

# 2026

## City of Duluth, Minnesota Construction Standards

# APPENDIX F

## Concrete Pavement Rehabilitation (CPR) Standard Details

Public Works & Utilities  
Engineering Division  
Duluth, MN





Minnesota Department of Transportation  
Office of Materials & Road Research  
1400 Gervais Avenue, MS 645  
Maplewood, MN 55109

## Memo

TO: Design Engineers  
Maintenance Engineers  
Materials Engineers  
Resident Engineers  
State Aid Engineers  
Concrete Paving Association of Minnesota

FROM: Maria A. Masten, Concrete Engineer

DATE: April 22, 2016 (**CPR Details Revised & Dated April 22, 2016**)

SUBJECT: Concrete Pavement Rehabilitation (CPR) Standard Detail and  
Special Provision Revisions

### **REVISIONS OF NOTE:**

- 1. All CPR repair details that require reinforcing steel contain revisions to the rebar sizing from metric [mm] back to standard 1/8<sup>th</sup> inch bar sizing.**

For example, a metric size No.13 bar [13mm] is now a No.4 bar (1/2 inch). CPR details with rebar sizing (metric to standard) revisions include Type BE, Type CD-HV, Type CX, Type CD-LV, Type C1-LV, Type C2-LV, and Type CA-LV. In addition, the “How to Repair Details” also contains metric to standard rebars sizing revisions. These details include, Catch Basin Repair, Curb and Gutter Repair, and Sidewalk / Median Walk Repair.

- 2. Changed the basis of payment on the Type A1 repair detail to “*Incidental.*”**

Within the limits of Types B (partial depth repairs) and Type C (full depth repairs), the Contractor is required to reestablish and seal all cracks and joints, in accordance with the Type A1 repair detail. For reference, always include the Type A1 repair detail with the basis of payment stated as “Incidental” in the plan set. Unless the project is sealing the in place joints outside Type B&C repairs limits. If so, include the Type A1 repair detail with the basis of payment stated as “Lineal Foot.”

In other words, the project would measure for payment, cracks and joints outside the limits of the Type B & C repairs that receive either a Type A1 repair (saw and seal) or Type A2 repair (clean and seal). Performing Type A1 repair on cracks and joint

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within the limits of Type B & C repairs would remain incidental.  
Contact the Concrete Engineering Unit for further clarification as to the intended use of Type A1 (Incidental vs. Lineal Foot) and the Type A2 (Lineal Foot) repairs.

3. **Type CD-HV repair detail increased the drill and grout dowel bar diameters from 1-inch dowel bars and increased the diameter to 1.25-inch dowel bars.**
4. **Type CD-HV repair detail now has a note clarifying the number of drill and grout dowel bars required. The note states “Add an additional dowel bar per side for each 1 foot increase in lane width/pay quantity.”**
5. **Both Type CD-HV and CD-LV repair detail and 2302 special provisions requires the drill bit diameter be minimum of 1/8<sup>th</sup> inch greater in diameter than the diameter of the specified dowel bar.**

Most (if not all) manufactures of non-shrink grout or epoxy adhesive used to anchor dowel bars/reinforcing steel to the in place concrete pavement, require a 1/8<sup>th</sup> inch to 1/4<sup>th</sup> inch oversized drilled hole diameter.

Displace the air in the drill hole with adhesive; begin the adhesive application at the back of the hole with a nozzle or hose with enough length to reach the back of the drill hole. Then with a continuous flow of adhesive, slowly pull the injection nozzle/hose outward. Displace the air with adhesive by filling the drill hole ¾ full of an approved non-shrink grout adhesive or epoxy adhesive, prior to installing the dowel bar or reinforcing steel.

The 1/8<sup>th</sup> to 1/4<sup>th</sup> inch drill hole oversizing allows the non-shrink grout adhesive or epoxy adhesive injected in the drill hole to freely flow out and around the dowel bar/reinforcing steel, displacing any air voids with adhesive.

Another effect of not drilling sufficient size holes is, the Contractors dowel bar installer begins to “dip and stick” the dowels bars. This is likely due to the inadequate space between the dowel bar and the drill hole walls, making it very hard if not impossible to force the grout or epoxy adhesive from the back of the hole out and around the dowel bar when the bar is installed into the drill hole.

6. **Both the Type CD-HV and Type CD-LV repair details have added a note clarifying the required length of the transverse epoxy coated No. 4 rebar. The note states “No.4 epoxy coated rebar length is equal to the width of the repair, minus 2 feet.”**



7. **One-inch dowel bars used in the Type CX repair and supplied in dowel bar assemblies (Standard Plate 1103) now have a CPR pay item, 2302 Dowel Bars (each). If a project has both concrete paving (2301) and CPR (2302) work, the designer should separately tabulate the paving dowel bars (2301) and the CPR dowel bars (2302) used in Type CX repairs.**
8. **The CD-HV drill & grout dowels increased 1.25” but the dowels supplied in dowel bar assemblies (Standard Plate 1103) will remain 1.0” dowel bars.**
9. **For continuity purposes, all CPR repair details are dated April 22, 2016.**

### **CONTRACTOR MIX DESIGN REQUIREMENTS:**

Starting in the fall of 2015, projects administered under the 2016 edition of MnDOT’s Standard Specification for Construction requires the Contractor to design most concrete mixtures, in accordance with specification 2461. With this new requirement, all CPR concrete batched from a ready mix plant will have revised concrete grade designations. In other words, all Type C repairs that required concrete grades 3A32/3A32HE will now have concrete grades 3R52/3RHE52. In addition, the “How to Repair Details” requires a Contractor designed concrete grade 3F52 (was grade 3A32 concrete).

Partial depth Type B repairs traditionally utilized MnDOT designed concrete grade 3U18. Type B repairs will remain unchanged and require MnDOT designed concrete grade 3U18. The individual material weights (mix design) for bagged 3U18 are stated in MnDOT Standard Specifications 3105. The contractor can also batch and mix 3U18 on site utilizing a mobile mixer. Batch weights for the mobile mixer are stated in 2302 CPR Special Provision.

### **DESIGNER NOTES:**

#### **1. Determination of whether to seal joints and cracks on repair projects.**

If a roadways speed limit is **50 mph or greater**, the Concrete Engineering Unit recommends **not** resealing joints and cracks outside the limits of the **Type B & C** repairs.

#### **2. Use of HV vs. LV Designations:**

- (a) Details that contain the HV (High Volume) designation are for state projects on Interstate highways or Trunk highways.
- (b) Details that contain LV (Low Volume) designation are for State Aid Projects and Local Aid Projects Only. However, State/Local Aid projects can also utilize



repair details designated as HV.

(c) Contact the Concrete Engineering Unit if you have questions about the HV vs. LV designation and the proper application of the CD-LV versus CD-HV Full Depth repairs.

(d) Repairs that do not contain the LV or HV extensions are suited for all projects.

### **CONCRETE REHABILITATION STANDARDS LOCATION:**

The Concrete Rehabilitation Standards are in a Microstation V8 (\*.dgn) file and are available for downloading as boilerplates on the Concrete Office website at:

<http://www.dot.state.mn.us/materials/concretepavement.html>.

There is also an Adobe Acrobat (\*.pdf) file of the Concrete Rehabilitation Standards available on the website for viewing and printing purposes. There is not currently a Metric version of the Concrete Pavement Rehabilitation Standards.

### **SPECIAL PROVISIONS LOCATION:**

To obtain the Special Provisions for CPR (which include method of measurement and basis of payment), dowel bar retrofit, or concrete grinding, you will need to go to the MnDOT Special Provisions Website and download from the SP2016 file.

<http://www.dot.state.mn.us/pre-letting/prov/index.html>

- SP2016-122 ~ (2302) Concrete Pavement Rehabilitation (CPR)
- SP2016-123 ~ (2302) Concrete Grinding (**with Ride Incentives**)
- SP2016-124 ~ (2302) Concrete Grinding (**without Ride Incentives**)
- SP2016-39 ~ (1717) Air, Land and Water Pollution (Concrete Grinding)\*\*\*

**\*\*\*Always include Provision (1717) on projects using either SP2016-123 or SP2016-124**

If you have any questions regarding CPR, please contact Gordy Bruhn at 651-366-5523 or myself.

