BRIDGE
LATERAL MOVE
TECHNOLOGY

Accelerated Bridge Construction (ABC)

U.S. Department of Transportation
Federal Highway Administration

SLIDE IN BRIDGE CONSTRUCTION (SIBC) FROM THE ENGINEER/DESIGNER PERSPECTIVE

April 3, 2014; 10:00am MST

SIBC Webinars

- Owner/Policy Maker Perspective
  - November 2013 (*complete*)
  - 2nd session scheduled later in year
- Engineer/Design Perspective
  - January 2014 (*complete*)
  - April 2014 (Today: Rocky Ford bridge slides, Colorado)
  - 3rd session scheduled later in year
- Contractor/Construction Perspective
  - March 2014 (*complete*)
  - Next Session: May 2014 (date TBD)
  - 3rd session scheduled later in year

Webinar Agenda

- National Update (~1 min.)
- Featured Presentation: Engineer/Design Perspective (~35 min.)
  - Jeff Dobmeier, PE, SE, Jacobs Engineering
- Questions & Answers (~15-20 min.)
- Next Steps (~3 min.)

National Update

- Interim Every Day Counts (EDC) Representative
  - Mr. Romeo Garcia
    - Minnesota Division Bridge Engineer
    - 651-291-6125
    - romeo.garcia@dot.gov
- FHWA backfilling Tim Cupples' position

STATE HIGHWAY 266 BRIDGE SLIDES ROCKY FORD, COLORADO

Jeff Dobmeier, PE, SE
Jacobs Engineering

Presentation Outline

- Project Overview & Site Orientation
- Selection of Structure Type & Slide-In System
- Design Details
- Specifications
- Lessons Learned

Project Overview

- Replaced three deficient bridges in southeastern Colorado
- Lengthy regional detours and expensive on-site detours major factors supporting slide-in construction
- CDOT project goals
  - Install at least one bridge with lateral move
  - Provide as many innovative features as possible
- Construction Manager / General Contractor (CM/GC)

Site Orientation

Site Orientation

Ft. Lyon Canal Bridge

Holbrook Canal Bridge

Design Development

- Bridge Working Sessions
  - Review concepts from past projects
  - Brainstorm ideas
  - Develop solutions
- Attendees
  - CDOT, Jacobs, & Kiewit
  - Vendors & subs as required

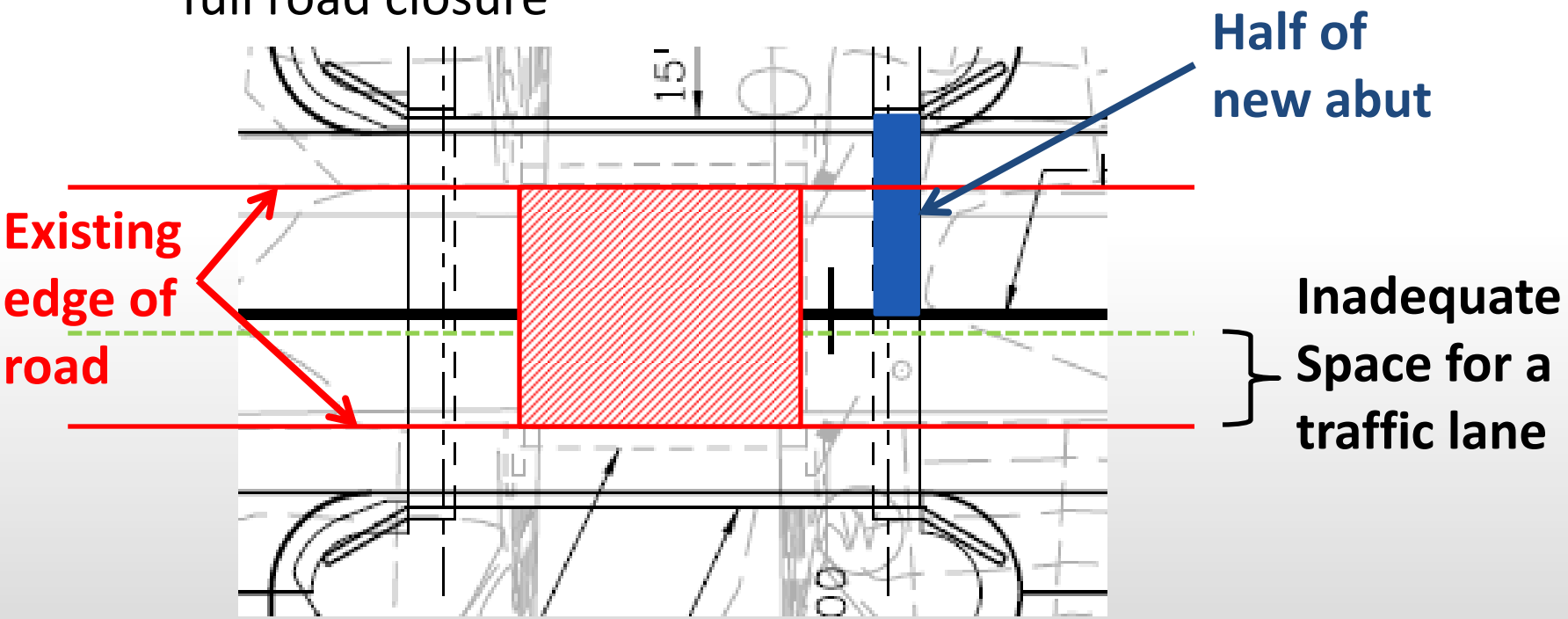
Overall Construction Approach

- Initial Concept
  - Build new superstructure adjacent to final location
  - Build new abutments behind existing abutments
    - Phased construction
    - Trench box with lids
  - Under short duration closure, demo existing bridges and move new superstructures into place

OR213 Project; Photo supplied by J. Kalvelage

Overall Construction Approach

- Problem
  - Inadequate space to phase abutment construction without full road closure



Overall Construction Approach

- Solution
  - While positioned at their temporary locations, use the permanent superstructures to carry traffic
  - Essentially constructing an on-site shoofly detour

Overall Construction Approach

Overall Construction Approach

Benefits

- Easier to construct new abutments at permanent location
- Removes some work items from critical path during short-duration, full closure
- Provides detour with less throw-away work

Drawbacks

- Requires a more substantial abutment design (live load)
- Use of a detour not necessarily aligned with spirit of ABC

