



Drainage Program Guide

Green Stormwater Infrastructure (GSI)

Best Management Practice: Permeable Pavement

Permeable pavement is a structural pavement consisting of a permeable pavement layer with a storage/infiltration bed underneath. A benefit of permeable pavement in colder climates is that snow and ice tend to melt faster and the pavement dries faster than on traditional impervious pavement, reducing deicing and snow removal costs and minimizing slips and falls. Permeable pavements are also ADA-compliant. Since they reduce stormwater discharges without requiring the use of additional land, they are a more favorable GSI practice for urban areas with land constraints. Permeable pavement can be used in many different locations including parking lots, parking spaces along roadways, sidewalks, alleys, and driveways.

What credits am I eligible for?

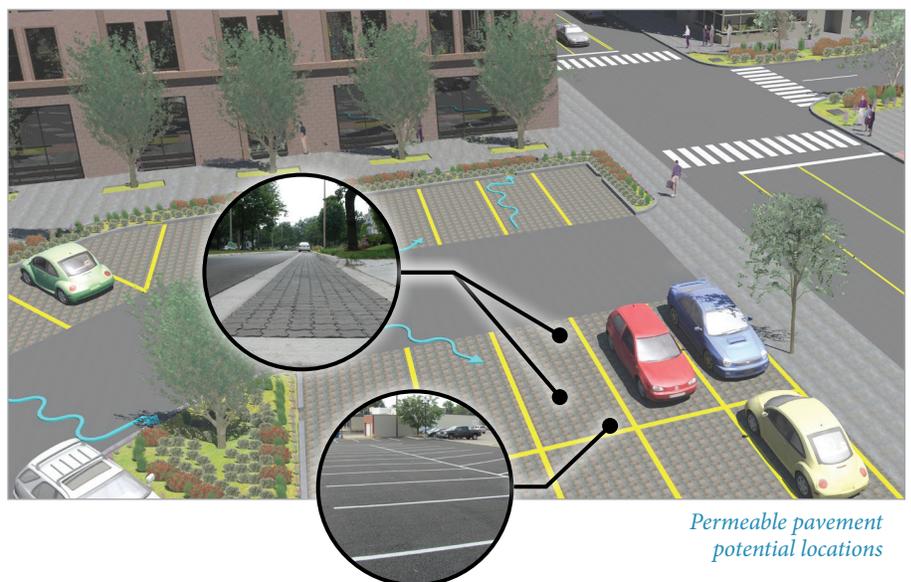
The installation of permeable pavement can achieve up to an 80 percent drainage charge credit, depending on the available storage and site conditions. Of the maximum 80 percent credit available, up to 40 percent peak flow credit can be attained for controlling how fast water is leaving the property (evaluated on a case-by-case basis) (peak flow credit) and up to 40 percent volume credit can be attained based on how much water can be permanently removed from the sewer system (volume credit). See [A Guide to Credits for Commonly Used Stormwater Management Practices](#) on DWSD's drainage website (www.detroitmi.gov/drainage) for further explanation.

NOTE: Residential customers receive an automatic 25 percent credit. If practice does not exceed the 25 percent automatic credit, no additional credit will be applied.

What is the typical cost of permeable pavement?

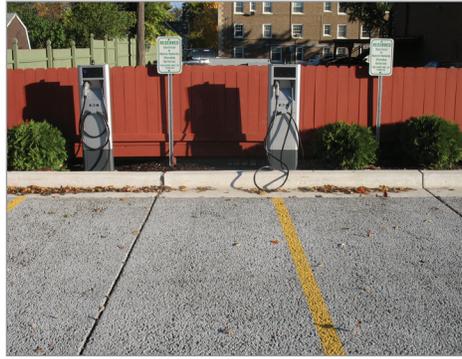
The cost of permeable pavement systems varies greatly depending on the type of permeable surface, depth of storage material below the pavement surface, and contractor installation familiarity. Costs can be higher than traditional pavement because of the underlying stone bed and slightly higher permeable pavement material costs. However, traditional stormwater management systems (such as catch basins and sewer pipes) can often be eliminated or significantly down-sized when permeable pavement is installed, off-setting the costs of the permeable pavement GSI practice.

