AGGREGATE & READY MIX
ASSOCIATION OF MINNESOTA

Pervious Pavement as Public Infrastructure

2013 ARM Convention & Annual Meeting

December 3, 2013

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City of Shoreview, MN

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Presentation Outline

- Development of Pervious Concrete in Minnesota
- Details of Shoreview Projects
- Observations/Successful Implementations

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Pervious Concrete History

- 1990's
  - Noise/Road Spray Research (FHWA, MnDOT)
  - High Speed, High Volume Applications
- 2000's
  - Green Road Initiatives
  - Low Volume Streets, Parking Lots

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Minnesota Based Research

- Local Road Research Board
  - Inv. 879, Pervious Concrete (current)
  - Storm Water BMP Guide (2009)
  - Street Sweeping Best Practices (2008)
  - MnRoad Facility Testing (2005)
- Transportation Engineering & Road Research Alliance (TERRA)
  - Pervious Concrete Fact Sheet (2008)
- RMC Foundation
  - Performance Evaluation of Pervious Concrete Pavements in Cold Weather (2010)

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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

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Shoreview, Minnesota

- 27,000 Pop.
- 12 Square Miles
- 33% Parks, Open Space & Water Bodies
- 100 miles of Streets
- Rapid Growth 1970/80's

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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

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Woodbridge Neighborhood Project

Residential Area 38 acres

- Fully Developed
- Adjacent to Impacted Water Body (Lake Owasso)

9,000 Sq. Yds. Of Existing Asphalt Roadway

Storm Drainage

- One (1) storm inlet for Neighborhood
- Direct Discharge to the Lake

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Project Objectives

Remove and Replace Roadway

Upgrade Municipal Utilities Where Needed

Improve Storm Water Management

- Traditional Design vs. Creative Approaches (Infiltration)
- Leverage Recent Cold-Weather Research Initiatives
- Cost-effective, Life Cycle Approach
- Pervious Concrete Selected by City Council

Total Project Cost $1.5M

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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

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Selection of Pervious Concrete

- Elimination of discharge pipe to lake
- Underground pipes not required
  - Reduce impact on neighborhood character
- Past City experience
  - 2007 installed 900 x 12 foot alley
- Soil type perfect for infiltration
- Advancements in mix designs and placement techniques
- **Could control maintenance schedule**

