



SHRP2 SOLUTIONS
STRATEGIC HIGHWAY RESEARCH PROGRAM

R26 Preservation Of High Traffic Volume Roadways

MnROAD Concrete Pavement Preservation

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MnDOT Concrete Pavement Preservation

MnDOT history:

Long and successful performance with CPR methods

- Partial-depth repairs
- Full-depth repairs
- Diamond grinding

Benefit of MnROAD facility:

Ability to take risks and easily monitor performance

- Innovate load transfer devices
- Innovative repair materials
- Innovative surface restoration techniques
- Quantified loadings and environmental effects

MnROAD Cold Regions Pavement Testing Facility

Interstate Mainline

3.5 miles

Traffic: I-94 Public

29,700 (2013) AADT

13% (2013) HCAADT

PCC = ~ 1.2 Million ESALs/year

HMA = ~ 0.8 Million ESALs/year

Low Volume Road

2.5 miles closed loop

Traffic: MnROAD 5-axle Semi

Inside Lane: 80,000 lbs, 5 days/week

Outside Lane: No loads (environmental effects)

Average 60 laps ≈ 225 ESALs per day

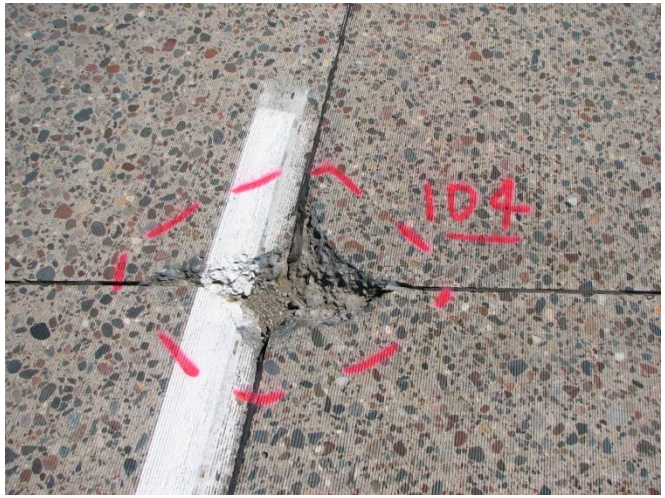
SHRP2 R26 Table 2.1
Common Pavement Preservation Treatments

- **Joint resealing** 
- Crack sealing
- **Diamond grinding** 
- **Diamond grooving**
- **Pavement Patching** 
  - **Partial-depth**
  - **Full-depth**
- **Dowel bar retrofit** 
- **Thin PCC overlay** 
- Ultrathin bonded wearing course
- Thin HMA overlay
- Drainage preservation

MnROAD Pavement Patching – Partial depth

In 2011, repairs needed for 7 mainline test cells

- **Cells 7, 8, 9, 12, 13, 63, 96 → 141 repairs in total**
- **Shallow deterioration along transverse and longitudinal joints**
- **1993 MnDOT mixes (higher w/cm)**
- **17 years to 1st patching typical for older MnDOT mixes**



MnROAD Pavement Patching – Partial depth

Prep

- Mill – rotary machine
- Jackhammer
- Sandblast
- Clean
- Prime with slurry of cement, sand, and water (if needed)

Patching

- Manufacturer/MnDOT installation
- Cure under plastic for one week

MnROAD Pavement Patching – Partial depth

Patch materials

- 18 cement/epoxy based
- 3 asphalt based
- MnDOT 3U18 control

MnROAD Pavement Patching – Partial depth

MnROAD Pavement Patching – Full depth

Joint repairs to evaluate innovative dowels

- Cell 12 – mainline, 9.5” design
- Cell 32 – LVR, 5” design
- Cell 38 – LVR, 6” design

Innovative dowels

- Plate dowels
  - PNA CoVex™
- Corrosion resistant dowels
  - CRT Long Life™ dowels

MnROAD Pavement Patching – Full depth

6” Cell 38 – Oct 2010 installation

- PNA CoVex, 3/8” thick plates
- Fiber-reinforced ready mix PCC

MnROAD Pavement Patching – Full depth

9.5” Cell 12 – Oct 2013 installation

- PNA CoVex, ¾” thick plates
- Fiber-reinforced ready mix PCC

MnROAD Pavement Patching – Full depth

9.5” Cell 12 – June 2014 installation

- CRT Long Life™ dowels, 1” and 1.5” diameter FRP clad steel

MnROAD Pavement Preservation

5” Cell 32 – Oct 2013 repairs

Prior condition:

- Cracked panels
- Significantly faulted (undoweled) joints
- History of pumping of base material

Repairs:

- Full-depth partial panel replacements
- PNA CoVex, 3/8” thick plates around perimeter
- Retrofit plate dowels
- Retrofit ¾” diameter standard epoxy coated dowels
- Diamond grinding to remove faulted joints
- Reseal joints and edge of repairs

MnROAD Pavement Preservation

5” Cell 32 – Oct 2013 repairs

MnROAD Pavement Preservation

5” Cell 32 – Oct 2013 repairs

MnROAD PCC Surface Restoration

Diamond grinding

Cells 7, 8, 9, 70, 71, 32, 37, 39 (Pervious PCC)

- Traditional
- Innovative
- NGCS

MnROAD Thin PCC Overlays

21 different thin concrete overlay test sections since 1997

Cells 39, 60-63, 92-97, 105-605, 160, 162, 140, 240

- **Thin bonded concrete overlay of asphalt (BCOA, aka whitetopping)**
- **Thin unbonded concrete overlay of concrete (UBOL)**
- **Thin bonded pervious concrete overlay of concrete**

