NEW CONCRETE PAVEMENT STANDARDS

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TxDOT, CSTM&P TxDOT

2014 Construction, Pavements, and Materials Conference

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2 CRCP(1)-13 Standard

3 CRCP(2)-13 Standard

4 TA(CP)-99 Standard

Background

CRCP(1)-13, Continuously Reinforced Concrete Pavement
One Layer Steel Bar Placement, 2013 version, has two sheets and replaces:

- CRCP(1)-11, Continuously Reinforced Concrete Pavement
  One Layer Steel Bar Placement, 2011 version, and

- CRCP(1A)-12, Continuously Reinforced Concrete Pavement
  One Layer Steel Bar Placement for Low CoTE Concrete, 2012 version

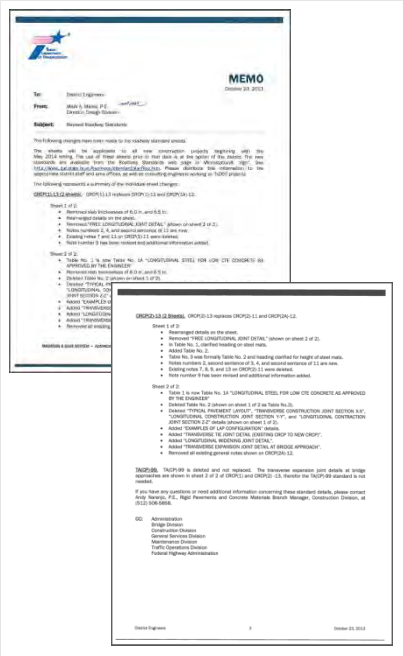
Background

CRCP(2)-13, Continuously Reinforced Concrete Pavement
Two Layer Steel Bar Placement, 2013 version, has two sheets and replaces:

- CRCP(2)-11, Continuously Reinforced Concrete Pavement
  Two Layer Steel Bar Placement, 2011 version, and

- CRCP(2A)-12, Continuously Reinforced Concrete Pavement
  Two Layer Steel Bar Placement for Low CTE Concrete, 2012 version

Background



Texas Department of Transportation

MEMO

October 23, 2013

To: District Engineers

From: Mark A. Marek, P.E.
Director, Design Division

Subject: Revised Roadway Standards

The following changes have been made to the roadway standard sheets.

The sheets will be applicable to all new construction projects beginning with the May 2014 letting. The use of these sheets prior to that date is at the option of the district. The new standards are available from the Roadway Standards web page in Microstation® "dgn". See http://www.dot.state.tx.us/business/standard/dgnfiles.htm. Please distribute this information to the appropriate district staff and area offices, as well as consulting engineers working on TxDOT projects.

The following represents a summary of the individual sheet changes:

CRCP(1)-13 (2 sheets). CRCP(1)-13 replaces CRCP(1)-11 and CRCP(1A)-12.

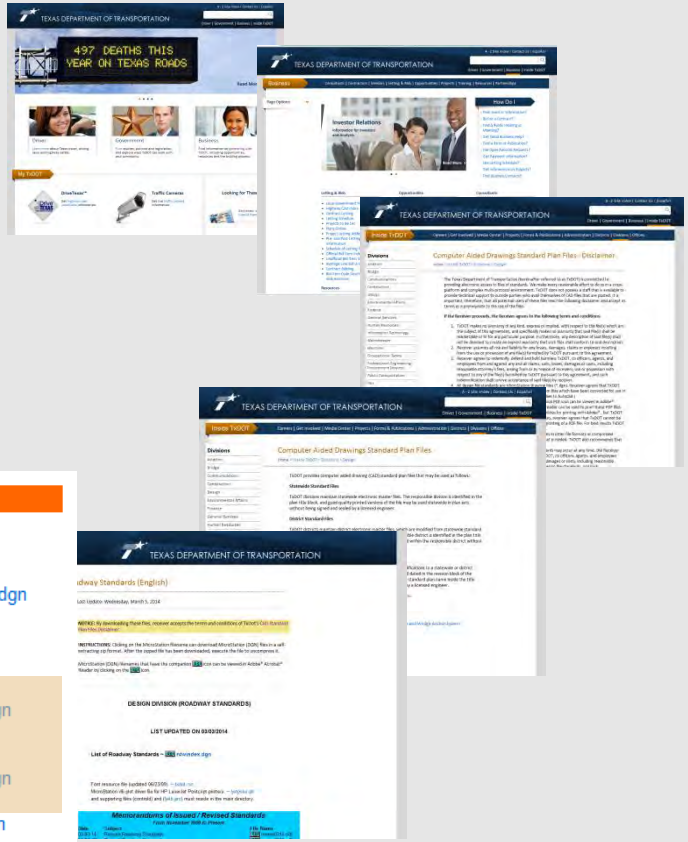
Sheet 1 of 2:

- Removed slab thicknesses of 6.0 in. and 6.5 in.
- Rearranged details on the sheet.

Background – Website Address

http://www.txdot.gov/inside-txdot/division/design/cad.html

- TxDOT website – www.txdot.gov
  - Select *Business*
  - Scroll to Resources
    - Select *Statewide Standard CAD Files*
  - Click "*I accept*"
  - Select *Roadway Standards*
  - Scroll to the Pavements



PAVEMENTS

Title	Description	File Name
TE(HMAC)-11	Tapered Edge Details HMAC Pavement	tehmac11.dgn
TWT-04	Thin Whitetopping Details	twt04.dgn
CRCP(1)-13	Continuously Reinforced Concrete Pavement One Layer Steel Bar Placement 2 Sheets	crcp113.dgn
CRCP(2)-13	Continuously Reinforced Concrete Pavement Two Layer Steel Bar Placement 2 Sheets	crcp213.dgn
FDRCP-05	Full Depth Repair for Concrete Pavement	fdrcp05.dgn
CPCD-94	Concrete Pavement Details, Contraction Design	cpcd94.dgn
JS-94	Concrete Paving Details, Joint Seals	js94.dgn

CoTE Requirements for CRCP(1)-13 and CRCP(2)-13

GENERAL NOTES

1. DETAILS FOR PAVEMENT WIDTH, PAVEMENT THICKNESS AND THE CROWN CROSS-SLOPE SHALL BE SHOWN ELSEWHERE IN THE PLANS. PAVEMENTS WIDER THAN 100 FT. WITHOUT A FREE LONGITUDINAL JOINT ARE NOT COVERED BY THIS STANDARD.

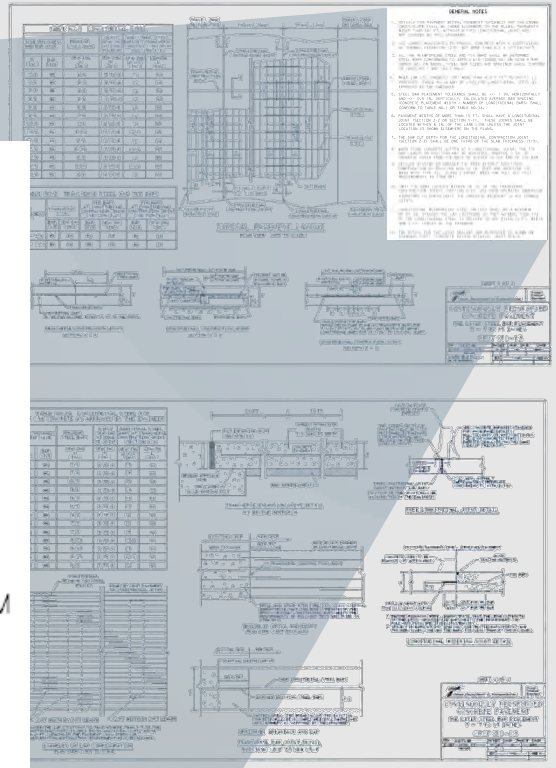
2. USE COARSE AGGREGATES TO PRODUCE CONCRETE WITH A COEFFICIENT OF THERMAL EXPANSION (CTE) NOT MORE THAN 5.5 X 10^{-6} IN/IN/°F.

