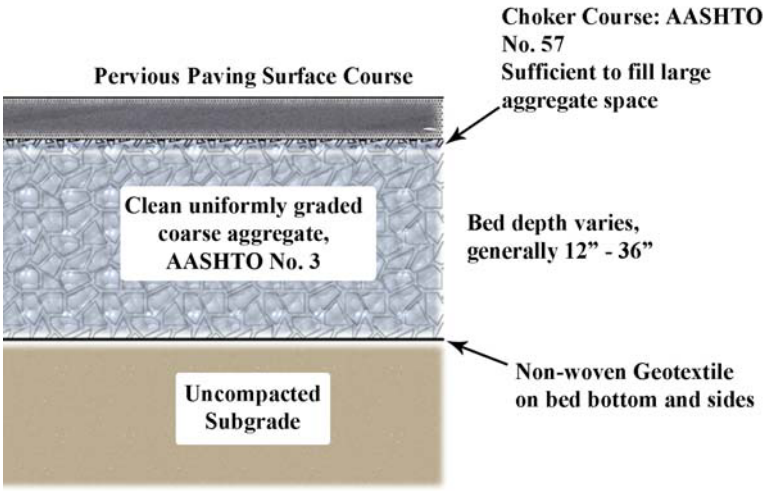
Volume/Peak Rate Reduction by Infiltration BMPs

BMP 6.1: Porous Pavement with Infiltration Bed



Porous pavement consists of a permeable surface course underlain by a uniformly-graded stone bed which provides stormwater management. The surface course may consist of porous asphalt, porous concrete, or various porous structural pavers laid on uncompacted soil.

Key Design Elements

- Surface with significant permeability (> 8" per hr)
- Open-graded subbase with minimum 40% void space
- Surface and stone bed suitable for design traffic loads
- Uncompacted sub-grade
- Underlain by nonwoven geotextile
- Level bed bottoms
- Generally not recommended for traffic surfaces with slope >5%.
- Provide positive stormwater overflow from beds
- Do not place bed bottom on compacted fill; fill with stone, as needed
- Protect from sedimentation during construction
- Line bed with nonwoven geotextile
- Provide perforated pipe network along bed bottom for distribution
- Allow 3 ft buffer between bed bottom and seasonal high ground water table and 2 ft for bedrock
- When possible, place infiltration beds on upland soils

Potential Applications

Residential:	**YES***
Commercial:	**YES**
Ultra Urban:	**YES**
Industrial:	**YES***
Retrofit:	**YES***
Highway/Road:	**LIMITED**

**Applicable with specific considerations to design*

Stormwater Functions

Volume Reduction:	**High**
Recharge:	**Med/High**
Peak Rate Control:	**High**
Water Quality:	**High**

Pollutant Removal

TSS:	**85%**
TP:	**85%**
NO_3:	**30%**

Other Considerations

- **Infiltration Systems Guidelines** and **Soil Investigation Guidelines** should be followed, see Section 6.8.

Description

Porous pavement bed consists of a porous surface course underlain by a stone bed of uniformly graded and clean-washed course aggregate, 1-1/2 to 2-1/2 inches in size, with a void space of at least 40%. The porous pavement may consist of porous asphalt, porous concrete, or pervious pavement units. Stormwater drains through the surface, is temporarily held in the voids of the stone bed, and then slowly exfiltrates into the underlying, uncompacted soil mantle. The stone bed is designed with an overflow control structure so that during large storm events peak rates are controlled, and at no time does the water level rise to the pavement level. A layer of nonwoven geotextile filter fabric separates the aggregate from the underlying soil, preventing the migration of fines into the bed. The bed bottoms should be level and uncompacted. If new fill is required, it should consist of additional stone and not compacted soil.

