

State-of-the-Practice Porous Asphalt Pavements

Kent R. Hansen, P.E.

Director of Engineering

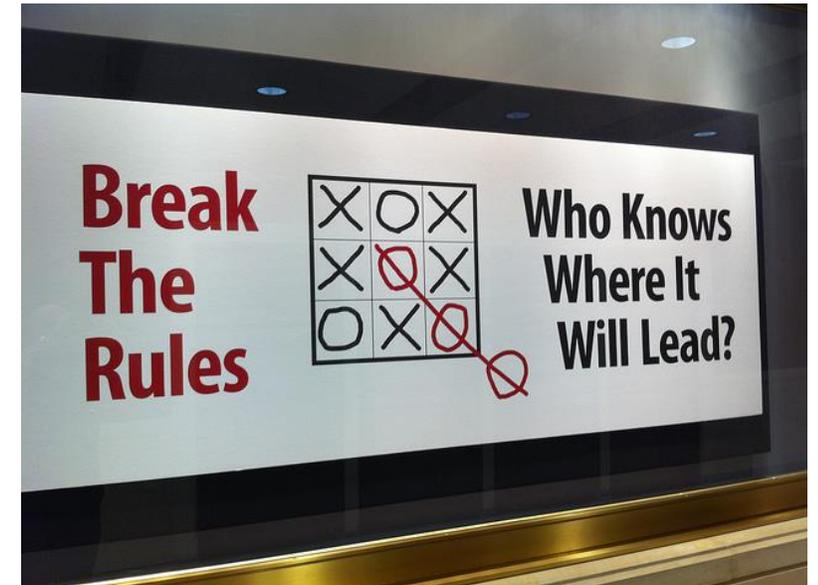
National Asphalt Pavement Association



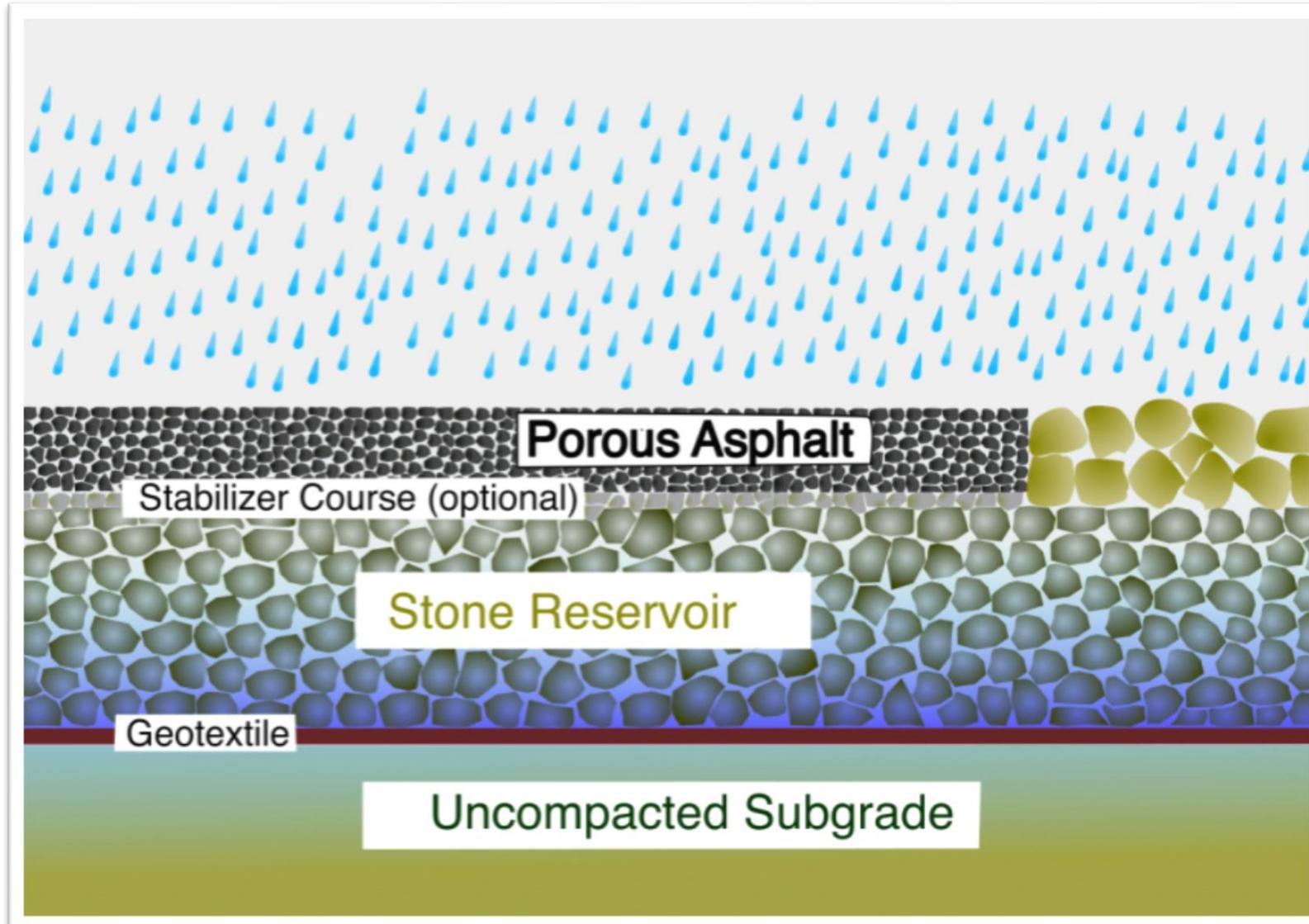
NATIONAL ASPHALT
PAVEMENT ASSOCIATION

Porous Pavements don't follow the rules

- Conventional Pavements
 - Do every thing to keep the water out
 - Reduces subgrade and base strength
- Porous pavements
 - Let the water through
 - Different base – water won't effect strength
 - Don't compact the subgrade – reduces support/increase pavement thickness

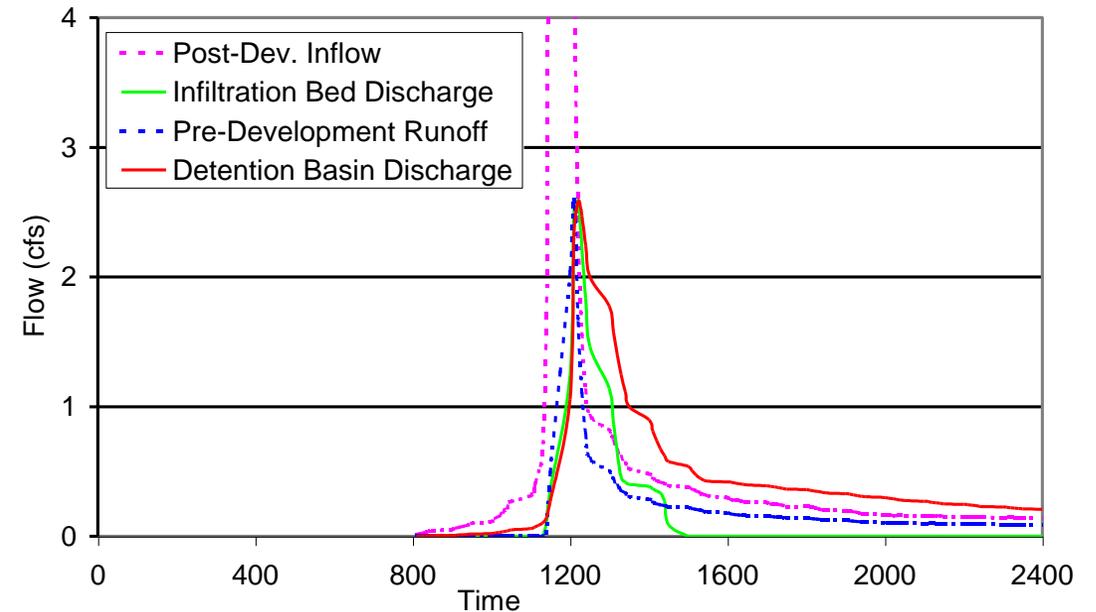


What are Porous Asphalt Pavements?



Why?

