PBES FOR LOCAL SYSTEMS – IOWA'S PERSPECTIVE, EXPERIENCE, AND RESEARCH

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ABC-UTC Webinar Series

February 19, 2015

IOWA DOT
SMARTER | SIMPLER | CUSTOMER DRIVEN

BRIDGE ENGINEERING CENTER

Outlines

- Background
  - Iowa DOT ABC History
- Perspectives: Iowa's County Engineers
  - Influencing Factors
  - Obstacles
- Iowa DOT Role
- Overview of the Local System Research Program
- PBES Projects on Iowa's Local System

Iowa DOT ABC History

State Perspective

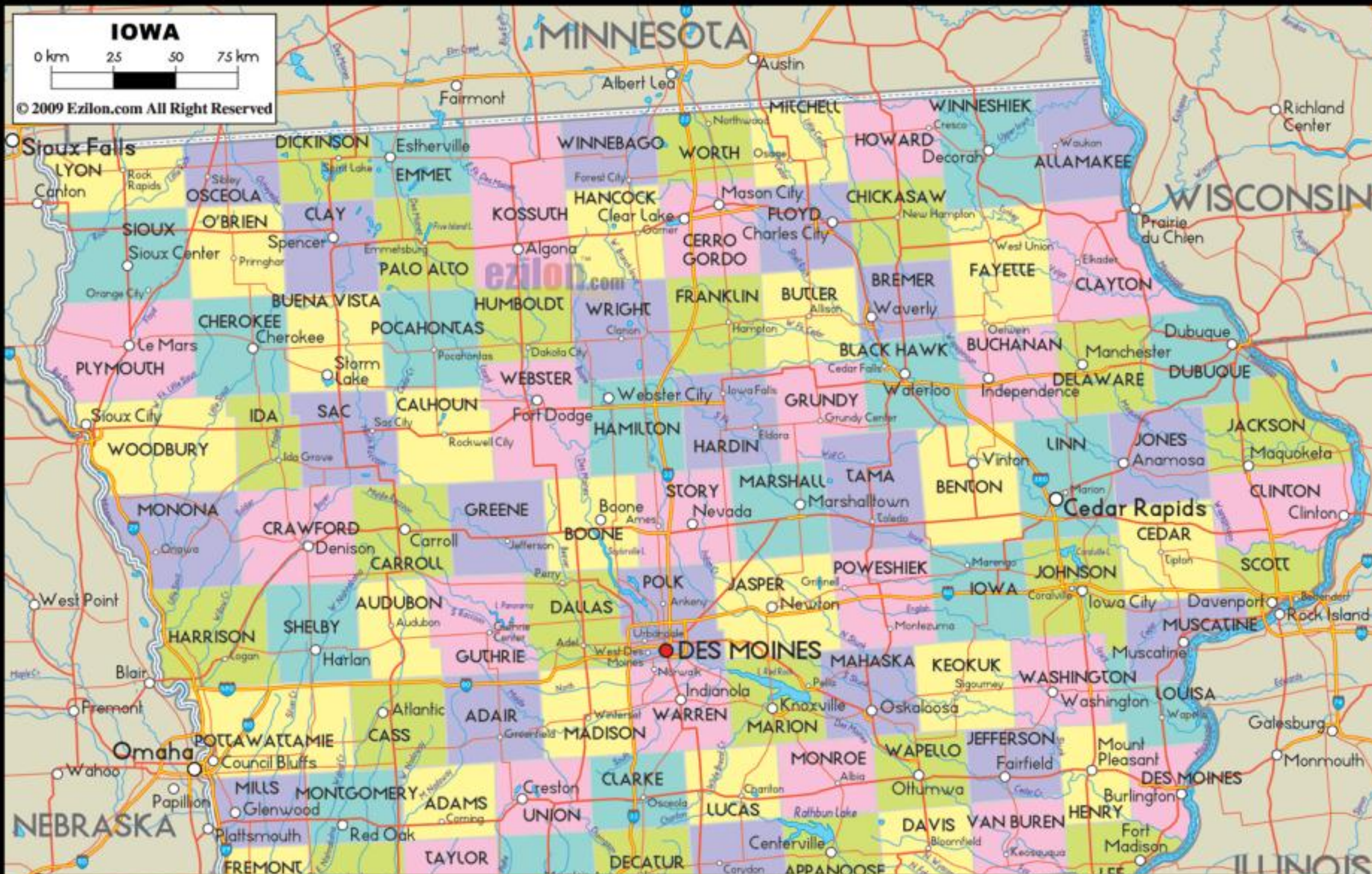
- Developed skills and design details through demonstration projects (IBRD, HfL, SHRP2, ..)
- Initial focus on developing effective systems, not ABC schedule
- Invested in research that included laboratory and field testing to confirm constructability and performance.

Iowa DOT ABC History Continued

- Participated in national pooled fund studies
- Involved local construction industry and held ABC workshops.
- Developed an ABC policy that includes decision making tools.
  - http://www.iowadot.gov/bridge/policy/08-00-00AbcLRFD.pdf

ABC Projects in Iowa

- Full-depth precast concrete deck panels
- Adjacent precast concrete box girders
- Precast concrete substructure elements such as columns, caps, footings, and wings.
- Modular steel beam/concrete deck superstructure units with UHPC joints
- Lateral slide
- Precast concrete approach panels
- Precast UHPC waffle deck panels
- Precast UHPC π-deck girder
- GRS



	Number of Bridges	Average ADT
County	19,008	190

ABC/PBES from the Local Perspective

- Ability to utilize local forces
- Emergency replacement due to floods or accidents
- Limited access to residents and businesses
- Seasonal Ag access/restrictions/needs
- Availability of local contractors with the appropriate equipment
- Use of in-house or local engineering for design
- Need to minimize environmental impacts
- Availability of suitable detours
- ADT volume
- Cost

Obstacles to ABC/PBES for Counties

- Cost
- Need for large equipment (high capacity cranes)
- Lack of local precast plants
- Limited contractor's pool with ABC experience
- Low ADT
- Delivery and handling of prefabricated units

Relationship between IA DOT and Locals

- Oversight responsibilities and administrative support through:
  - Office of Local System (central)
  - District Offices (regional)
- Office of Bridges and Structures: design and technical support
- Iowa Highway Research Board: research and implementation assistance

