

New Concrete Design Guidelines for Cities and Counties

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LTAP Research

New Guidelines 2 Areas

- Concrete Pavement Construction
 - Flatwork Specifications

- Concrete Pavement Rehabilitation
 - MnDOT CPR Specifications - LV

Local Roads Concrete Flatwork Specifications

- Developed for less agency inspection and greater contractor responsibility
- Intent is for more durable concrete
- Greater responsibility put on contractor for Quality Control

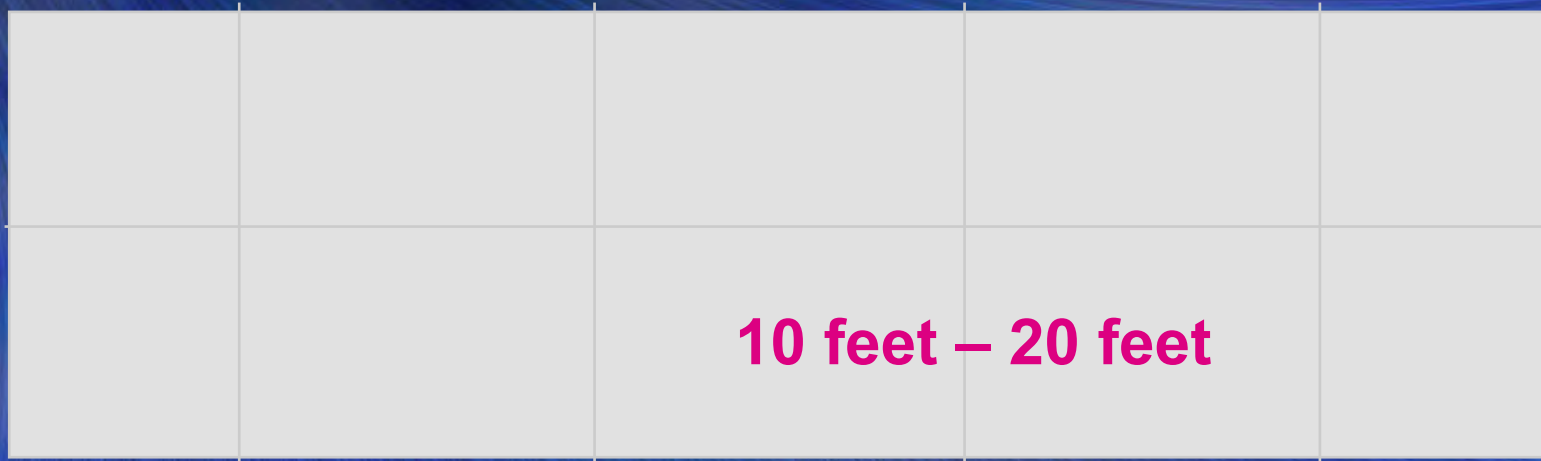
Local Roads Concrete Flatwork Specifications

- Less Bid items for Designers
- Concrete Pavement to include all items
- Different Thickness - 7 " Concrete Pavement

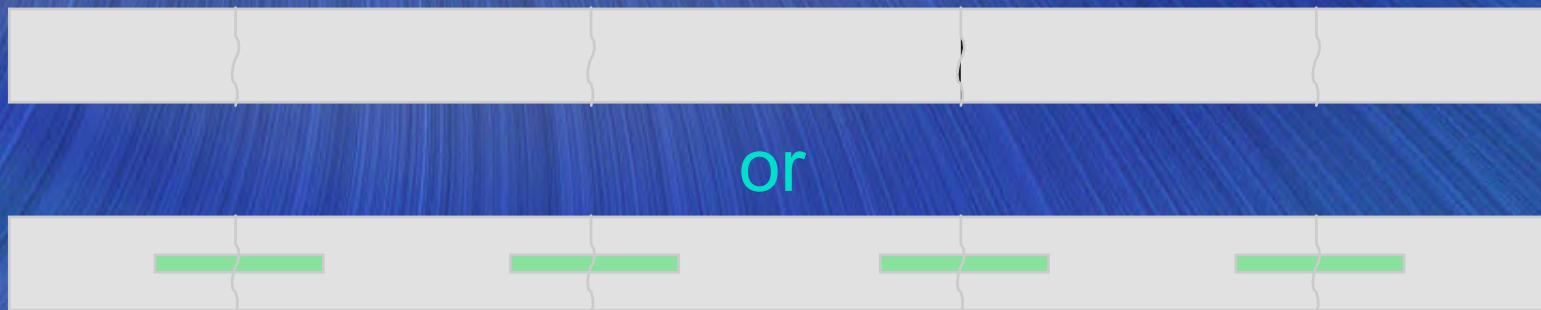
- Current MnDOT system Example
 - Dowels
 - Steel