- New stormwater regulations
 - Reduce volume (not just peak flow)
 - Limiting impervious area
 - Taxing runoff
- Sustainability
- Market share

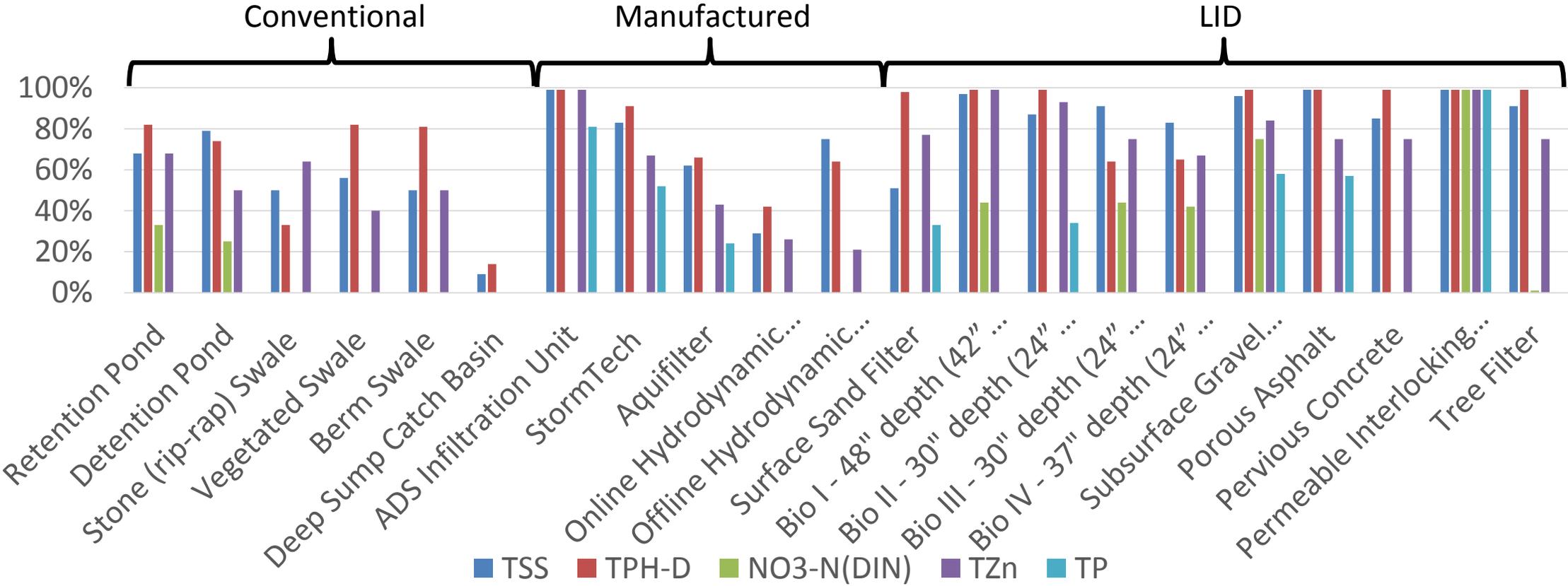


EPA

Small MS4 Stormwater Program Overview

- *Applicable controls could include preventative actions such as protecting sensitive areas (e.g., wetlands) or the use of structural BMPs such as grassed swales or porous pavement.*