3. ALL THE REINFORCING STEEL AND TIE BARS SHALL BE DEFORMED STEEL BARS CONFORMING TO ASTM A 615 (GRADE 60) OR ASTM A 996 (GRADE 60) OR ABOVE. STEEL BAR SIZES AND SPACINGS SHALL CONFORM TO TABLE NO.1 AND TABLE NO.2.

4. WHEN LOW CTE CONCRETE (NOT MORE THAN 4.0 X 10^{-6} IN/IN/°F) IS PRODUCED. TABLE NO.1A MAY BE USED FOR LONGITUDINAL STEEL AS APPROVED BY THE ENGINEER.

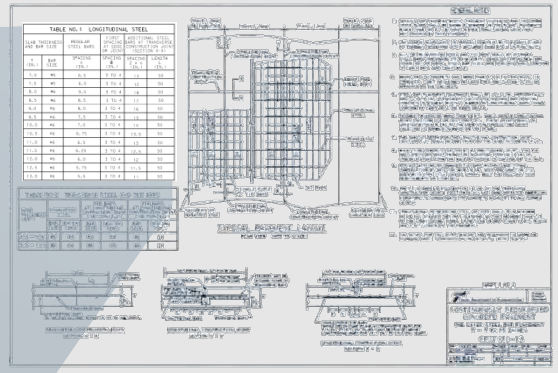
5. STEEL BAR PLACEMENT TOLERANCE SHALL BE +/- 1 IN. HORIZONTALLY AND +/- 0.5 IN. VERTICALLY. CALCULATED AVERAGE BAR SPACING (CONCRETE PLACEMENT WIDTH / NUMBER OF LONGITUDINAL BARS) SHALL CONFORM TO TABLE NO.1 OR TABLE NO.1A.

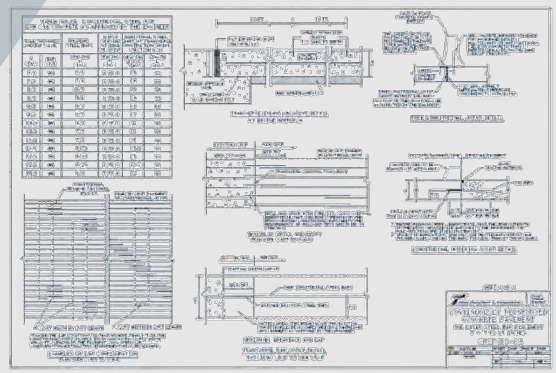
6. PAVEMENT WIDTHS OF MORE THAN 15 FT. SHALL HAVE A LONGITUDINAL JOINT (SECTION Z-Z OR SECTION Y-Y). THESE JOINTS SHALL BE LOCATED WITHIN 6 IN. OF THE LANE LINE UNLESS THE JOINT LOCATION IS SHOWN ELSEWHERE ON THE PLANS.



CRCP(1)-13 – Longitudinal Steel Requirements

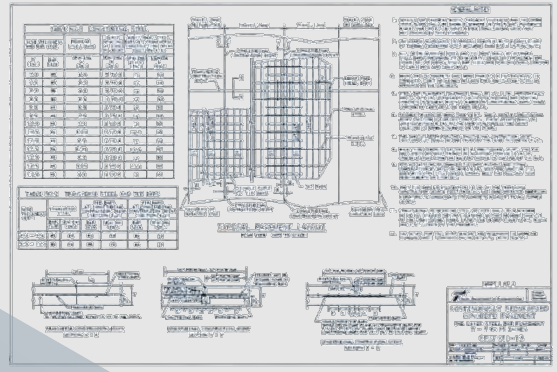
TABLE NO. 1 LONGITUDINAL STEEL					
SLAB THICKNESS AND BAR SIZE		REGULAR STEEL BARS	FIRST SPACING AT EDGE OR JOINT	ADDITIONAL STEEL BARS AT TRANSVERSE CONSTRUCTION JOINT (SECTION X-X)	
T (IN.)	BAR SIZE	SPACING c (IN.)	SPACING a (IN.)	SPACING 2 x c (IN.)	LENGTH L (IN.)
7.0	#5	6.5	3 TO 4	13	50
7.5	#5	6.0	3 TO 4	12	50
8.0	#6	9.0	3 TO 4	18	50
8.5	#6	8.5	3 TO 4	17	50
9.0	#6	8.0	3 TO 4	16	50
9.5	#6	7.5	3 TO 4	15	50
10.0	#6	7.0	3 TO 4	14	50
10.5	#6	6.75	3 TO 4	13.5	50
11.0	#6	6.5	3 TO 4	13	50
11.5	#6	6.25	3 TO 4	12.5	50
12.0	#6	6.0	3 TO 4	12	50
12.5	#6	5.75	3 TO 4	11.5	50
13.0	#6	5.5	3 TO 4	11	50

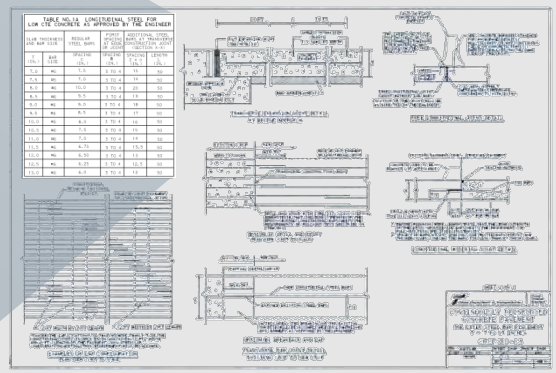




CRCP(1)-13 – Longitudinal Steel Requirements

TABLE NO. 1A LONGITUDINAL STEEL FOR LOW CTE CONCRETE AS APPROVED BY THE ENGINEER					
SLAB THICKNESS AND BAR SIZE		REGULAR STEEL BARS	FIRST SPACING AT EDGE OR JOINT	ADDITIONAL STEEL BARS AT TRANSVERSE CONSTRUCTION JOINT (SECTION X-X)	
T (IN.)	BAR SIZE	SPACING c (IN.)	SPACING a (IN.)	SPACING 2 x c (IN.)	LENGTH L (IN.)
7.0	#5	7.5	3 TO 4	15	50
7.5	#5	7.0	3 TO 4	14	50
8.0	#6	10.0	3 TO 4	20	50
8.5	#6	9.5	3 TO 4	19	50
9.0	#6	9.0	3 TO 4	18	50
9.5	#6	8.5	3 TO 4	17	50
10.0	#6	8.0	3 TO 4	16	50
10.5	#6	7.5	3 TO 4	15	50
11.0	#6	7.0	3 TO 4	14	50
11.5	#6	6.75	3 TO 4	13.5	50
12.0	#6	6.50	3 TO 4	13	50
12.5	#6	6.25	3 TO 4	12.5	50
13.0	#6	6.0	3 TO 4	12	50



