

Updates on Pervious Pavement Design and Construction

Jason T. Peterlein, P.E.
June 19, 2012



Program Outline

- Pervious Pavement Basics
- Pervious Pavement Construction
- Maintenance
- MSD Regulations Update



Permeable Pavement-Does it work?



Permeable Pavement-Does it work?



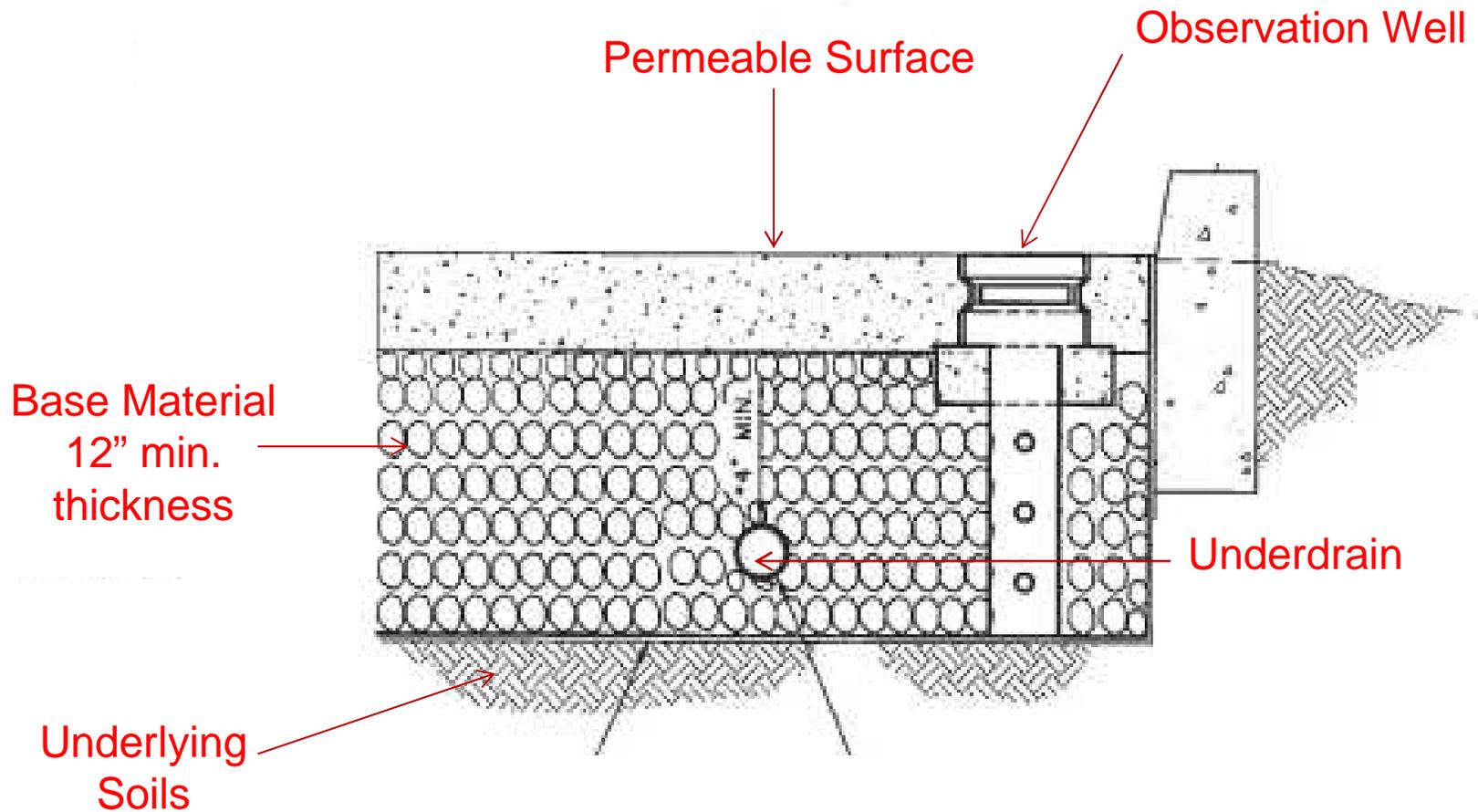
Permeable Pavement-Does it work?

