Best Management Practices Fact Sheet

Porous Asphalt

A close up comparison shows the difference in void space between conventional and porous asphalt.

PURPOSE: Porous asphalt used in place of traditional impervious paving materials decreases the total amount of runoff leaving a site, promotes infiltration of runoff into the ground, reduces the amount of pollutants carried to a storm drain or waterway, and aids with reducing peak runoff velocity and volume.

Developing land for residential, commercial and industrial use carries the detrimental effect of vastly increasing the amount of impervious surface area as land is paved to create roads and parking lots. During a storm, runoff flows over impervious pavement, picking up pollutants such as dirt, grease and oil, and transports these contaminants to streams and storm sewer systems.

In response to this issue, designers developed porous paving systems that allow runoff to pass through the pavement into a stone base, then into the soil below to recharge the groundwater supply. With proper installation and maintenance, porous paving allows for infiltration of up to 80% of annual runoff volume. Additionally, studies indicate that porous paving systems can remove between 65 and 85 percent of undissolved nutrients from runoff and up to 95% of sediment from runoff.

The design for application of porous asphalt consists of at least four layers: a two to four-inch layer of asphalt, a one to two-inch filter layer of half-inch crushed aggregate, a 12-inch minimum reservoir layer of one to three-inch aggregate, and a layer of geotextile material. Porous asphalt consists of standard bituminous asphalt in which the fines have been screened and reduced, creating void space to make it highly permeable to water. The void space of porous asphalt is approximately 16%, as opposed to two to three percent for conventional asphalt. Porous asphalt itself provides for some pretreatment of runoff. The crushed aggregate filter layer aids with pollutant removal and provides stability for the stone reservoir layer during application of pavement. Treated runoff is stored in the reservoir bed, a highly permeable layer of open-graded clean-washed aggregate with at least 40% void space. Nonwoven geotextile material placed between the reservoir bed and uncompacted subsoil prevents the migration of fines into the stone reservoir, which could clog the system. The treated water then percolates through the uncompacted soil base to recharge the groundwater supply.

Porous asphalt is applicable to many uses, including parking lots, driveways, sidewalks, bike paths, playgrounds and tennis courts. With proper maintenance, including regular vacuuming of the surface to prevent clogging by sediment, porous asphalt can have a minimum service life of 20 years.

VARIATIONS: Installing a berm at the edge of porous paving keeps off-site runoff and sediment from entering the porous paved surface area, which prevents clogging. Roof leaders may be connected to the system via an inlet that uses a water quality insert. A subsurface drain may be incorporated into the design of the stone reservoir to collect water and route it to a detention or infiltration basin.

NOTE: Porous paving materials are not effective at removing dissolved nutrients from water; therefore, they should be installed at least 100 feet from drinking water sources. Pre-treatment of runoff is recommended where oil, grease or other groundwater contaminants are expected.

Benefits and Uses

- Filters contaminants from runoff prior to its discharge to the storm sewer system
- Reduces peak velocity and volume of stormwater runoff delivered to storm sewer system
- Can alleviate flooding downstream
- Applicable to all types of sites (residential/commercial/industrial)
- Recharges groundwater supply
- Reduces total amount of impervious cover
- Allows for land use in areas that otherwise would not meet stormwater retention guidelines
- Requires less need for curbing and storm sewers
- Provides better traction in icy conditions than traditional asphalt

Additional Resources

PA Department of Environmental Protection
- www.dep.state.pa.us
- Pennsylvania Stormwater Best Management Practices Manual

US Environmental Protection Agency
www.epa.gov

Cahill Associates
www.thcahill.com - click on “Technologies” for project examples and general information

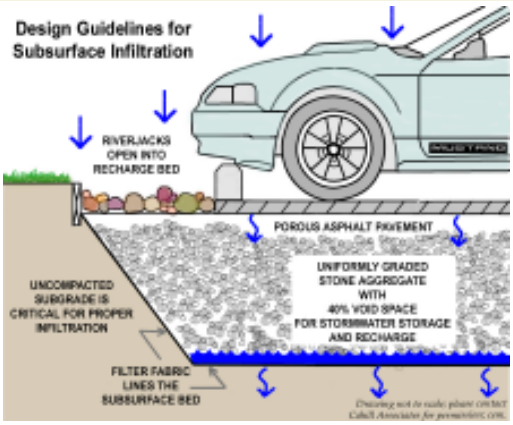

Diagram courtesy of Cahill Associates

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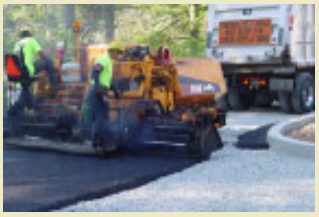
Proceed with Caution!