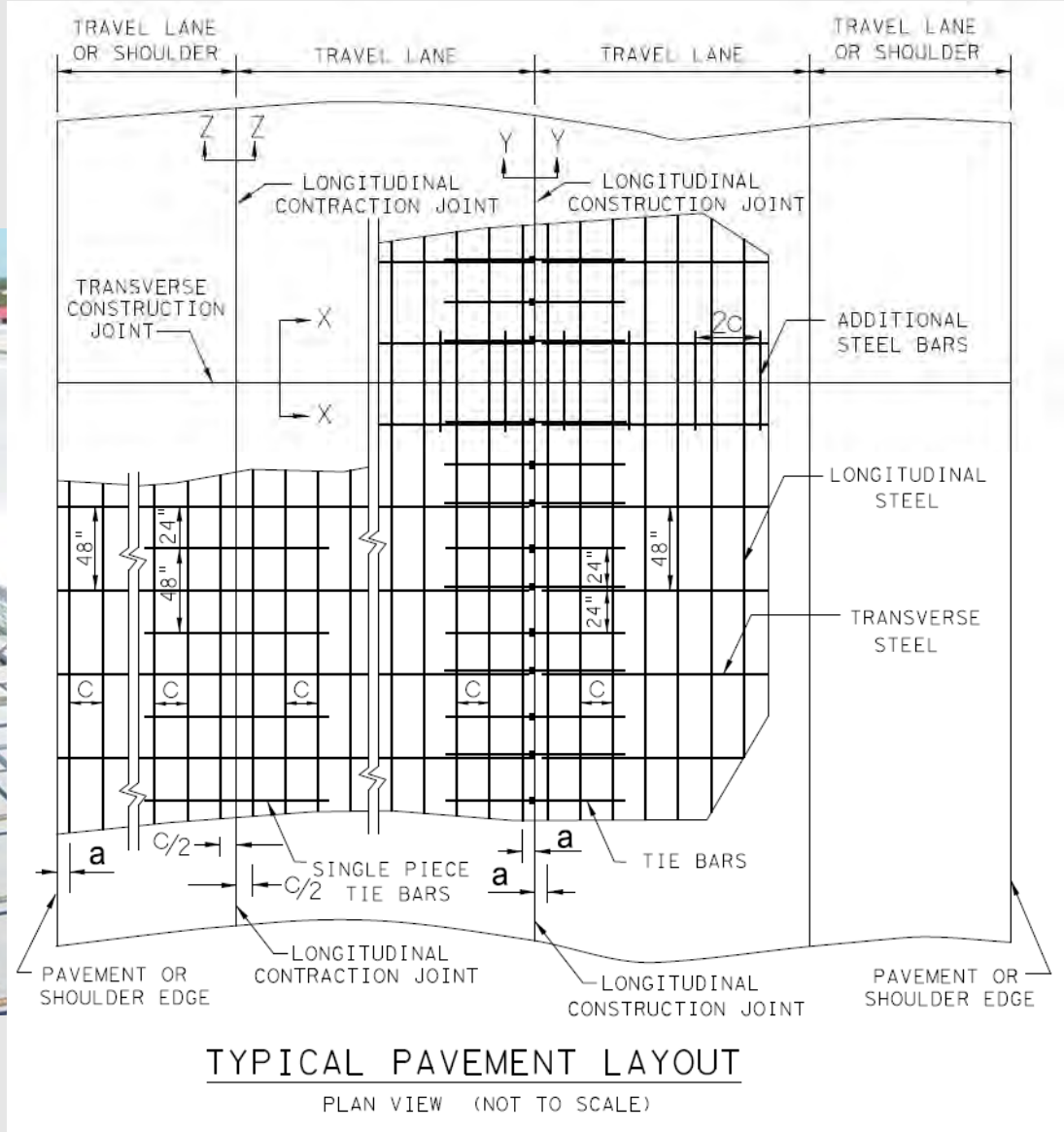


CRCP(1)-13, Typical Pavement Layout

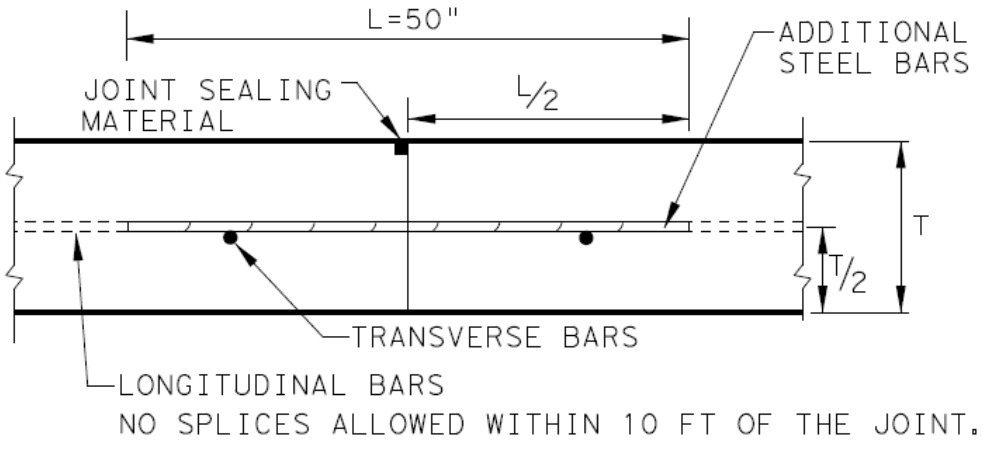
CRCP(1)-13

Pavement Thickness

of 7 to 13 in.



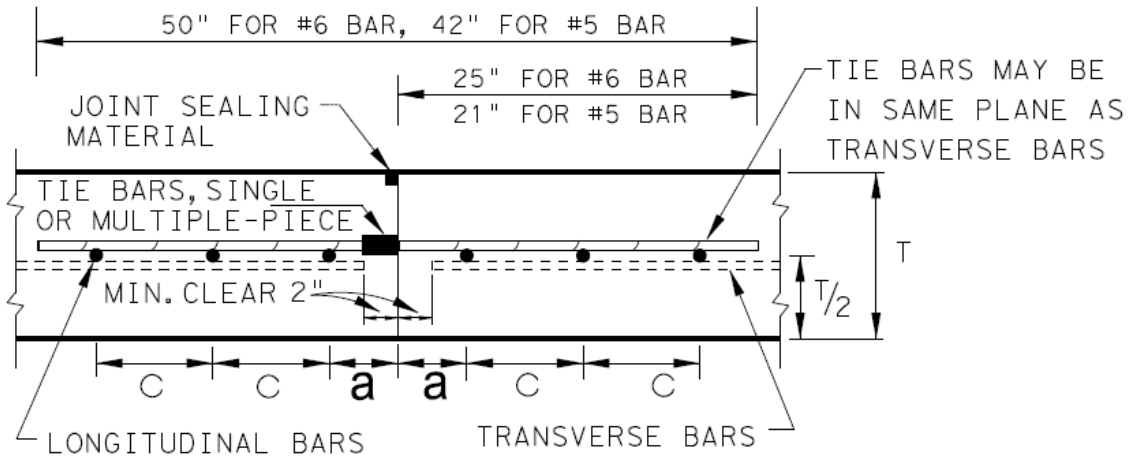
CRCP(1)-13, Transverse Construction Joint



