SELLWOOD BRIDGE Project

MULTNOMAH COUNTY

Western Bridge Engineers' Seminar

The Shoo Fly

Sliding the Sellwood Bridge

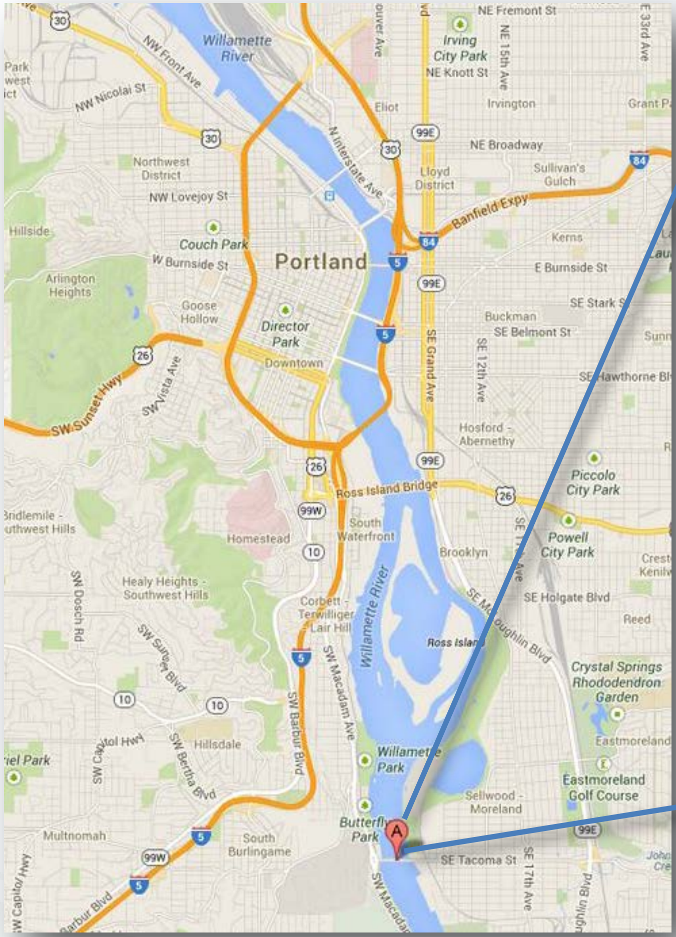
September 2013

Presenters:

Kenneth Huntley, Scott Nettleton, Anthony Calcagno

Project Overview

Replace existing 88 year old bridge with new Steel Deck Truss Span



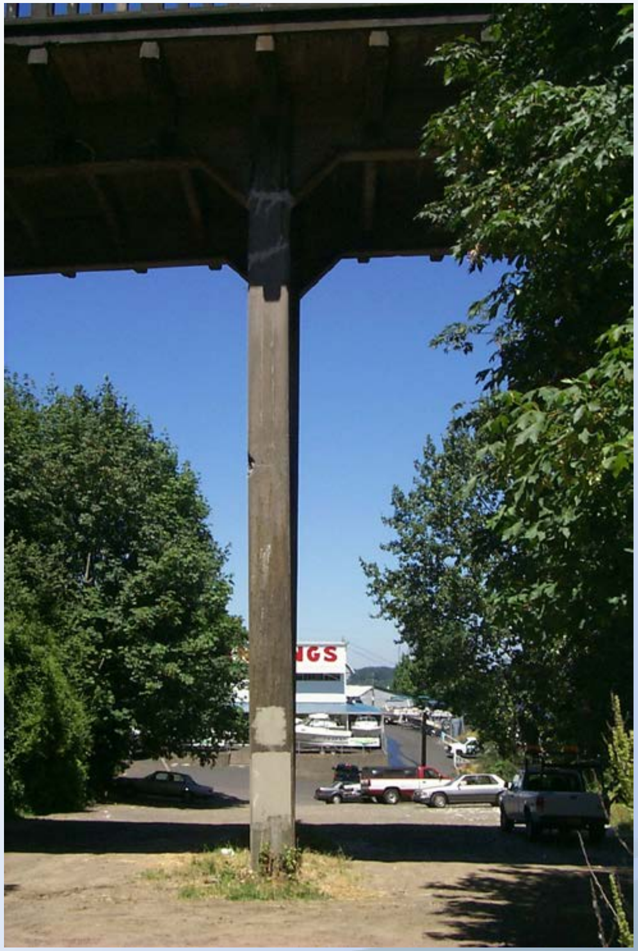
Existing Bridge
(looking north)

Heavy Cracking & Spalling

2004 Load Limit Change

West End Anchors added in the 60's

Column Twist



Building Encroaches on Bridge

Goals of "Shoo-Fly"

Provide Full Service Detour, Improved Safety, Speed Construction and Cost Savings

