Jacobs Challenging today. Reinventing tomorrow.

Design and Construction of the Chico Creek Bridges

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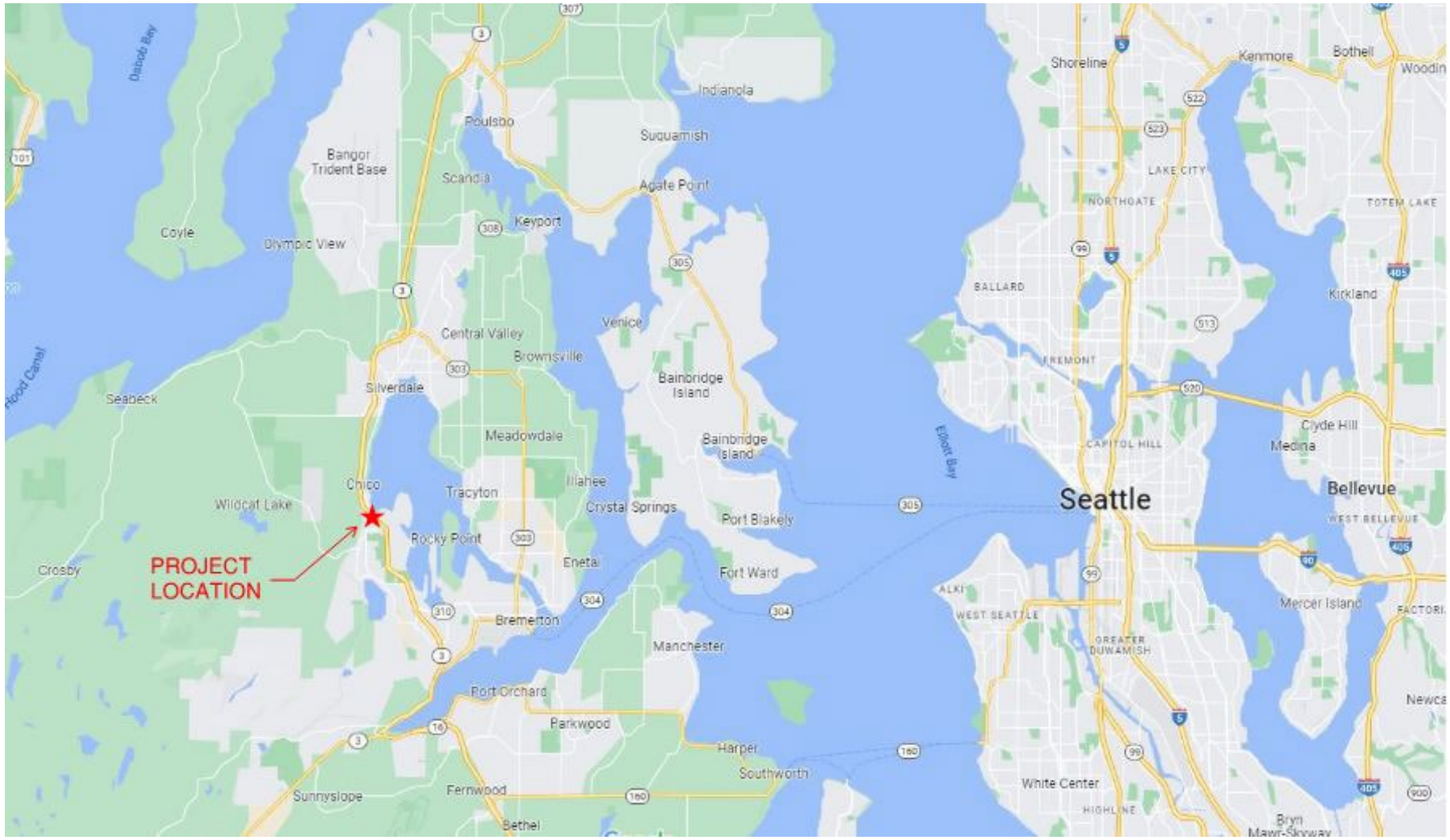
Western Bridge Engineers' Seminar

September 5-8, 2023

Overview

- Project Location
- Project Background
- SR 3 Over Chico Creek Bridge (Chico Creek Bridge)
- Chico Way over Unnamed Tributary Bridge (Unnamed Tributary Bridge)
- Conclusions

Project Location

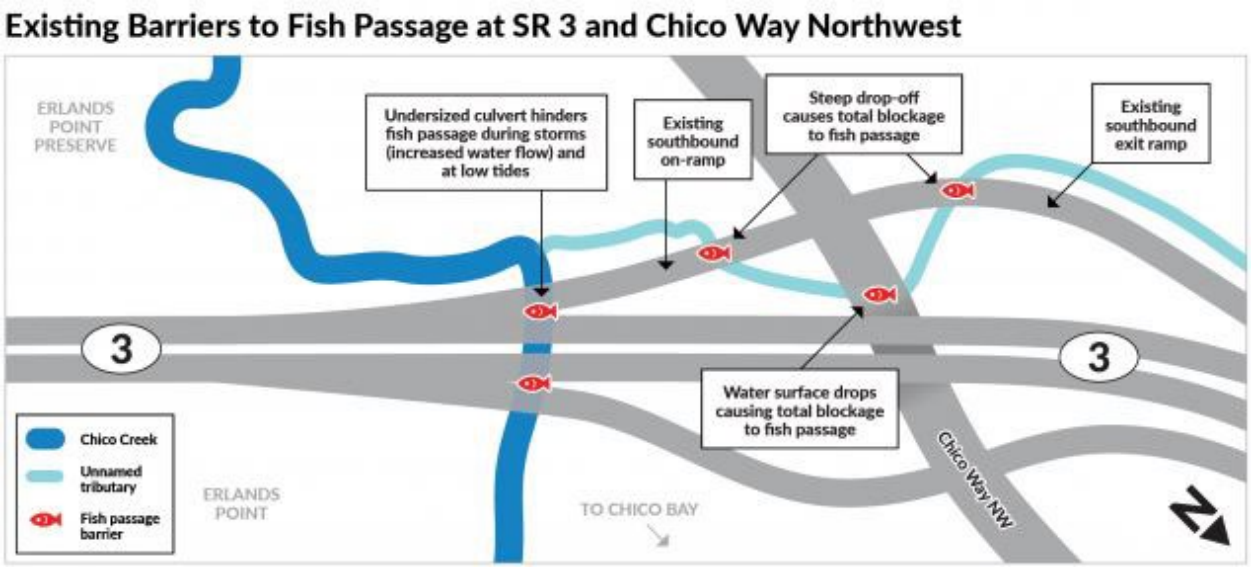


Project Background

- Part of WSDOT's Fish Passage Barrier Removal Program
  - Approximately 1000 culverts under state highways subject to federal court injunction

- 5 undersized culverts at Chico Creek and Unnamed Tributary required to be replaced

- Design Build Contract
  - Owner: WSDOT
  - Prime Contractor: Atkinson
  - Lead Designer: Jacobs

