SELLWOOD BRIDGE
Project
MULTNOMAH COUNTY

Sellwood Bridge Replacement Project

Western Bridge Engineers' Seminar

September 7th, 2017

Sellwood Bridge Replacement Project

Presenter:

Ian Cannon, P.E., Multnomah County
Eric Rau, P.E., T.Y. Lin International

Sellwood Past

Sellwood Former

Sellwood Current

Agenda

- Sellwood Site Background
- Bridge Replacement Project
- Community Involvement
- Main Arch Bridge Configuration
- Construction Overview

- Photo Credits:
  - Oregon Department of Transportation (aerial)
  - Multnomah County
  - Slayden/Sundt Joint Venture
  - © Victor Von Salza

Sellwood Site Background

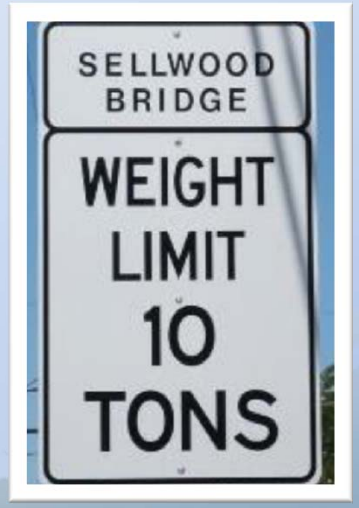
Project Location

Ferry at Spokane St

Sellwood Bridge

History

- Bridge opened 1925
- West approach moved 3ft by 1960
- Loads restricted in mid 1980's
- Large cracks discovered in 2003
- "Band aids" installed
- Loads further restricted 2004
- NEPA process started in 2006



Issues

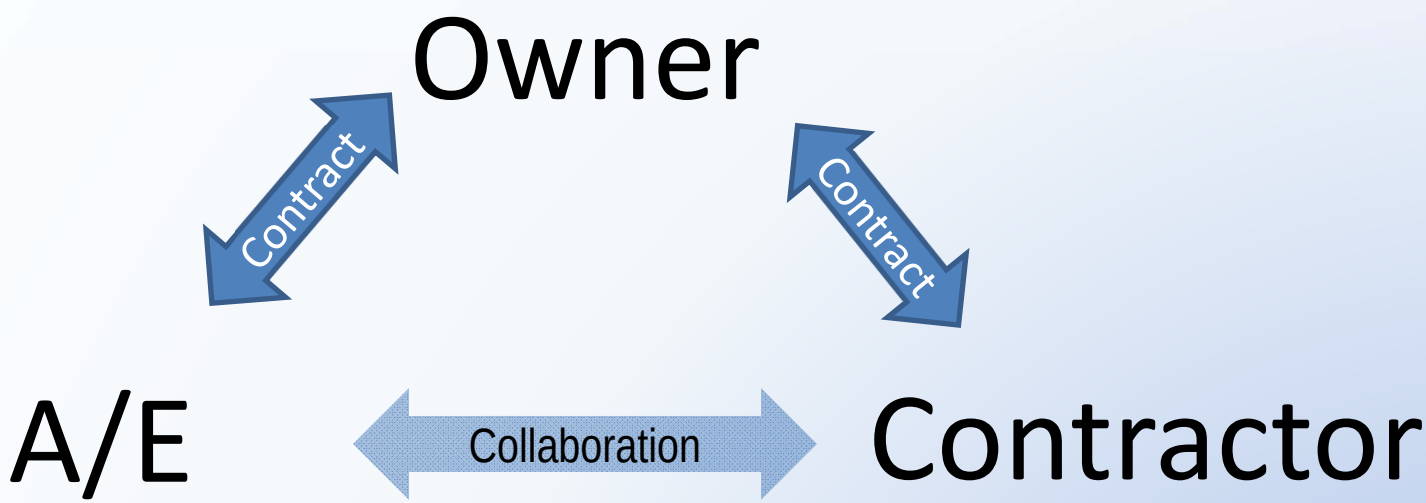
- West end slope instability
- Buses / trucks restricted
- Narrow travel lanes, no shoulders
- Single 4-ft sidewalk
- No bicycle facilities, poor connections
- General deterioration
- 1925 Bridge not designed for earthquakes
- NBI Rating 2 out of 100

Bridge Replacement Project

Project Team

- Agencies
  - Multnomah County
  - City of Portland
  - Oregon Department of Transportation
  - Federal Highway Administration
- Consultants
  - T. Y. Lin International, Prime Design Firm
  - CH2M Hill, Lead Subconsultant
  - Cornforth Consultants, Landslide Mitigation Consultant
  - Safdie Rabines Architects
  - David Evans and Associates, Owners Rep
- Contractor
  - Slayden/Sundt Joint Venture

CM/GC Model



- Contractor input during design phase:
  - Constructability and pricing
  - Scheduling and phasing of the work
- Collocated project office to increase collaboration

Project Information

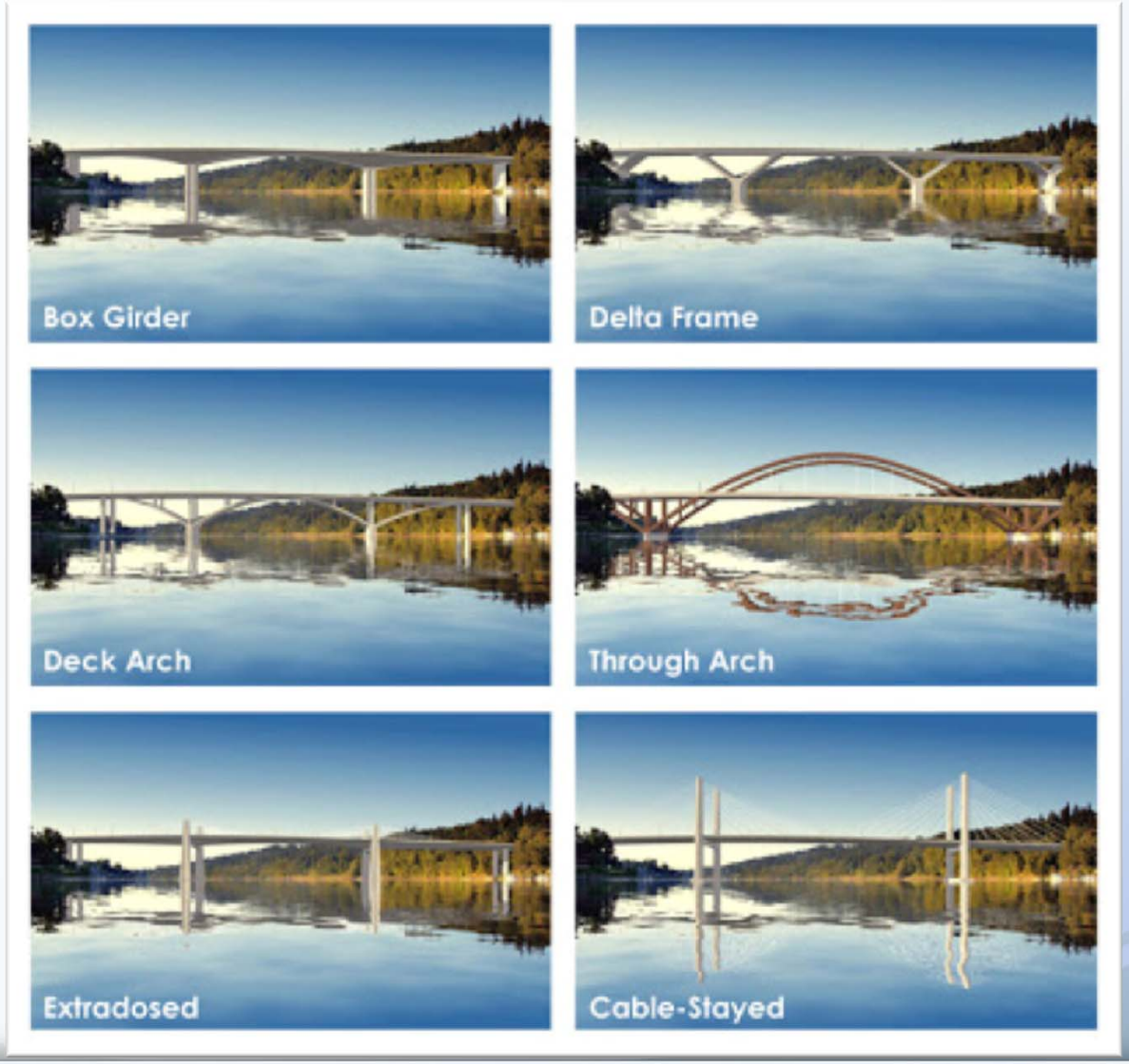
- Project Cost - $325 million (approximate)
- Utilizing CM/GC delivery method
- NEPA Phase – 2006
- Slayden/Sundt Joint Venture Selected - 2010
- Final Design Phase - 2011-2012
- “Shoofly” arrangement – January 2013
- Traffic on new span – Spring 2016
- Substantial Project Completion – January 2017

Community Involvement

Selection Process

- Conducted in 2010
- 12 bridge types evaluated
- 9 criteria scored in a matrix including:
  - Cost
  - Construction risk
  - Environmental impact
  - Aesthetics
- Public involvement: CAC $\Rightarrow$ PSC $\Rightarrow$ BCC
- CAC preferred alternative - Steel Deck Arch

Bridge Type Selection



Project Site Overview

Project Site Overview

Roadway Section

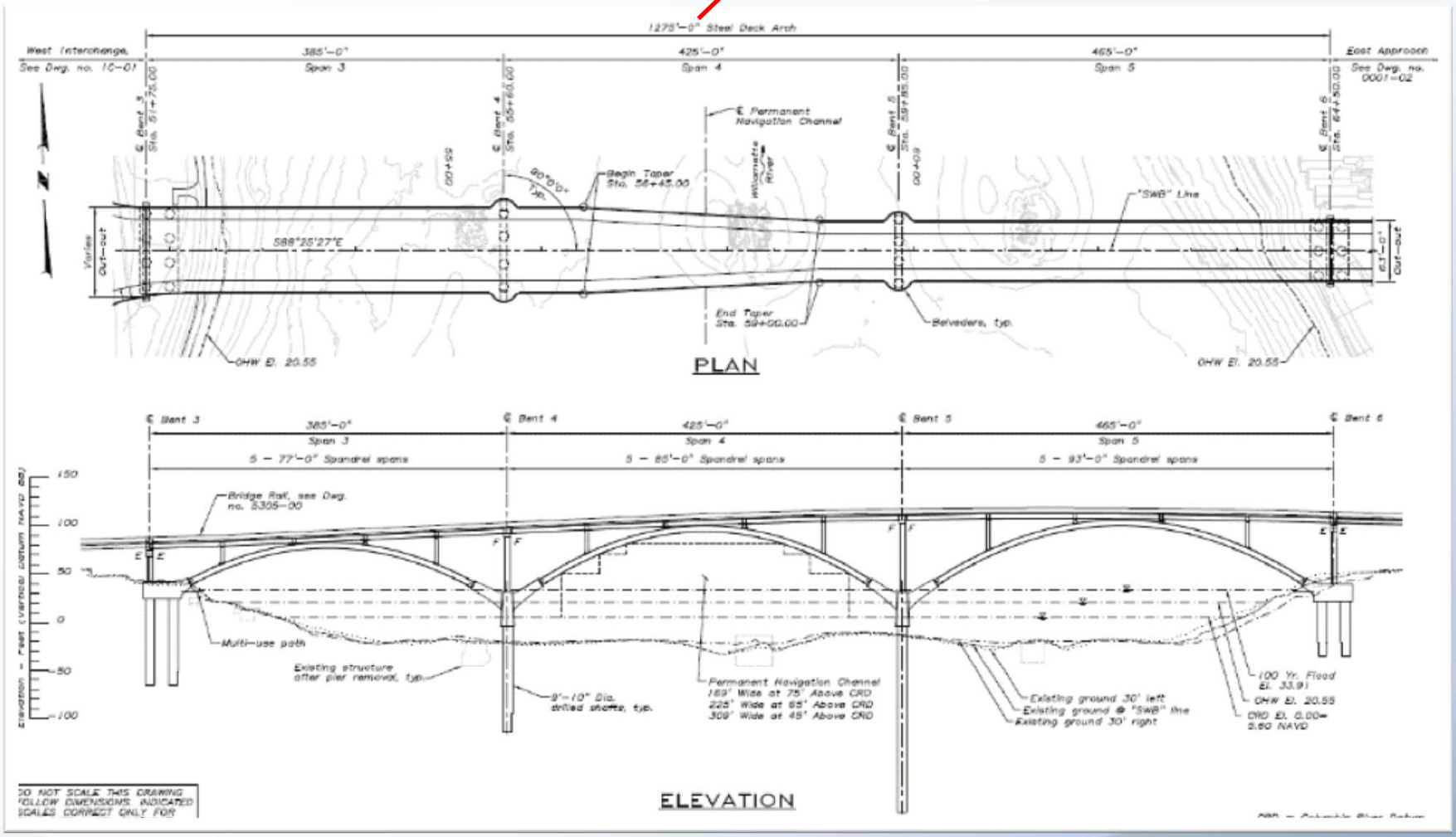
- Existing Bridge
  - 32-ft Structure width
  - Two thru traffic travel lanes
  - Single 4-ft sidewalk