Approaches in Place Translated Truss

Construct Main Span

Option 1 - Stage 2, East approach first stage Construction

Complete East Approach

Option 1 - Stage 3, East approach
second stage construction

Finish Demolition

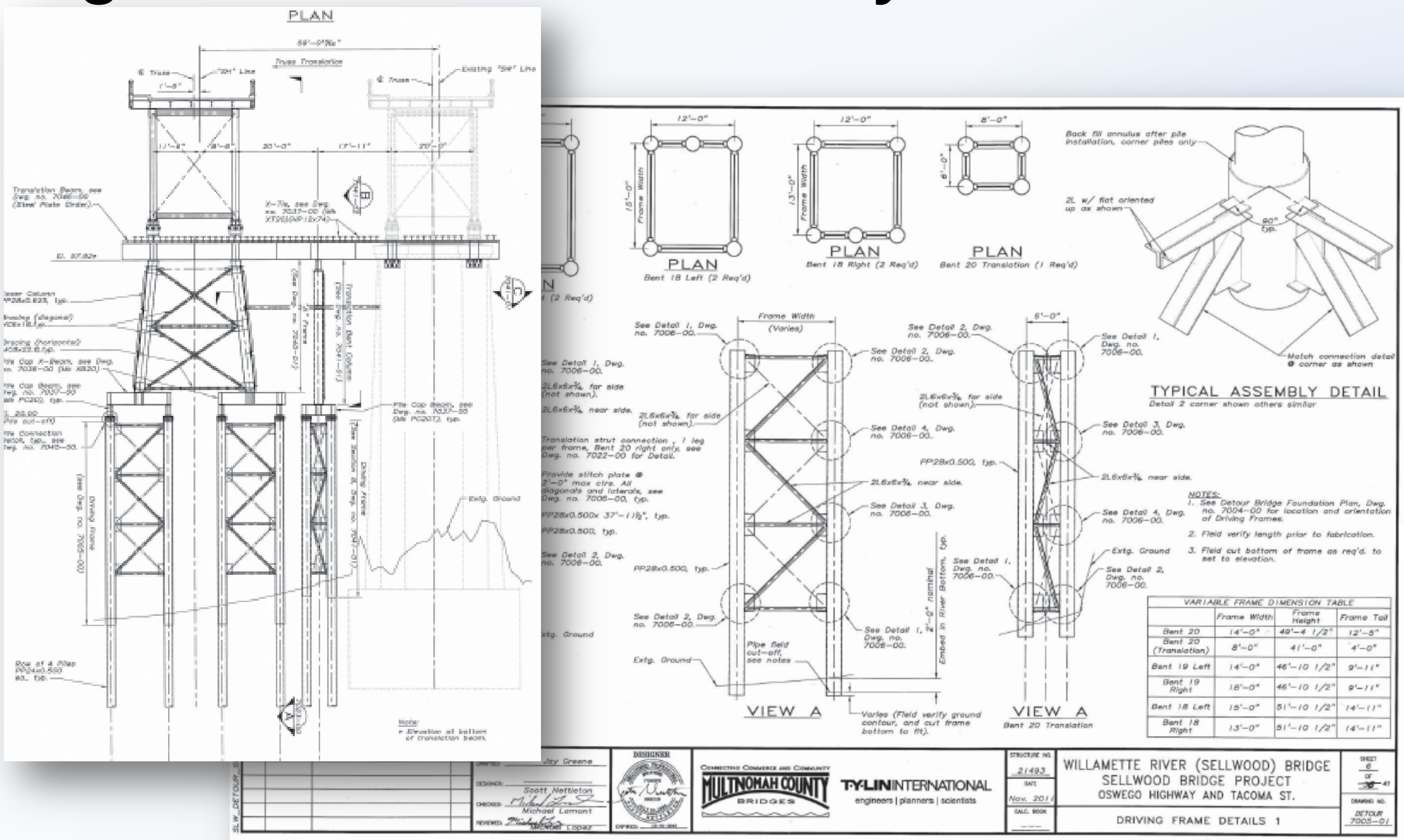
http://www.sellwoodbridge.org

Challenges for Engineering the Sellwood Shoo Fly

- Split responsibilities
  - Contractor Engineer provided approach structural designs
- Site impacts
  - Condos on NE side
  - Coordination with City and Permitting
  - Communication of Intent to Permitting Agencies