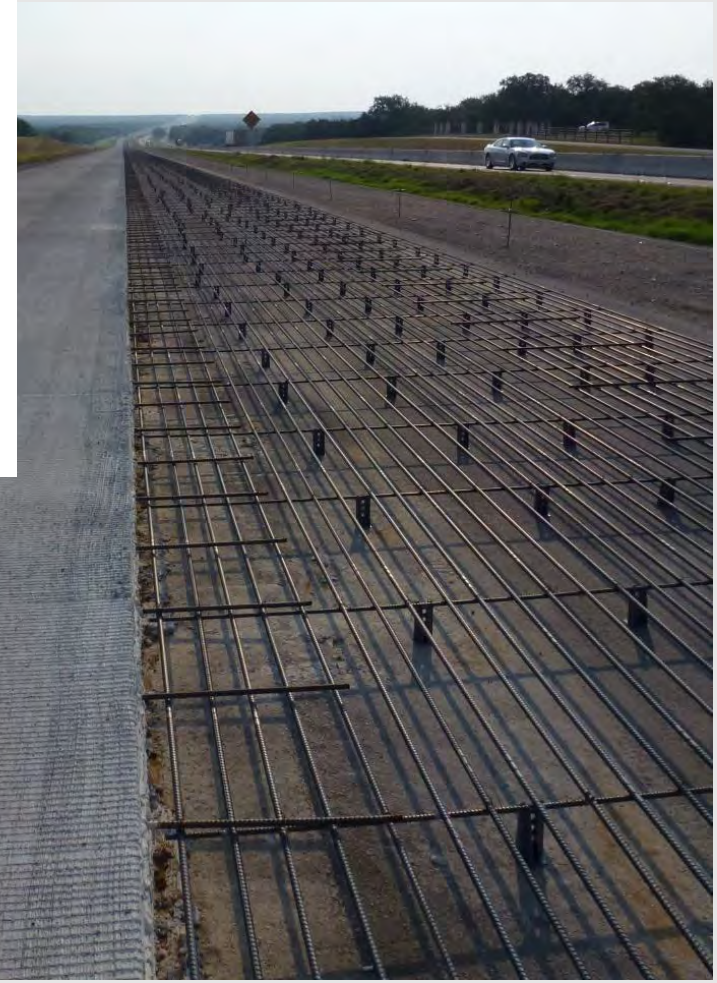
TRANSVERSE CONSTRUCTION JOINT

SECTION X - X

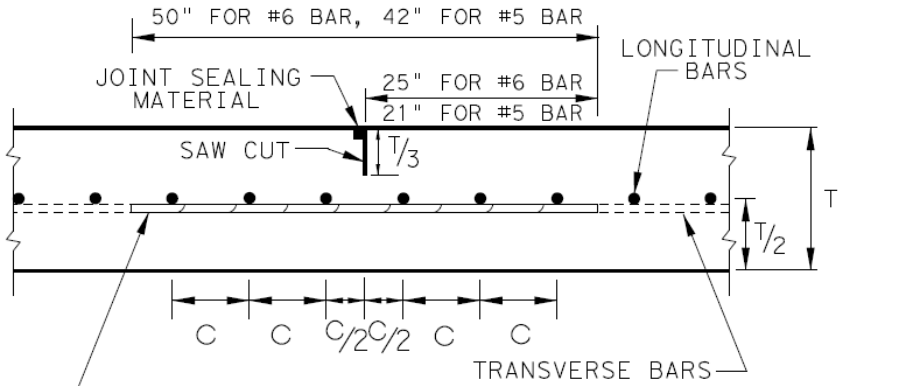
CRCP(1)-13, Longitudinal Construction Joint



LONGITUDINAL CONSTRUCTION JOINT
SECTION Y - Y

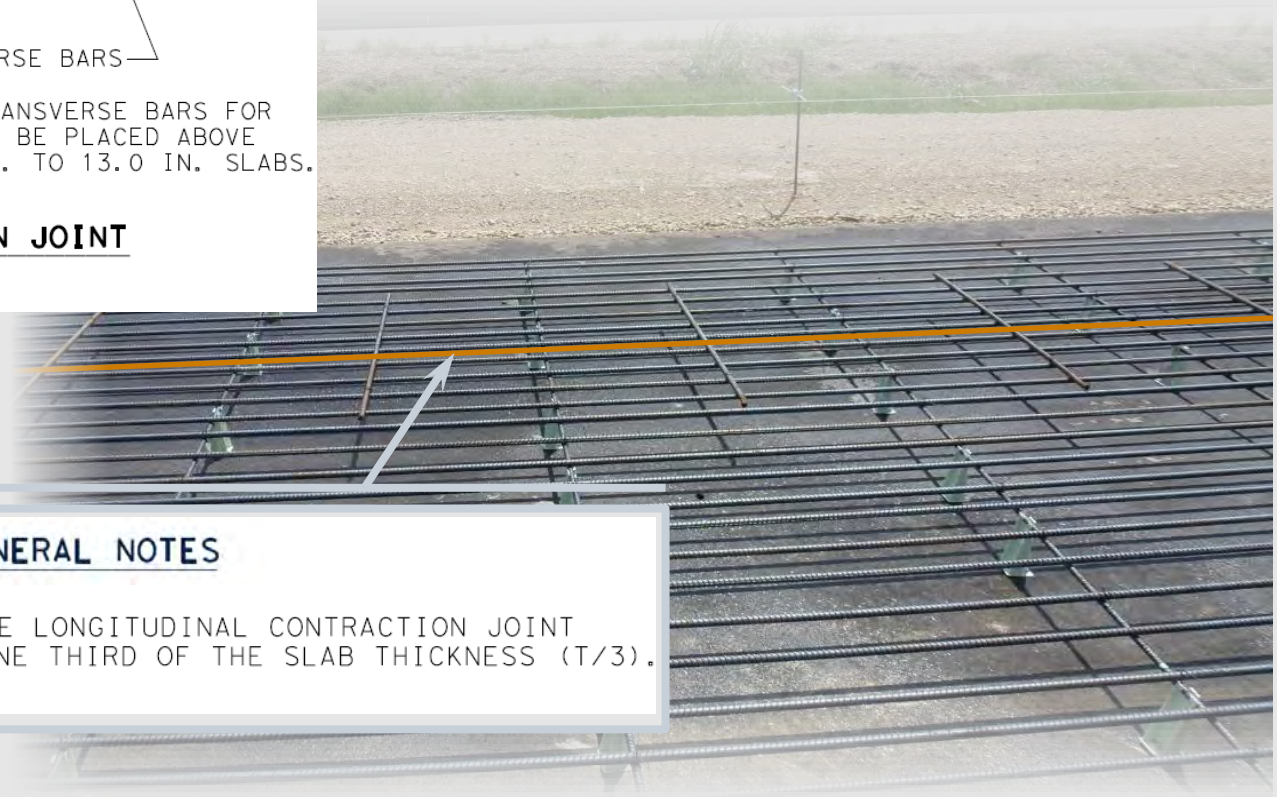


CRCP(1)-13, Longitudinal Contraction Joint



LONGITUDINAL CONTRACTION JOINT

SECTION Z - Z



GENERAL NOTES

7. THE SAW CUT DEPTH FOR THE LONGITUDINAL CONTRACTION JOINT (SECTION Z-Z) SHALL BE ONE THIRD OF THE SLAB THICKNESS (T/3).

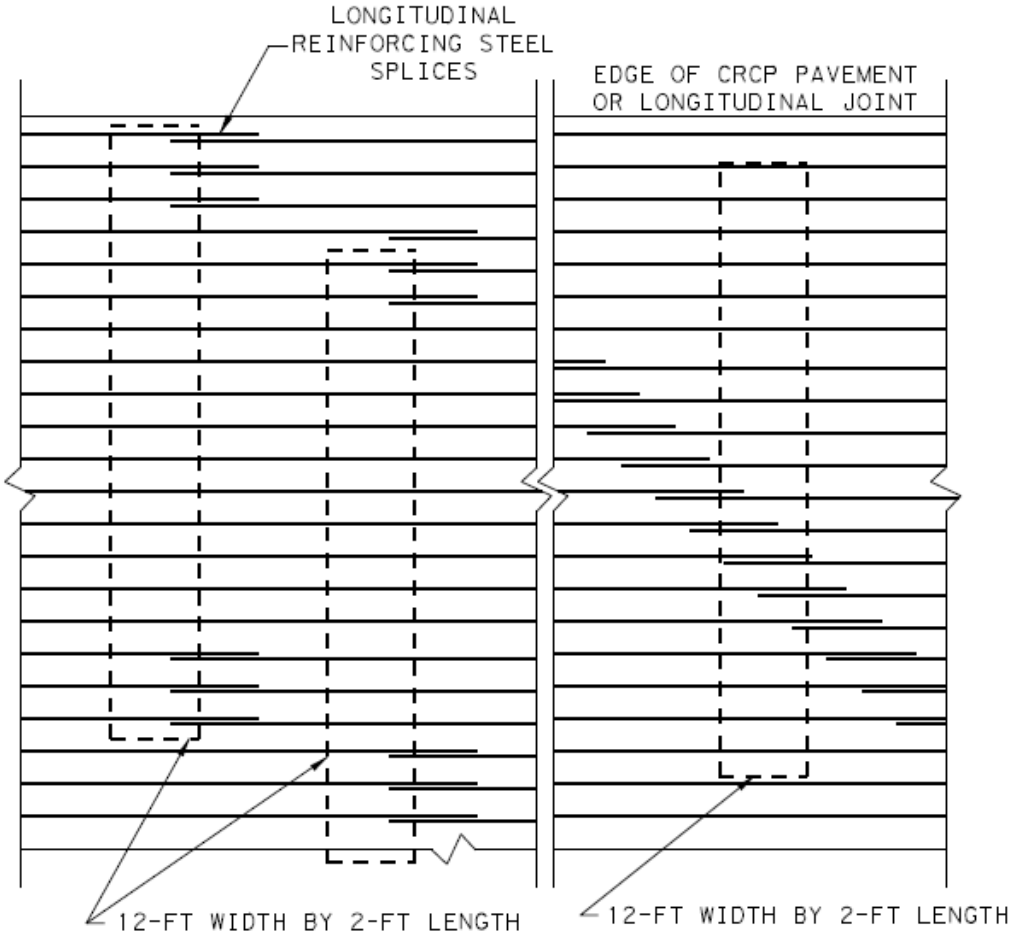
Steel Continuity in Longitudinal Direction, in CRCP

