

Concrete Pavement Rehabilitation Partial Depth Repairs

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Concrete Pavement Rehabilitation (CPR) Website

www.dot.state.mn.us/materials/concretepavement.html



Concrete Pavement Rehab Website

www.dot.state.mn.us/materials/concretepavementrehabilitation.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
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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)



D-cracked pavement

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.

The Good



The Bad



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



North St. Paul, MN





Unfortunately things will get worse before they get better



Mn/DOT

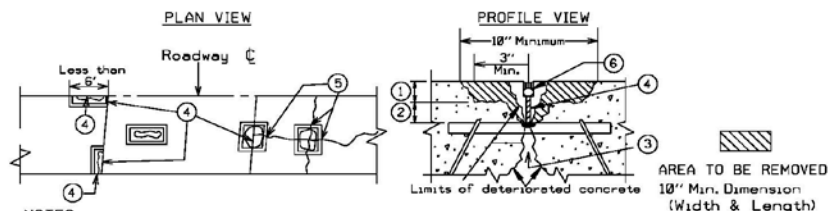
Partial Depth Repairs (Type B Repairs)

- ▶ 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)

DESCRIPTION: REMOVE CONCRETE, REESTABLISH JOINTS AND CRACKS, FURNISH AND PLACE CONCRETE, SAW AND SEAL JOINTS AND CRACKS.



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 $\frac{1}{4}$ " minimum thickness (Standard Spec. 3702). (4) Wax coated cardboard is allowed on cracks that are $\frac{1}{4}$ " or less in width. (5)
- 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 unsound concrete by milling (1) and chipping hammers. (2) Taper all sides of the repair 30° - 60° from vertical and to a minimum depth of 2". (1)
- If the end of the dowel bar is exposed, remove the dowel.
- Clean exposed surface by sandblasting 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. (3)
- Provide joint compression relief above the dowel bars by furnishing and installing preformed joint filler. (4)

AND / OR

Reestablish the crack through the repair by furnishing and installing wax coated cardboard. (5)

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

AND / OR

The Contractor may use water to precondition the in place concrete prior to placing concrete backfill. Reapply water if concrete dries prior to placing concrete backfill.

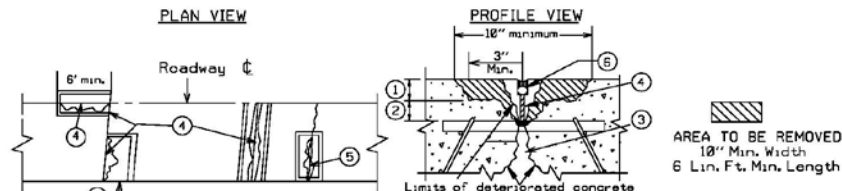
- Furnish & place Concrete Mix Number 3UI8. Vibrate, finish to grade and slope, edge adjacent to joint filler, Seal edges with grout and apply cure.
- Saw and seal joints and cracks in accordance with Joint Repair (Type A1) detail. (6) (Incidental)

BASIS OF PAYMENT

2302 Partial Depth Repair (Type BA) (Sq. Ft.)

JOINT AND CRACK REPAIR (TYPE B3)

DESCRIPTION: REMOVE CONCRETE, REESTABLISH JOINTS AND CRACKS, FURNISH AND PLACE CONCRETE, SAW AND SEAL JOINTS AND CRACKS.



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 $\frac{1}{4}$ " minimum thickness (Standard Spec. 3702). (4) Wax coated cardboard is allowed on cracks that are $\frac{1}{4}$ " or less in width. (5)
- 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 unsound concrete by milling (1) and chipping hammers. (2) Taper all sides of the repair 30° - 60° from vertical and to a minimum depth of 2". (1)
- If the end of the dowel bar is exposed, remove the dowel.
- Clean exposed surface by sandblasting 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. (3)
- Provide joint compression relief above the dowel bars by furnishing and installing preformed joint filler. (4)

AND / OR

- Reestablish the crack through the repair by furnishing and installing wax coated cardboard. (5)

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

AND / OR

The Contractor may use water to precondition the in place concrete prior to placing concrete backfill. Reapply water if concrete dries prior to placing concrete backfill.