Pervious Pavement Basics

- “When it rains, it drains...”
 - Surface Coarse (concrete, asphalt, blocks)
 - Base material
 - Observation Wells / Cleanouts
 - Underdrain
 - Drainage Characteristics of the underlying soils

Pervious Pavement Basics

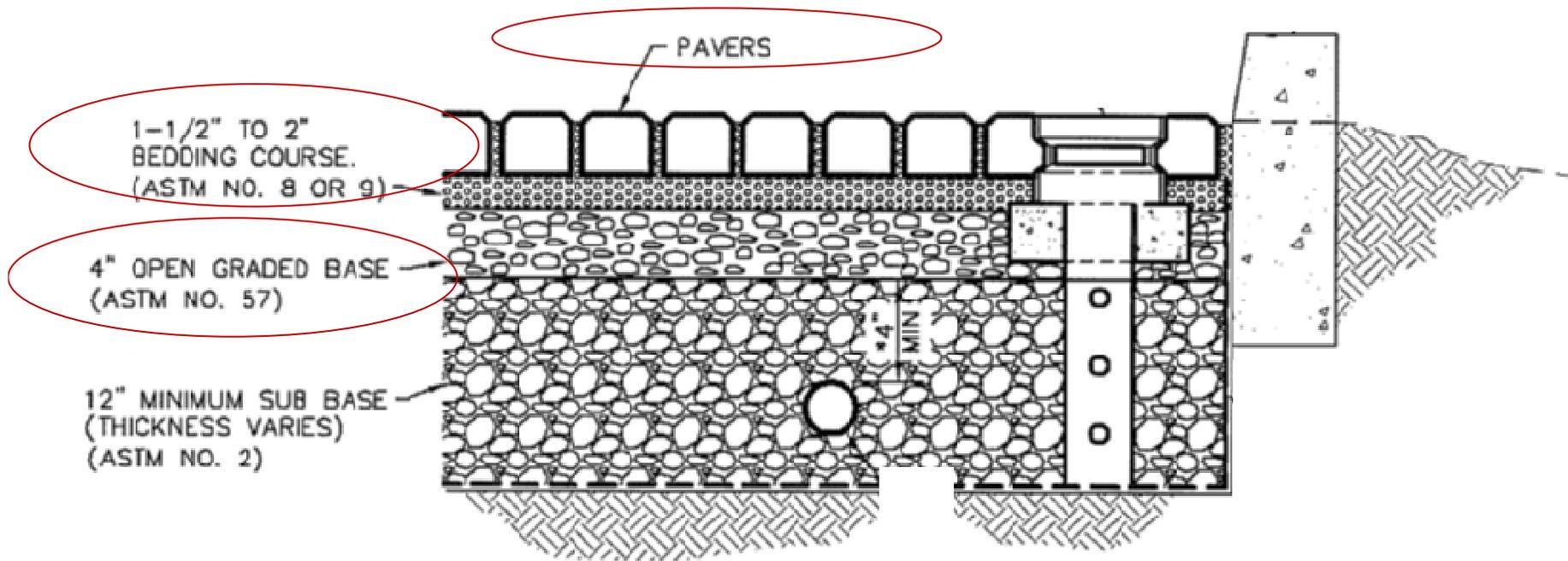
(Porous Asphalt & Permeable Concrete)