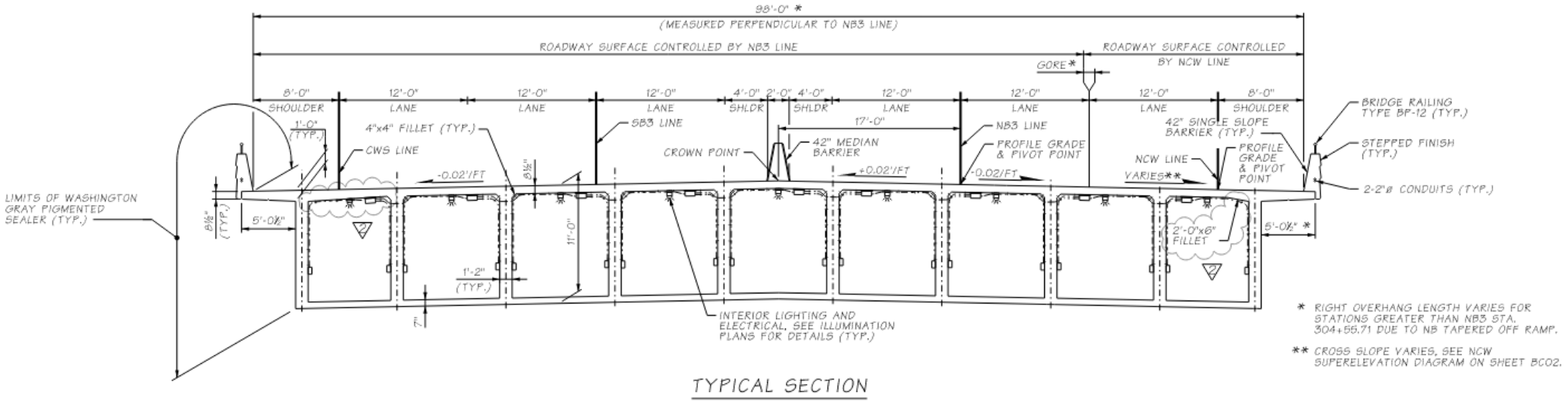


Project Background

Chico Creek Bridge

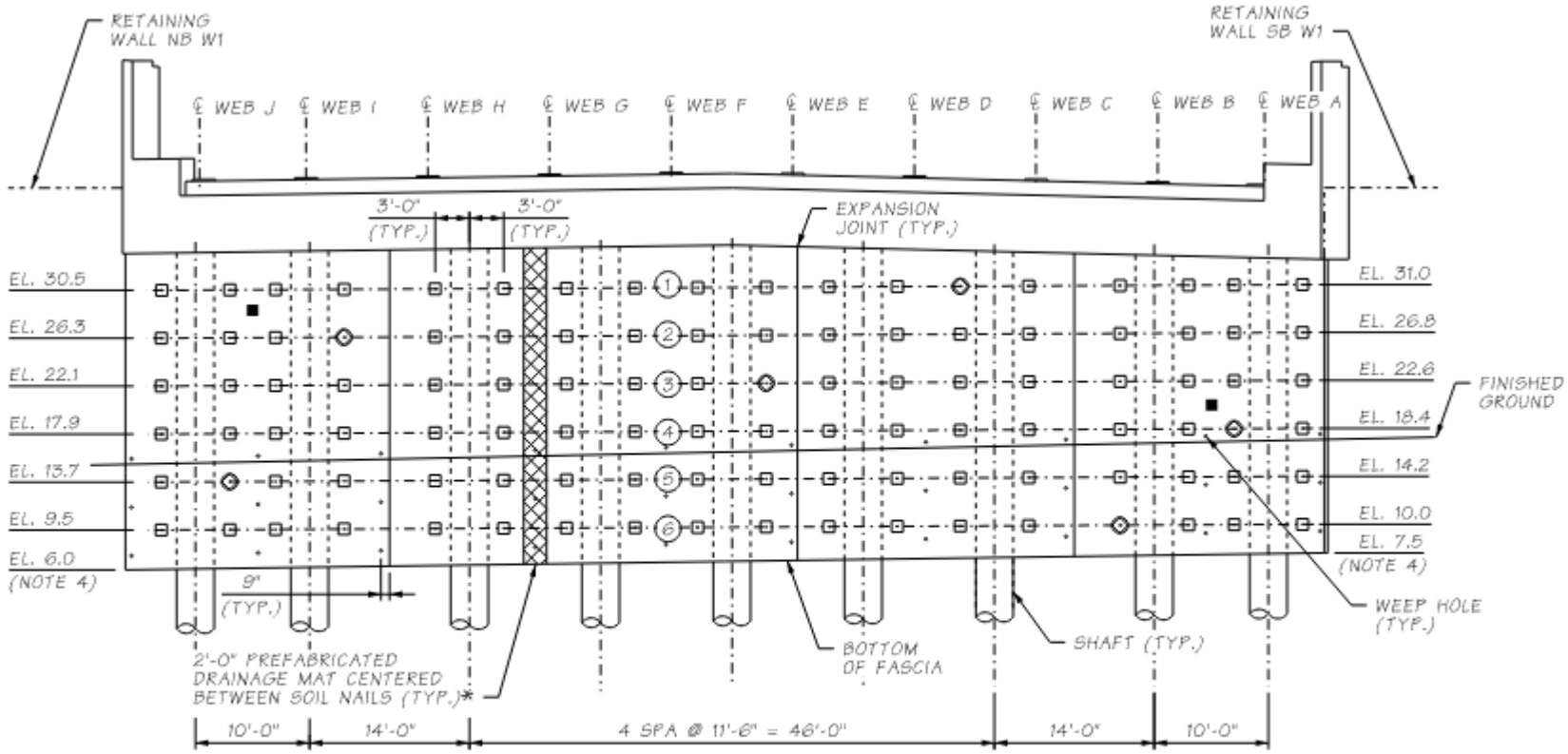
- Clear span over 200’ creek migration zone
- 215’ single span cast-in-place post-tensioned box girder
- Hybrid drilled shaft/ soil nail wall abutments