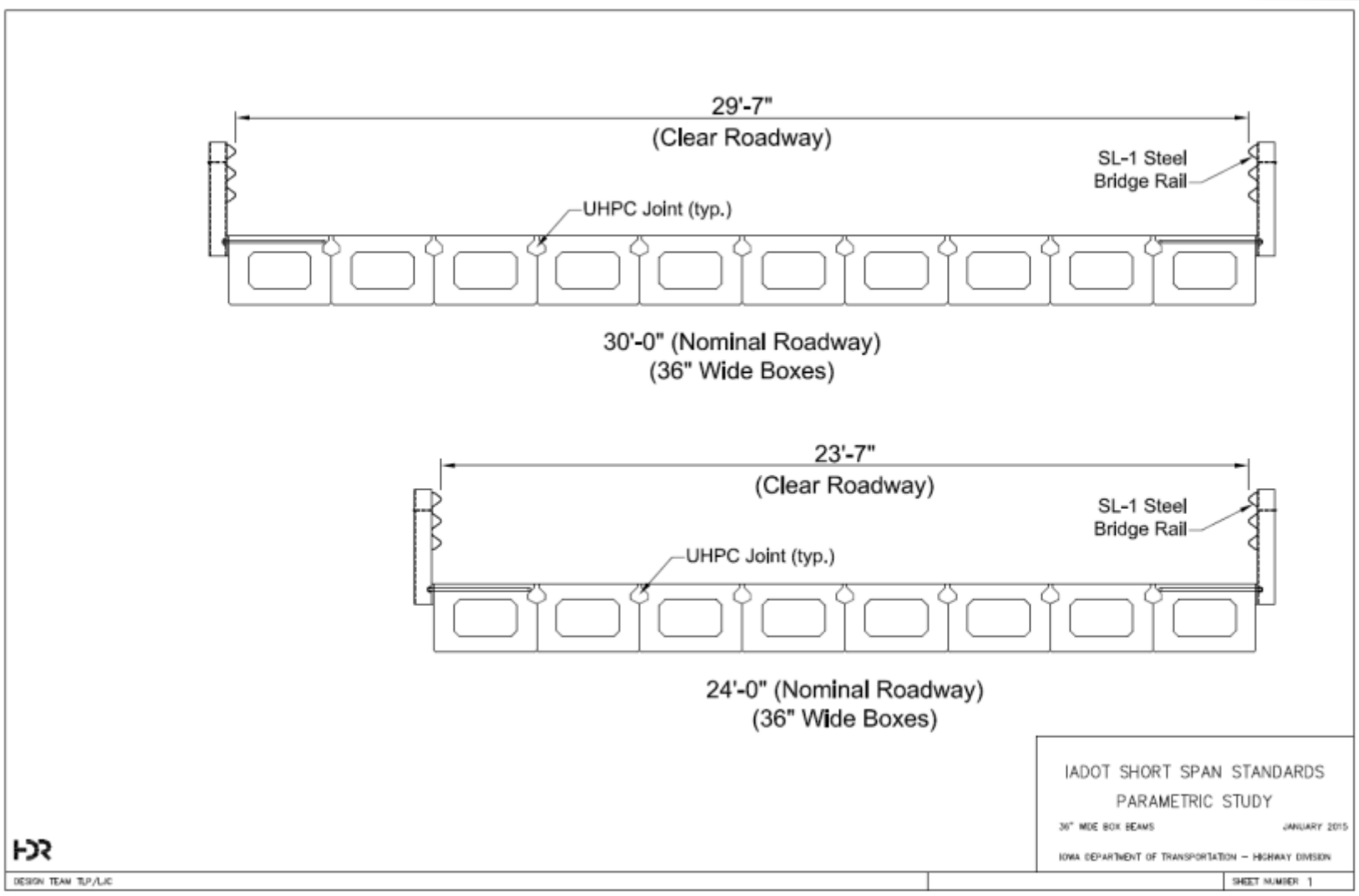
Research: Iowa ABC/PBES History

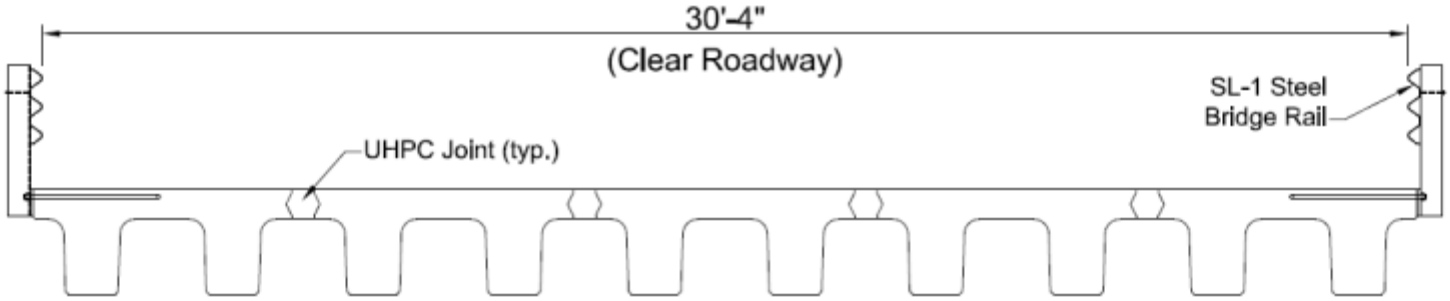
- Most ABC/PBES Projects have been piloted through our research program for locals
- Over 65 years old – It started with Secondary Road Research Funds!
- Iowa Highway Research Board – advisory board to the DOT
  - 15 members
    - 7 County Engineers
    - 4 Iowa DOT
    - 2 City Engineers
    - 2 University Representatives
  - Alternate members

TR-682: Short Span Precast Bridge Standards with UHPC Connections

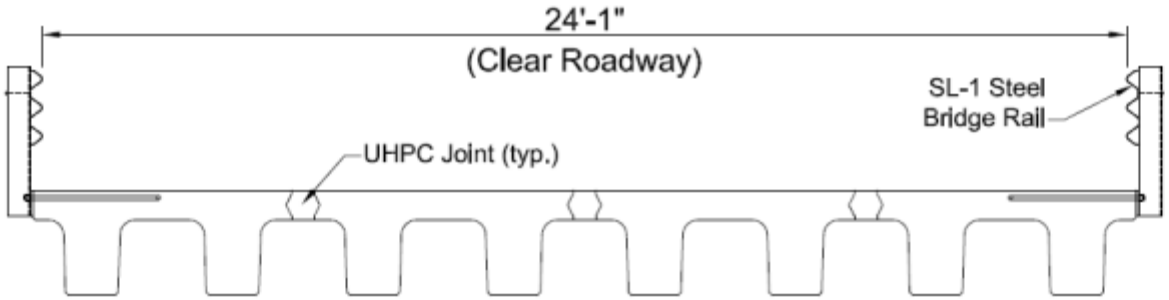
- Cost effective and for local fabricators to bid
- 24'-0 to 30'-0 wide roadway
- Skews 0-0, 15-0, and 30-0 degrees
- Span Lengths 30’-0, 40’-0, 50’-0, 60’-0, 70’-0 – Precast Concrete beams (prestressing only in spans which require it)
- Consider voided box beams
- Consider the weight of the beams due to concerns with moving and placing the beams when weights start to exceed 45,000 lbs.
- Beams could be strengthened transversely with threaded rod (no post-tensioning).
- Precast abutments as well as details for option to do cast-in-place abutments on pile foundations.

Preliminary Details





30'-0" (Nominal Roadway)
(69" Wide Sections)



24'-0" (Nominal Roadway)
(69" Wide Sections)

IADOT SHORT SPAN STANDARDS
PARAMETRIC STUDY

69" WIDE DOUBLE TS JANUARY 2015

IOWA DEPARTMENT OF TRANSPORTATION – HIGHWAY DIVISION

HDR

DESIGN TEAM TLP/LJC

SHEET NUMBER 3

TR-682: Continued

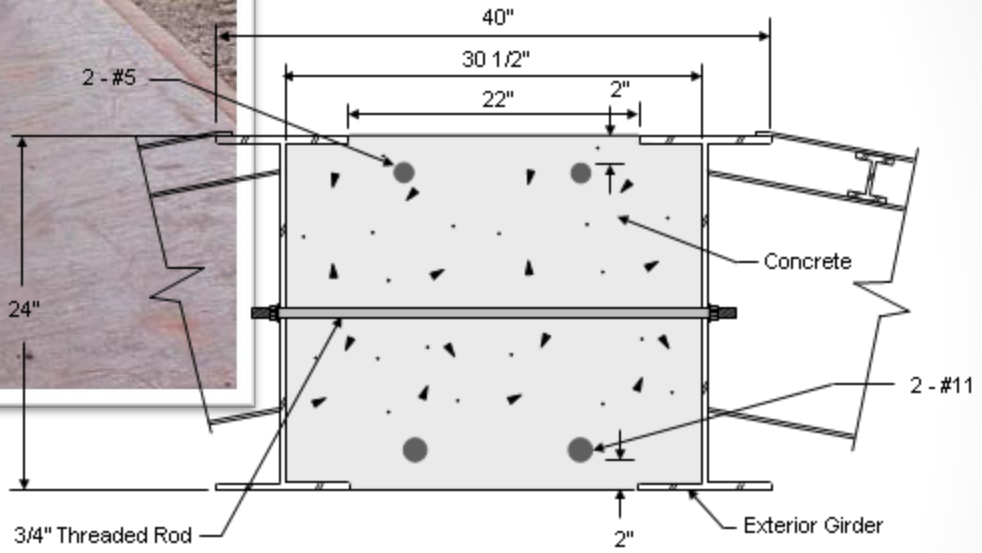
- Comment period on preliminary results and recommendations from the consultant
  - Contractors
  - Precast/Prestress Industry
  - County Engineers

