

# Sellwood West Approach Interchange Bridge

## Design Challenges and Project Delivery



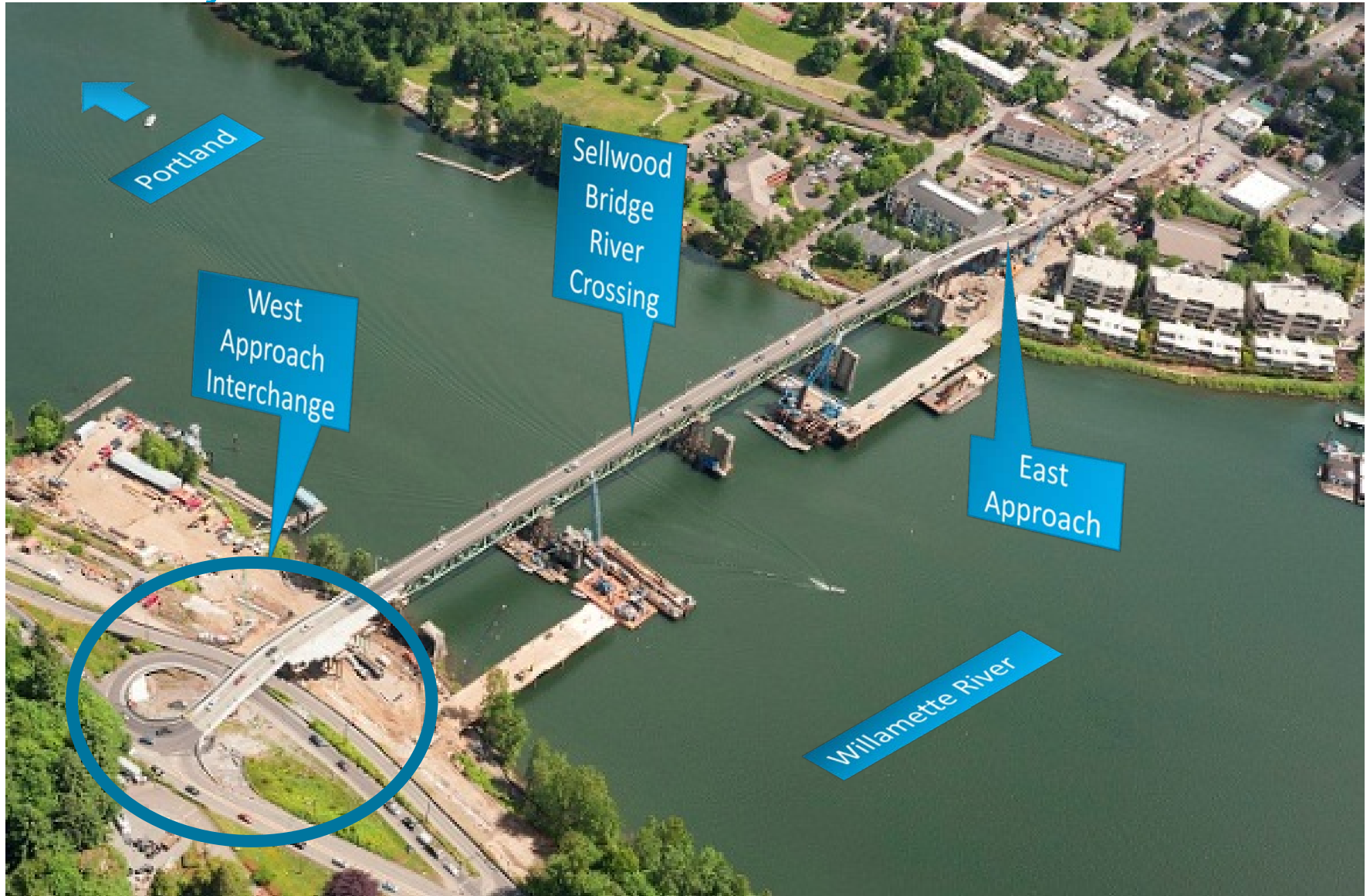
**ch2m.**  
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# Overview

- Sellwood Bridge Background
- Landslide Mitigation
- Seismic Analysis
- Drilled Shaft Design
- Cast in Place Girders and Deck Flare
- Future Streetcar Loading
- Shared Bent Cap Design
- Construction