- Steel continuity in longitudinal direction is important to ensuring good pavement performance
- Continuity of longitudinal steel is achieved by overlapping individual steel bars
- Minimum lap requirements per Item 440, Table 5.

- Testing has shown:
  - Stresses in one steel bar can effectively be transferred to the next steel bar
  - Stresses are transferred via the surrounding concrete

Steel Continuity in Longitudinal Direction, in CRCP

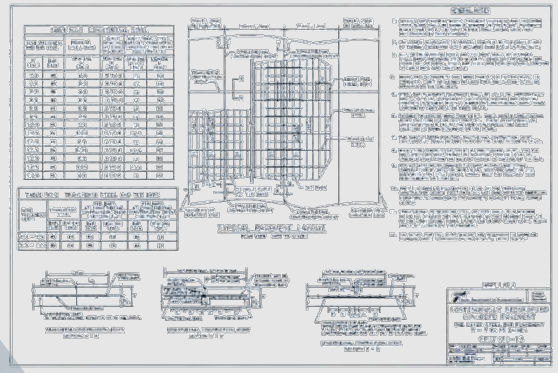
CRCP(1)-13, Lap Configuration

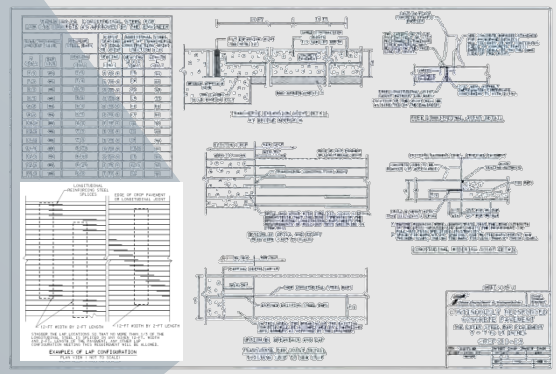


STAGGER THE LAP LOCATIONS SO THAT NO MORE THAN 1/3 OF THE LONGITUDINAL STEEL IS SPLICED IN ANY GIVEN 12-FT. WIDTH AND 2-FT. LENGTH OF THE PAVEMENT. ANY OTHER LAP CONFIGURATION MEETING THIS REQUIREMENT WILL BE ALLOWED.

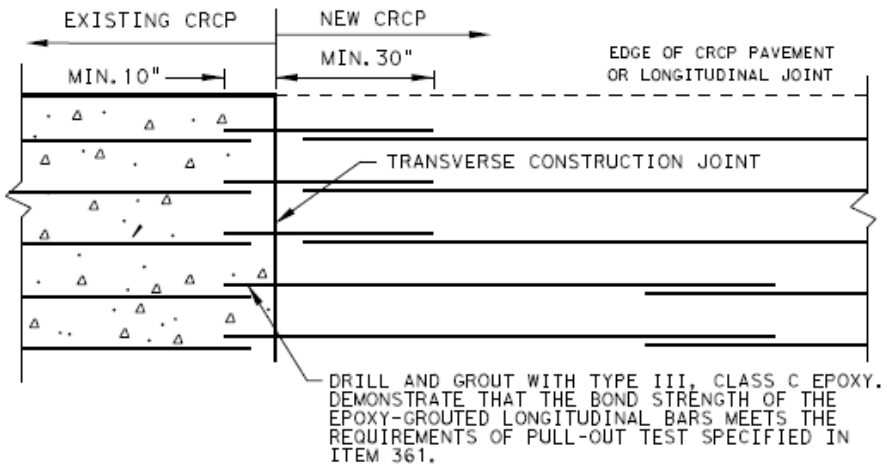
EXAMPLES OF LAP CONFIGURATION

PLAN VIEW (NOT TO SCALE)

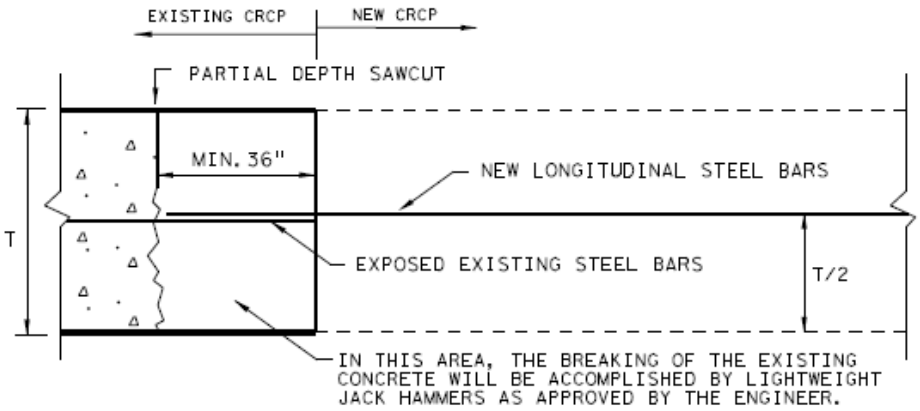




CRCP(1)-13, Transverse Tie Joint Detail

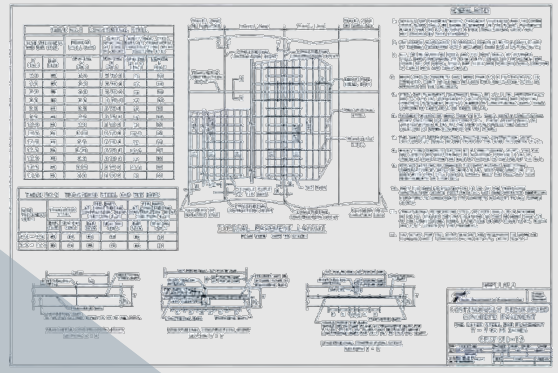


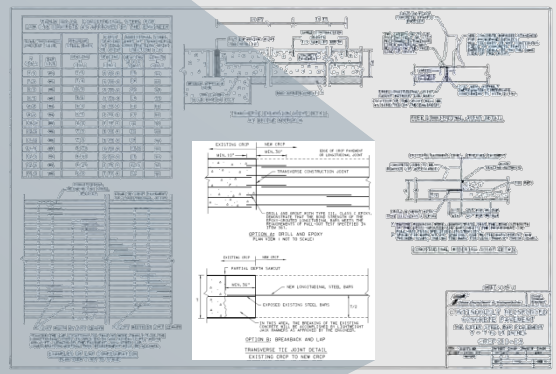
OPTION A: DRILL AND EPOXY
PLAN VIEW (NOT TO SCALE)