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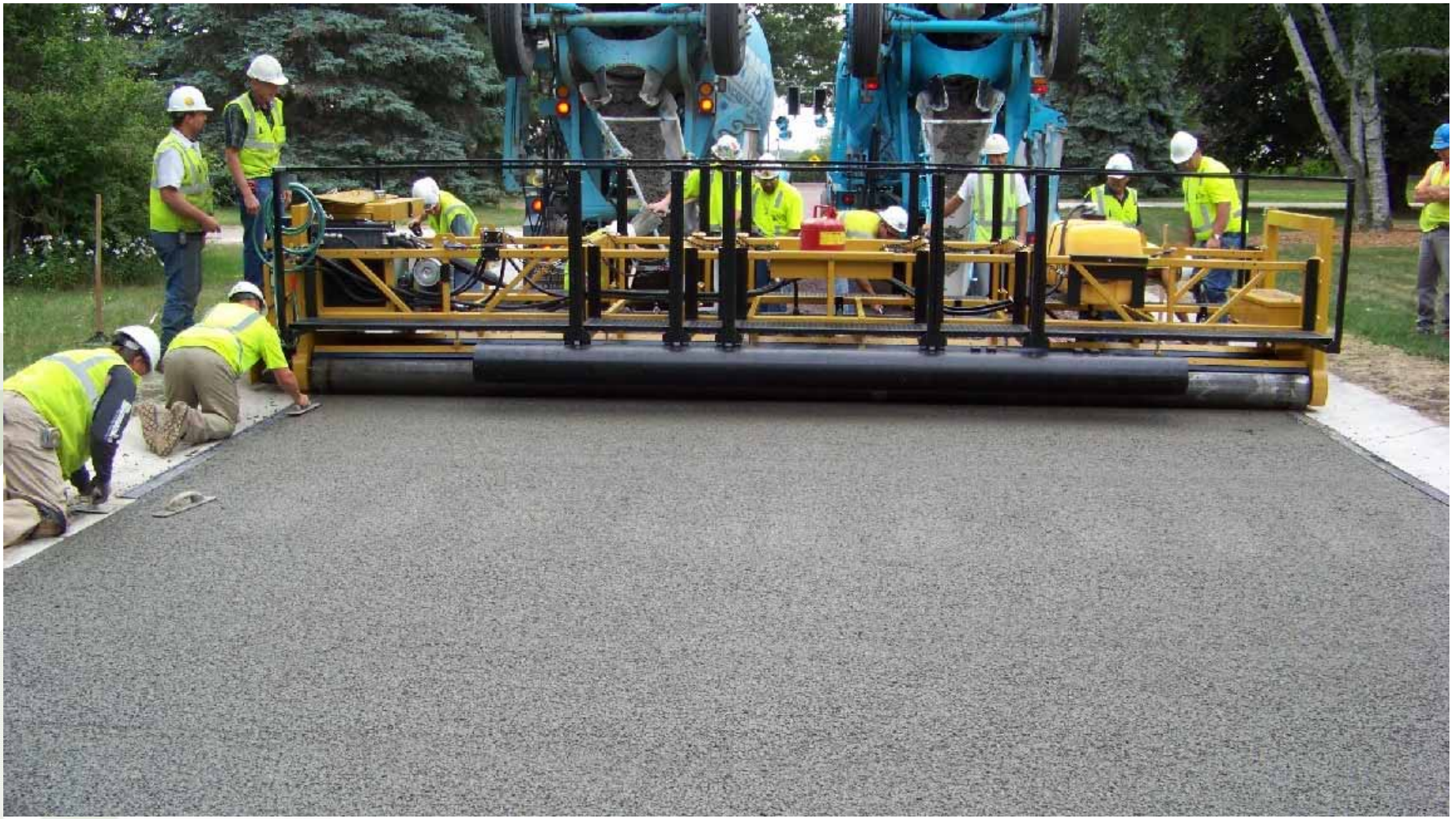

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WATER

Pervious Concrete Cost Comparison (Woodbridge Neighborhood 2009)

- Common Excavation – 11,000CY($6.00/CY) = $ 66,000*
- Fabric – 11,000SY($1.00/SY) = $ 11,000
- 1-1/2” Crushed Rock – 5000CY($52.00/CY) = $260,000*
- 7” Pervious Concrete – 8470SY($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*

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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

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Pervious Concrete 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

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Pervious Concrete 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

Keeping the Pavement Clean

Infiltration rates of 300–500in/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

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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

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Staying Green……

- Winter Maintenance Philosophy (Shoreview)
  - Use zero salt
  - 1 ton PU for plowing
- Educating Residents
  - Need continued outreach effort
  - Focused Erosion Control/Grading Inspections
- Monitoring Wells/Rain Gauge

So How's It Working?