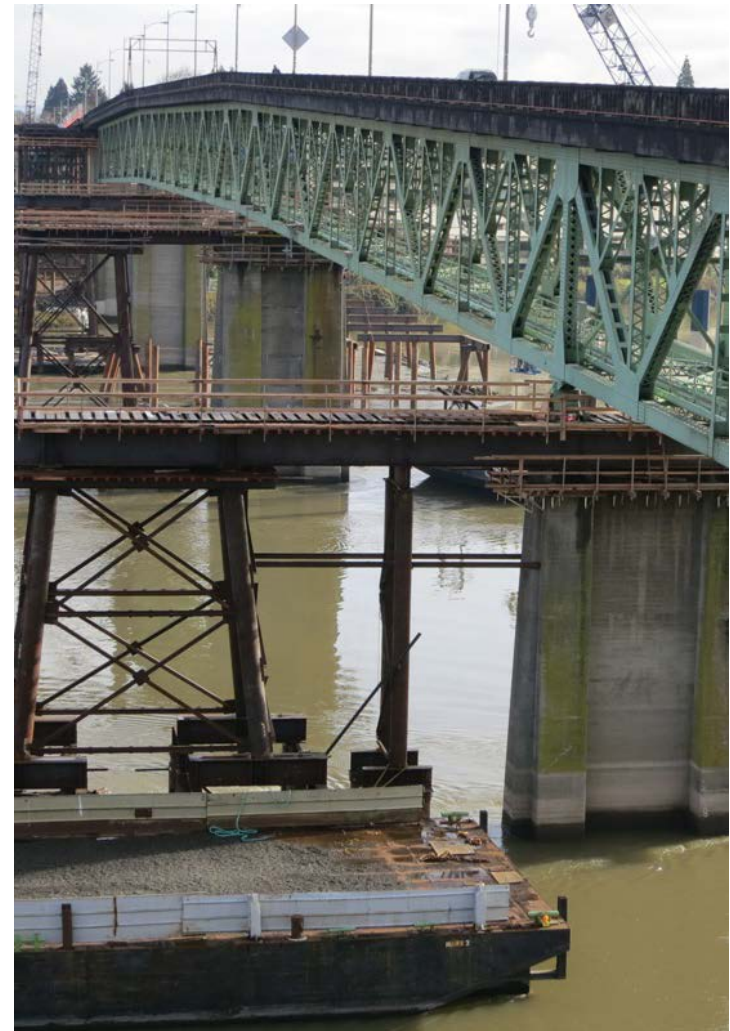


# The Project Site

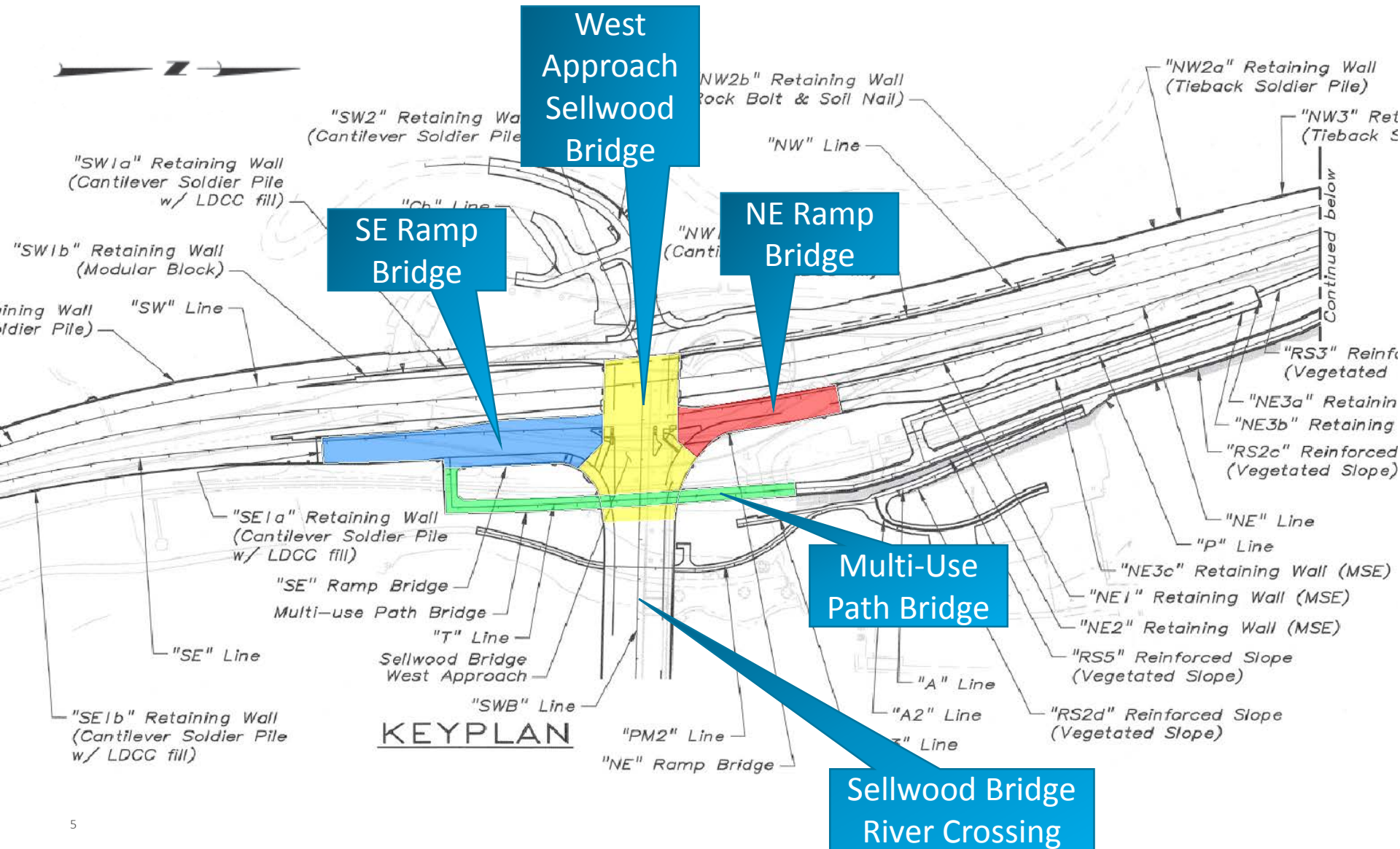


# Sellwood Bridge Background

- Opened on December 15, 1925
- The Busiest Two-Lane Bridge in Oregon
- Sufficiency Rating: 2 out of 100
- Weight limit reduced to 10 tons in 2004
- Bridge Replacement Currently Underway
- Cost: Approx. \$310 Million



# West Approach Interchange



# Landslide Impacts

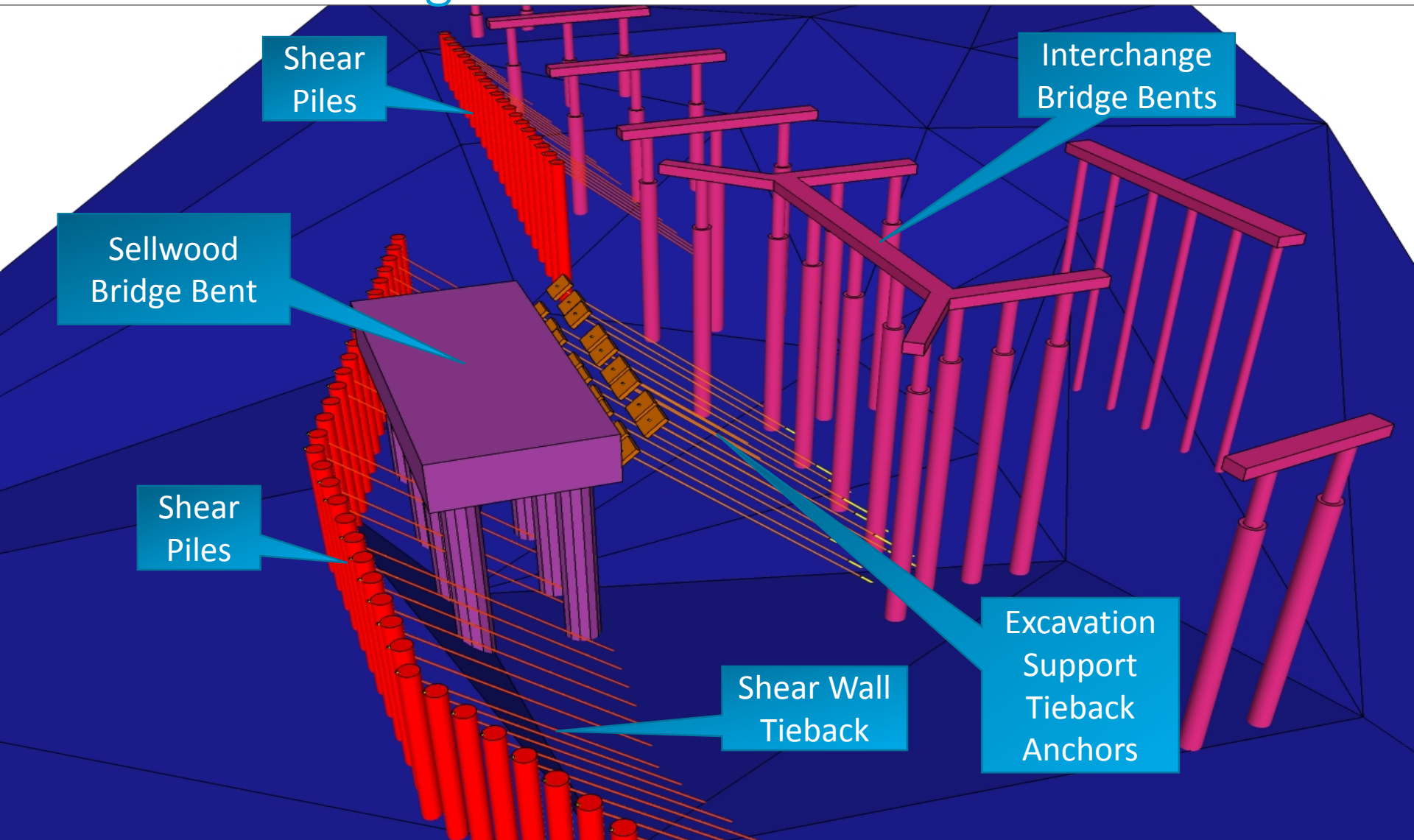


# Landslide Background

- Landslide movement of 2 to 5 feet between 1925 and 1960
- In 1960, piers west of river observed to be extremely out of vertical due to slide movement
- Portions of upper landslide debris excavated to reduce load on slope
- CH2M HILL began landslide monitoring program in January 2007
- Landslide has moved an average of 0.1 to 0.2 inches per year since 2007