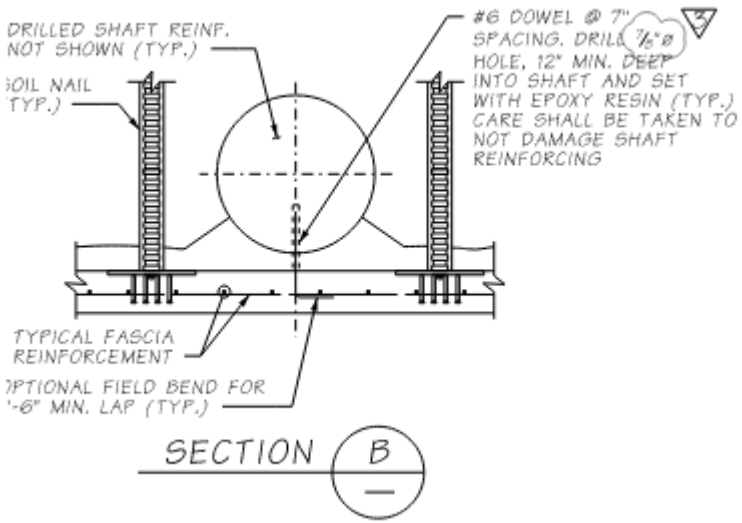
Chico Creek Bridge



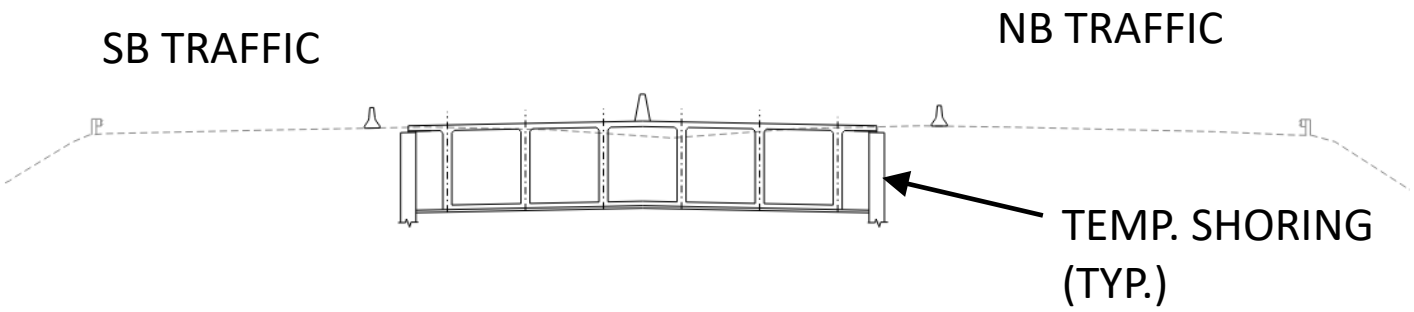
TYPICAL SECTION

Chico Creek Bridge



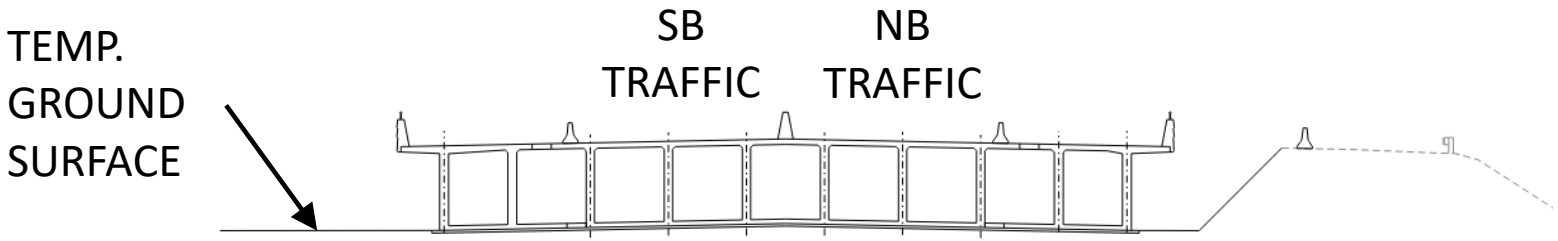


Chico Creek Bridge, Construction Staging- Maintenance of Traffic



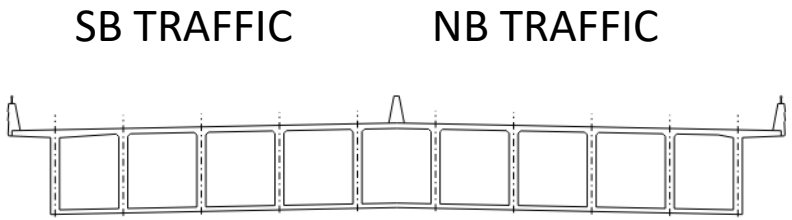
STAGE 1-

SHIFT TRAFFIC OUTSIDE AND BUILD MIDDLE PORTION OF SUPERSTRUCTURE



STAGE 2-

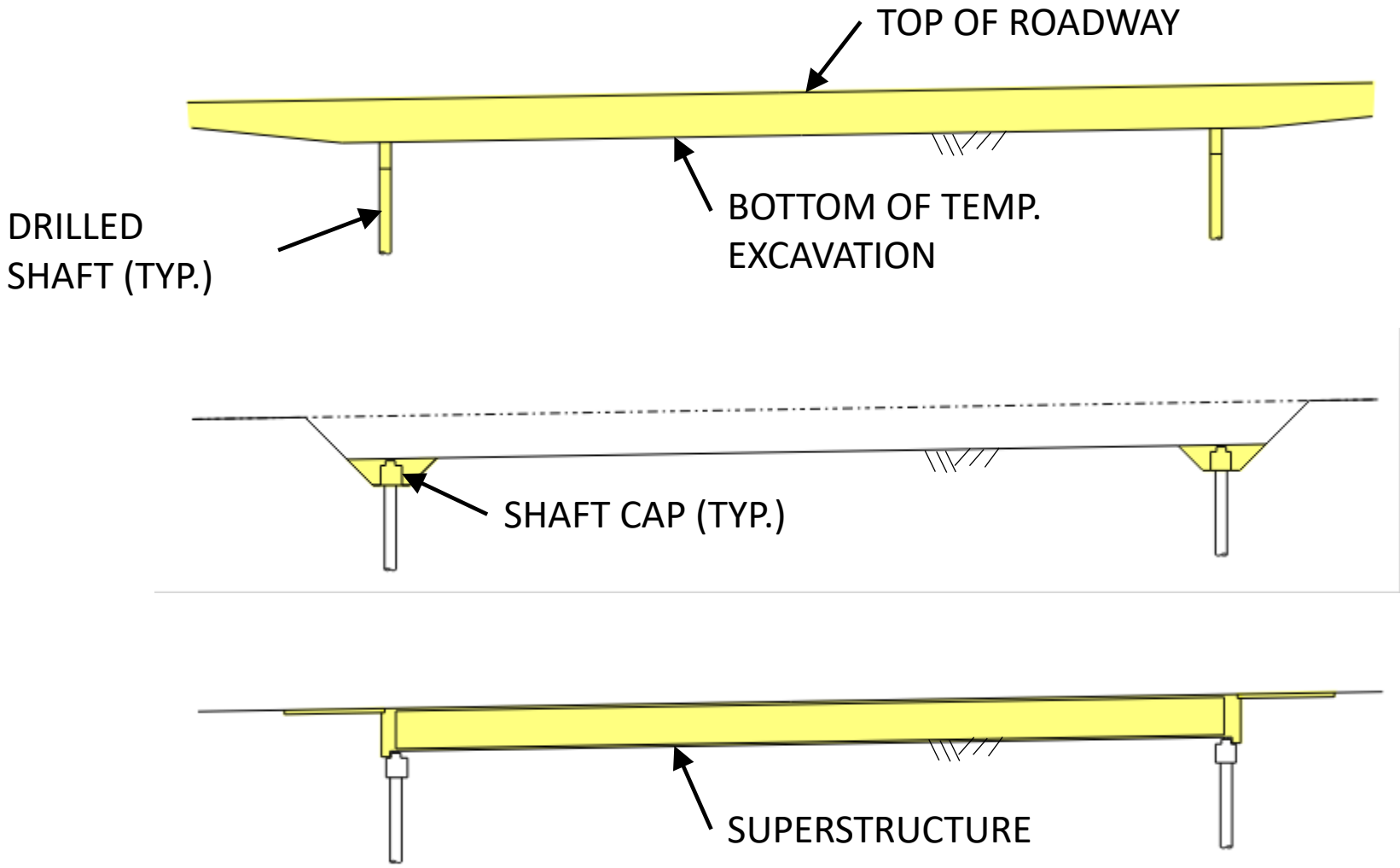
SHIFT TRAFFIC TO STAGE 1 BRIDGE AND BUILD OUTSIDE PORTIONS OF BRIDGE



STAGE 3-

SHIFT TRAFFIC TO FINAL CONFIGURATION, EXCAVATE BELOW BRIDGE

Chico Creek Bridge, Top-Down Construction (Stage 1 and 2)