- New Bridge
  - 63-ft to 90-ft Structure width
  - Two thru traffic travel lanes
  - Two turn lanes
  - Two 12-ft sidewalks
  - Two 6.5-ft bike/shoulders

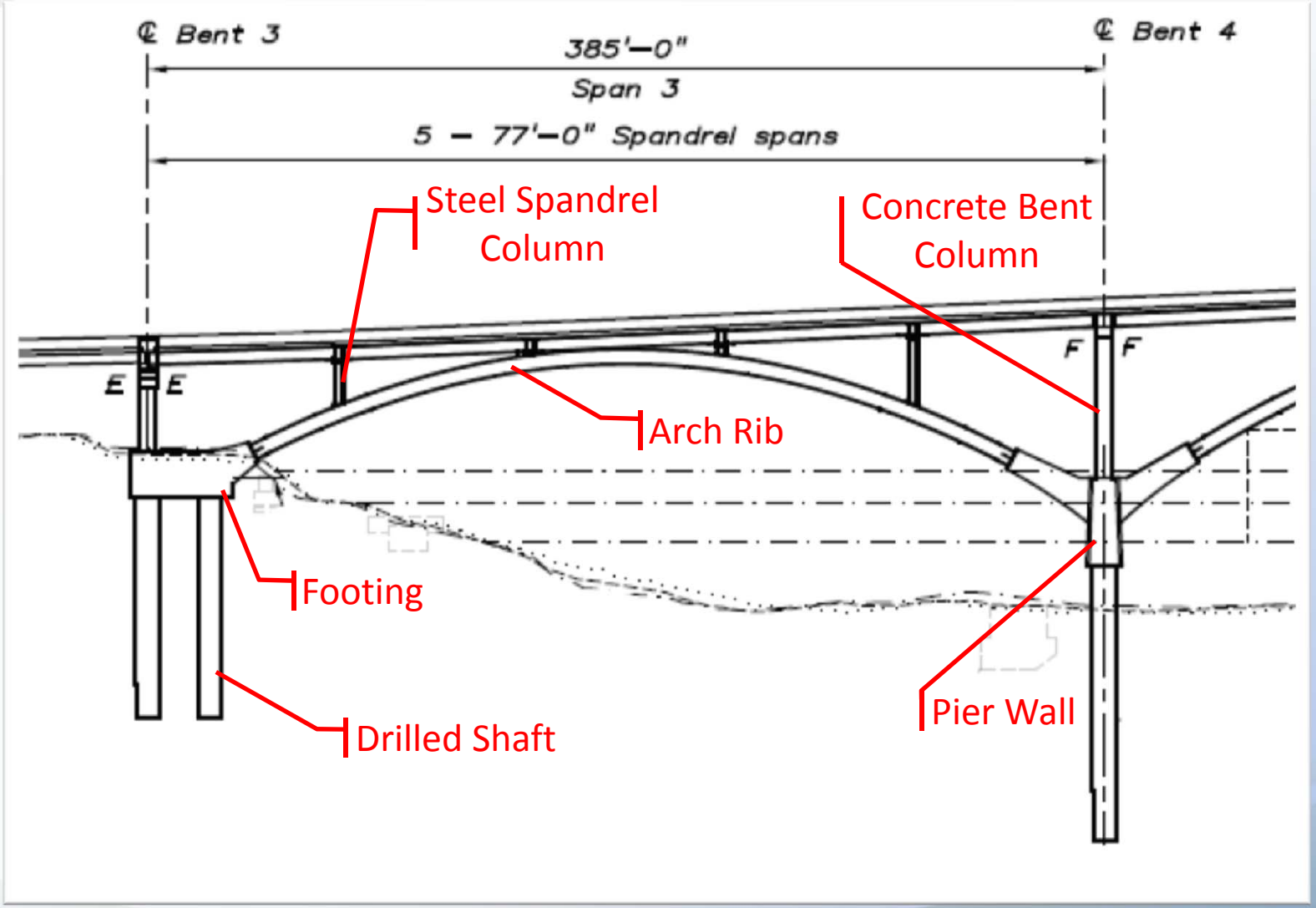
Roadway Section

Main Span Plan and Elevation

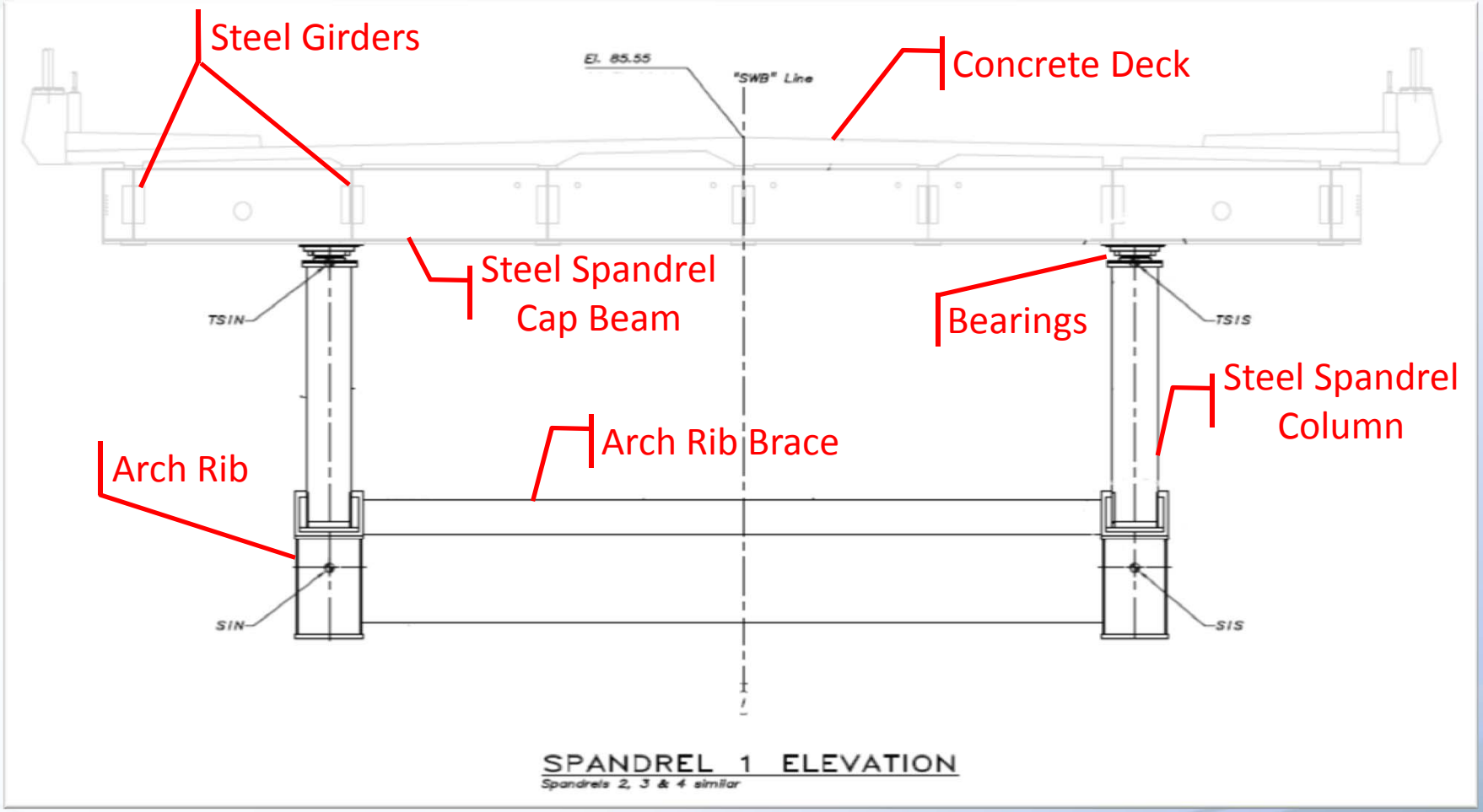
1275’-0”