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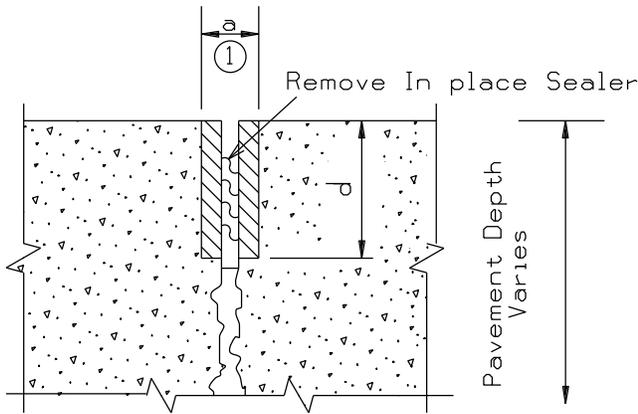


# VARIABLE WIDTH JOINT CRACK REPAIR / JOINT REPAIR (TYPE A1)

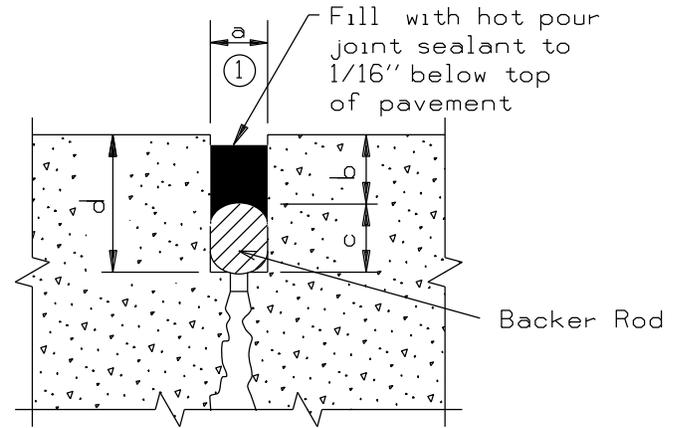
DESCRIPTION: IN NEWLY CONSTRUCTED REPAIRS OR IN PLACE JOINTS OR CRACKS.

SAW, CLEAN, SEAL TRANSVERSE AND / OR LONGITUDINAL PAVEMENT JOINTS OR CRACKS.

## SECTION REMOVAL



## SECTION INSTALLATION



 AREA TO BE REMOVED BY SAWING, IN PLACE JOINT OR CRACK MAY CONTAIN JOINT SEALER

### NOTES

\* On roadways with posted speed limits of 45 mph or greater the maximum recommended "a" dimension is  $\frac{5}{8}$  inch. ①

JOINT WIDTH (INCHES)	SEALANT BEAD THICKNESS (INCHES)	BACKER ROD DIAMETER (INCHES)	MINIMUM JOINT DEPTH (INCHES)	ESTIMATED QUANTITY (ft/gal)	ESTIMATED QUANTITY (lb/lf)
a	b	c	d	(ft/gal)	(lb/lf)
1/4	1/4	3/8	11/16	268	0.035
3/8	3/8	1/2	15/16	119	0.079
1/2	1/2	5/8	1-3/16	67	0.140
5/8	5/8	3/4	1-7/16	43	0.219
3/4	3/4	7/8	1-11/16	30	0.316
7/8	7/8	1.0	1-15/16	22	0.430
1.0	1.0	1-1/8	2-3/16	17	0.562
1-1/8	1-1/8	1-1/4	2-7/16	13	0.711
1-1/4	1-1/4	1-3/8	2-11/16	11	0.877

### WORK TO BE DONE

1. Remove in place joint sealant, if applicable.
2. Saw both joint faces to configuration shown then immediately water flush the joint or crack.
3. Clean and dry joint or crack by sandblasting and air blasting.
4. Furnish and install backer rod of appropriate diameter in joint or crack opening. Furnish and install backer rod when joints are 1/4" wide or greater.
5. Fill joint or crack with Joint and Crack Sealer (Specification 3725 Hot Poured).
6. To prevent tracking of the Joint and Crack Sealer use tissue paper if necessary.

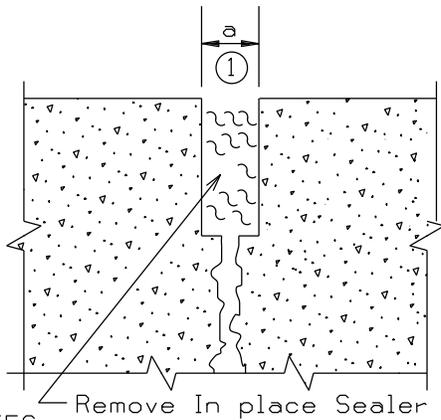
### BASIS OF PAYMENT

2302 Joint Repair (Type A1)  
(Lin. Ft.)

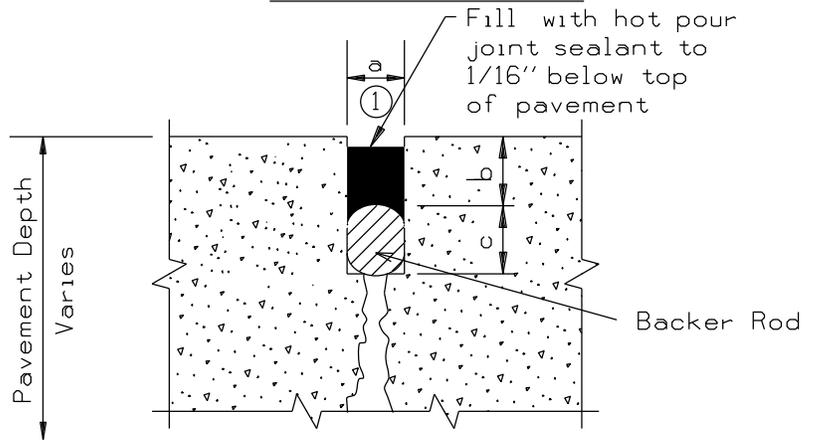
VARIABLE WIDTH IN PLACE JOINT OR CRACK REPAIR / JOINT REPAIR (TYPE A2)

DESCRIPTION: REMOVE IN PLACE JOINT SEALER, CLEAN AND SEAL TRANSVERSE AND / OR LONGITUDINAL PAVEMENT JOINTS OR CRACKS.

SECTION REMOVAL



SECTION INSTALLATION



NOTES

\* On roadways with posted speed limits of 45 mph or greater the maximum recommended "a" dimension is 3/4 inch. ①

JOINT WIDTH (INCHES)	SEALANT BEAD THICKNESS (INCHES)	BACKER ROD DIAMETER (INCHES)	MINIMUM JOINT DEPTH (INCHES)	ESTIMATED QUANTITY (ft/gal)	ESTIMATED QUANTITY (lb/lf)
a	b	c	d		
1/4	1/4	3/8	11/16	268	0.035
3/8	3/8	1/2	15/16	119	0.079
1/2	1/2	5/8	1-3/16	67	0.140
5/8	5/8	3/4	1-7/16	43	0.219
3/4	3/4	7/8	1-11/16	30	0.316
7/8	7/8	1.0	1 15/16	22	0.430
1.0	1.0	1 1/8	2 3/16	17	0.562
1 1/8	1 1/8	1 1/4	2 7/16	13	0.711
1 1/4	1 1/4	1 3/8	2 11/16	11	0.877

WORK TO BE DONE

BASIS OF PAYMENT

1. Remove in place joint sealant, if applicable.
2. Clean and dry joint or crack by sandblasting and air blasting.
3. Furnish and install backer rod of appropriate diameter in joint or crack opening. Furnish and install backer rod when joints are 1/4" wide or greater.
4. Fill joint or crack with Joint and Crack Sealer (Specification 3725 Hot Poured).
5. To prevent tracking of the Joint and Crack Sealer use tissue paper if necessary.

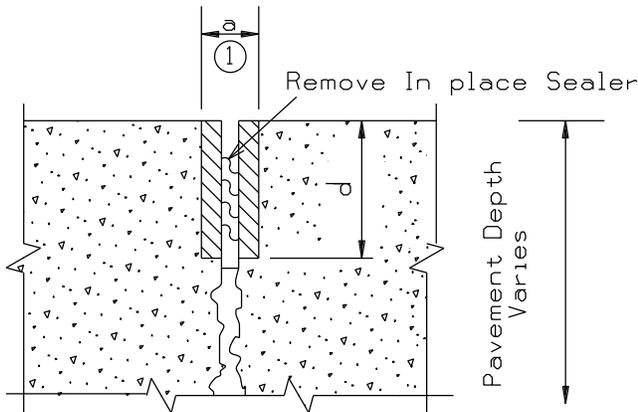
2302 Joint Repair (Type A2)  
(Lin. Ft.)

# VARIABLE WIDTH JOINT CRACK REPAIR / JOINT REPAIR (TYPE A1)

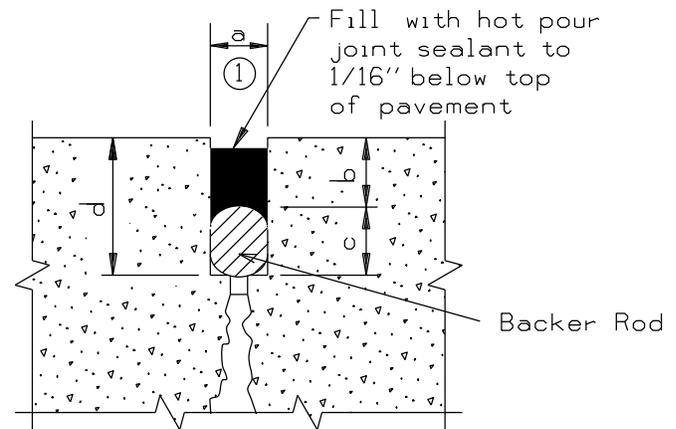
DESCRIPTION: IN NEWLY CONSTRUCTED REPAIRS OR IN PLACE JOINTS OR CRACKS.