- Furnish & place Concrete Mix Number 3UI8. Vibrate, finish to grade and slope, edge adjacent to joint filler, Seal edges with grout and apply cure.
- Saw and seal joints and cracks in accordance with Joint Repair (Type A1) detail. (6) (Incidental)

2302 Joint and Crack repair (Type B3) (Lin. Ft.)

Chaining & Marking Repair Areas



All Required Work is Combined
Into a Single Pay Item Including...

Concrete Removal

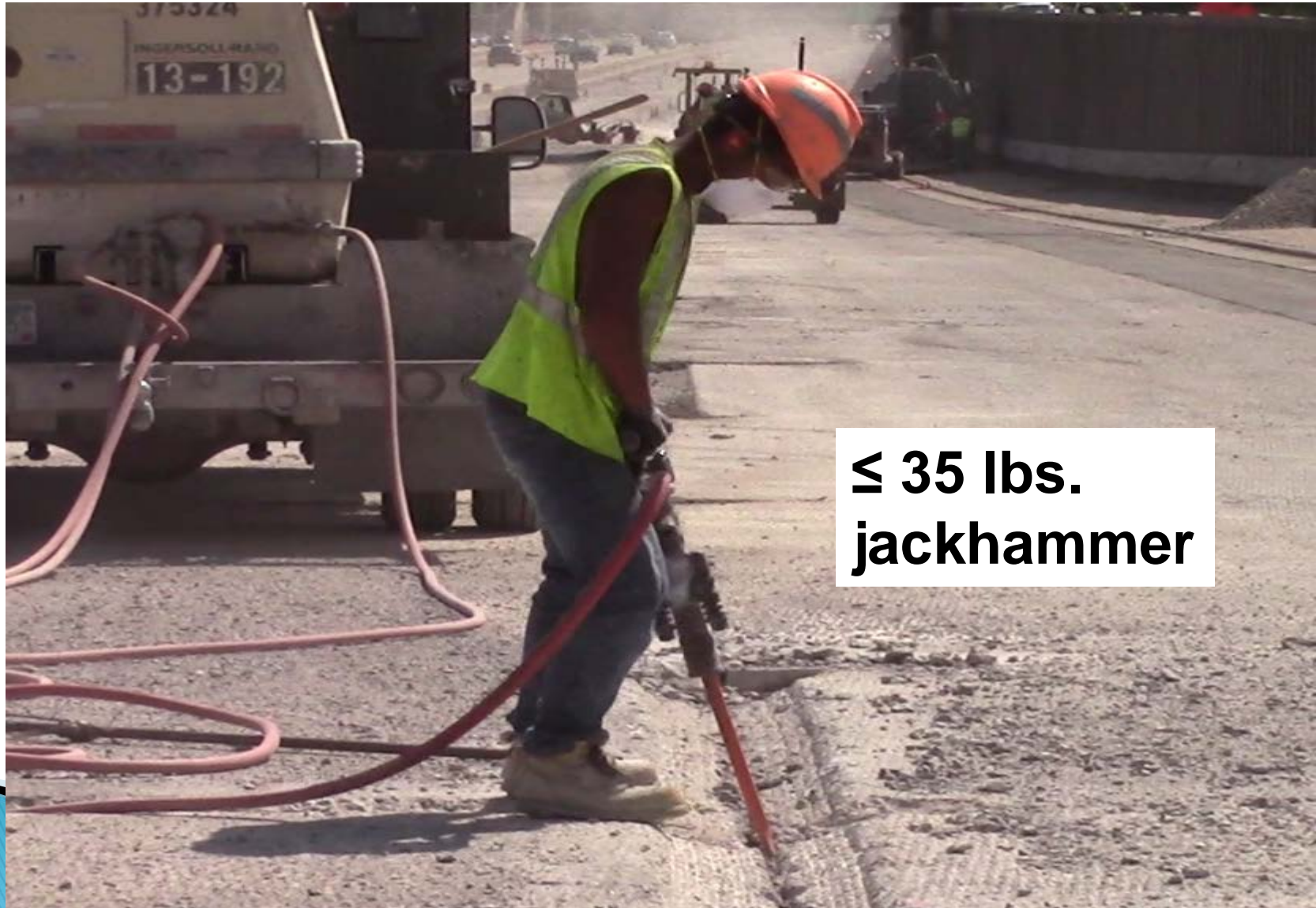


Use of ≤ 35 pound
chipping hammers
For removal