Jointed Plain

Plan



Profile



Steel Will Be Incidental to Concrete Pavement Item



Materials

Use MnDOT Approved



- Cement
- Water
- Fine Aggregate
- Coarse Aggregate
- Admixtures
- Joint Sealers

Local Roads Concrete Flatwork Specifications

- MnDOT is all Prescriptive mixes
- Performance for Paving
- New Spec is all Performance

Local Roads Concrete Flatwork Specifications

- Concrete Mix Design Performance
- Compressive Strength of 4000 psi at 28 days
- 400 lbs Minimum Cement Content
- 658 lbs Maximum Cementitious Content
- Maximum W/C = 0.42 for Machine Placed Concrete
- Maximum W/C = 0.45 for Hand Placed Concrete

Concrete Maturity History

- Nurse & Saul 1950
- Eden Expressway 1975
- ASTM 1987
- AASHTO 1995
- FHWA 1997
- NIST 2001
- ICC 2003

Maturity Testing are Industry Standards:



- **ASTM C 1074** – Standard Practice for Estimating Concrete Strength by the Maturity Method
- **ASTM C 918** – Measuring Early Age Compressive Strength & Projecting Later Age Strength
- **ACI Committee 318**, Par 6.2 – Building Code Requirements for Structural Concrete
- **ACI Committee 228**, Par 2.7 – Nondestructive Committee
- **ACI Committee 306**, Par 6.4 – Cold Weather Committee
- **OSHA** Section 1926.752 & 1926.703
- **FHWA** SA-97-105