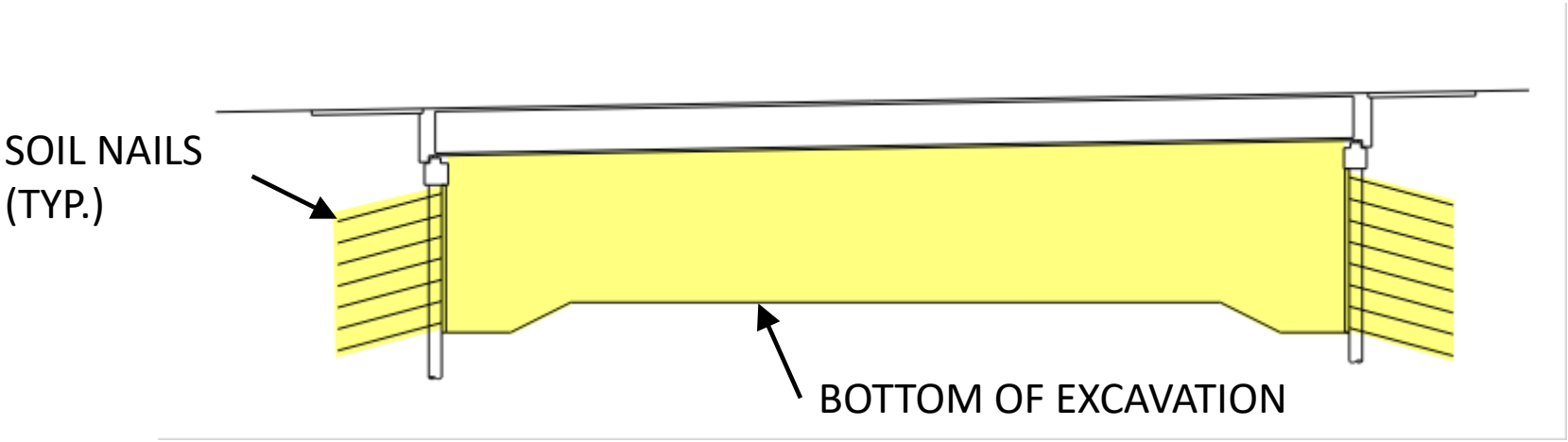


STEP 1-
EXACAVATE FOR SUPERSTRUCTURE AND INSTALL SHAFTS

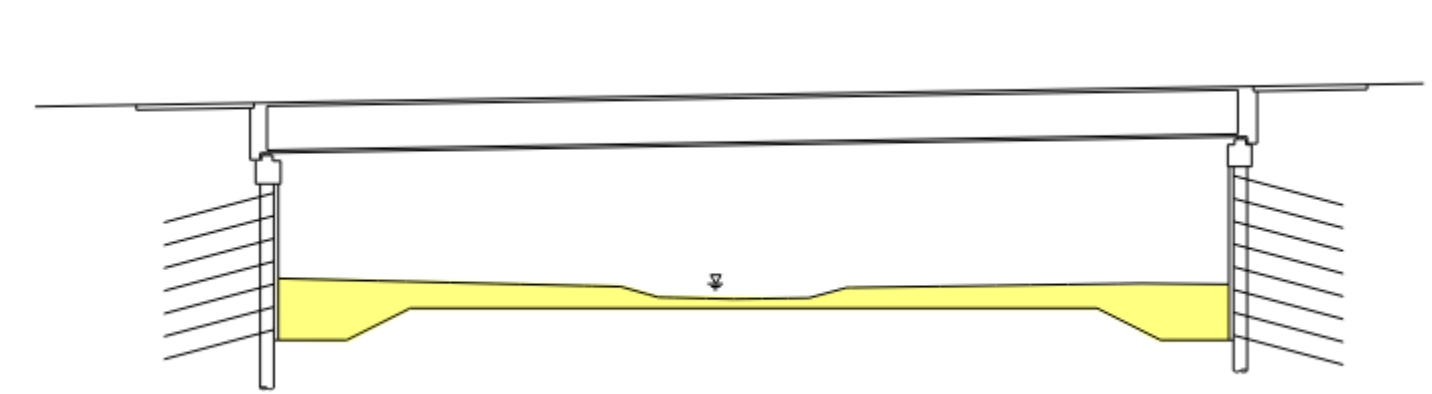
STEP 2-
EXCAVATE AND INSTALL SHAFT CAPS

STEP 3-
CONSTRUCT SUPERSTRUCTURE

Chico Creek Bridge, Top-Down Construction (Stage 3)

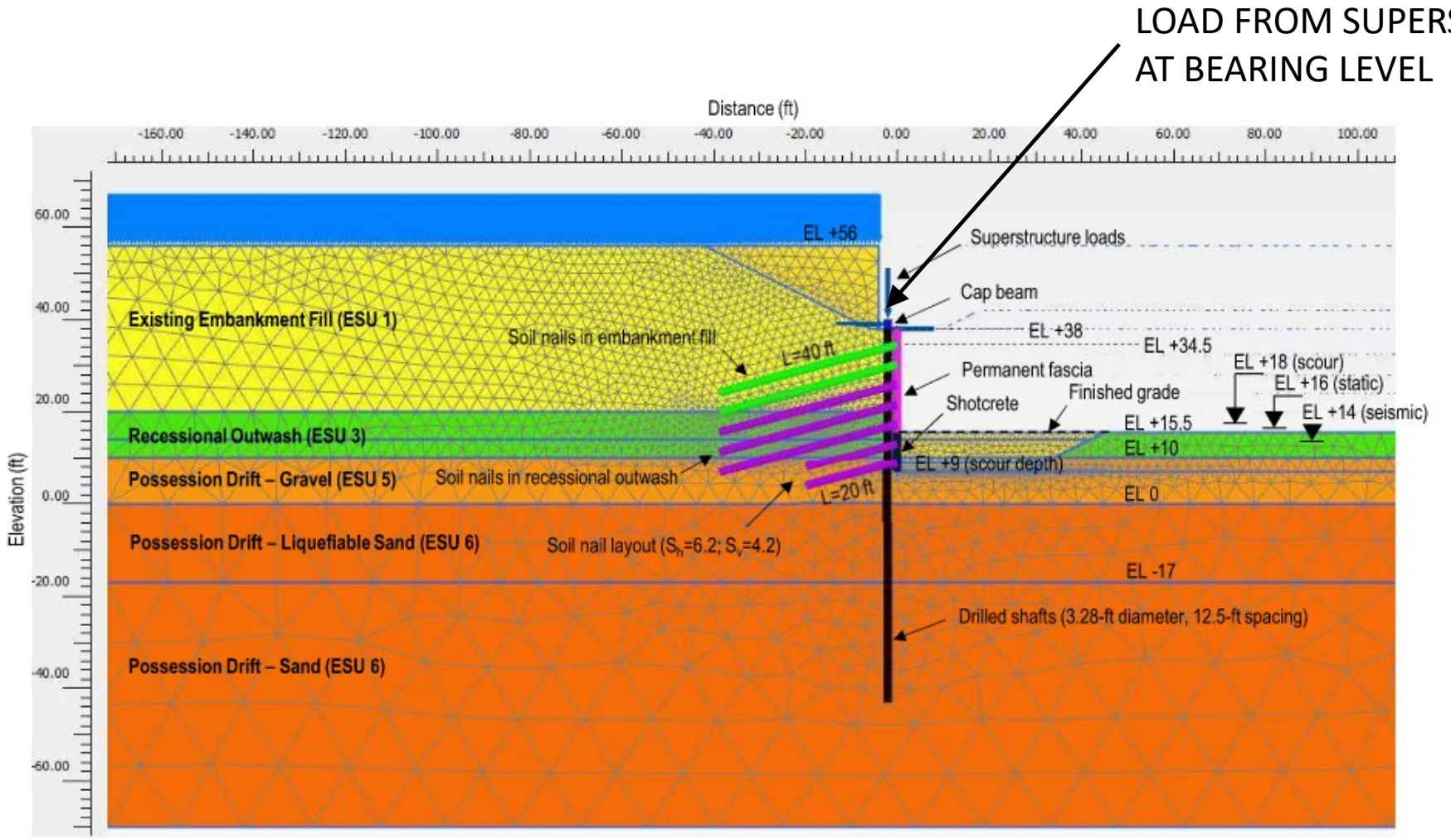


STEP 4-
EXCAVATE AND INSTALL SOIL NAIL WALL



STEP 5-
BUILD CREEK CHANNEL, DIVERT CREEK INTO NEW CHANNEL

Chico Creek Bridge: Geotechnical Finite Element Analysis



Software: Plaxis 2D

Construction sequencing included in analysis

Chico Creek Bridge, Construction Stage 1

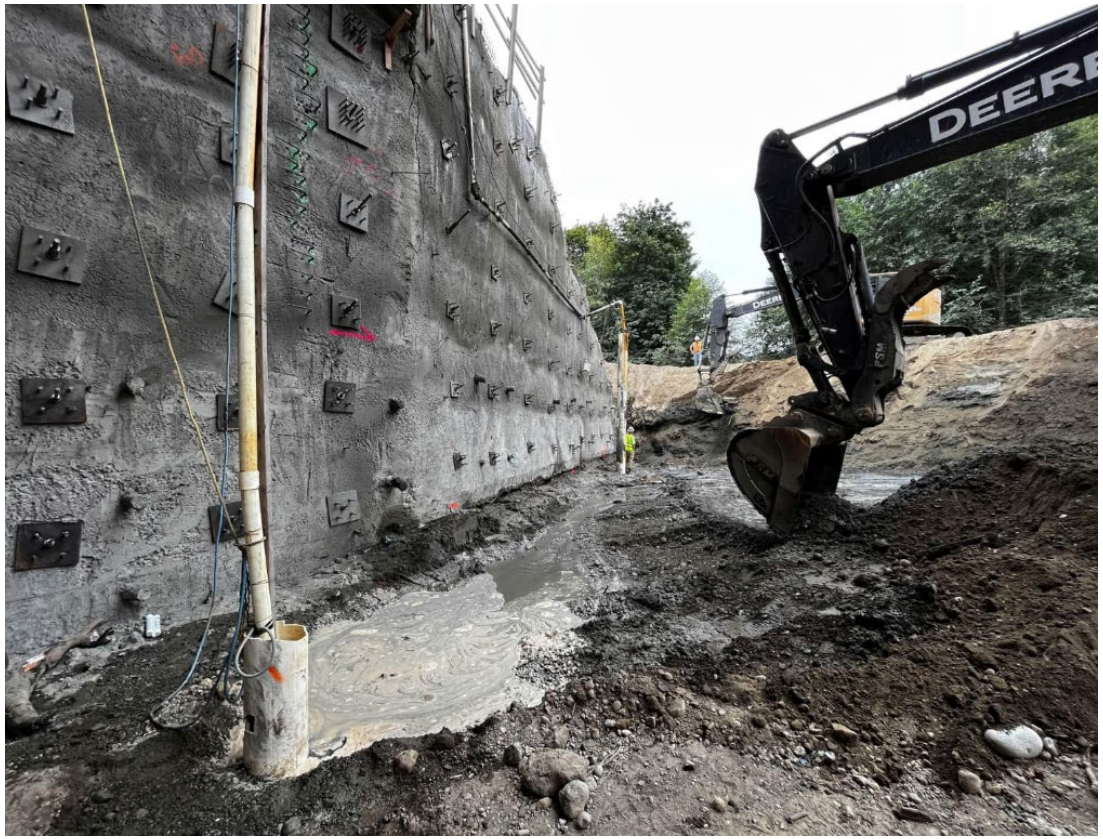
Chico Creek Bridge, Construction Stage 2