SAW, CLEAN, SEAL TRANSVERSE AND / OR LONGITUDINAL PAVEMENT JOINTS OR CRACKS.

## SECTION REMOVAL



## SECTION INSTALLATION



 AREA TO BE REMOVED BY SAWING, IN PLACE JOINT OR CRACK MAY CONTAIN JOINT SEALER

### NOTES

\* On roadways with posted speed limits of 45 mph or greater the maximum recommended "a" dimension is  $\frac{5}{8}$  inch. ①

JOINT WIDTH (INCHES)	SEALANT BEAD THICKNESS (INCHES)	BACKER ROD DIAMETER (INCHES)	MINIMUM JOINT DEPTH (INCHES)	ESTIMATED QUANTITY (ft/gal)	ESTIMATED QUANTITY (lb/lf)
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1/4	1/4	3/8	11/16	268	0.035
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1/2	1/2	5/8	1-3/16	67	0.140
5/8	5/8	3/4	1-7/16	43	0.219
3/4	3/4	7/8	1-11/16	30	0.316
7/8	7/8	1.0	1-15/16	22	0.430
1.0	1.0	1-1/8	2-3/16	17	0.562
1-1/8	1-1/8	1-1/4	2-7/16	13	0.711
1-1/4	1-1/4	1-3/8	2-11/16	11	0.877

### WORK TO BE DONE

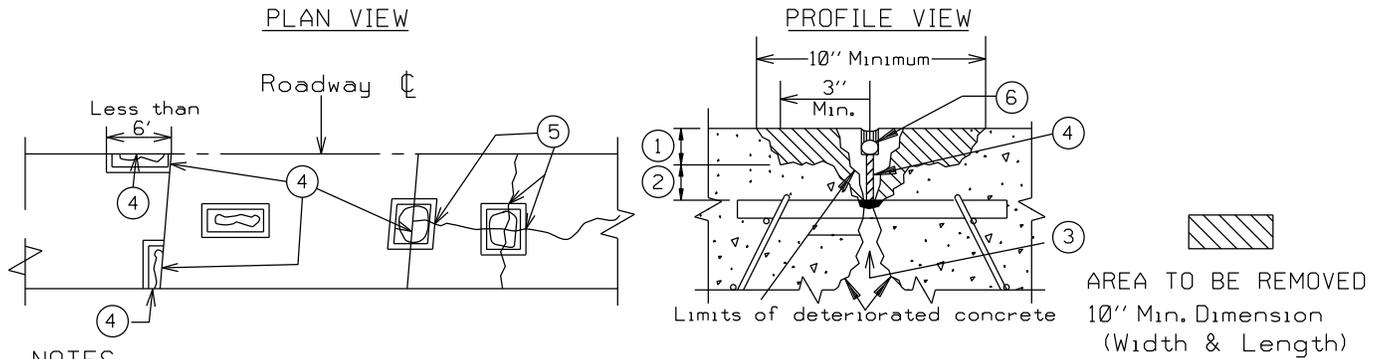
1. Remove in place joint sealant, if applicable.
2. Saw both joint faces to configuration shown then immediately water flush the joint or crack.
3. Clean and dry joint or crack by sandblasting and air blasting.
4. Furnish and install backer rod of appropriate diameter in joint or crack opening. Furnish and install backer rod when joints are 1/4" wide or greater.
5. Fill joint or crack with Joint and Crack Sealer (Specification 3725 Hot Poured).
6. To prevent tracking of the Joint and Crack Sealer use tissue paper if necessary.

### BASIS OF PAYMENT

Incidental

# 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

1. 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  $30^\circ - 60^\circ$  from vertical and to a minimum depth of 2". (1)
2. If the end of the dowel bar is exposed, remove the dowel.
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. (3)
6. 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)

7. 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.

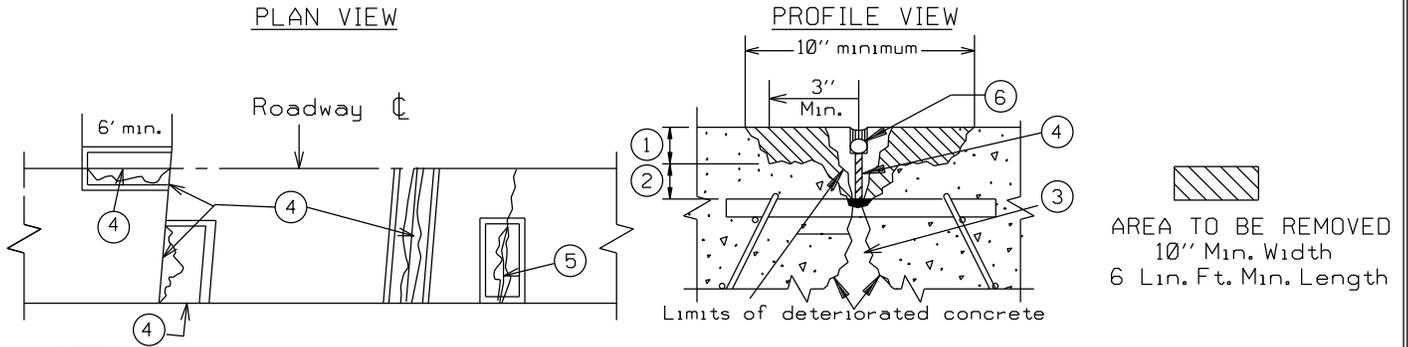
8. Furnish & place Concrete Mix Number 3U18. Vibrate, finish to grade and slope, edge adjacent to joint filler, Seal edges with grout and apply cure.
9. Saw and seal joints and cracks in accordance with. Joint Repair (Type A1) detail. (6) (Incidental)

## 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

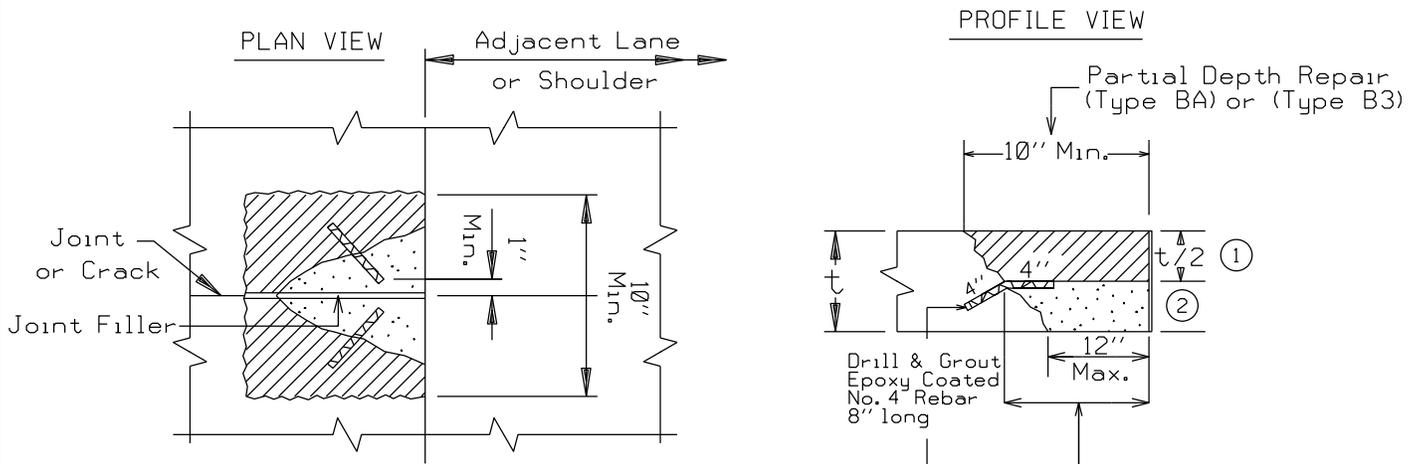
BASIS OF PAYMENT

1. 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  $30^{\circ}$  -  $60^{\circ}$  from vertical and to a minimum depth of 2". (1)
  2. If the end of the dowel bar is exposed, remove the dowel.
  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. (3)
  6. Provide joint compression relief above the dowel bars by furnishing and installing preformed joint filler. (4)
- AND / OR
- 6A. Reestablish the crack through the repair by furnishing and installing wax coated cardboard. (5)
  7. 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.
8. Furnish & place Concrete Mix Number 3U18. Vibrate, finish to grade and slope, edge adjacent to joint filler, Seal edges with grout and apply cure.
  9. 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.)

# PARTIAL DEPTH REPAIR SPECIAL (TYPE BE)

DESCRIPTION: REMOVE CONCRETE, INSTALL REINFORCEMENT BARS, FURNISH & PLACE CONCRETE, SAW AND SEAL JOINTS.



