sup>1</sup>

b) With underlying perforated drain pipes:

at or below bottom of base layer

Impervious surface

elevated within the base course<sup>2</sup>

Model as impervious surface routed to an infiltration basin<sup>1</sup>

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<sup>1</sup> See section 7.8 for detailed instructions concerning how to represent the base material below grade as an infiltration basin in the Western Washington Hydrology Model.

<sup>2</sup> If the perforated pipes function is to distribute runoff directly below the wearing surface, and the pipes are above the surrounding grade, follow the directions for 2a above.

Description of Private Facilities (driveways, parking lots, walks, patios)

- |   |   |
|---|---|
| 1. Base material below grade without perforated drain pipes         | 50% grass on underlying underlying soil; 50% impervious |
| 2. Base material below grade with underlying perforated drain pipes | Impervious surface                                      |

*7.1.1.2 Grid/lattice systems (non-concrete) and Paving Blocks*

Description of Public Road or Public Parking lot

Model Surface as

1. Base material laid above surrounding grade

a) Without underlying perforated drain pipes

Grid/lattice systems: grass on underlying soil (till or outwash).

Paving Blocks: 50% grass on underlying soil; 50% impervious.

b) With underlying perforated drain pipes

Impervious surface

2. Base material laid partially or completely below surrounding grade

a) Without underlying perforated drain pipes

Option 1:  
Grid/lattice as grass on underlying soil.  
Paving blocks as 50% grass; 50% impervious.

Option 2:  
Impervious surface routed to an infiltration basin.<sup>1</sup>

b) With underlying perforated drain pipes

at or below bottom of base layer

Impervious surface

elevated within the base course<sup>2</sup>

Model as impervious surface routed to an infiltration basin.<sup>1</sup>

## Description of Private Facilities (driveways, parking lots, walks, patios)

Base material laid partially or completely below surrounding grade

- |  |                          |
|--|--------------------------|
| a) Without underlying perforated drain pipes | 0% grass; 50% impervious |
| b) With underlying drain pipes               | Impervious surface       |

### *7.1.2 Design Criteria for Permeable Pavements*

#### Subgrade

- Compact the subgrade to the minimum necessary for structural stability. Use static dual wheel small mechanical rollers or plate vibration machines for compaction. Do not allow heavy compaction due to heavy equipment operation. The subgrade should not be subject to truck traffic.
- Use on soil types A through C.

#### Geotextile

- Use geotextile between the subgrade and base material/separation layer to keep soil out of base materials.
- The geotextile should pass water at a greater rate than the subgrade soils.

#### Separation or Bottom Filter Layer (recommended but optional)

- A layer of sand or crushed stone (0.5 inch or smaller) graded flat is recommended to promote infiltration across the surface, stabilize the base layer, protect underlying soil from compaction, and serve as a transition between the base course and the underlying geotextile material.

#### Base material

- Many design combinations are possible. The material must be free draining. For more detailed specifications for different types of permeable pavement, see section 6.2: Permeable Paving.
  - Driveways (recommendation):
    - ✓ > 4" layer of free-draining crushed rock, screened gravel, or washed sand.
    - ✓ < 5% fines (material passing thru #200 sieve) based on fraction passing #4 sieve.
  - Roads & Parking lots: The standard materials and quantities used for asphalt roads should be followed. For example:
    - ✓ Pierce Co. cites larger rock on bottom, smaller on top (e.g., 2" down to 5/8"); compacted; minimal fines; 8 inches total of asphaltic concrete and base material.
    - ✓ WSDOT lists coarse crushed stone aggregate (AASHTO Grading No. 57: 1.5 inch and lower); stabilized or unstabilized with modest compaction; meets fracture requirements.
    - ✓ FHWA suggests three layers between the porous pavement and geotextile. Typical layers would be:

Filter course: 13 mm diameter gravel, 25 to 50 mm thick.  
Stone reservoir: 40-75 mm diameter stone.  
Filter course: 13 mm diameter gravel, 50 mm thick.