Pervious Pavement Basics

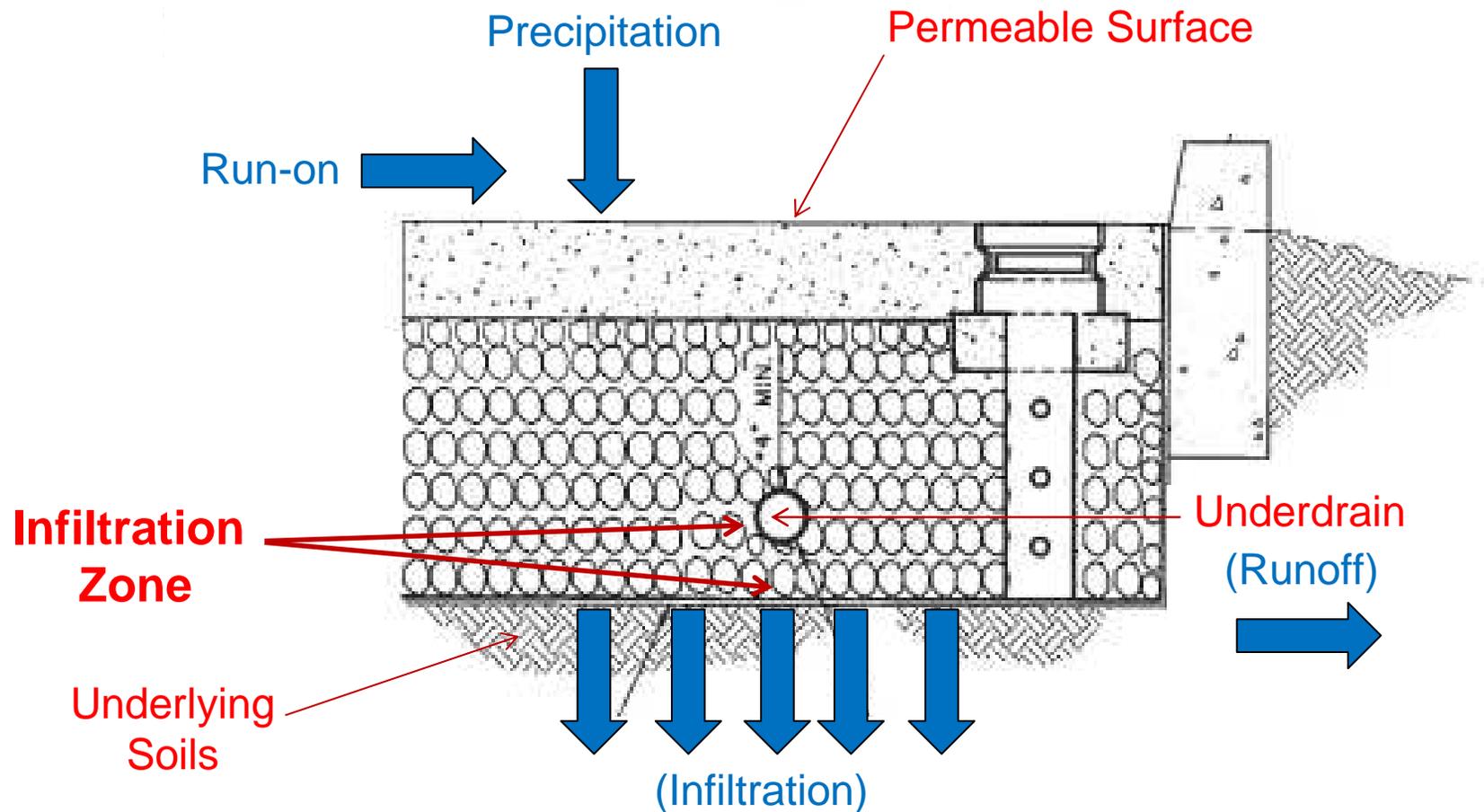
(Permeable Interlocking Concrete Pavement "PICP" or "Pavers")

Same performance concept, but slightly different components...