-  Paid as Partial Depth Repair Special (Type BE) (Only when reinforcement bars are installed)
-  Paid as Partial Depth Repair (Type BA) or (Type B3)

## NOTES

- \* Do not use this repair in the wheel paths, use the Full Depth Repair (Type CD).
- \* 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 joint filler in a single piece for the full depth of the repair.
- \* Furnish preformed joint filler of a width equal to the existing transverse joint or cracks  $\frac{1}{4}$ " minimum thickness (Standard Spec. 3702). Wax coated cardboard is allowed on cracks that are  $\frac{1}{4}$ " or less in width.
- \* Chipping hammers are limited to a maximum weight of 35 pounds.

## WORK TO BE DONE

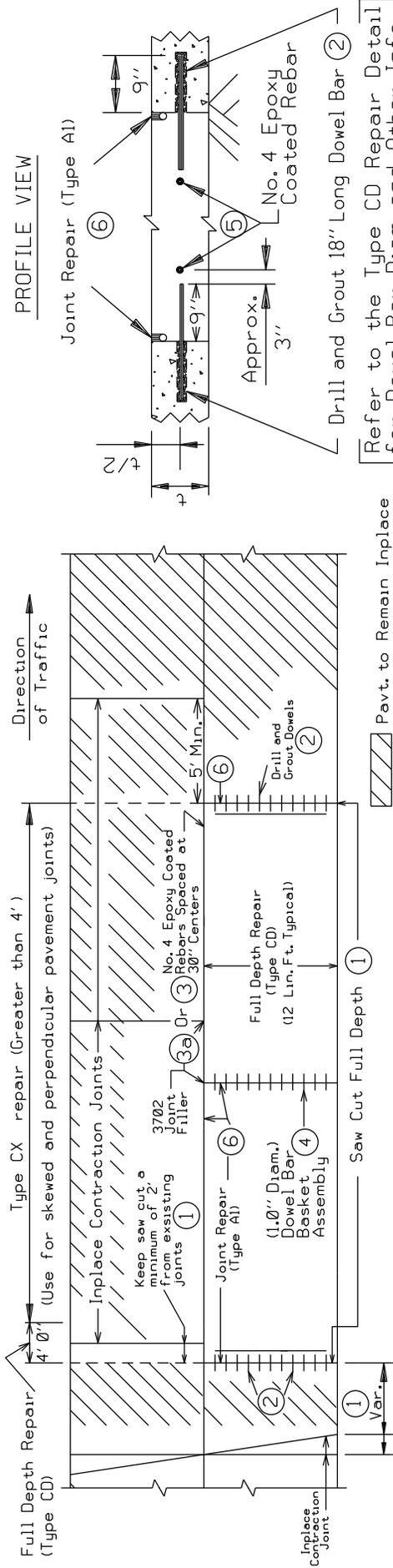
## BASIS OF PAYMENT

- |   |   |  |                                     |  |                                     |  |  |  |              |  |  |  |                             |  |  |  |                      |  |  |  |  |  |  |  |                                   |  |  |  |                     |  |  |  |                     |
|---|---|--|-------------------------------------|--|-------------------------------------|--|--|--|--------------|--|--|--|-----------------------------|--|--|--|----------------------|--|--|--|--|--|--|--|-----------------------------------|--|--|--|---------------------|--|--|--|---------------------|
| <ol style="list-style-type: none"> <li>1. See Partial Depth Repair (Type BA) or Crack and Joint Repair (Type B3) details for additional information.</li> <li>2. Remove all concrete to limits shown in the details, including all unsound concrete, by milling ① and chipping hammers. ②</li> <li>3. Remove in place reinforcement bars and dowel bars as needed.</li> <li>4. Clean exposed surface by sandblasting and air blasting.</li> <li>5. Drill &amp; grout reinforcement bars.</li> <li>6. Reestablish the crack through the repair by furnishing and installing wax coated cardboard.</li> <li>7. Apply bonding grout immediately prior to concrete placement. Re-sandblast and air blast if the bonding grout dries before the concrete is placed.</li> </ol> <p style="text-align: center;">AND / OR</p> <ol style="list-style-type: none"> <li>7a. 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.</li> <li>8. Furnish, place, and vibrate Concrete Mix No. 3U18.</li> </ol> | <table border="0"> <tr> <td style="border-left: 1px solid black; border-right: 1px solid black; width: 20px;"></td> <td style="border-left: 1px solid black; border-right: 1px solid black; width: 20px;"></td> <td style="border-left: 1px solid black; border-right: 1px solid black; width: 20px;"></td> <td>2302 Partial Depth Repair (Type BA)</td> </tr> <tr> <td></td> <td></td> <td></td> <td>(Sq. Ft.) OR</td> </tr> <tr> <td></td> <td></td> <td></td> <td>2302 Crack and Joint Repair</td> </tr> <tr> <td></td> <td></td> <td></td> <td>(Type B3) (Lin. Ft.)</td> </tr> <tr> <td colspan="4" style="border-top: 1px solid black;"></td> </tr> <tr> <td></td> <td></td> <td></td> <td>2302 Partial Depth Repair Special</td> </tr> <tr> <td></td> <td></td> <td></td> <td>(Type BE) (Sq. Ft.)</td> </tr> <tr> <td></td> <td></td> <td></td> <td>(1 Sq. Ft. Minimum)</td> </tr> </table> |  |                                     |  | 2302 Partial Depth Repair (Type BA) |  |  |  | (Sq. Ft.) OR |  |  |  | 2302 Crack and Joint Repair |  |  |  | (Type B3) (Lin. Ft.) |  |  |  |  |  |  |  | 2302 Partial Depth Repair Special |  |  |  | (Type BE) (Sq. Ft.) |  |  |  | (1 Sq. Ft. Minimum) |
|   |   |  | 2302 Partial Depth Repair (Type BA) |  |                                     |  |  |  |              |  |  |  |                             |  |  |  |                      |  |  |  |  |  |  |  |                                   |  |  |  |                     |  |  |  |                     |
|   |   |  | (Sq. Ft.) OR                        |  |                                     |  |  |  |              |  |  |  |                             |  |  |  |                      |  |  |  |  |  |  |  |                                   |  |  |  |                     |  |  |  |                     |
|   |   |  | 2302 Crack and Joint Repair         |  |                                     |  |  |  |              |  |  |  |                             |  |  |  |                      |  |  |  |  |  |  |  |                                   |  |  |  |                     |  |  |  |                     |
|   |   |  | (Type B3) (Lin. Ft.)                |  |                                     |  |  |  |              |  |  |  |                             |  |  |  |                      |  |  |  |  |  |  |  |                                   |  |  |  |                     |  |  |  |                     |
|   |   |  |                                     |  |                                     |  |  |  |              |  |  |  |                             |  |  |  |                      |  |  |  |  |  |  |  |                                   |  |  |  |                     |  |  |  |                     |
|   |   |  | 2302 Partial Depth Repair Special   |  |                                     |  |  |  |              |  |  |  |                             |  |  |  |                      |  |  |  |  |  |  |  |                                   |  |  |  |                     |  |  |  |                     |
|   |   |  | (Type BE) (Sq. Ft.)                 |  |                                     |  |  |  |              |  |  |  |                             |  |  |  |                      |  |  |  |  |  |  |  |                                   |  |  |  |                     |  |  |  |                     |
|   |   |  | (1 Sq. Ft. Minimum)                 |  |                                     |  |  |  |              |  |  |  |                             |  |  |  |                      |  |  |  |  |  |  |  |                                   |  |  |  |                     |  |  |  |                     |



# PAVEMENT REPLACEMENT (TYPE CX)

DESCRIPTION: REMOVE CONCRETE, RESTORE AND COMPACT BASE, PLACE DOWELS AND REINFORCEMENT BARS, FURNISH AND PLACE CONCRETE, SAW AND SEAL JOINTS.



**Notes**

- \* Place saw cut at least 2' up stream or 5' down stream from any transverse joints in the adjacent lane.
- \* Drill concrete pavement utilizing a drill bit diameter an > 1/8-inch larger than dowel/re-bar bar diameter. (2)
- \* Dowel bar basket required when longitudinal length of the repair is > 15'. Place dowel bar assemblies at 15' centers, when repair length exceeds 30'. (4)

**WORK TO BE DONE**

1. See Full Depth Repair (Type CD) for additional information.
2. Saw full depth & remove in place concrete pavement. Restore and compact in place base. (1)
3. Drill in place concrete for dowel bars. Eliminate inside 5 dowels for (Type CD-LV) repairs (2)
4. Furnish and install dowels. Secure dowels to the in place concrete with a approved non shrink grout or epoxy adhesive. (2) Coat free end of dowels with a form coating material meeting Spec. 3902.
5. If matching in place transverse joints, drill and grout epoxy coated tie bars into the adjacent lane. ~~Drill and grout reinforcement bars not require if repair length is under 75'. (3)~~  
OR  
5a. Isolate all transverse pavement joints and cracks. Furnish and install joint filler 3702 between the adjacent in place lane and the (Type CX) repair. (3a) (Incidental)
6. As needed, furnish (1.0" Diam.) Dowel Bar Assemblies, in accordance with Standard Plate 1103. (4)
7. Clean vertical surfaces of in place concrete.
8. Place epoxy coated supplemental reinforcing bars over culverts as needed, See Standard Plate 1070.
9. Furnish and place Concrete Mix Number 3R52.
10. Furnish and install epoxy coated rebars in conc. repair, located 3" from end of dowel bar. (5)
11. Vibrate, finish to grade and slope, edge, texture, and apply cure.
12. Green saw joints over dowel bar baskets. (4)
13. Saw and seal joints in accordance with Joint Repair (Type AI) detail. (6) (Incidental)

**BASIS OF PAYMENT**

- 2302 Full Depth Repair (Type CD) (Lin. Ft.)
- 2302 Drill and Grout Reinforcement Bars (Epoxy Coated) (Each)
- 2302 Dowel Bar (Each)
- 2302 Supplemental Reinforcement Bars (Epoxy Coated) (Pound)
- 2302 Pavement Replacement (Type CX) (Sq. Yd.)

