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**
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 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
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5” Cell 32 – Oct 2013 repairs
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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
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
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
Contact Information

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