OPTION B: BREAKBACK AND LAP

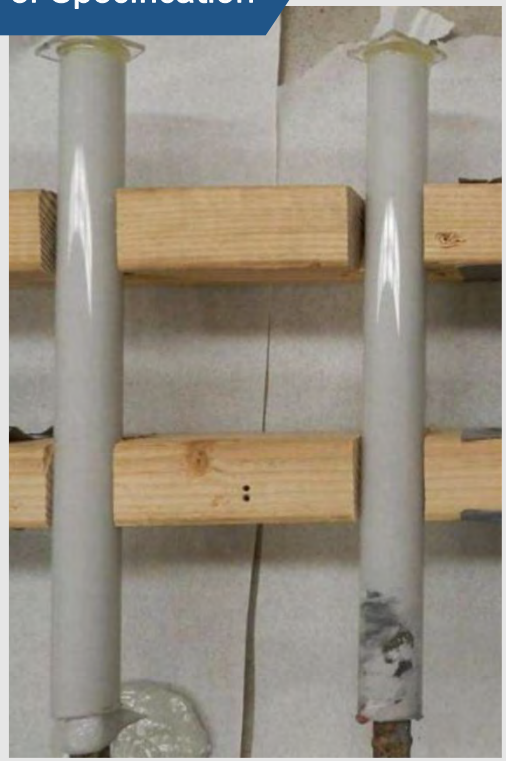
TRANSVERSE TIE JOINT DETAIL
EXISTING CRCP TO NEW CRCP





CRCP(1)-13, Transverse Joint, Option A – Drill and Epoxy

Per Specification



Non-Compliance

ITEM 361

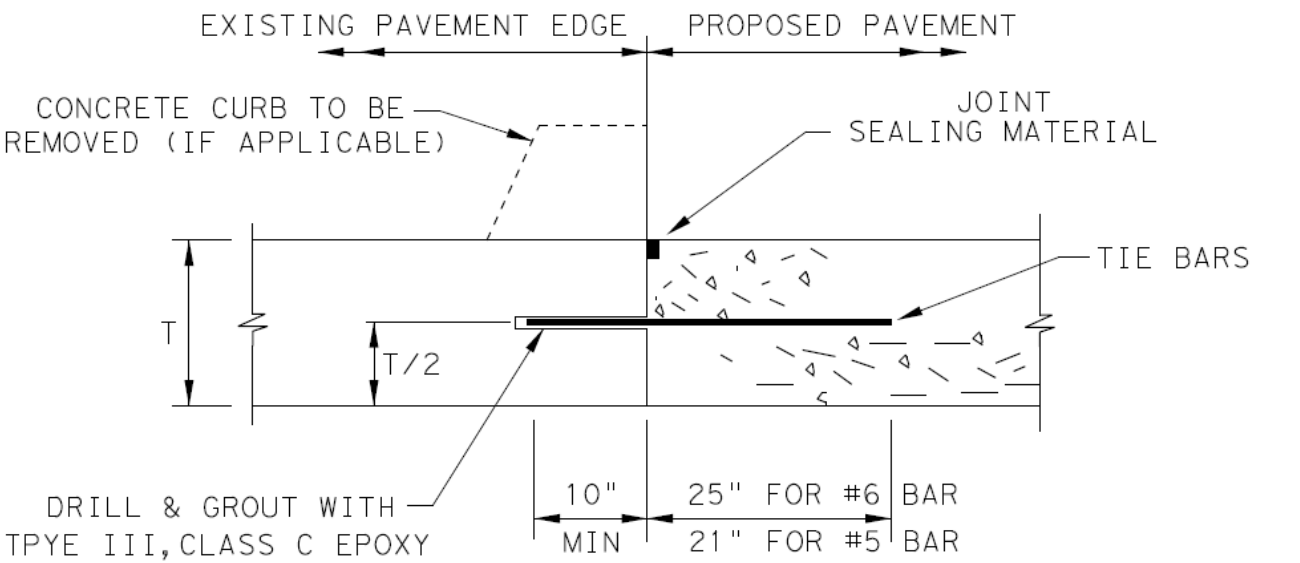
Completely fill tiebar hole with epoxy before inserting tiebar into hole

CRCP(1)-13, Transverse Joint, Option B – Breakback and Lap

1. Partial depth saw cut
2. Break the concrete by lightweight Jack hammers as approved
3. Expose min. 36 in. existing bars

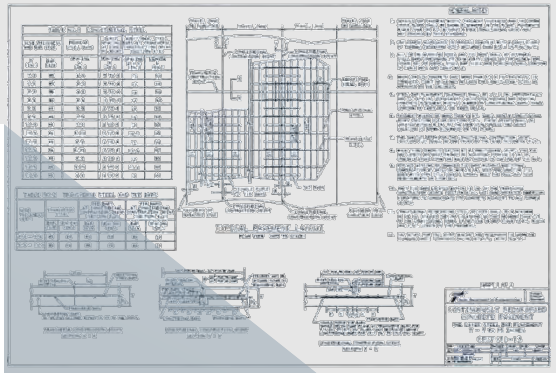
Paul Wong, ATL

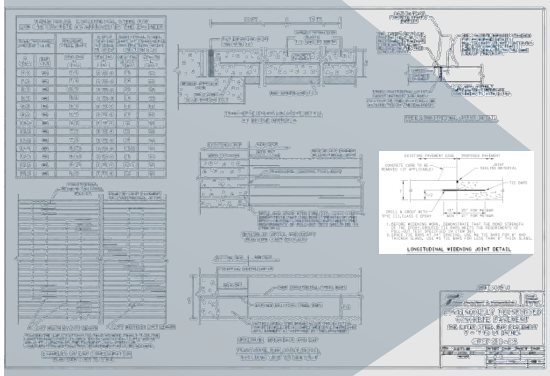
CRCP(1)-13, Longitudinal Widening Joint



1. BEFORE WIDENING WORK, DEMONSTRATE THAT THE BOND STRENGTH OF THE EPOXY-GROUTED TIE BARS MEETS THE REQURIMENTS OF PULL-OUT TEST SPECIFIED IN ITEM 361.
2. SPACE TIE BARS AT 24" SPACING. USE #6 TIE BARS FOR 8" AND THICKER SLABS, USE #5 TIE BARS FOR LESS THAN 8" THICK SLABS.

LONGITUDINAL WIDENING JOINT DETAIL





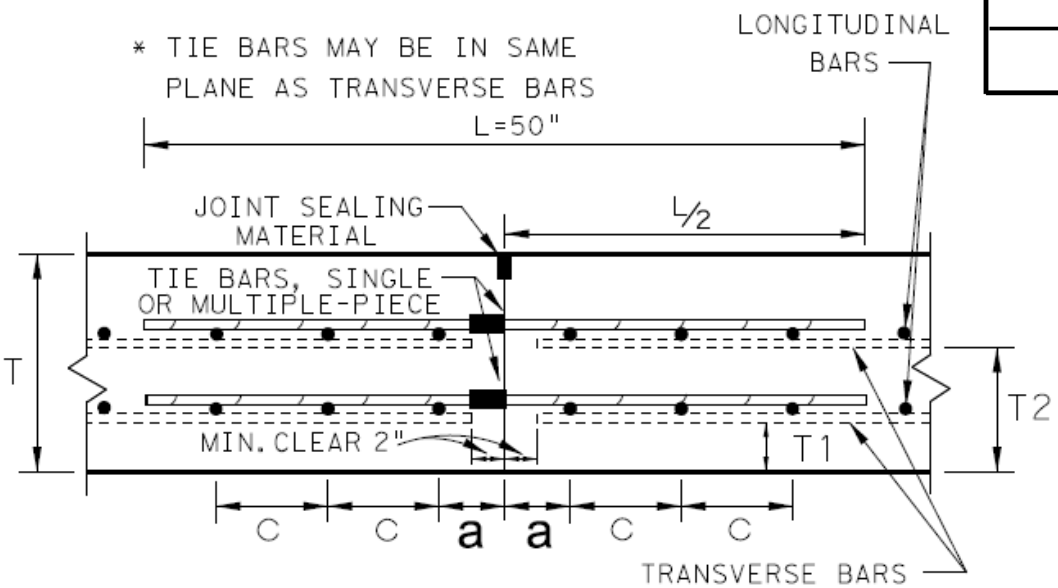
CRCP(2)-13, Typical Pavement Layout

CRCP(2)-13

Pavement Thickness

of 14 in. & 15 in.