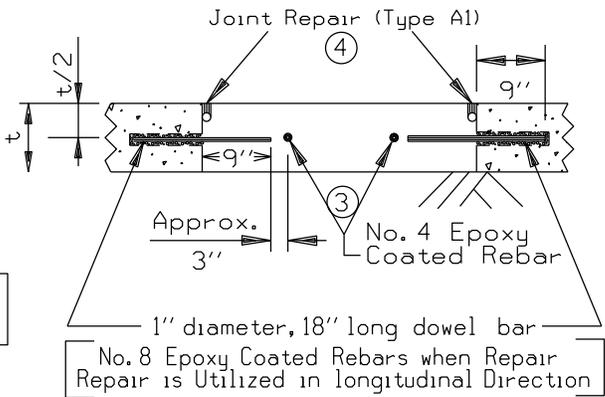
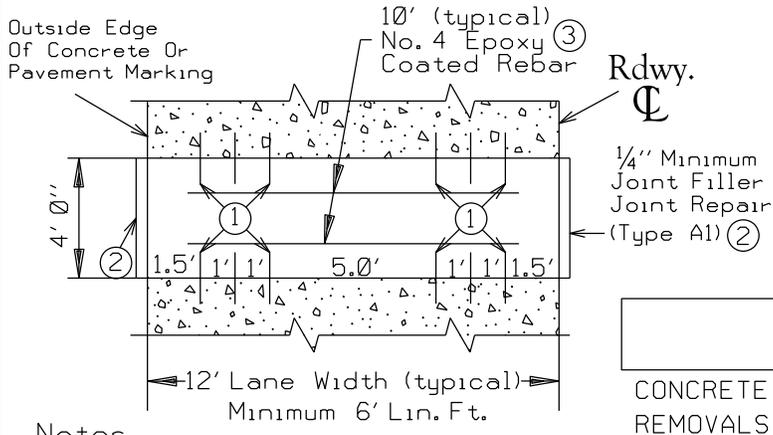
Refer to the Type CD Repair Detail for Dowel Bar Diam. and Other Info.

# FULL DEPTH REPAIR (TYPE CD-LV)

DESCRIPTION: REMOVE CONCRETE, PLACE REINFORCEMENT BARS AND DOWELS, FURNISH AND PLACE CONCRETE, SAW AND SEAL JOINTS.

PLAN VIEW

PROFILE VIEW



Notes

- \* When repairing random cracks on newly constructed concrete pavements, contact the Concrete Engineering Unit for recommendations.
- \* When the roadway width is 16' or greater, add an additional set of 4 dowels. Install additional dowels at mid point of the roadway.
- \* Drill in place pavement utilizing drill bit(s) with a stated or measured diameter of at least one eighth inch larger in diameter than D&G dowel/re-bar diameters. ①
- \* This repair is also used on tied longitudinal joints (2' on each side of the joint). Replace dowels with 18" long No. 8 epoxy coated reinforcement bars. Furnish and install reinforcement bars (epoxy coated) at 2' Centers. Install 1/2" joint filler at the up and down stream ends of the longitudinal repair. ②
- \* If repair is placed over an existing skewed contraction joint, match existing contraction joint skew, unless otherwise allowed by the Engineer.
- \* No. 4 epoxy coated rebar ③ length is equal to the width of the repair, minus 2 feet.

WORK TO BE DONE

BASIS OF PAYMENT

1. Saw cut to full depth and remove concrete pavement. Restore and compact in place base.
2. Drill in place concrete pavement for dowels or epoxy coated reinforcement bars longitudinal repairs. ①
3. Furnish and install dowels or reinforcement bars. Secure the dowel bars or reinforcement bars to the in place concrete by using an approved non shrink grout or epoxy adhesive. Coat free end of dowel bars with form coating material meeting Spec. 3902. ①
4. Clean the vertical surfaces of the in place concrete.
5. Furnish and install joint filler. ②
6. Furnish and place Concrete Mix Number 3R52.
7. Furnish and install reinforcement bars in plastic concrete, 3" from end of dowel bar at mid depth. ③
8. Vibrate, finish to grade and slope, edge, texture, and apply cure.
9. Saw and seal joints in accordance with Joint Repair (Type A1) detail. ② ④ (Incidental)

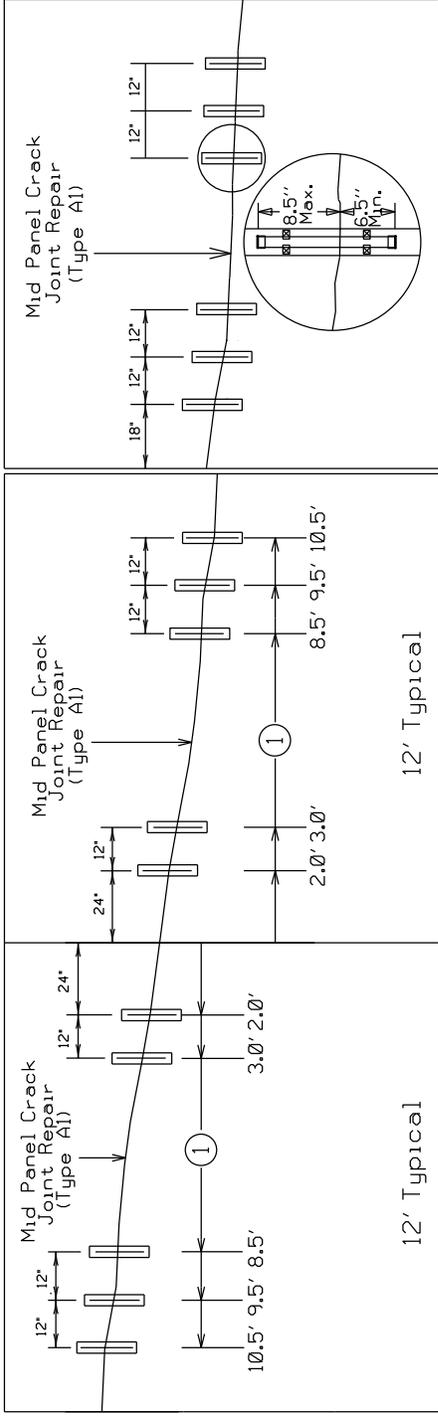
— 2302 Full Depth Repair (Type CD-LV) (Lin. Ft.)

# DOWEL BAR RETROFIT

DESCRIPTION: THIS REPAIR IS INTENDED TO BE USED TO ESTABLISH/RESTORE LOAD TRANSFER AT TRANSVERSE JOINTS OR CRACKS.

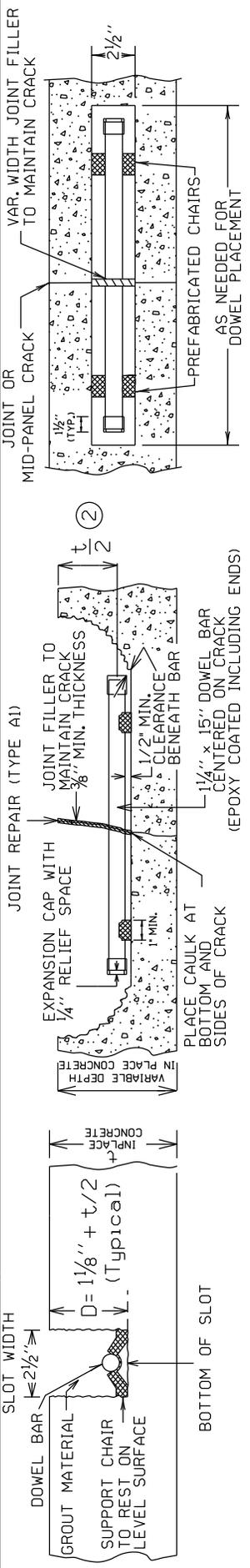
Sheet 1 of 2  
PLAN VIEW

## TYPICAL DOWEL BAR RETROFIT LAYOUT



### Notes:

- \* Not recommended for cracks that are  $\frac{3}{4}$ " or greater in width, use Full Depth Repair (Type CD)
- \* Chipping hammers are limited to a maximum weight of 35 pounds.
- \* Move retrofit dowels as needed to avoid in place dowel bars.
- \* Always measure from the roadway center line for dowel bar offsets. ①
- \* For pavements of 8" or under contact the Concrete Engineering Unit for dowel bar depth and minimum cover recommendations. ②



S.P. NO.