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

- ▶ As needed, remove steel and dowel bars



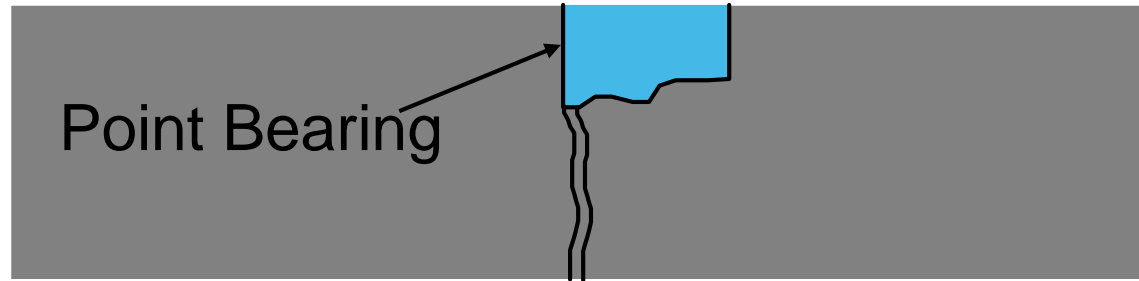
NOTE: cross-sectional diameter loss of dowel bar

Install Compression Relief Material

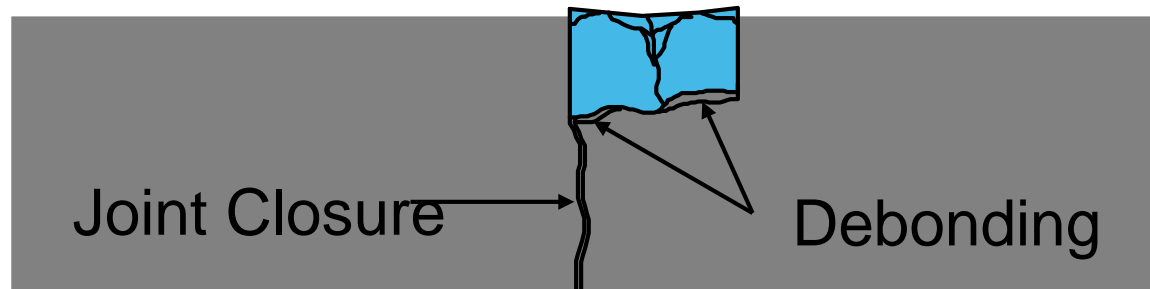
Cut Dowel to allow full depth Bit Fiber Install



Transverse Contraction joint



Popout & Breakage



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



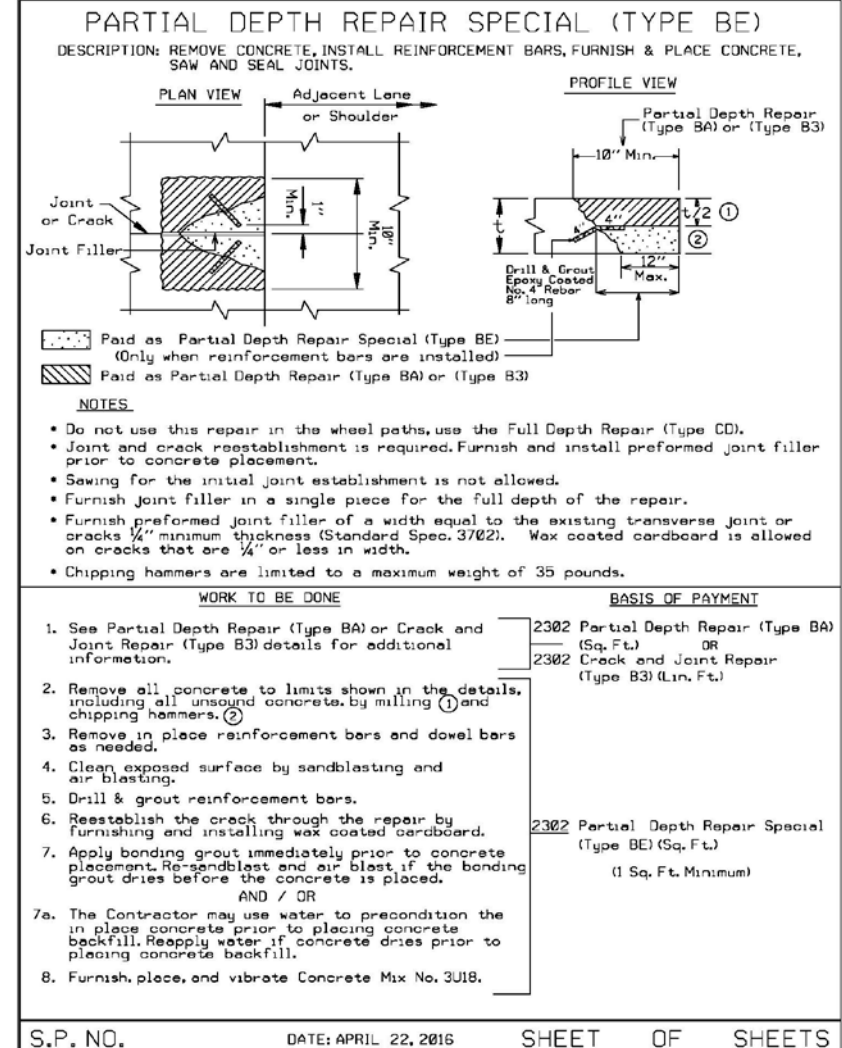
Once the Inspections gig's have been corrected, Sandblast the Partial Depth Repairs