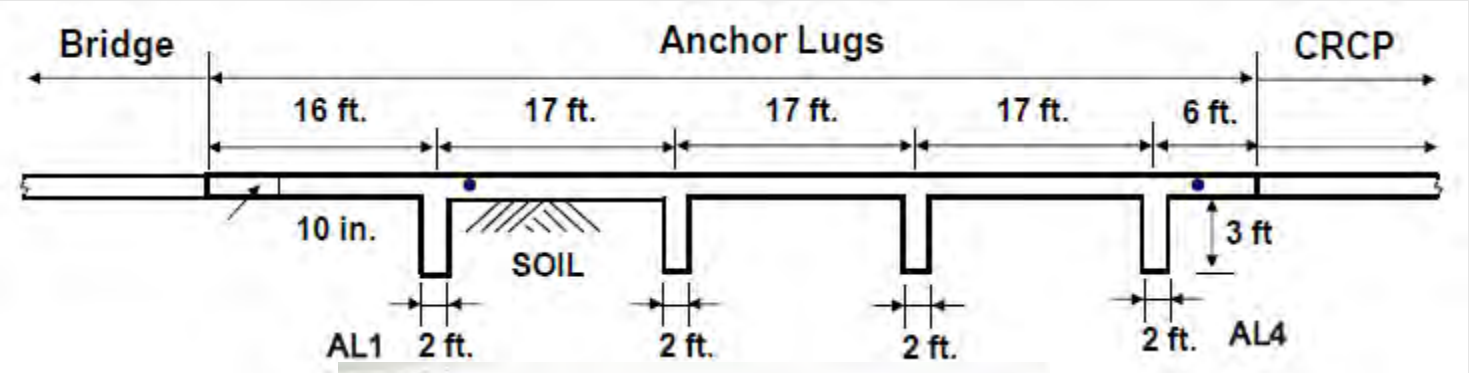
TABLE NO. 3 TWO LAYER STEEL PLACEMENT HEIGHT OF STEEL MATS		
SLAB THICKNESS T (IN.)	LOWER STEEL MAT HEIGHT T1 (IN.)	TOP STEEL MAT HEIGHT T2 (IN.)
14	4.5	8.0
15	5.0	8.5



LONGITUDINAL CONSTRUCTION JOINT

SECTION Y - Y

TA(CP)-99, Anchor Lug System



Research Project 0-6326

- Three terminal systems used to protect bridge structures in Texas
- Research Project 0-6326
  - Performed from 09/2008 to 08/2011
  - Investigated movement of CRCP near bridges and
  - Effectiveness of three terminal systems
- Researcher: Dr. Moon Won
- Project Director: Tomas Saenz, P.E.

Figure 4.1 Drilling of transverse hole to install a groutable anchor

Figure 4.2 Drilling of a vertical hole to install invar

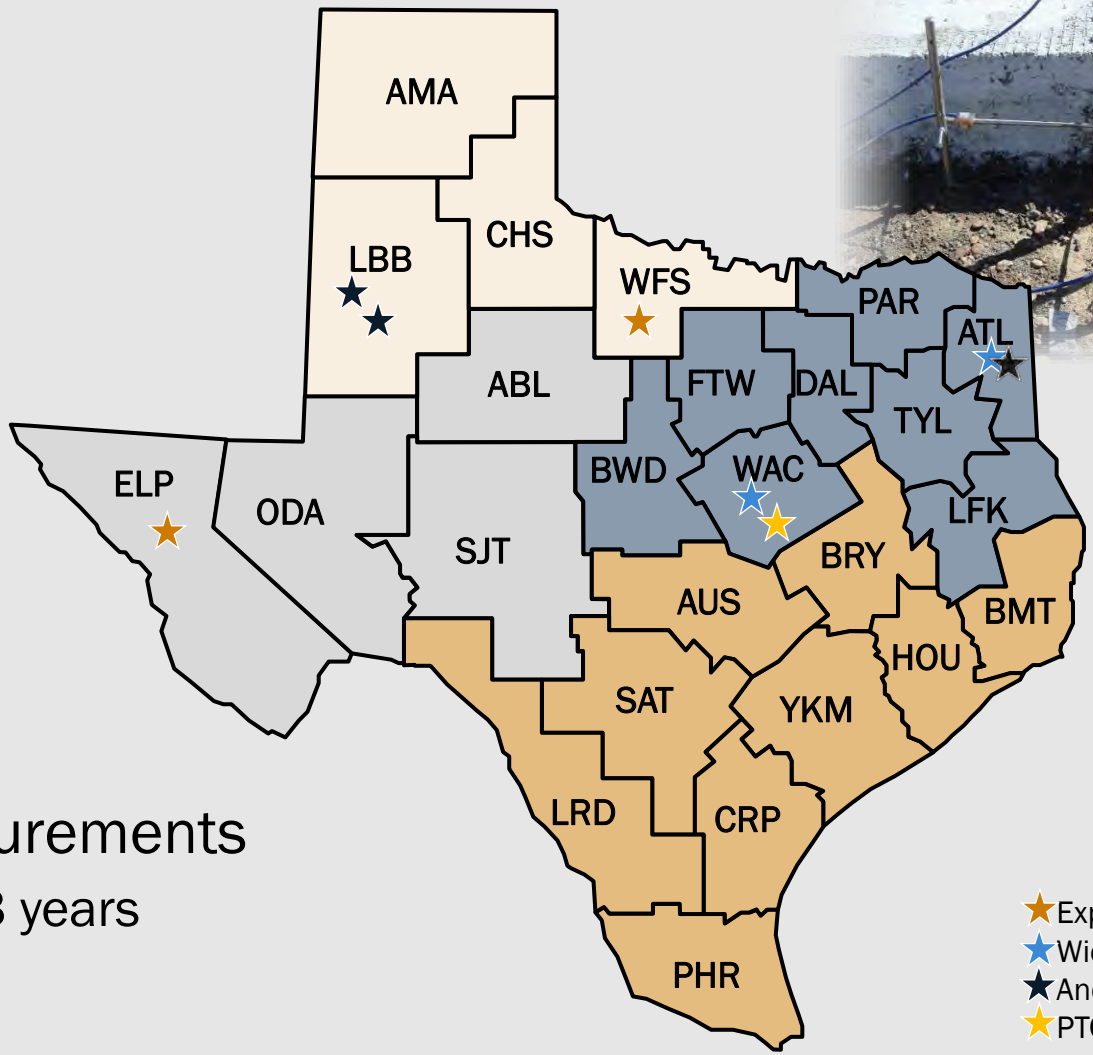
Figure 4.3 One end of crackmeter is connected to groutable anchor and the other to the invar