- Technical
  - Foundations
  - River flow, scour and flood
  - Seismic
  - Wind
  - Staging
  - Connection to old structure

Foundations

Driving Frames and Vibratory Pile Installation



River Flow, Scour and Flood

Where is the flow coming from?

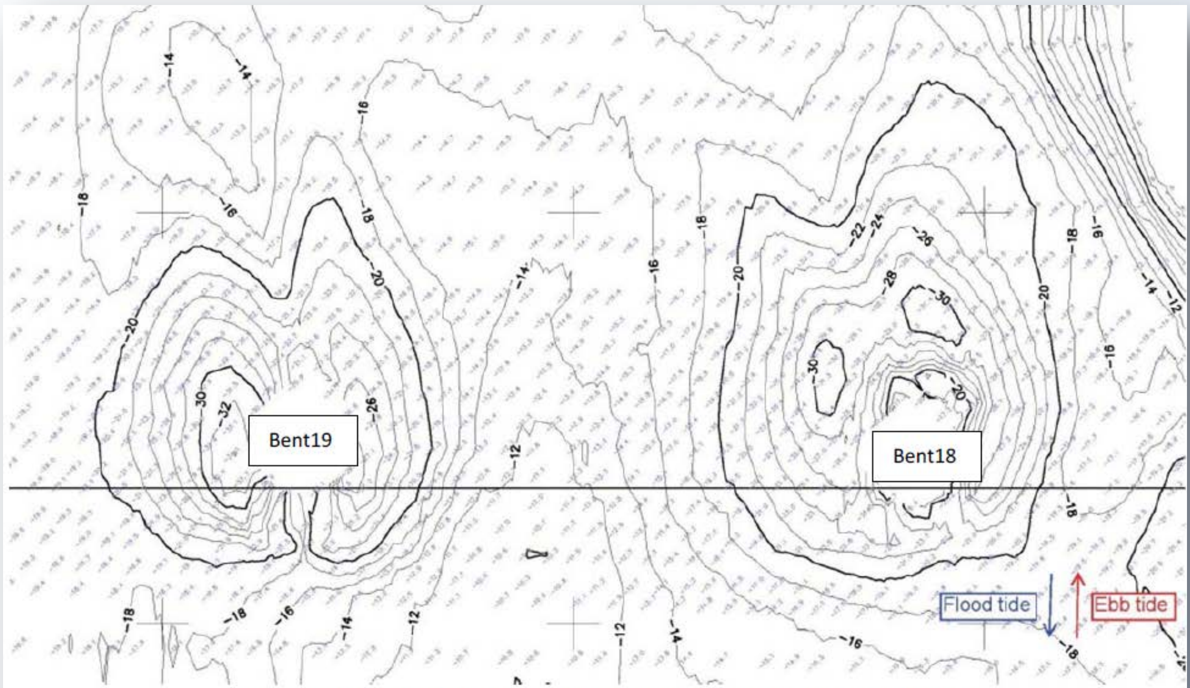


Figure 2. 2007 Hydrographic Survey of the Sellwood Bridge

Tidal influence causes most long term scour

River Flow, Scour and Flood

Modeling of Proposed Construction

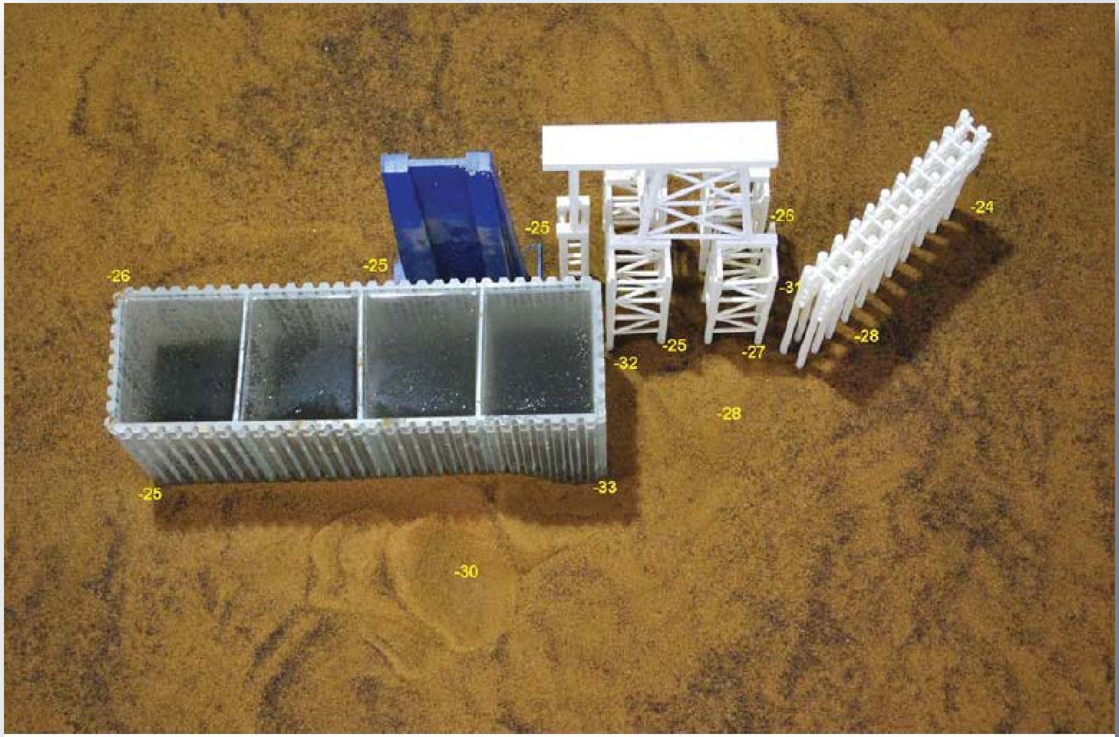
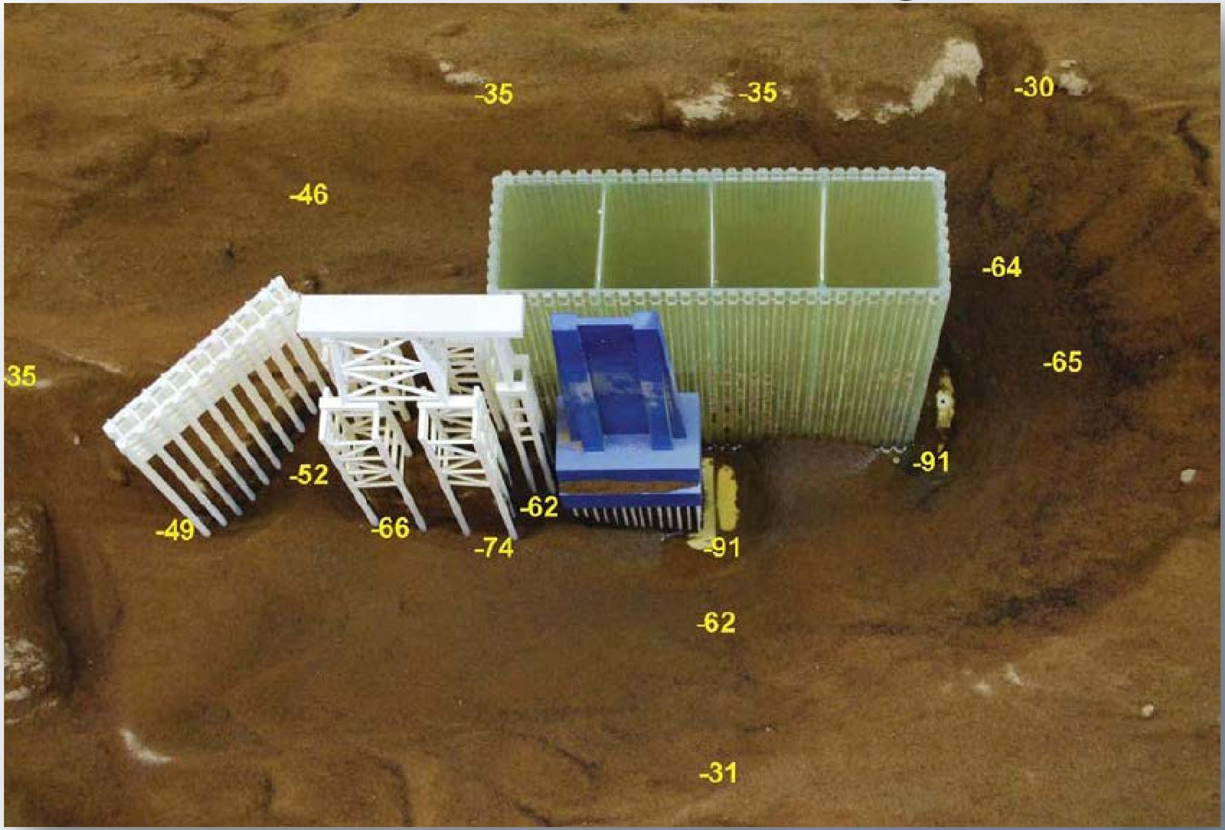