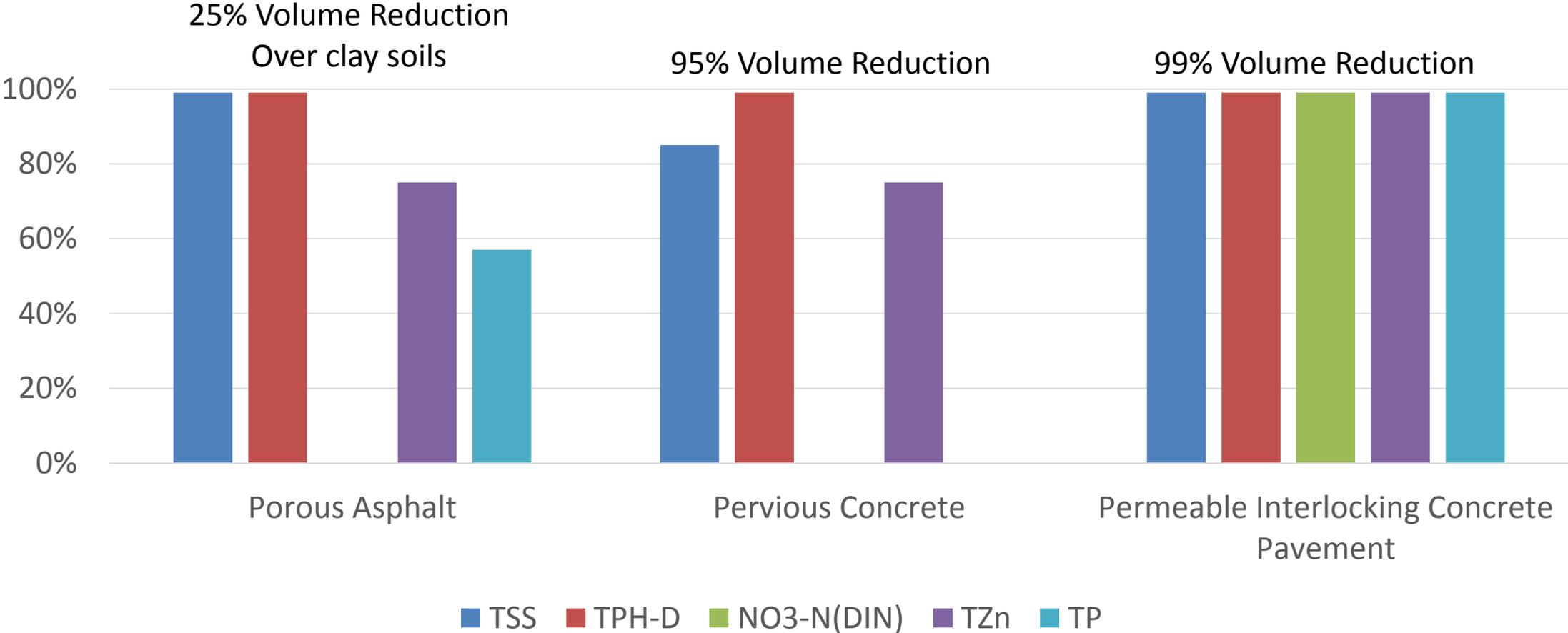
UNHSC Median Removal Efficiencies



Ref: University of New Hampshire Stormwater Center 2012 Biennial Report



UNHSC Median Removal Efficiencies

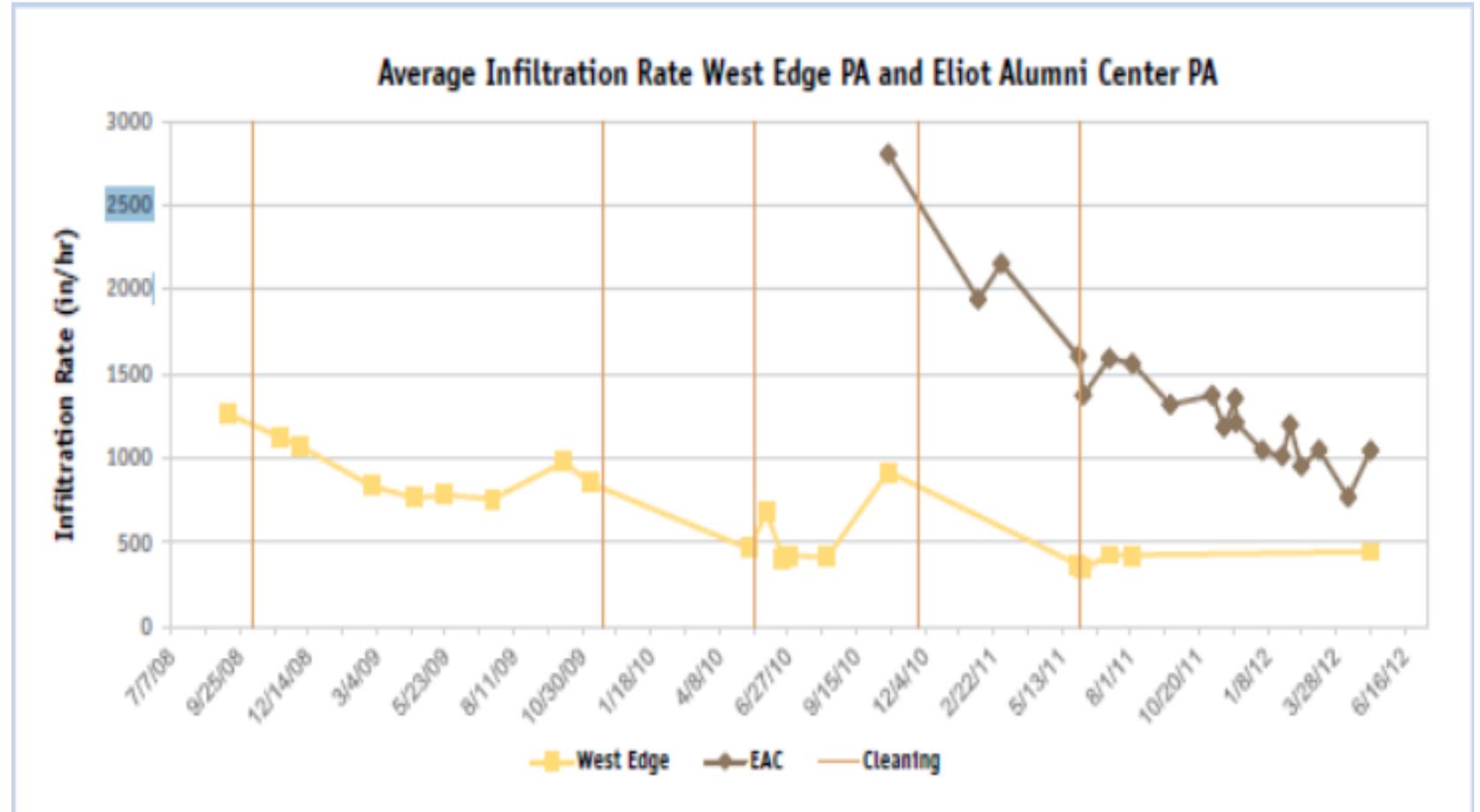


Ref: University of New Hampshire Stormwater Center 2012 Biennial Report



UNHSC Infiltration Rates

“Even for a worst case “no maintenance” scenario, infiltration rates will remain high enough such that there should be no significant runoff from common storm events.”



Ref: University of New Hampshire Stormwater Center 2012 Biennial Report

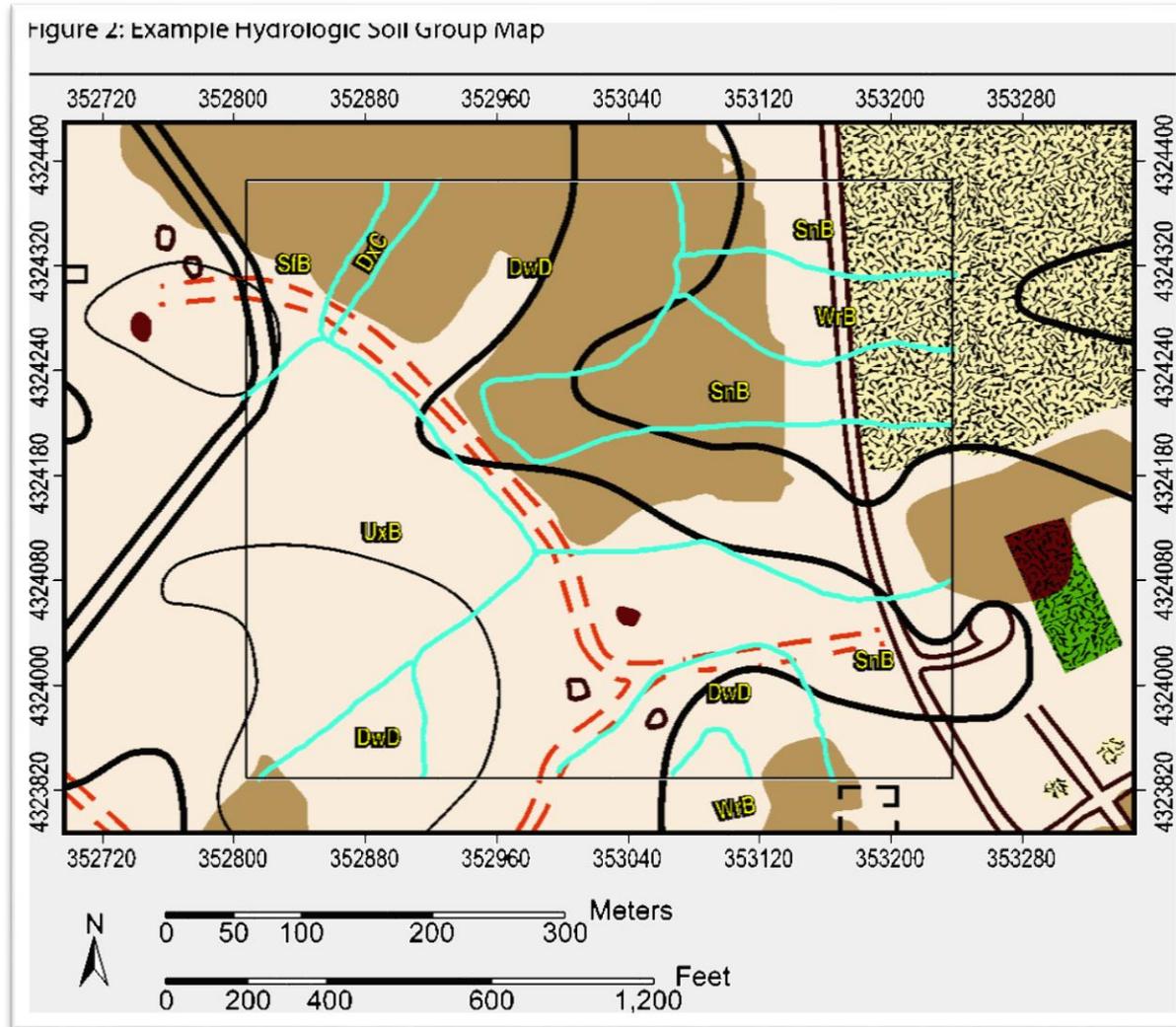


NATIONAL ASPHALT
PAVEMENT ASSOCIATION

Uses



Location



<http://websoilsurvey.nrcs.usda.gov>

Soils Investigation

- Borings and/or test pits
 - Test permeability
 - Determine depth to high water table
 - Determine depth to bedrock