DATE: APRIL 22, 2016

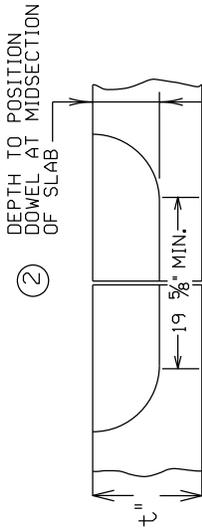
SHEET OF SHEETS

# DOWEL BAR RETROFIT DETAILS

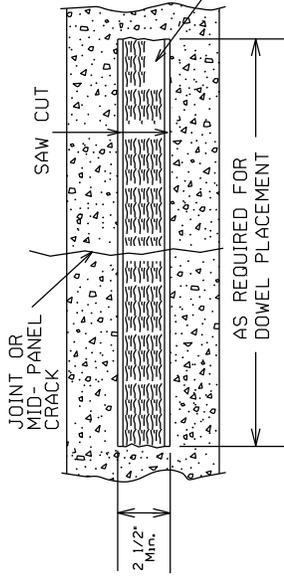
## Sheet 2 of 2

### STEP 1

SAW SLOT FOR EACH DOWEL BAR.  
(AVOID IN- PLACE DOWEL BARS)

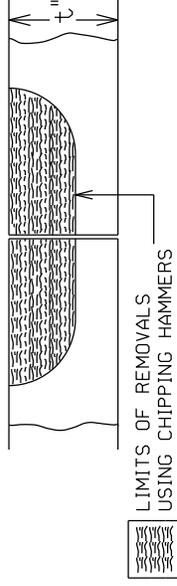


### STEP 1 AND 2 PLAN VIEW



### STEP 2

REMOVE CONCRETE BETWEEN SAW CUTS,  
INCLUDING CONCRETE TO FORM KERF.

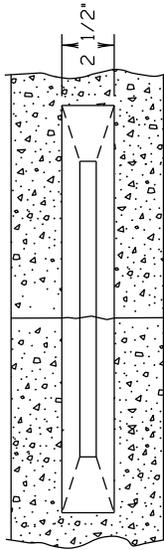


### STEP 3

CLEAN EXPOSED SURFACES INSIDE THE SLOT BY SANDBLASTING, AIR BLASTING, AND VACUUM.

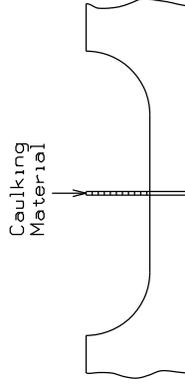
#### NOTE

CONTINUE TO SANDBLAST UNTIL THE VERTICAL SIDES ARE ROUGH TO THE TOUCH.



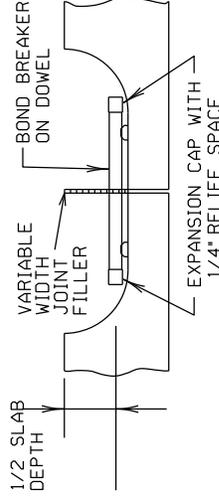
### STEP 4

TO KEEP THE PATCHING MATERIAL FROM LEAKING INTO THE JOINT OR CRACK, SEAL THE CRACK WITHIN THE SLOT WITH CAULKING MATERIAL. PLACE THE JOINT FILLER IN CONJUNCTION WITH THE CRACK SEALER.



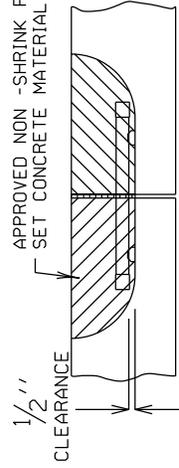
### STEP 5

FURNISH AND INSTALL DOWEL BARS ALIGN DOWELS PARALLEL WITH THE PAVEMENT SURFACE AND CENTERLINE OF THE ROADWAY. FURNISH AND INSTALL JOINT FILLER TO MAINTAIN CRACK THROUGH THE SLOT.



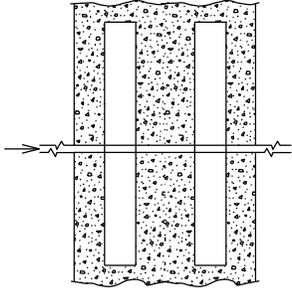
### STEP 6

MOISTEN INSIDE OF SLOT WITH WATER. (STANDING WATER IS NOT ALLOWED) FURNISH AND PLACE APPROVED NON-SHRINK RAPID SET CONCRETE MATERIAL FOR DOWEL BAR RETROFIT REPAIRS, AND APPLY CURE. (EDGING ONLY REQUIRED ALONG THE JOINT FILLER)



### STEP 7

SAW AND SEAL THE JOINT OR CRACK THE ENTIRE ENTIRE WIDTH OF THE LANE IN ACCORDANCE WITH JOINT REPAIR (TYPE A1) (INCIDENTAL)

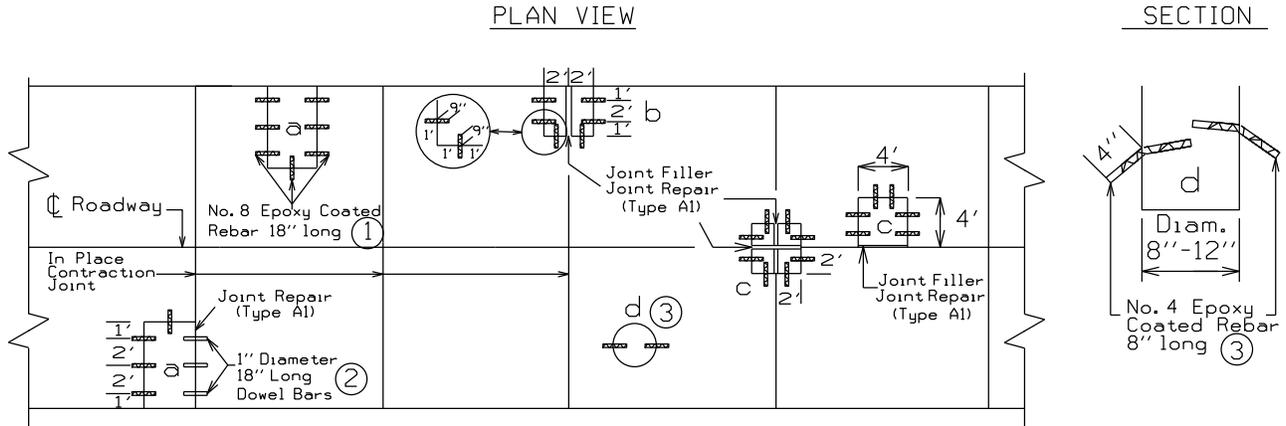


BASIS OF PAYMENT

2302 RETROFIT DOWEL BAR (EACH)

# SPOT FULL DEPTH REPAIR TYPE (C1-LV)

DESCRIPTION: SAW CONCRETE, REMOVE CONCRETE. PLACE REINFORCING AND DOWELS AS REQUIRED. FURNISH AND PLACE CONCRETE, SAW AND SEAL JOINTS.



## Repair Dimensions

□ AREA TO BE REMOVED

- a) Exterior Edge, 3' 6" x 6' min. for a one half lane repair.
- b) Exterior edge at a joint location, 4' x 4' min. size.
- c) Interior edge at centerline, 4' x 4' min. size.
- d) Gas line or exploratory core hole 4" diameter minimum size and 12" diameter maximum size.

## Notes

\* Drill in place pavement utilizing drill bit(s) with a stated or measured diameter of of at least one eighth inch larger in diameter than D&G dowel/re-bar diameters. (1)(2)(3)