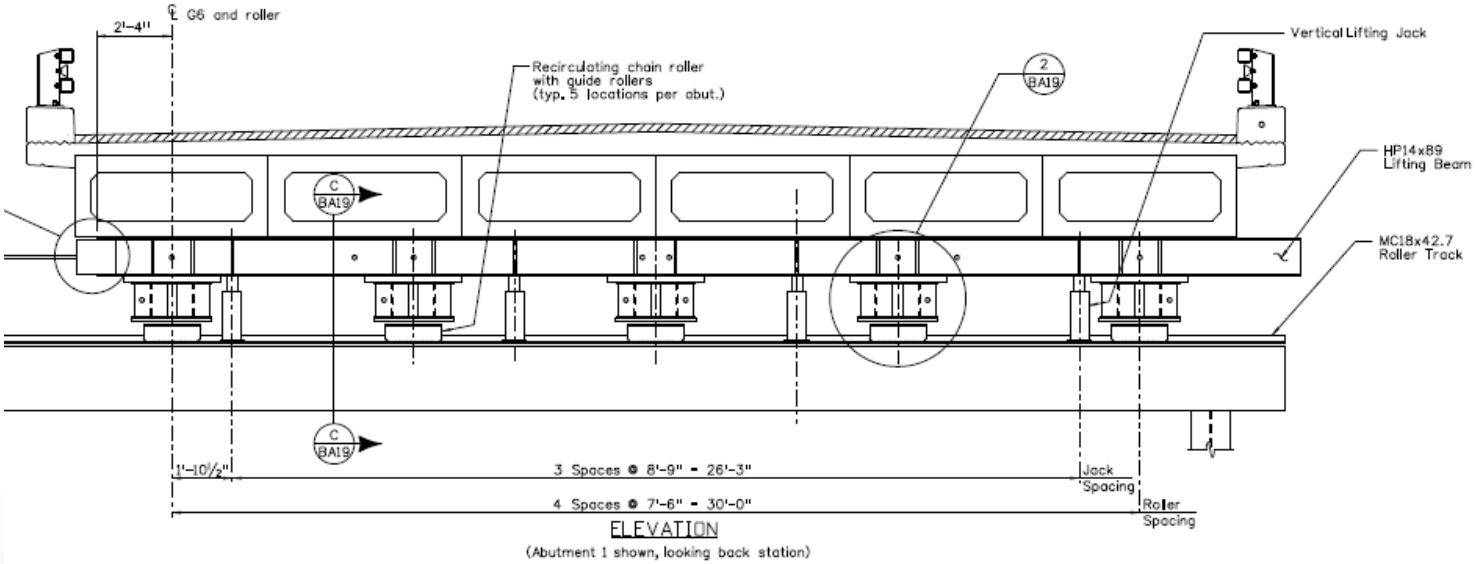
Selection of Structure Type and Slide-In System

- Structure Type Selection Report identified bridge constraints and feasible structure types
- Structure type and slide-in system are interdependent items
- General approach: Can standard details be modified slightly to accommodate slide-in construction?

Selection of Structure Type and Slide-In System: Ft. Lyon Bridge

- Two most viable superstructure alternates
  - Prestressed concrete adjacent box beams
  - Cast-in-place concrete box beams
- Contractor preferred prestressed adjacent box beams
- Traditional system of thin topping and endwall made transverse lifting beams attractive for slide-in system
- Lifting beam works well with heavy-duty rollers

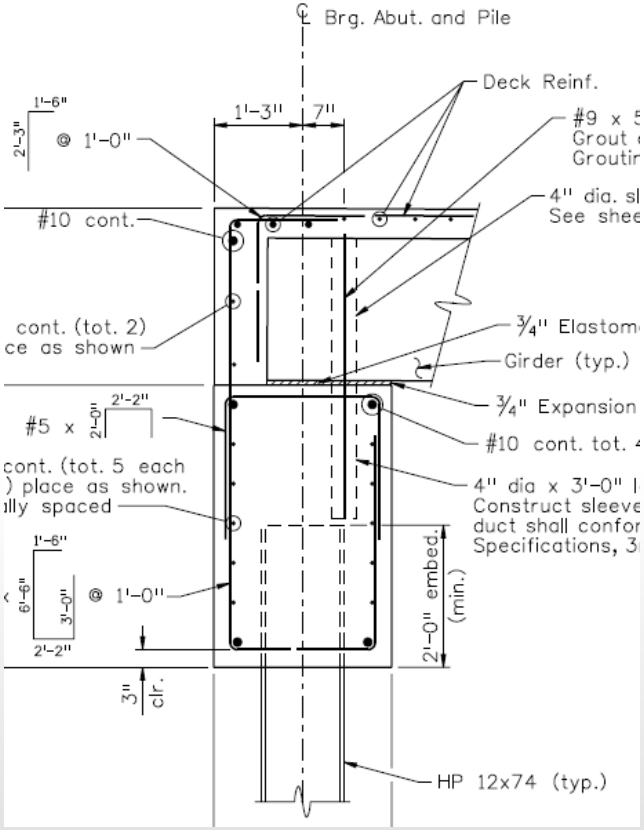
Selection of Structure Type and Slide-In System: Ft. Lyon Bridge



Selection of Structure Type and Slide-In System: Ft. Lyon Bridge

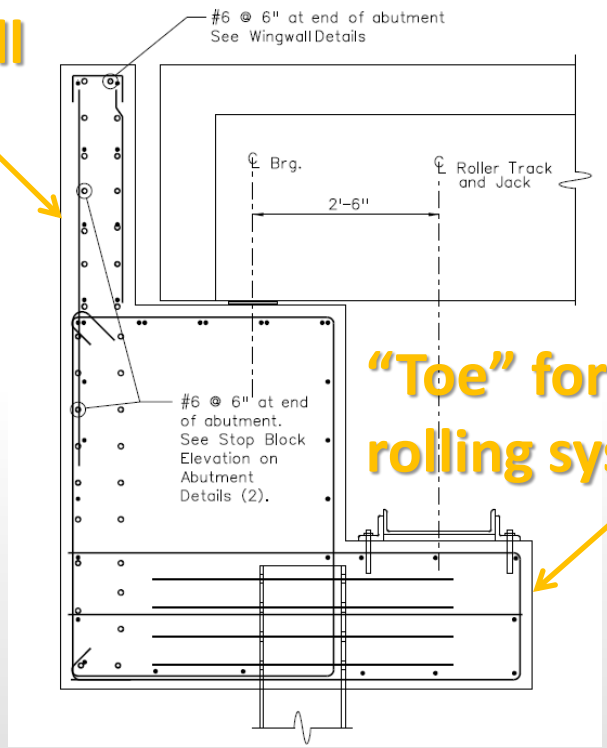
- Configure the abutments to accommodate the superstructure type and slide-in system
- Influencing factors
  - Need to retain roadway fill at bridge staging area
  - Need to support live load at bridge staging area
  - Need to accommodate transverse lifting beam and rollers
  - Contractor preference of a constant abutment configuration per bridge