Porous concrete construction costs range from \$2 to 15 per square foot with an average cost of \$8 per square foot. Pervious asphalt costs approximately \$8 per square foot, while permeable pavers cost \$7 to 20 per square foot with an average cost of \$13 per square foot (all costs from Cincinnati – Ellwood, 2012).





Example of pervious asphalt installation at a municipally owned parking lot in Adrian, MI



Example of porous concrete installation at Lansing Community College in Lansing, MI



Example permeable paver blocks installation in Lansing, MI

What are the different types of permeable pavement?

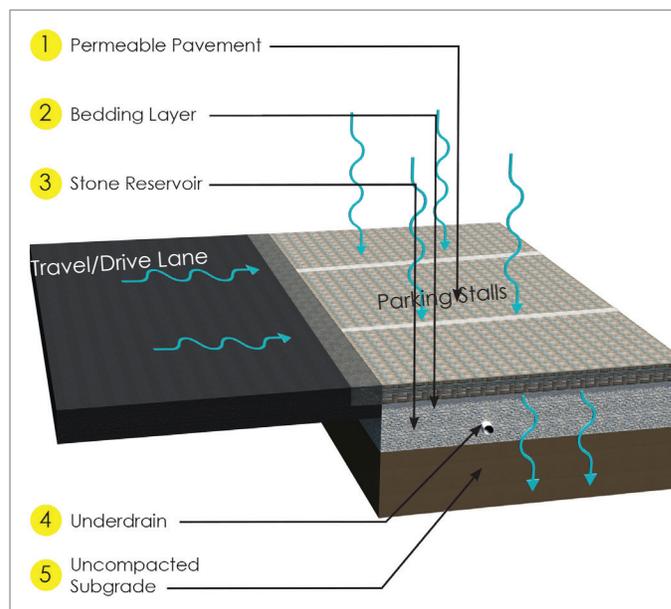
There are a variety of permeable pavements including porous concrete, pervious asphalt, glass porous paving, or various types of interlocking pavers.

In addition, plastic grid systems (also called reinforced turf pavement) can be used in areas with limited vehicular traffic (such as overflow/infrequent parking areas or emergency vehicle or fire access lanes).

Permeable pavement surface types can vary, but they consist of similar components including a surface pavement layer that is permeable, a thin bedding layer to stabilize the pavement, an underlying crushed stone reservoir layer, an underdrain, and in some instances, a filter or fabric layer installed in between the stone reservoir and the uncompacted subgrade.

Credit Related Design Guidelines

- ◆ The managed impervious area should not be more than twice the permeable pavement area.
- ◆ The outlet must be controlled to reduce discharge rates to the sewer system during storm events. The outlet must have a release rate of 0.15 cfs per acre or less.
- ◆ The retention area of the practice must drain in 72 hours.
- ◆ An underdrain should be considered for practices in colder climates.
- ◆ No credit is given for water stored in the permeable pavement.
- ◆ Practice can be designed to earn both a volume and peak flow credit.



Components

- 1 **Permeable Pavement:** Pavement that allows stormwater to pass through to be temporarily detained or infiltrated through to the native soil.
- 2 **Bedding Layer:** Aggregate stone layer for leveling and stabilizing permeable pavement.
- 3 **Stone Reservoir:** Stone layer where water will collect until it infiltrates into the subsoil or is released into the underdrain.
- 4 **Underdrain:** Perforated pipe that takes excess water to DWSD's combined sewer system.
- 5 **Uncompacted Subgrade:** Existing soil below the stone reservoir where stormwater infiltrates.

Permeable pavement components

How do I maintain permeable pavement?