## WORK TO BE DONE

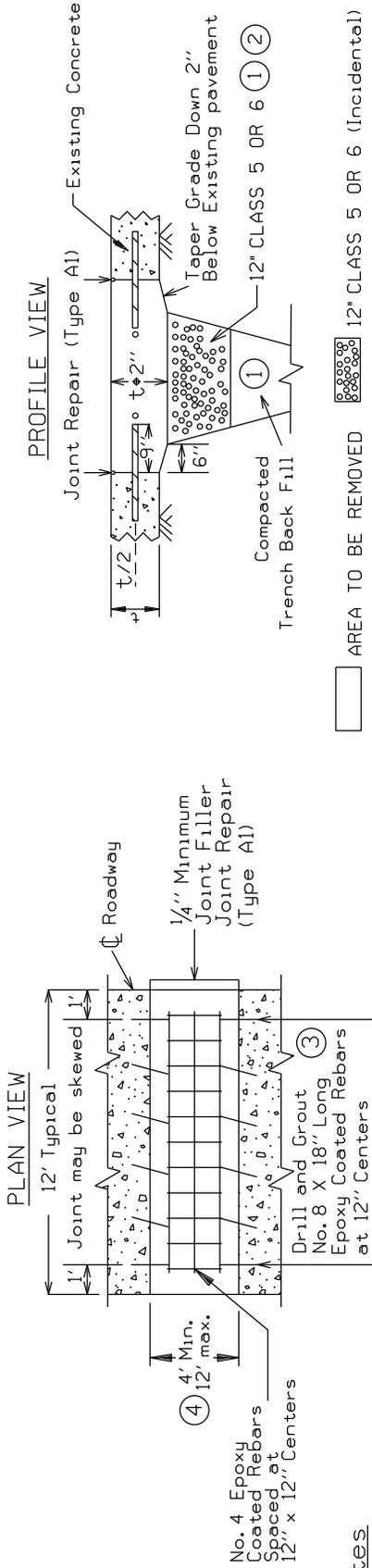
## BASIS OF PAYMENT

1. Saw cut to full depth and remove concrete pavement. Restore and compact in place base.
2. Drill in place concrete at 2' C. to C.: for No. 8 epoxy coated reinforcement bars (1) or, 1" dowel bars (2) or, No. 4 epoxy coated reinforcement bars. (3)
3. Furnish and install epoxy coated reinforcement bars or dowel bars. Secure the reinforcement bars or dowel bars to the in place concrete by using an approved non shrink grout or epoxy adhesive. Coat free end of dowel bars with a form coating material meeting Specification 3902.
4. Clean the vertical surfaces of the in place concrete.
5. Furnish and install joint filler.
6. Furnish and place Concrete Mix Number 3R52 or furnish and place 3U18 for core hole "d" repairs.
7. Vibrate, finish to grade and slope, edge, texture, and apply cure.
8. Saw and seal joints in accordance with Joint Repair (Type A1) detail. (Incidental)

2302 Spot Full Depth Repair (Type C1-LV) (Sq. Ft.)

# UTILITY TRENCH FULL DEPTH REPAIR (TYPE C2-LV)

DESCRIPTION: SAW FULL DEPTH AND REMOVE CONCRETE, FURNISH AND INSTALL REINFORCEMENT BARS, FURNISH AND PLACE CONCRETE, SAW OR FORM JOINTS, SAW AND SEAL JOINTS.



Notes

- \* When the Type C2 repair is located within 2' of an existing contraction joint, widen the Type C2 repair as needed to remove the existing contraction joint. When a contraction joint is removed, replace the No. 8 epoxy coated rebar with 1" diameter dowels bars. Drill and grout dowels in accordance with the Full Depth Repair (Type CD-LV or CD-HV).
- \* Check the plan for method of compaction. If a method of compaction is not stated in the plans use the quality compaction method in accordance with MnDOT Specification 2105. (1)
- \* Construct Class 5 or 6 aggregate base in accordance with MnDOT Specification 2211. Class 5 or 6 aggregate is incidental to the Utility Trench Full Depth Repair (Type C2). (2)
- \* Furnish and installed No. 8 reinforcement bars either straight or skewed at 20°. (3)
- \* When the length of the repair exceeds 12', Contact the Concrete Engineering Unit for recommendations. (4)
- \* Drill in place pavement utilizing drill bit(s) with a stated or measured diameter of (3) of at least one eighth inch larger in diameter than D&G dowel/re-bar diameters.

WORK TO BE DONE

1. Saw cut full depth and remove concrete pavement.
2. Excavate utility trench, back fill utility trench with in situ soils. Back fill trench to 14" below the bottom of existing pavement.
3. Furnish and place 12" class 5 or 6 aggregate base.
4. Drill in place concrete for No. 8 epoxy coated reinforcement bars.
5. Furnish and install epoxy coated reinforcement bars. Secure the reinforcement bars to the in place concrete with an approved non - shrink grout or epoxy adhesive.
6. Furnish and install preformed joint filler.
7. Furnish and install No. 4 epoxy coated supplemental steel spaced at 12" Centers
8. Furnish & place Concrete Mix Number 3R52. Vibrate, finish to grade and slope, edge forms and joint filler, apply texture and cure.
9. Saw and seal joints in accordance with Joint Repair (Type A1) detail. (Incidental)

BASIS OF PAYMENT

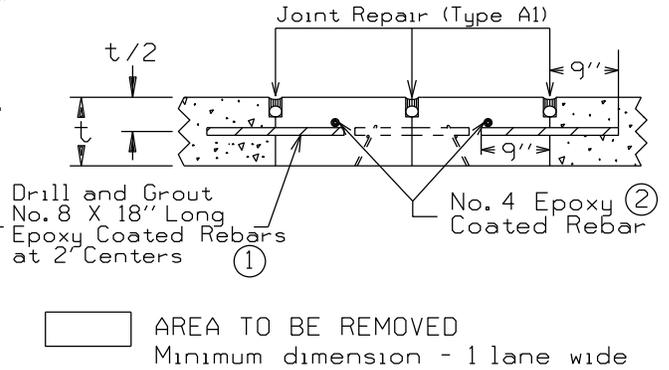
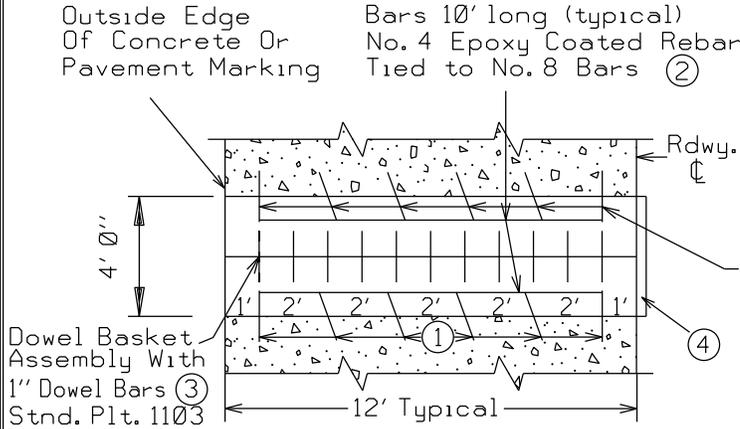
2302 Utility Trench Full Depth Repair (Type C2-LV) (Sq. Yd.)

# FULL DEPTH REPAIR (TYPE CA-LV)

DESCRIPTION: SAW CONCRETE, REMOVE CONCRETE. PLACE REINFORCING AND DOWELS BAR ASSEMBLY, FURNISH AND PLACE CONCRETE, SAW AND SEAL JOINTS.

PLAN VIEW

PROFILE VIEW



AREA TO BE REMOVED  
Minimum dimension - 1 lane wide

Notes

- \* The Contractor may use the Full Depth Repair (Type CD-LV) in lieu of the Full Depth Repair (Type CA-LV).
- \* The No. 8 reinforcement bars maybe skewed at 20° or straight at the discretion of the Contractor. (1)
- \* Drill in place pavement utilizing drill bit(s) with a stated or measured diameter of of at least one eighth inch larger in diameter than D&G dowel/re-bar diameters. (1)
- \* For skewed repairs, eliminate a tie bar at centerline edge with acute angle.
- \* No. 4 epoxy coated rebar (2) length is equal to the width of the repair, minus 2 feet.

WORK TO BE DONE

BASIS OF PAYMENT

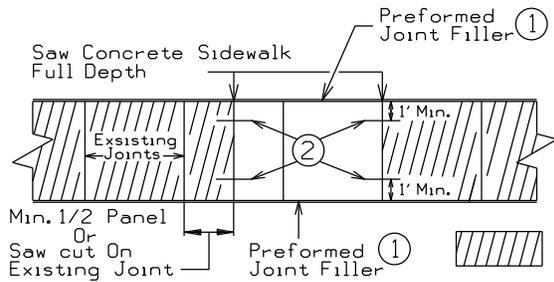
1. Saw cut to full depth and remove concrete pavement. Restore and compact in place base.
2. Drill in place concrete at 2' Centers for No. 8 epoxy coated reinforcement bars. (1)
3. Furnish and install epoxy coated reinforcement bars. Secure the reinforcement bars to the in place concrete by using an approved non shrink grout or epoxy adhesive. (1)
4. Furnish and install No. 4 epoxy coated reinforcing bars tied to the D&G No. 8 bars. (2)
5. Furnish and install dowel bar assembly with 1" diameter dowel bars. (3) Coat dowel bars with a form coating material meeting Spec. 3902
6. Furnish and install joint filler. (4)
7. Furnish and place Concrete Mix Number 3R52. Vibrate, finish to grade, slope, edge, texture, and apply cure.
8. Saw and seal joints in accordance with Joint Repair (Type A1) detail. (Incidental)

2302 Full Depth Repair (Type CA-LV), (1in. ft.)

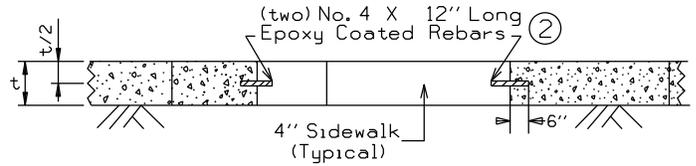
# REPAIR SIDEWALK OR MEDIAN WALK

DESCRIPTION: REMOVE CONCRETE. RESTORE BASE. PLACE REINFORCING STEEL.  
FURNISH AND PLACE CONCRETE. REFORM JOINTS AS NECESSARY.