The Maturity Equipment

Logger - “Intelligent Sensor”:
Microprocessor
Memory
Temp. Sensor
Battery



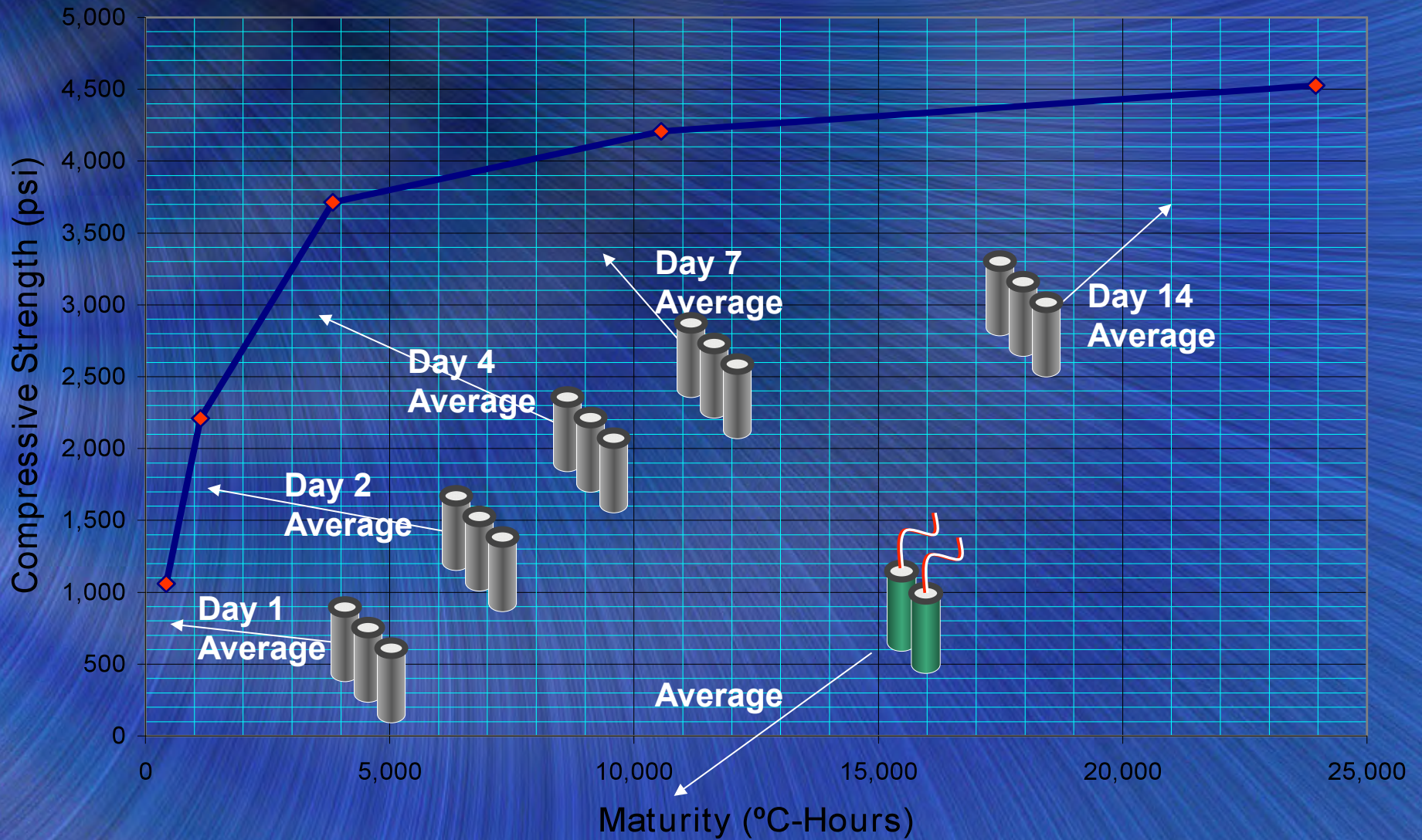
Reader:
Communicates
with loggers

Calibration of Your Mix Design





- **Calibration** – Generating a calibration curve

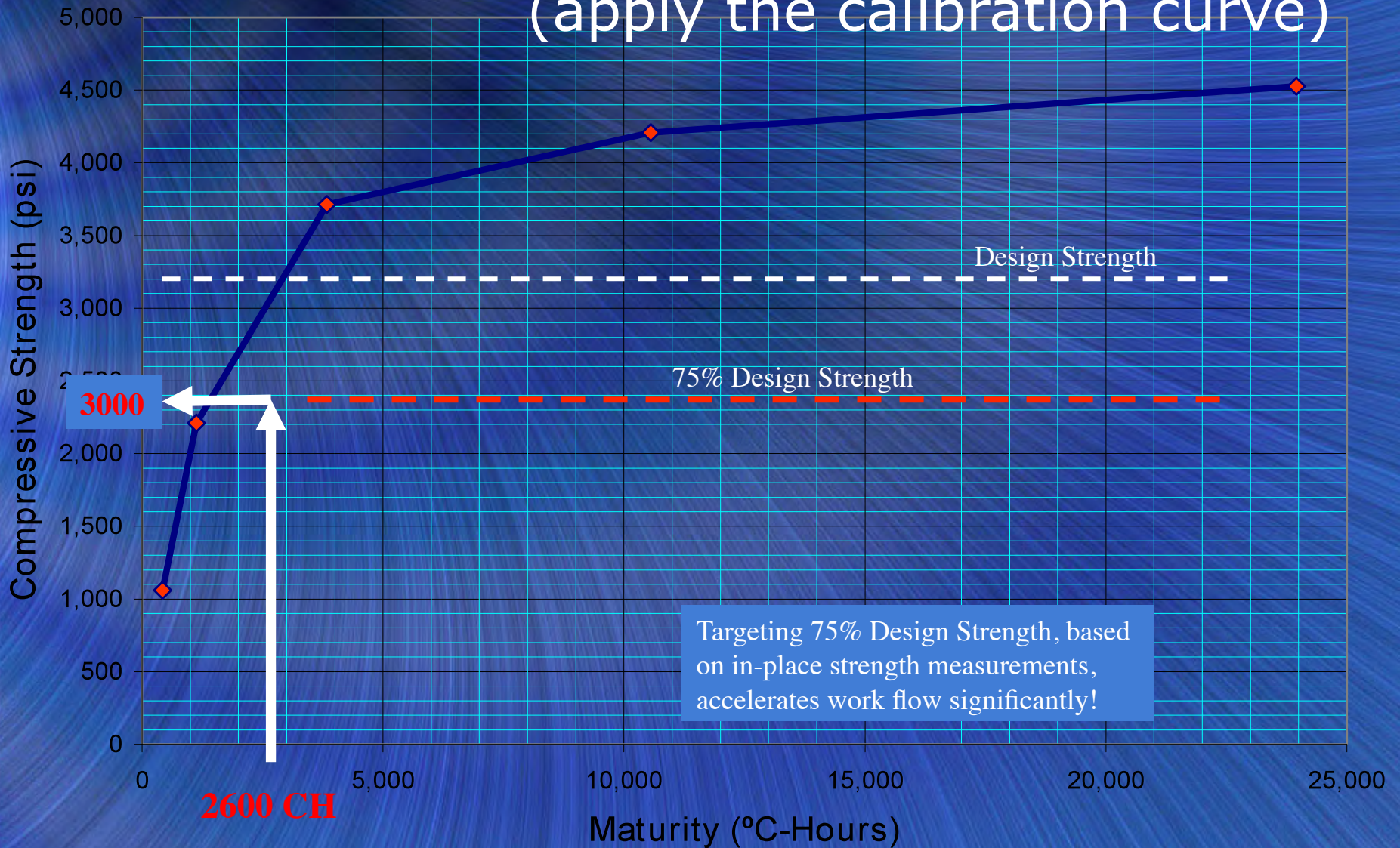


Temperature-Time Factor for each break

- **Application – Embed Sensors**



- **Application – Convert Maturity to Strength (apply the calibration curve)**





Local Roads Concrete Flatwork Specifications

- Minimize surface defects by:
 - Better & timely curing
 - Curing Compound will be the same as being used on MnDOT Concrete Pavements _ 3754 AMS



MnDOT 3754 AMS Curing
Compound

Local Roads Concrete Flatwork Specifications

- Minimize surface defects by:
 - Qualified personnel
 - Will Require Contractor to have an ACI Certified Flatwork Technician on Job during concrete placement.

Certified Personnel



Local Roads Concrete Flatwork Specifications



- Quality Control Plan required
 - Submittals
 - Plastic Concrete Testing
 - Smoothness
 - Thickness

Testing of Air / Plastic



- Will be done by Contractor Personnel
- Rate will be set by Specification
- Reports turned in to Contracting Authority

- Verification Testing will be done by Contracting Authority or a 3rd Party

Slump Maximum 5"

- No Slump Penalties
- Slump only run on Hand Placed Concrete
- Slump, air and Temperature when strength specimens are made



