



www.oregonmetro.gov

GREEN from the Ground Up

This fact sheet is one of a series on nature-friendly development practices created by Metro through its Nature in Neighborhoods initiative.

Nature-friendly development practices minimize the impact of development on natural resources and can help developers save money and add value to their properties.

Nature in Neighborhoods is Metro's long-term effort to protect and restore fish and wildlife habitat throughout the urban area and ensure that every citizen in the region has access to nature.

Porous surfaces

Porous surfaces help manage stormwater on site and improve water quality



Willamette Graystone

Porous surfaces are areas covered with highly porous material that allow water from precipitation to pass through, yet are strong and durable enough to support vehicular or pedestrian traffic. The value of porous surfaces as a low impact development practice is in reducing site runoff and recharging ground water levels. Porous materials used for patios, walkways, driveways, parking areas and roadways mimic the natural hydrologic process by storing and infiltrating rainwater rather than producing runoff. Through this process pollutants that otherwise are carried by runoff to local streams and waterways are filtered out.

Impervious surfaces made of conventional asphalt and concrete increase the flow rate and total volume of stormwater runoff with no ability to filter out pollutants. Large sewer

systems then channel this water directly to creeks and rivers along with other surface water instead of into the ground. In some areas, expensive water treatment systems are built to cleanse the water before it re-enters the natural water cycle.

Reducing the flow rate and volume of runoff by directing it back into the ground through a porous surface also minimizes the damage done to streambeds and riverbanks by erosion and downcutting, thereby preserving valuable habitat for fish and wildlife.

The most common types of porous surfaces are made of porous asphalt, pervious concrete, permeable pavers and pervious flexible paving systems (also called porous grass or gravel grids). Other types of porous surfaces are loose aggregate, soft porous surfacing, decks and boardwalk. They are durable and attractive, allowing for great flexibility as a design element.



National Ready Mixed Concrete Association



Metro | *Keep nature in neighborhoods*

Benefits/added value

Porous surfaces provide:

- nature-friendly stormwater management systems
- pleasing aesthetics that can command higher real estate values
- quieter neighborhoods by absorbing traffic noise
- more room to build by reducing the need for conventional stormwater systems.

Cost compared to conventional development techniques

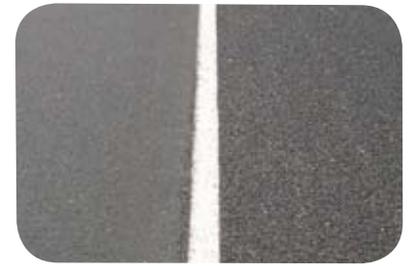
The cost of using porous materials is often greater than that of conventional materials due to the need for a thicker base requiring more rocks and deeper excavation.

The higher cost can be offset by freeing up more land for development through reducing the need for detention ponds and other stormwater management devices.

The savings on stormwater management systems may lower the overall project costs on a first-cost basis.

Most common porous materials

Porous asphalt or open graded mix contains the same elements as conventional asphalt minus the finest-textured materials. Because the fine particles are not present, it has more air voids than conventional asphalt. While porous asphalt performs much like conventional asphalt, the air voids allow rainwater to drain through to an underlying open-graded, crushed stone bed where it slowly infiltrates into the subsoil. It appears coarser in texture than conventional asphalt.



Conventional Porous

Pervious concrete or no-fines concrete contains the same elements as conventional concrete minus the finest-textured materials. It is made by mixing carefully controlled amounts of water and cement to create a paste that coats the gravel and rock, binding the aggregates together and leaving spaces between them that allow rainwater to seep through. This mixture appears dryer and coarser in texture than conventional concrete.



Permeable interlocking concrete pavers are similar to regular pavers except they are installed with wider joints or openings at the corners, allowing rainwater to drain into the joints between the pavers and down through an open-graded base. Most commonly used for parking lots and walkways, these interlocking pavers provide a surface that is stable enough for vehicular traffic.



Pervious flexible paving systems such as porous grass and gravel grids consist of plastic cells (often cylinders or cubes) connected on a grid system to provide a flexible and structural load-bearing surface. For a porous grass grid, the cells are filled with soil and planted with grass; it has a full grass-covered surface and looks no different than a normal turf area or lawn. For a porous gravel grid, the cells are filled with gravel. In both systems, the cells are supported with an open-graded stone base. These systems are extremely strong and have a large amount of void space allowing rain water to drain through. Both porous grass and gravel grids are suitable for low vehicle traffic such as emergency fire lanes or overflow parking areas.



invisible structures



Appropriate site conditions

Porous surfaces are most appropriate for light to moderate traffic areas. Site conditions that favor the use of porous materials include:

- less than 10 percent slope
- ability to control runoff onto the site
- at least three feet between the bottom of the drain rock and the top of the water table
- at least two feet between the bottom of the drain rock and the top of bedrock
- excavation and grading accomplished with light equipment to prevent soil compaction
- ability to keep sediment off porous materials during construction.

Note: Check local codes to determine requirements in your jurisdiction. Not appropriate for use in areas at high risk for contaminant spills or in contaminated soils.