Photo 3. Flood-Tide Design Event Result (All Structures)

River Flow, Scour and Flood

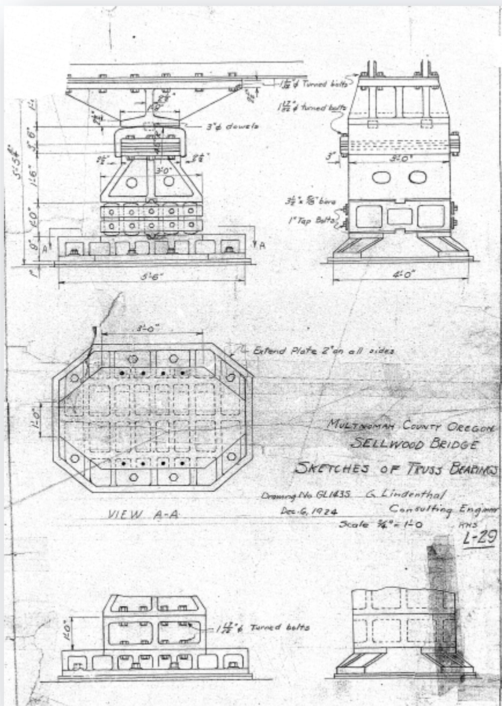
Extreme Event, Monitoring Installed

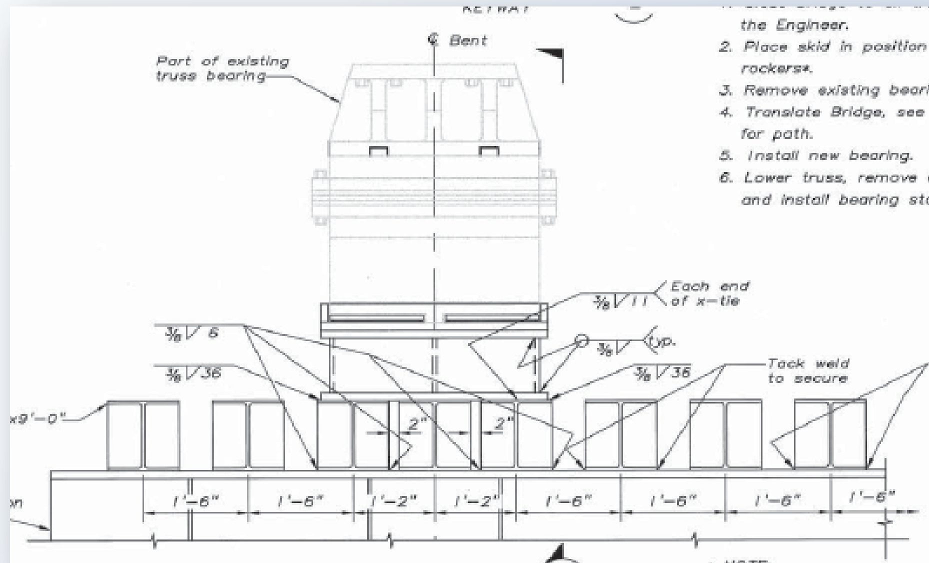


Seismic Design

Use of Existing Superstructure

Seismic Accelerations Reduced by 2.5 for Temporary Works

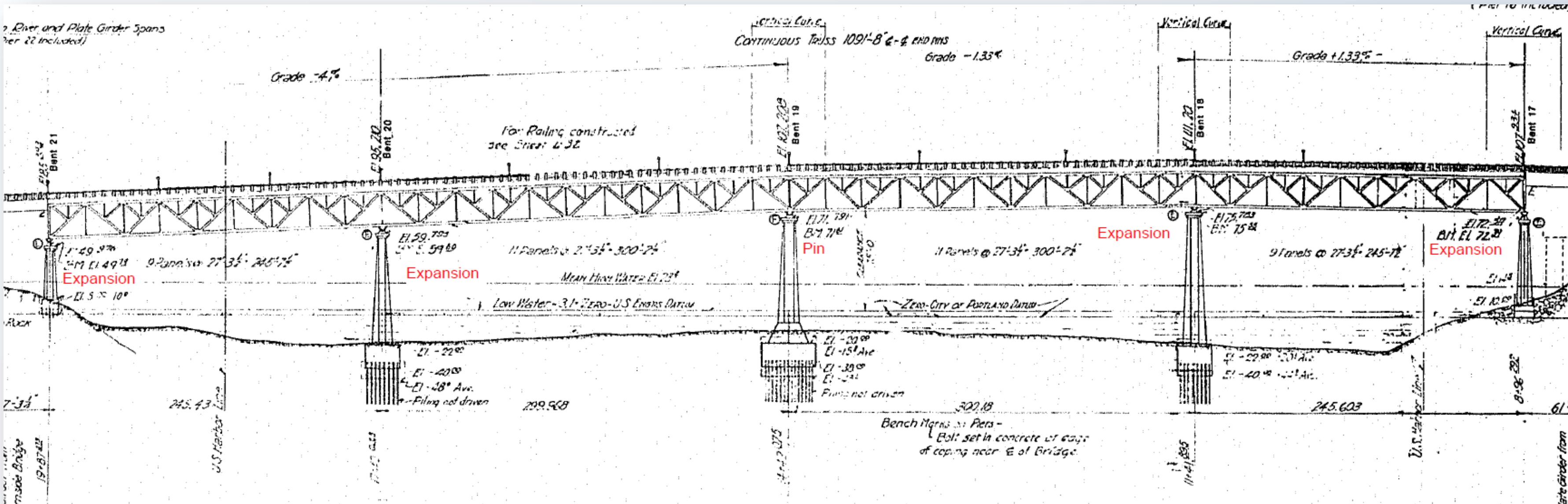




Transverse

Seismic Design

Use of Existing Superstructure



Longitudinal

Wind Loading

The Controlling Load

Period of Record...October 1940 - May 1999

	Climatic Averages		Extremes of Wind (1951-June 1999)							
			Highest Avg.		Fastest Mile[2]			Peak Wind Gust		
Month	*Dir.*	*Speed*	Speed	Year	Dir.	Speed	Year	Dir.	Speed	Year
Jan.	*ESE*	*9.9*	15.1	1995	S	54	1951	SW	63	1990
Feb.	*ESE*	*9.2*	12.2	1993	SW	61	1958	S	68	1965
March	*ESE*	*8.3*	10.9	1956	S	57	1963	S	71	1971
April	*NW*	*7.4*	9.3	1981	S	60	1957	S	63	1972
May	*NW*	*7.1*	8.6	1963	SW	42	1960	SW	48	1971
June	*NW*	*7.2*	9.1	1974	SW	40	1958	SW	40	1994, '97
July	*NW*	*7.6*	8.9	1962	SW	33	1983	SW	35	1983
Aug.	*NW*	*7.1*	8.7	1966	SW	29	1961	E	38	1966
Sept.	*NW*	*6.5*	8.0	1961	S	61	1963	SW	61	1963
Oct.	*ESE*	*6.5*	8.4	1975	S	88	1962	S	104[3]	1962
Nov.	*ESE*	*8.6*	11.2	1979	SW	56	1961	S	71	1981
Dec.	*ESE*	*9.5*	12.9	1977	S	57	1951	S	74	1995[4]
Annual	*ESE*	*7.9*	8.8	1995	S	88	Oct 1962	S	104[3]	Oct 1962

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WIND STUDY
WILLAMETTE RIVER TRANSIT BRIDGE
PORTLAND, OREGON
FINAL REPORT

for

T. Y. Lin International

Job No. 10-03

9 August 2011

by

Jon D. Raggett, PhD, PE
President, West Wind Laboratory, Inc.

REGISTERED PROFESSIONAL ENGINEER
JON D. RAGGETT
No. 2247
STRUCTURAL
STATE OF CALIFORNIA

exp 12/31/11

Historical Data, Comparison with Topography

Conclusion - 65 MPH Design Wind Speed

Staging

Working Around Landslide Mitigation

Additionally, the bridge width and the existing bridge rail do not meet current standards for a detour bridge

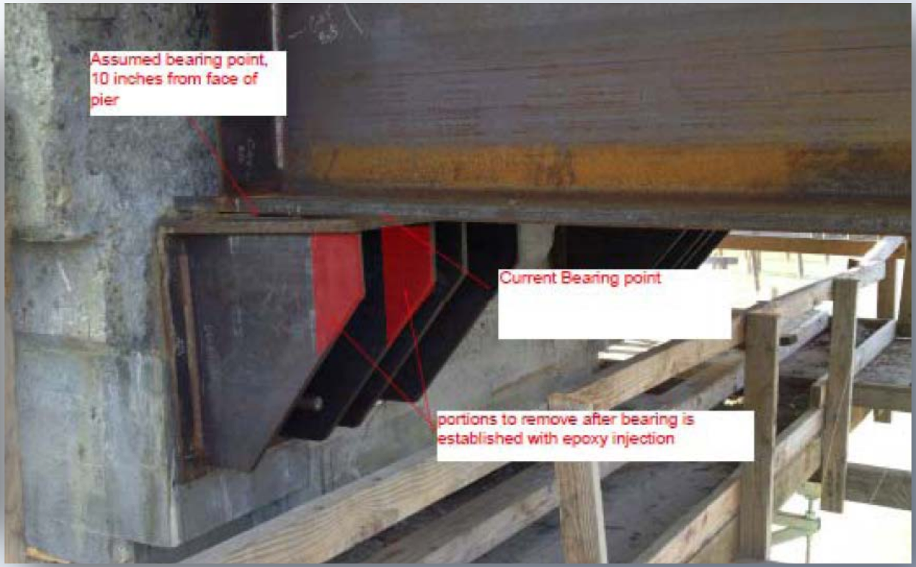
Connections to Existing

Material Properties, Geometry

Testing results are for Informational Purposes only.

Specimen number	CH-2-1	CH-2-2	CH-3-1	CH-3-2
Location (Top of Core Depth)	1'3" to 1'11"	2'7" to 3'3"	0'0" to 0'8"	1'11" to 2'7"
Date tested	05/27/08	05/27/08	05/27/08	05/27/08
Nominal Maximum Aggregate Size	1 ½"	1 ½"	1 ½"	1 ½"
Length of specimen prior to capping	7.13	7.20	7.21	7.21
Length of specimen after capping	7.25	7.32	7.33	7.39
Direction of load in respect to	P	P	P	P
Moisture condition at time of testing	Surface Dry	Surface Dry	Surface Dry	Surface Dry
Average diameter of core specimen	3.66	3.66	3.66	3.66
Length to diameter ratio (l/d) *	1.98	2.00	2.00	2.02
Applied load at specimen failure (lbs)	72961	80508	61293	73125
Specimen area (sq. in.)	10.52	10.52	10.52	10.52
Uncorrected unit psi	6935	7653	5826	6951
Strength correction factor *	---	---	---	---
Corrected unit psi (nearest 10 psi)	6940	7650	5830	6950

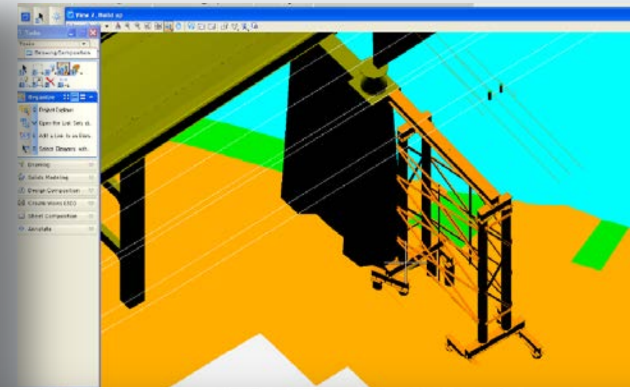
P - Perpendicular *Specimen correction factor applied when length to diameter ratio falls below 1.8.