MnROAD Thin PCC Overlays

Thin BCOA (Whitetopping) variables studied

- Thickness
  - 3”, 4”, 5” 6”
- Panel size
  - 4’x4’, 5’L x 6’W, 6’x6’, 10’L x 12’W
- Joints
  - Doweled, undoweled, reduced dowels
  - Sealed, unsealed
- Fiber PCC
  - Shrinkage, structural

Repairs

- Full panel
- Partial-depth joint
- Diamond grinding

MnROAD Thin PCC Overlays

Thin UBOL – variables studied

- Thickness
  - 3”, 4”, 5”
- Panel size
  - 6’ x 6’, 6’L x 6.5’W, 6’L x 7’W, 15’L x 13’W, 15’L x 14’W
- Interlayer
  - PASSRC, standard nonwoven geotextile, thin nonwoven geotextile
- Fiber PCC
  - Structural

Repairs

- Retrofit plate dowels

MnROAD Thin PCC Overlays

Ultrathin unbonded concrete overlay of concrete

- Cells 140, 240 – constructed June 2013
- Thickness = 3”
- Panel size = 6’ x 6’
- Interlayer = standard nonwoven geotextile, thin nonwoven geotextile
- Fiber PCC = Structural

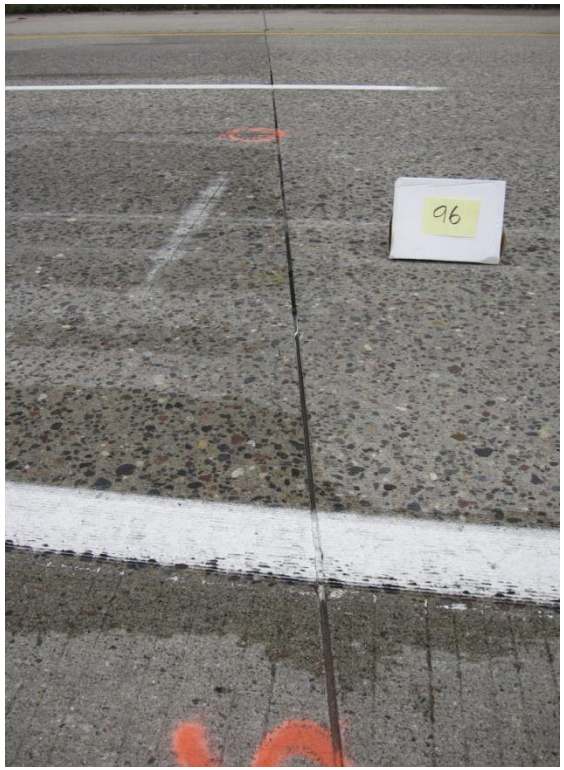
MnROAD Joint Resealing

Evaluating effectiveness of penetrating sealers

- Test joints part of pooled fund TPF 5(224)
  [Joint deterioration in PCC]
- Penetrating sealants applied to MnROAD transverse joints
  - Cells 8 & 9 (20 years old)
  - Cell 505 (2 years old)
- Silane/Siloxane
- Similar studies being conducted in Michigan and Indiana

MnROAD Joint Resealing

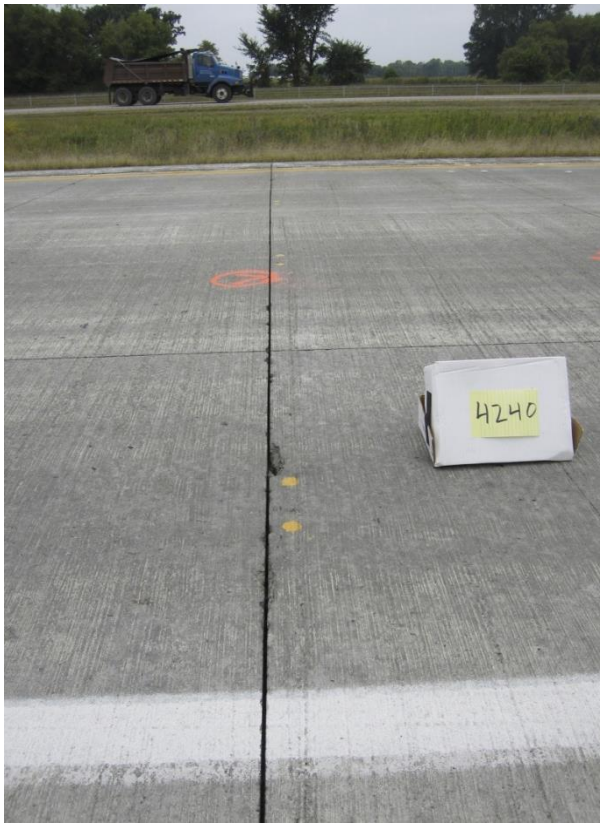
Fall 2013, applied Silane/Siloxane to transverse joints in MnROAD Cells 8 and 9 (7.5” PCC on PASB)



- **Minor MRD distress along joints**
- **Removed and reinstalled silicone joint sealant**

MnROAD Joint Resealing

Fall 2013, applied Silane/Siloxane to transverse joints in MnROAD Cell 505 (5” UBOL on fabric)



Unsealed joints in excellent condition

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