Typical Arch Elevation

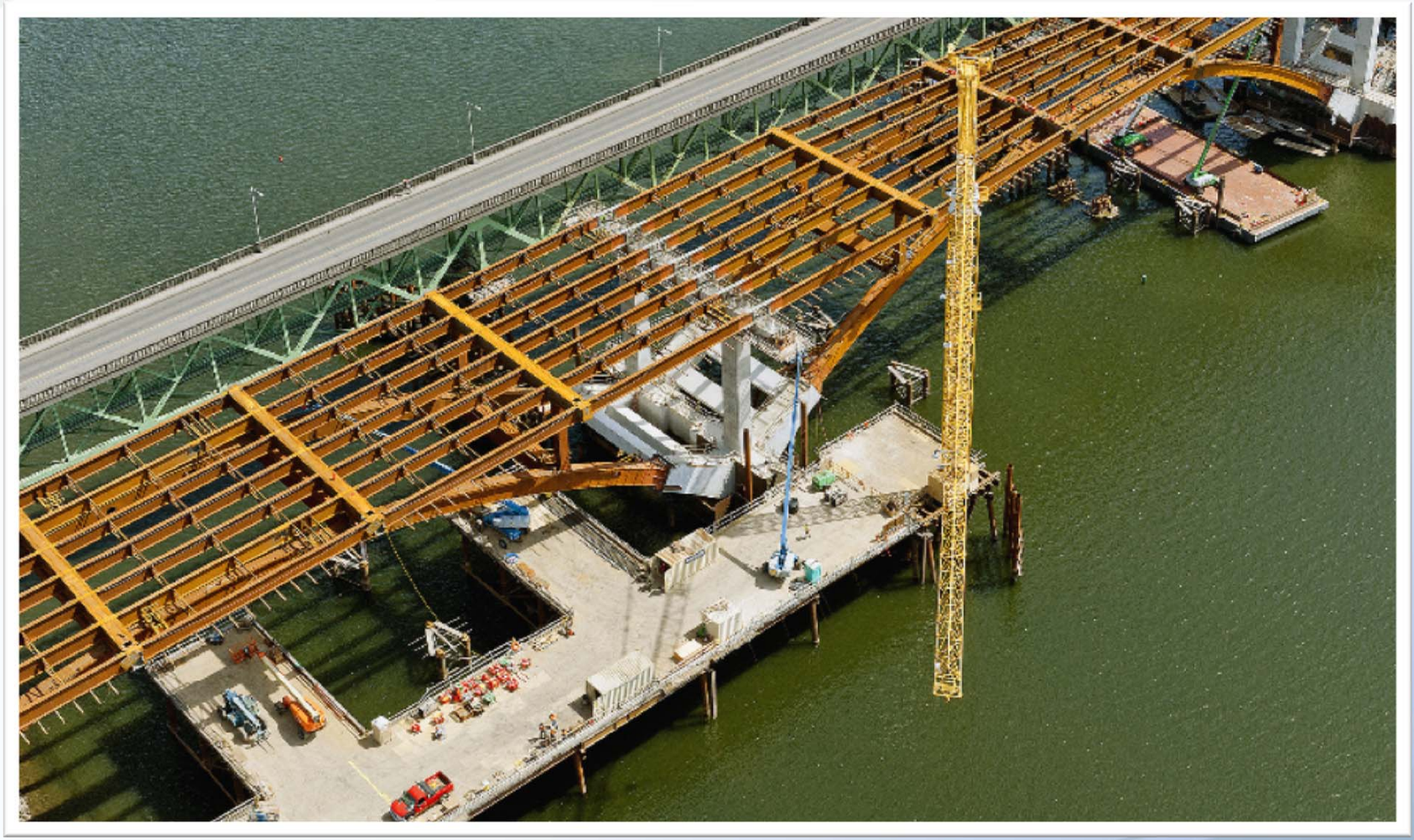


Typical Arch Section



Steel Framing

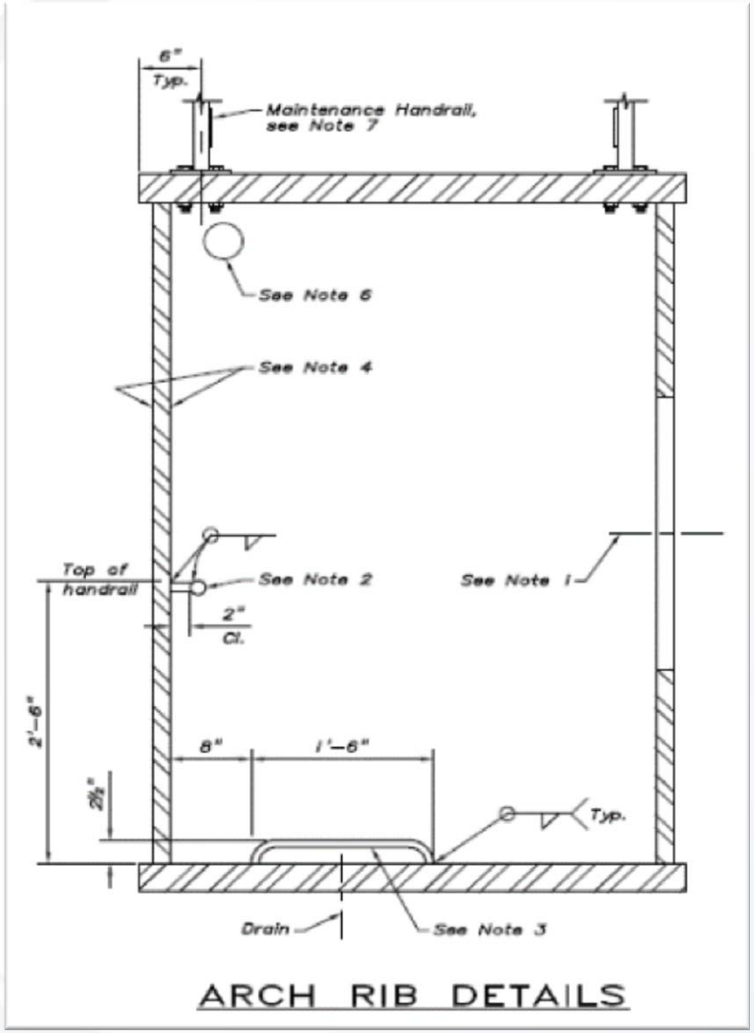
Steel Framing

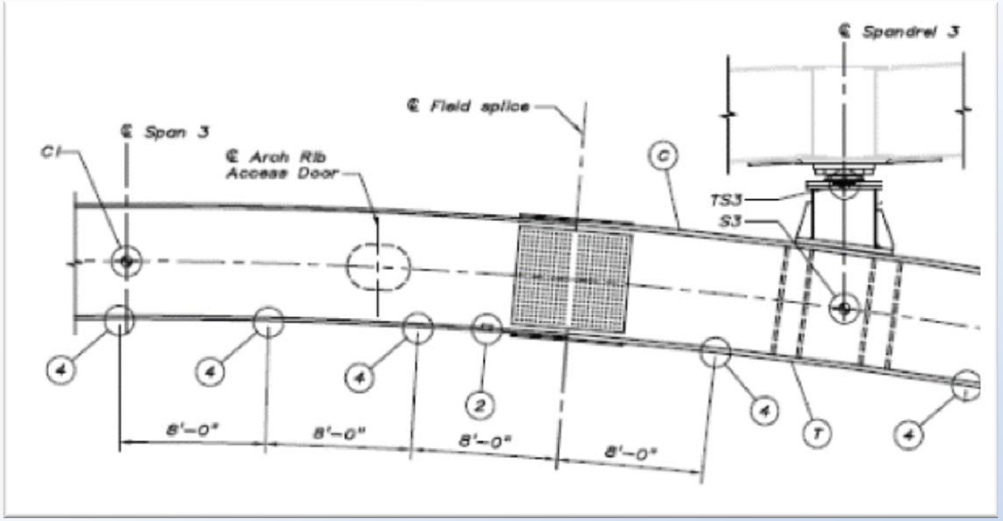


Structural Steel

- Structural Steel
  - ASTM A709, Grade 50W structural steel
  - 10 Million lbs
  - ASTM A 325 and A490 Type 3 high-strength bolts
- Sub Contractors
  - Fabricator: Thompson Metal Fab Vancouver, WA
  - Erector: Carr Construction Portland, OR

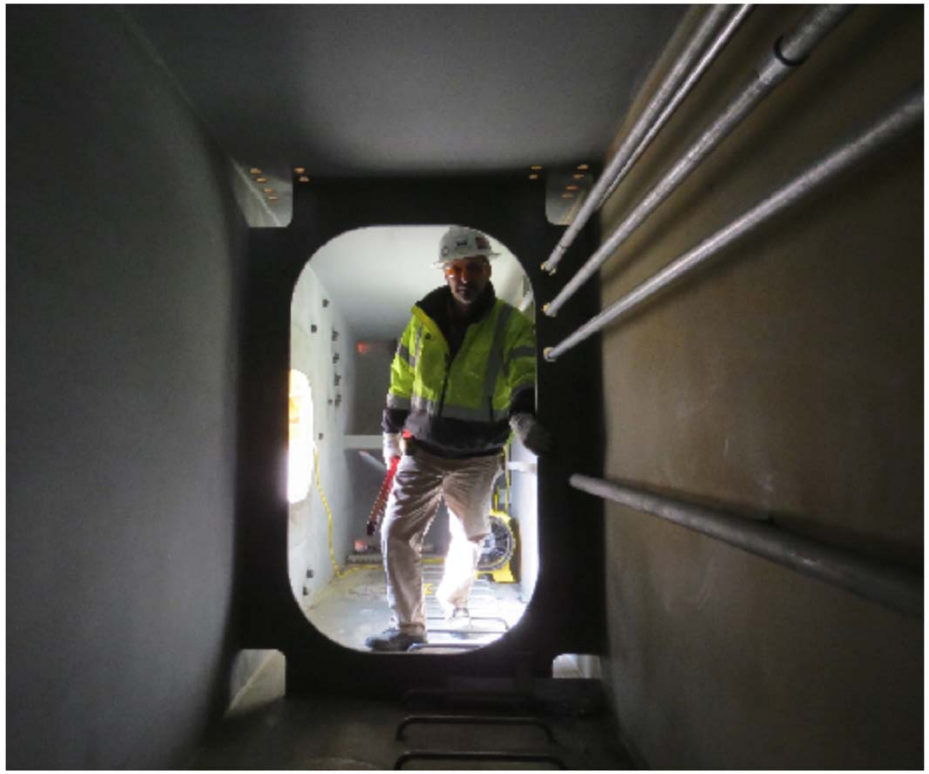
Arch Rib

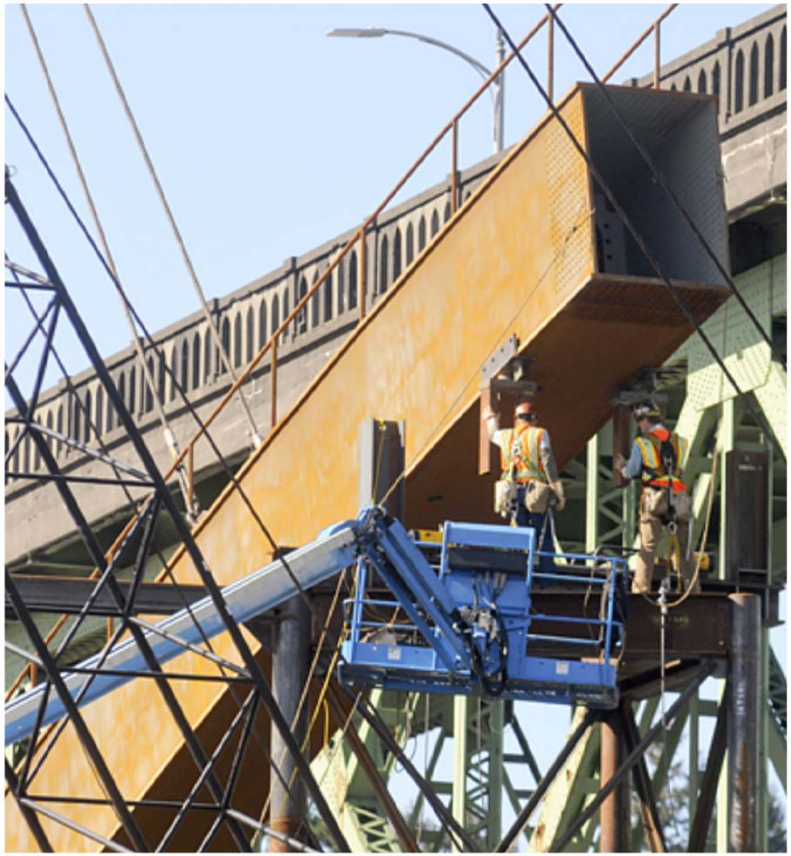




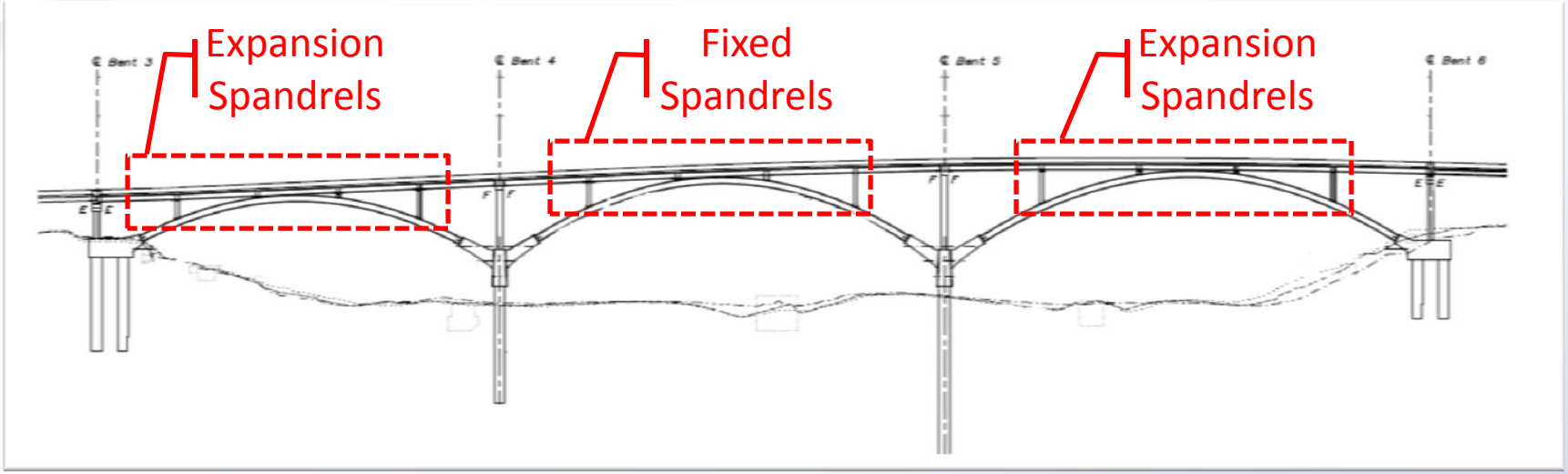
- Arch Rib Box Section
  - Web Depth of 70” with plates ranging from 1.5” to 2.0”
  - Flange Width of 54” with plates ranging from 2.0” to 3.0”

