



[Home](#) [About](#) [Sponsors](#) [Contact](#)

Search

Advanced Search

TOOLBASE RESOURCES : [TECHNOLOGY INVENTORY](#) [FIELD EVALUATIONS](#) [TECHSETS](#) [NEWSLETTERS](#)

[Search Technologies](#) [Submit a Technology](#) [About the Technology Inventory](#)

Home > Technology Inventory > View All Technologies

[email page](#) [print](#)

[Back to Search Results](#)

Browse by Building System
Appliances

GO >

[View All Technologies](#)

Symbol Legend

Permeable Pavement

Pavement system that allows water to seep through the surface, permitting natural filtration

[Details](#) [Manufacturers](#) [Testimonials](#) [Resources](#) [CAD Details](#)

[Summary](#)
[Installation](#)
[Warranty](#)
[Benefits/Costs](#)

PATH
Attributes:
[Ease of Implementation:](#)



[Initial Cost:](#)
[Operational Cost:](#)
[Field Evaluations:](#)
[Code Acceptance](#)

NR
N/A

Summary

Just as drinking water can be filtered to remove impurities, the soil particles filters rainwater percolating through soil on its way to surface waters and to groundwater aquifers, This important step in the natural process of water purification is bypassed when rainwater falls on impermeable pavement surfaces or roofs and is carried directly through storm drainage systems into waterways. Since engineered curb and gutter storm drainage systems are costly to design and build, use of permeable pavement systems can also result in a reduction of construction costs for developers or municipalities. Pervious pavements are also denoted as porous or open-graded pavement.



Pollution carried in rainwater runoff is another concern, especially in urban areas. Storm water flowing across streets and sidewalks picks up contaminants associated with air pollution particles, spilled oil, detergents, solvents, de-icing salts during freezing conditions, dead leaves, pesticides, fertilizer, and bacteria from pet waste. Natural filtration of water through soil is the simplest way to control these pollutants, and is a direct advantage of permeable pavement.

There are many options for permeable pavement materials:

Porous Asphalt: A great advantage to porous asphalt is that the same mixing and application equipment is used as for impervious asphalt. Only the formula for the paving material changes with porous bituminous pavement. For more details on the various layers of materials see, the [Pennsylvania Stormwater Management Manual Porous pavement specification](#) used by the City of Seattle Washington Park Department. The amount of asphalt binder required is about 6% by weight which is somewhat higher than required for standard impermeable asphalt mixes.

Bituminous permeable paving is appropriate for pedestrian-only areas and for very low-volume, low-speed areas such as overflow parking areas, residential driveways, alleys, and parking stalls. Permeable

Other technologies to reduce impact of development

[Rainwater Harvesting](#)

[Low Impact Development \(LID\) Practices for Storm Water Management](#)

A PATH Top Ten Technology! See others at:

[2007 PATH Top Ten Technologies](#)

PDF documents require the free [Adobe Reader](#).

All PDF documents open in a new browser window. Close the browser window to return to the site.

paving is an excellent technique for dense urban areas because it does not require any additional land. With proper design, cold climates are not a major limitation.

Permeable paving is not ideal for high traffic/high speed areas because it has lower load-bearing capacity than conventional pavement. Nor should it be used on stormwater "hotspots" with high pollutant loads because stormwater cannot be pretreated prior to infiltration. Perkiomen Watershed Conservancy has an on line video presentation on [Porous Pavement](#) which requires the "Real Player" [Media Player](#), to view.

Porous Concrete: Again, the same equipment may be used as for standard concrete. Larger pea gravel and a lower water-to-cement ratio is used to achieve a pebbled, open surface that is roller compacted. This material was recently used in [a parking area](#) in Fair oaks, California as a way to reduce solar heat-gain solar from absorption. Project costs were reduced because no retention pond or connection to the municipal storm drain system was required.

Plastic Grid Systems: High strength plastic grids (often made from recycled materials) are placed in roadway areas. Some are designed to be filled with gravel on top of an engineered aggregate material, while others are filled with a sand/soil mixture on top of an aggregate/topsoil mix that allow grass to be planted on the surface. The grids provide a support structure for heavy vehicles, and prevent erosion. After heavy rains, the grids act as mini holding-ponds, and allow water to gradually absorb into the soil below.

Block Pavers: This material can be used to create a porous surface with the aesthetic appeal of brick, stone, or other interlocking paving materials. They are most often used for driveways, entryways, walkways, or terraces to achieve a more traditional, formal appearance.

[BACK TO TOP](#) ^

PATH Attributes

-  Permeable pavements save open space for alternate use, as well as eliminate the cost of piping stormwater to an outfall.
-  Permeable pavement provides a reservoir and percolation field for surface water to re-enter ground aquifers.