Selection of Structure Type and Slide-In System: Ft. Lyon Bridge



Typical Abutment

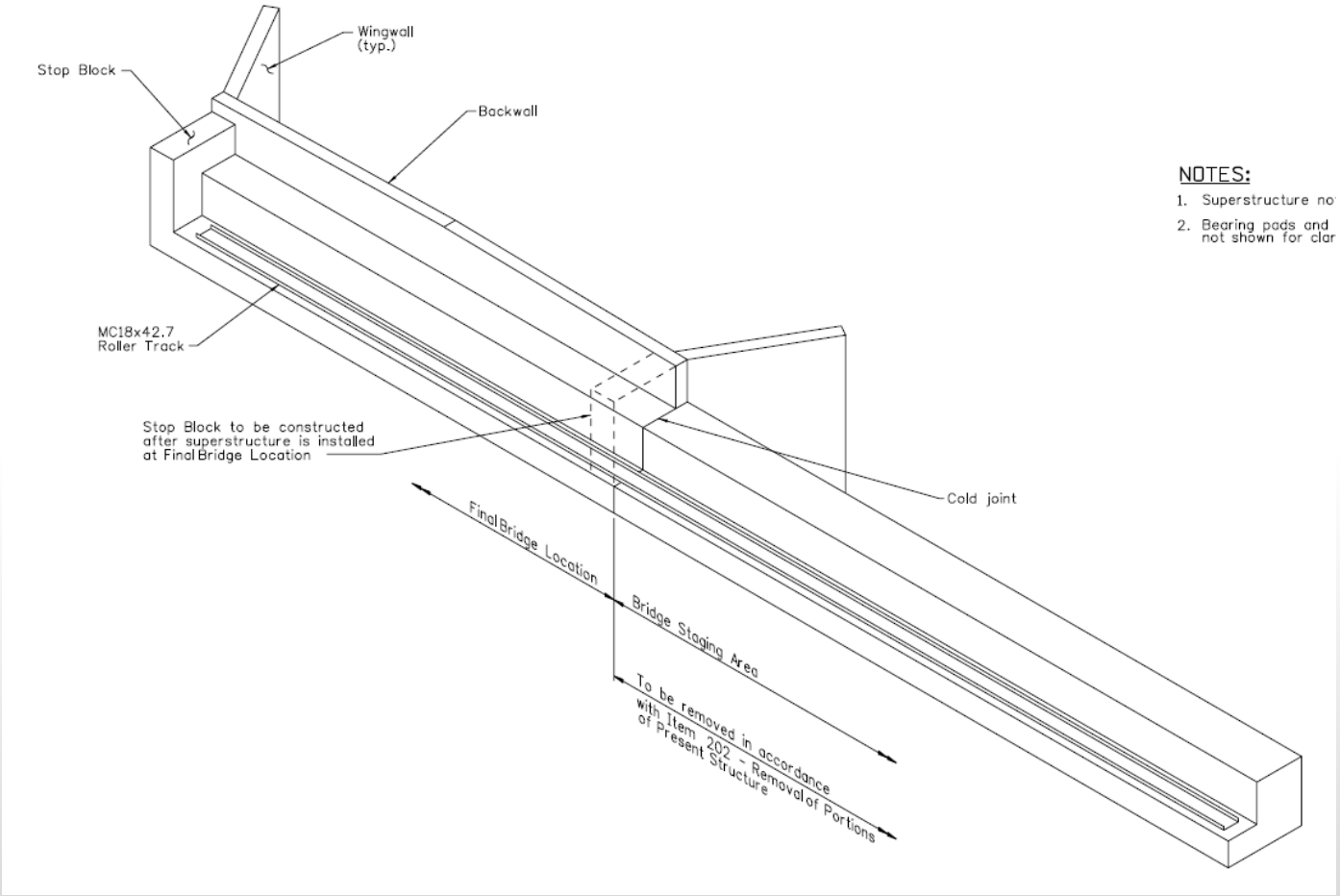
Abutment Backwall



"Toe" for rolling system

Modified Abutment

Selection of Structure Type and Slide-In System: Ft. Lyon Bridge



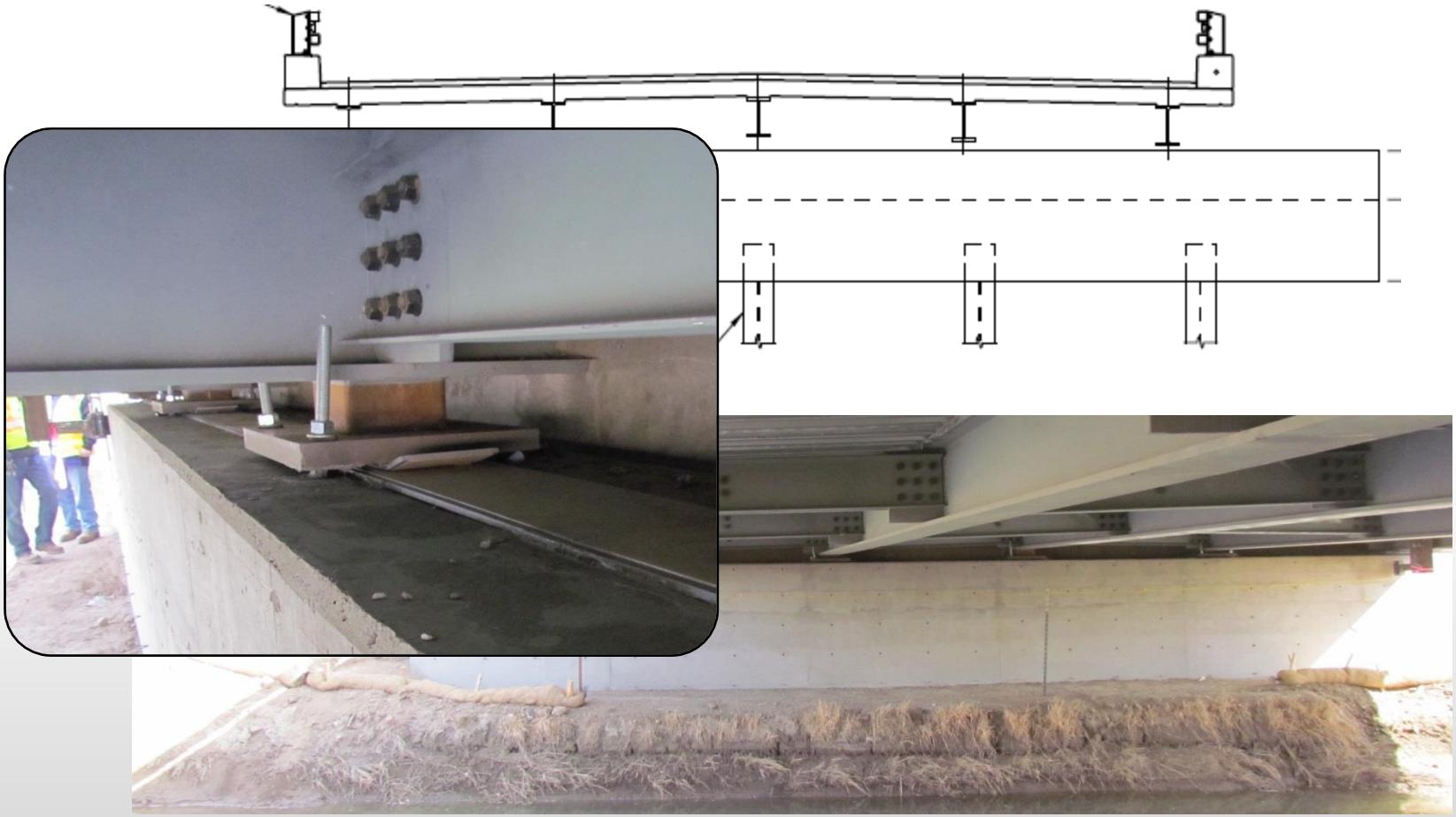
Selection of Structure Type and Slide-In System: Ft. Lyon Bridge

Selection of Structure Type and Slide-In System: Ft. Lyon Bridge

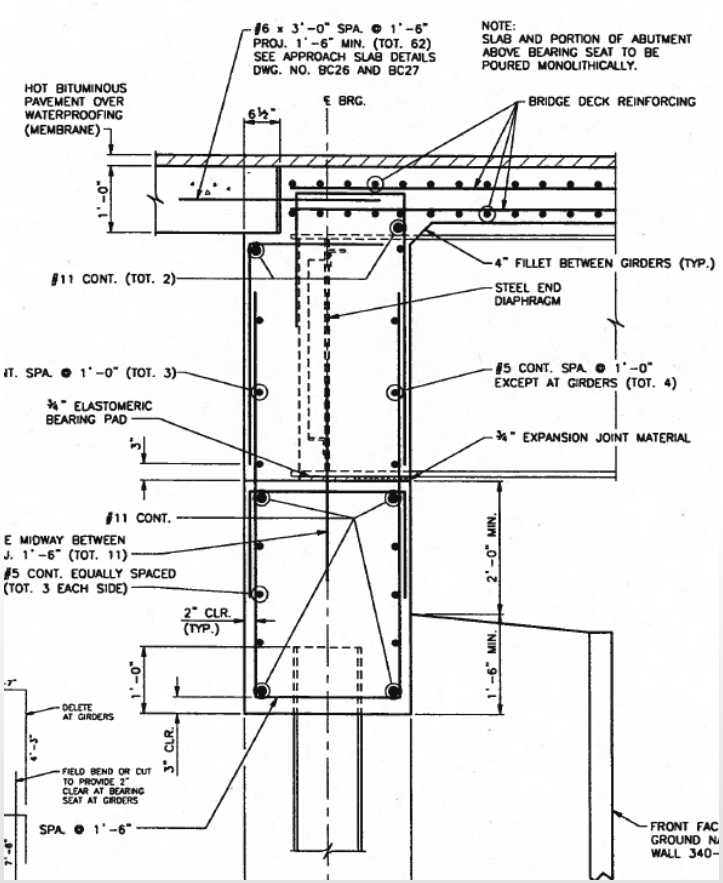
Selection of Structure Type and Slide-In System: Holbrook Bridge

- High flow season for canal