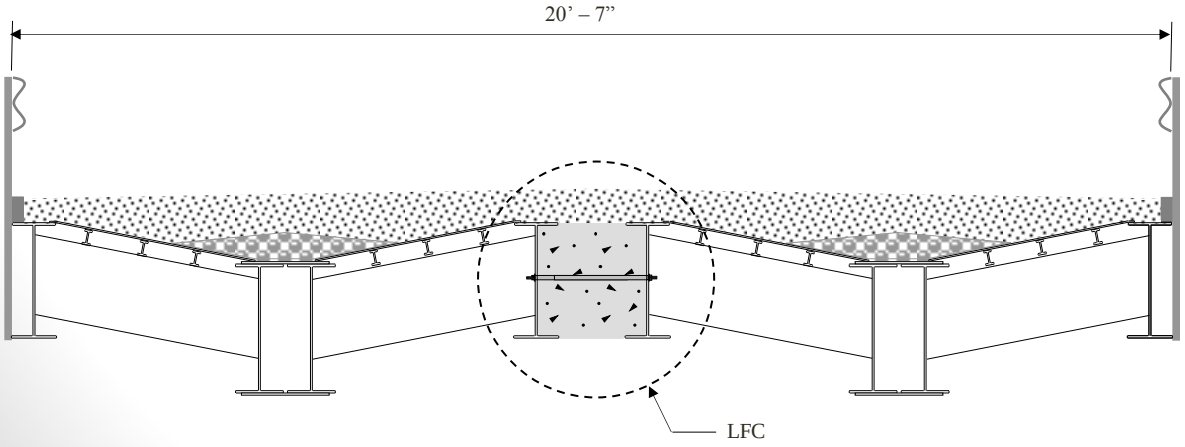
- Final set of standards are due by fall 2015

IOWA'S LOCAL PBES PROJECT HIGHLIGHT

Railroad Flatcar Bridges

WP
60315
WP
WP


40"
30 1/2"
22"
2"
2 - #5
Concrete
24"
2 - #11
3/4" Threaded Rod
2"
Exterior Girder

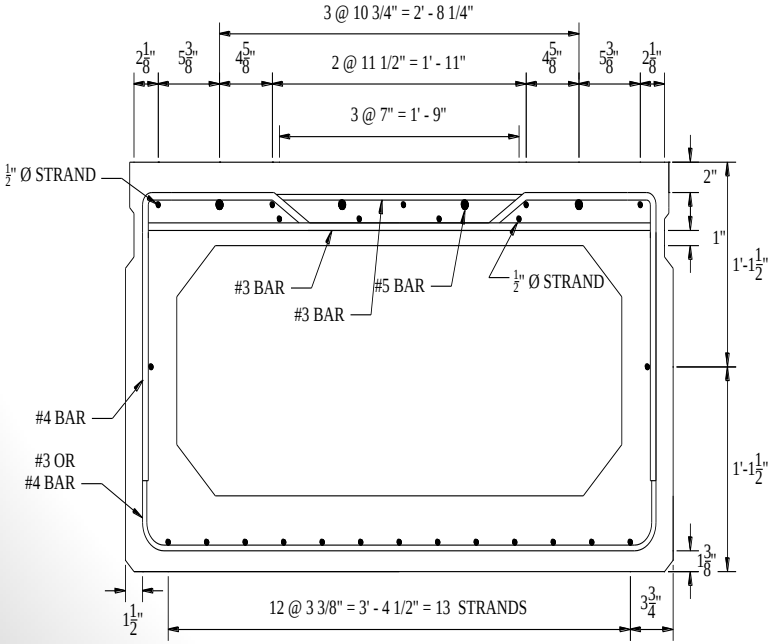

20' – 7"
LFC

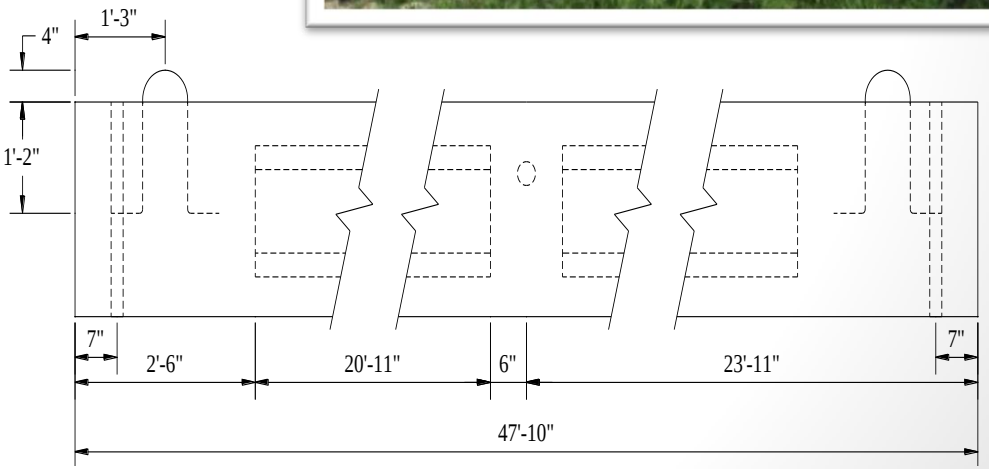
Precast, Adjacent Box Beam Bridges

- Used in several counties with a variety of innovations.
  - Madison County
    - Based upon design concepts used in Illinois
  - Buchanan County
    - Cast on-site using internal curing concrete
  - Buena Vista County
    - Bridge construction completed in less than 6 days

Madison County

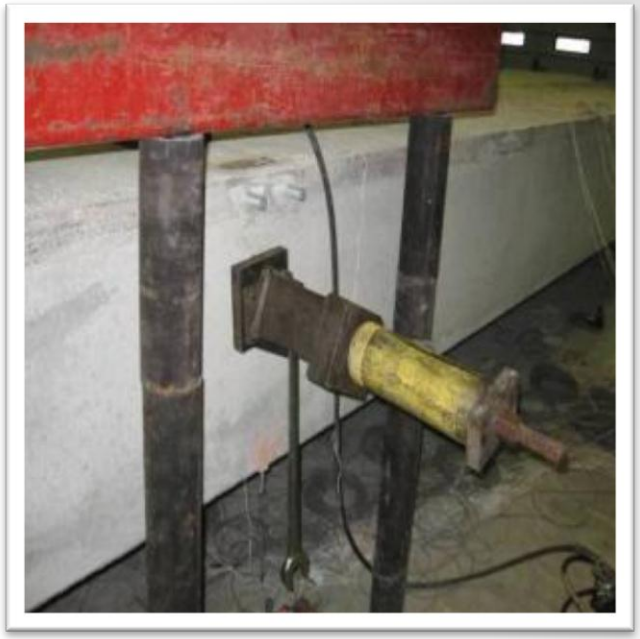
- 48 ft long, 24 ft wide
- Founded on HP 10x42 piles
- Precast cap beam
- Thrie beam guardrail with embedded hardware