**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 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)



**#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





Duct Tape Placement on Dowel Bars





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

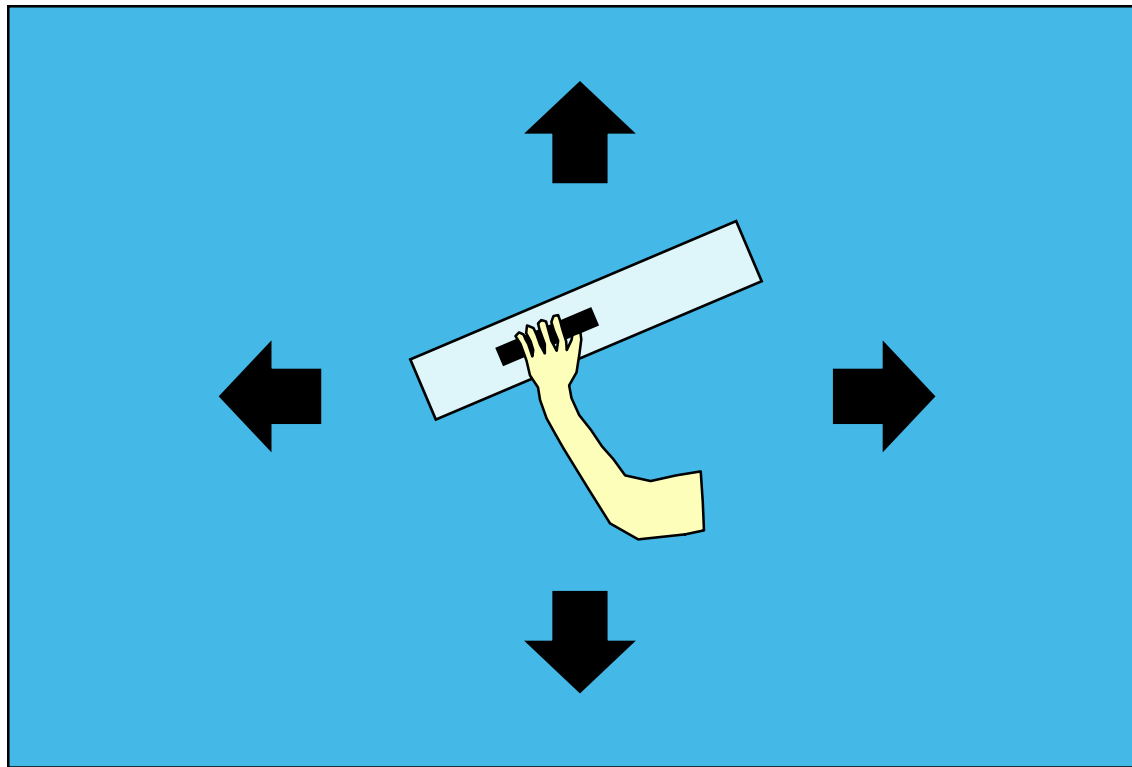