  - Likely during superstructure construction and slide-in
  - Likely abutments could be constructed beforehand
- Needed a configuration that kept the sliding system above high water elevation
  - Sliding system without vertical jacking is compact
  - Rolled steel beams presented a shallow superstructure
  - Discrete beams also work well with individual skid shoes

Selection of Structure Type and Slide-In System: Holbrook Bridge



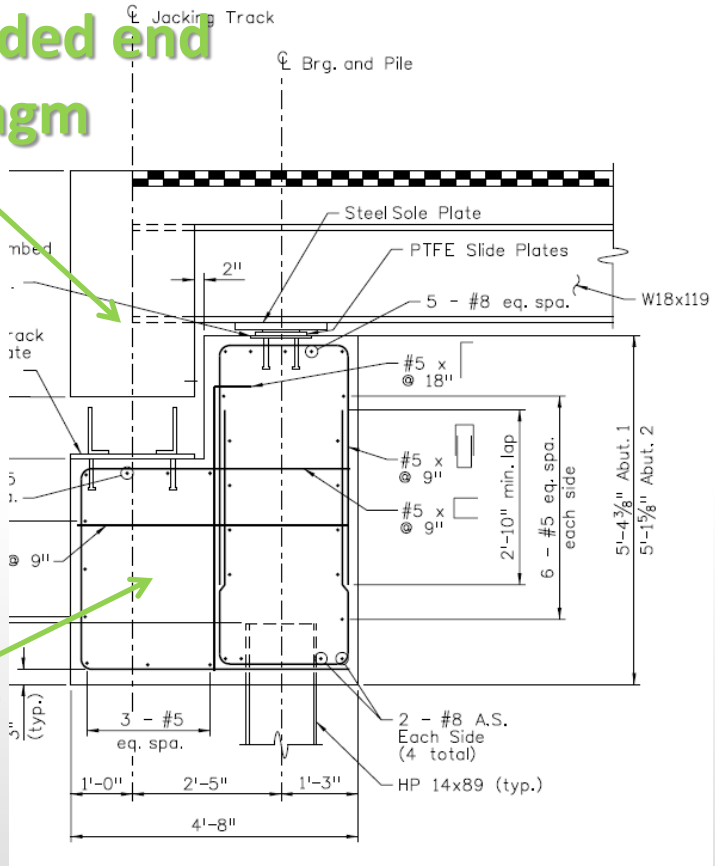
Selection of Structure Type and Slide-In System: Holbrook Bridge