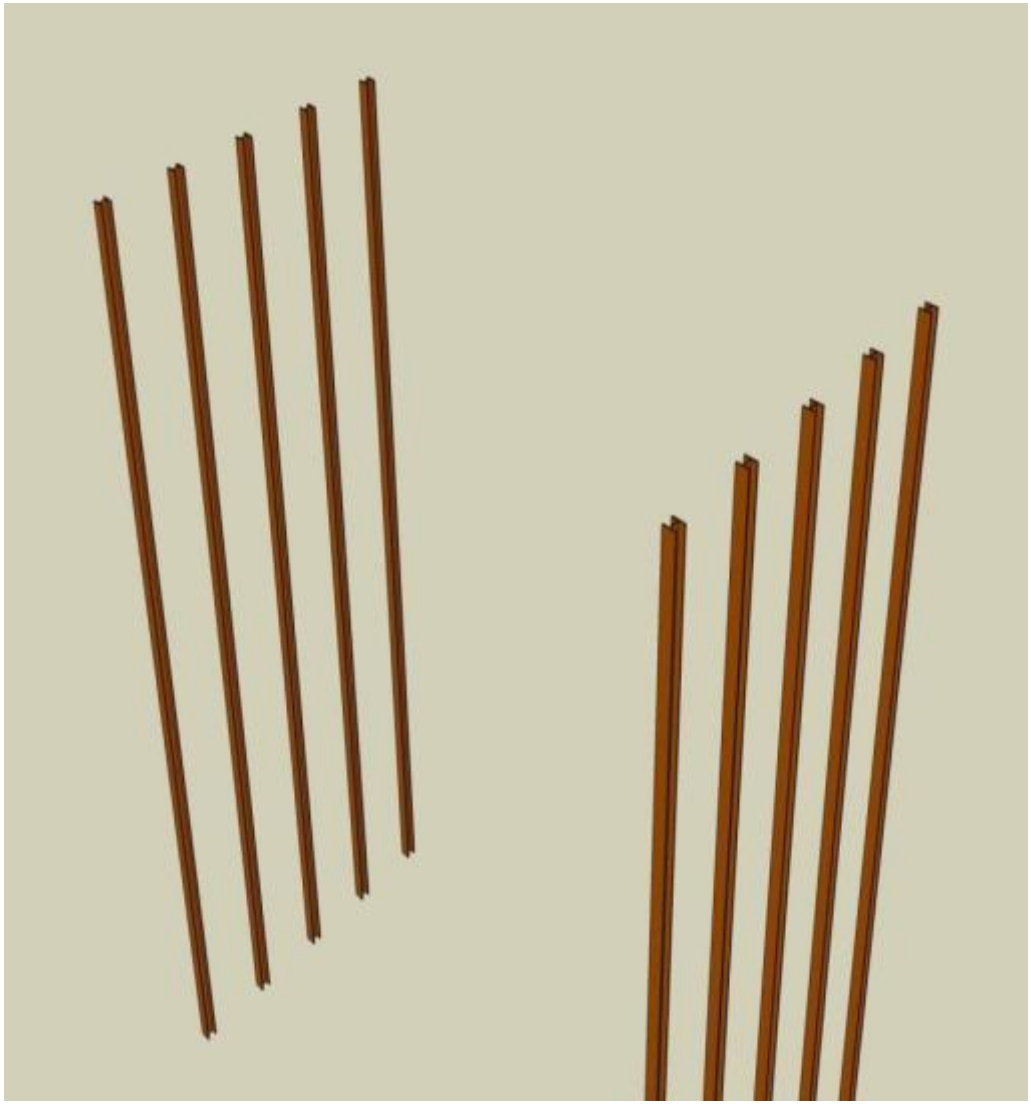
DEC 11 2006

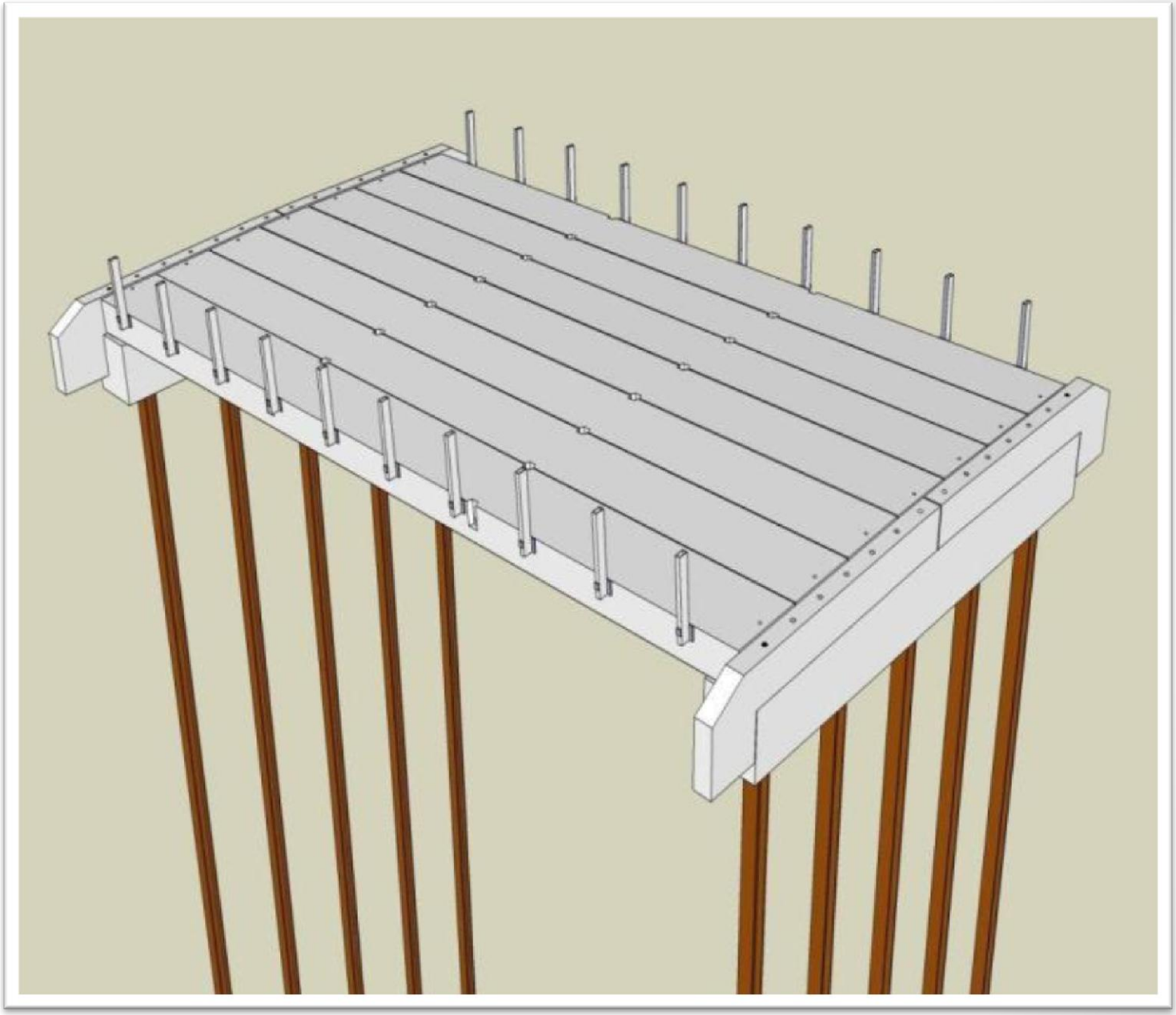
Laboratory Testing



Buena Vista County

- Designed by Iowa DOT Office of Bridges and Structures
- Construction completed in 6 days