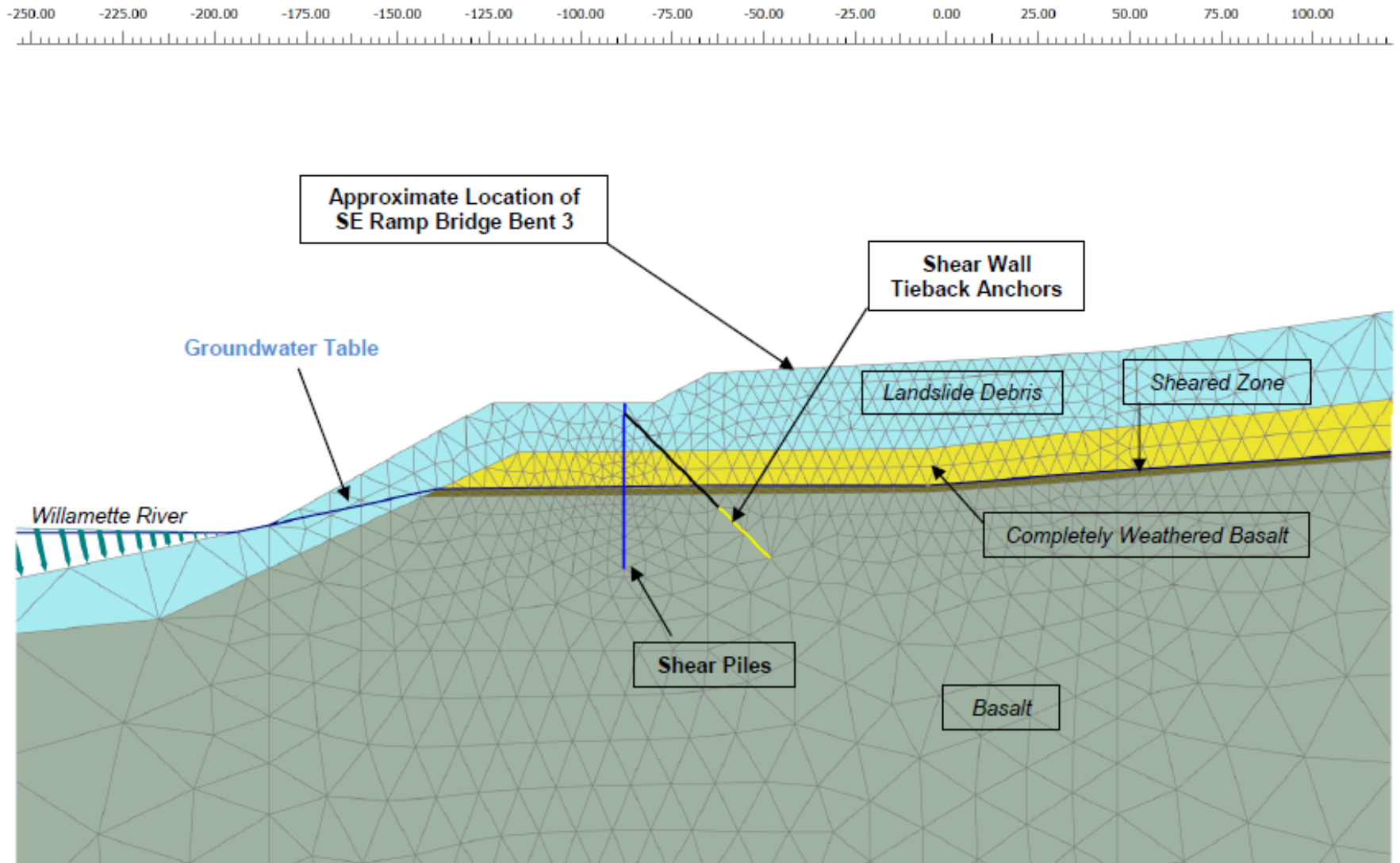


# Landslide Mitigation





# Global Landslide Stability Analysis



Elevation (ft)

# Predicted Seismic Landslide Movement

- 3 to 6 inches of movement during 1000 year design event
- Predicted movements are AFTER landslide mitigation
- Varying degrees of movement across all piers
- Some piers are located outside of landslide zone

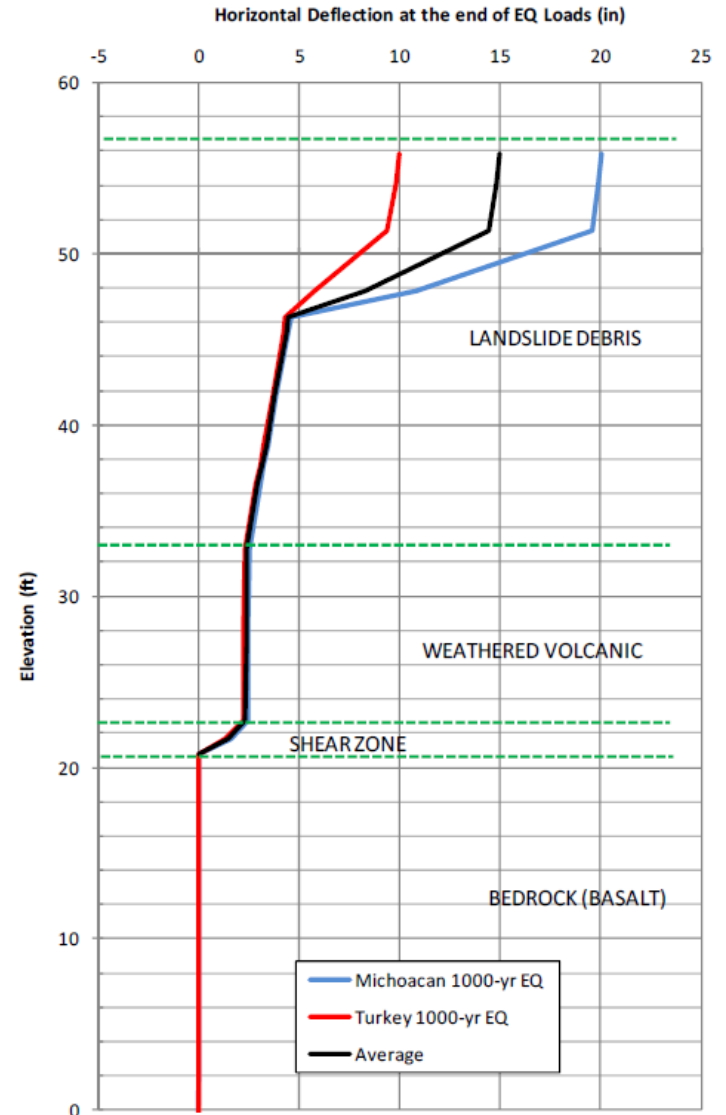
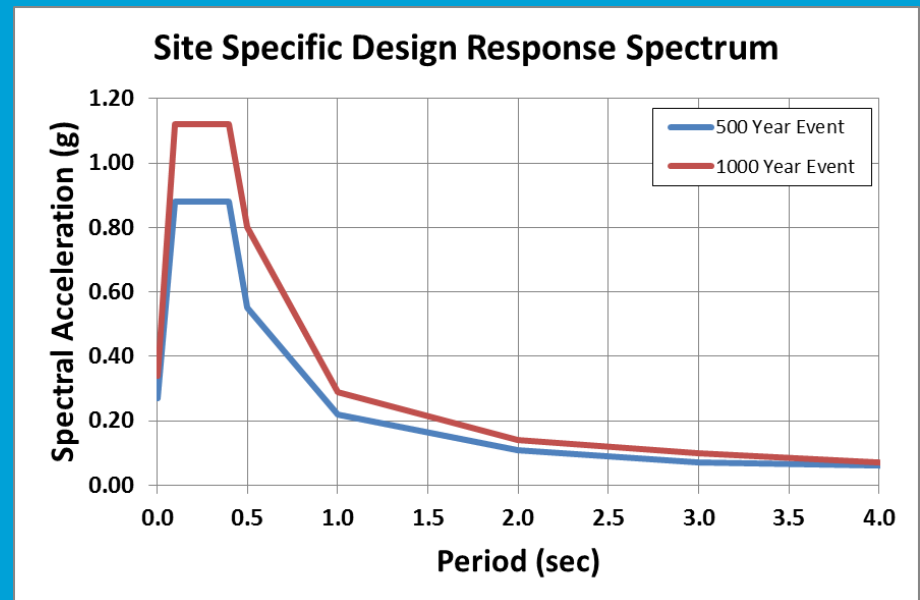