To ensure the pavement systems remain functional over the long-term, regular maintenance is required.

The following are some typical maintenance activities:

- Keep sediment or areas with bare soil from draining onto permeable pavement.
- Inspect at least twice a year and remove trash and litter regularly.
- Vacuum porous asphalt or permeable concrete at least twice a year with standard street-cleaning equipment equipped with a vacuum device. Stone between pavers will need to be replaced after vacuuming as needed.
- Educate landscapers and other contractors to maintain permeable pavement by not dumping materials or sediment onto the pavement.
- Use of sand and fine aggregate for winter conditions will quickly clog permeable pavement and should not be used.
- Do not resurface or seal the permeable pavement as you normally would with a traditional pavement.
- Observe performance during rainstorms. When water begins to pond during typical rainfall events, its time to vacuum the pavement.
- Install signs to notify maintenance personnel, employees, and the public of the existence of permeable pavement.



Use signage to ensure proper maintenance of permeable pavement

Setback Requirements

- From property line: 2-foot minimum
- From building foundation: 10-foot minimum
- From municipal sanitary or combined sewer: 10-foot minimum
- From public water supply well: 50-foot minimum

Permits and Forms

Any changes in parking or driveways may require approval from the Buildings, Safety Engineering and Environmental Department (BSEED) to address minimum parking code requirements. See Sec. 61.14.21 for the parking schedule and Sec. 61.14.151 for parking space dimension information. <http://www.detroitmi.gov/Portals/0/docs/BSEE%20-%20Zoning/Ch61Mar012016.pdf>. Sec. 61.14.21 includes the parking schedule and Sec. 61.14.151 includes parking space dimension information. Contact BSEED Zoning Department for more information.

Make sure to identify and avoid utilities by contacting MISS DIG at 811 or 1.800.482.7171 before starting the project.

If the project will disturb 1 acre or more, or is within 500 feet of a water of the state, contact Wayne County Environmental Services for a Soil Erosion and Sedimentation Control (SESC) permit.

Underdrain connection to a public sewer will require a permit from BSEED (plumbing) and DWSD (sewer tap).

- Sewer Tap (DWSD): Contact DWSD at 313.964.9236
- Plumbing Permit (BSEED): Any time project work on private property connects to City sewer, contact: BSEED's Plumbing Inspector at 313.224.3158
- Construction and any other required City, State, or Federal permit

Complete engineered drawings stamped by a registered Professional Engineer or Landscape Architect must accompany the Drainage Charge Credit Application. Additional required documentation is found on the application and can be downloaded from www.detroitmi.gov/drainage.

The Asphalt Pavement Association of Michigan (www.apa-mi.org/) and Michigan Concrete Association (<https://miconcrete.org/>) can help identify qualified installers for porous asphalt and pervious concrete.

Additional Resources

For Drainage Charge Credit information and other resources, visit the drainage webpage: www.detroitmi.gov/drainage

Specific documents to review:

- ◆ Guide to Drainage Credits
- ◆ Guide to Credits for Commonly Used Stormwater Management Practices
- ◆ Credit Calculator
- ◆ Credit Application

Michigan Concrete Association. 2011. Specifier's Guide for Pervious Concrete Pavement Design. https://miconcrete.org/sites/default/files/inline-files/MCA_PerviousSpecifiersGuide.pdf

Minnesota PCA. Undated. Minnesota Stormwater Manual. Design criteria for permeable pavement. https://stormwater.pca.state.mn.us/index.php/Design_criteria_for_permeable_pavement

Ellwood, Nancy. "A Detailed Look at Costs Associated with Green Stormwater Controls." Proceedings from Water Environment Federation Stormwater Symposium, 2012.

Virginia DEQ. 2011. Design Specification No. 7. Permeable Pavement. Version 1.8. <http://www.vwrrc.vt.edu/swc/documents/2013/>

Uncontrolled document when printed. Refer to website for most current version.