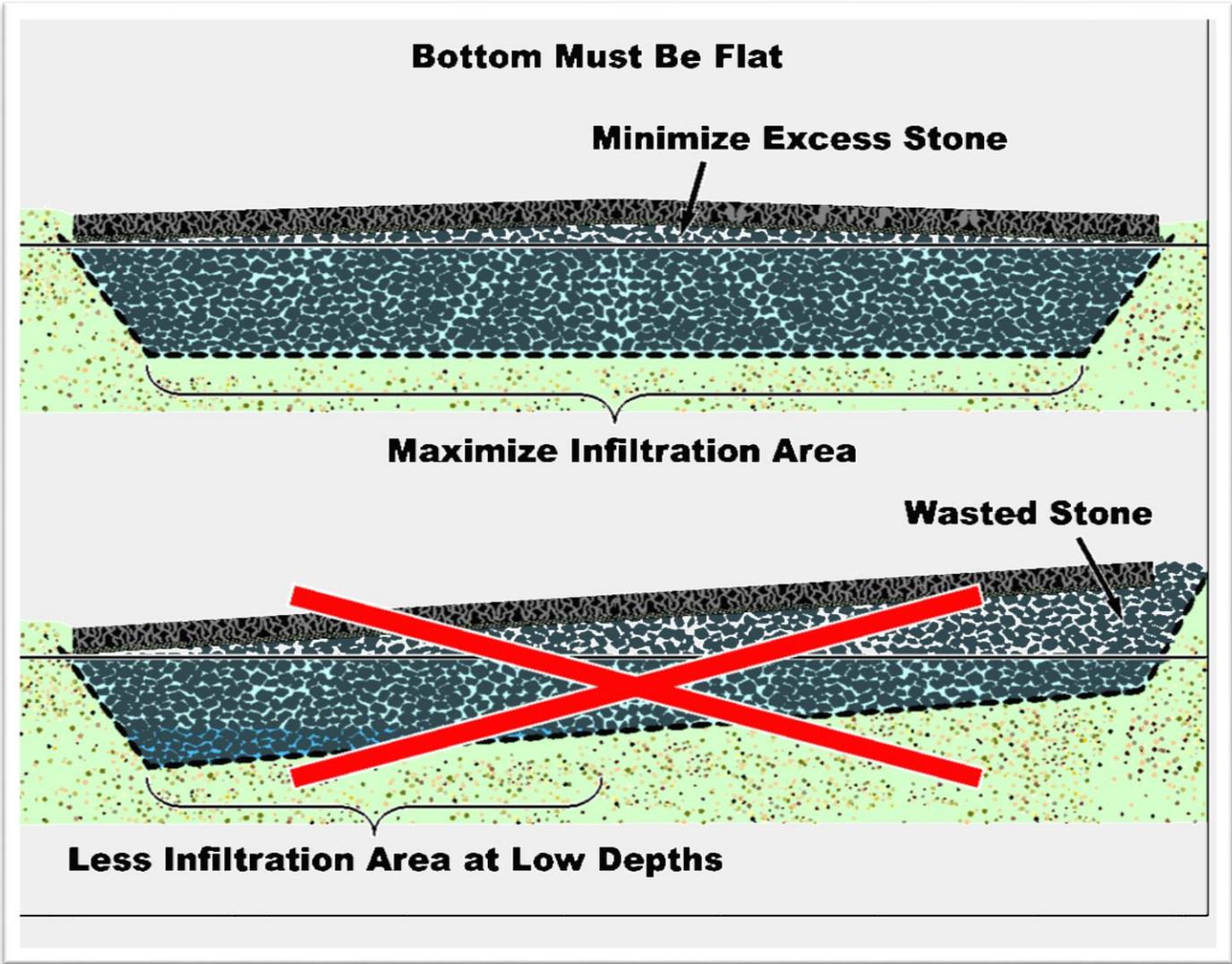


Site Conditions

- Soil permeability/infiltration rate
 - EPA and NJ recommend 0.5"/hour
 - 0.1"/hour still OK
- Depth to bedrock or high water > 2'
- Fill – not recommended
- Frost
 - Old recommendation – Pavement section should exceed frost depth. Not required



Flat Bottom



Slopes

- Slope – limit surface slope to 5%
 - Terrace when necessary
 - Use conventional HMA for steeper slopes