Construction Stage 3- Excavation Below Superstructure

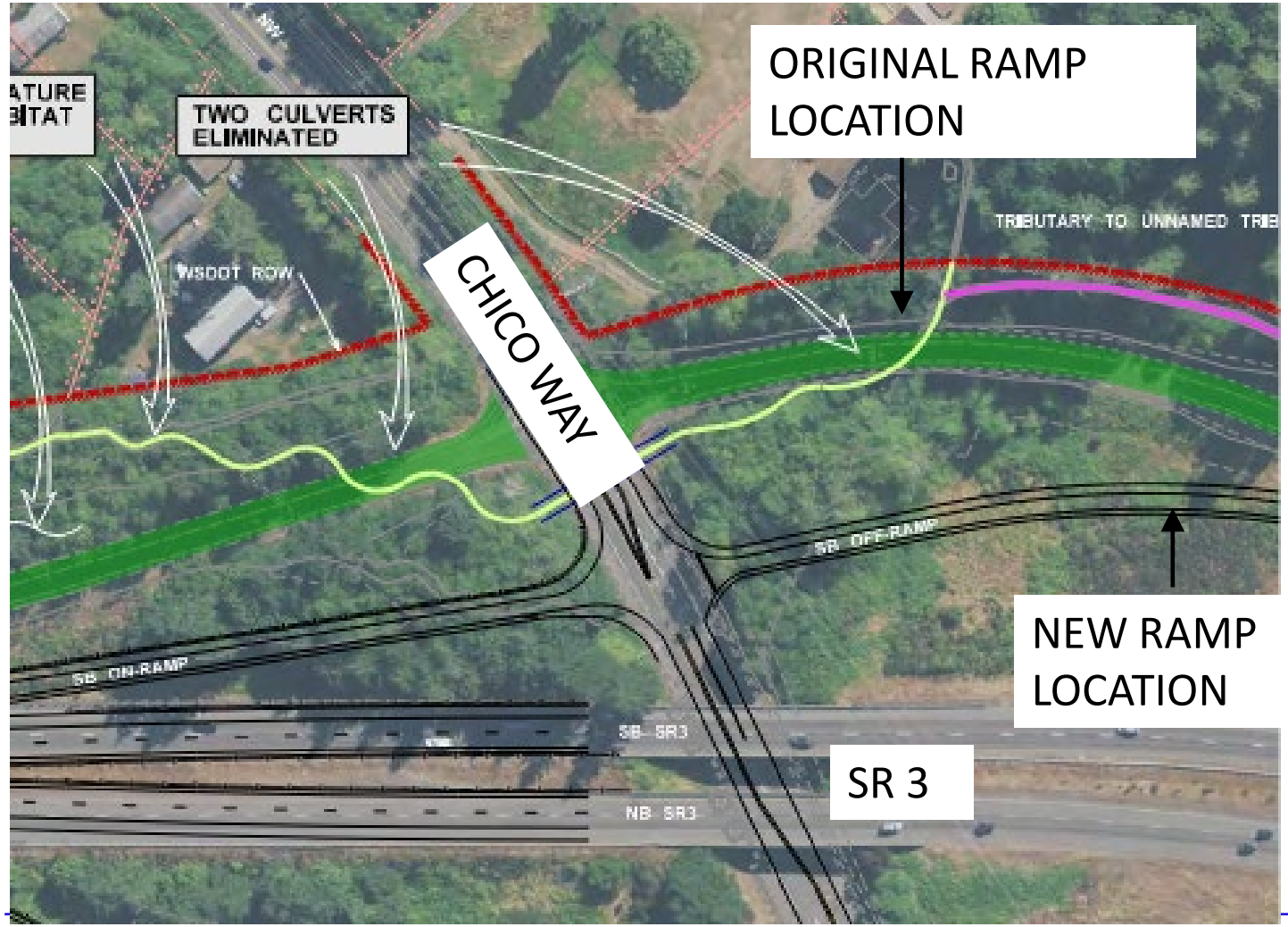
Chico Creek Bridge, Construction Challenges

- Soil sloughing in lower layer
- Soil nail locations out of spec tolerance
- Some soil nail nuts and anchor plates not installed until later

Chico Creek Bridge, Construction Challenges



Chico Way Over Unnamed Tributary Bridge (Unnamed Tributary Bridge)



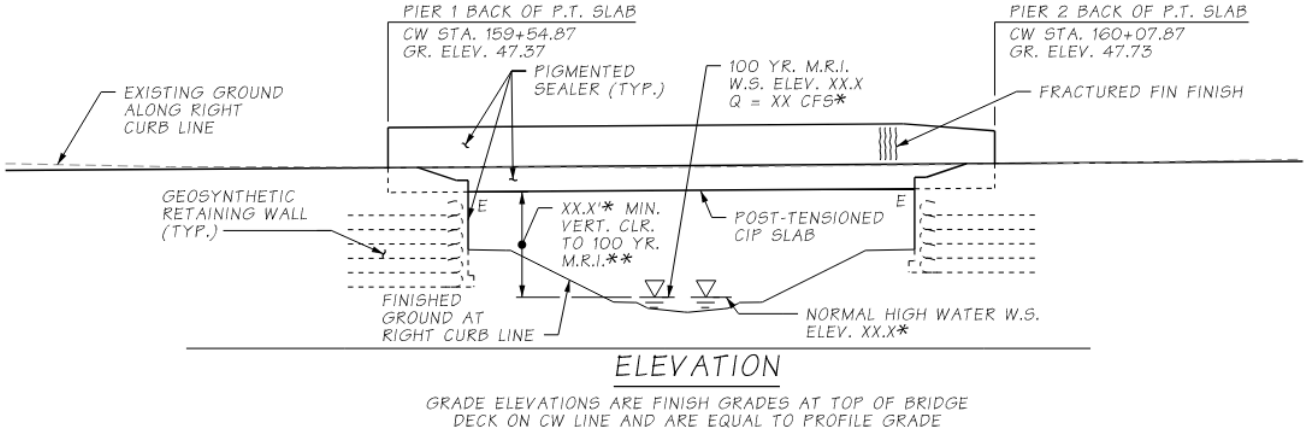
- Part of Alternative Technical Concept (ATC) to re-align SB ramps
  - Eliminated two crossings
  - Moved ramps closer to the SR3 for one stream crossing under Chico Way

Unnamed Tributary Bridge

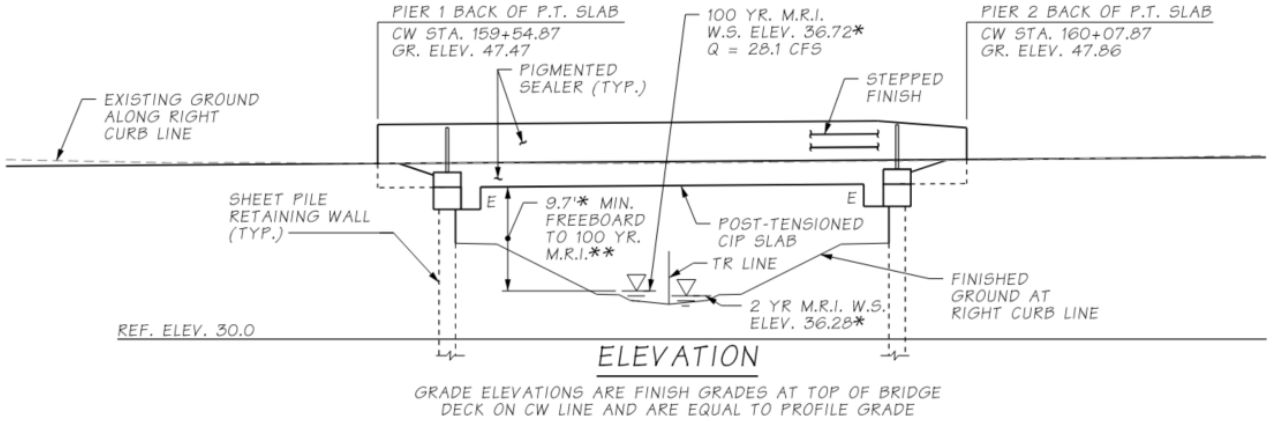
- 39’ clear span
- 53’ cast-in-place post-tensioned slab
- Sheet pile abutments