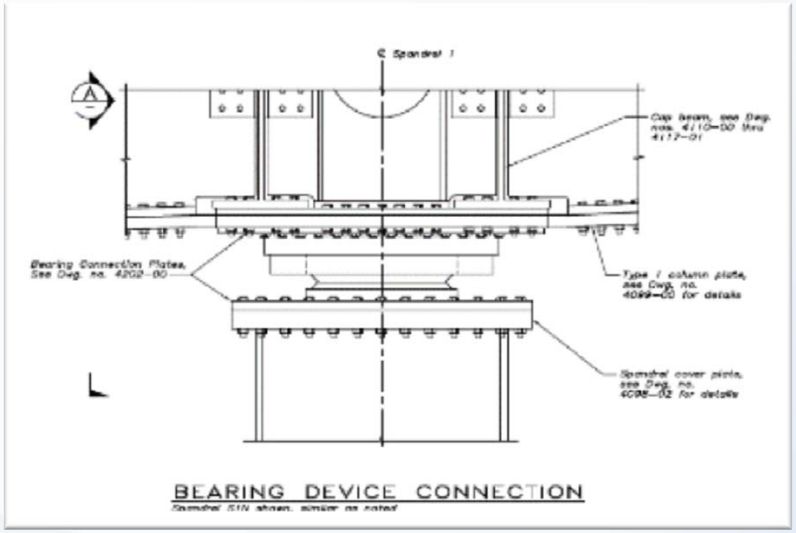
Arch Rib

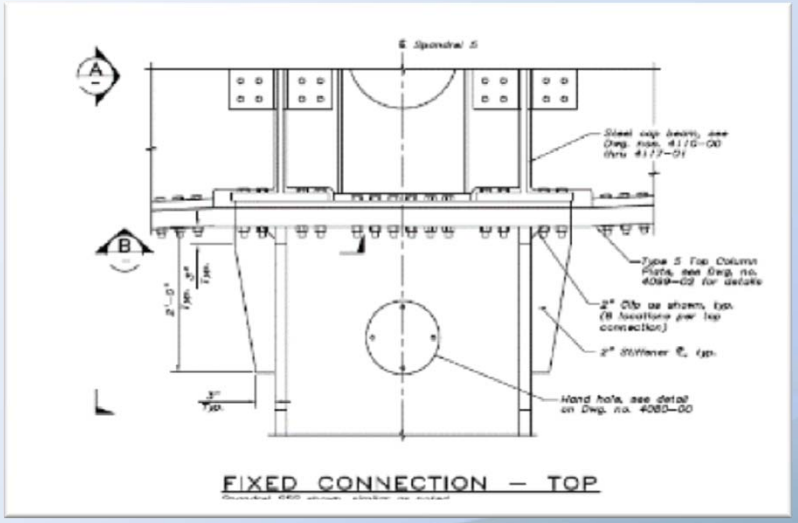




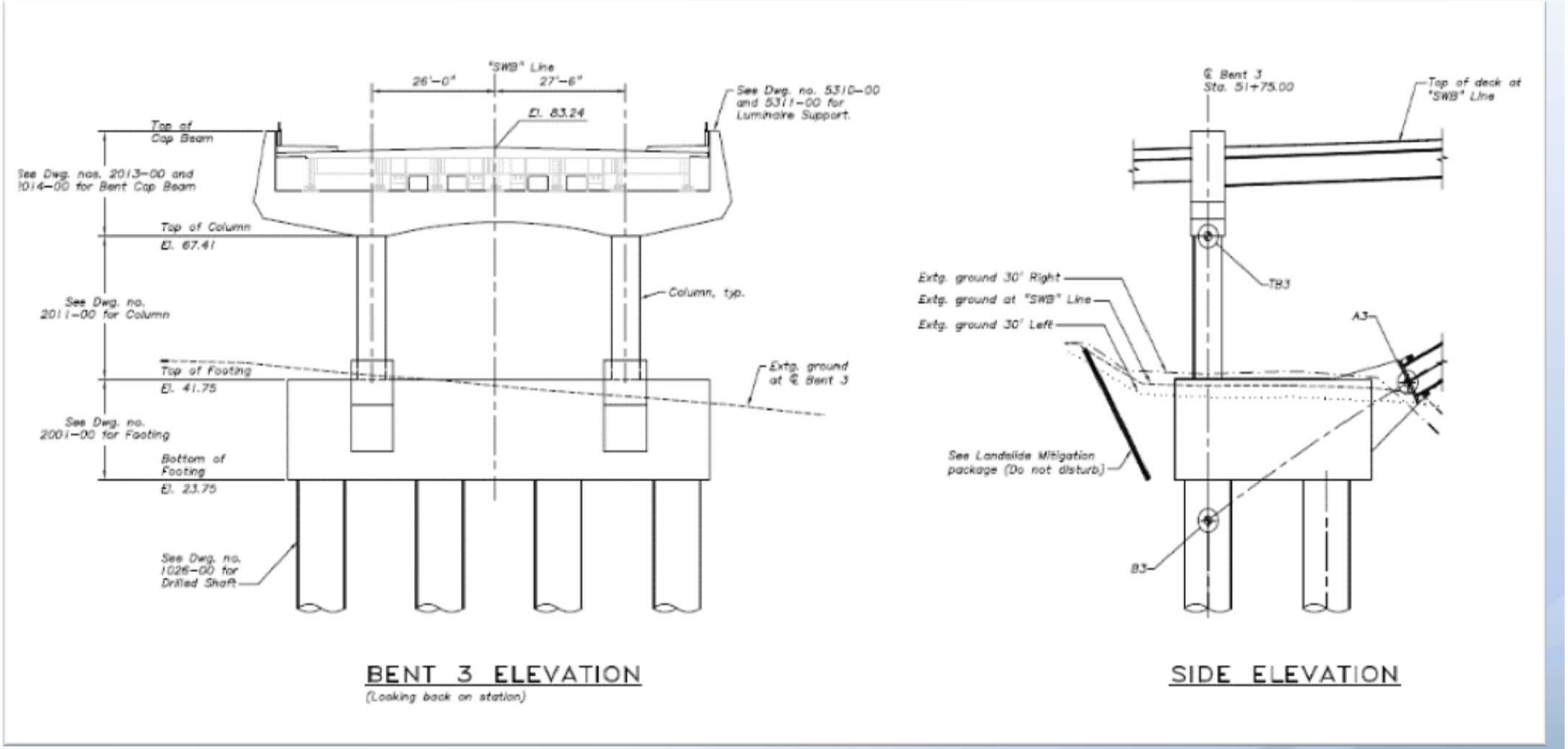
Spandrel Columns





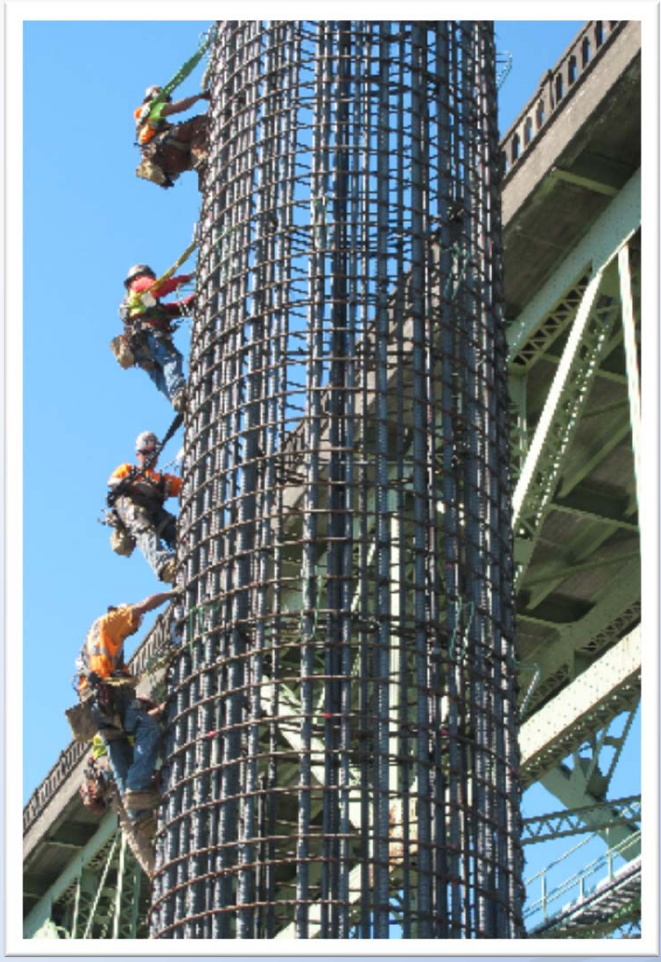


West Shore Pier



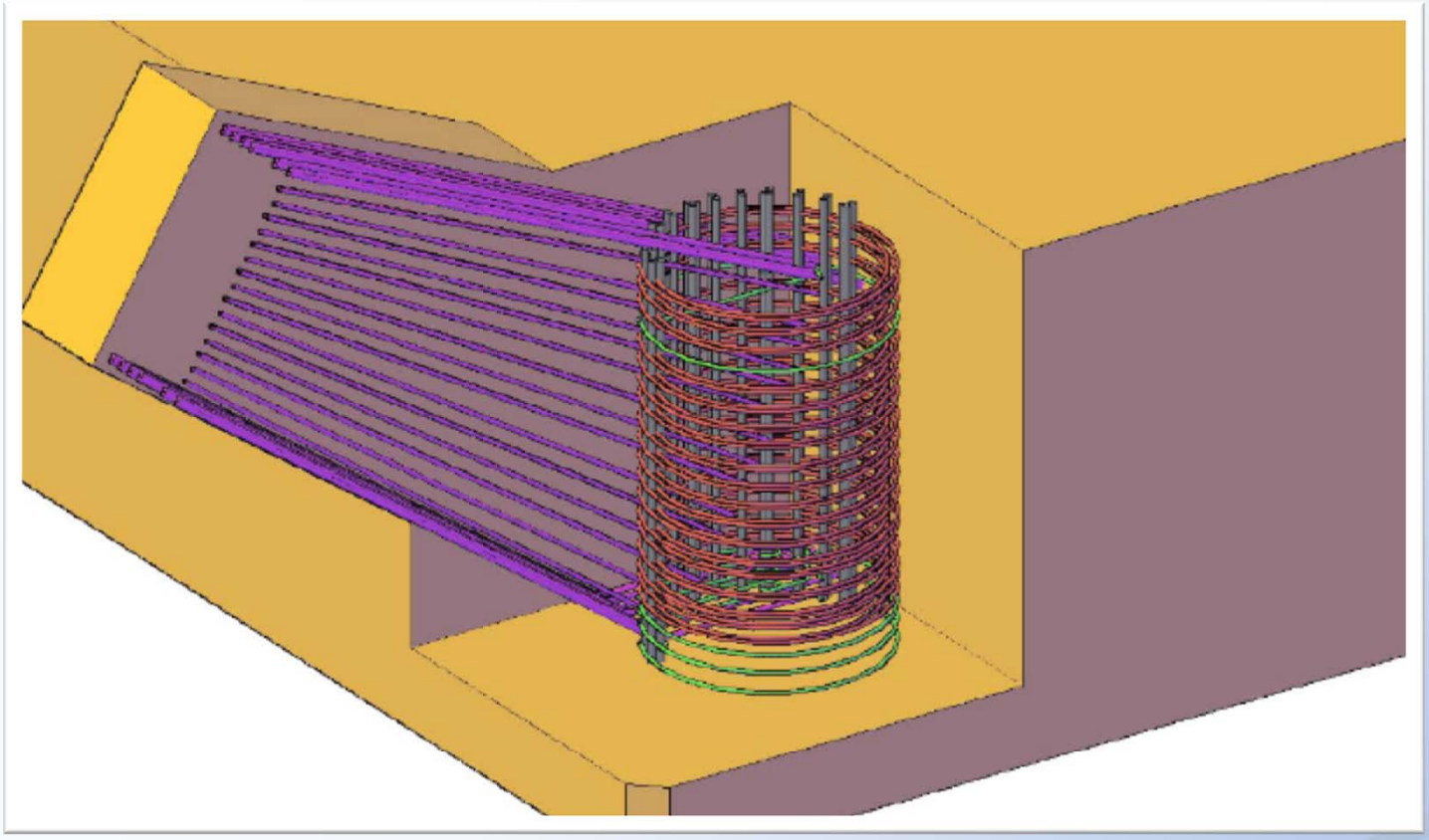
Bridge Substructure

Drilled Shaft Construction

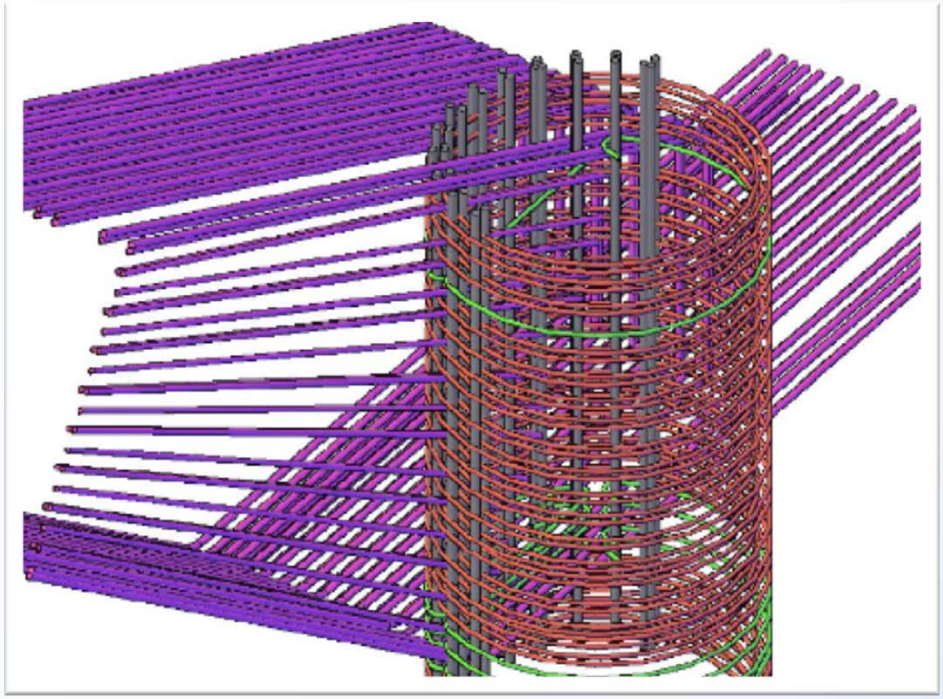


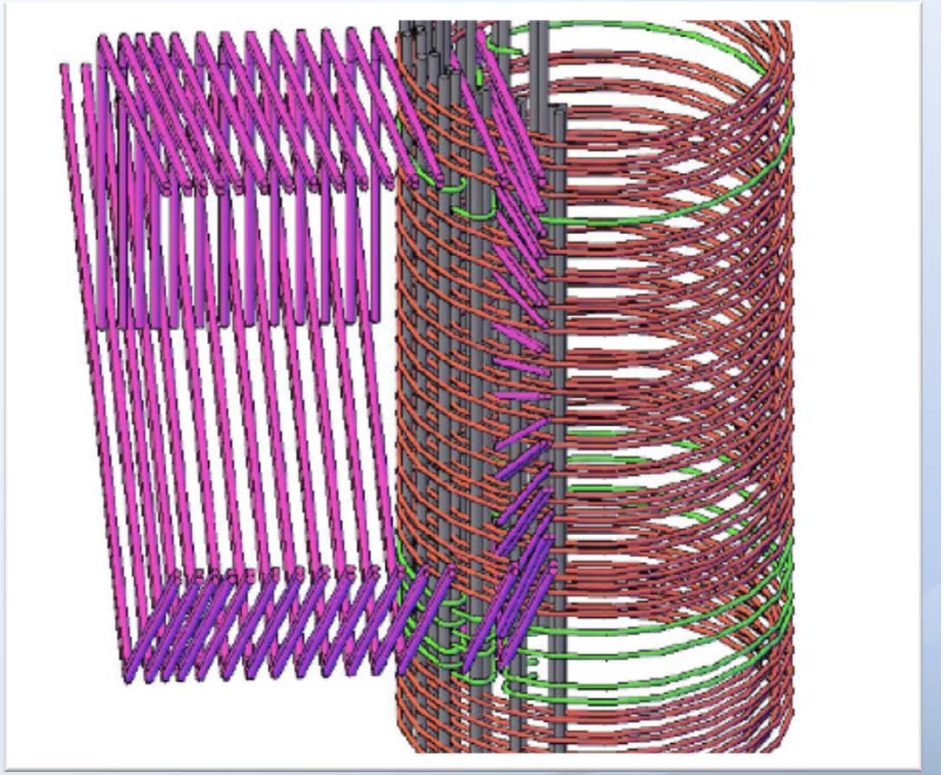
- Shaft tip = -175’ (approx.)