Typical Abutment

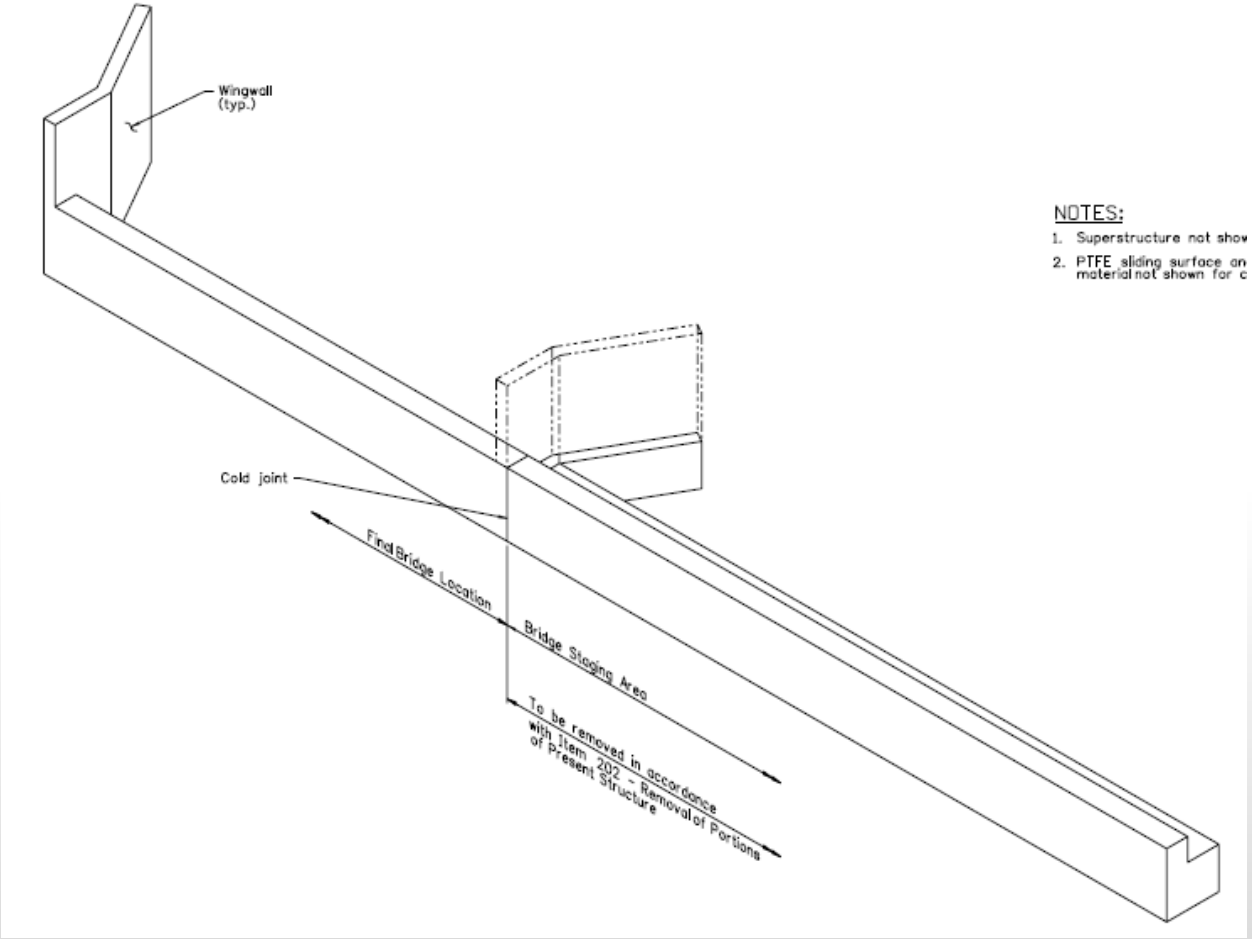
Suspended end diaphragm

"Heel" for jacking system



Modified Abutment

Selection of Structure Type and Slide-In System: Holbrook Bridge



Selection of Structure Type and Slide-In System: Holbrook Bridge

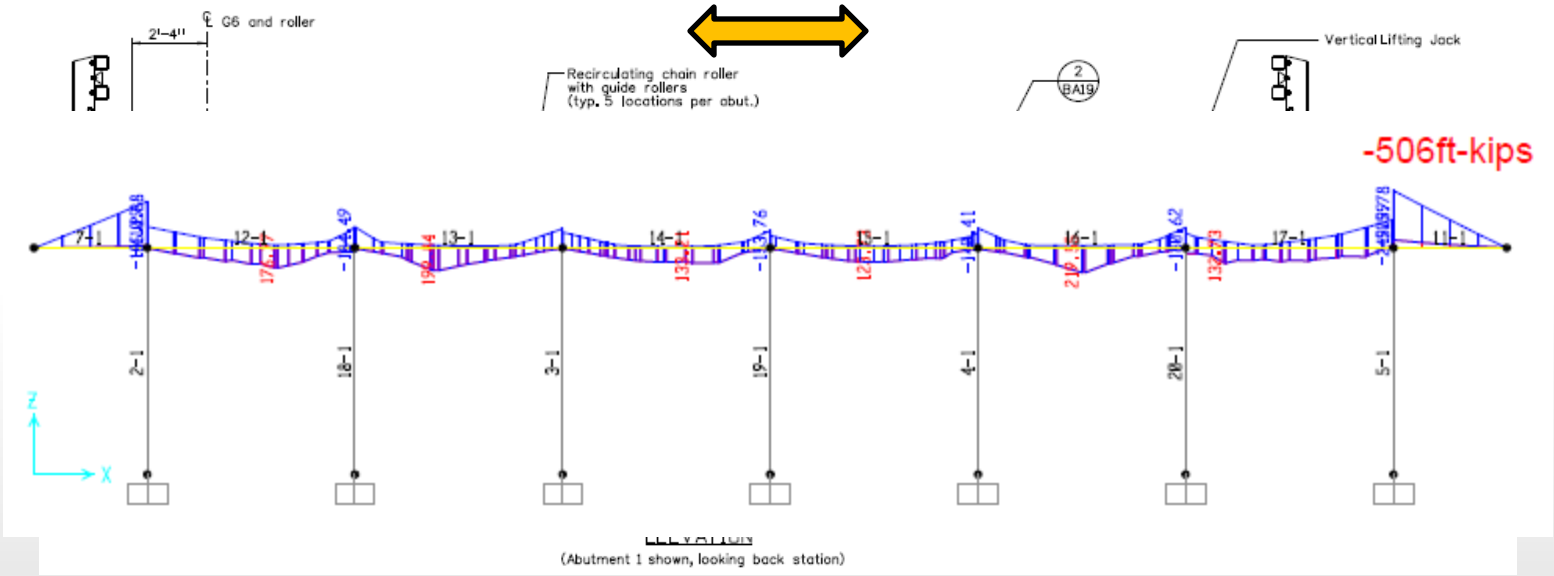
Selection of Structure Type and Slide-In System: Holbrook Bridge