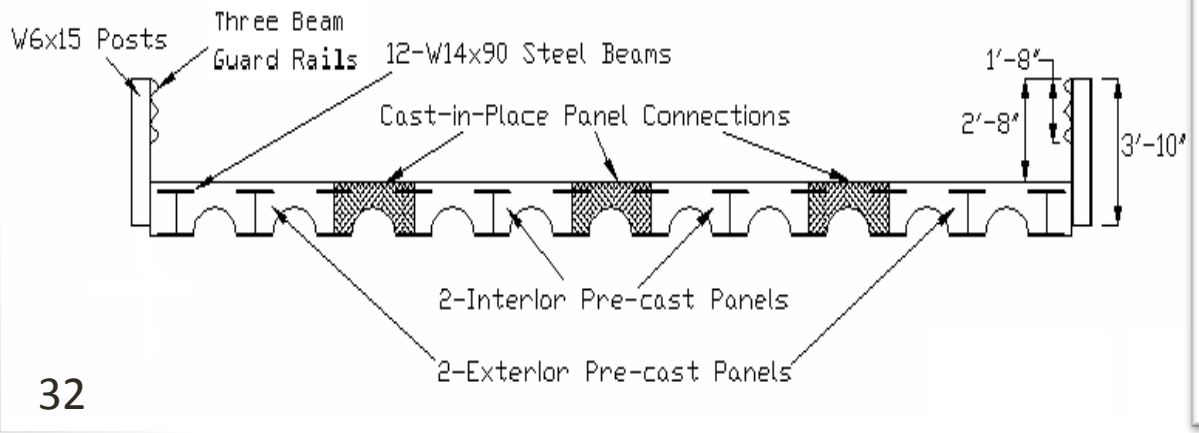


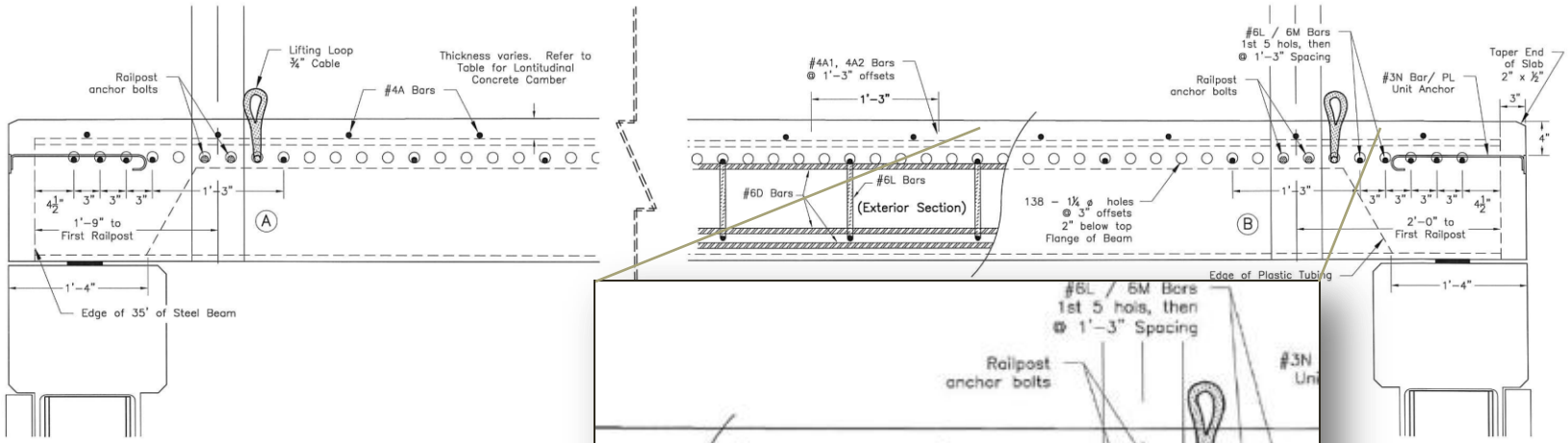
Buchanan County

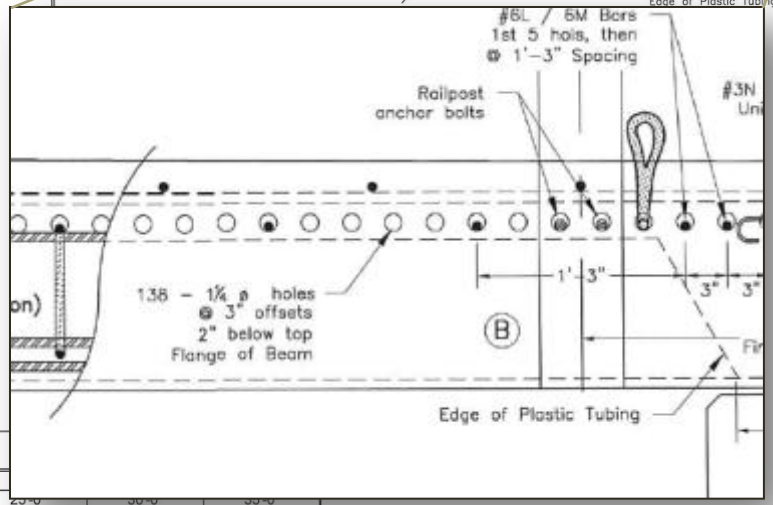
- Only mild reinforcement throughout beams
- Lightweight internal curing aggregate concrete used
- Founded on GRS abutment faced with sheet piling
- Placed without the use of an overhead crane
- Can be used with or without the sonotubes

494-05
LC

Blackhawk County Beam-in-Slab Bridge







Longitudinal Concrete Camber							
Based on a 34' span and a 35' long beam							
0'-0"	5'-0"	10'-0"	15'-0"	20'-0"			
2.125	2.500	2.875	3.125	3.125	2.875	2.500	2.125
2 1/8"	2 1/2"	2 7/8"	3 1/8"	3 1/8"	2 7/8"	2 1/2"	2 1/8"

Design for 0 Skew
34' x 30 CBIS Bridge
Steel Abutment & Wings

Dwg. by: MK
Dwg. date: 12/4/2014

BLACK HAWK COUNTY Foulk Rd. Bridge Replacement PROJECT NUMBER: L-1507 Sheet No. U.03

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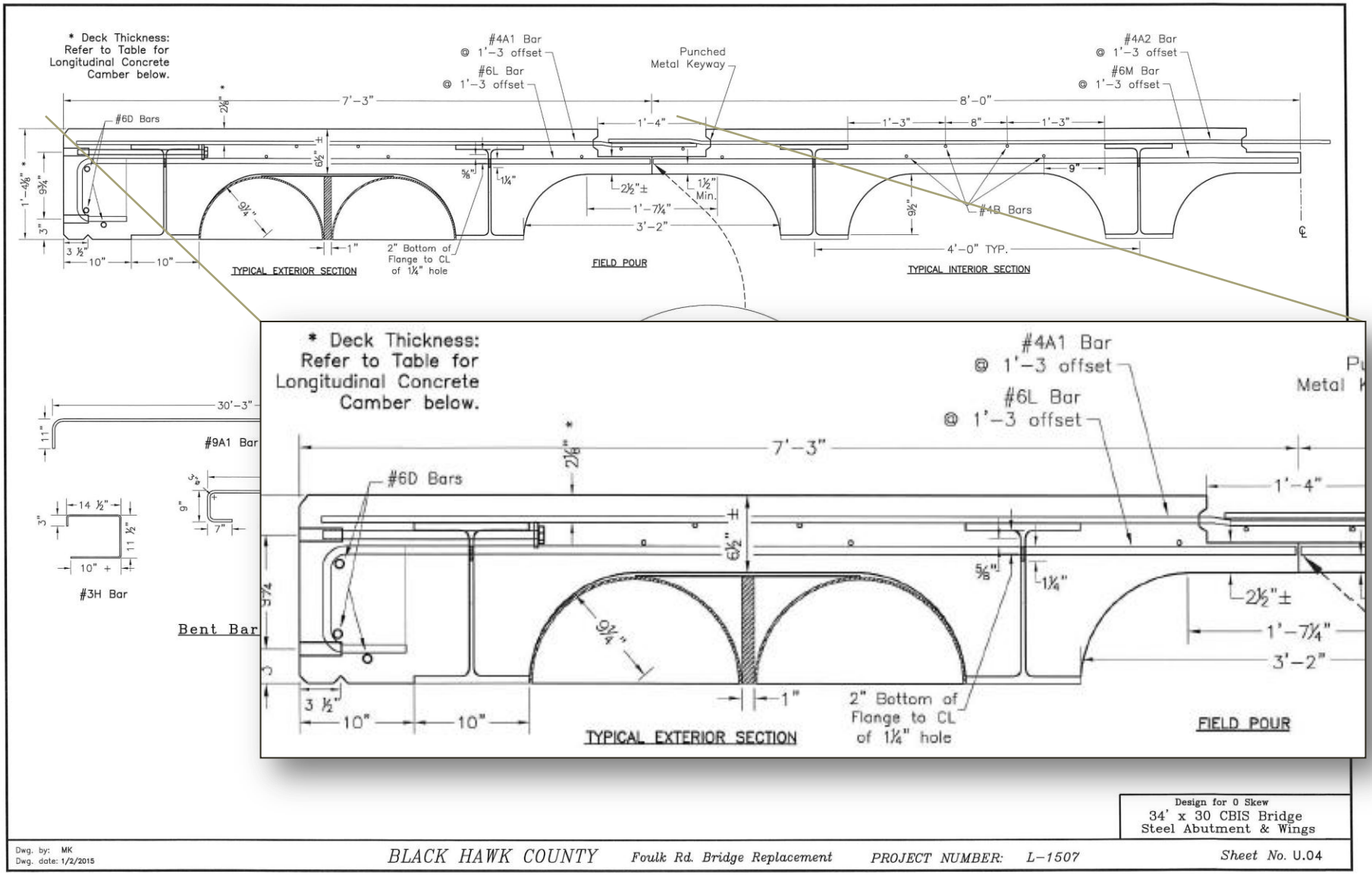

Design for 0 Skew
34' x 30 CBIS Bridge
Steel Abutment & Wings

Dwg. by: MK
Dwg. date: 1/2/2015

BLACK HAWK COUNTY *Foulk Rd. Bridge Replacement* *PROJECT NUMBER: L-1507* *Sheet No.* U.04