- River Bottom = -20’ (approx.)
- Bottom Pier = -4’
- Top Rebar = 26’

3D Rebar Modeling

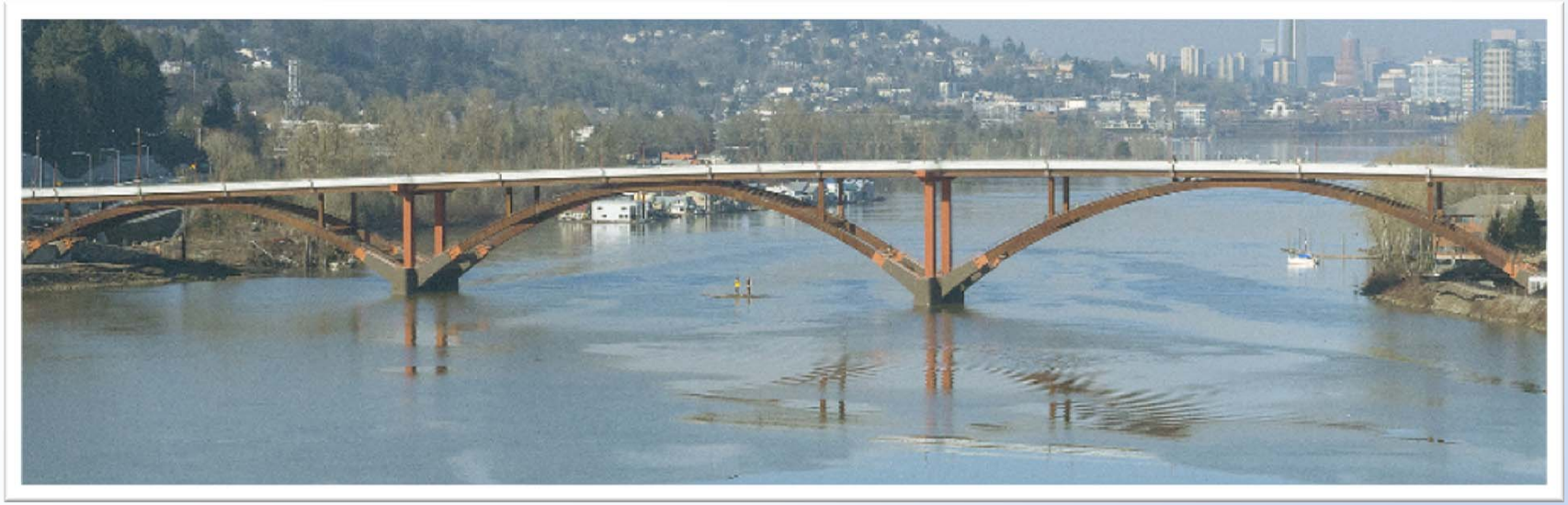


3D Rebar Modeling



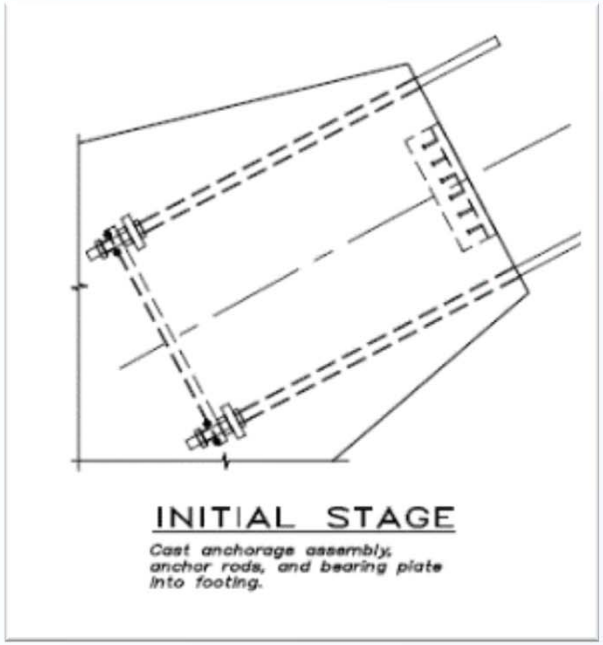


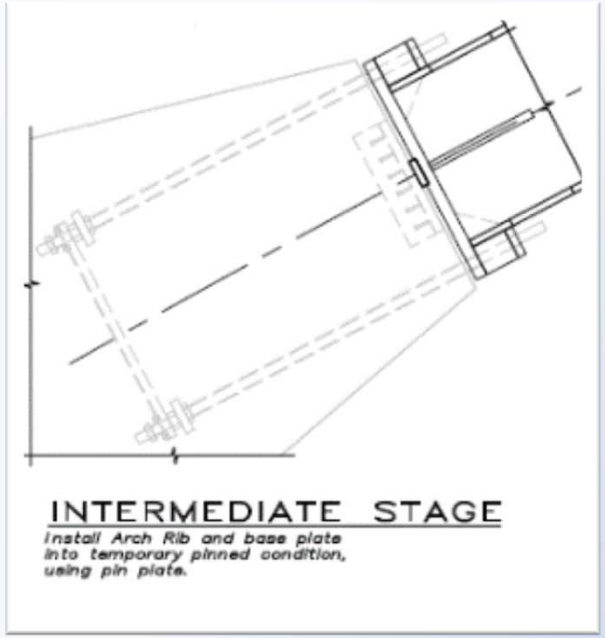
Arch Rise-to-Span

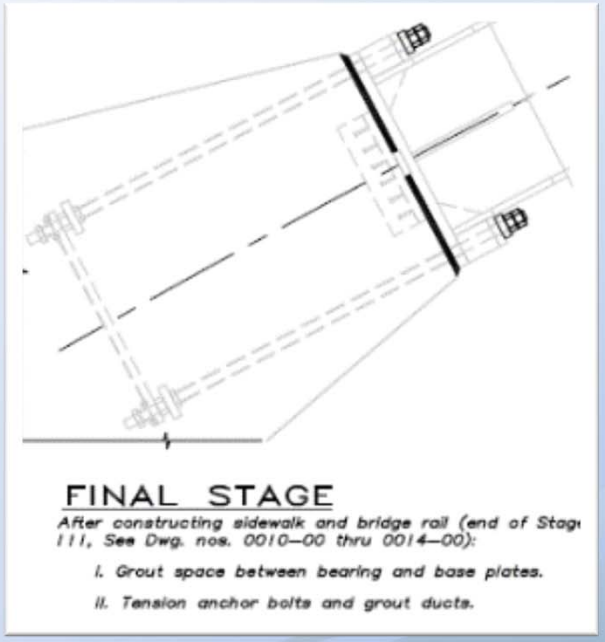


- Shallow Arch Spans to fit site condition
- Span 3 = 0.13 (1:7.7) to Span 5 = 0.16 (1:6.4)
- Increased bending demands, reduced arching action