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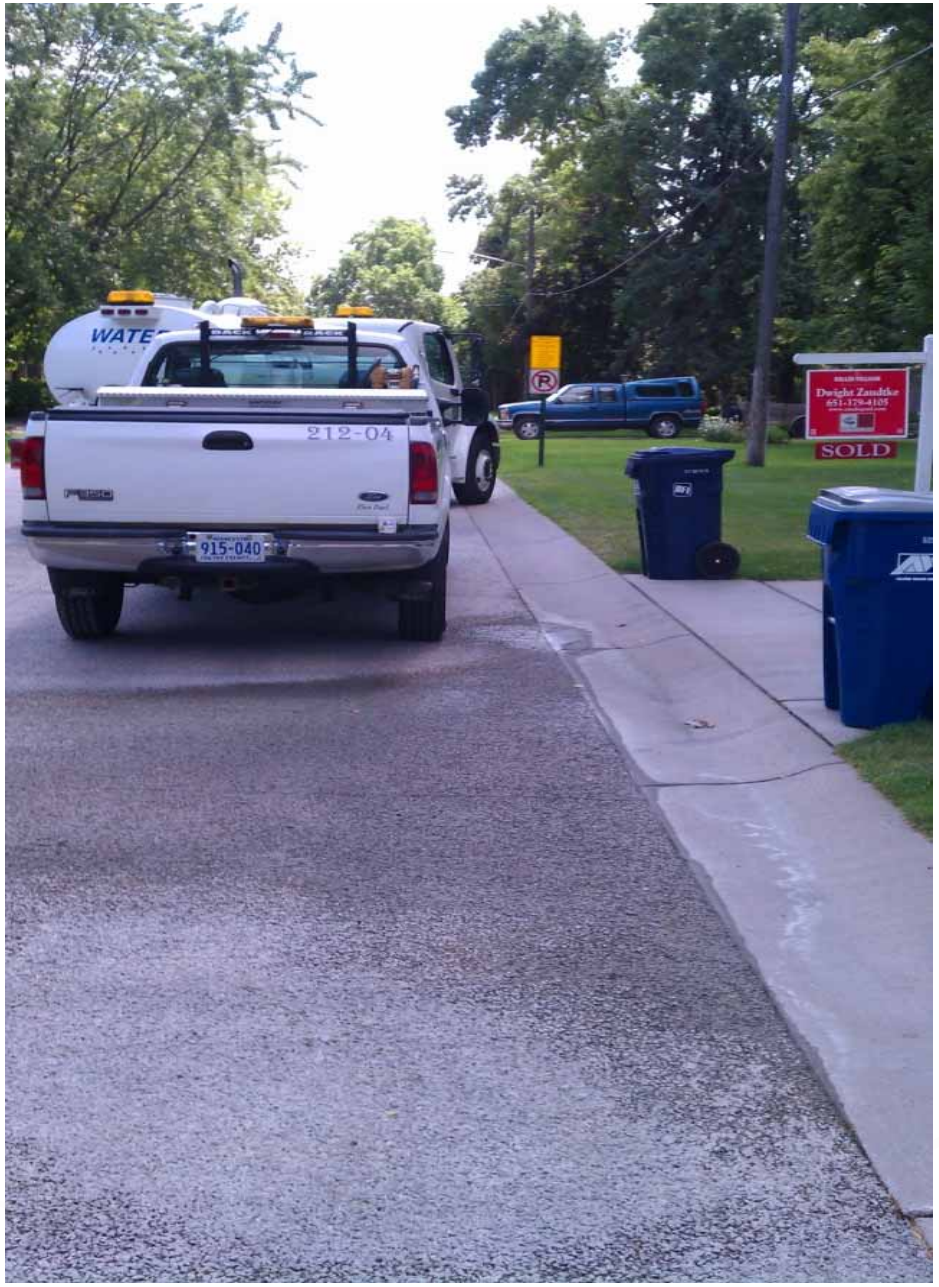
PERVIOUS PAVEMENT
THE FOLLOWING ARE NOT ALLOWED ON THE ROADWAY:
• NO LANDSCAPING MATERIALS
• NO DISCHARGED GRASS CLIPPINGS
• NO DUMPSTERS
• NO BUILDING MATERIALS
PLEASE HELP KEEP YOUR ROAD CLEAN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Minnesota's Experience…..

Soil Types Can Be A Significant Factor

Significant Resources Available

Can Be Built and Maintained Correctly

Pervious Pavements Do Work As Public Infrastructure

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Contacts

Local Government- City of Shoreview, Minnesota

- Woodbridge Project (www.shoreviewmn.gov)

Research Resources

- TERRA (terraroadalliance.org)
- Mn LRRB (lrrb.org)
- RMC Foundation (rmc-foundation.org)

Industry Certifications

- Nat'l Ready Mix Concrete Assn. (nrmca.org)
- Minnesota Aggregate Ready Mix Assn (armofmn.com)

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