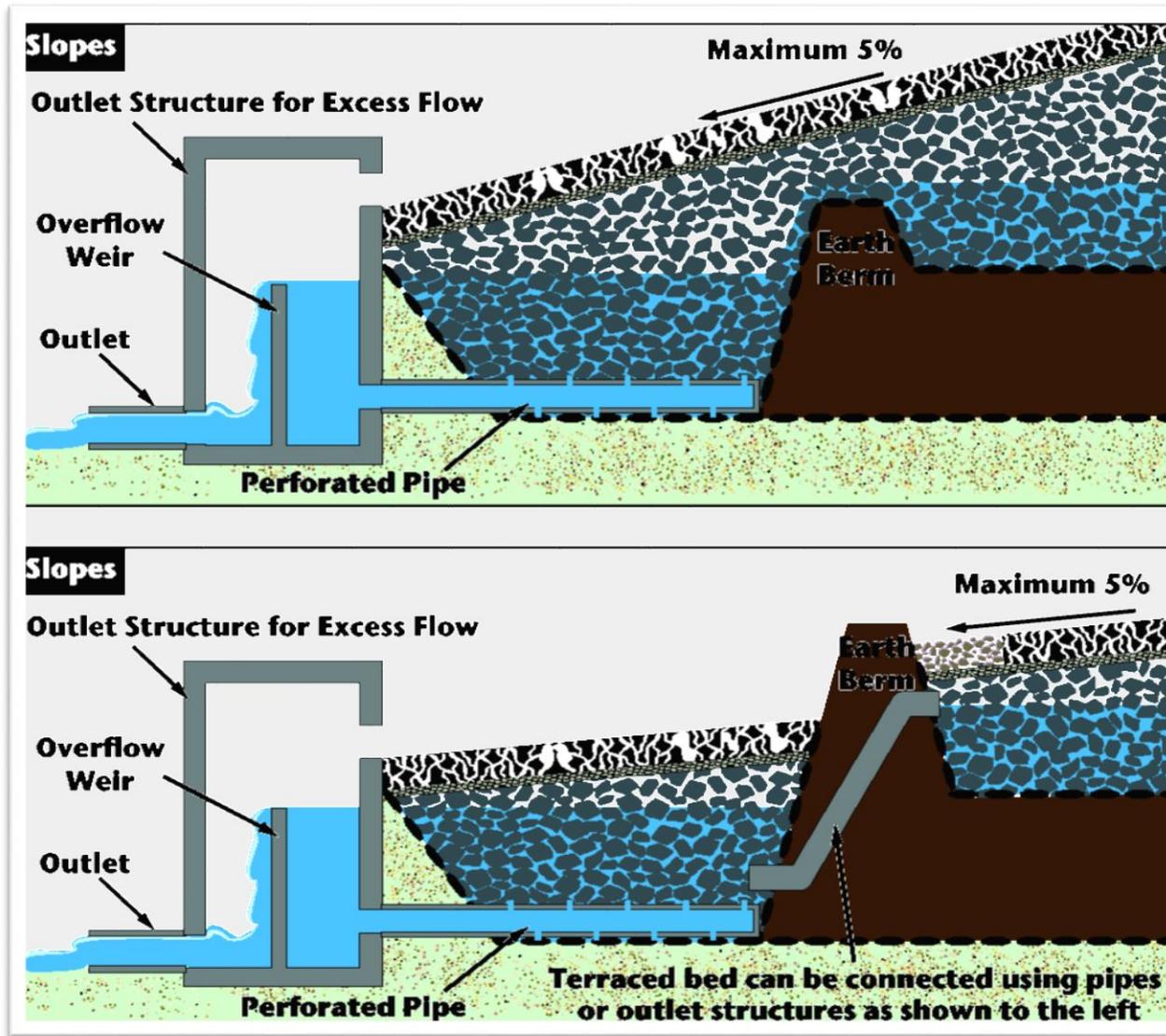


Ref: Pennsylvania Stormwater Best Management Practices Manual



NATIONAL ASPHALT
PAVEMENT ASSOCIATION

Slopes

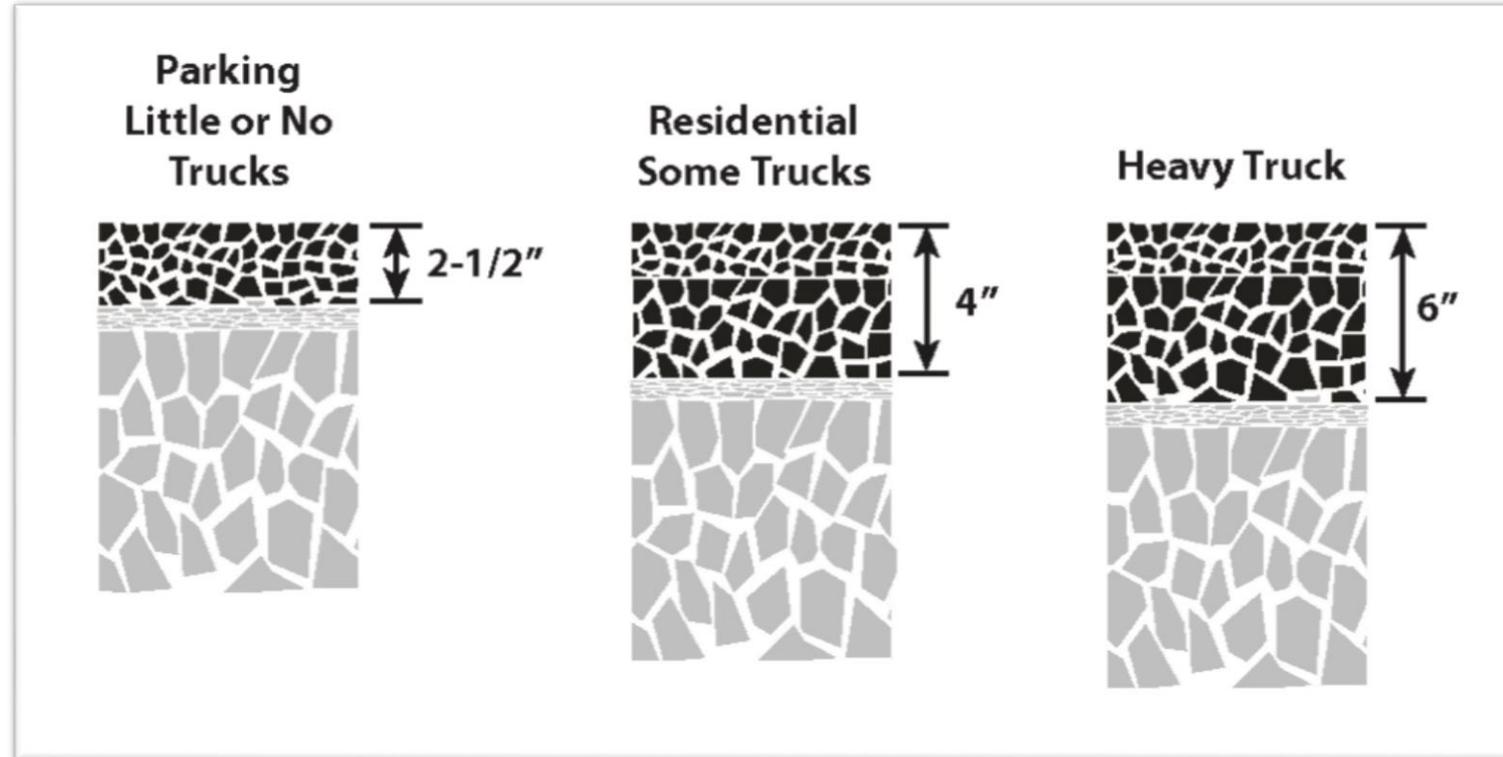


Structural Design

Follow AASHTO Design Procedures

– Layer coefficients

- Open-Graded 0.40-0.42
- ATPB 0.30-0.35
- Stone bed 0.10-0.14



Porous Asphalt Mix Options

Mix Size	Application	Layer Thickness
3/8" Open	Parking/Recreational Facilities	1.5 – 2.5 Inches
1/2" Open	Wearing Surface, Roads, Streets, Heavy Commercial	2.0 – 4.0 Inches
3/4" Open	Wearing Surface, Roads, Heavy Commercial	2.0 – 5.0 Inches
3/4" ATPB	Base Course	3.0 – 6.0 Inches

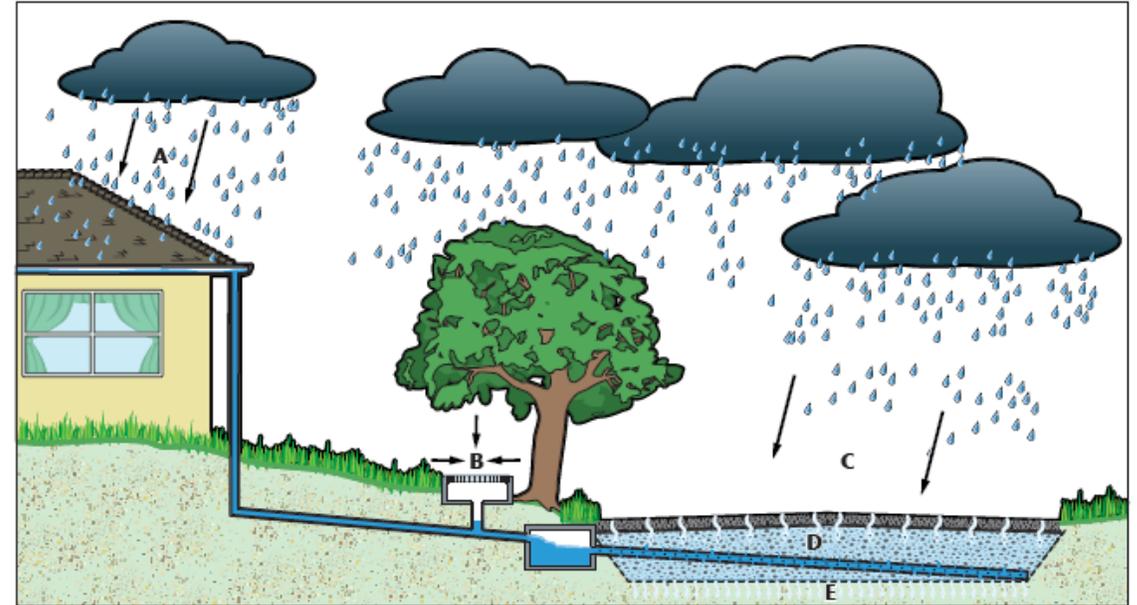
Ref: Asphalt Pavement Association of Oregon



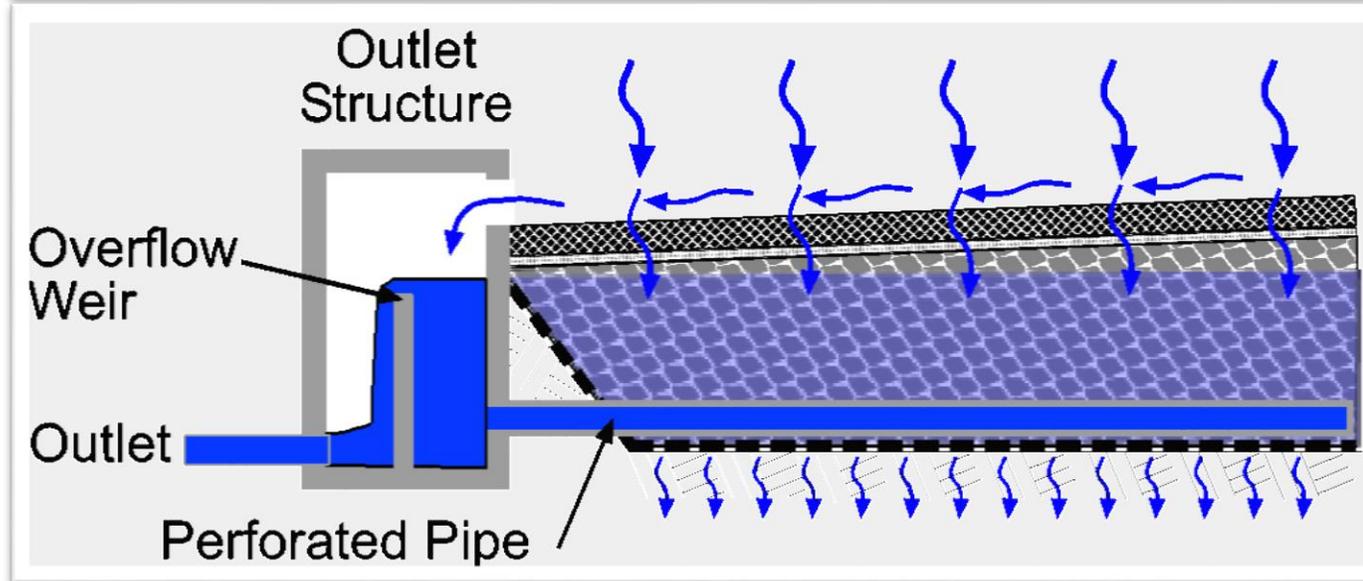
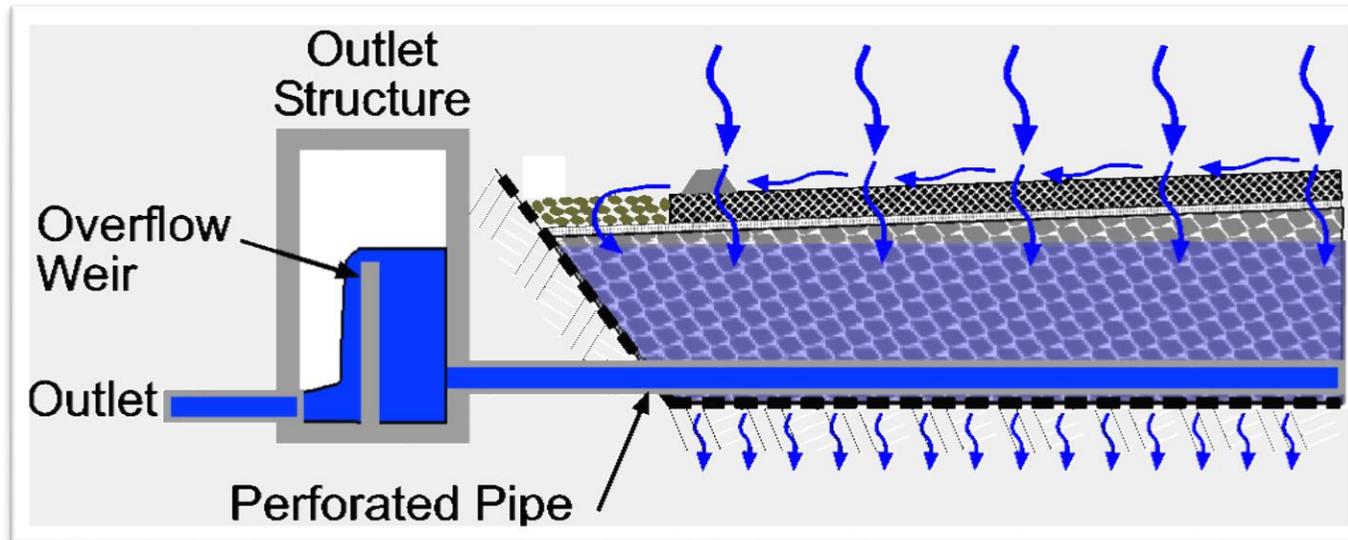
NATIONAL ASPHALT
PAVEMENT ASSOCIATION

