
Minuteman National Park
Hanscom Drive Underpass
Completed: Spring 2005
Photo: October 2006


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Minuteman National Park
Hanscom Drive Underpass
Stabilized Soil
Chip-Seal
Completed: Spring 2005
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Measures of Success
NPS Battle Road

- Construction Issues
  - Ease of construction
  - Affordability
- Performance
  - Engineering Standards
  - Aesthetics
- Maintenance
  - Does it last?
  - How easy to fix?

Stabilized Soils
Do They Work?

- Design Expectations
  - Aesthetics
  - Historic environments
  - Natural environments
- Functional Requirements
  - ADAAG and AAB requirements
  - Durability

Stabilized Soils Maintenance Considerations

- Seasonal considerations
  - Certain rains – Inspection
  - No plowing
- Plan for repair
  - Edges, transitions, low points
  - Training
  - Material preparation
  - Material Storage
- “Use is maintenance”

Stabilized Soils
Design Considerations

- Grading Drainage
  - Slopes and approaches
  - Low points
  - Cross flow
- Transitions
  - Transitional materials
  - Anticipate maintenance
- Edge Conditions
  - Trees and shade
  - Compensating for cross section

Cost Summary

LOCATION	Upper Charles River Basin	Plymouth Seaside Rail Trail	National Park Service Minuteman Park Path At Hanscom Road	Typical
Installation Date	2004	2005	2005	
Asphalt	---	---	$8/SY [$21/SY avg]	$9/SY '04 $15/SY '05
Organically Stabilized Stone Dust/Aggregate	$28/SY -	$41/SY	$8/SY [$23/SY avg]	---
Cement Stabilized Stone Dust Aggregate	---	---	$8/SY [$23/SY avg]	---
Chip Seal over 3.5 in Asphalt	---	---	$30/SY [$32/SY avg]	---

Federal Guidance

DESIGNING SIDEWALKS AND TRAILS FOR ACCESS

Best Practices Design Guide

Table 15-1. Firmness, Stability, and Slip Resistance for a Variety of Common Trail Surfacing Materials

Surface Material	Firmness	Stability	Slip Resistance (dry conditions)
Asphalt	firm	stable	slip resistant
Concrete	firm	stable	slip resistant*
Soil with Stabilizer	firm	stable	slip resistant
Packed Soil without Stabilizer	firm	stable	not slip resistant
Soil with High Organic Content	soft	unstable	not slip resistant
Crushed rock (3/4" minus) with Stabilizer	firm	stable	slip resistant
Crushed rock without Stabilizer	firm	stable	not slip resistant
Wood Planks	firm	stable	slip resistant
Engineered Wood Fibers that	moderately	moderately	not slip
comply with ASTM F1951	firm	stable	resistant
Grass or Vegetative Ground Cover	moderately firm	moderately stable	not slip resistant
Engineered Wood Fibers that do not comply with ASTM F1951	soft	unstable	not slip resistant
Wood Chips (bark, cedar, generic)	moderately firm to soft	moderately stable to unstable	not slip resistant
Pea Gravel or 1-1/2" Minus Aggregate	soft	unstable	not slip resistant
Sand	soft	unstable	not slip resistant

*A broom finish significantly improves the slip resistance of concrete.

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Tested Materials with <1/4 limestone aggregate

- Mountain Grout* single component hybrid polyurethane system (name has been changed)
- Road Oyl Resin Modified Emulsion - a pine resin emulsion and is not petroleum
- Stabilizer -concentrated organic (ground seed hulls) soil additive powder.

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ANSI/RESNA Standards for Firmness and Stability

	Very Firm/Stable	Moderately Firm/Stable	Not Firm/Stable
Firmness	0.3 inch or less	>0.3 & <0.5 inch	>0.5 inch
Stability	0.5 inch or less	>0.5 & <1.0 inch	>1.0 inch

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Application	Penetration
<1/4” Limestone MountainGrout	.009-.03 inches
<1/4” Limestone with Road Oyl	.05-.08 inches
<1/4” Limestone	.10-.90 inches
Soil and Mountain Grout Soil Stabilizer	.21-.87 inches
<1/4” Limestone with Stabilizer	.36-.59 inches
50% #11 Limestone and 50% soil	.45-1.2 inches
Soil	.35-1.80 inches