Concrete Thickness Verification

- Contractor Probing



- Coring to Verify Probing



Concrete Protection

Rain

Cold Weather

Hot Weather

Contractor must submit a plan for each of the above potential problems

Rain Protection



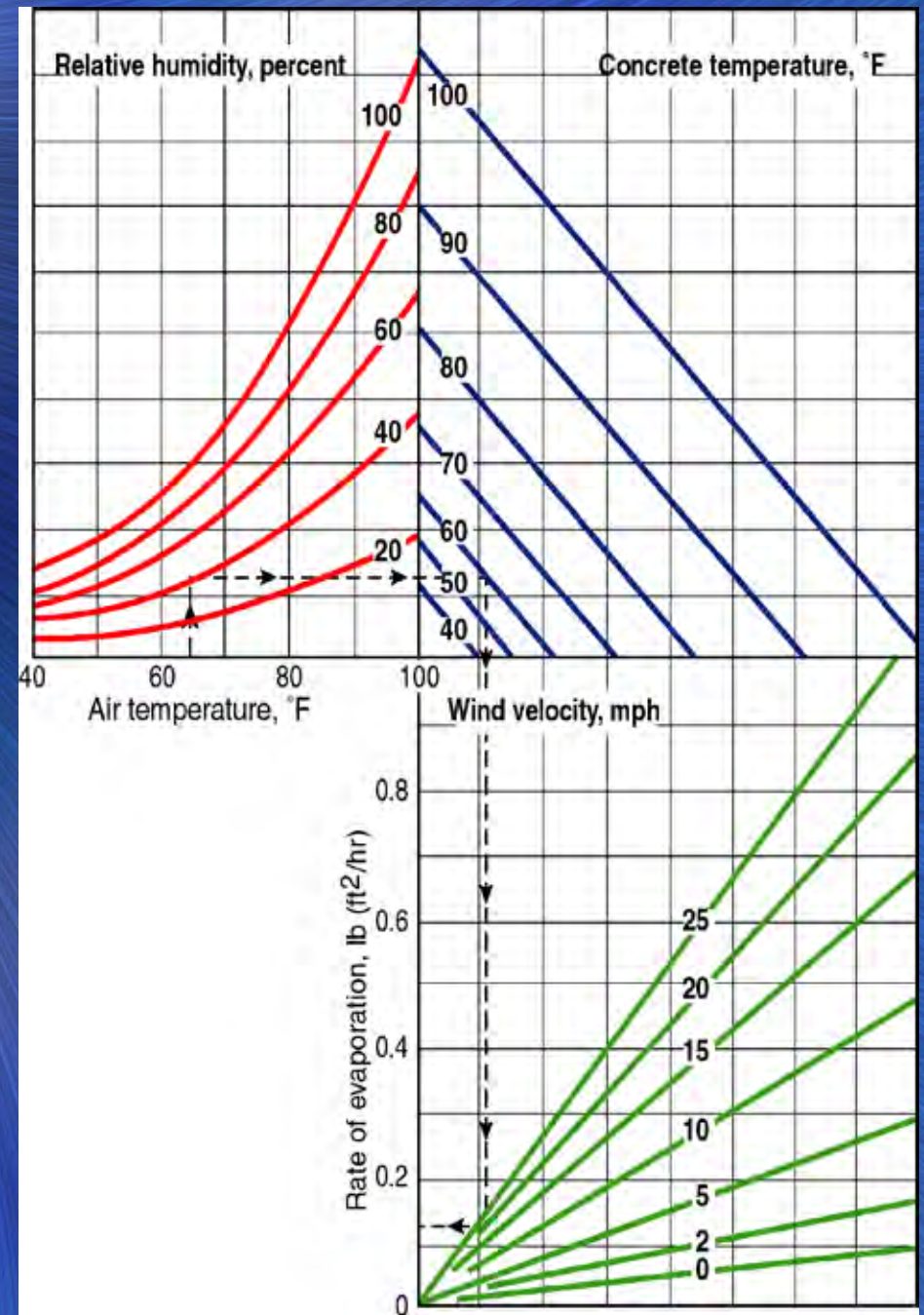
Cold Weather Concrete



Hot Weather

Evaporation of Surface Moisture from Concrete

When prediction exceeds
0.2 lb/water/square foot / hour
Contractor must Provide a Plan



Summary

- Contractor Testing and Mix Design
- Use DOT for approved Products
- Less Bid Items and Design Time
- Lower W/C Ratio for Improved Durability
- Maturity for Strength Determination