Upper skid shoe

Suspended end diaphragm

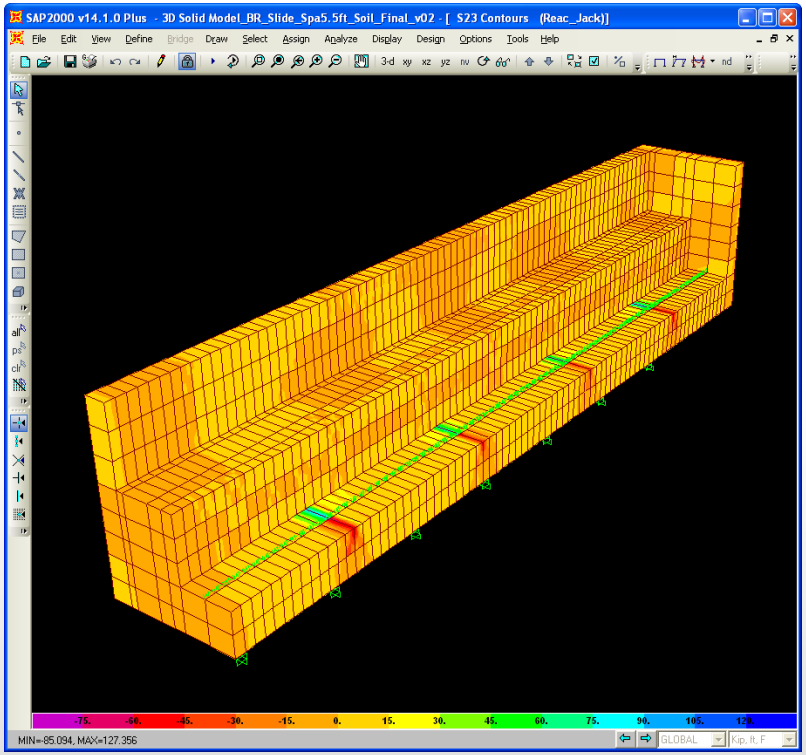
Design Details: Slide Analysis

- Used “moving load analyses” to check abutments under slide-in events

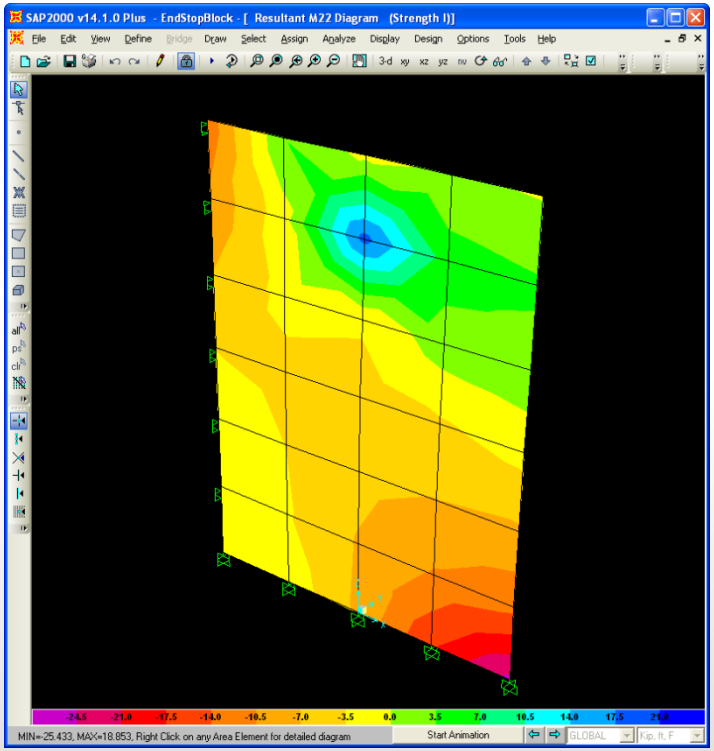


Design Details: Slide Analysis