FIGURE 9b Horizontal Displacement Profile at the Location of SE Ramp Bridge Bent 3 (1,000-yr EQ)

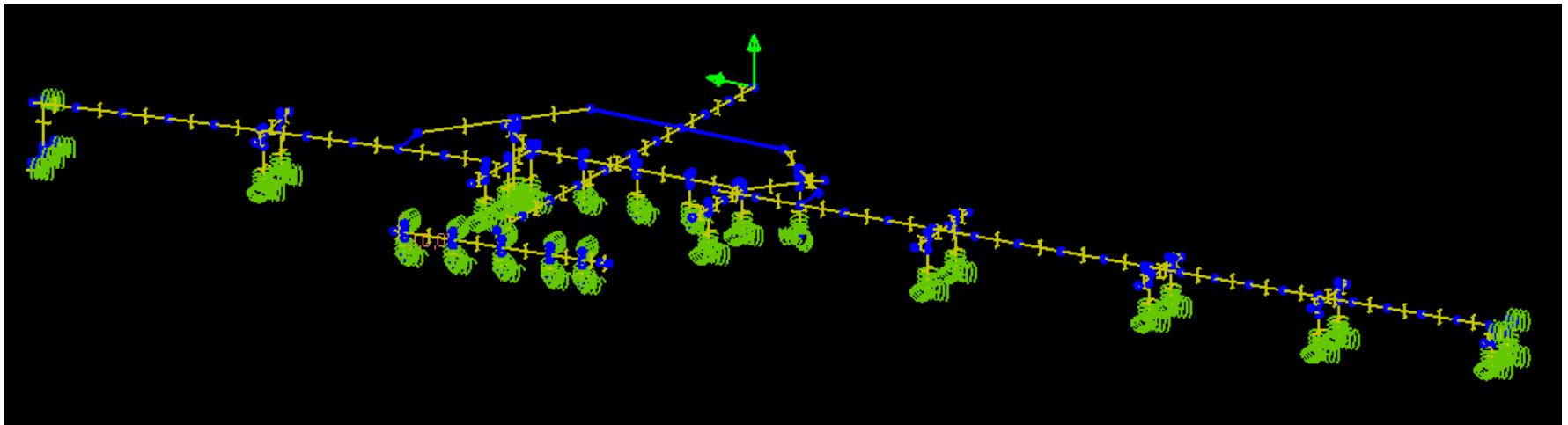
# Seismic Design Criteria

- AASHTO Guide Specifications for LRFD Seismic Bridge Design and ODOT Bridge Design & Drafting Manual
- SDC D due to “liquefaction-induced lateral spreading or slope failure that may impact the stability of the bridge” per AASHTO Guide Specifications for LRFD Seismic Bridge Design
- Two-level performance criteria
  - 1000-year “no collapse”
  - 500-year “serviceable”
- Site specific response spectrum



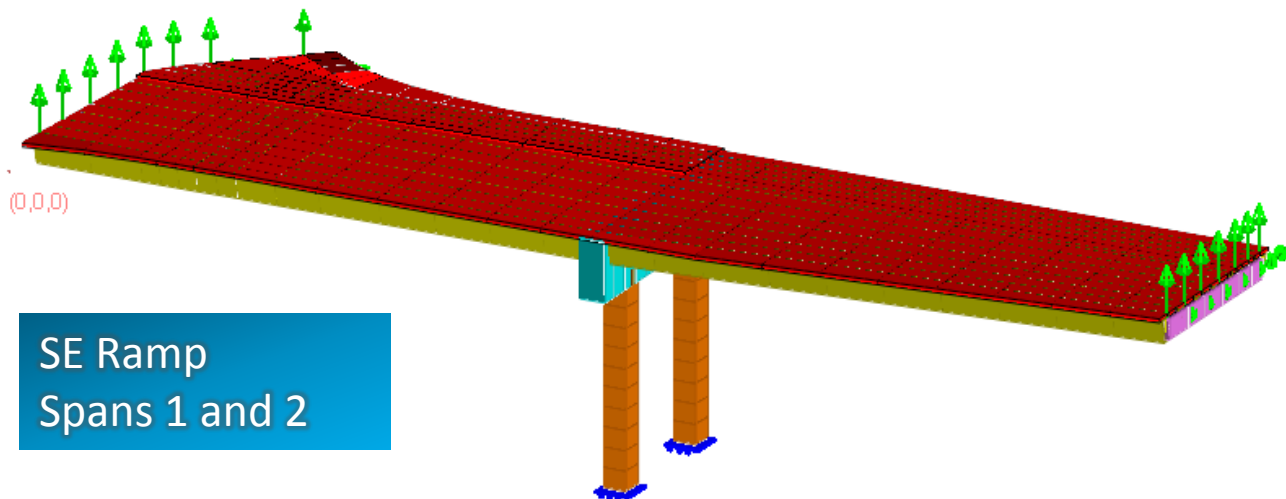
# LARSA Seismic Modeling

- Prestressed concrete girder superstructure
- Drilled shaft foundation
- Linear response spectrum analysis
- Nonlinear static pushover analysis
- Linear translation and rotational springs at the top of each drilled shaft



# LARSA Seismic Modeling

- Many models created to bound anticipated response:
  - 1000 and 500 year events
  - Expansion joints “closed” or “open”
  - Passive soil resistance activated by abutment back wall movement
  - Upper bound and lower bound soil parameters
  - Oversized shafts with permanent casing
  - With and without landslide



# Concrete Drilled Shafts

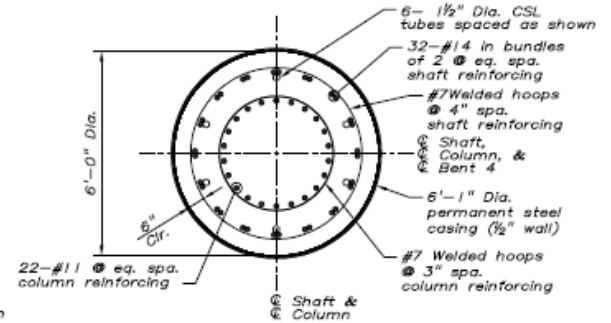
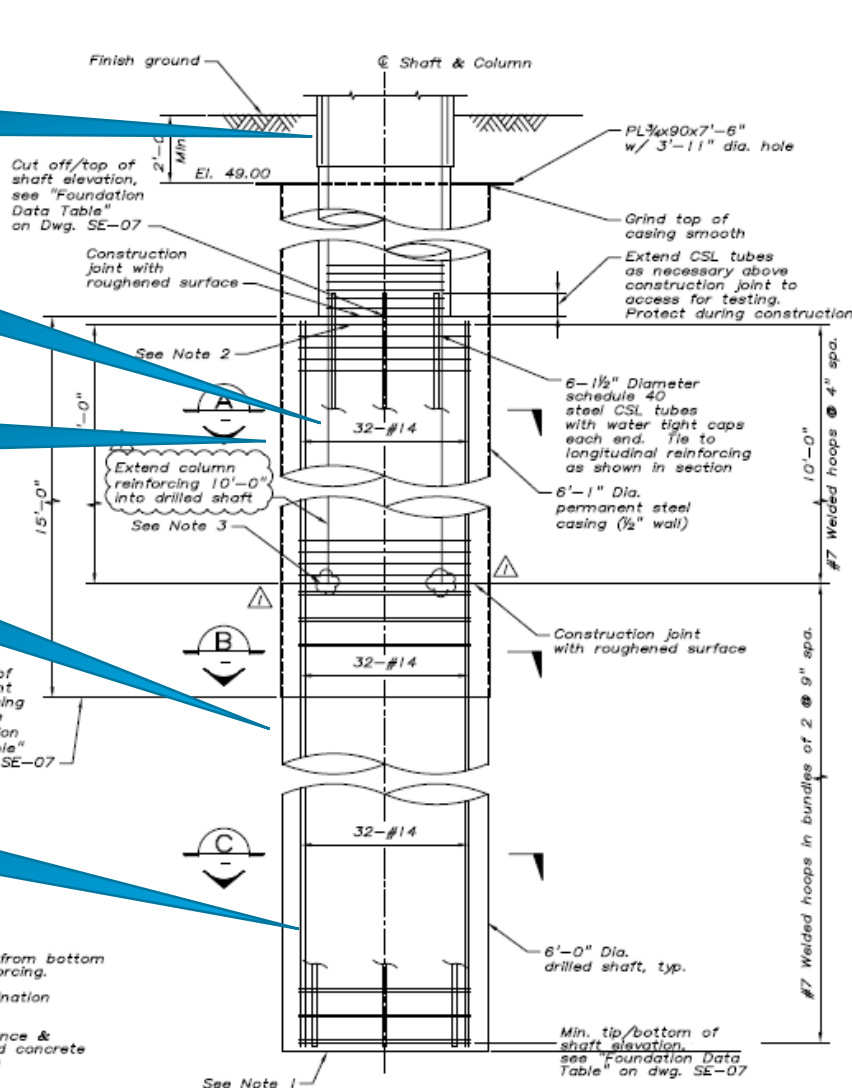
4' Square  
Column