MnDOT Concrete Rehabilitation Specifications

- Local Roads Specifications Published in 2006 replaced with new MnDOT CPR Specs.
- Repairs Specific to Local Applications
- Low Volume (LV)

Concrete Rehab Basics

- All Joint Repairs are A
- All Partial Depth Repairs are B
- All Full Depth Repairs are C
- All Sidewalk Repairs are SW
- All Curb and Gutter Repairs are CG

Joint Re-Sealing Type A Repairs

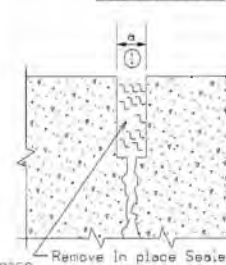
Cost is incidental to
Concrete Repair Item

Hot Pour Sealant is no
longer a pay item

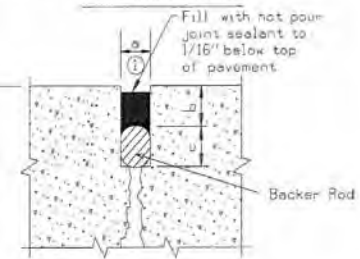
VARIABLE WIDTH IN PLACE JOINT OR CRACK REPAIR / JOINT REPAIR (TYPE A2)

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/100)	ESTIMATED QUANTITY (lb/100)
a	b	c	d	(ft/100)	(lb/100)
1/4	1/4	3/8	1 1/16	268	0.035
3/8	3/8	1/2	1 5/16	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. 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.

BASIS OF PAYMENT

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

S.P. NO.

DATE: NOV-14-2011

SHEET

OF SHEETS

Partial Depth Repairs Type BA

PARTIAL DEPTH REPAIR (TYPE BA)

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

PLAN VIEW

PROFILE VIEW

AREA TO BE REMOVED
10" Min. Dimension
(Width & Length)

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.
- Chipping hammers are limited to a maximum weight of 35 pounds.

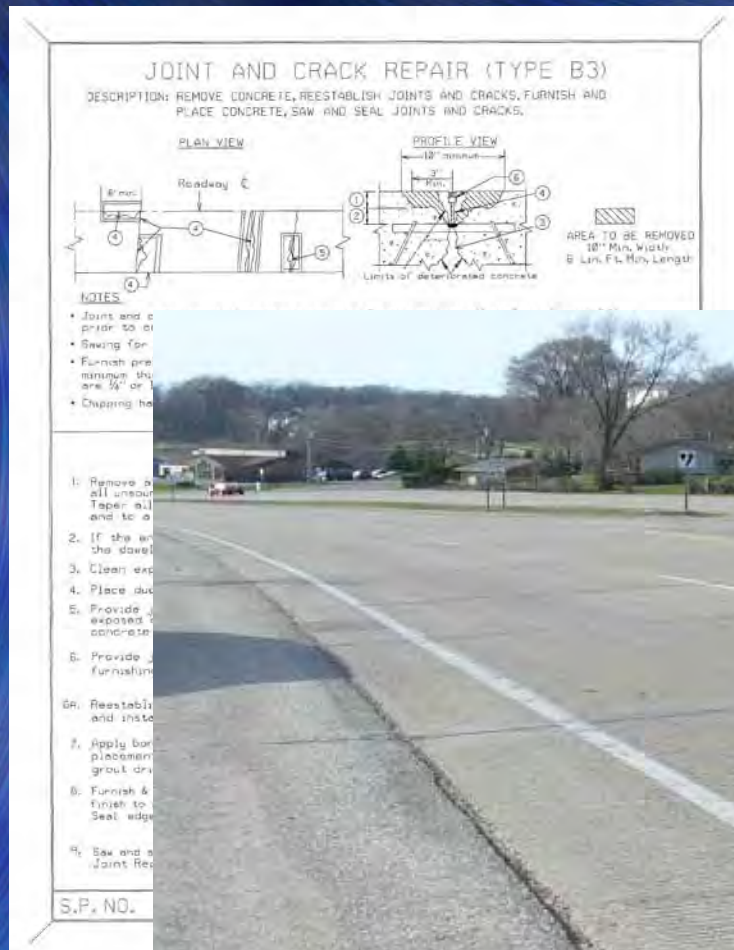
WORK TO BE DONE	BASIS OF PAYMENT
<ol style="list-style-type: none"> 1. Remove all concrete to limits shown in detail, including all unsound concrete by milling (1) and chipping hammers. (2) Taper all sides of the repair 30" - 60" from vertical and to a minimum depth of 2". (1) 2. If the end of the dowel 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) 	<p>2302 Partial Depth Repair (Type BA) (Sq. Ft.)</p>
<p>BA. Provide joint compression relief above the dowel bars by furnishing and installing preformed joint filler. (4) AND / OR</p> <ol style="list-style-type: none"> 6. 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. 8. Furnish & place Concrete Mix Number 3015. Vibrate, finish to grade and slope, edge adjacent to joint filler, and texture. Seal edges with grout and apply cure. <p>4. See and seal joints and cracks in accordance with Joint Repair (Type A) detail. (6) (Incidental)</p>	