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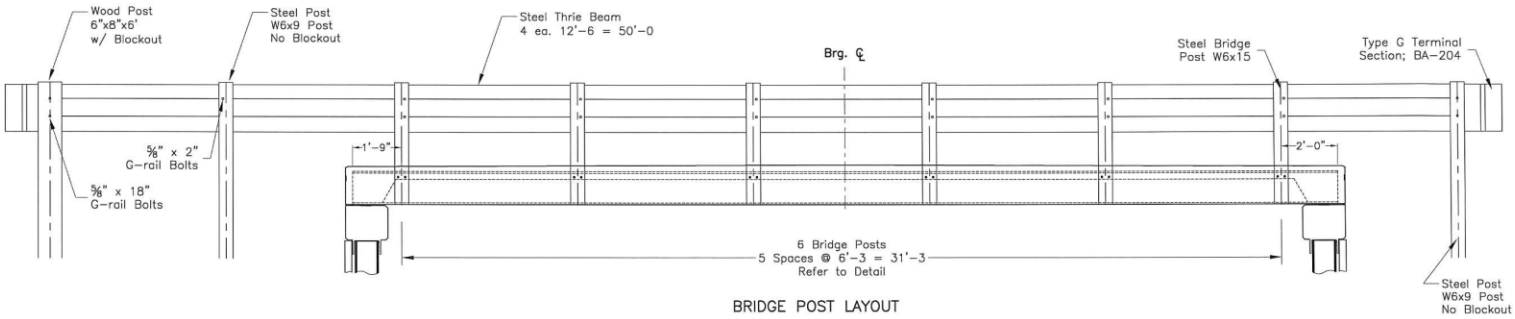
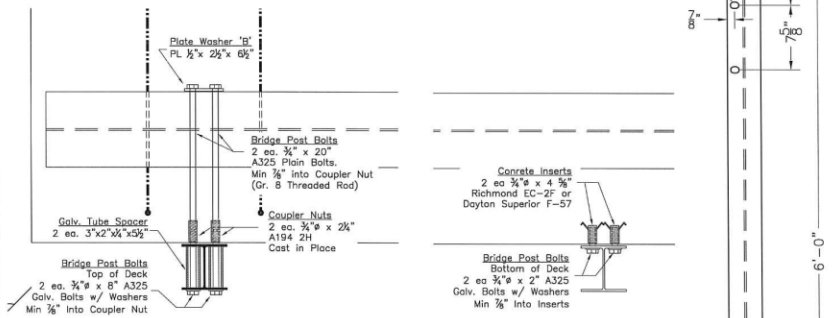
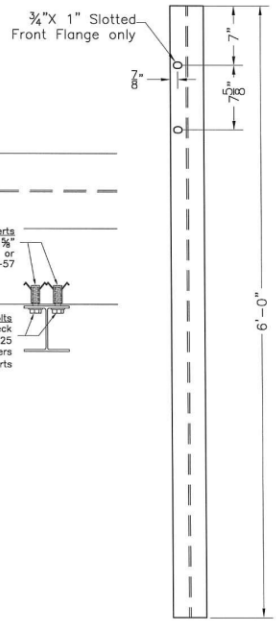
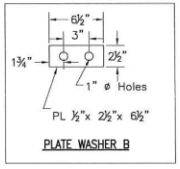


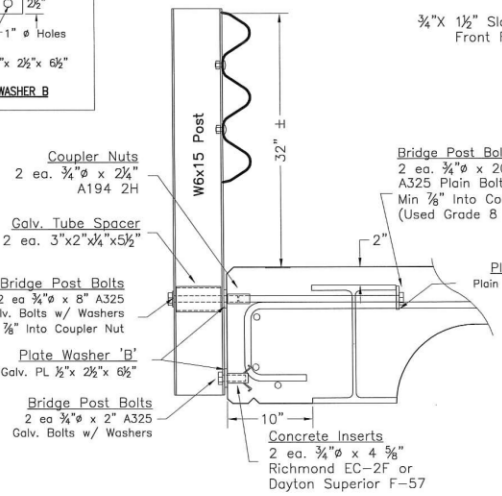
BRIDGE POST LAYOUT

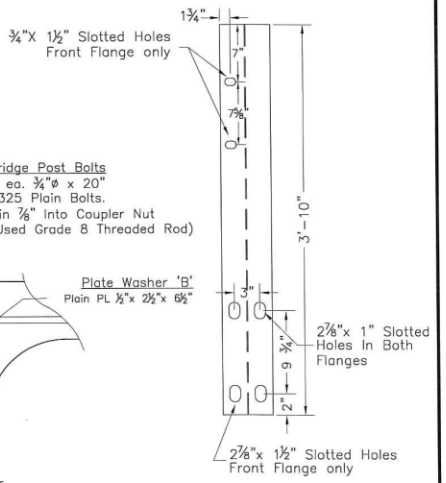


POST / ANCHOR DETAIL









BRIDGE POST DETAIL

Design for 0 Skew
34' x 30 CBIS Bridge
Steel Abutment & Wings

Dwg. by: MK
Dwg. date: 12/4/2014

BLACK HAWK COUNTY *Foulk Rd. Bridge Replacement* *PROJECT NUMBER: L-1507* *Sheet No. U.05*

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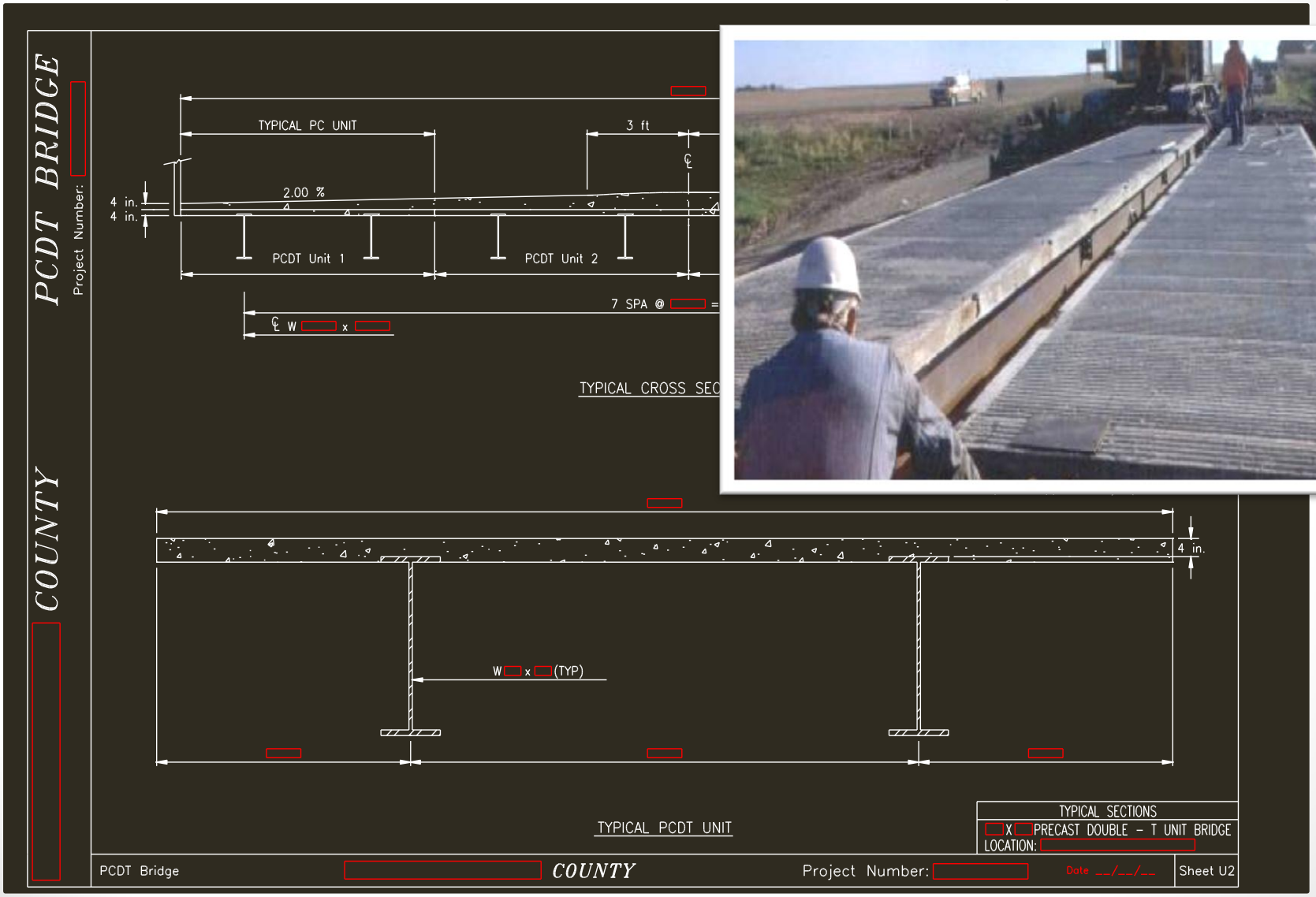
Precast Double-T System