Arch Springing Assembly

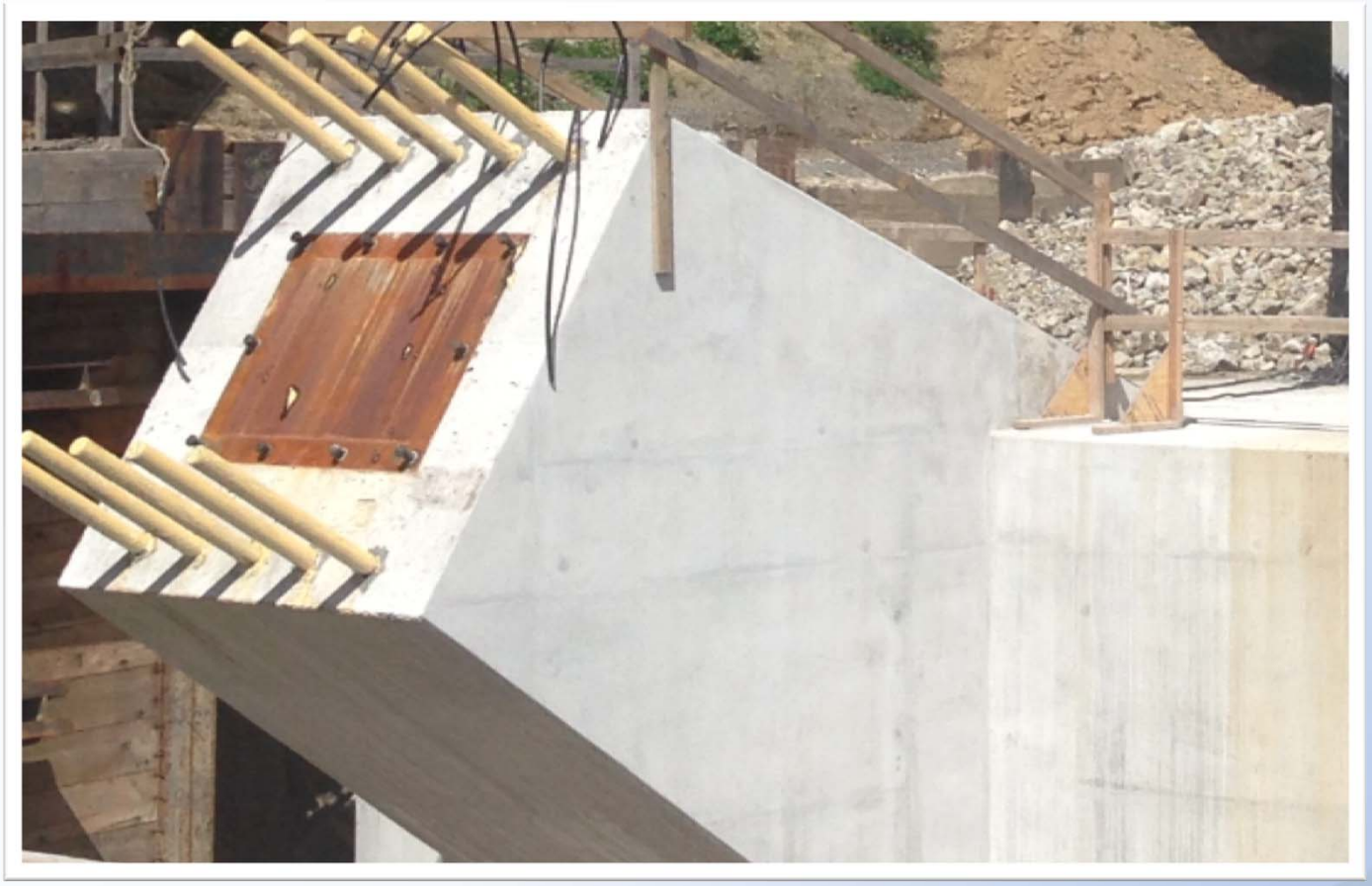




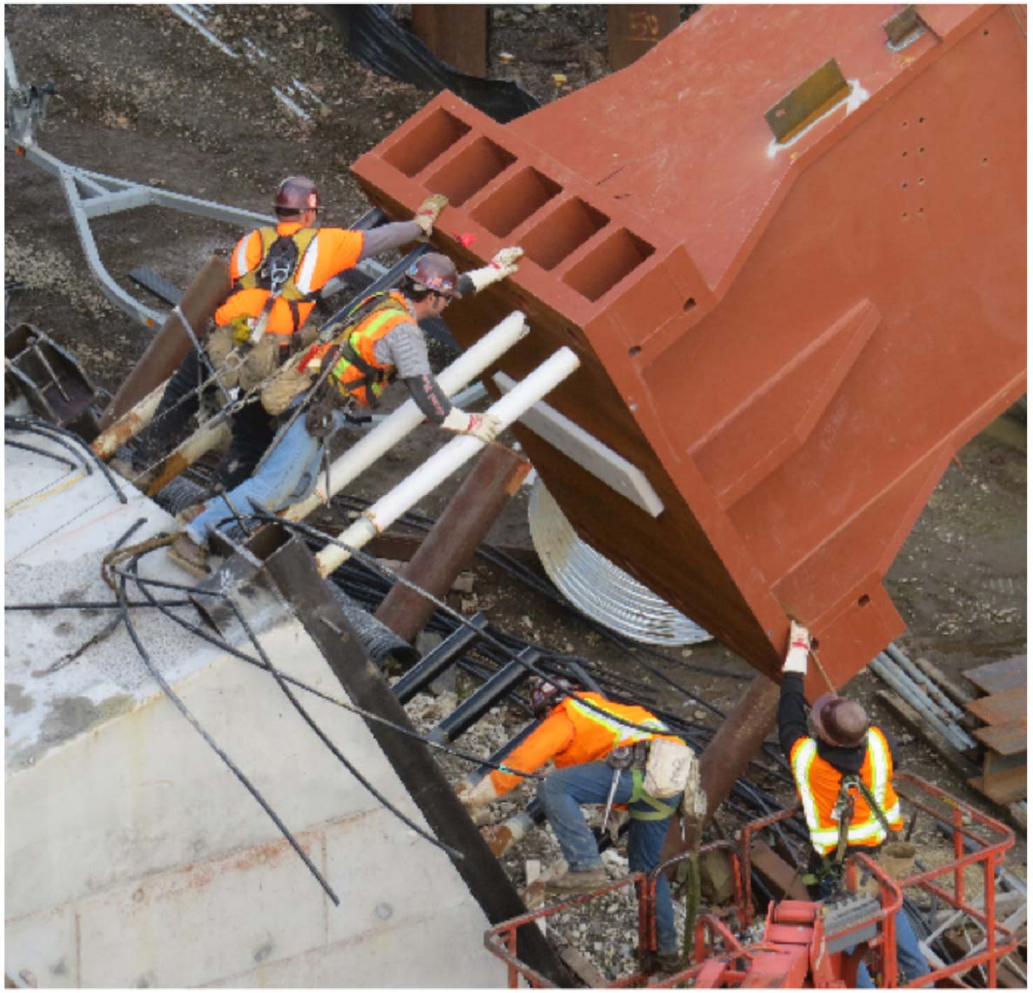


Arch Springing Assembly

Arch Springing Assembly

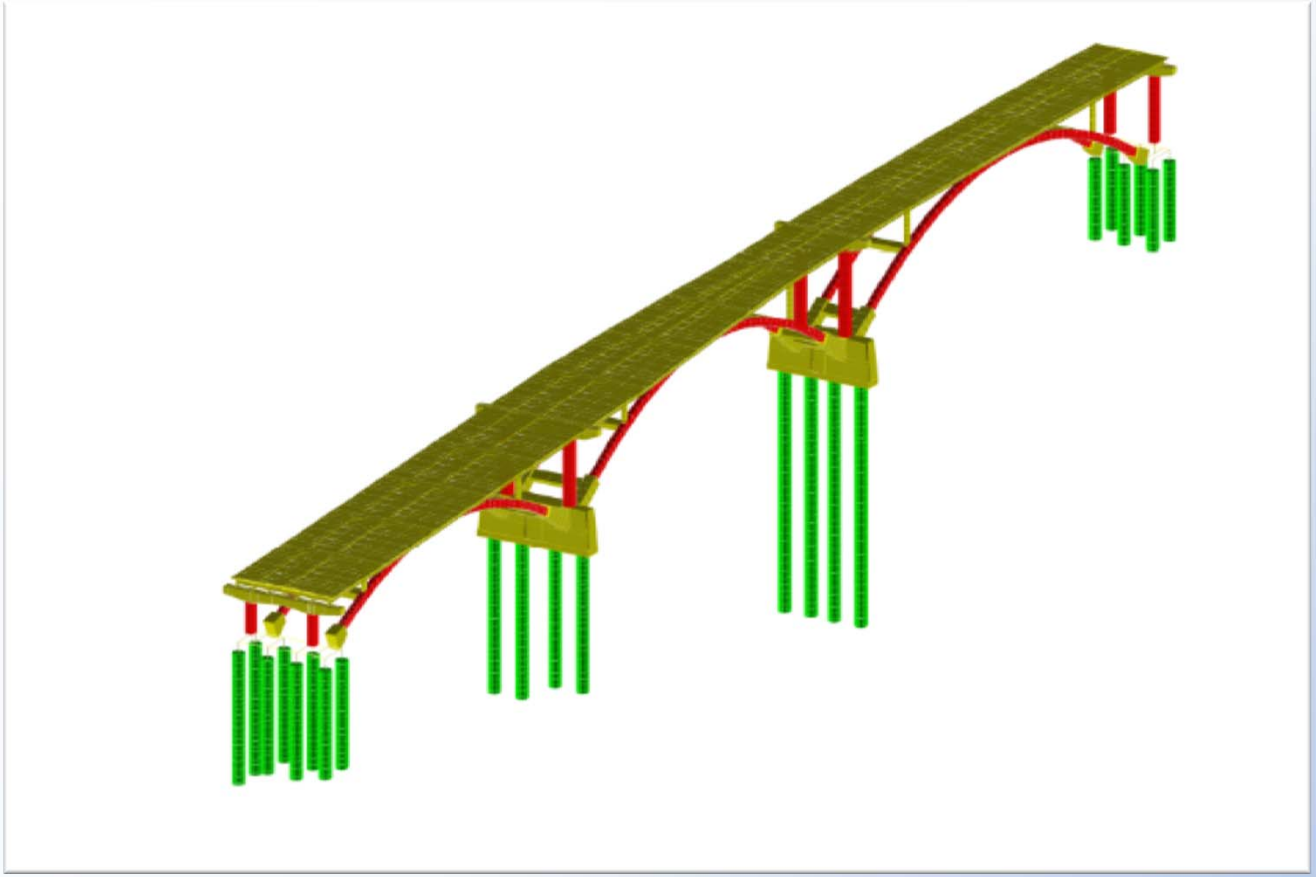


Arch Springing Assembly



Arch Springing Assembly

Analysis and Design Criteria



LARSA 4D Global Analysis Model

Design Criteria

- **Seismic:**
  - Minimal damage allowed in a 500-year earthquake
  - Collapse is prevented in a 1000-year earthquake
  - Allowable material strains are defined and enforced for these events
  - Structure response is calculated via enveloped suites of site-specific acceleration response spectra and nonlinear static push analyses.

- **Landslide**:
  - Mitigation measures are being constructed to prevent movement in service conditions.
  - Finite element analysis was performed using scaled time histories of four earthquakes to predict soil-structure interaction with the proposed structure and mitigation in place.