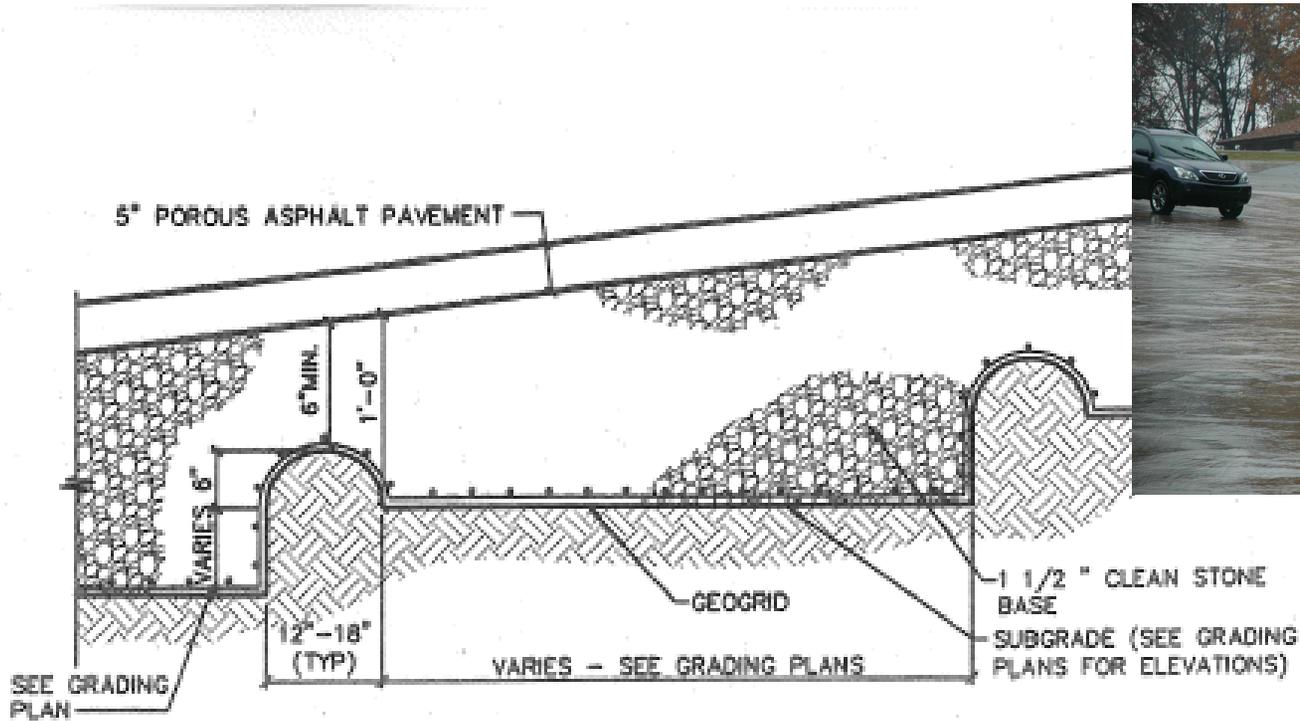
Pervious Pavement Basics

The Mechanics of BMP Performance



Pervious Pavement Basics

The world is not flat



12 TYPICAL SUBGRADE GRADING
9 SCALE: N.T.S.

Pervious Pavement Basics

- If using permeable pavement in conjunction with bioretention, make sure a good physical barrier such as a short wall or flush curb is in place to separate the two...



Pervious Pavement Basics

- If designed in conjunction with Bioretention, Permeable Pavement can preserve sheet flows and reduce erosion potential within the Bioretention Cell



Conventional Pavement

Permeable Pavement

Sheet Flow

*Slower Velocities,
better sheet flow
conditions

Pervious Pavement Construction

PICP – Delivered on Site



Pervious Pavement Construction

PICP – Bedding Course



Pervious Pavement Construction

PICP – Project Complete



Pervious Pavement Construction

Permeable Concrete - Installation



Pervious Pavement Construction

Permeable Concrete: Finished Product



Pervious Pavement Construction

Porous Asphalt – Up Close



Pervious Pavement Construction

As-Built Certification

PERVIOUS PAVEMENT AS-BUILT CERTIFICATION

DATE: _____

To: Metropolitan St. Louis Sewer District
Department of Engineering
Attn: Keith Milson

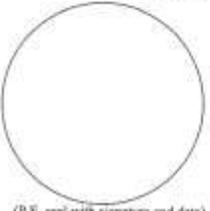
From: _____ (Consultant Engineer's Name)
Title: _____

Consulting Engineer Company Name & Address

Re: Engineering/Construction Certification for the following project:
MSD Project Name: _____
MSD PW: _____
Project Address: _____

For the project's pervious pavement practice, this correspondence shall serve as a certification of the following:

1. The Pervious Pavement was built in accordance with the details, dimensions, and materials as approved by MSD for this project.
2. The Pervious Pavement was installed by a qualified contractor, and has satisfied all applicable quality control and performance tests.
3. The Pervious Pavement installation was witnessed periodically by the certifying engineer or a representative under their direct supervision.


(P.E. seal with signature and date)

Printed Name: _____
Discipline: _____
License No.: _____

Prior to MSD Construction Approval, a P.E. must certify that the permeable pavement construction was:

- Constructed in accordance with the MSD approved plans
- Accomplished by qualified personnel
- Was witnessed periodically by themselves or a representative under their supervision

Certification can be completed by the design engineer or a third party engineer (i.e. geotech doing the onsite testing services, other consultant)

Maintenance

- Maintenance Plan should be a “living” document
- Inspect frequently during the first year to establish benchmarks for “normalcy”
- Keep the drainage area clean
- *Normally* sweep/vacuum twice a year
- Protection - Signage



MSD Regulations Update



Metropolitan St. Louis Sewer District
 2350 Market Street
 St. Louis, MO 63103-2555
 (314) 768-6200

March 16, 2012

RE: Permeable Pavement Applicability as a Stand Alone Water Quality BMP

To Whom It May Concern:

The purpose of this letter is to convey a Metropolitan St. Louis Sewer District (MSD) policy change regarding pervious pavement as a stand-alone water quality post-construction best management practice (BMP).

Policy Change Summary

MSD will recognize permeable pavement as a stand-alone water quality BMP, when designed and constructed to comply with MSD permeable pavement guidance described herein.

As a result of this change, MSD will no longer require that porous asphalt, permeable concrete, and permeable interlocking concrete pavement (PICP) be provided with an infiltration basin/trench, sand filter, or other supplemental BMP in order to meet MSD stormwater quality criteria.