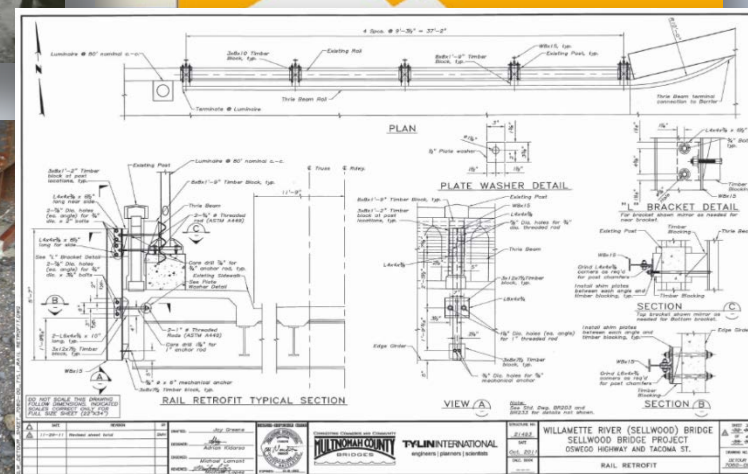


Information gathering, corrections at final Inspection

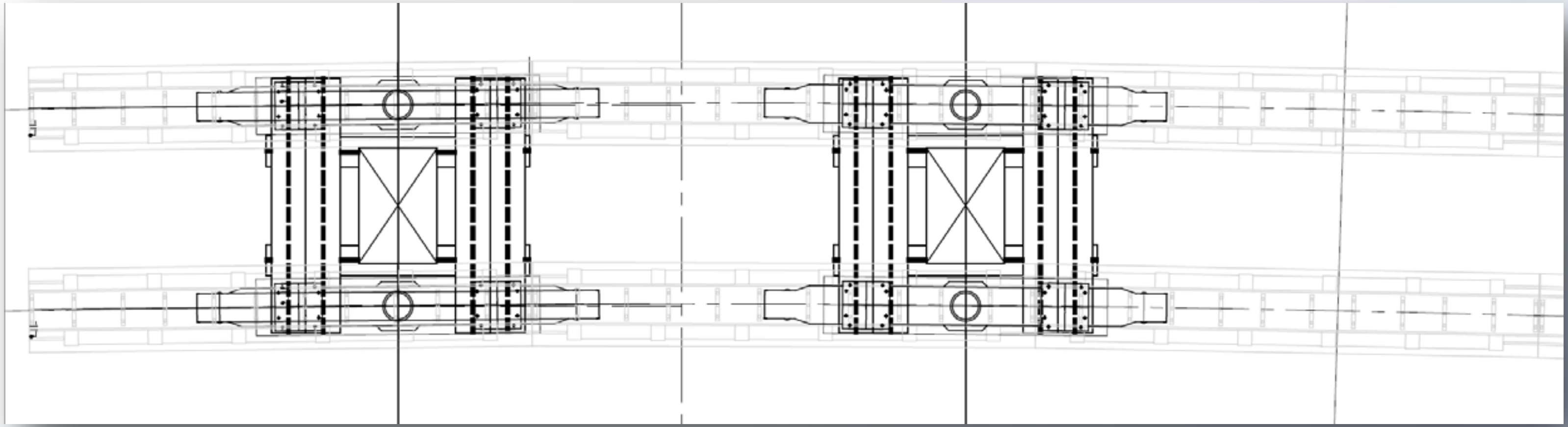
More Stuff

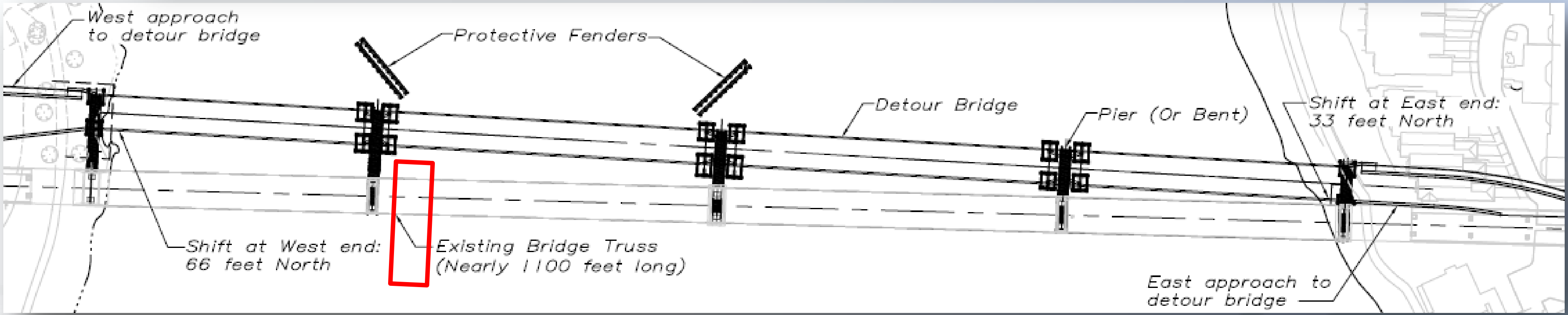
- Collision Fender
- Guard Rail Transition
- Piling Conflict Bent 17
- Support at Bent 21
- River Isolation
- Lighting