Route Water from Impervious Areas

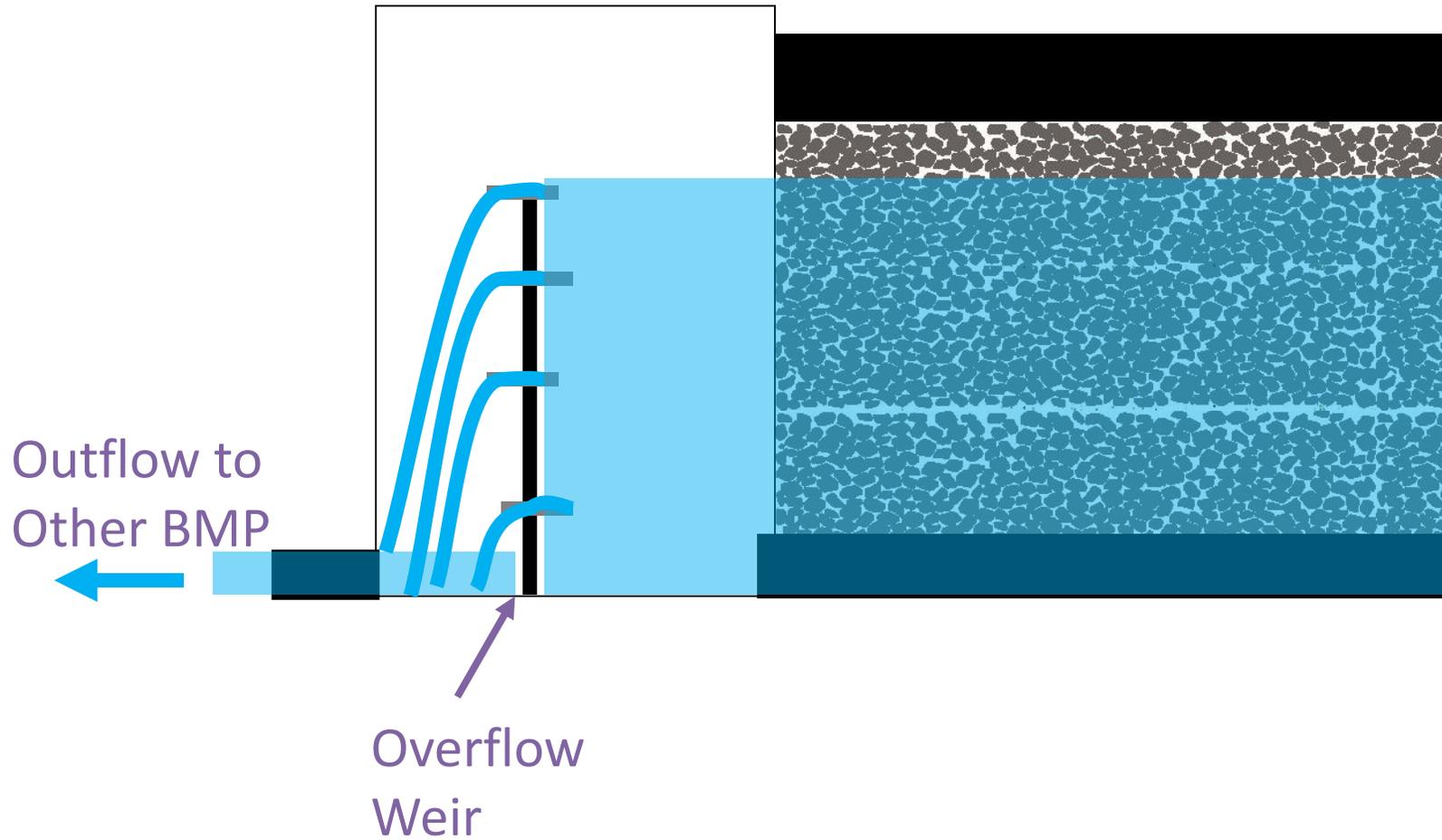
- Use to infiltrate from other impervious surfaces
 - Avoid piping water long distances
- Spread infiltration over largest area possible
 - 5:1 Impervious: Infiltration
 - 3:1 If risk of sink holes



