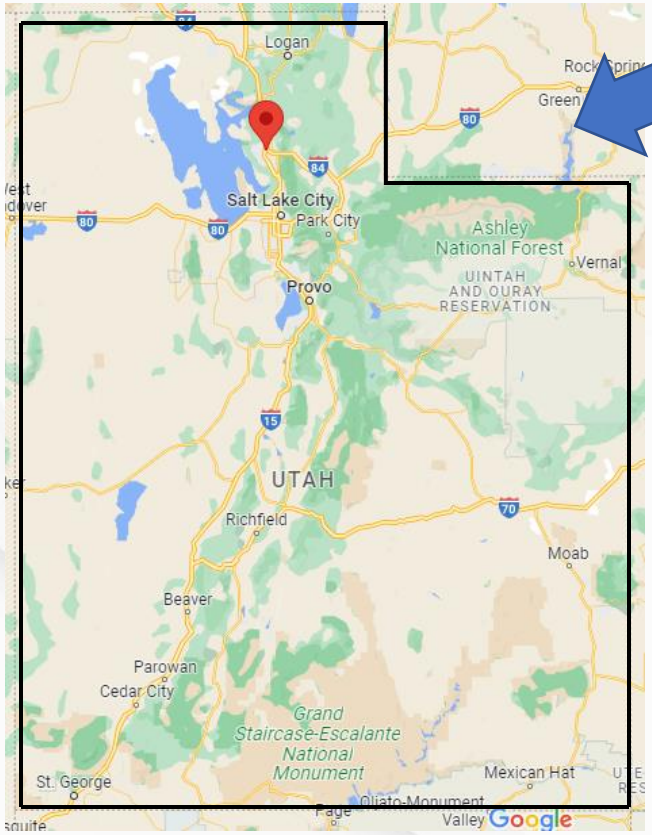
Utah's Riverdale Road over I-84 Precast Substructure & Performance

ABC-UTC 2023 In-Depth Web Training Module 5 **9-12-2023**

Owner: UDOT
Designer: Michael Baker International
Contractor: Granite Construction – CM/GC

Presenters:
Michael S. Arens, P.E.
Michael P. Culmo, P.E.

Project Location



Riverdale SPUI Bridge

Project Goals

- Increase Interchange Capacity using a Single Point Urban Interchange (SPUI)
- Replace Deteriorating Bridge
- Accelerate Construction to Finish in One Construction Season
- Implement ABC To Minimize Traffic Impacts and Construction Time

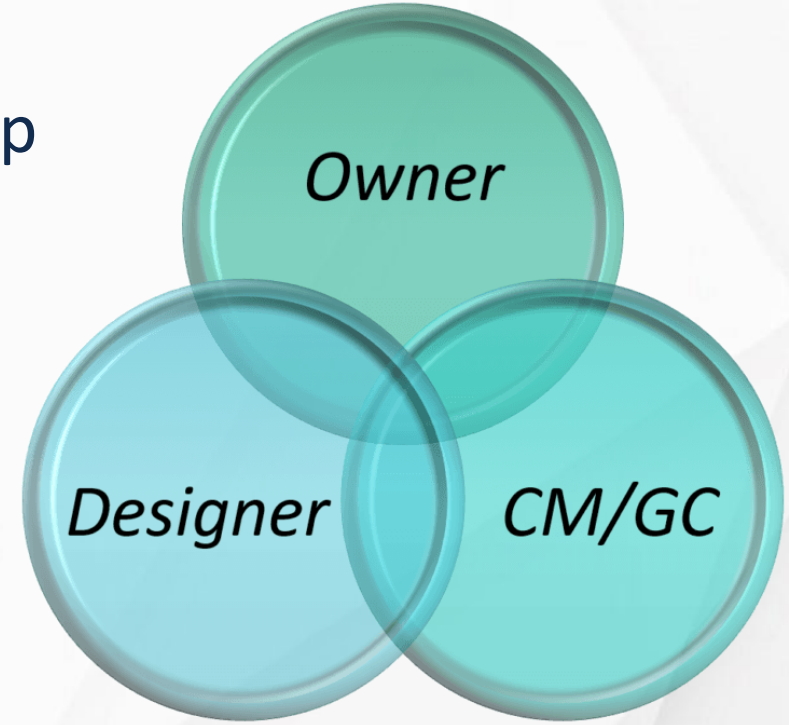
Existing Conditions

- Cast-in-Place Deck & Girder Bridge
- Some Deck Spalling and Cracking
- Limited Ability to Widen
- New SPUI Structure Doubling Deck Area