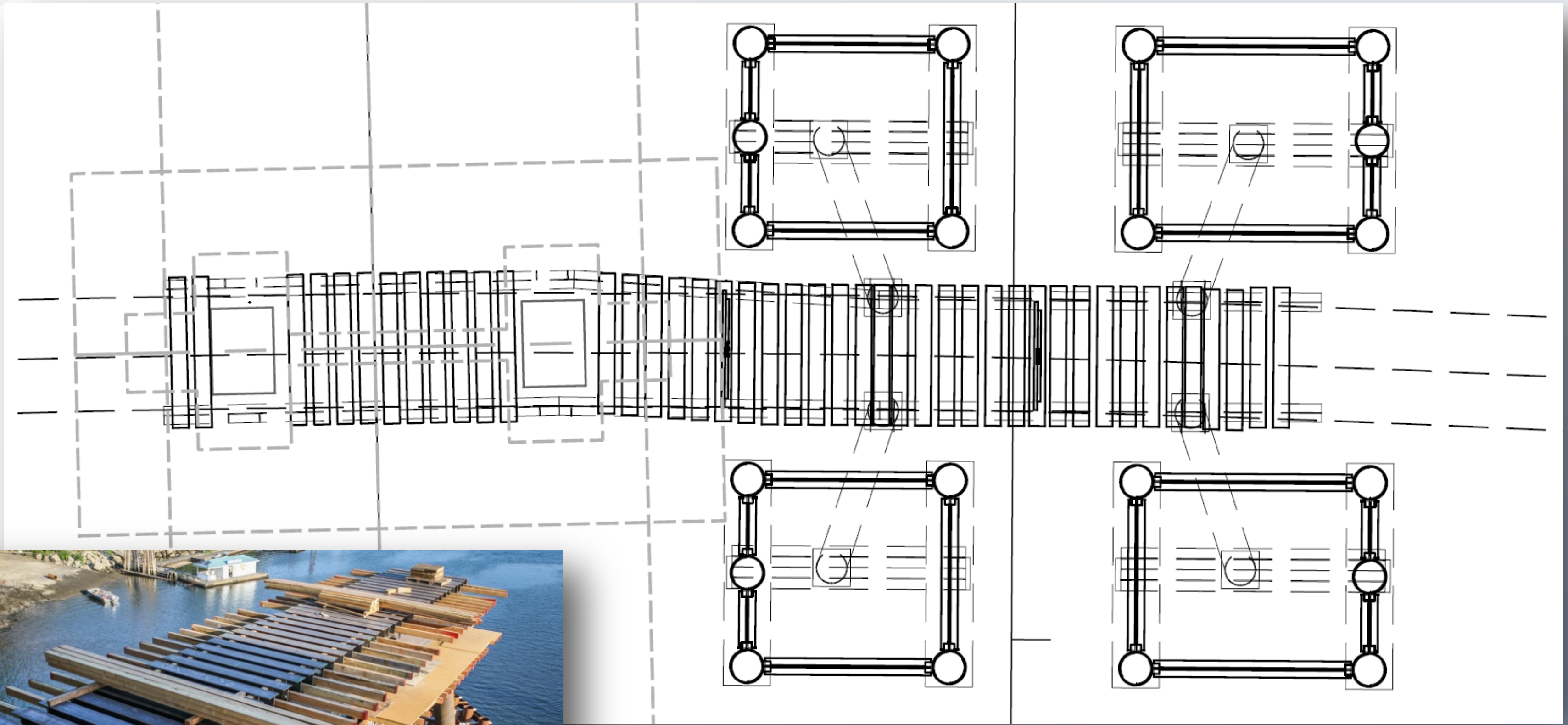
Truss Jacking System
Layout on a Radius





Original design assumed single support track

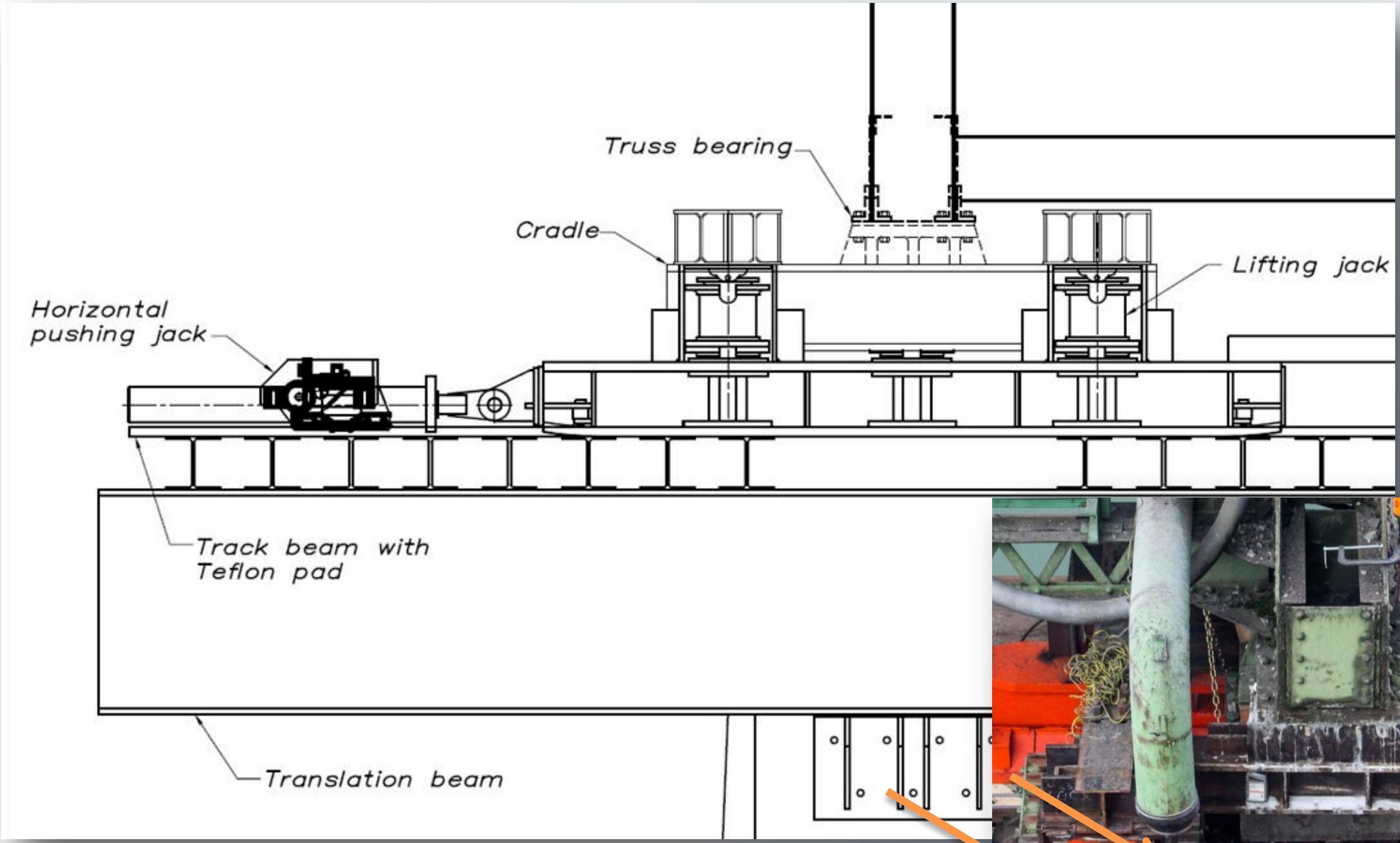
Truss Translation Layout



Layout of translation path was critical

Truss Cradle Design

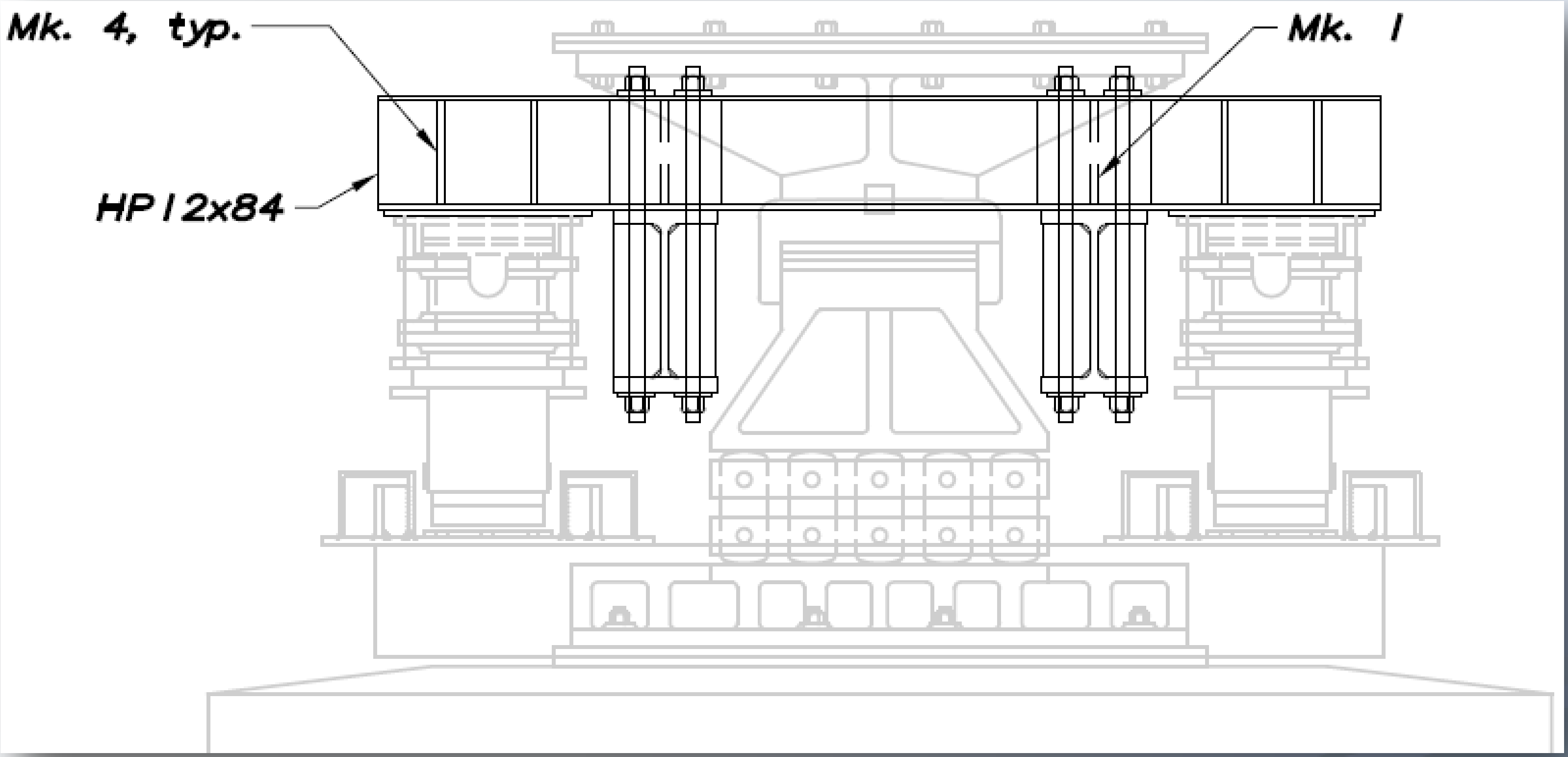
Support Bearing Across Skid Beams



Vertical plates in case of jack failure