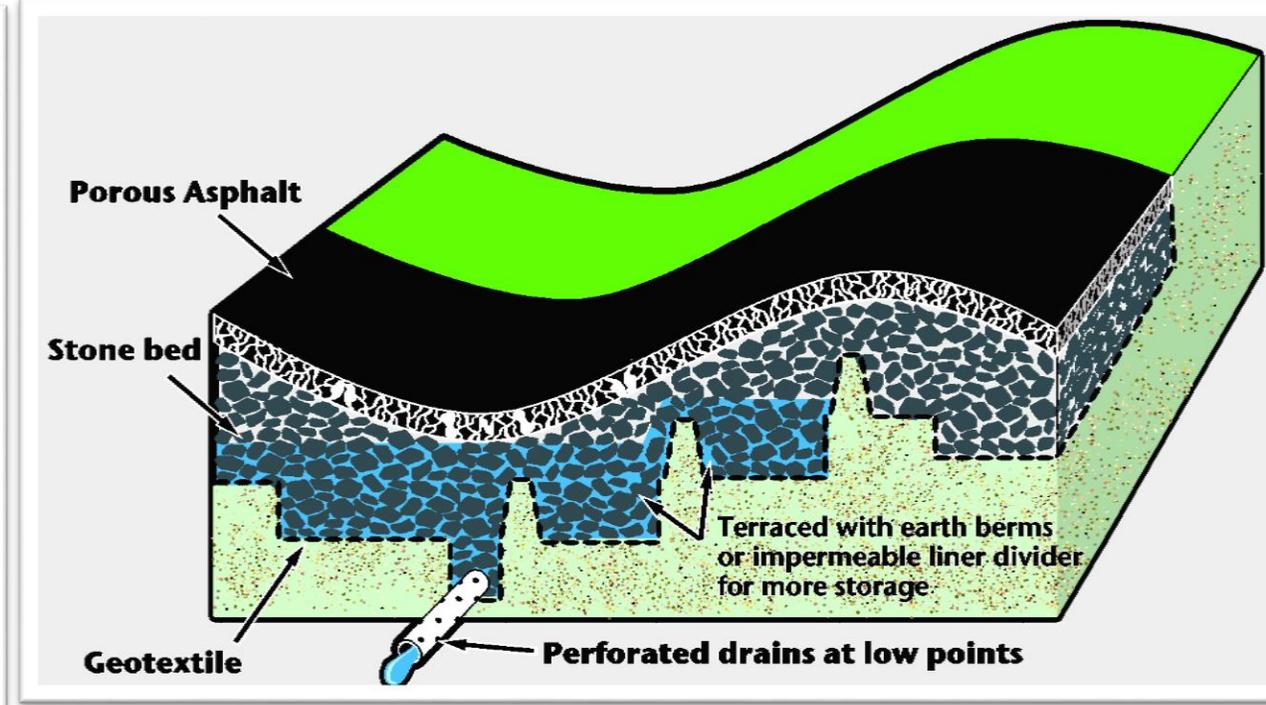
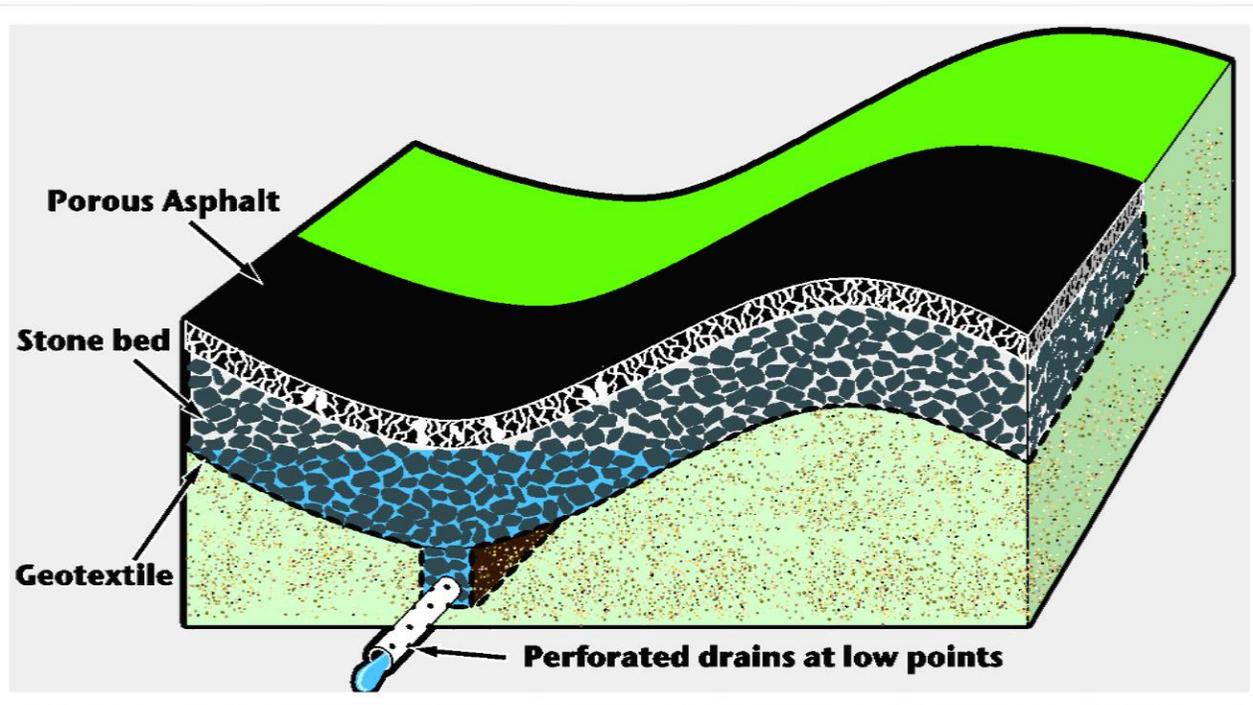
Alt Path & Overflow



What if infiltration too slow



Paths

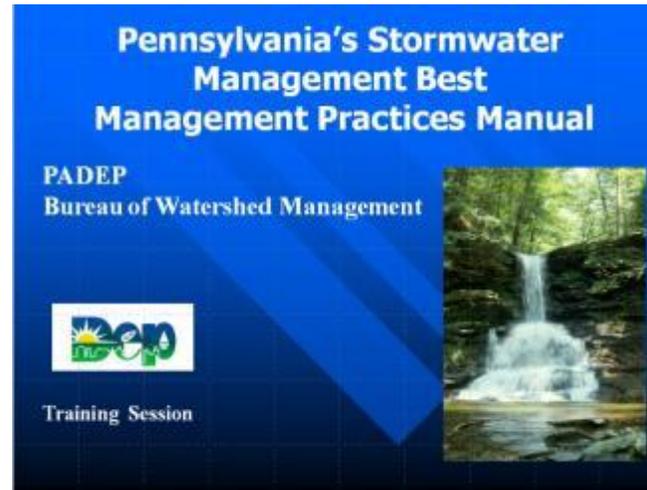


Specifications



D 7064

MARYLAND ASPHALT ASSOCIATION



Key Properties to Look for in Specifications

- Air Voids – key to permeability
 - Recommend $\geq 18\%$
- Draindown – performance & permeability
 - Draindown $\leq 0.3\%$
- Asphalt Content – for durability
 - Recommend 6.0% minimum
 - Absolute minimum 5.5%
- Max Agg Size (Surface) – 100% passing 19 mm



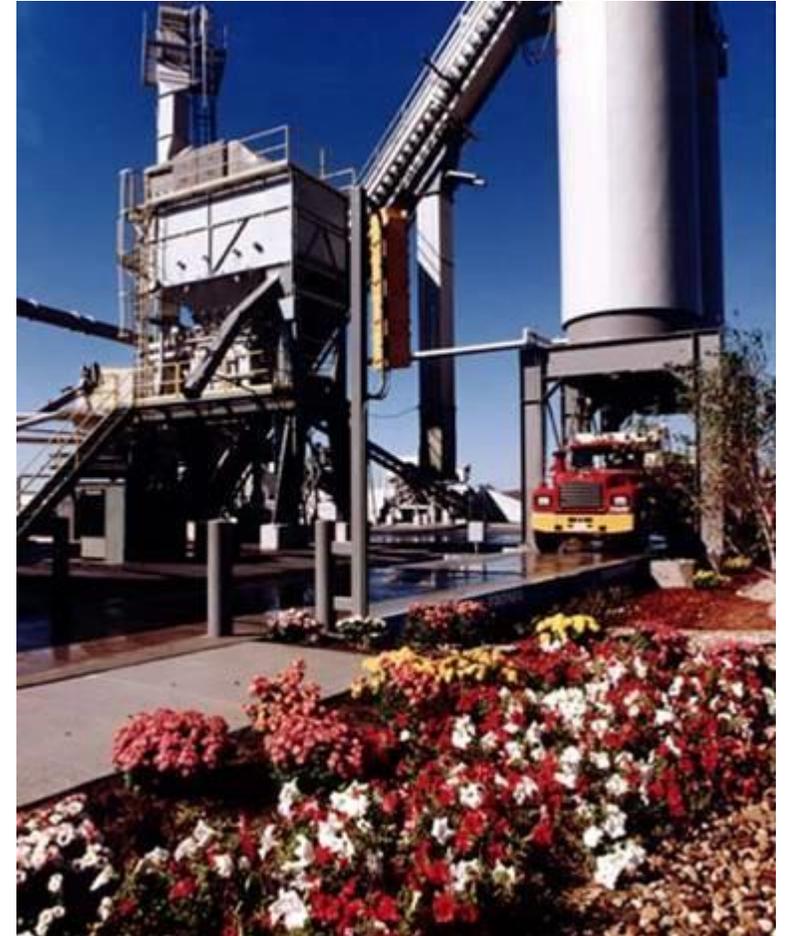
Which binder is right for Porous Asphalt Pavements?

- Recommend one or two grade bumps from standard grade
- Example:
 - Standard Grade PG 64-22
 - One grade bump PG 70-22
 - Two grade bump PG 76-22



Mix Production

- All plants capable of producing mix.
- Not a standard mix.
 - Polymer modified binders
 - Fibers – for draindown
- Talk to producers early.