Though permeable paving materials have been in existence since the 1970's, their implementation has been slow, due predominantly to unfamiliarity with correct procedure, leading to faulty installation, and a subsequently high rate of failure. However, with proper installation and maintenance, these systems can be very effective and long-lasting. Key design factors to ensure optimum pollutant removal and longevity include:

- Placement in areas with highly permeable soils; if underlying soil is damp, microbiological decomposition of pollutants may be impeded
- Existence of organic material in soil
- Vacuum sweeping on a quarterly schedule
- Use in low-density parking areas
- Restrictions on use by heavy vehicles
- Limited use of de-icing chemicals
- Inspection and enforcement of specifications during construction
- Pretreatment of runoff to paved area
- Implementation of a sediment control plan
- Extending the depth of reservoir level to below the frost line to prevent subgrade from frost heave

1. *(above)* Site is excavated.

3. *(above)* Stone is spread and graded level.



5. *(above)* Asphalt is laid.

6. *(right)* Silt fence borders area to protect asphalt from debris and sediment.

Porous Asphalt Installation

2. *(above)* Nonwoven geotextile material is laid over excavated area.

4. *(above)* Stone is rolled.

General Design Considerations

- Design of system should consider expected type and frequency of usage
- Test soil 4 feet below base of stone reservoir for permeability of at least 0.5 inch per hour
- Porous surface permeability should be at least 8 inches per hour
- Suitable for drainage area of less than 15 acres
- Existing soil base must be level to prevent ponding under the system
- Avoid compaction of soil base; if new fill is required, the addition of stone is recommended over adding compacted soil
- Use light equipment with tracks or oversized tires during grading to prevent compaction of the soil base
- Install at least 4 feet above the seasonal high groundwater table to avoid contamination
- Design should include overflow drainage to remove excess stormwater
- Perforated pipe placed in the stone bed will distribute runoff evently throughout the bed, and may provide additional storage volume, depending on the size of pipe
- Stone reservoir layer is placed in lifts and lightly rolled
- Stone bedding layer should drain within 72 hours of a rain event
- Slope of pavement surface should be less than 5%
- Aggregate for reservoir bed should be approximately 1 to 3 inches in diameter
- Aggregate for reservoir must be clean-washed and contain at least 40% void space
- Reservoir layer is typically 12 to 36 inches deep
- Place porous asphalt directly on stone bed in a single 3.5 inch lift then roll to a finished depth of 2.5 inches
- Use 85 to 100% penetration grade to prevent surface from being scuffed by vehicle wheels
- Temperature of asphalt should be between 240 and 260°F
- Air temperature during paving must be at least 50°F
- Not suitable for areas of recent fill (less than 5 years)
- Roll asphalt when it has cooled enough to withstand a ten-ton roller
- Compact surface layer with one or two passes of roller; more frequent rolling can reduce infiltration capacity of pavement
- Control of sediment is critical - remove surface sediment with a vacuum or by sweeping; avoid power washing, as it will clog the system
- Prohibit use of sand, salt or other de-icers that may clog system
- Design must provide for a backup method for water to enter stone reservoir (ex. stone-edged drain near wheel stop if curbing is not in place)
- May not be suitable for "stormwater hot spots" (truck stops, gas stations, etc.) due to high level of contaminants present
- Use snow plows with caution during snow removal
- Not recommended for installation in areas of high traffic or heavy vehicle loads
- Not recommended in areas where wind erosion supplies significant amounts of windblown sediment
- Protect pavement from vehicular traffic for at least two days after installation
- Post signs to prevent vehicles with muddy tires from entering area
- Potholes and cracks may be patched with traditional patching mix, unless more than 10% of porous surface area needs to be repaired