Concrete Pavement Repair In Minnesota: Let’s Learn from Each Other

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Concrete Pavement Rehabilitation (CPR) Website
www.dot.state.mn.us/materials/concretepavement.html
Pavement rehabilitation program

Investigation
It is recommended that investigation into soundness of the pavement be performed before a project and specific repairs are decided upon. This investigation should include 'chaining' the pavement, coring and sometimes milling at the joints to determine severity of deterioration, and coring near and far away from the joints to test for freeze-thaw durability.

Revisions and modifications
CD-HV and CX repair details have been revised to include 11 dowel bars per lane instead of the previously published 8 dowel bars per lane. CPR details and State Aid repair details have been modified and combined as of August 2015. Review the CPR memo and boiler plates for details about specific revisions and modifications.

CPR memo and boiler plates
- CPR memo with changes and boiler plates (revised 4/22/16) - Adobe Acrobat (*.pdf)
- CPR boiler plates (revised 4/22/16) - Microstation (*.dgn)
MnDOT Repair Details

- Type A Repairs, Joint and Crack Sealing
- Type B Repairs, Partial Depth Repairs (PDR’s)
- Type C Repairs, Full Depth Repairs (FDR’s)
- Dowel Bar Retrofits (DBR’s)
- Concrete Grinding (Surface Planning for Ride and Friction)
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Determine if PDR’s are a Feasible Repair

• Partial Depth Repairs perform best when used correctly...
• Meaning, PDR’s should remain (mostly) partial depth.
• Take Cores to determine extent (depth) of deterioration
Stay away from pavements with Alkali-Silica Reactivity (ASR) or have Expansive Aggregates (D-cracked pavements)
Some Roadways Are Too Far Gone

Compromised Air Entrainment System
Coring the Project is ESSENTIAL.
PDR’s work well when placed on solid concrete.

Typical Minnesota Bottom up Deterioration

When in Doubt, Take it Out!
Preparing a CPR Project?

- Consider traffic/amount of truck traffic,
- Life expectancy...How long do you want it to last?
- Remember, Full Depth Repairs are the “Gold Standard”
- Location of the repairs...A PDR’s in the wheel path will not last as long.

The Good

The Bad
You Never Know What Lies Below
Little Late to Take Cores Now

The Ugly

Could have done a FDR for less cost
You Never Know What Lies Below

I-394 Bit Overlaid Twice

Core Shows Underlying Pavement was Solid
CPR work tends to look like a bomb went off.
Mn/DOT Partial Depth Repairs (Type B Repairs)

- Partial Depth Repair Type BA (ft²)
- Partial Depth Repair Type B3 (lineal foot)
- Partial Depth Repair Special Type BE (ft²)
Partial Depth Repair (Type BA & B3)

**Partial Depth Repair (Type BA)**

**WORK TO BE DONE**
1. Remove all concrete to limits shown in detail, including all unsound concrete by milling and chipping hammers.
2. If the end of the dowel bar is exposed, remove the dowel bar.
3. Clean exposed surface by sandblasting and air blasting.
4. Place duct tape as a bond breaker on exposed dowel bars.
5. Provide joint compression relief in the void below the exposed dowel bar by furnishing and placing clean concrete sand (level with the top of the dowel bars).
6. Provide joint compression relief above the dowel bars by furnishing and installing preformed joint filler.

**Basis Of Payment**
- Reestablish the crack through the repair by furnishing and installing wax coated cardboard.
- Apply bonding grout immediately prior to concrete placement. Reapply water if concrete grouts prior to placing concrete backfill.
- The contractor may use water to precondition the in place concrete prior to placing concrete backfill. Reapply water if concrete grouts prior to placing concrete backfill.

**NOTES**
- Joint and crack reestablishment is required. Furnish and install preformed joint filler prior to concrete placement.
- Sawing for the initial joint establishment is not allowed.
- Furnish preformed joint filler of a width equal to the existing transverse joint or crack 0.25" minimum thickness (Standard Spec. 3720).
- Wax coated cardboard is allowed on cracks that are 0.25" or less in width.
- Chipping hammers are limited to a maximum weight of 35 pounds.

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**Joint and Crack Repair (Type B3)**

**WORK TO BE DONE**
1. Remove all concrete to limits shown in detail, including all unsound concrete by milling and chipping hammers.
2. If the end of the dowel bar is exposed, remove the dowel bar.
3. Clean exposed surface by sandblasting and air blasting.
4. Place duct tape as a bond breaker on exposed dowel bars.
5. Provide joint compression relief in the void below the exposed dowel bar by furnishing and placing clean concrete sand (level with the top of the dowel bars).
6. Provide joint compression relief above the dowel bars by furnishing and installing preformed joint filler.