Non-contact  
lap splice

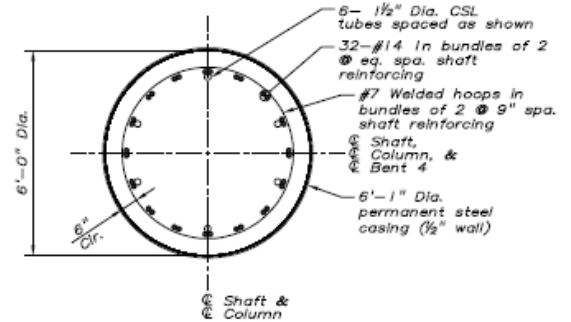
Permanent  
Casing

6' Diameter  
Shafts

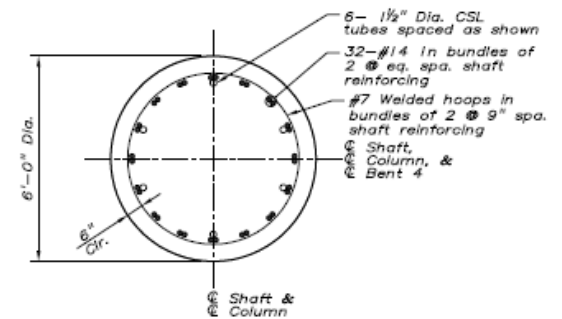
ASTM A706  
80ksi Rebar



**SECTION A**  
SCALE: 1/2" = 1'-0"



**SECTION B**  
SCALE: 1/2" = 1'-0"



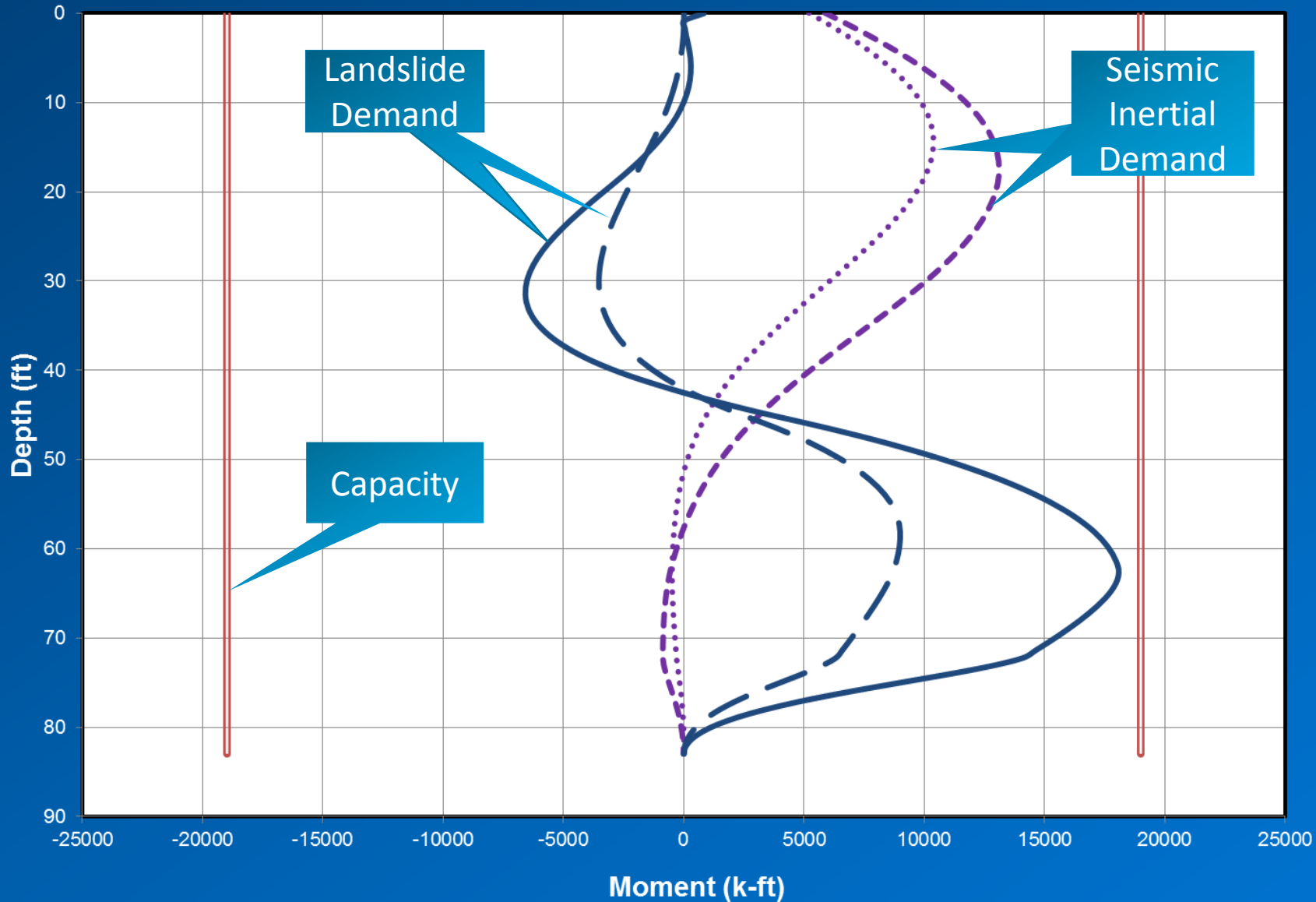
**SECTION C**  
SCALE: 1/2" = 1'-0"

- Notes:
- 3" Minimum clearance from bottom of shaft to shaft reinforcing.
  - See Spiral Splice/Termination Detail on Dwg. SE-08
  - Remove sediment, laitance & weak concrete to sound concrete prior to setting column reinforcement.