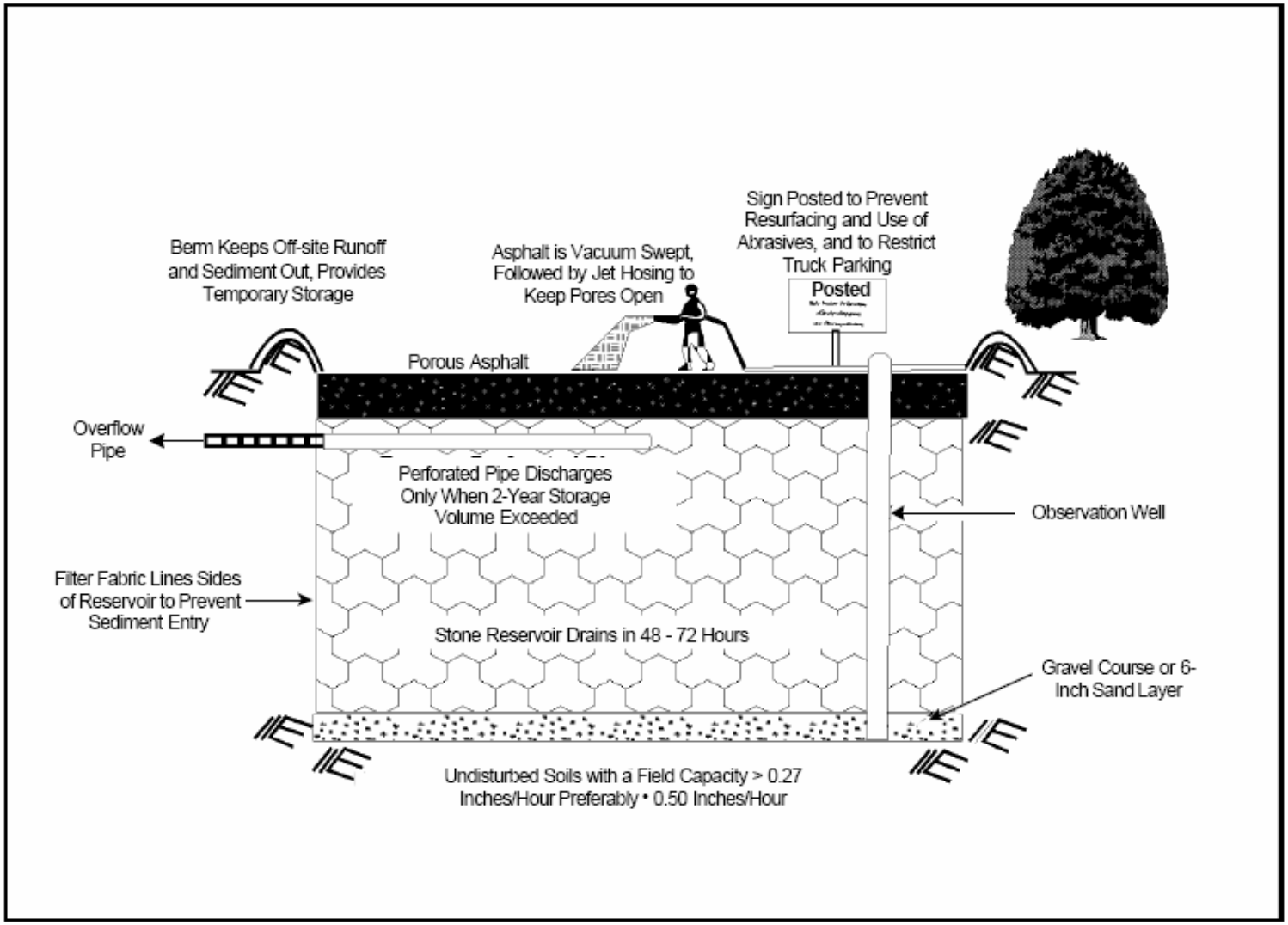
Porous Pavement
URI Study

Variety of Products and Recommendations

- Unit pavers
- “Grass Block” pavers
- Porous Concrete
- Porous Asphalt

Porous Pavement

Porous Pavement
EPA Technology Fact Sheet



Source: Modified from MWCOG, 1987.

FIGURE 1 TYPICAL POROUS PAVEMENT INSTALLATION

Porous Pavement
Walden Pond Study (1980)

Considerations

- Conditions: Hinckley excessively drained soils, plus testing to ensure excessively drained soils to 3 feet depth
- Four different porous cross sections developed
- Findings: clogging and compaction determined to be “major deterrent to full-scale use” of installations

Porous Pavement
EPA Technology Fact Sheet (1999)

Some specific disadvantages of porous pavement include the following:

- Many pavement engineers and contractors
- lack expertise with this technology.
- Porous pavement has a tendency to become
- Clogged if improperly installed or maintained.
- Porous pavement has a high rate of failure.

Porous Pavement
URI Study (2005) – Porous Asphalt

- Cost of asphalt slightly more than conventional (OG course)
- Construction
  - Porous asphalt is installed over a 1” layer of chocker course
  - 18-36”bed of uniformly graded, clean washed crushed rock
  - Geotextile fabric separator
- Cost of base is more, expected to be offset by not having to provide drainage system
- Vacuum sweeping recommended for maintenance

Porous Pavement Application for Shared Use Path

Benefit/Cost Analysis

- Excavation requirements
- Evaluate true runoff vs. percolation
  - compare shoulder drainage
- Material requirements
- Maintenance requirements
- Clogging

Planning Considerations

Purpose of Alternative Surfaces

- Environmental – Low Impact Development
  - Runoff Impacts (?)
- Material Impacts to environment (?)
- Aesthetics

Research

- Better understanding of different products
  - Organic vs. Portland cement, lime, other materials
  - Surface stabilizers vs. mixed materials
  - UMass Study – Alternative Strategies– Dr. Mogawer
  - National Center on Accessibility Stabilized Soil Study http://www.ncaonline.org/trails/soil-study.shtml
- Environmental benefits
- Maintenance
  - Benefit cost studies

Thank Yous

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- MHD District 4 Construction
- MHD District 5 Construction

THANK YOU!

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