CMGC Procurement

ABC Benefits

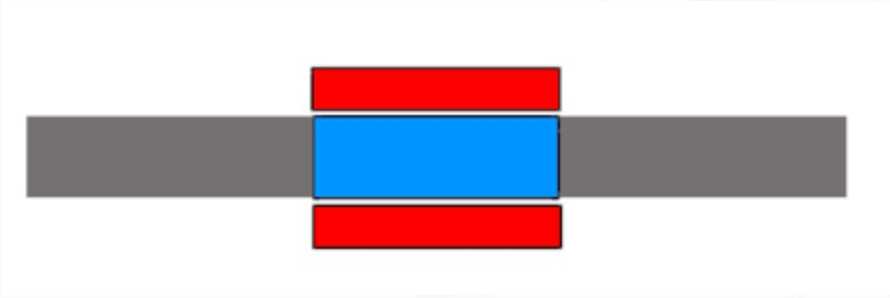
- Allowed Contractor to Develop Concept with Designer
- Designer can Tailor Details to Contractor
- Allowed for Accelerated Project Schedule with Early Material Order



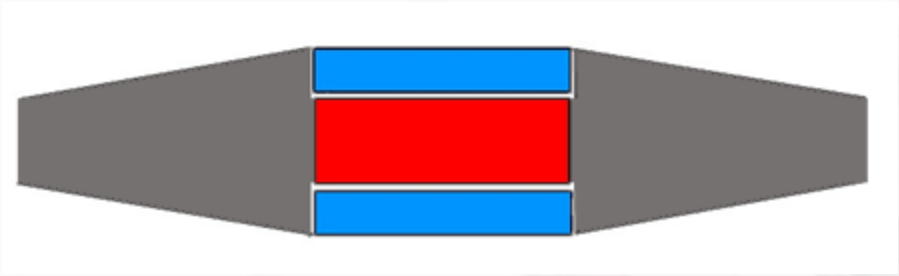
ABC Strategy-Phasing

Construct Oversized Rectangular SPUI Bridge

- Phase I
  - Construct Outside Bridge Quarters



- Phase II
  - Move Traffic to Outside, Construct Inside 2 Quarters



- Phase III
  - Tie Phases Together and Open Entire Bridge

ABC Strategy-Substructure

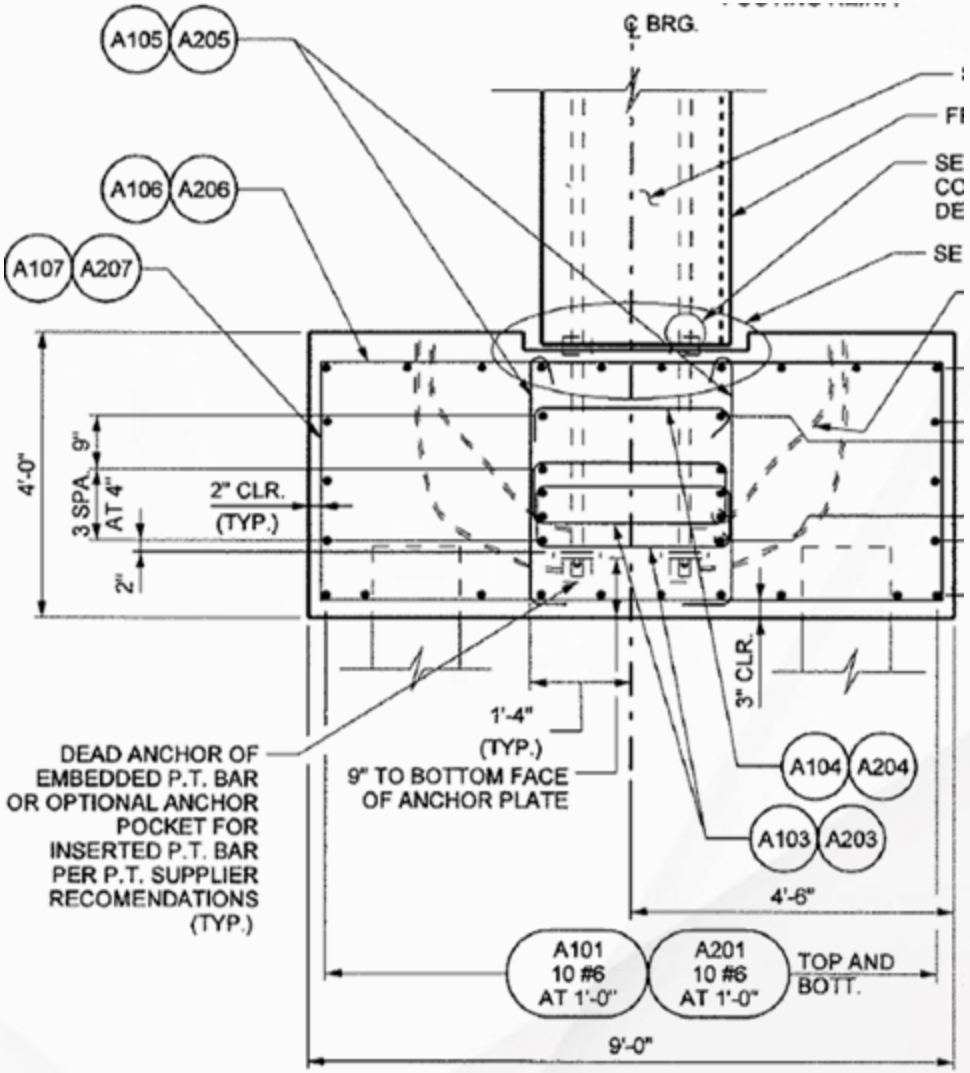
Pre-Fabricated Bridge Elements

1. High-Early Strength C.I.P. Footings on Piles
2. Precast Abutment Segments
3. Precast Bent Columns and Caps
4. MSE Wall Panels tying into Abutment

Precast Abutment

- 42’ L x 3’ W x 4’ H
- Pieces Vertically ***Match-Cast***
- Final Horizontal Joints Matched Very Well
- Set on C.I.P. Pile Cap with Shims