**DRILLED SHAFT DETAIL**  
SCALE: 1/2" = 1'-0"

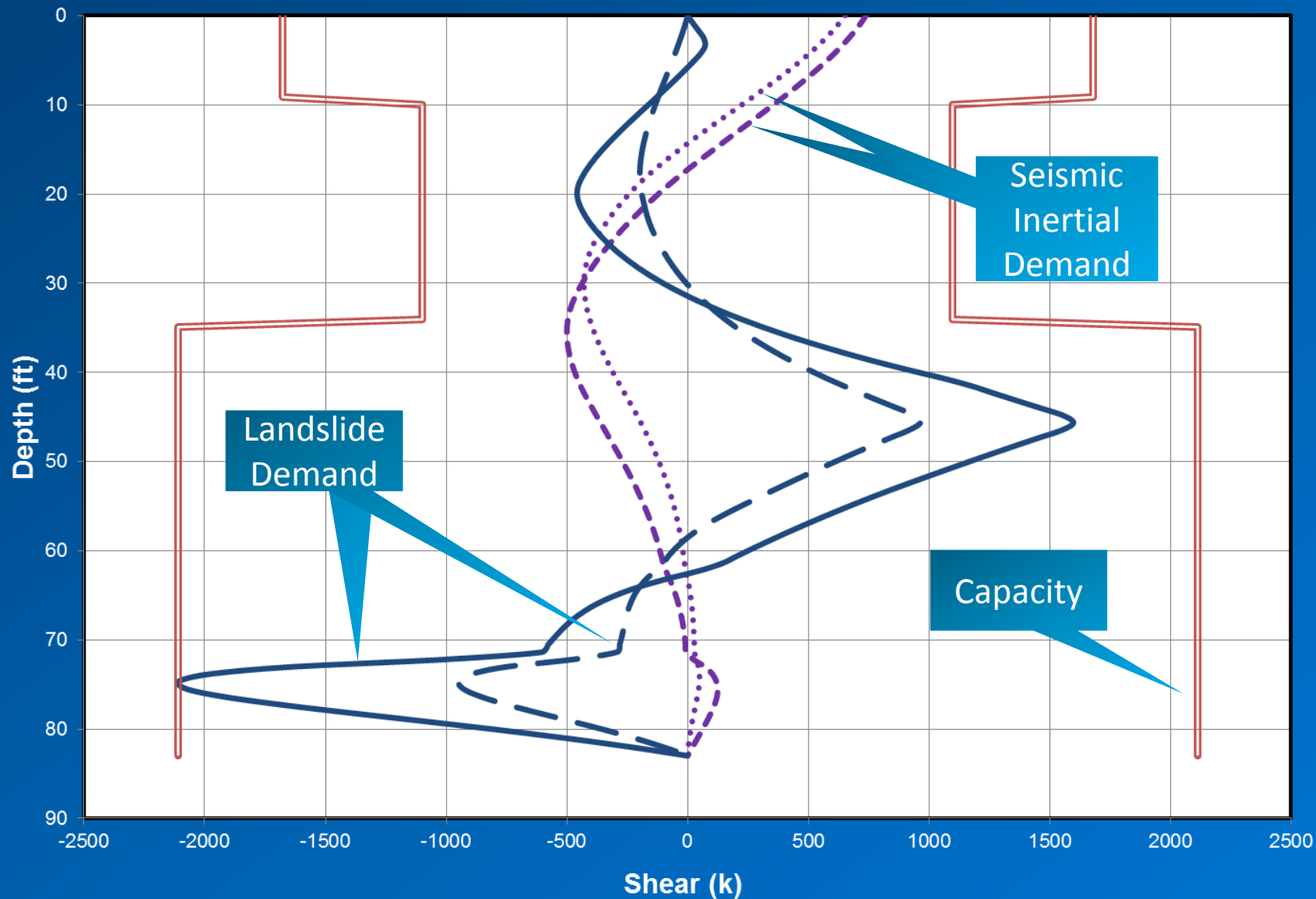
# LPILE Drilled Shaft Analysis

## NE Ramp Bent 2 - Drilled Shaft Moment - Stiff Case



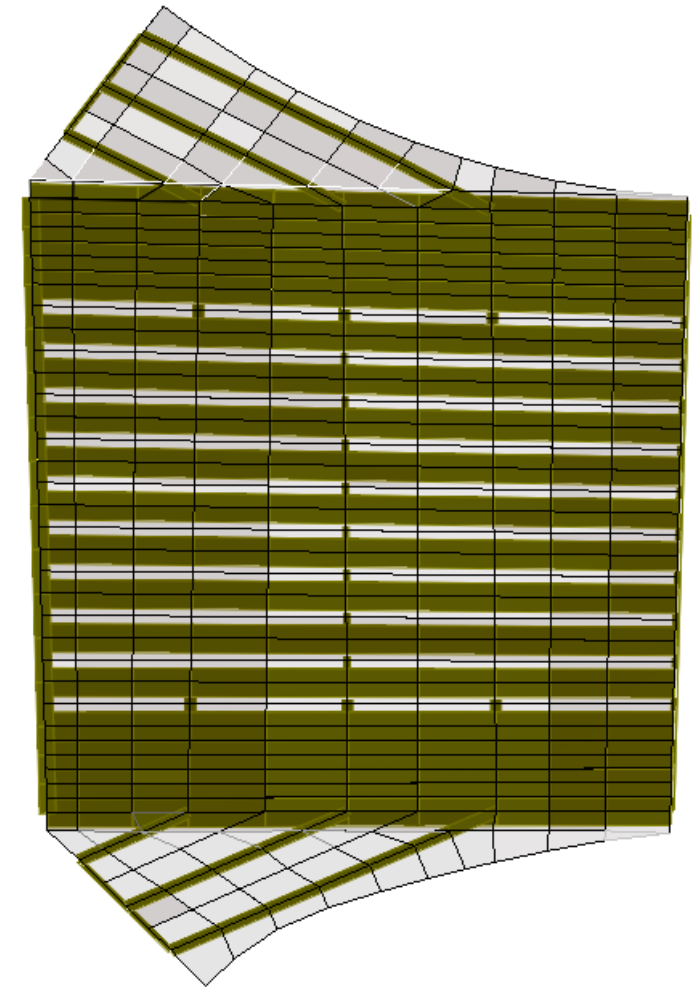
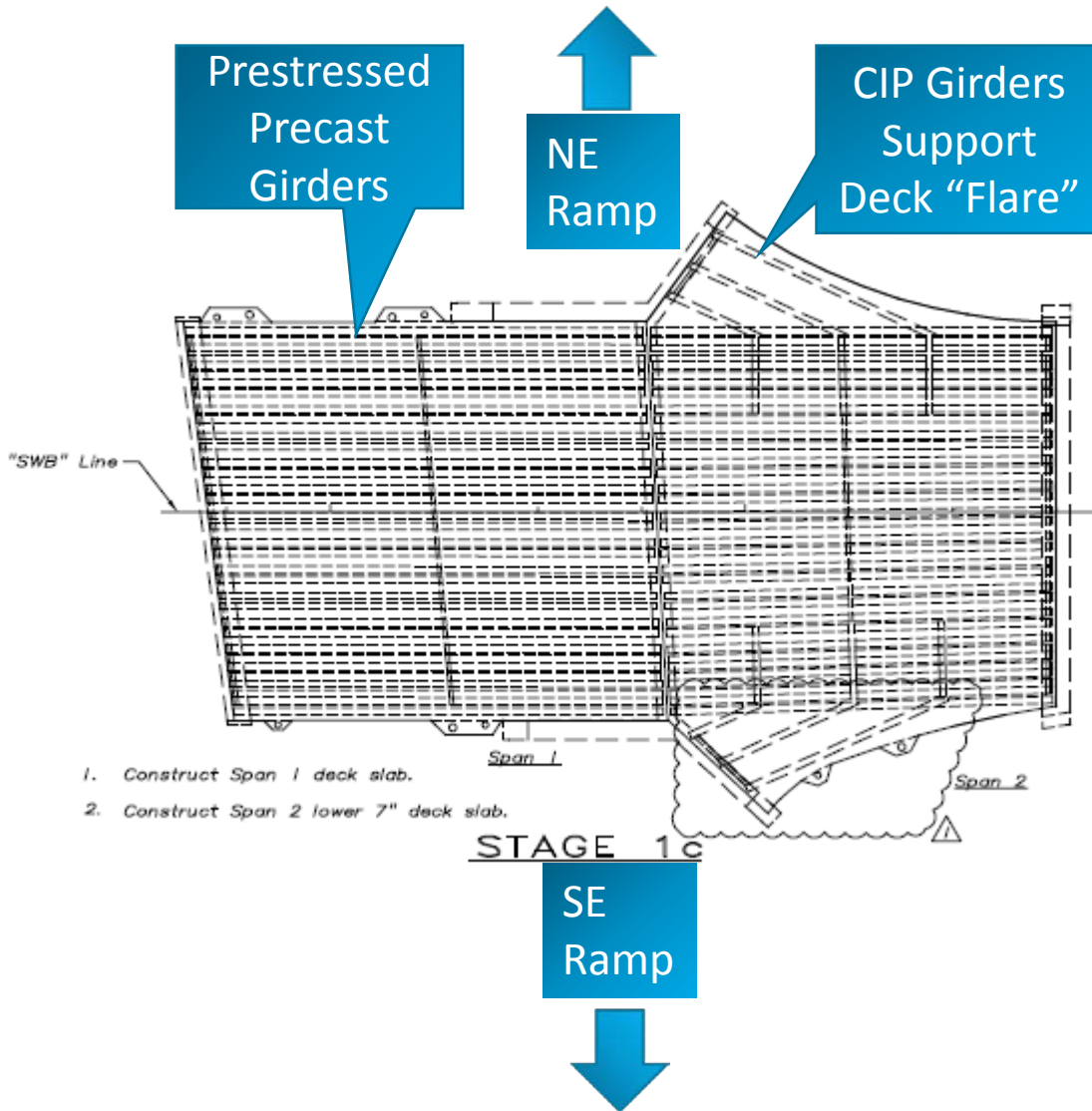
# LPILE Drilled Shaft Analysis