**Basis Of Payment**
- Reestablish the crack through the repair by furnishing and installing wax coated cardboard.
- Apply bonding grout immediately prior to concrete placement. Reapply water if concrete grouts prior to placing concrete backfill.
- The contractor may use water to precondition the in place concrete prior to placing concrete backfill. Reapply water if concrete grouts prior to placing concrete backfill.
- Furnish preformed joint filler of a width equal to the existing transverse joint or crack 0.25" minimum thickness (Standard Spec. 3720).
- Wax coated cardboard is allowed on cracks that are 0.25" or less in width.
- Chipping hammers are limited to a maximum weight of 35 pounds.
All Required Work is Combined Into a Single Pay Item, Including...

Concrete Removal

Use of ≤ 35 pound chipping hammers for removal

Milling is not required, Contractors use mills to speed up removals process
Minimum Depth of 2 Inches
Taper Edges 30° to 60° from Vertical

≤ 35 lbs.
jackhammer
Tie Steel Placed Across Contraction Joint

- Cut and remove steel and dowel bars

NOTE: cross-sectional diameter loss of dowel bar
Install Compression Relief Material

Cut Dowel to allow full depth Bit Fiber Install
Separate the repair from the adjacent lane
Transverse Contraction joint

Point Bearing

Pop-outs & Breakage

Joint Closure

Debonding

Expansion ➔ ← Expansion
Before Proceeding, Inspect!

• Check removal by sounding with hammer

• If unsound concrete is found, remove with a small ≤ 35# chipping hammer

Remove Reinforcing Steel
Once the Inspections gig’s have been corrected, Sandblast the Partial Depth Repairs

If PDR is rained on prior to concrete backfilling, Contractor is required to redo the sandblasting.
Partial Depth Repair Special (Type BE)

- Pays for the lower half of repair, if...
- 8” long by #4 rebars are drill & grouted
- Paid in conjunction with Types BA/B3 PDR item
- Limit projection into driving lane to 12 inches.
- Min. payment is 1 ft²
PDR “Special” (Type BE)

- Spot full depth removal
- Drill and grout 8” rebar(s)
- Measured Ft² at surface for Type BA payment
- Also measured at mid-depth for Type BE payment
Cracked PDR “Special” (Type BE)

Reflective Crack at Thickness Differential

#4 epoxy coated rebar 8” long, w/4” drilled & grouted
This is not the intent of a BE repair

Take Cores!
Changing a Partial Depth Repair to a Full Depth Repair

Pay 40% of PDR and Pay 100% of FDR
Reestablish “Joint” with Wax Coated Cardboard
Duct Tape Placement on Dowel Bars

Dowel Bar Bond Breaker

6/7/2007
Final Blowing of Debris with Leaf Blower
Partial Depth MnDOT Mix-3U18

- Small Aggregate 100% passing 3/8” sieve
- 850 lbs Type I Cement
- 6.5% - liquid air
- Maximum 1 inch slump
- Cure times down to as little as 12 hours
- Ready Mix is NOT Allowed
Apply Bonding Grout
Just Prior to Concrete Backfill

Do Not Allow Grout to Dry.
If Grout Whitens, Re-Sandblast
Reestablishing Longitudinal Crack

Use wax coated cardboard to reestablish longitudinal crack.
Vibrate 3U18 Concrete
Finishing Tip
Thick layer of Grout along outside Edges

- Not an edge sealer,
- Due to 30°-60° tapered edges, Use as a sacrificial coating of grout around perimeter of repair.
- Same grout as bonding grout
Curing must take place within 10 minutes of final finishing...

Dowel Bar Retrofits
Curing Compounds
Alpha-Methyl-styrene or Linseed oil  ONLY
Finally...

Saw & Hot Pour Seal Repairs
Saw & Sealing is also Incidental, Within the Limits of the Repair
Failed Partial Depth Repair?

- More In Place Pavement Needed to be Removed
- Agency should have done a better check!
- On CPR Projects...

You don’t get what you expect, you get what you inspect.
Shrinkage Cracks are Considered to be Failed Repairs
Ultra High Early Concrete Mixes Seem to be predisposed to cracking
Repair Warranty

• Repair any areas of failure within thirty (30) calendar days at no cost to the department.

• The 30 calendar day warranty commences after all Type B, Type C, Dowel Bar Retrofits repair and Concrete Grinding (if required) are completed in a single traffic lane.

• Not just a visual check, check the bond to the in place pavement by chaining the PDR’s.
Concrete Diamond Grinding
Thank You
Questions?

I-35 Duluth, MN