Precast Abutment

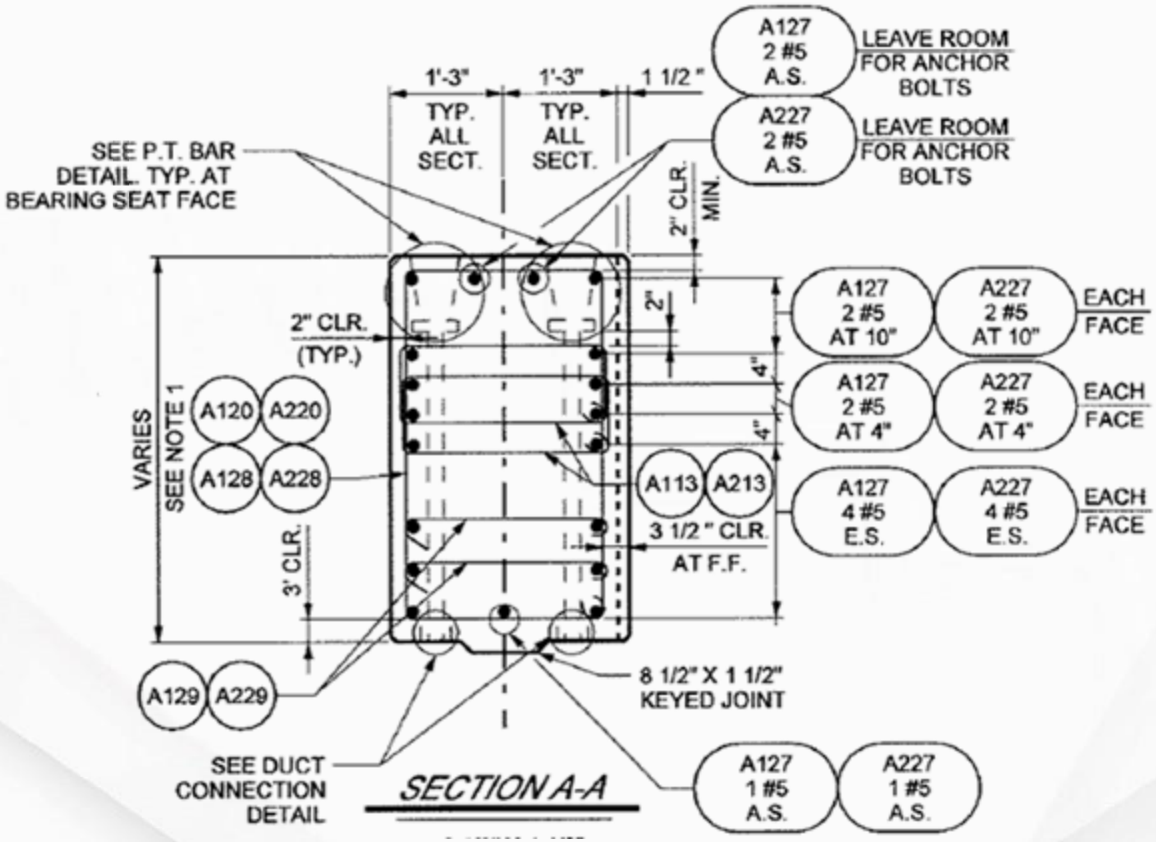


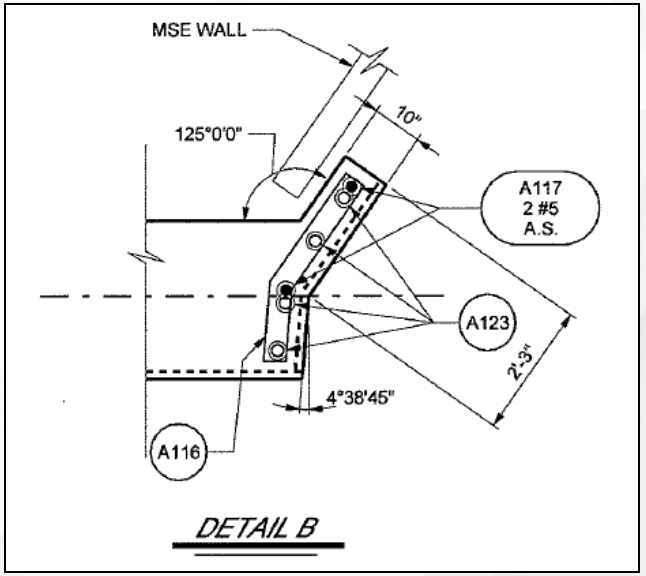
Precast Abutment

Post-Tensioned Abutment

- P-T'd using 1 3/8" Rods
- Rods Extended with PVC Pipe to Facilitate Installation
- Epoxy Layer Between Sections
- Waterproofing Along Joints
- Elastic Design for Seismic Forces