## NE Ramp Bent 2 - Drilled Shaft Shear - Stiff Case





# Superstructure Modeling



Interchange Bridge  
Span 2

# Interchange Bridge Exterior Prestressed Girder

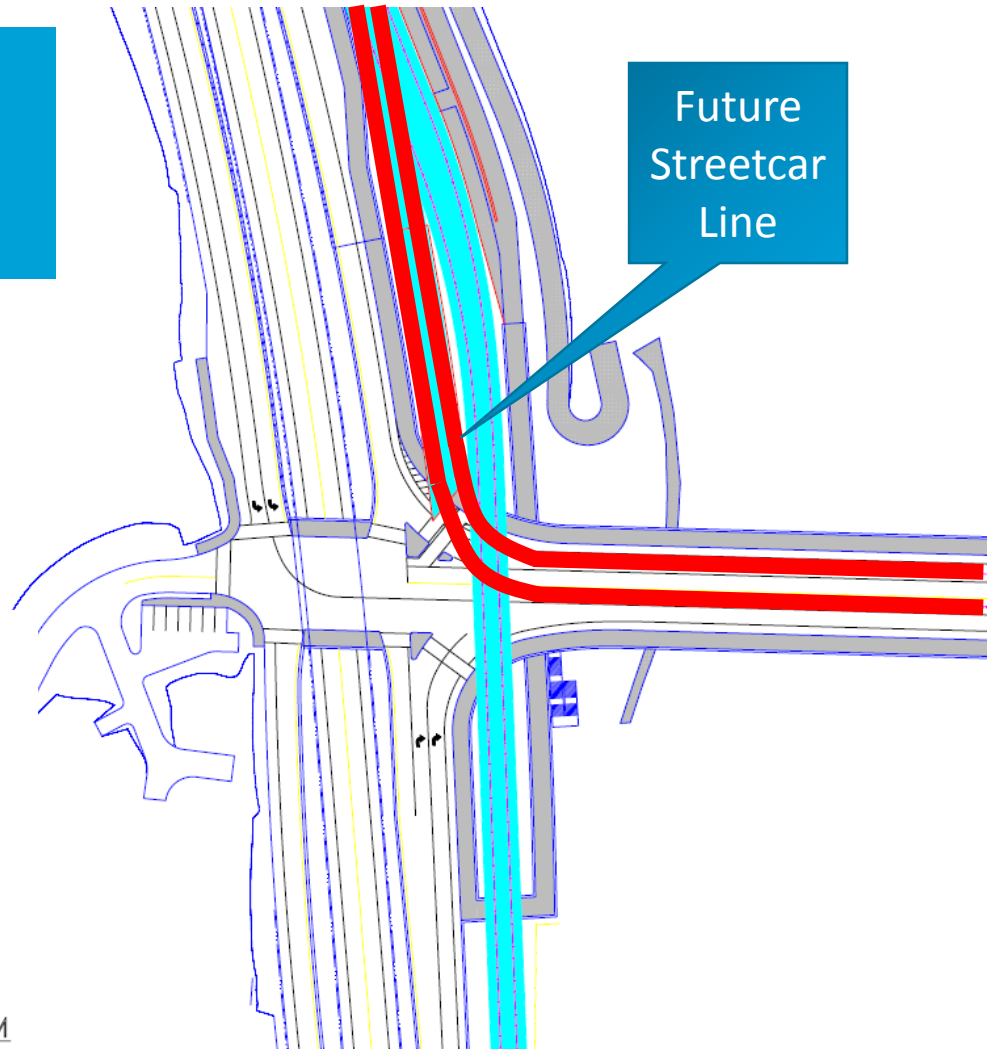
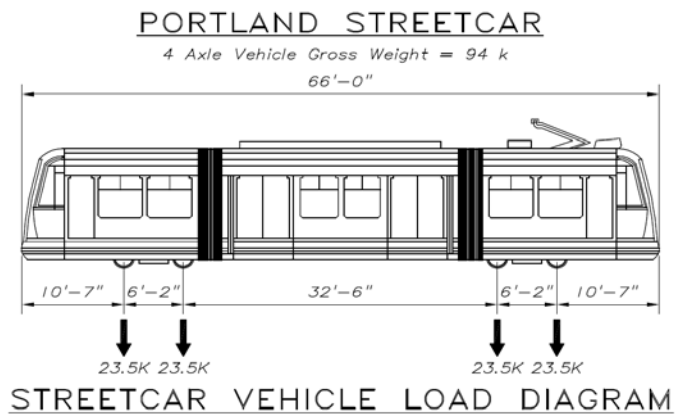