Figure 6.1-1 Porous pavement at the Morris Arboretum, photo taken during Hurricane Floyd, (CA, 1983)

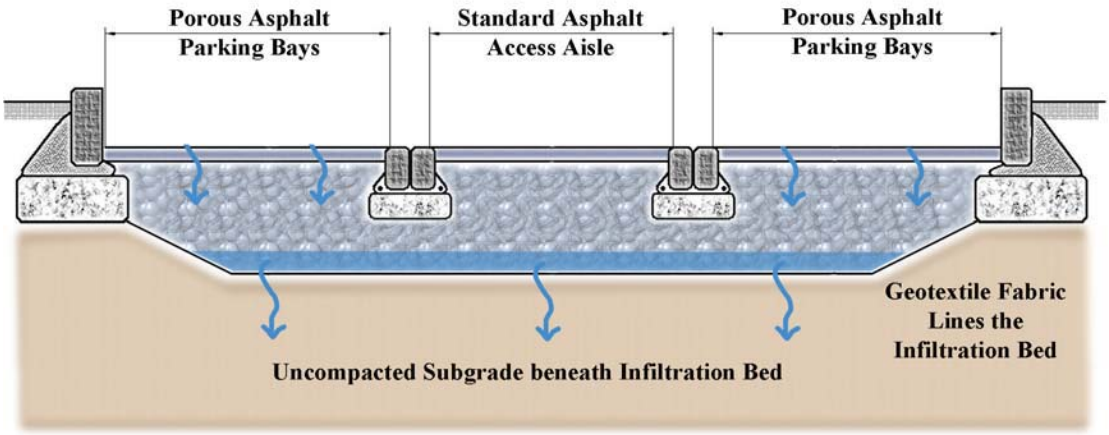


Figure 6.1-2 Cross-section through the Morris Arboretum parking lot, (CA, 2004)

Porous pavement is well suited for parking lots, walking paths, sidewalks, playgrounds, plazas, tennis courts, and other similar uses. Porous pavement can be used in driveways if the homeowner is aware of the stormwater functions of the pavement. Porous pavement roadways have seen wider application in Europe and Japan than in the U.S., although at least one U.S. system has been constructed. In Japan and the U.S., the application of an open-graded asphalt pavement of 1" or less on roadways has been used to provide lateral surface drainage and prevent hydroplaning, but

these are applied over impervious pavement on compacted soil-grade. This application is not porous pavement.

Properly installed and maintained porous pavement has a significant life-span, and existing systems that are more than twenty years in age continue to function. Because water drains through the surface course and into the subsurface bed, freeze-thaw cycles do not adversely affect porous pavement.

Porous pavement is most susceptible to failure difficulties during construction, and therefore it is important that the construction be undertaken in such as way as to **prevent**:

- Compaction of underlying soil
- Contamination of stone subbase with sediment and fines
- Tracking of sediment onto pavement
- Drainage of sediment laden waters onto porous surface or into constructed bed

Staging, construction practices, and erosion and sediment control must all be taken into consideration when using porous pavements.

Studies have shown that porous systems have been very effective in reducing contaminants such as total suspended solids, metals, and oil and grease. When designed, constructed, and maintained according to the following guidelines, porous pavement with underlying infiltration systems can dramatically reduce both the rate and volume of runoff, recharge the groundwater, and improve water quality.

In northern climates, porous pavements have less of a tendency to form black ice and often require less plowing. Sand and gravel should never be used on porous pavements, although salt may be used on porous asphalt, and commercial deicers may be used on porous concrete. Porous asphalt and concrete surfaces provide better traction for walking paths in rain or snow conditions.

Figure 6.1-3 Standard pavement and porous pavement look very similar

Variations

Porous Bituminous Asphalt

Porous asphalt pavement was first developed in the early 1970's by the Franklin Institute in Philadelphia and consists of standard bituminous asphalt in which the fines have been screened and reduced, allowing water to pass through very small voids. Porous asphalt is placed directly on the stone subbase in a single 3 ½ inch lift that is lightly rolled to a finish depth of 2 ½ inches.

Because porous asphalt is standard asphalt with reduced fines, it is similar in appearance to standard asphalt. Recent research in open-graded mixes for highway application has led to additional improvements in porous asphalt through the use of additives and binders. Porous asphalt is suitable for use in any climate where standard asphalt is appropriate.

Figure 6.1-4 Porous asphalt parking lot at the Hockessin Library, Delaware (CA, 1991)

Figure 6.1-5 Porous asphalt parking lot at the University of North Carolina, Chapel Hill (CA, 2001)