Figure 4.4 Wires from crackmeter connected to data logger

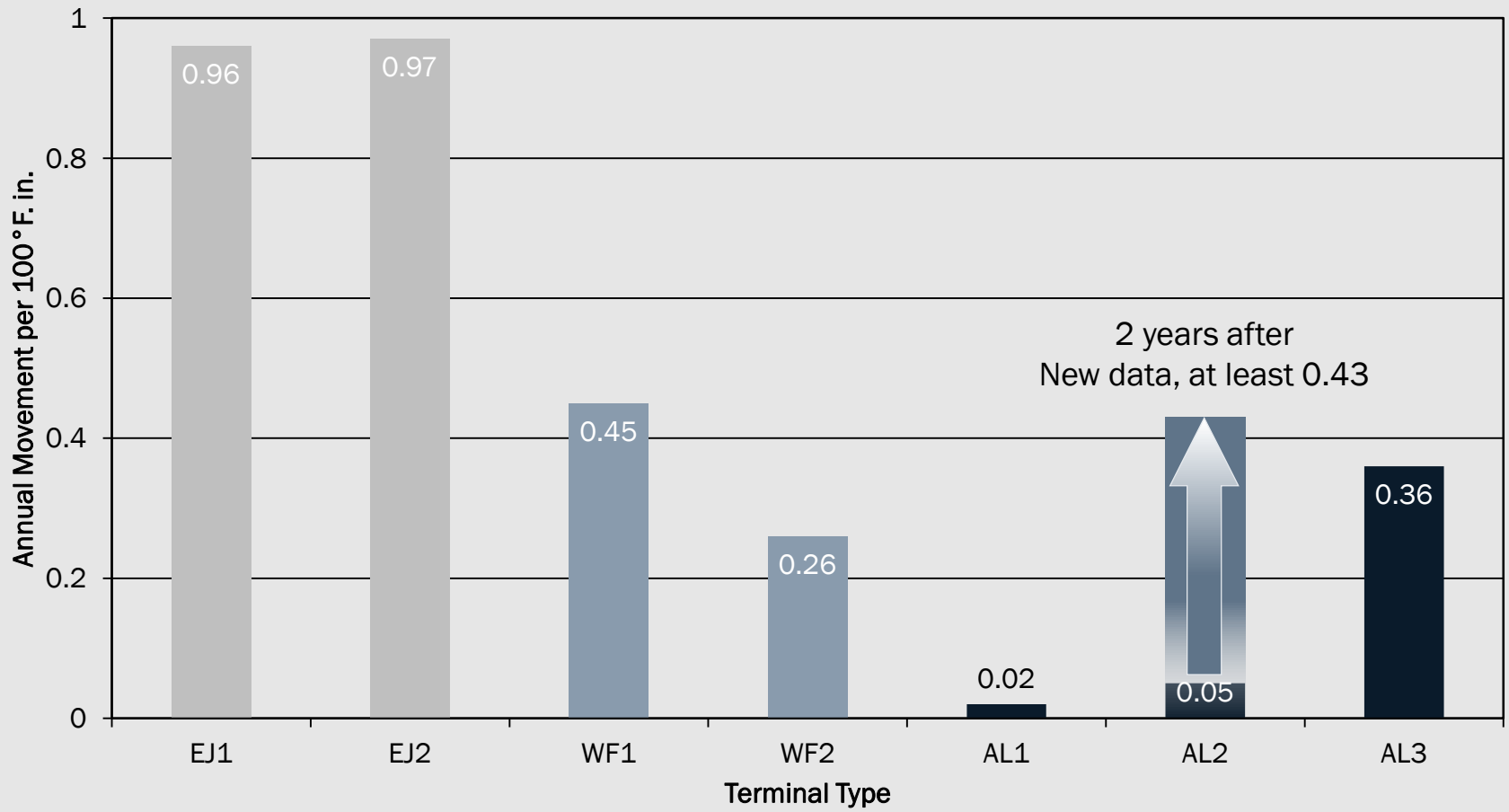
Research Project 0-6326, Field Experimentation

- El Paso - EJ
- Wichita Falls - EJ
- Atlanta 1 - WF
- Atlanta 2 - AL
- Lubbock 1 - AL
- Lubbock 2 -AL
- Waco - WF
- Waco (PTCP)

- Data Log of Measurements
  - from 6 months to 3 years
  - Varied by location



Research Project 0-6326



Research Project 0-6326, Findings

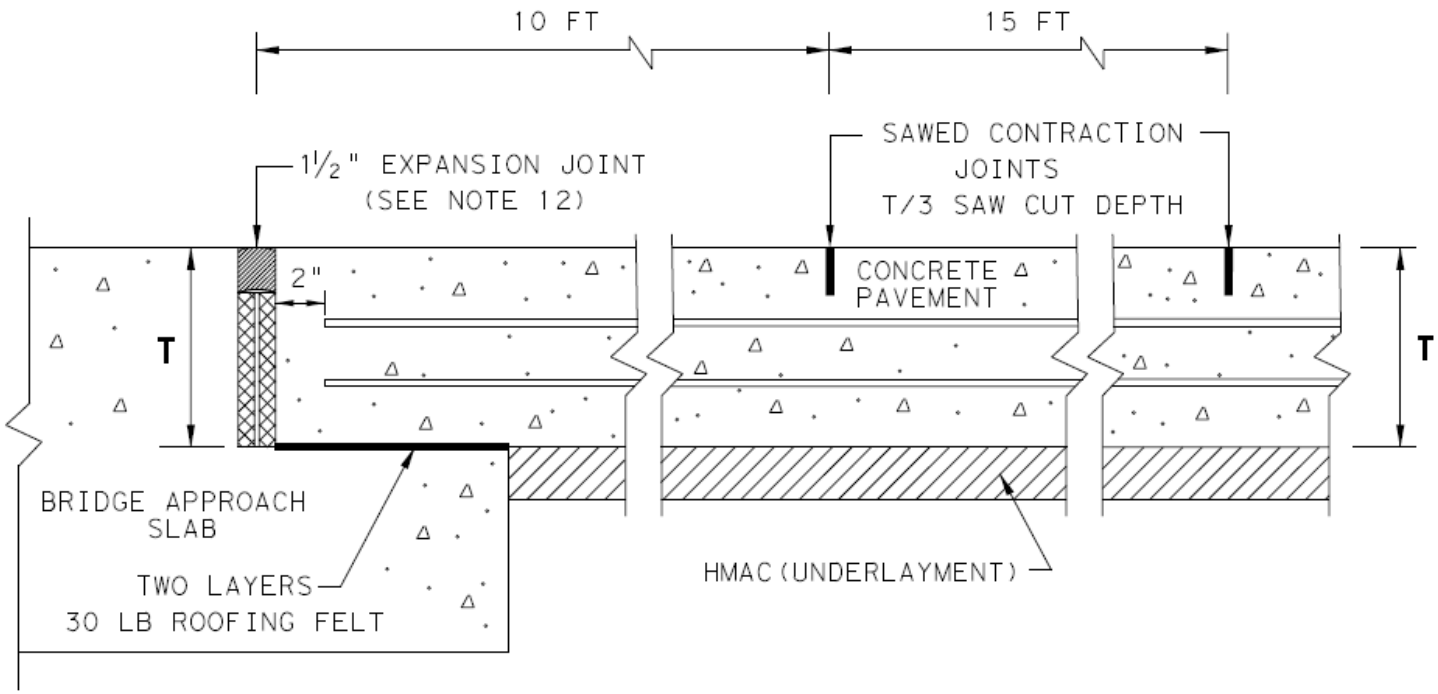
- Stresses generated in soil due to slab expansion at lug walls are large enough to result in permanent deformations in soils
- Soil does not retract with lug when pavement contracts
- Permanent deformation results in voids between the soil and lug walls

Research Project 0-6326, Findings

- Subbase friction restrains slab movements effectively
- Using rough textured subbase might be most effective tool to control slab movement
- Anchor lug system is not effective in the long run
- Simple expansion joint system or wide-flange system is effective in accommodating slab movement

TA(CP)-99 Replacement

- **TA(CP)-99 Deleted** and not replaced
- Transverse Expansion joint detail at Bridge Approaches
  - Replacement shown on sheet 2 of CRCP(1)-13 & CRCP(2)-13
- Detail adapted from Fort Worth district standard



TRANSVERSE EXPANSION JOINT DETAIL
AT BRIDGE APPROACH

THANK YOU !