- Used additional FEM's to evaluate jacking demands



Vertical Jacking



Lateral Jacking

Design Details: Stresses when lifting

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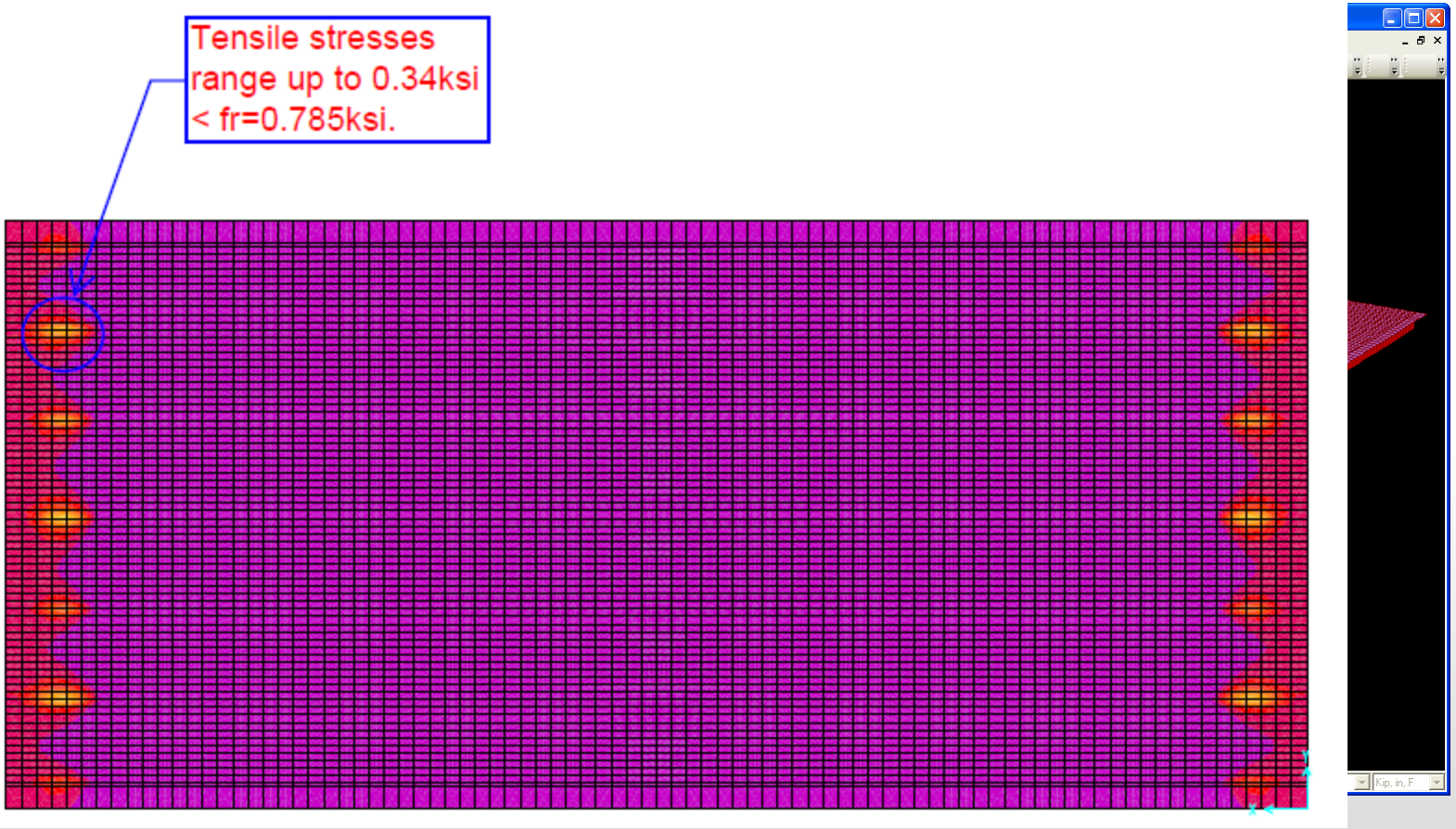


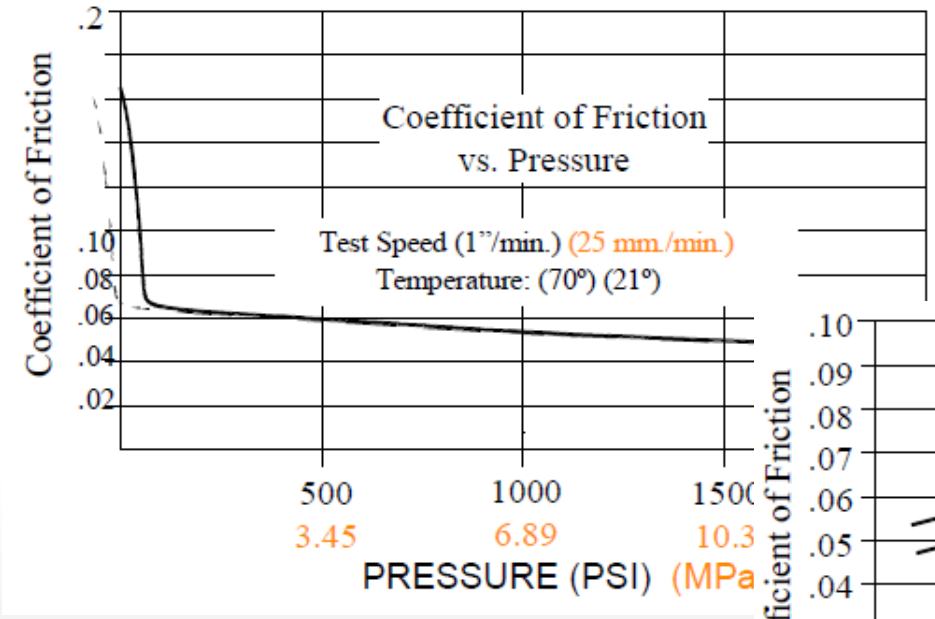
Design Details: Lateral Stability System