PLAN VIEW



PROFILE VIEW



SIDEWALK TO REMAIN IN PLACE  
 SIDEWALK TO BE REMOVED

Notes

- \* Place preformed joint filler when sidewalk is placed adjacent to concrete curb and gutter. See Standard Plate 7035 for further information on joint filler placement and joint layout. (1)
- \* Where the sidewalk doubles as a driveway, place 6" Concrete Driveway Pavement for private driveways or 8" Concrete Driveway Pavement for commercial driveways. See Standard Plate 7035 for further information.

WORK TO BE DONE

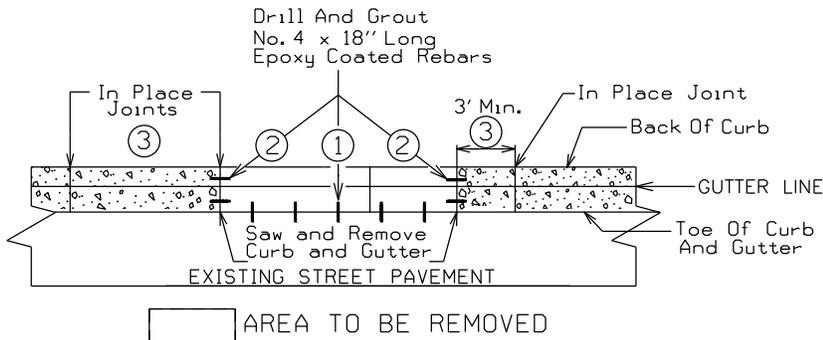
BASIS OF PAYMENT

<p>1. Saw cut concrete walk full depth. (Incidental)</p>	}	2104 Remove Sidewalk (Sq. Ft.)
<p>2. Remove concrete sidewalk, restore and compact in place base.</p>	}	
<p>3. Drill in place concrete sidewalk for No. 4 epoxy coated reinforcement bars.</p>	}	
<p>4. Furnish and install two epoxy coated reinforcement bars at each end of the removal area. Secure the reinforcement bars to the in place concrete by using an approved non shrink grout or epoxy adhesive. (2)</p>	}	2302 Drill and Grout Reinforcement Bars (Epoxy Coated) (Each)
<p>5. Clean the vertical surfaces of the in place concrete.</p>	}	
<p>6. Furnish and install joint filler.</p>	}	
<p>7. Furnish and place Concrete Mix Number 3F52.</p>	}	2521 _____ inch Concrete Walk (Sq. Ft.)
<p>8. Vibrate, finish to grade and slope, edge, texture, and apply cure.</p>	}	And / Or
<p>9. Restore joints by green sawing or hand tooling the plastic concrete to match the in place joint pattern.</p>	}	2531 _____ inch Concrete Driveway Pavement (Sq. Yd.)

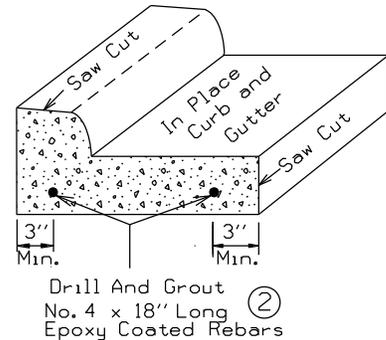
# CURB AND GUTTER REPAIR

DESCRIPTION: REMOVE CONCRETE. RESTORE BASE. PLACE REINFORCING STEEL.  
FURNISH AND PLACE CONCRETE. REFORM JOINTS AS NECESSARY.

## PLAN VIEW



## CROSS SECTION VIEW



### Notes

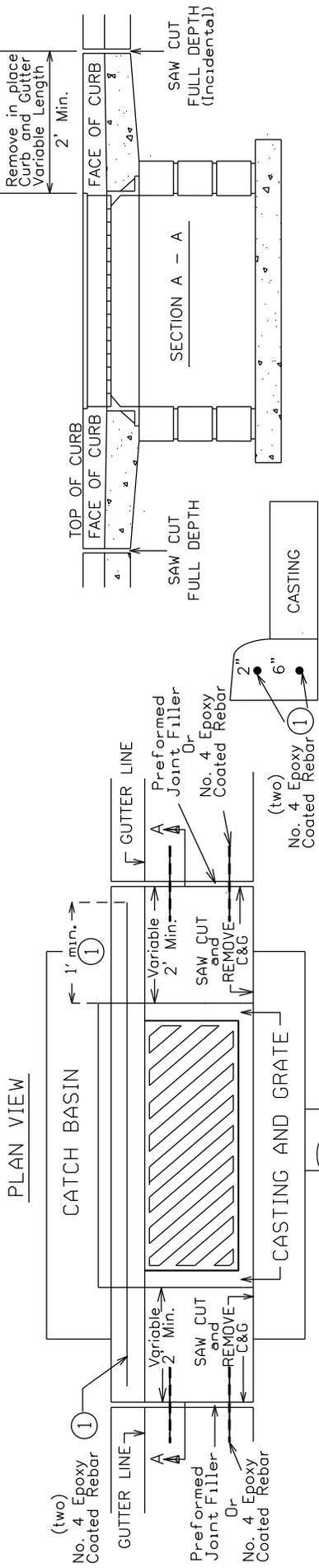
- \* When the existing pavement is concrete, drill and grout reinforcement bars at 30" centers. (1)
- \* Locate saw cut to leave a minimum of 3' of in place curb and gutter between an existing joint and the proposed saw cut. If the 3' minimum can not be maintained, place the saw cut over the existing joint. (3)

### WORK TO BE DONE

- |   |   |  |
|---|---|--|
| <ol style="list-style-type: none"> <li>1. Saw cut curb and gutter full depth. (Incidental)</li> <li>2. Remove curb and gutter, restore and compact in place base.</li> </ol>  | } | <p>2104 Remove Concrete Curb and Gutter (Lin. Ft.)</p>               |
| <ol style="list-style-type: none"> <li>3. Drill in place concrete pavement and curb and gutter for No. 4 epoxy coated reinforcement bars. (1) (2)</li> <li>4. Furnish and install epoxy coated reinforcement bars. Secure the reinforcement bars to the in place concrete by using an approved non shrink grout or epoxy adhesive.</li> </ol> | } | <p>2302 Drill and Grout Reinforcement Bars (Epoxy Coated) (Each)</p> |
| <ol style="list-style-type: none"> <li>5. Clean the vertical surfaces of the in place concrete.</li> <li>6. Furnish and place Concrete Mix Number 3F52.</li> <li>7. Vibrate, finish to grade and slope, edge, texture, and apply cure.</li> </ol>   | } | <p>2531 Concrete Curb and Gutter, Design ----- (Lin. Ft.)</p>        |
| <ol style="list-style-type: none"> <li>8. Restore joints by green sawing or hand tooling the plastic concrete to match the in place joint pattern.</li> </ol>   | } |  |

# CATCH BASIN REPAIR

DESCRIPTION: SAW AND REMOVE IN PLACE CURB AND GUTTER, RESTORE AND COMPACT BASE, DRILL AND GROUT REINFORCEMENT BARS ADJUST FRAME OR RING CASTINGS, PLACE FORMS FOR CURB AND GUTTER, PLACE CONCRETE CURB AND GUTTER, SAW AND SEAL JOINTS.



### Notes

- \* This detail is intended to fix sunken catch basins and the adjacent curb and gutter.
- \* If the existing curb is integral with the concrete pavement, saw pavement full depth parallel to the curb face and at a offset distance equal to or greater than the width of the casting.
- \* If concrete curb extends in back of the casting, Place two No. 4 epoxy coated rebars behind the casting. ① Extend reinforcement bars at least 1' foot beyond the limits of the casting. ①

### WORK TO BE DONE

1. Define curb and gutter for removal. Remove any low spots that do not have positive flow into the catch basin.
2. Saw cut curb and gutter full depth. (Incidental)
3. Remove the in place curb and gutter. Do not damage the casting assembly during curb and gutter removals.
4. Salvage casting, remove deteriorated rings, add adjusting rings as needed, set casting, grout rings and casting.
5. When the existing pavement is concrete, drill and grout No. 4 reinforcement bars, 18" long, installed at 2' centers and placed 9" into existing concrete pavement.
6. Compact in place base and set forms for curb and gutter.
7. Furnish and place Concrete Mix Number 3F52.
8. Vibrate, finish to grade and slope, edge, texture, and apply cure.
9. Saw and seal longitudinal joints in accordance with Joint Repair (Type A1). (Incidental)

### BASIS OF PAYMENT

2104	Remove Curb and Gutter (Lin. Foot)
2506	Adjust Frame or Ring Casting (Each)
2302	Drill and Grout Reinforcement Bars (Epoxy Coated)(Each)
2531	Concrete Curb and Gutter, Design ----- (Lin. Foot)