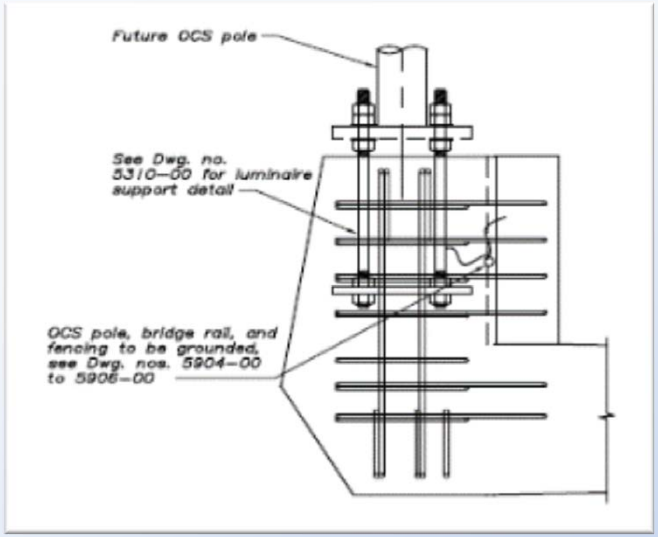
- **Vessel Collision:**
  - Bridge designed for vessel impact
  - Controlling vessel was the Portland Spirit , 150-ft long, 420 long ton

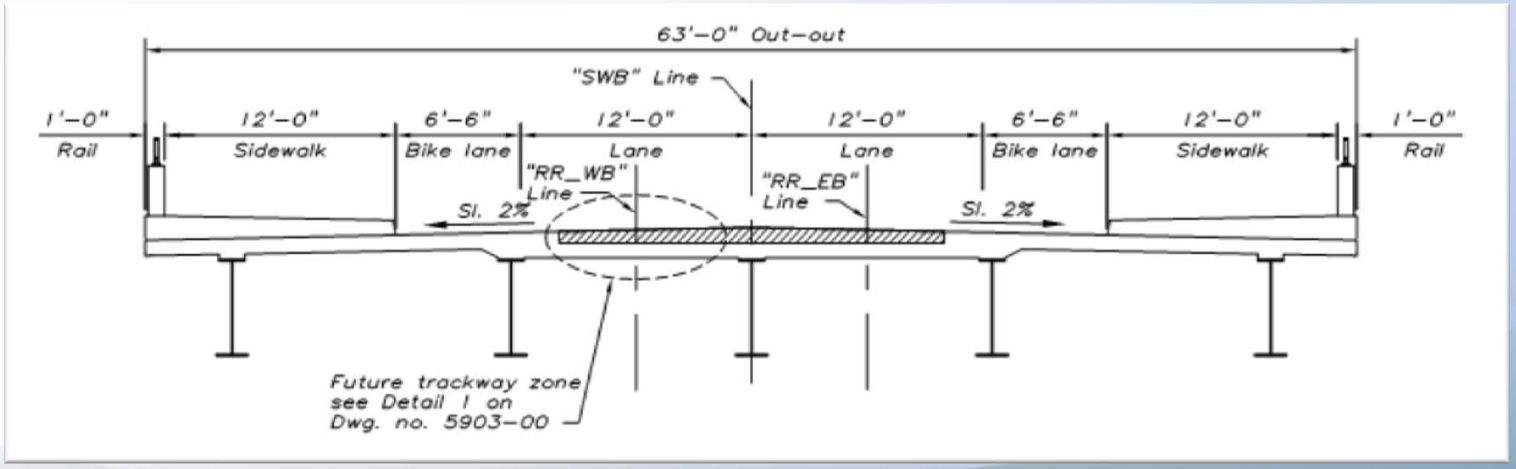
- **AASHTO Live Load:**
  - Bridge designed for trucks and pedestrians; conditions were evaluated with complete removal of sidewalks.

- **Streetcar Live Load:**
  - Streetcar vehicles were substituted into load combinations for HL-93 trucks.

Future Streetcar Provisions

- "Streetcar Ready"
  - Approved alignment
  - Thickened deck section for rail install
  - OCS anchorage at light poles
  - Enhanced grounding system
  - Conduit blockouts