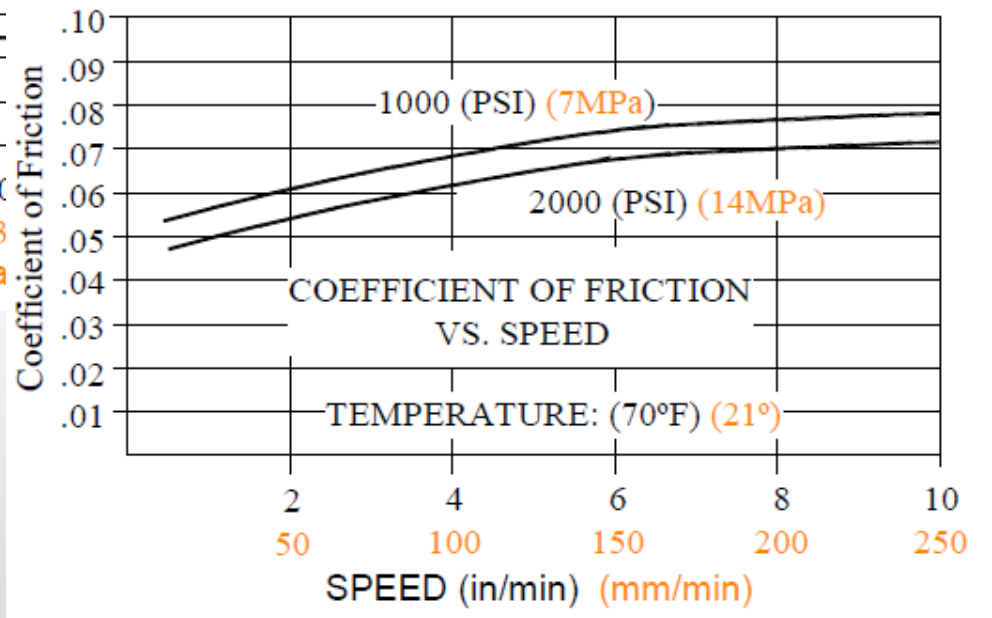
Design Details: Fail Safes

Design Details: Fail Safes

- Capacity-controlled guidance roller

Design Details: PTFE Variables





Specifications

- Created two project special provisions
- Mix of prescriptive and performance based
  - Example of prescription: Minimum jacking capacity
  - Example of performance: Motion monitoring system
- Consulted other project specs

Specifications

- Required Bridge Move Plan and Pre-Move Conference

631.02 Section 631.02 shall include the following:

Schedule of Bridge Slide Events
The contractor shall submit a preliminary Bridge Slide Plan, host a Pre-Slide Conference, and submit a final Bridge Slide Plan in accordance with the following schedule:

MILESTONE	MINIMUM SUBMITTAL TIMELINE
Submit preliminary Bridge Slide Plan	Two weeks prior to Pre-slide conference
Host Pre-slide Conference	One week prior to the start of bridge sliding operations
Submit final Bridge Slide Plan	Prior to the start of bridge sliding operations

631.03 Section 631.03 shall include the following:

Preliminary Bridge Slide Plan
The Bridge Slide plan submitted prior to the pre-slide conference is referred to as the Preliminary Bridge Slide Plan (PBSP). The PBSP shall be stamped "Approved for Construction" and signed by the Contractor. The PBSP will not be approved by the Engineer. If falsework drawings are required, they shall conform to and be submitted in accordance with subsection 601.11.

The PBSP shall provide complete details of the sliding process and address the following:

1. A schedule addressing the timing and sequence of the sliding operation. The following activities shall be shown on the schedule:
    a. When full closure of SH266 starts

Specifications

- Written to allow alternate jacking systems and configurations

5. Configuration of the vertical jacking equipment, that indicates one of the following:
   a. Certification that the vertical jacking equipment is located at the positions shown in the contract drawings
   b. If alternate vertical jacking locations are used, calculations showing that the stresses and deformations developed in the bridge during the vertical lifting or lowering operations are acceptable. The calculations shall be signed and sealed by a professional engineer registered in the state of Colorado.
6. Configuration of the lateral jacking equipment, that indicates one of the following:
   a. Certification that the lateral jacking equipment is both
      i. Located at the positions shown in the contract drawings
      ii. Attached to the lifting beam as shown in the contract drawings
   b. If alternate lateral jacking locations or attachment points are used, calculations showing that the stresses and deformations developed in the bridge during the lateral rolling operation are acceptable. The calculations shall be signed and sealed by a professional engineer registered in the state of Colorado.
7. Configuration of the rollers, that indicates one of the following:
   a. Certification that the rollers are located at the positions shown in the contractor drawings.
   b. If alternate roller locations are used, calculations showing that the stresses and deformations

Specifications

- Specified tolerances
  - Unsym…on)
  - Final i…

The contractor sha… the rolling operation and take… more than 2 inches.

The contractor sha… erances:

1. Maximun…
2. Maximun…
3. Maximun…

Successful Vertical Placement at Ft. Lyon

Lessons Learned

- Abutment configuration at Ft Lyon
  - Big time saver on overall work activities
  - Consider a wider gap to minimize fit-interference
- Contractor input
  - Extremely valuable and helpful
  - If not DB or CM/GC, consider discussions with industry
- Movement mechanisms
  - Both systems performed well

Lessons Learned

- Attachment of lower slide plate and roller track
  - Desirable to have more construction friendly details
- My preference:
  - Slide system – eliminates vertical jacking
  - Pushing jacks – smaller footprint, more stable
  - Abutment backwall – allows roadway installation in advance of move

QUESTION & ANSWER PERIOD

Kevin Thompson, URS Moderator (~15 minutes)

Q&A Panel

- Kevin Thompson, P.E., URS Corporation
  916.993.7638, kevin.thompson@urs.com
- Jeffrey Dobmeier, P.E., S.E., Jacobs Engineering
  303.820.4892, jeffrey.dobmeier@jacobs.com
- Don Garcia, Project Manager, CDOT Region 2
  719.659.8220, donf.garcia@state.co.us
- Mike Monroe, Kiewit Infrastructure Co.
  303.797.9330, mike.monroe@kiewit.com
- Michael Arens, P.E., S.E., Michael Baker Jr., Inc.
  801.352.5981, marens@mbakercorp.com
- Travis Boone, P.E., URS Corporation
  303.740.2671, travis.boone@urs.com

NEXT STEPS

Kevin Thompson, URS (~3 minutes)

Websites/Resources

- SIBC Webinar Training Project Website
  - www.slideinbridgeconstruction.com
  - Webinar registration, a recording of today's webinar, presentation slides, video, and Q&A results will be posted within 10 business days
- FHWA SIBC Website
  - http://www.fhwa.dot.gov/construction/sibc/
  - Many resources, case studies, SIBC Implementation Guide, etc. available

FHWA SIBC Technical Services Support Center (TSSC)

- Request personal, professional answers to questions via TSSC
- Download topical resources
- Learn about instructor-based training courses (available beginning May 2014)

www.fhwa.dot.gov/construction/sibc/

or

search "**FHWA slide**"

Future SIBC Training

- Contractor/Construction Perspective
  - **Next Session:** Tentatively set for May 2014
- Owner/Policy Maker Perspective
  - Tentatively set for June 2014
- Engineer/Design Perspective
  - Tentatively set for July 2014
- Web-based training modules

SPECIAL NOTICE: Next FIU ABC Center Webinar *"Crane Sizing for ABC Bridges"*
Thursday, April 17, 2014 (1:00 – 2:00 p.m. Eastern)

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THANK YOU FOR YOUR PARTICIPATION!

For issues or questions regarding this training or the www.slideinbridgeconstruction.com website, please e-mail sibc@urs.com