[BACK TO TOP](#) ^

Ease of Implementation



Porous asphalt and concrete can be supplied by any qualified contractor.

Not all soils are absorptive enough to provide proper drainage under permeable surfaces. Permeable pavement may also have different

maintenance requirements than conventional materials.

Because permeable pavements are not in wide use, they require special planning and expertise to install. It is not possible to retrofit paved areas with permeable surfaces without re-engineering all substrate and fill materials.

[BACK TO TOP ^](#)

Initial Cost

The costs for some of the permeable surfaces currently available are shown below, courtesy of the Center for Watershed Protection in Ellicott City MD:

Product	Manufacturer	Cost (Square Foot)
Asphalt	Various	\$0.50 - \$1.00
Geoweb®	Presto Products, Inc.	\$1.00 - \$2.00
Grasspave™, Gravelpave™	Invisible Structures, Inc	\$1.00 - \$2.00
Grassy™	Pavers RK Manufacturing	\$1.00 - \$2.00
Geoblock®	Presto Products, Inc	\$2.00 - \$3.00
Turfstone	Westcon Pavers	\$2.00 - \$3.00
UNI-Eco-stone	Uni-Group USA	\$2.00 - \$3.00
Checkerblock	Hastings Pavement Co.	\$3.00 - \$4.00

[BACK TO TOP ^](#)

Operational Cost

Municipal governments are still collecting data on the maintenance costs associated with permeable pavements.

[BACK TO TOP ^](#)

U.S. Code Acceptance

All permeable materials must meet applicable material quality specifications, and requirements for compressive strength, water absorption, and freeze-thaw resistance. Mixes and/or installation methods should meet appropriate ASTM standards for public-use surfaces like parking lots and roads.

Concrete used in a slab for a carport or garage must meet minimum strength requirements.

Codes in many jurisdictions require the use of certain types of curbs, gutters, or stormwater piping that would prevent the possible cost savings from permeable surfaces to be fully realized.

[BACK TO TOP](#) ^

Field Evaluations

Not Applicable

[BACK TO TOP](#) ^

Installation

Installation techniques vary for the type of permeable material chosen, but in general are similar to requirements for the impervious materials they replace. Engineering of substrate material becomes more critical when porous surfaces are used, with special attention needed in hydraulic design for the overall system. In general the underlying soil must have a minimum infiltration rate of at least 0.3 inches/hour.

First step in installation is the excavation down to the design depth of the pavement /gravel reservoir system. The uncompacted base soil is covered with a geotextile fabric to reduce migration of soil fines into the gravel reservoir. The geotextile fabric is then covered with 12 to 36 inches crushed gravel (AASHTO no. 3 stone, median stone dimensions of one inch nominal). The thickness of the layer and the stone dimension of the crushed gravel storage reservoir vary with the specifying agency. A "choker course of 2-3 inch depth AASHTO no. 57 which fills the spacing in the underlying coarser aggregate is then placed followed by the hot mix asphalt layer 2.5-3.5 inches with the fine portion of the aggregate component removed.

The ability of systems to handle 10, 25, or 100 year storm events must be calculated and incorporated into designs as the application requires.

[BACK TO TOP](#) ^

Warranty

Parking and road surfaces generally do not carry warranties because of the use and harsh conditions they are subject to. Dutch researchers have predicted a ten year highway service life for open-graded friction course asphalt compared to a twelve year life for the impervious (dense-graded) alternative.

[BACK TO TOP](#) ^

Benefits/Costs

As discussed above, the main advantages to permeable pavement are cost savings compared to typical stormwater drainage systems. Permeable pavement may become an important element in finding solutions to water use challenges while still meeting roadway requirements for traffic load support, durability, and safety.

Permeable pavement also tends to be less reflective, causing less glare and allowing motorists to see pavement markings better.

Initial costs of permeable paving may be competitive with conventional materials, or somewhat higher. These costs are often offset when the need for other types of stormwater drainage is eliminated.

[BACK TO TOP](#) ^

Disclaimer: The information on the system, product or material presented herein is provided for informational purposes only. The technical descriptions, details, requirements, and limitations expressed do not constitute an endorsement, approval, or acceptance of the subject matter by the U.S. Department of Housing and Urban Development (HUD/FHA), The Partnership for Advancing Technology in Housing (PATH), or any PATH-affiliated Federal agency or private company. There are no warranties, either expressed or implied, regarding the accuracy or completeness of this information. Full reproduction, without modification, is permissible.

[Privacy Policy](#) | [Terms of Use](#) | [Disclaimer](#) | [Accessibility Statement](#) | [Site Index](#)
ToolBase Services, c/o NAHB Research Center, 400 Prince George's Blvd., Upper Marlboro, MD 20774 © 2001-2007 NAHB Research Center