Concrete Pavement Rehabilitation
Partial Depth Repairs

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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

- Joint and Crack Sealing (Type A)
- Partial Depth Repairs (Type B)
- Full Depth Repairs (Type C)
- Pavement Replacement (Type CX)
- Dowel Bar Retrofits
- Repair Special….Contact Concrete Unit for unique repairs
Pavement rehabilitation program

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Determine if PDR’s are a Feasible Repair
Need to do Your Homework!

- 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 Joint Are Too Far Gone
Coring the Project is **ESSENTIAL**.
Partial Depth Repairs work 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?
- Full Depth repairs are the “gold standard”
- Location of the repairs...A PDR’s in the wheel path will not last as long.
You Never Know What Lies Below
Now its too Late to Take Cores

The Ugly
You Never Know What Lies Below

I-394 Bit Overlaid Twice

Core Chows Underlying Pavement was Solid
Unfortunately things will get worse before they get better
Partial Depth Repair 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)**

**Description:** Remove concrete, reestablish joints and cracks, furnish and place concrete, saw and seal joints and cracks.

**Plan View**

- Limits of deteriorated concrete
- Area to be removed: 18" Min. Dimension (Width & Length)

**Profile View**

- Limits of deteriorated concrete

**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 joints or cracks 1/4" minimum thickness (Standard Spec. 37821). Wax coated cardboard is allowed on cracks that are 1/4" or less in width.
- Chipping hammers are limited to a maximum weight of 35 pounds.

**Work to Be Done**

- Remove all concrete to limits shown in detail, including all uncracked concrete by milling and/or chipping hammers.
- Taper all sides of the repair 30° - 60° from vertical and to a minimum depth of 2".
- If the end of the dowel bar is exposed, remove the dowel.
- Clean exposed surface by sand blasting and air blasting.
- Place duct tape as a bond breaker on exposed dowel bars.
- 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.
- Provide joints compression relief above the dowel bars by furnishing and installing preformed joint filler.

**Basis of Payment**

AND / OR

Reestablish the crack through the repair by furnishing and installing wax coated cardboard.

7. Apply bonding grout immediately prior to concrete placement. Re-sandblast and air blast if the bonding grout dries before the concrete is placed.

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

**Description:** Remove concrete, reestablish joints and cracks, furnish and place concrete, saw and seal joints and cracks.

**Plan View**

- Limits of deteriorated concrete
- Area to be removed: 18" Min. Width & Length

**Profile View**

- Limits of deteriorated concrete

**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 when placed over random cracks.
- Furnish preformed joint filler of a width equal to the existing transverse joint or crack 1/4" minimum thickness (Standard Spec. 37821). Wax coated cardboard is allowed on cracks that are 1/4" or less in width.
- Chipping hammers are limited to a maximum weight of 35 pounds.

**Work to Be Done**

- Remove all concrete to limits shown in detail, including all uncracked concrete by milling and/or chipping hammers.
- Taper all sides of the repair 30° - 60° from vertical and to a minimum depth of 2".
- If the end of the dowel bar is exposed, remove the dowel.
- Clean exposed surface by sand blasting and air blasting.
- Place duct tape as a bond breaker on exposed dowel bars.
- 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.
- Provide joints compression relief above the dowel bars by furnishing and installing preformed joint filler.

**Basis of Payment**

AND / OR

Reestablish the crack through the repair by furnishing and installing wax coated cardboard.

6A. Apply bonding grout immediately prior to concrete placement. Re-sandblast and air blast if the bonding grout dries before the concrete is placed.

**S.P. No.**

DATE: APRIL 22, 2016

**Sheet of Sheets**
Chaining & Marking Repair Areas
All Required Work is Combined Into a Single Pay Item Including…

Concrete Removal

Use of $\leq 35$ 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

- As needed, 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
Transverse Contraction joint

Point Bearing

Popout & Breakage

Joint Closure

Debonding

Expansion ➔ ◀ Expansion
Before Proceeding…

- Check removal by sounding with hammer
- If unsound concrete is found, remove with a small $\leq 35\#$ 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 BE

- Only pays for the bottom half of repair
- Only pay when 8’’ #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 ft$^2$
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

#4 epoxy coated rebar 8” long, w/4” drilled & grouted
This is not the intent of a BE repair
Changed a Partial Depth Repair to a Full Depth Repair

Pay 40% of PDR and Pay 100% of FDR
Duct Tape Placement on Dowel Bars

Bond Breaker

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

- Small Aggregate 100% passing 3/8” sieve
- 850 lbs Type I Cement
- 6.5% - liquid air
- Maximum 1 inch slump
- Can’t get out of Ready Mix
- Cure time of 12 hours
Apply Bonding Grout
Just Prior to Concrete Backfill

Do Not Allow Grout to Dry.
If Grout Whitens, Redo Sandblasting
Reestablishing Longitudinal Crack

Use of wax coated cardboard to reestablish crack
Vibrate 3U18 Concrete
Finishing Tip
Grout on Edges

- Due to tapered edges, Use as a sacrificial coating of grout around perimeter of repair.

- Same grout as bonding grout
Curing Compound
Curing Compounds
Alpha-Methyl-styrene or Linseed oil ONLY

Curing
Finally...

Saw & Hot Pour Seal Repairs
Saw & Sealing is also Incidental
Repair Warranty

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

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

- More In Place Pavement Needed to be Removed
Shrinkage cracks are considered to be failing repairs.
PDR’s Utilizing Ultra-High Early Concrete, Tend to have Shrinkage Cracks.
Thank You—Questions

I-35 Duluth Mn