Press-Brake Plate Girder

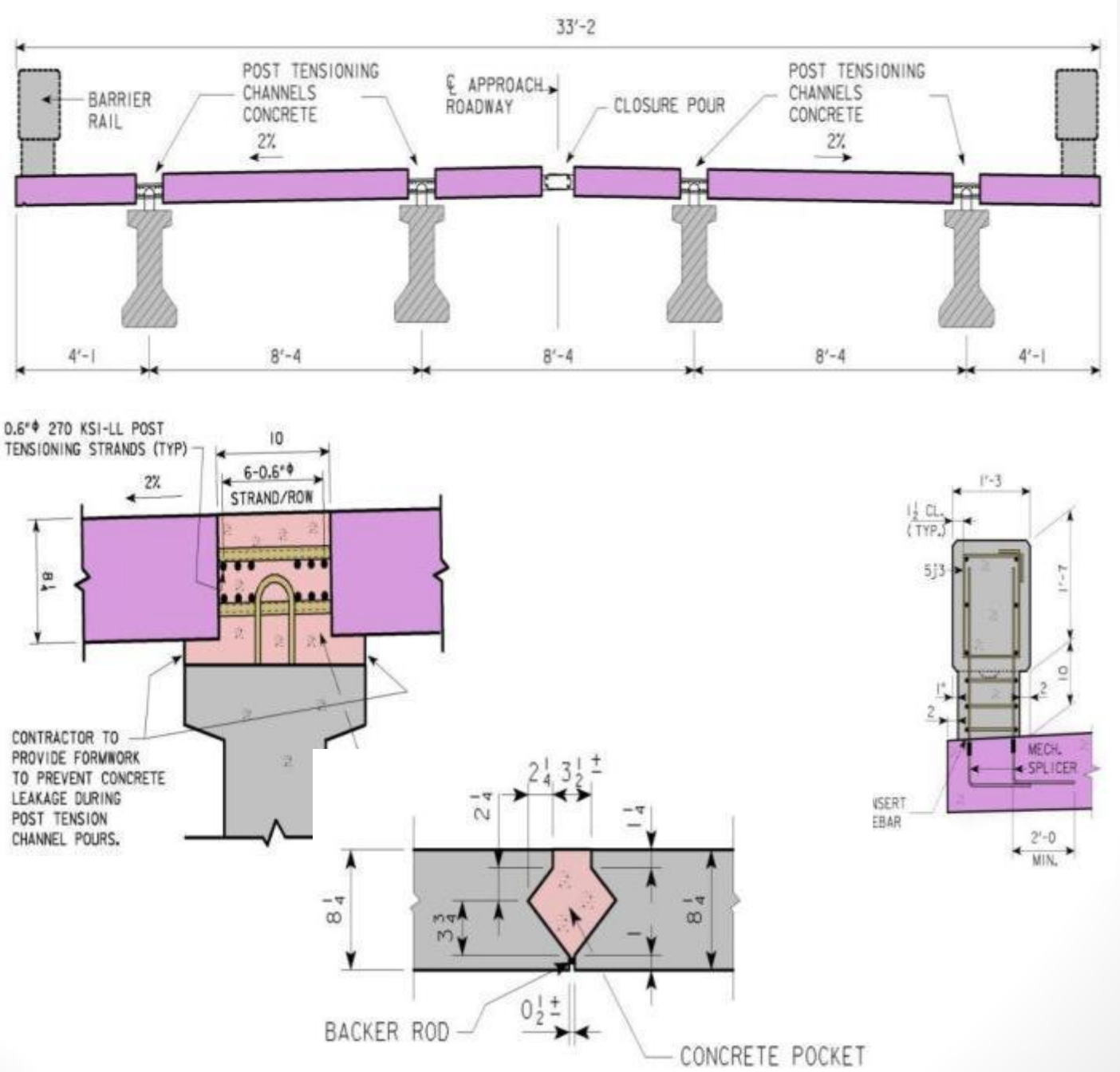
Glued-Laminated Timber

- Iowa State University, Iowa DOT, and the USDA Forest Products Laboratory are currently working on a next generation system that creates composite action between the deck and girders.

4. 2. 2009

Boone County – Precast Deck Panels

- Precast deck panels – 8.25 in. thick
- Precast beams
- Precast pier caps
- Precast abutments seats
- Pipe piles at the piers
- H piles at the abutments

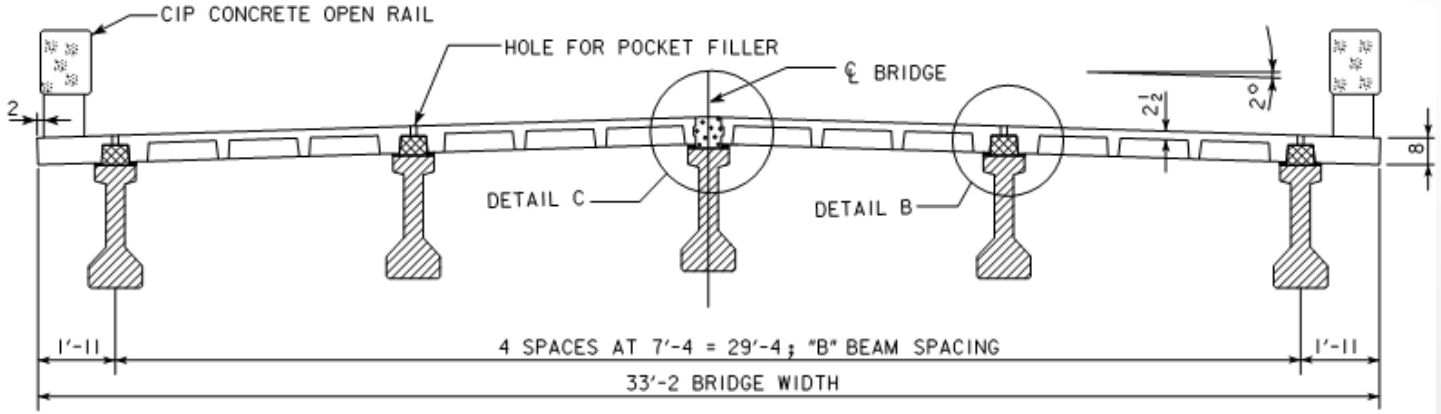

33'-2
BARRIER RAIL
POST TENSIONING CHANNELS CONCRETE
2%
℄ APPROACH ROADWAY
CLOSURE POUR
POST TENSIONING CHANNELS CONCRETE
2%
4'-1
8'-4
8'-4
8'-4
4'-1
0.6"Φ 270 KSI-LL POST TENSIONING STRANDS (TYP)
10
6-0.6"Φ STRAND/ROW
2%
8¼
CONTRACTOR TO PROVIDE FORMWORK TO PREVENT CONCRETE LEAKAGE DURING POST TENSION CHANNEL POURS.
2¼
3½ ±
1¼
8¼
¾
1
8¼
0½ ±
BACKER ROD
CONCRETE POCKET
1'-3
1½ CL. (TYP.)
5@3
1'-7
10
1"
2
2
MECH. SPLICER
NSERT EBAR
2'-0 MIN.