# Bridge Deck Slab Flare



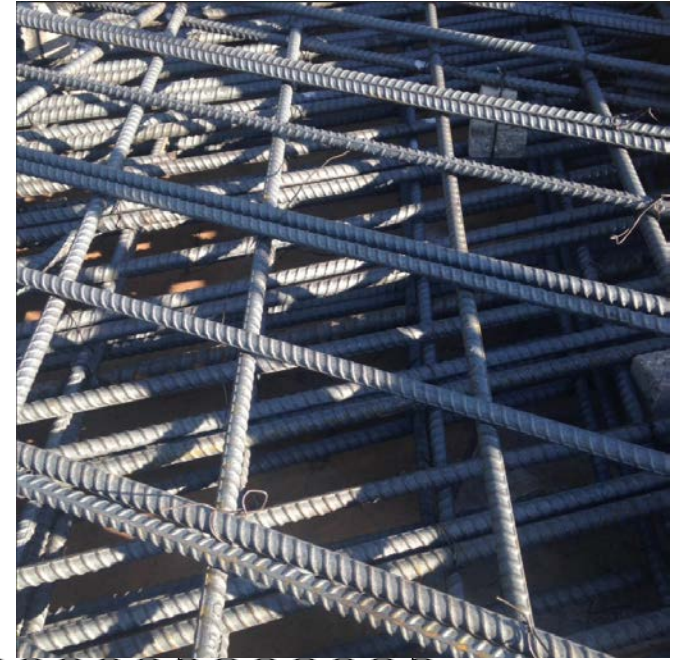
# Future Streetcar Line

Streetcar loads and track constructability considered in current design



# Future Streetcar Line

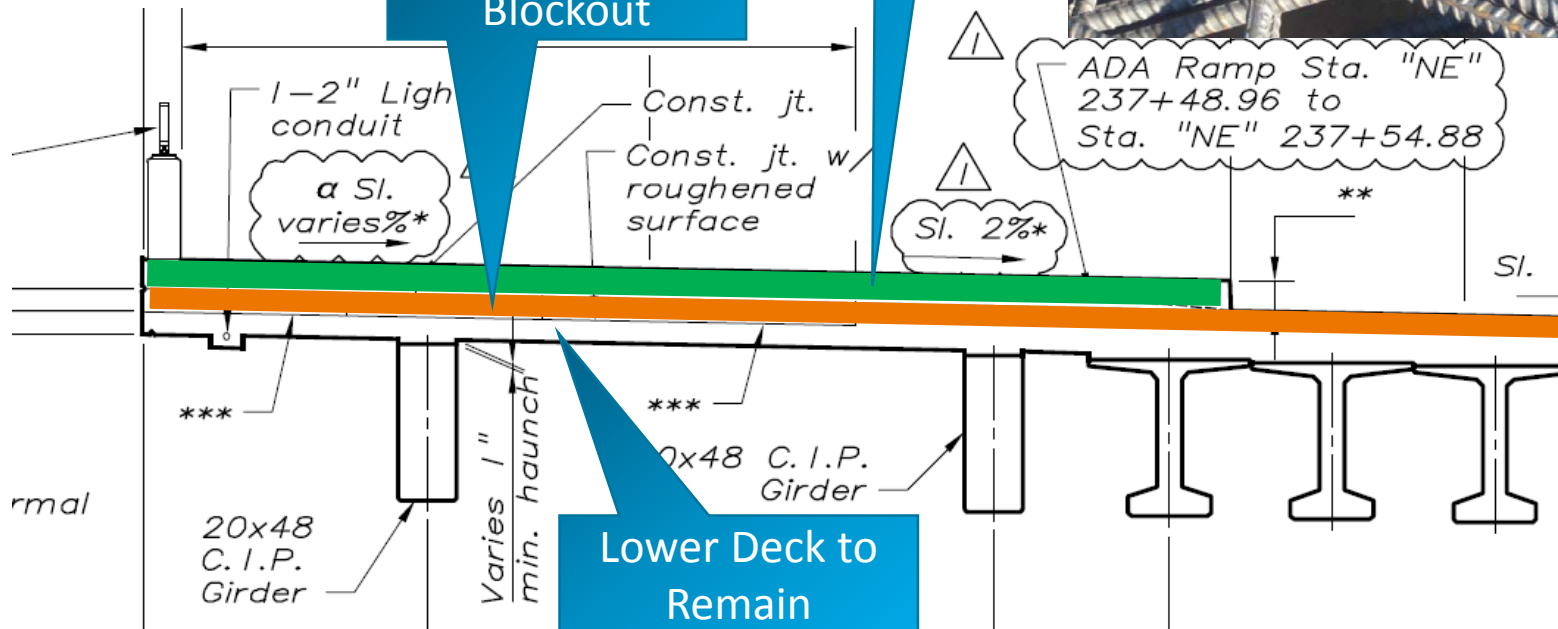
Two stage deck slab



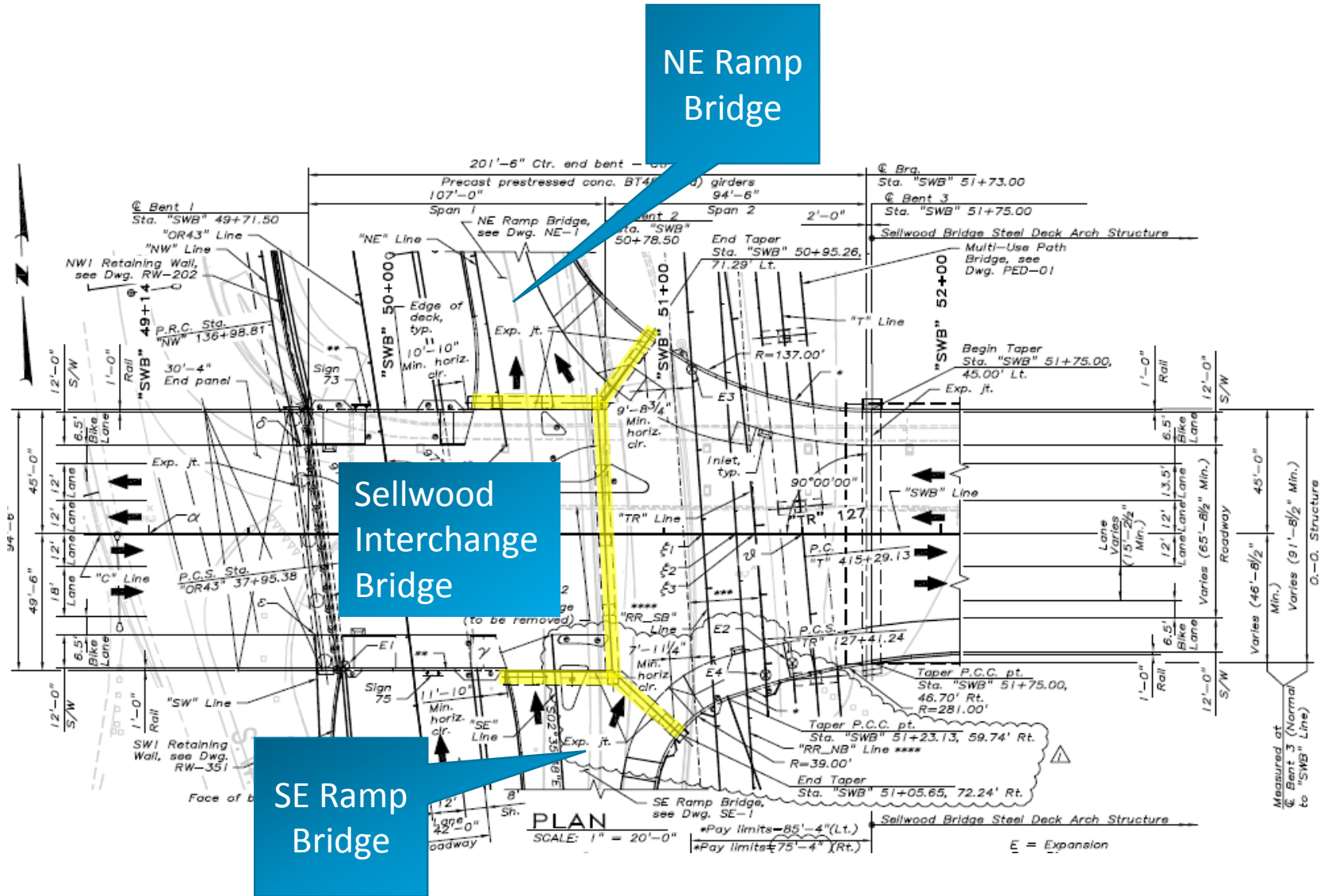
Sidewalk to be Removed

Future Streetcar Blockout

Lower Deck to Remain



# Shared Bent



# Shared Bent



# Shared Bent





# SE Ramp Bridge – Cap Beams



# SE Ramp Bridge - Girders



# SE Ramp Bridge – Deck Pour



# Transition to Sellwood Bridge



Thank You

ch2m.<sup>SM</sup>