### Wearing layer

- For all surface types, a minimum initial infiltration rate of 10 inches per hour is necessary. To improve the probability of long-term performance, significantly higher infiltration rates are desirable.
- *Porous Asphalt*: Products must have adequate void spaces through which water can infiltrate. A void space within the range of 12 – 20% is common.
- *Porous Concrete*: Products must have adequate void spaces through which water can infiltrate. A void space within the range of 15 – 21% is common.
- *Grid/lattice systems filled with gravel, sand, or a soil of finer particles with or without grass*: The fill material must be at least a minimum of 2 inches of sand, gravel, or soil. It should be underlain with 6 inches or more of sand or gravel to provide an adequate base. The fill material should be at or slightly below the top elevation of the grid/lattice structure. Modular-grid openings must be at least 40% of the total surface area of the modular grid pavement. Provisions for removal of oil and grease contaminated soils should be included in the maintenance plan.
- *Paving blocks*: 6 inches of sand or aggregate materials should fill spaces between blocks and must be free draining. Do not use sand for the leveling layer or filling spaces with EcoStone.
- The block system should provide a minimum of 12% free draining surface area (area between the blocks).
- Provisions for removal of oil and grease contaminated soils should be included in the maintenance plan.

### Drainage conveyance

Roads should still be designed with adequate drainage conveyance facilities as if the road surface was impermeable. Roads with base courses that extend below the surrounding grade should have a designed drainage flow path to safely move water away from the road prism and into the roadside drainage facilities. Use of perforated storm drains to collect and transport infiltrated water from under the road surface will result in less effective designs and less flow reduction credit.

### Acceptance test

- Driveways can be tested by simply throwing a bucket of water on the surface. If anything other than a scant amount puddles or runs off the surface, additional testing is necessary prior to accepting the construction.
- Roads may be initially tested with the bucket test. In addition, test the initial infiltration with a 6-inch ring, sealed at the base to the road surface, or with a sprinkler infiltrometer. Wet the road surface continuously for 10 minutes. Begin test to determine compliance with 10 inches per hour minimum rate.

## Limitations

- No run-on from pervious surfaces is preferred. If runoff comes from minor or incidental pervious areas, those areas must be fully stabilized.
- Slope impervious runoff away from the permeable pavement to the maximum extent practicable. Sheet flow from up-gradient impervious areas is not recommended, but permissible if porous surface flow path  $\geq$  impervious surface flow path. (Note: Impermeable surface that drains to a permeable pavement can also be modeled as noted above as long as the flow path restriction is met.
- Do not use at “high-use” sites, auto commercial services (gas stations, mini-marts, commercial fueling stations, auto body and auto repair shops, auto wash), commercial truck parking areas, areas with heavy industrial activity (as defined by USEPA regulations), or areas with high pesticide use.
- Soils must not be tracked onto the wear layer or the base course during construction.
- Slopes:
  - Asphalt: Works best on level slopes and up to 2%. Do not use on slopes  $\geq$  5%.
  - Concrete: Maximum recommended slope of 6%.
  - Interlocking pavers: Maximum recommended slope of 10%.
  - Grid/lattice systems: Maximum generally in 5-6% range.
- Do not use in areas subject to heavy, routine sanding for traction during snow and ice accumulation.
- Comply with local building codes for separation distances from buildings and wells. Inquire with the local jurisdiction concerning applicable setbacks.

## Maintenance

- Inspect project upon completion to correct accumulation of fine material. Conduct periodic visual inspections to determine if surfaces are clogged with vegetation or fine soils. Clogged surfaces should be corrected immediately.
- Surfaces should be swept with a high-efficiency or vacuum sweeper twice per year; preferably, once in the autumn after leaf fall, and again in early spring. As long as annual infiltration rate testing demonstrates that a rate of 10 inches per hour or greater is being maintained, the sweeping frequency can be reduced to once per year. For porous asphalt and concrete surfaces, high pressure hosing should follow sweeping once per year.

## **7.2 Dispersion**

### *7.2.1 Full Dispersion for the Entire Development Site (fulfills treatment and flow control requirements)*

Developments that preserve 65% of a site (or a threshold discharge area of a site) in a forested or native condition, can disperse runoff from the developed portion of the site into the native vegetation area as long as the developed areas draining to the native vegetation do not have impervious areas that exceed 10% of the entire site. Runoff must be dispersed into the native area in accordance with the BMPs cited in BMP T5.30 of Volume V - Chapter 5. Additional impervious areas are allowed, but should not drain to the native vegetation area and are subject to the thresholds, treatment and flow control requirements of this stormwater manual.