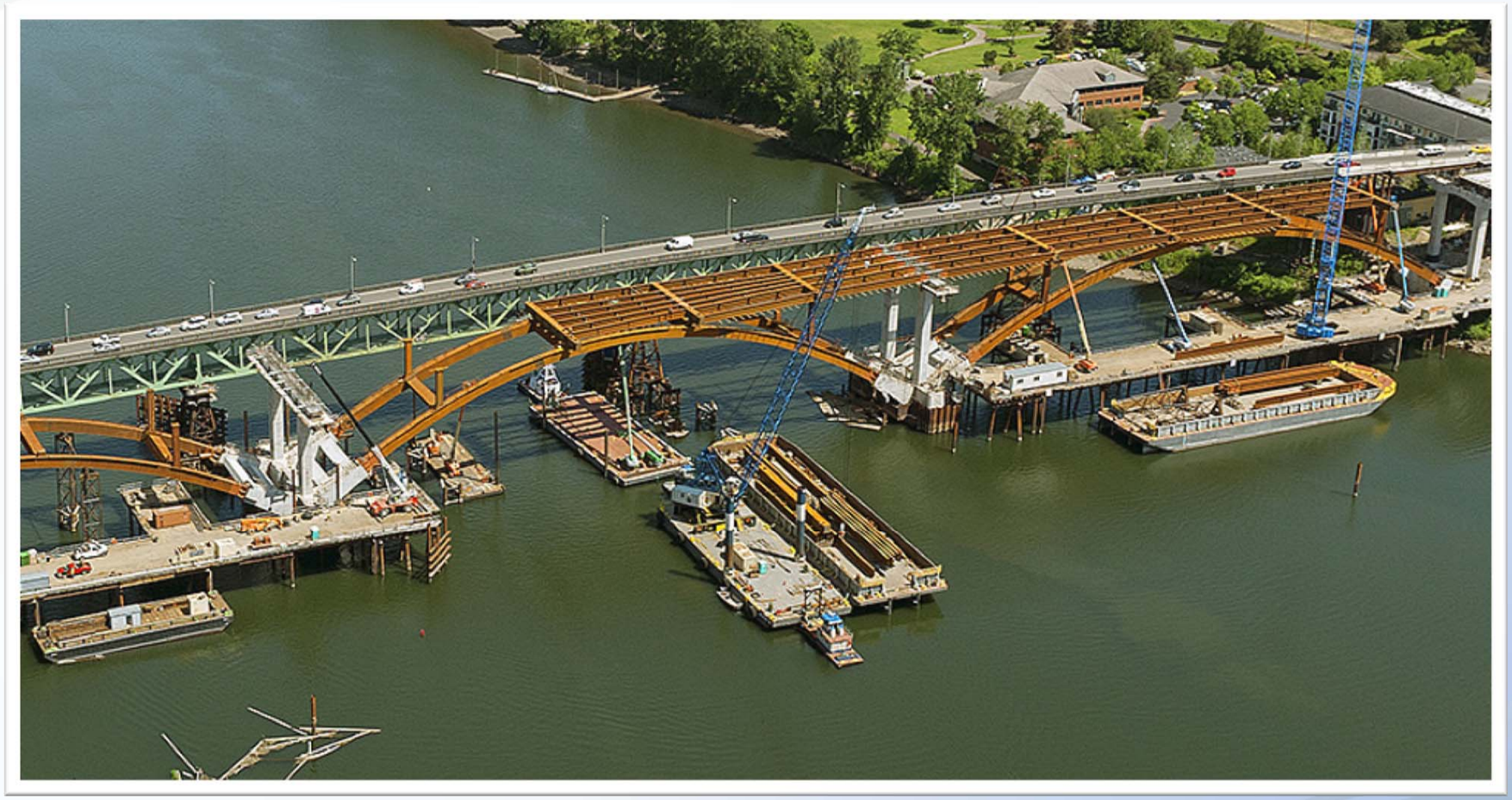


Construction Overview
Arch Bridge Focused

Construction Overview

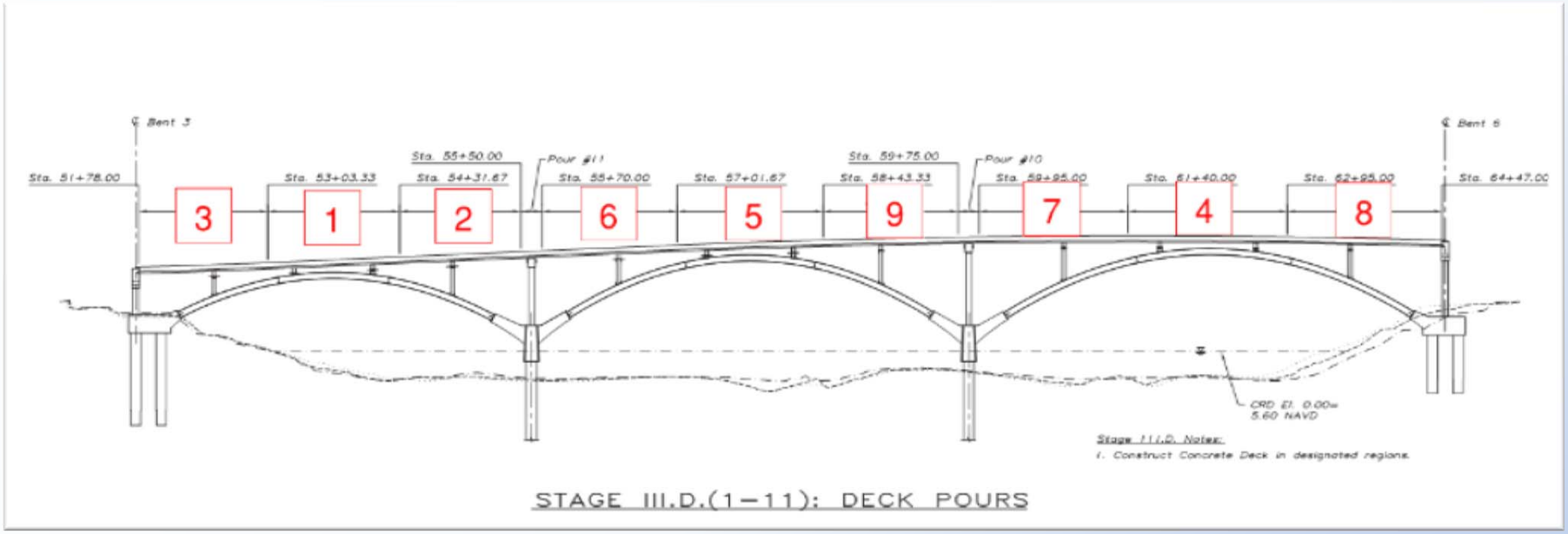
Construction Overview

Construction Overview



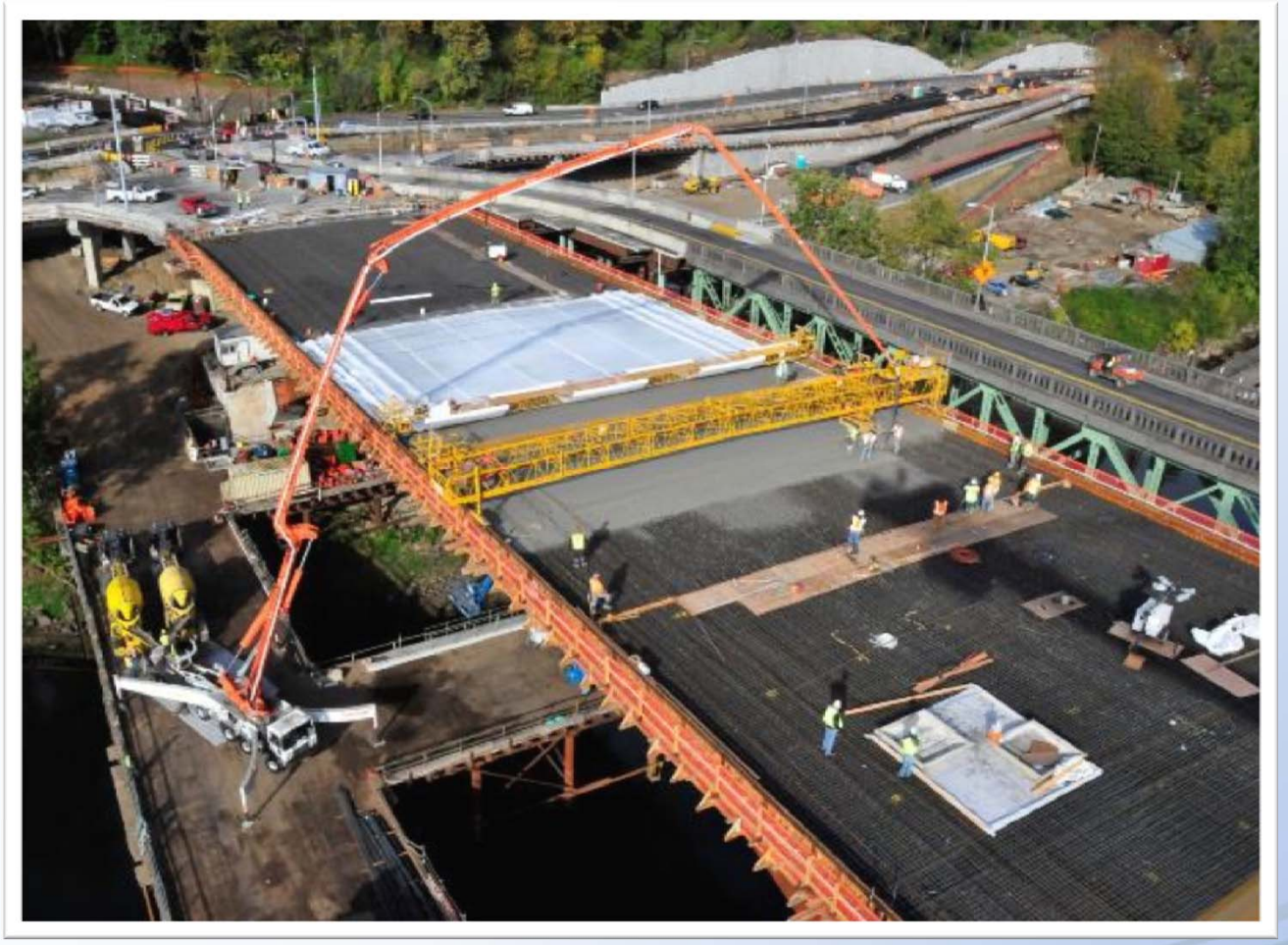
Construction Overview

Construction Overview

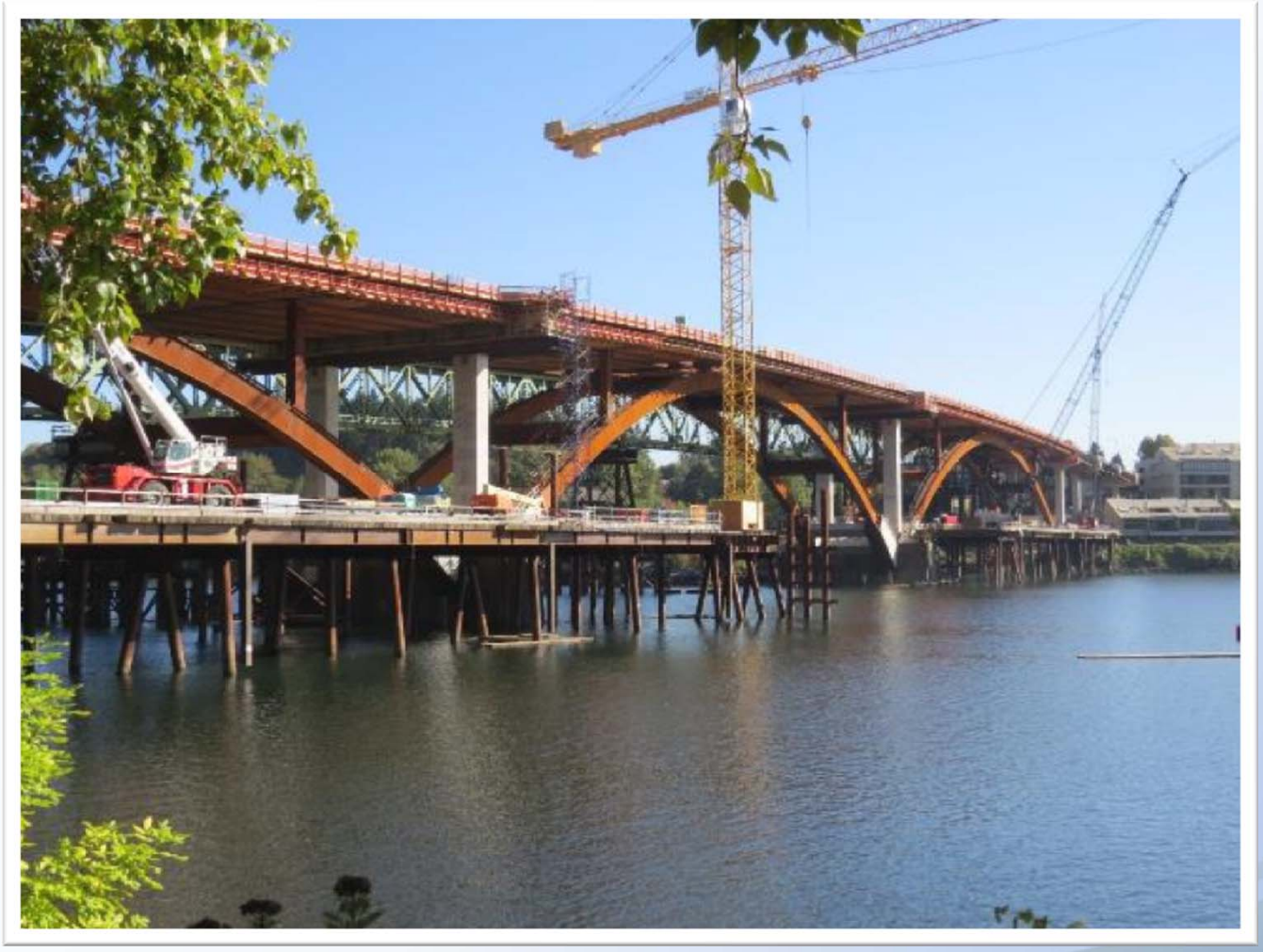


STAGE III.D.(1–11): DECK POURS

Construction Overview

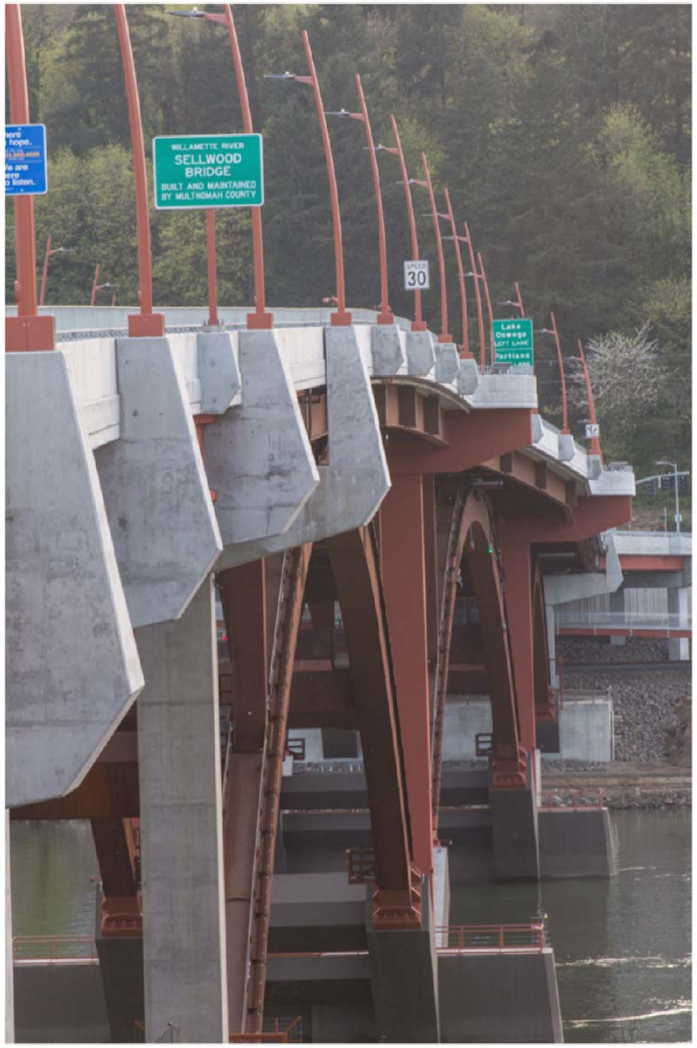


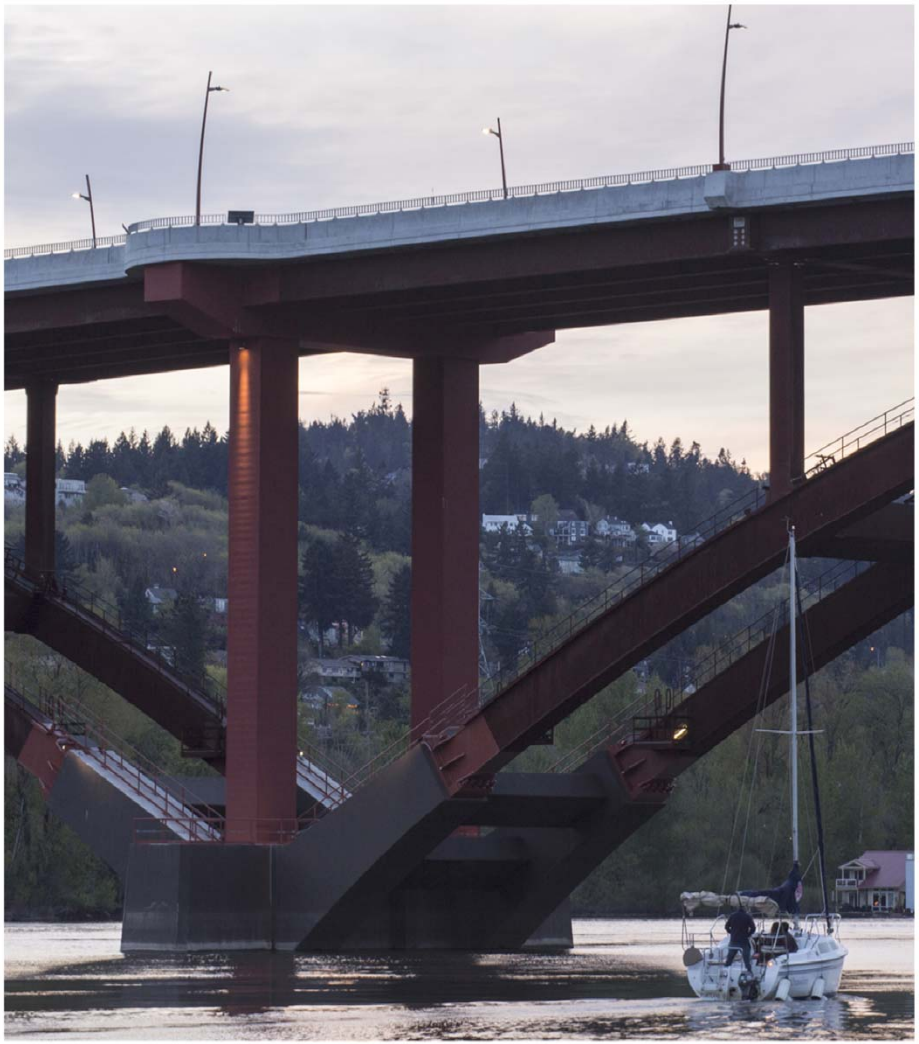
Construction Overview



Finished Product

Finished Product





Finished Product

Finished Product

Questions