Cradle Beam Challenges

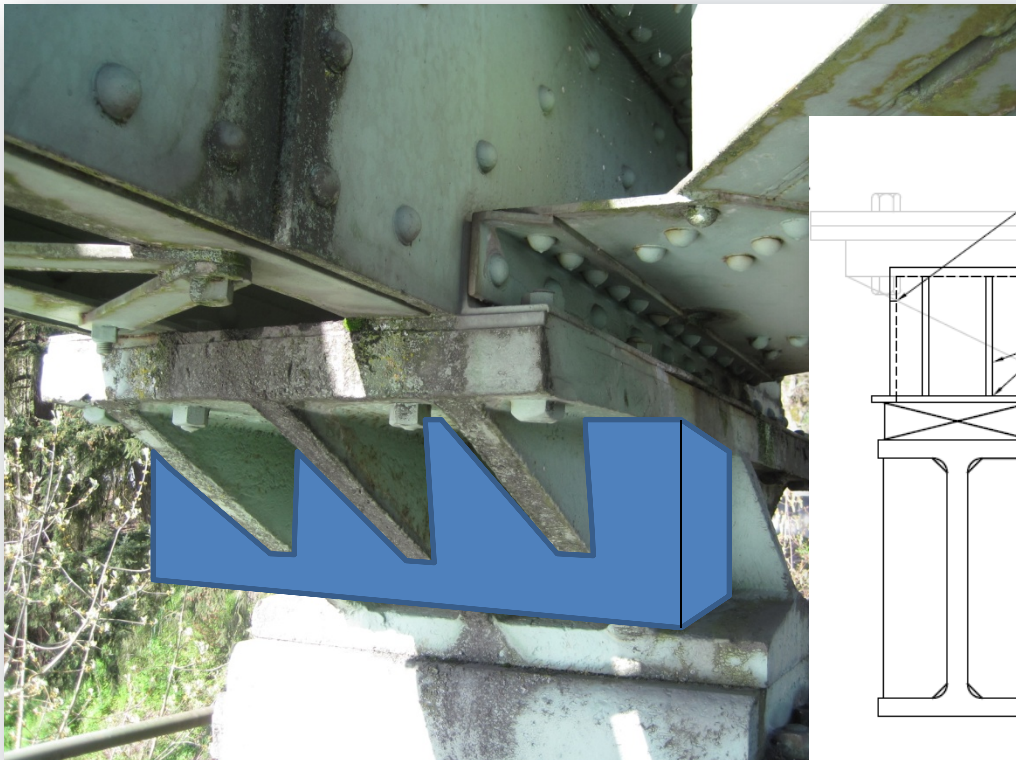
Fitting Beams into Tight Spaces

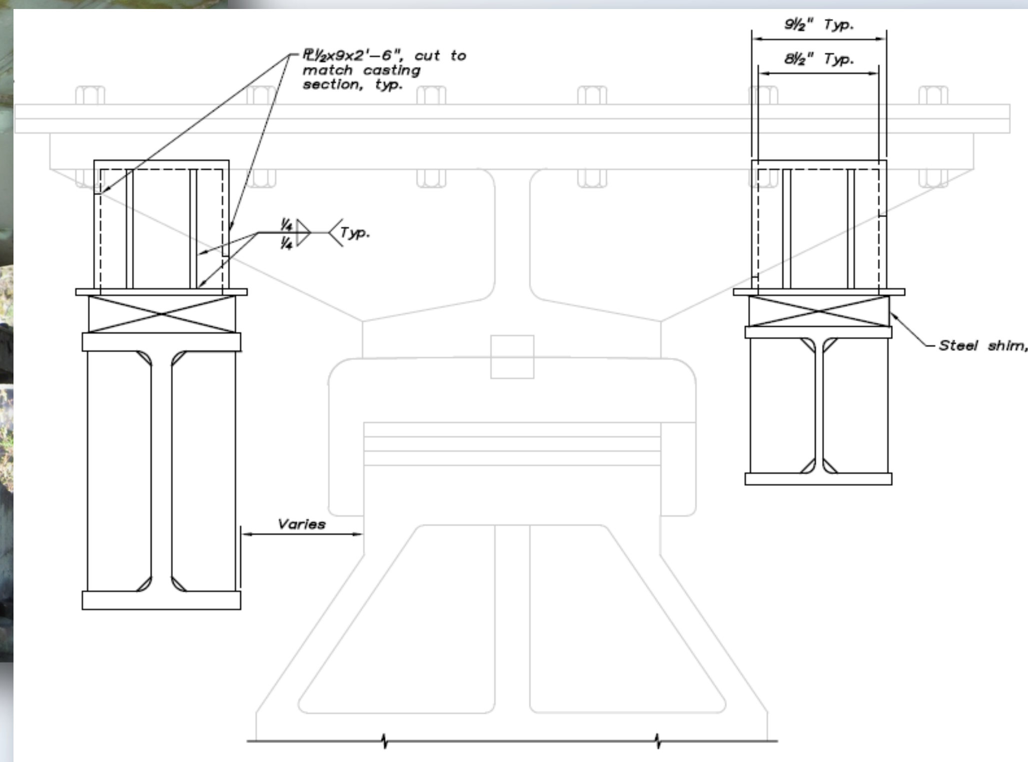


Temporary Bearing

Steel Box Filled with Grout

Truss chords unable to take load

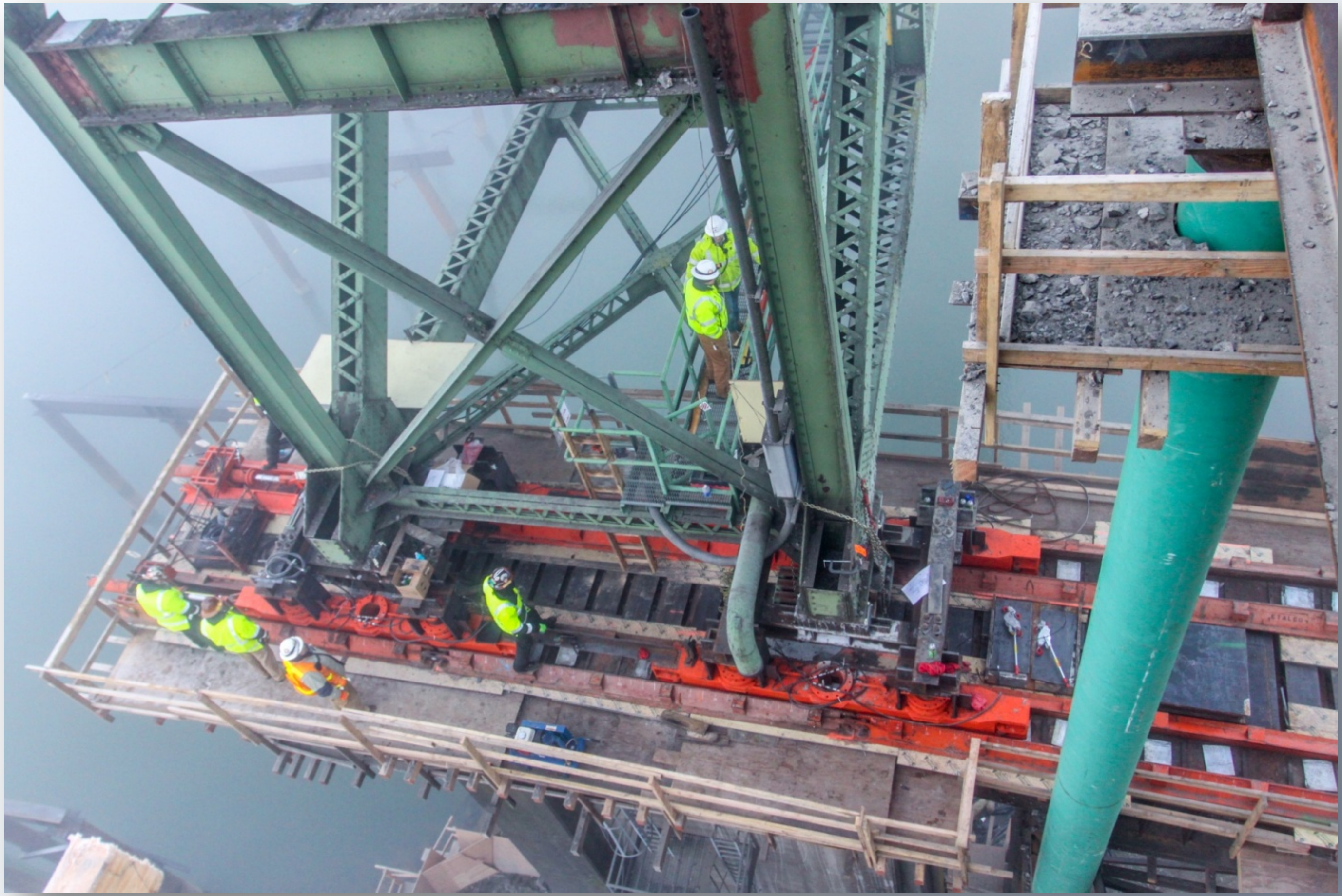




Sides cut to fit irregular shape of the bearing casting

Photos of the Slide

Photos of the Slide Cont.