S.P. NO. DATE: NOV-14-2011 SHEET OF SHEETS

- Sawing and Sealing of repair incidental to cost of repair
- Only for spot repairs



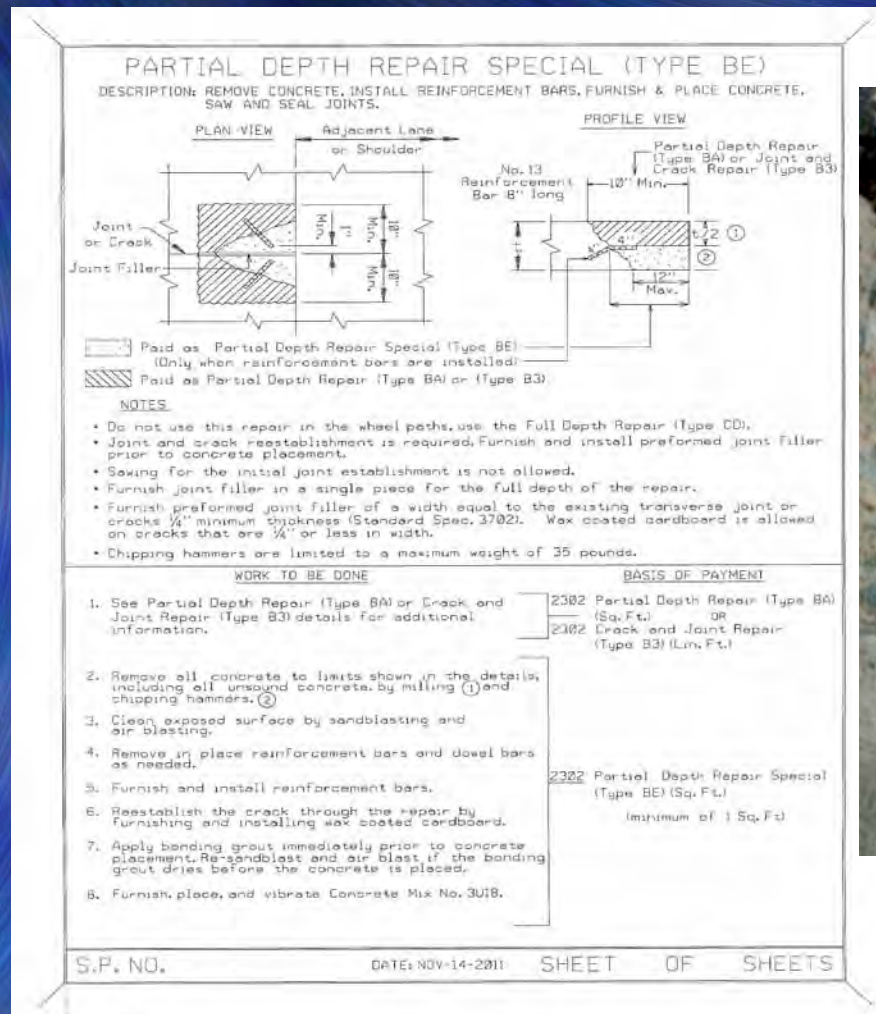
Partial Depth Repairs Type B3



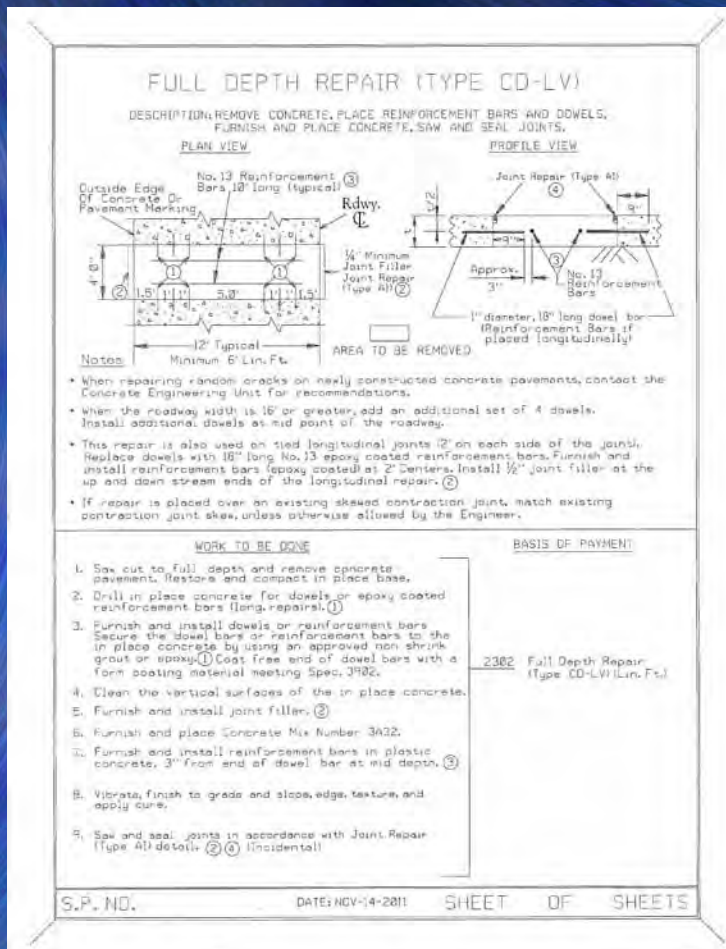
- Paid by the Lineal Foot
- Sealing incidental to cost



Partial Depth Repair Type BE



Full Depth Repairs CD-LV



JUL 1 2008

Full Depth Repairs C1 - LV



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.

PLAN VIEW **SECTION**

Repair Dimensions

- a) Exterior Edge, 3' 6" x 5' 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.

□ AREA TO BE REMOVED

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. 25 epoxy coated reinforcement bars, (1) 1" dowel bars (2) or, No. 13 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. Coat free end of dowel bars with a form coating material meeting Specification 3982.
4. Clean the vertical surfaces of the in place concrete.
5. Furnish and install joint filler.
6. Furnish and place Concrete Mix Number 3432 or furnish and place 3U8 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 A) detail. (Incidental)

2302 Spot Full Depth Repair (Type C1-LV) 15q, Ft/

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LTAP U of MN Center for Transportation

- 1st Class October 12-13, 2005 Owatonna, MN
- 2nd class October 3-4, 2006, Mpls, Mn
- 3rd Class Oct. 2007, Olmsted County - Rochester, MN
- 4th Class April 2009, Waseca County

LTAP U of MN Center for Transportation

- Next Class will be April 2012 for MnDOT
- Next Class for City of Minneapolis May 2012
- Next Class October 2012 Washington
County

Questions????



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