Unnamed Tributary Bridge

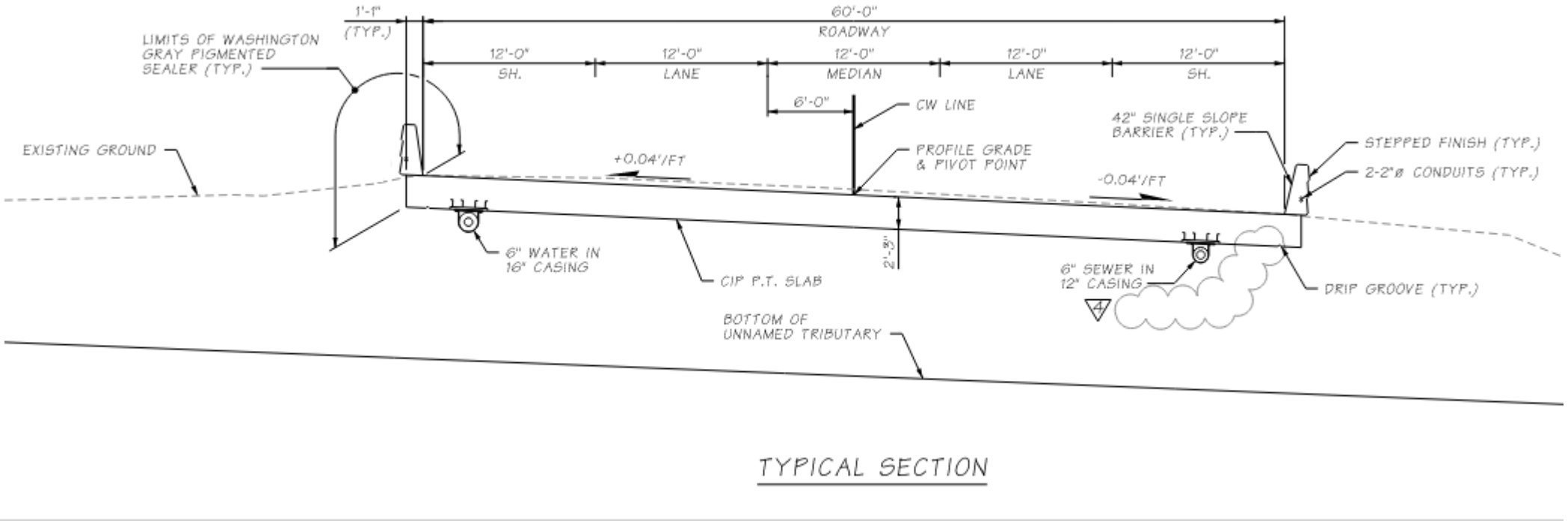
- Original Geosynthetic Concept



- Revised Sheet Pile Abutment

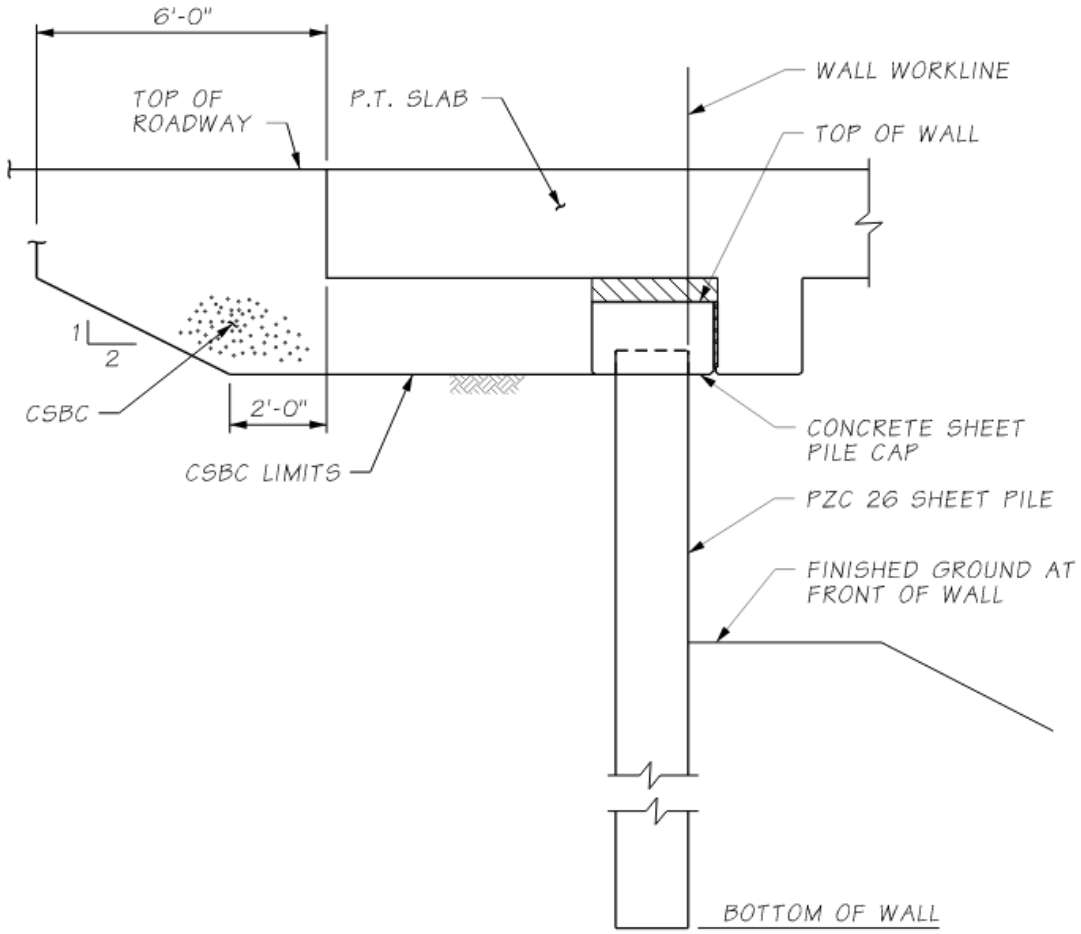


Unnamed Tributary Bridge

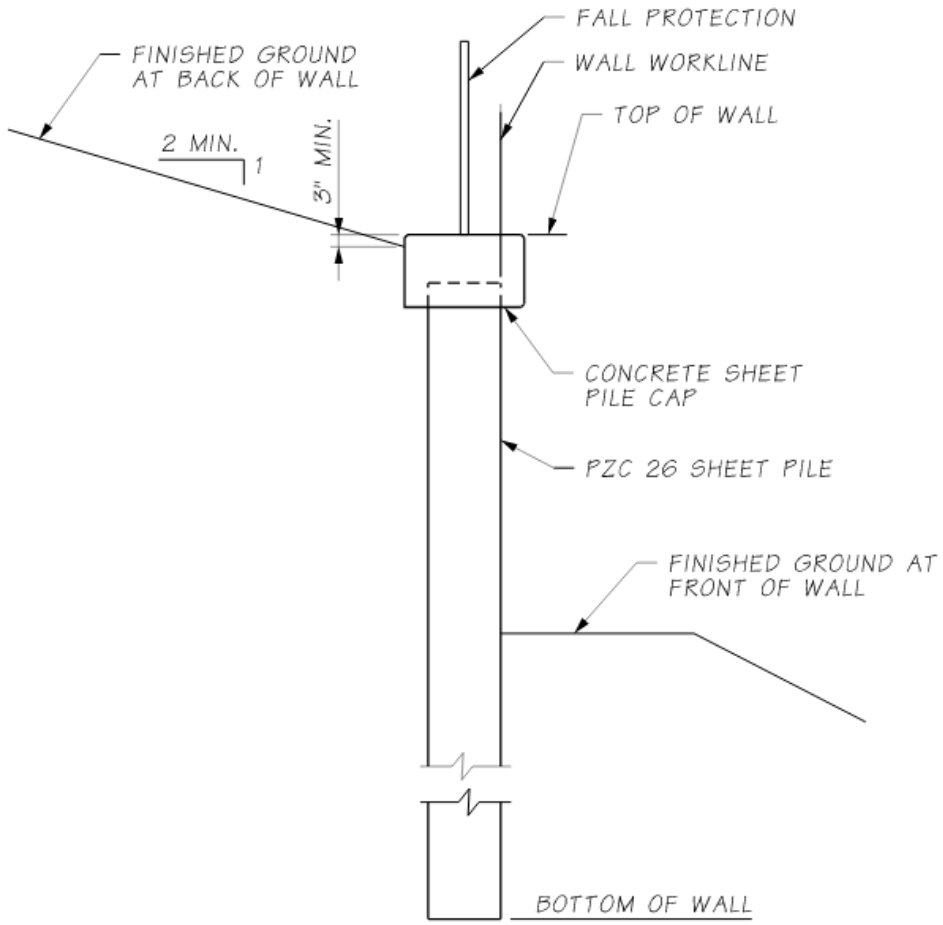


TYPICAL SECTION

Unnamed Tributary Bridge

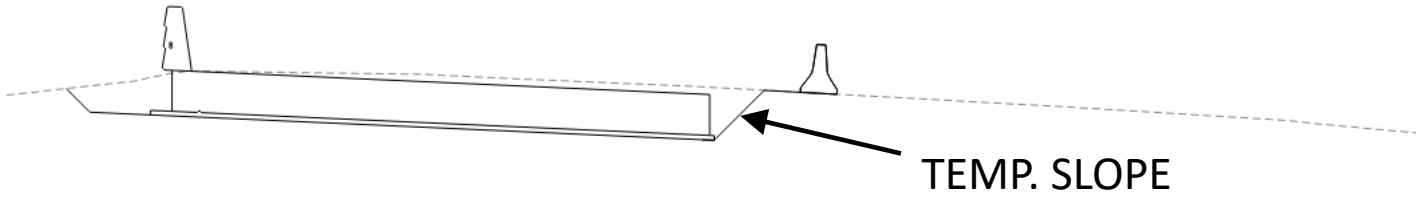


TYPICAL SECTION - BELOW BRIDGE

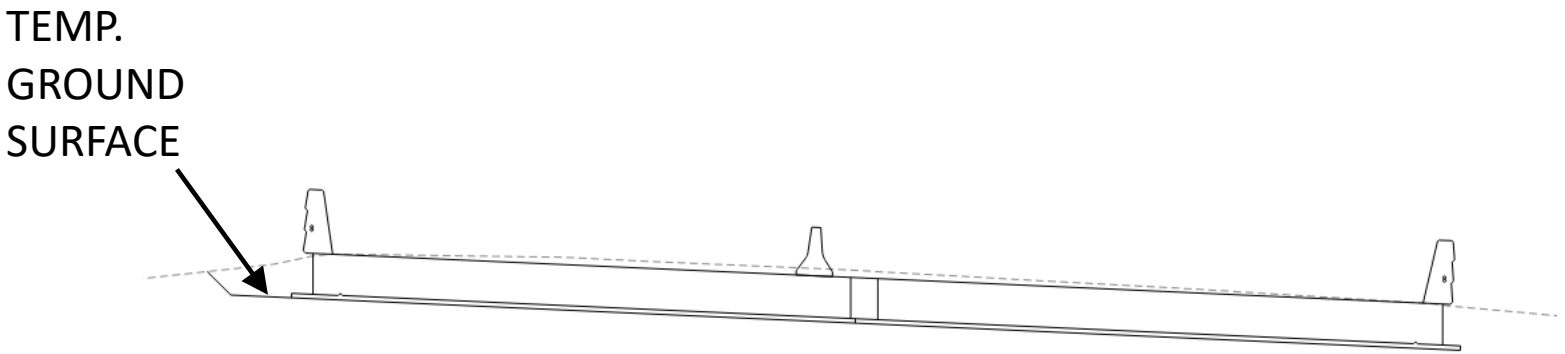


TYPICAL SECTION - OUTSIDE OF BRIDGE

Unnamed Tributary Bridge, Construction Staging- Maintenance of Traffic



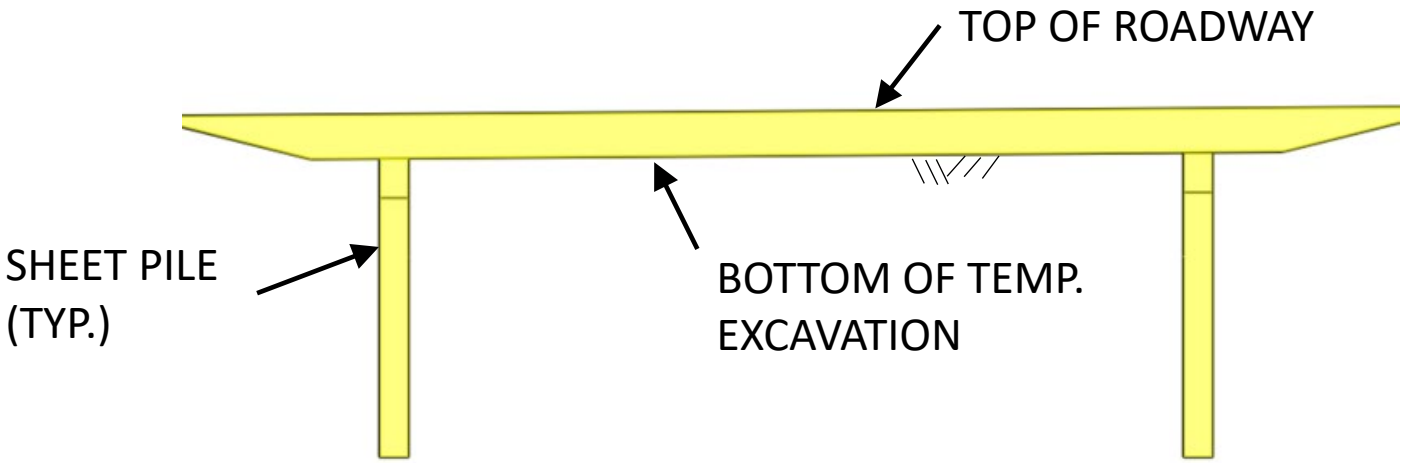
STAGE 1A-
SHIFT TRAFFIC TO RIGHT AND BUILD LEFT PORTION OF SUPERSTRUCTURE