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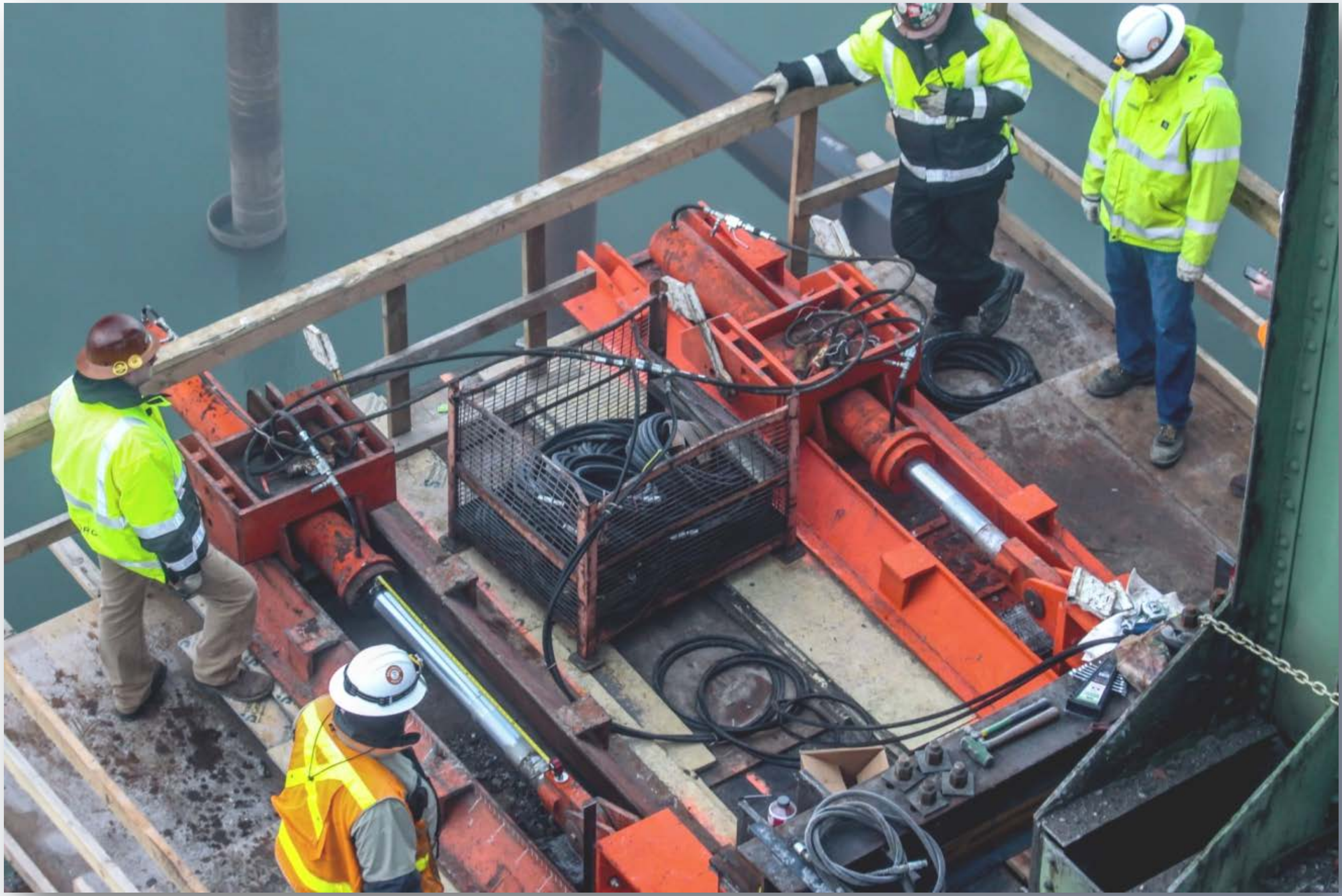

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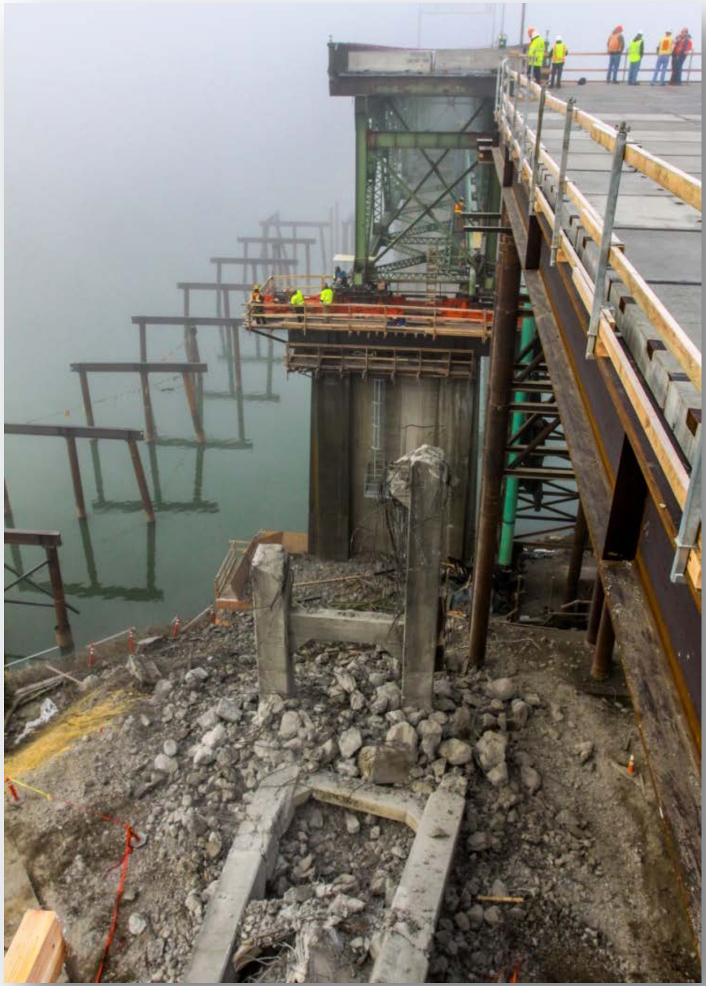

Lessons Learned

- Leave a little extra space for field fit
- Coordination and planning paid off
  - Closure schedule was met
  - Opened 15 hours early
  - Public was well-informed = good press

Credits

Owner: Multnomah County

Engineers: T.Y. Lin International (*Main Span Bridge*)

CH2M HILL (*Roadway & Geotechnical*)

McGee Engineering (*Approach Bridge*)

Prime Contractor: Slayden-Sundt Joint Venture

Slide Subcontractor: Omega Morgan Inc.

Quick Facts:

Truss Length = 1,091 feet

Truss Weight = 3,400 Tons

Time to Slide = 13 hours


Any Questions