Design Performance

For new and redevelopment sites, to be considered an effective stand-alone water quality BMP, BMP designs shall be capable of the following.¹

1. Capture and treat the required water quality volume (WQ). (This is equivalent to capturing and treating 90% of annual rainfall.)
2. Remove 80% of the TSS.
3. Have an acceptable longevity rate in the field.

Additionally, on new development sites, BMPs performance includes "mimicking the pre-construction runoff condition", to the maximum extent practicable. One objective of this criterion is to utilize BMPs that help reduce runoff volume to its pre-development condition.²

For both new and redevelopment sites, MSD will presume permeable pavement to meet these criteria when the BMP's saturated soil hydraulic conductivity, infiltration bed thickness, and ratio of impervious pavement to pervious pavement satisfy the parameters listed in Table 1.

Table 1
Stand-Alone Water Quality Permeable Pavement Design Parameters

Subgrade Saturated Hydraulic Conductivity (in./hr.)	Infiltration Bed Gravel Thickness (in.)	Maximum Ratio of Drainage Area to Pervious Pavement Area
0.05	6	2:1
0.1	12	3:1
0.15	18	4:1

¹ See Section 4.080.05 of MSD Rules and Regulations.
² See Amendment 3 of Section 4.080.01 of MSD Rules and Regulations.

- When Water Quality BMPs are required, Permeable Pavement may be utilized as a stand-alone BMP under certain cases
- New policy adopted on March 16, 2012
- Design Criteria posted on the MSD Website

MSD Regulations Update

Design Parameters

- Subgrade Saturated Hydraulic Conductivity (in/hr)
- Infiltration Bed Thickness (in.)
- Ratio of Drainage Area to Pervious Pavement Area

MSD Regulations Update

Design Parameters

Stand-Alone Water Quality Permeable Pavement Design Parameters

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- Based on Continuous Simulation Modeling using historical local rainfall data and conservative assumptions
- Very generalized – “typical St. Louis site”
 - Silty Clay soils over limestone
 - Not applicable to Major River sites (e.g. sites within Levee Districts)
- Assumes tributary area draining to the pervious pavement is 100% impervious
- If you apply the table you can satisfy WQv requirements
- Site specific continuous simulation modeling may be considered

MSD Regulations Update

Infiltration Bed Thickness

- Minimum Gravel Bed Thickness Remains 12"
- Provide adequate thickness to also keep frequent storms from ponding up into the pavement (2yr -24 hr event)
- The infiltration zone occurs beneath the underdrain, behind a subgrade berm, or a weir in the outfall structure.

MSD Regulations Update

Saturated Hydraulic Conductivity

- A Geotechnical Assessment of soils conditions is recommended
- Assume 0.05 in/hr without site specific soil testing
- On site soils investigation is required to support assumptions greater than 0.05 in/hr

MSD Regulations Update

Drainage Area Ratio

- The ratio of upgradient area to pervious pavement affects the percentage of captured storms and BMP longevity
- Typical ratios will range between 2:1 and maximum of 4:1
- Ratios are controlled by upstream drainage area characteristics

MSD Pervious Pavement Information

<http://www.stlmsd.com/engineering/planreview/PlanReviewInformation/ProprietaryBMPs>

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Proprietary BMPs

MSD Stormwater Program Proprietary Practices and Application

Proprietary Pavements:

Pervious Concrete PICP Porous Asphalt

Manufacturer	Product	Contact	Product Status
Pace Construction, Inc.	Porous Asphalt	Phil Hoher Pace Construction, Inc 1620 Woodson Rd. St. Louis, MO 63114 314-624-7223	Provisional Use Level Approval 10/27/09
Fred Weber, Inc.	Porous Asphalt	David B. Marshall Fred Weber, Inc 2320 Creve Coeur Mill Road Maryland Heights, MO 63043 314-344-0070	Provisional Use Level Approval 10/27/09
Concrete Council	Pervious Concrete	Evan Bolesta Concrete Council 8000 Maryland Ave. Suite 1320 St. Louis, MO 63105 314-862-0324	Provisional Use Level Approval 10/30/09
Kirchner Block & Brick	Permeable Interlocking Concrete Pavements (PICP)	David Mudd 12901 St. Charles Rock Rd. Bridgeton, MO 63044 314-291-3200	Provisional Use Level Approved 08/31/10
Building Products Corp.	Permeable Interlocking Concrete Pavements (PICP)	Aron Rauls 494 N. 33rd Street East St. Louis, IL 62205 314-304-1754	Provisional Use Level Approved 08/28/09



Summary

- Pervious Pavement Basics
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Questions

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