Precast Abutment



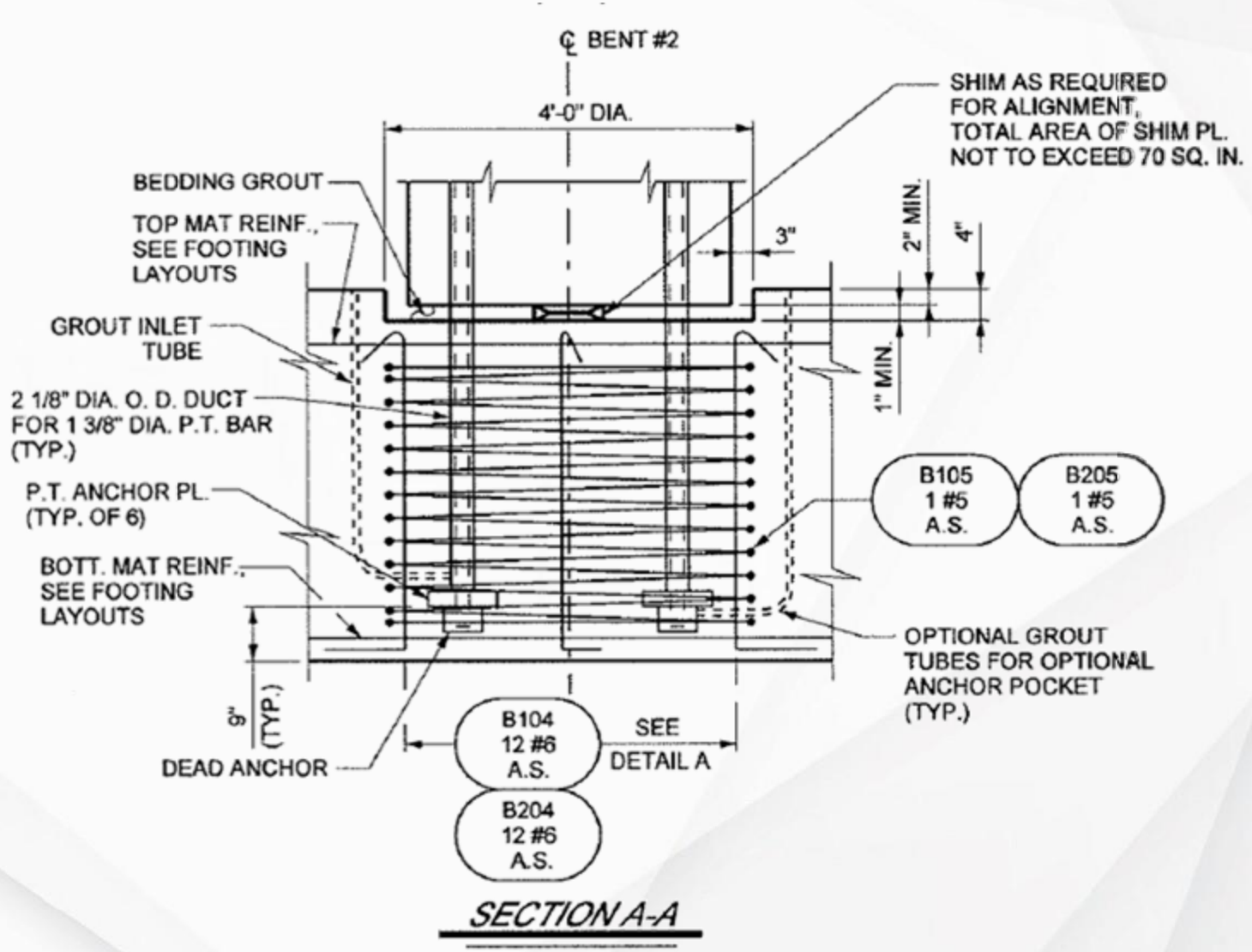


Precast Bent

Post-Tensioned Bent Columns

- P-T'd using 1 3/8" Rods
- Placed on C.I.P. Pile Cap with Shims
- 2 of 6 Rods Terminated in Column Other 4 Continue into Cap
- Octagonal Shape to Facilitate Casting