Vibrate 3U18 Concrete





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**



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

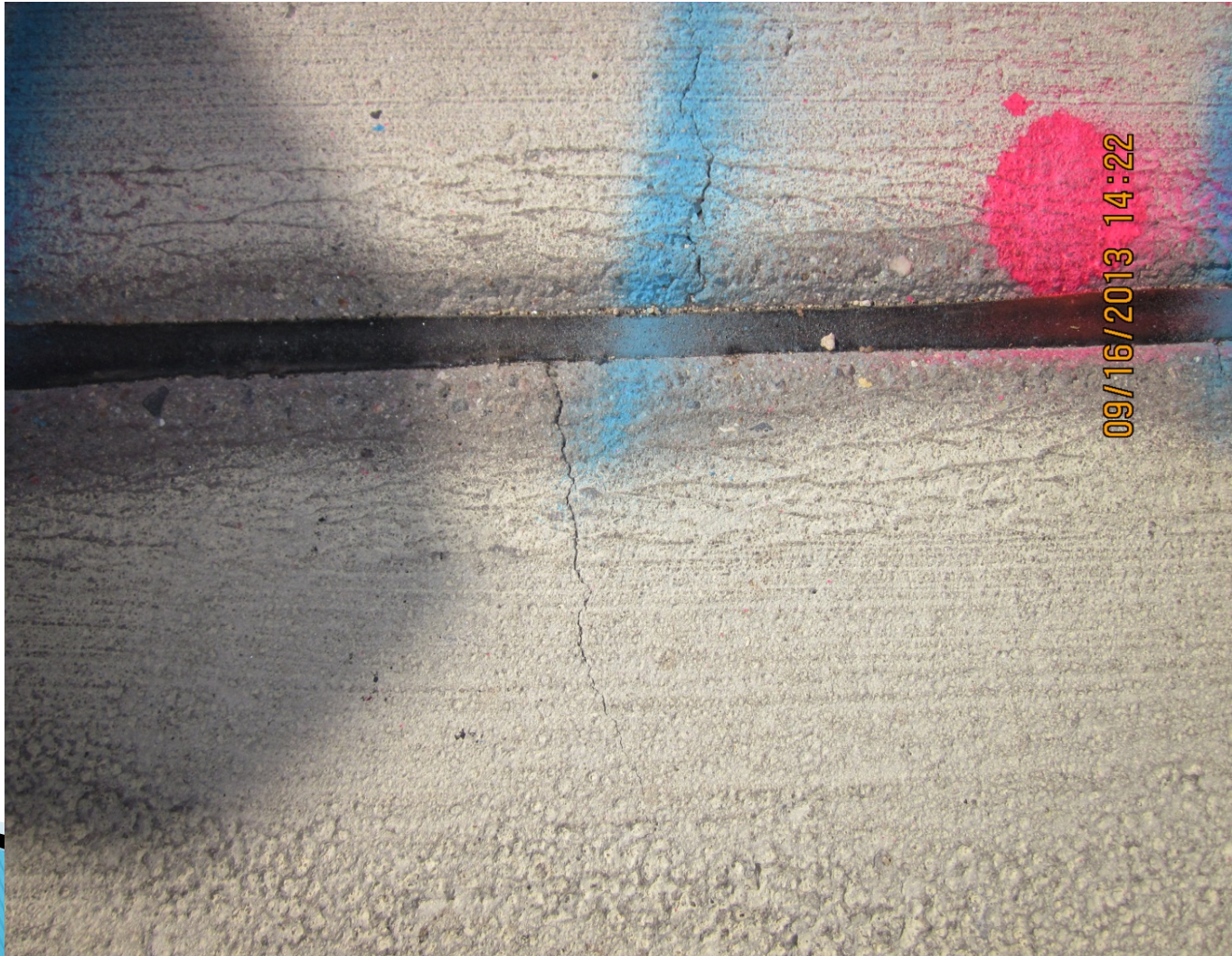
- ▶ More In Place Pavement Needed to be Removed



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