PCI
k-Belt

PCI

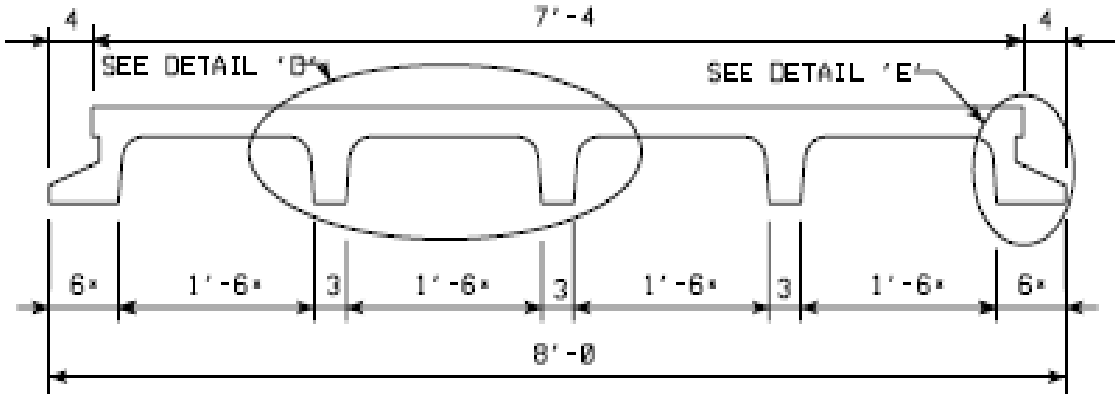
UHPC Waffle Deck Panel Demonstration Bridge

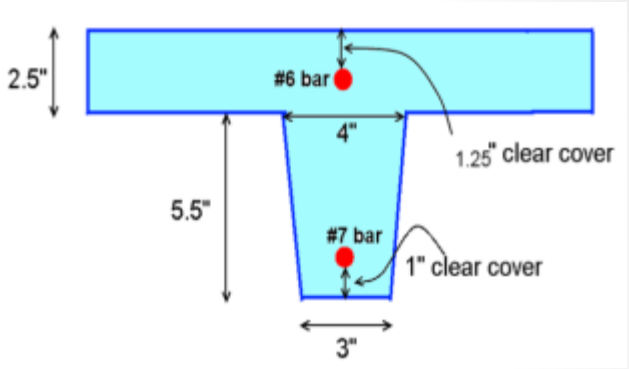
- Bridge in Wapello County, Iowa
- 33’-2 wide deck (30 ft roadway) by 60’-0 single span prestressed concrete beam bridge (30’-0 Roadway)
- 5 beam cross section spaced 7’-4
- Iowa B-beam (39 in. deep 9 in web)
- Integral abutments

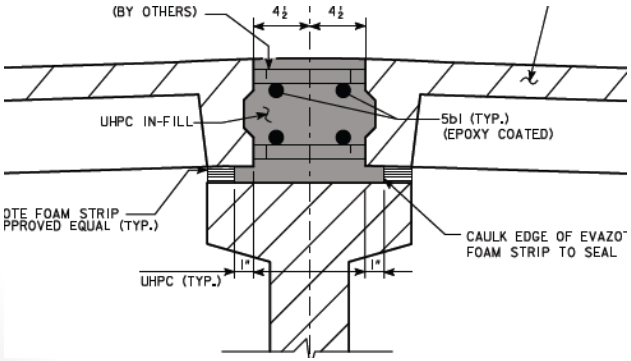


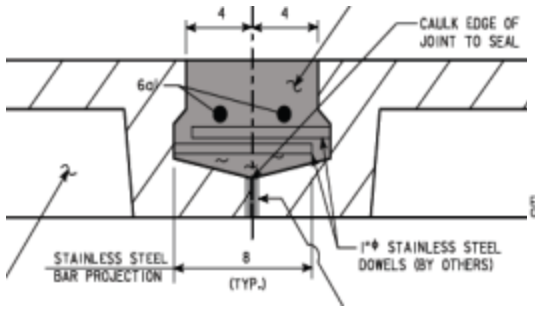
SECTION THRU PANELS

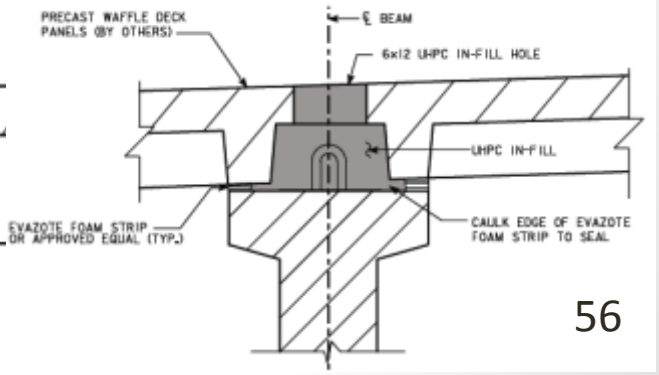
Connection Details

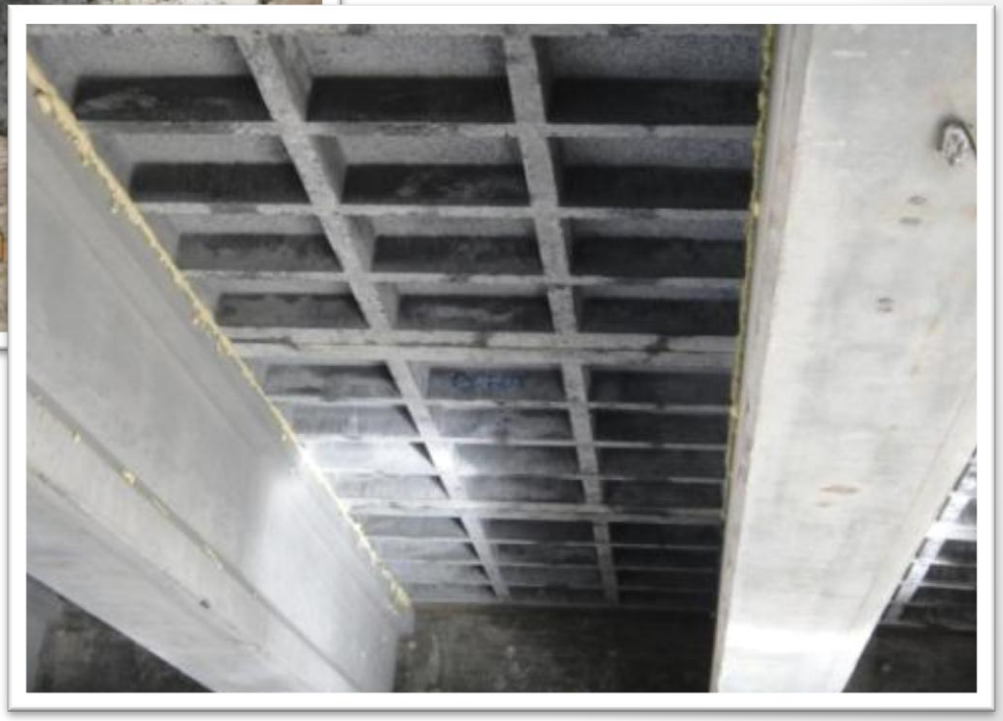












Reports

- Reports for all of these research projects are available at:
  - http://www.iowadot.gov/research/reports.html
- TR-682: Standards for Single Span Prefabricated Bridges for Counties – due fall/winter 2015
- TR-681: Lab and Field Evaluation of a Composite Glue-Laminated Girder to Deck Connection – due in 2017
- TR-648: Evaluation of Light-Weight Fine Aggregate in Concrete Bridge Deck – due in 2016
- TR-614: Structural Characterization of a UHPC Waffle Bridge Deck
- TR-605: Evaluation of Buena Vista IBRD Bridge: A furthering of ABC in Iowa

Project Reports Continued…

- TR-604: Field Testing and Evaluation of a Demonstration Timber Bridge
- TR-568: Modified Sheet Pile Abutments for Low Volume Bridges
- TR-561: Laboratory, Field Testing and Evaluation of Precast Bridge Elements
- TR-529: Construction and Evaluation of a Prestressed Concrete Bridge using UHPC
- TR-498 (Phase III) – Vol I and II, Field Testing of Railroad Flat Car Bridges
- TR-467: Investigation of the Modified Beam-in-Slab Bridge System
- TR-452: Alternative Solutions to Meet the Service Needs of Low Volume Bridges in Iowa

Project Reports Continued…

- TR-444 (Phase II) – Demonstration Project Using Railroad Flatcars for Low Volume Road Bridges
- TR-440: Field and Laboratory Evaluation of Precast Concrete Bridges
- TR-421 (Phase I) – Use of Railroad Flat Cars for Low Volume Road Bridges
- TR-410: Investigation of Two Bridge Alternatives for Low Volume Roads Phase II
- TR-382: Investigation of Two Bridge Alternatives for Low Volume Roads Phase I
- HR-865: Evaluation of Bridge Replacement Alternatives for the County Bridge System
- 8E-10-C010-085: Evaluation of a Folded Plate Girder Bridge (due in 2017)

Thank You!

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