Pervious Concrete Pavement as Public Infrastructure

City Engineers Association of Minnesota
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Presentation Outline

• Development of Pervious Concrete in Minnesota

• Highlight Successful Implementations

• Share Observations
Pervious Concrete History

• 1990’s
  – Noise/Road Spray Research
  – High Speed, High Volume Applications

• 2000’s
  – Green Road Initiatives
  – Low Volume Streets, Parking Lots
Minnesota Based Research

- Local Road Research Board
  - Inv. 879, Pervious Concrete (current)
  - Storm Water BMP Guide (2009)
  - Street Sweeping Best Practices (2008)
- Transportation Engineering & Road Research Alliance (TERRA)
  - Pervious Concrete Fact Sheet (2008)
- RMC Foundation
  - Performance Evaluation of Pervious Concrete Pavements in Cold Weather (2010)
Minnesota Examples

- At Least 50 Locations (public/private)
- Public Infrastructure
  - Minneapolis, Duluth, St. Cloud, Detroit Lakes, Richfield, Shoreview
- Options for environmental permitting
- Maintenance is a Mixed Bag
Dale Street Alley (2007)
900’ long, 12’ wide (1,200 SY)
8” Pervious Concrete, 6” CA Filter, 12” Select Granular Subgrade Drainage (low infiltration soils)
Rolled-in Joints, Poly Sheeting
Woodbridge Neighborhood (2009)
25’ Wide Residential Streets (8,600 SY)
7” Pervious Concrete, 18”-30” CA Filter
No Storm Sewer or Sub drains (high infiltration soils)
Saw Joints, Curing Fabric
Pervious Concrete Cost Comparison

Common Excavation – 11,000 CY($6.00/CY) = $ 66,000*
Fabric – 11,000 SY($1.00/SY) = $ 11,000
1-1/2” Crushed Rock – 5000 CY($52.00/CY) = $260,000*
7” Pervious Concrete – 8470 SY($46.50/SY) = $394,000
Total Cost for Pervious Concrete System = $731,000
Per SY Cost for Pervious Concrete System = $ 86.30**

*Average depth beneath concrete = 1.75-feet

Estimated Bituminous Road Cost = $257,000
Estimated Underground Infiltration Cost = $417,500
Total Est Cost – Bit Road & Infiltration = $674,000
Per SY Est Cost – Bit Road & Infiltration = $ 79.60**

**8.5% Increased Cost for Pervious Concrete
Shoreview Maintenance Building (2011)

20 Vehicle Parking Lot (800 SY)
6” Pervious Concrete, 30” CA Filter Aggregate
Subgrade Drainage (low infiltration soils)
Saw Joints, Curing Fabric
Pervious Concrete Success Stories

Leverage High Infiltration Soils
  – Cost-effective without drainage systems

Creative Approach Preserves Character
  – Developed areas without room for ponds

Maintenance Requirements Understood
  – Owner with training and equipment
Observations

Mix Design

125 pcf, 21% air voids +/- 3% (Avg)

Joints

Saw cut joints 24-48 hrs after pour
Saw cut appears more durable than rolled-in

Coarse Filter Aggregate

Angular vs. Rounded
1-1/2” Railroad Ballast
Need 40% Void Space
Observations

Concrete Curing

Fabric in lieu of poly sheeting
Very vulnerable to drying out (spalling)

Placement

Roller tube paver provided tighter surface
cores show top 2 inches more consolidated

Restoration behind curb
Maintenance Considerations

Keeping the Pavement Clean

– Infiltration rates of 300–500 in/hr – can live with some clogging
– Clogging occurs in top ¼ inch
– Need Vacuum/Regenerative air sweeper
  • Best surface cleaning based on in-field tests
  • Some areas require deeper cleaning
  • Schedule of cleaning is a work in progress
Other Considerations

Winter Maintenance Philosophy (Shoreview)
  – Use zero salt
  – 1 ton PU for plowing

Educating Residents
  – Need continued outreach effort
  – Focused Erosion Control/Grading Inspections
Woodbridge Neighborhood (2012)
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Contacts

Owner       City of Shoreview
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Research Resources
– TERRA (terraroadalliance.org)
– Mn LRRB (lrrb.org)
– RMC Foundation

Industry Certifications
– Nat’l Ready Mix Concrete Assn. (nrmca.org)
– Minnesota Aggregate Ready Mix Assn (armofmn.com)