Precast Bent

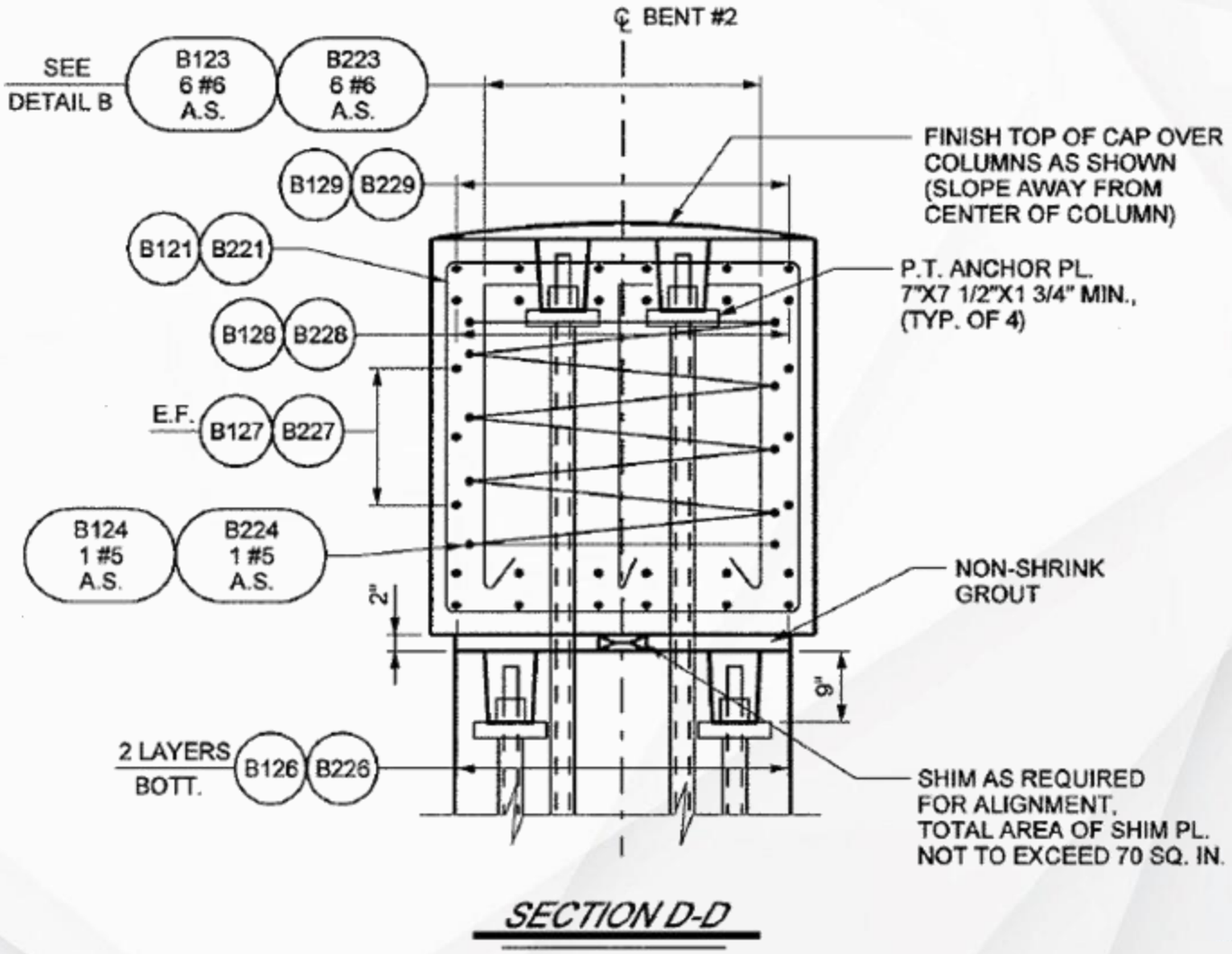


Precast Bent

Post-Tensioned Bent Cap

- Bent Split into 4 Smaller Bents to Accommodate
  Phasing & Installation
- Cast on Site to Avoid Transport
- Continuous P-T Rods to Tie Cap to Columns
- PTFE Sliding Bearings to Isolate Bent from Seismic Forces
  - allow for elastic design of bent

Precast Bent



SECTION D-D

Final Bridge

Final Bridge

Final Bridge

Conclusions

Conclusions / Lessons Learned

- Match Casting Worked Very Well
- Allow for Precast Time Up Front
- Coordinate Accelerated Bridge Construction with Overall Schedule
  - Wall Schedule Interference

ABC-UTC 2023 In-Depth Web Training
Module 5

Performance of the Riverdale Road Bridge Substructures

Presented by:
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Chief Bridge Engineer
CHA Consulting, Inc.

September 12, 2023

Utah DOT Lessons Learned

Goal:

- To study the performance of common ABC Details and methods

Repeated on regular intervals to track long-term performance

- 2009, 2010, 2011, 2013, 2016, 2019, and 2023

Approximately 50 bridges have been studied

Riverdale Road Inspections:

- 2009, 2010, 2011, 2013, 2016, 2019, and 2023

Utah DOT Lessons Learned

ABC Technologies Studied

- SPMT systems
- Lateral slide systems
- Precast concrete decks with various connections
  - Welded tab connections
  - Longitudinal post-tensioning
  - UHPC
- Substructures
  - Piers
  - Abutments (integral and cantilever)

Utah DOT Lessons Learned

Overview of findings