Planning



NATIONAL ASPHALT
PAVEMENT ASSOCIATION

Bed Excavation



Non-woven Geotextile



 **Cahill Associates**
ENVIRONMENTAL CONSULTANTS



**NATIONAL ASPHALT
PAVEMENT ASSOCIATION**

Stone Recharge Bed



Aggregates

- Crushed
- Washed
- Single-size
- #2 or similar for bed
- #57 for choker course



Choker Course

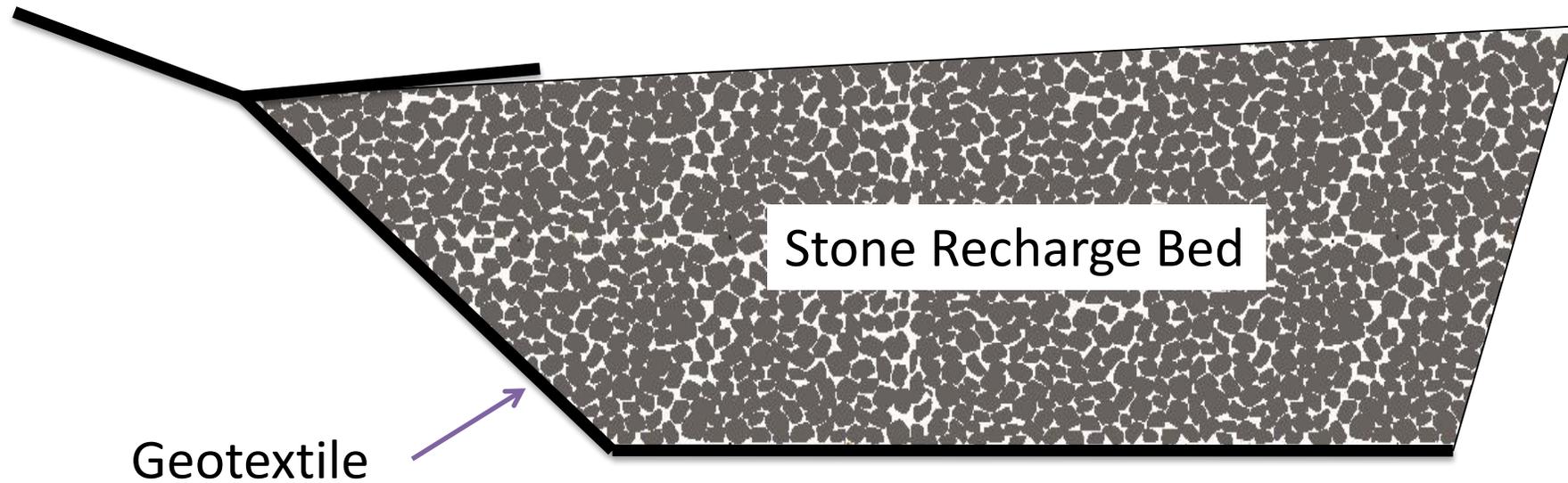


 **Cahill Associates**
ENVIRONMENTAL CONSULTANTS

NAPA

NATIONAL ASPHALT
PAVEMENT ASSOCIATION

Use Excess Fabric for Temporary Protection from Sediment





Paving



Compaction



NATIONAL ASPHALT
PAVEMENT ASSOCIATION

After Compaction



Maintenance



NATIONAL ASPHALT
PAVEMENT ASSOCIATION

City of Robbinsdale, MN



Performance

- Many projects over 20 years old.



Keys to Success

- Make sure site conditions are acceptable
 - Permeability
 - Depth to groundwater and/or bedrock
- Design
 - Bottom of infiltration bed level
 - Limit surface slope < 5%
 - Runoff from adjacent areas will not plug pavement



Keys to Success

➤ Construction

- Don't compact subgrade
- Protect pavement from contamination
 - Build porous pavement late
 - Stabilize adjacent areas before constructic

➤ Maintenance

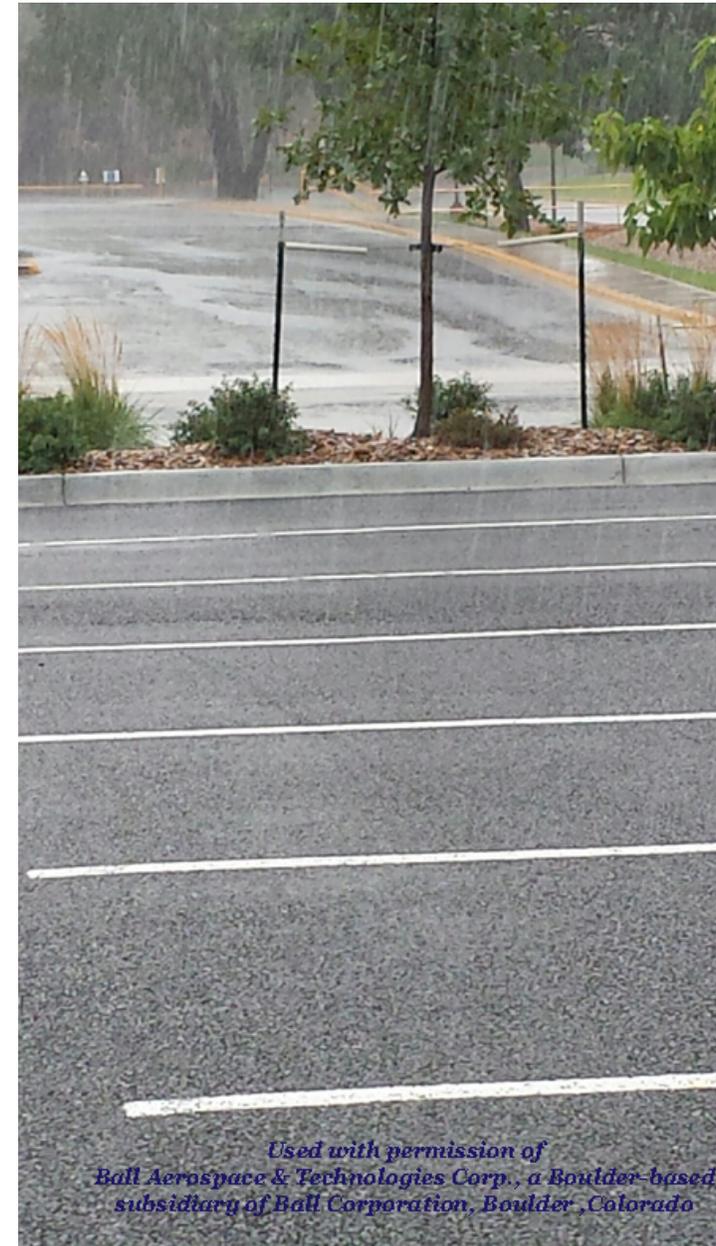
- Do not sand, or ash pavements
- Install signage to warn maintenance personnel
- Can patch with conventional asphalt < 10%



Ball Aerospace, Boulder, Colorado



*Used with permission of
Ball Aerospace & Technologies
Corp., a Boulder-based subsidiary of
Ball Corporation, Boulder, Colorado*



*Used with permission of
Ball Aerospace & Technologies Corp., a Boulder-based
subsidiary of Ball Corporation, Boulder, Colorado*



**NATIONAL ASPHALT
PAVEMENT ASSOCIATION**

Information

Information Series 131



Porous Asphalt Pavements for Stormwater Management

Design, Construction and Maintenance Guide



TechBrief

The Asphalt Pavement Technology Program is an integrated national effort to improve the long-term performance and cost effectiveness of asphalt pavements. Managed by the Federal Highway Administration through partnerships with state highway agencies, industry and academia, the program's primary goals are to reduce congestion, improve safety, and foster technology innovation. The program was established to develop and implement guidelines, methods, procedures and other tools for use in asphalt pavement materials selection, mixture design, testing, construction and quality control.



U.S. Department of Transportation
Federal Highway Administration

Office of Asset Management,
Pavements, and Construction

FHWA-HIF-15-009

April 2015

Porous Asphalt Pavements with Stone Reservoirs

This Technical Brief provides an overview of the benefits, limitations and applications of porous asphalt pavements with stone reservoirs. Considerations for design and construction, as well as maintenance, are discussed.

Introduction

Porous asphalt pavements with stone reservoirs are a multifunctional low impact development (LID) technology, which integrates ecological and environmental goals for a site with land development goals, reducing the net environmental impact for a project. Not only do they provide a strong pavement surface for parking, walkways, trails, and roads; they are designed to manage and treat stormwater runoff. With proper design and installation, porous asphalt pavements can provide a cost-effective solution for stormwater management in an environmentally friendly way. As a result, they are recognized as a best practice by the U.S. Environmental Protection Agency (EPA) and many state agencies (EPA n.d.; PDEP 2006; NJDEP 2004).

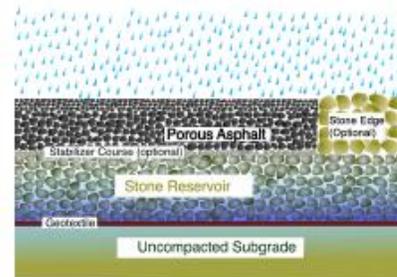


Figure 1: Typical porous asphalt pavement with stone reservoir cross section

www.porousasphalt.net



NATIONAL ASPHALT
PAVEMENT ASSOCIATION