UNI-GROUP U.S.A.

City of Portland, OR

PROJECT:
Westmoreland Permeable Pavement Pilot Project
Portland, Oregon

Joint project of the Portland Office of Transportation, Bureau of Environmental Services, and Water Bureau

ENGINEERING & CONSTRUCTION:
Steve Townsen, P.E.
City Engineer, Portland
Steve Burger, P.E.
Senior Engineer
Bureau of Environmental Services, Portland

CONSULTING ENGINEER:
Gille Wilbanks
Wilbanks King International
Portland, Oregon

PAVER CONTRACTOR:
Brian Crooks
BC Construction
Renton, Washington

CONCRETE PAVER MANUFACTURER:
Mutual Materials, Inc.
Oregon and Washington

PAVERS:
Ecoloc®
3 1/8 in. (80mm) thick
Color Blend - 19,000 sq ft

Case Study

The City of Portland utilized over 19,000 sf of permeable Ecoloc® interlocking concrete pavers in a pilot project in the Westmoreland neighborhood

The City of Portland, long considered a leader in the protection of the environment in the northwestern United States, is building sustainable stormwater projects around the city to reduce the detrimental impacts of stormwater runoff on the Willamette River and surrounding tributaries.

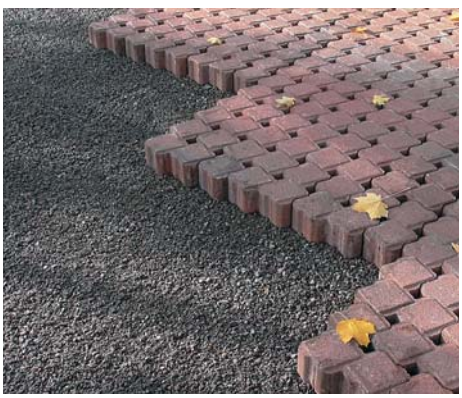
In November of 2004, a pilot project to install Ecoloc® permeable interlocking concrete pavement (PICP) in the 80-year old Westmoreland neighborhood was undertaken as part of a joint project by the Portland Office of Transportation, Bureau of Environmental Services, and the Portland Water Bureau. The city also secured a grant for $80,000 from the U.S. Environmental Protection Agency Innovative Wet Weather Program.

The Westmoreland Permeable Pavement Project will test how well PICP performs on a public residential street. Though permeable pavers have been installed in many driveways and in commercial parking areas in the Pacific Northwest, this project is the first installation in a public street for the City of Portland. The project will provide data on durability, drainage capabilities of the Ecoloc® pavement, and maintenance requirements.

The project area consists of four blocks. One block is paved curb to curb with Ecoloc® permeable pavers, while two other blocks consist of a center travel lane paved with asphalt and two parking lanes of Ecoloc® on each side of the roadway. The last block is paved with standard asphalt.

Large-diameter sewer pipes had been installed in the area in 2003, necessitating street reconstruction. The city used this opportunity to incorporate sustainable practices into the neighborhood with the installation of the PICP streets. At the same time, deteriorated driveway aprons and concrete curbs were replaced as needed. Existing storm drainage inlets and pipes were kept in place to handle any potential overflow during excessively heavy storms.

As in many older cities, increasing pressure on outdated storm and sanitary sewer systems call for new approaches in managing stormwater runoff to minimize overflows, which in Portland's case, results in untreated sewage entering into the Willamette River. Ecoloc® offered a solution.