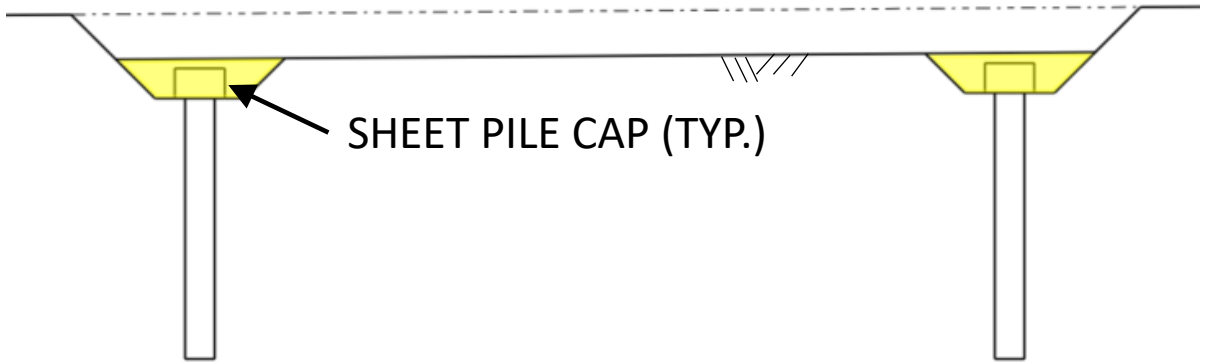
STAGE 2-
SHIFT TRAFFIC TO STAGE 1A BRIDGE AND BUILD RIGHT PORTION OF BRIDGE

STAGE 3-
SHIFT TRAFFIC TO FINAL CONFIGURATION, EXCAVATE BELOW BRIDGE

Unnamed Tributary Bridge, Top-Down Construction

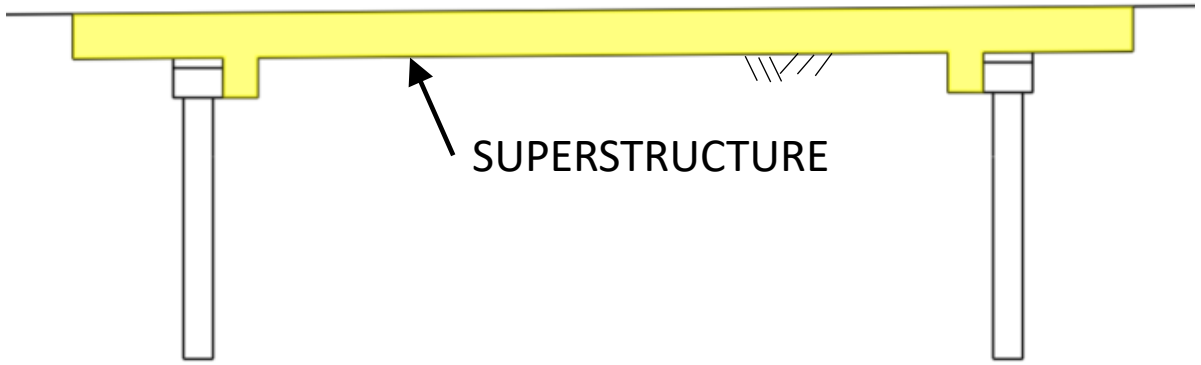


STEP 1-
EXCAVATE AND DRIVE SHEET PILES

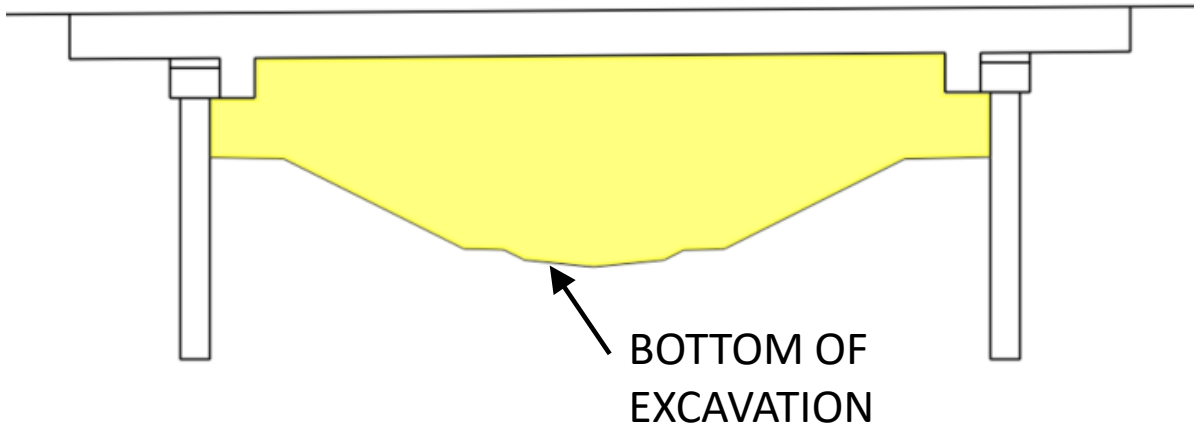


STEP 2-
EXCAVATE AND INSTALL SHEET PILE CAPS

Unnamed Tributary Bridge, Top-Down Construction

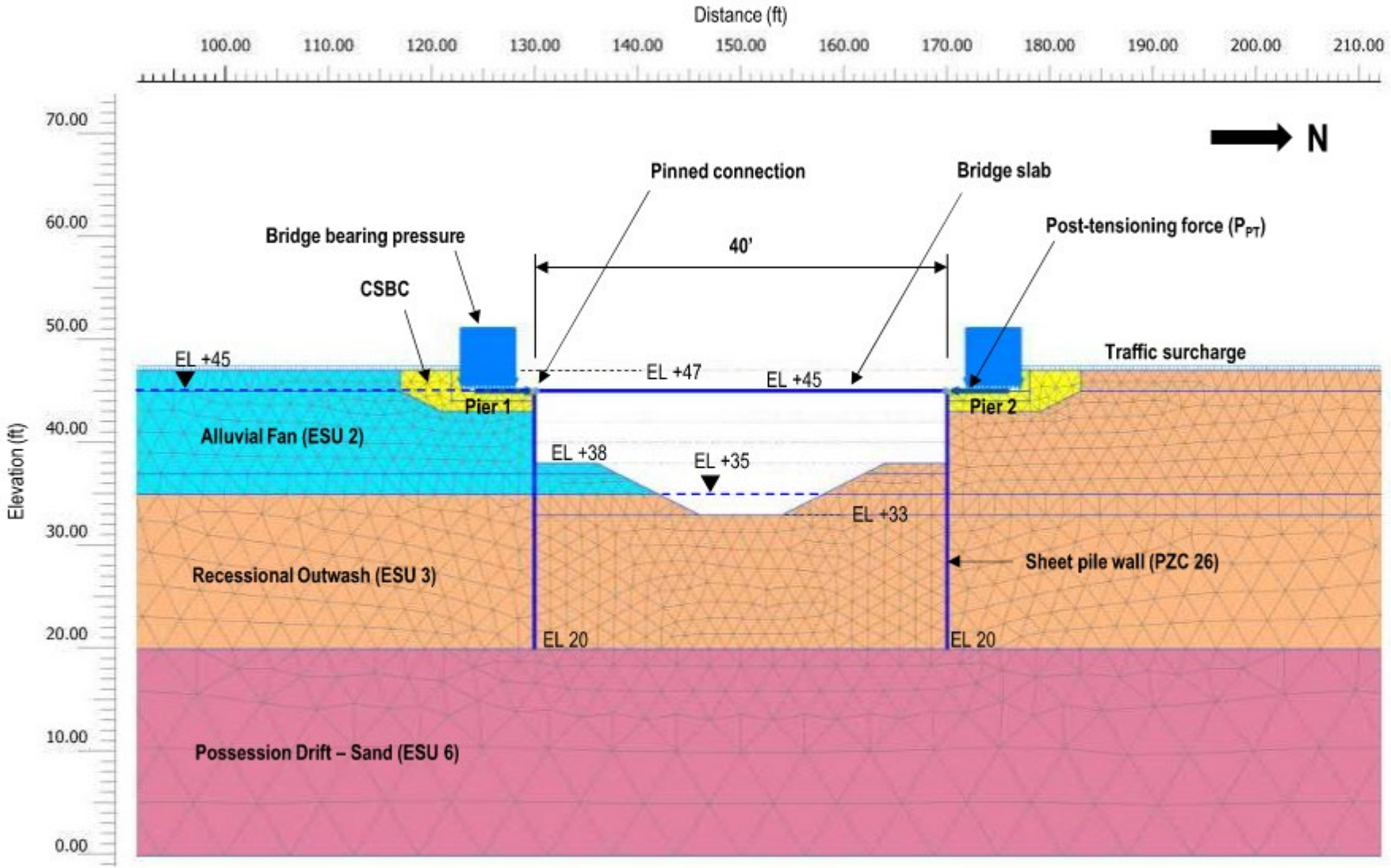


STEP 3-
CONSTRUCT SUPERSTRUCTURE



STEP 4-
EXCAVATE UNDER BRIDGE, BUILD CREEK CHANNEL

Unnamed Tributary Bridge: Finite Element Analysis



Software: Plaxis 2D

Construction sequencing included in analysis

Unnamed Tributary Bridge- Construction Stage 1A

Unnamed Tributary Bridge, Construction Stage 2

Unnamed Tributary Bridge, Construction Stage 3- Excavation Below Superstructure

Conclusions

- Top-down construction can reduce construction time and cost, can be used for small and large bridges
- Be flexible in design to manage risk (sloughing soil, dewatering)
- Soils can be unpredictable when working near a stream

Thank You

Jacobs

Challenging today.
Reinventing tomorrow.