- Almost all details are fairing very well
- Some details did not function well
  - Details were developed based on engineering judgment
  - There were no design specifications available
- Details that are consistent with the AASHTO LRFD Guide Specifications for ABC perform well
- Issues were uncovered that are not related to ABC
  - Overlays and waterproofing
  - Approach slabs
  - CIP concrete
  - We need to be careful to separate out these issues from ABC Durability

Riverdale Road Performance

ABC Prefabricated Bridge Substructure Elements

- Precast abutment
- Precast Pier

Riverdale Road Performance

Precast Pier

- Connected with vertical post-tensioning rods
- Performing well

Riverdale Road Performance

Precast Pier

Inspection Year: 2013

Inspection Year: 2016

Inspection Year: 2019

Inspection Year: 2023

Riverdale Road Performance

Precast Abutments

- Connected with vertical post-tensioning rods
- Performing well – No issues have been noted

Approach Slab Joints

Approach Slabs

Inspection Year: 2016

Inspection Year: 2019

Inspection Year: 2023

Approach Slab Joints

Approach Slabs

Inspection Year: 2019

Repaired prior to 2023 Inspection

Conclusions

- The Riverdale Road Bridge is a great example of a total precast solution
- This bridge substructures are performing very well
- There are no issues with the substructures
- There are minor issues with the approach slabs – This has been addressed
- The service life of this bridge's precast substructure should be equivalent to or greater than a conventional bridge