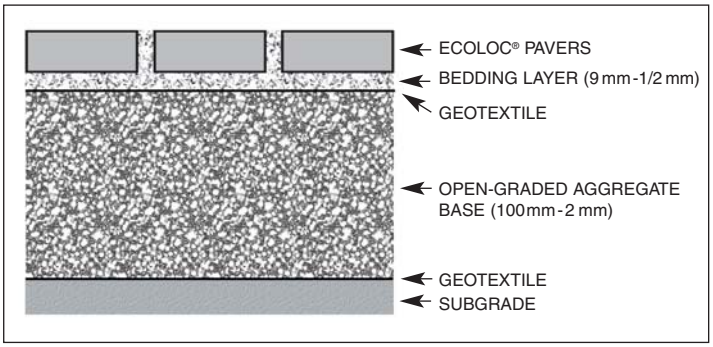


Ecoloc® pavers were placed on a bedding layer of ODOT 02610.10 open-graded aggregate

Mechanized installation allows for fast placement of Ecoloc®

Uni-Group U.S.A. manufacturer Mutual Materials, Inc. supplied the 3 1/8 in. (80mm) thick Ecoloc® permeable interlocking pavers used in the project. The company worked closely with the city and consulting engineers to help ensure the project's goals were met.

Construction of the pavement system consisted of a 10 in. (250mm) thick base of open-graded aggregate ODOT 00360.11, which ranges in size from 4 in. to 1/16 in. (100mm-2mm). A 3 in. (75mm) layer of ODOT 02610.10 (9mm to 1/2 mm) small, open-graded aggregate was installed as the bedding for the pavers. This same material also was used to fill the joints and drainage openings in the pavers. Geotextile was used between the bedding and base layers, as well as the base and soil subgrade, as there was concern about meeting filter criteria between the layers. City Engineer Steve Townsen, P.E., notes that they may consider eliminating the geotexile between the bedding and drainage base layer in future installations.



In the pavement cross-sections that utilize the center asphalt travel lane in conjunction with the Ecoloc® parking lanes, the drainage base layer extends underneath the asphalt's dense-graded base to provide additional storage capacity and infiltration. The dense-graded and open-graded materials are separated by geotextile to maintain filter criteria.

Infiltration tests conducted by the Bureau of Environmental Services on the area's silty soils resulted in a conservative 1 in./hr (7 x 10^{-6} m/sec) design infiltration rate that was used to determine the thickness for the base reservoir. This thickness was deemed to be sufficient for the expected traffic loads on the pavement. The project manager, Steve Burger, P.E., Senior Engineer with the Bureau of Environmental Services states that the Ecoloc® pavement is designed to handle a 10-year storm (NRCS Type 1a), including the runoff from adjacent driveways, sidewalks, impervious asphalt and roofs.

The center travel asphalt lane slopes towards the permeable Ecoloc® pavers to capture and infiltrate stormwater runoff

Maintenance protocol calls for sweeping the pavement from four to six times annually using the city's high-suction street cleaning equipment, however sweeping occurred only three times the first year. The pavement is dry-swept to loosen fine sediment, then a vacuum sweeper follows, with the suction adjusted to prevent uptake of the small aggregate in the openings. Brett Kesterson, P.E. with the Bureau of Transportation Engineering and Development noted that weed growth, most likely caused by leaves and grass clippings left on the pavement surface by the residents, had not been closely monitored and a gysophate-based spray was used to get the weeds under control. He said that they have had no problems with the structural aspect of the pavers. Since then, maintenance also has purchased a more powerful vacuum sweeper.

"The Westmoreland permeable paver streets appear to function hydraulically as designed, in spite of the weed growth," added Steve Burger. Test results show that infiltration is still rapid, infiltrating all flow before it reaches the curb line. Information on the project is included on the city's website, www.portlandonline.com.

References:

• *Permeable Pavement - Westmoreland Pilot Project* and *Westmoreland Pervious Pavers,* Environmental Services, City of Portland

• *Portland Tries Permeable Interlocking Concrete Steet Pavements,* Interlocking Concrete Pavement Magazine, May 2005

Thank-you to ICPI for use of project photography.

Note: Permeable interlocking concrete pavement systems are dependent on project design objectives, design storm requirements, available construction materials, existing soils, and local environmental conditions. For information on formulating design procedures and specifications, please contact your local UNI® Manufacturer. A qualified engineer or other design professional should be consulted for applications utilizing Ecoloc® or UNI Eco-Stone®.

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