Installation tips

Protect porous pavement areas throughout construction process by:

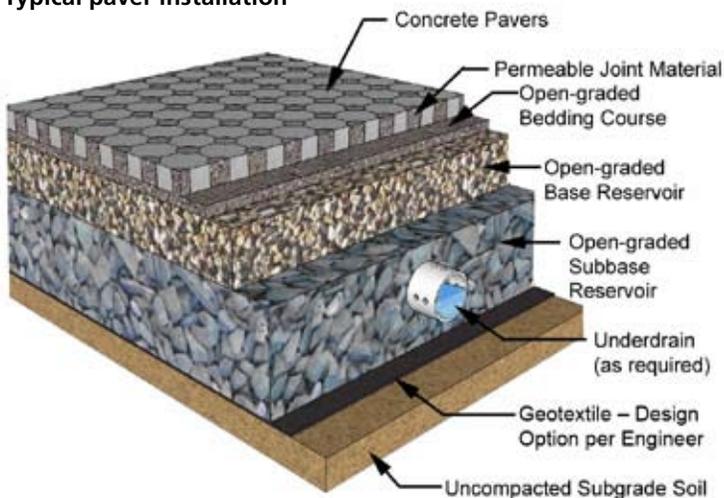
- excavating from the sides of the area to prevent compaction
- covering with geotextile immediately after fine grading is completed to prevent sediment accumulation
- hosing off base course rock on site to a very clean standard even if “clean” rock is ordered
- placing rock in 6” lifts by backing over area
- using a base course and choker course as designed and then covering with the pavement surface course
- minimizing the amount of rolling on porous asphalt so it doesn’t become compacted
- ensuring a long drying time for pervious concrete by covering with plastic so it does not dry too quickly.

Porous pavement does not have to be graded for runoff as there is no runoff.



Willamette Graystone

Typical paver installation



Interlocking Concrete Pavement Institute

Maintenance considerations

Porous paving is best suited to sites where paving maintenance is part of a routine site maintenance program. Examples include parking areas for condominium complexes, institutional buildings, office buildings and commercial facilities.

General maintenance recommendations:

- frequent inspection for the first few months during storm events and annually thereafter
- vacuum-sweeping at least twice per year
- cleaning by flush or jet washing (only if clogging occurs)
- prohibiting snow removal with snow plows or loader buckets due to potential for damage to pavers
- avoiding sand or cinders as a traction agent
- maintaining the turf of a porous grass grid as any other grass-covered open area
- dedicated removal of mud or sediment tracked onto surfaces.



Clean air and clean water do not stop at city limits or county lines. Neither does the need for jobs, a thriving economy and good transportation choices for people and businesses in our region. Voters have asked Metro to help with the challenges that cross those lines and affect the 25 cities and three counties in the Portland metropolitan area.

A regional approach simply makes sense when it comes to protecting open space, caring for parks, planning for the best use of land, managing garbage disposal and increasing recycling. Metro oversees world-class facilities such as the Oregon Zoo, which contributes to conservation and education, and the Oregon Convention Center, which benefits the region's economy.

Your Metro representatives

Metro Council President
David Bragdon

Metro Councilors
Rod Park, District 1
Carlotta Collette, District 2
Carl Hosticka, District 3
Kathryn Harrington, District 4
Rex Burkholder, District 5
Robert Liberty, District 6

Auditor
Suzanne Flynn

GREEN from the Ground Up
Seminars for land-savvy developers

For more information on nature-friendly development practices or Metro's Nature in Neighborhoods initiative, visit www.oregonmetro.gov/nature, send e-mail to nature@oregonmetro.gov or call 503-797-1555.

Funding for this and other fact sheets in the Nature in Neighborhoods nature-friendly development practices series is provided in part by an **Oregon Department of Environmental Quality** Section 319 Grant.

Victoria Cottages, townhome development in Gresham



With a malfunctioning dry well and a storm sewer already at capacity, developer Chet Antonsen of Pacwest II, LLC, had just the right set of conditions at the construction site of Victoria Cottages, a 24-unit townhome development in Gresham, to take full advantage of the benefits porous surfaces deliver. Choosing porous asphalt as a roadway cover, pervious concrete for the sidewalks and permeable pavers for the driveways, Antonsen had everything to gain by minimizing stormwater runoff on the largest surface areas of the development. While choosing porous surfaces was the most expensive alternative, Antonsen is now a believer in the system's value for effective stormwater management under the most challenging conditions.

For this project, the price of using porous surfaces was roughly \$2,000 per house for the sidewalk and driveway and \$500 per house for the street. While porous materials cost approximately \$12,000 more than drywells and an underground

detention system would have, using porous materials supported Antonsen's desire to be a better steward of the property and provided another option to using a surface detention system. This opened up extra land allowing for additional lots for the development.

As the developer, Pacwest II bears the responsibility for the warrantee on the porous surface so they're monitoring the site closely to ensure sediment doesn't get onto the street and plug the pavement. During construction, it was critical to keep the surfaces clean from sediment which was achieved by covering the surfaces with a geotextile while the first six houses were built.

The aesthetic benefits that translate into buyer appeal, according to Antonsen, are a surface texture that bears a close resemblance to traditional materials and flexibility for use in design that gives the driveways a high quality appearance.

As the project builder, Doug Moore of Doug Moore Homes Inc., attests to the ease of installing porous surfaces on driveways and sidewalks. He encourages other builders to consider porous surfaces to minimize runoff, despite the additional cost. Moore says he would absolutely consider using porous materials again.

List of resources

Portland Cement Association
www.concretethinker.org
Information and case studies on pervious paving.

National Asphalt Pavement Association
www.hotmix.org
News, conferences and information on porous asphalt.

Interlocking Concrete Pavement Institute
www.icpi.org
Technical specifications, where to find a certified installer and digital editions of Interlocking Concrete Pavement Magazine.

Partners in the use of low impact development practices:

