



Stretch that Bridge! **Lengthening of a 2-span Concrete Box Girder Bridge**

Bridge 405/17.7 — Renton Ave Over I-405

Presented by: Thomas Wilson
Date: September 8, 2023

Outline

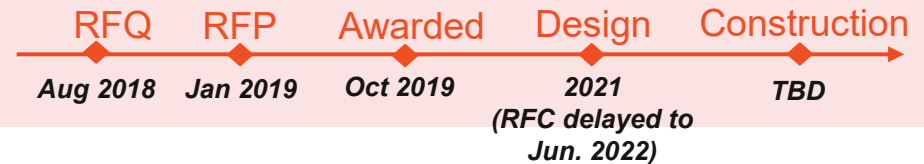
- Project Overview
- Opportunities
- Challenges
- Superstructure Design
- Substructure Design
- Construction Sequence

Project Overview

Overview



- WSDOT I-405 Widening
- Design-Build
 - Contractor: Flatiron – Lane CJV
 - Prime Consultant: Wood (now WSP)
- Timeline

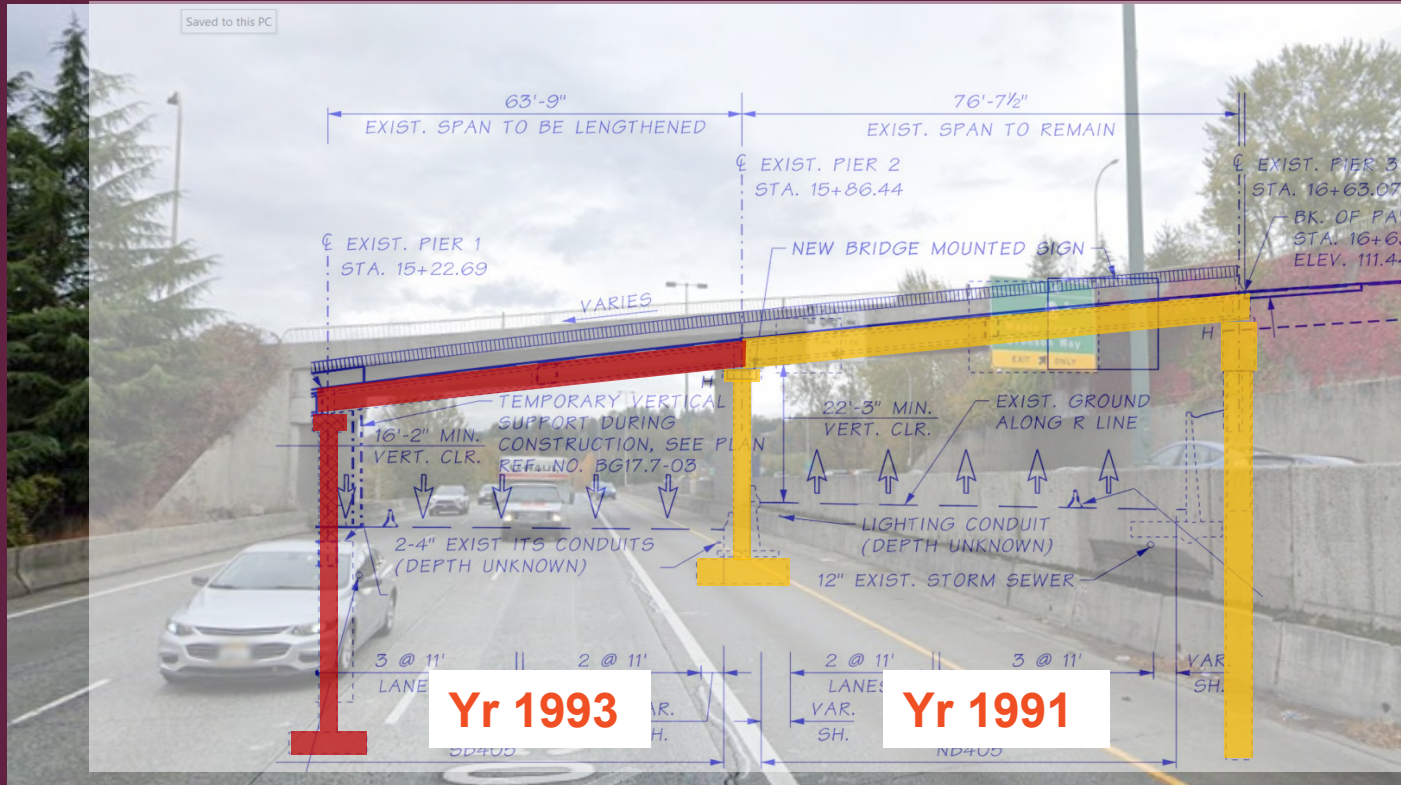


RFP Concept

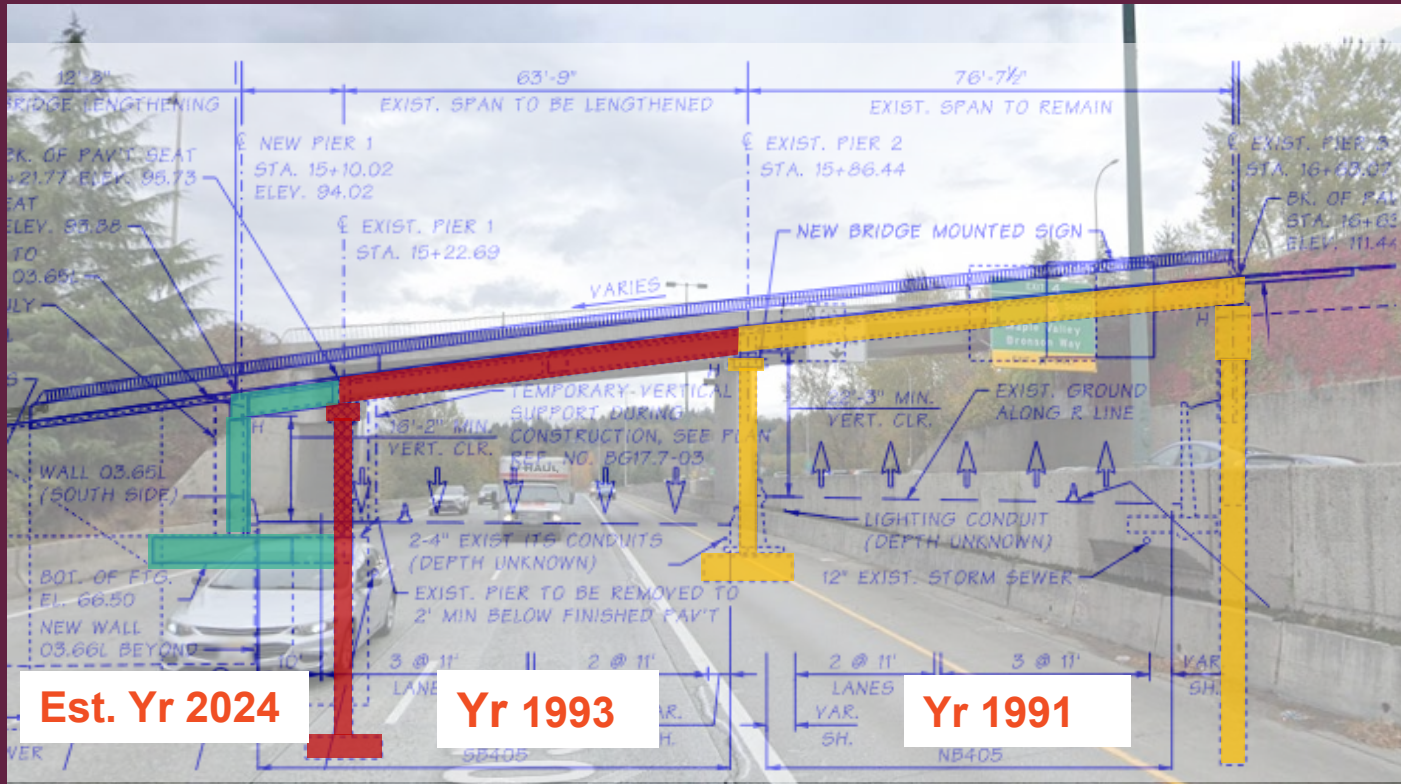
- Replacement of existing structure with new 2-span bridge
- No concept for substructures (reuse existing or build new?)
- NB roadway same width, SB roadway widened

- Our team proposed Alternative Technical Concept to salvage existing bridge. Version with reduced SB shoulders rejected.
- Got approved ATC to reduce shoulders on adjacent Cedar Ave bridge, allowing existing bridge to remain.

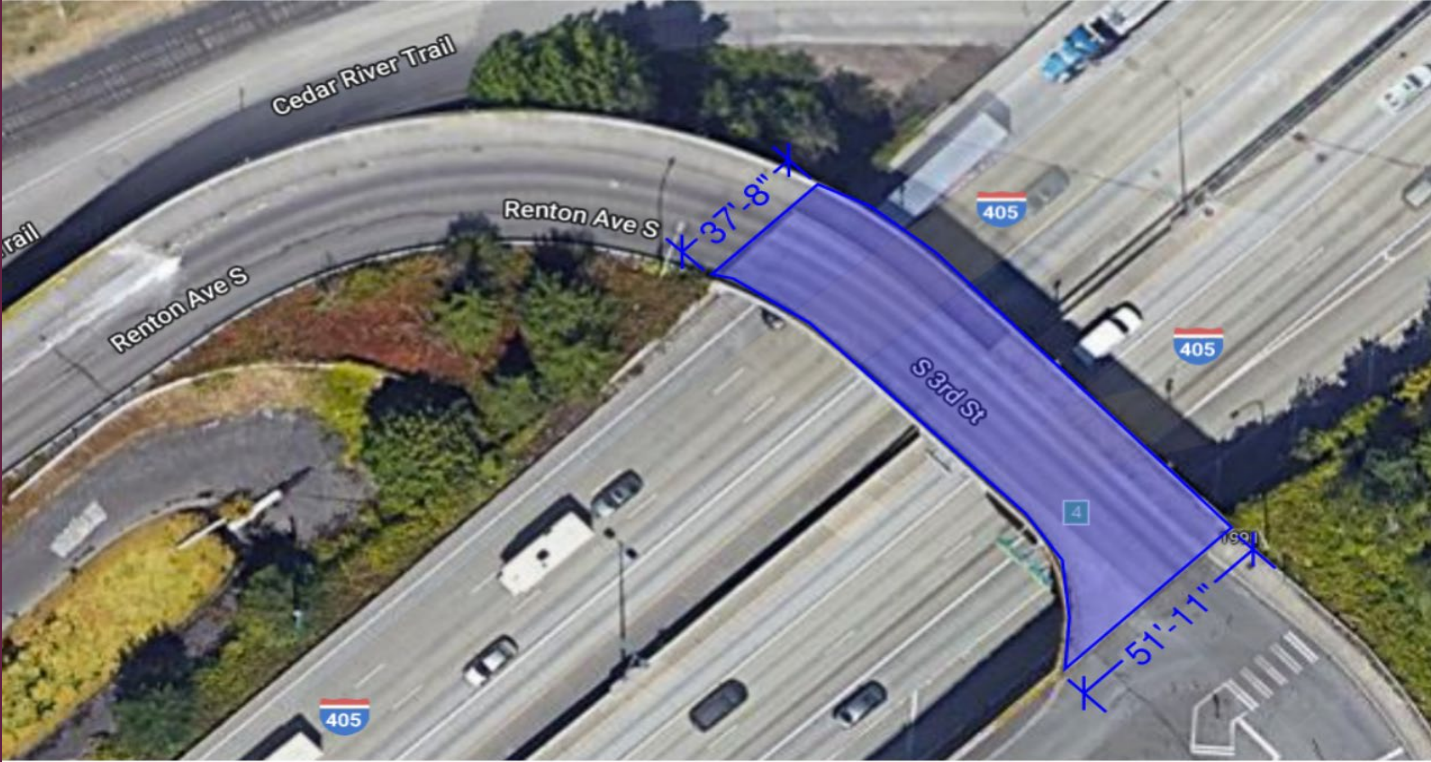
Existing Structure



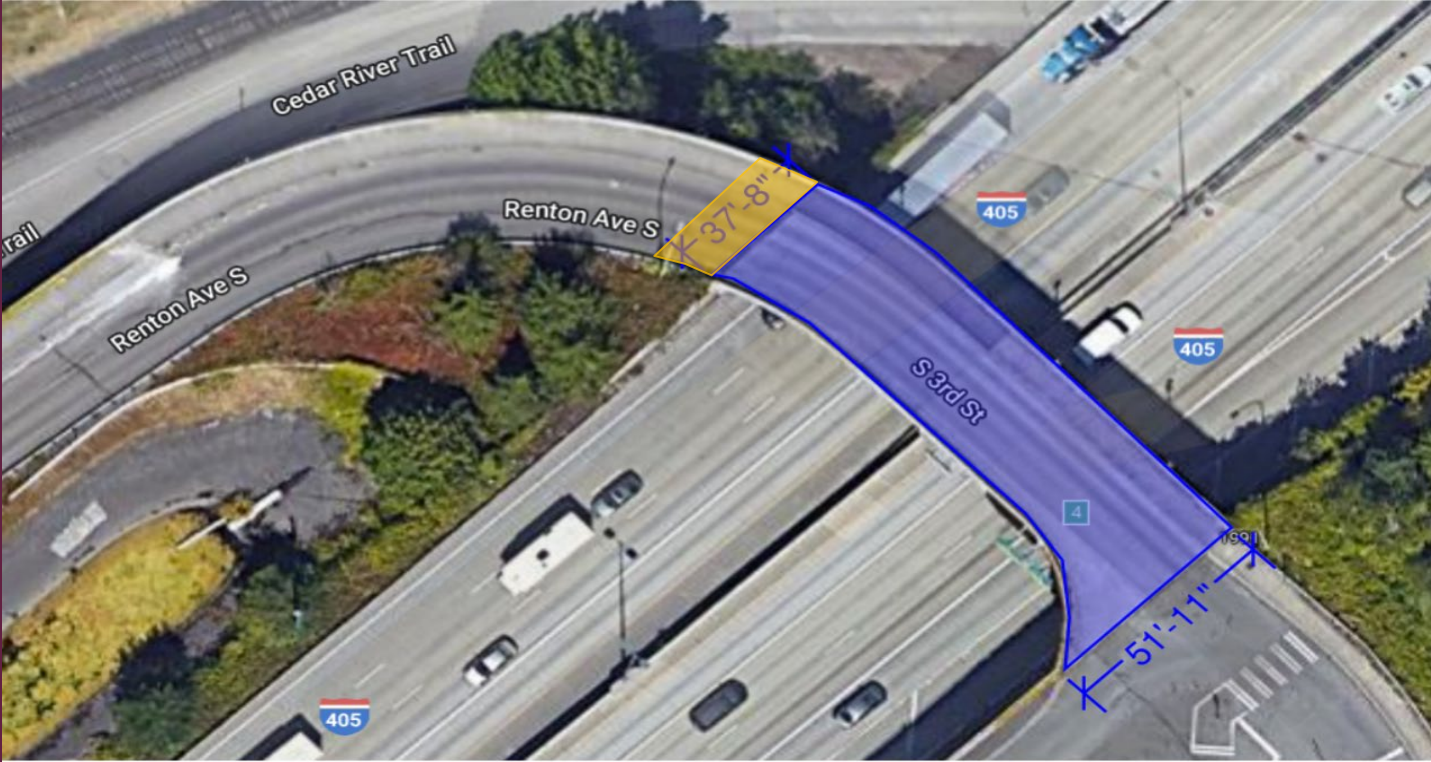
Proposed Structure



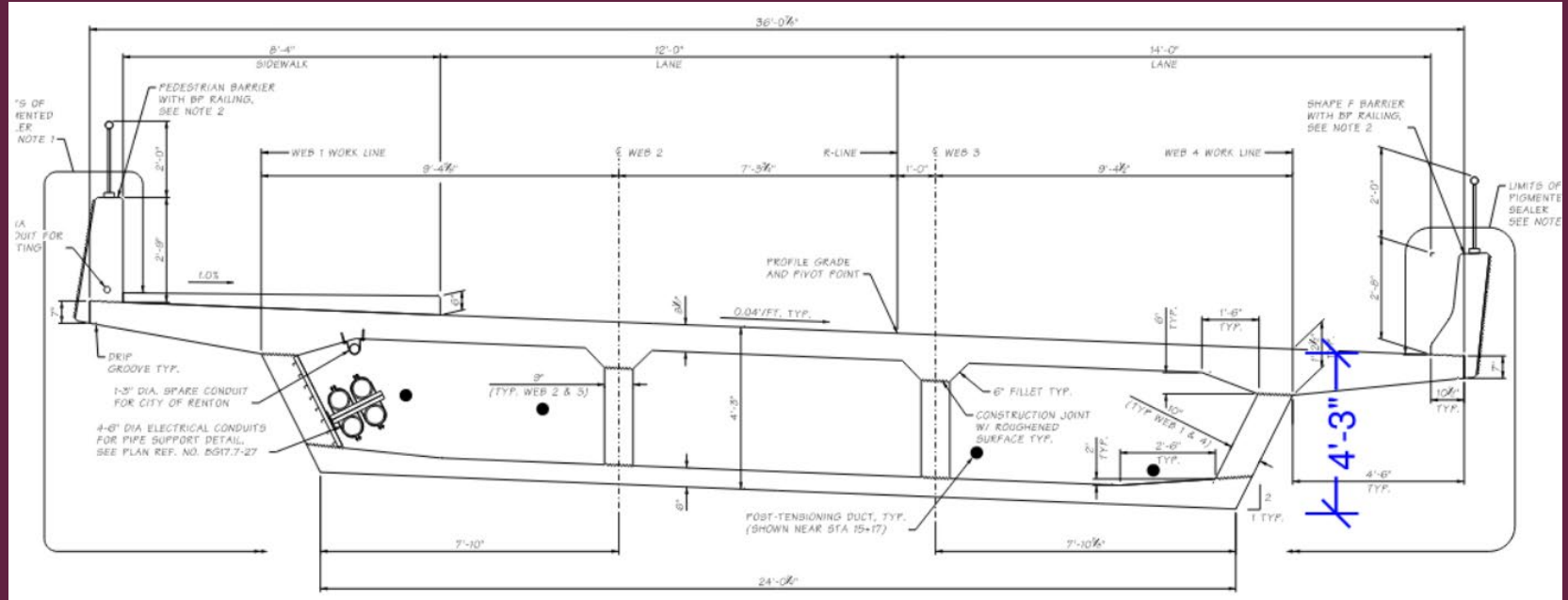
Existing Structure



Proposed Structure



Existing Structure



Opportunities

Opportunities

- Span configuration
- Sufficient girder depth
- Adequate existing structure condition
- Traffic accommodation
- Seismic resiliency



Challenges

Challenges

- Bridge lengthening on curve
- Limited construction space in box girder
- Structure stability during construction
- Modification of the existing structure
- New west abutment inside existing Hilfiker retaining wall
- Construction sequence and lateral loads

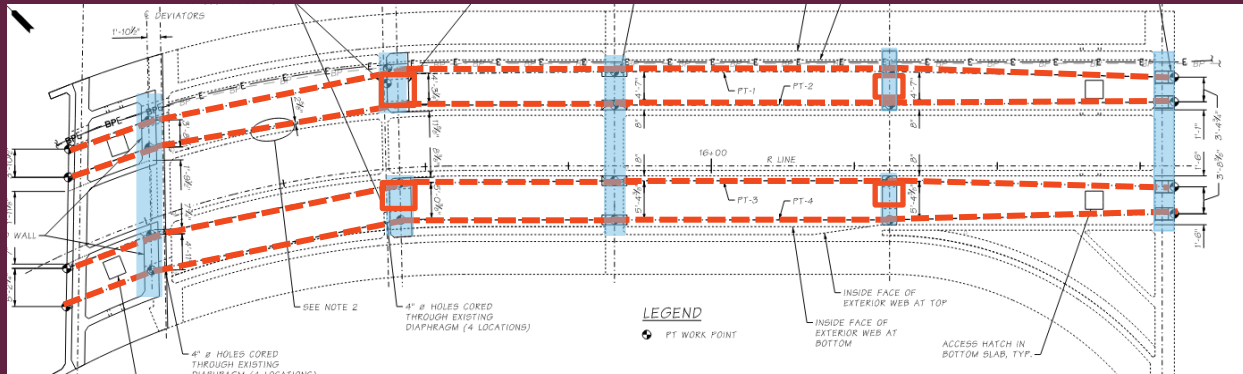
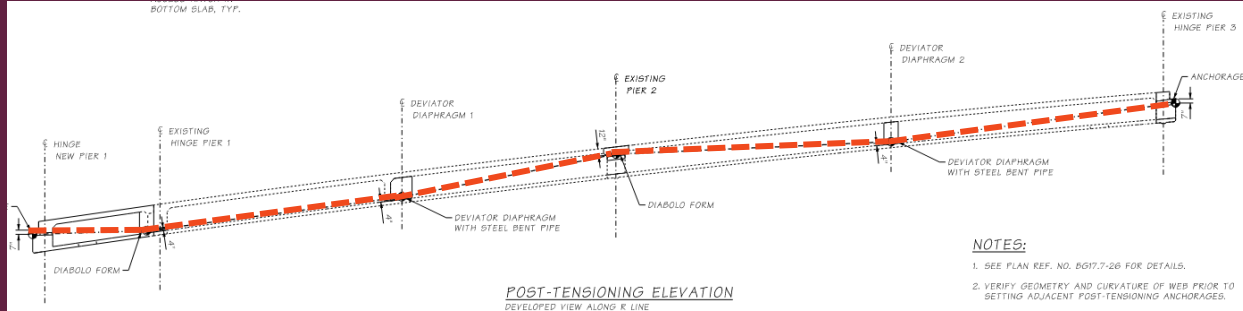




Superstructure Design

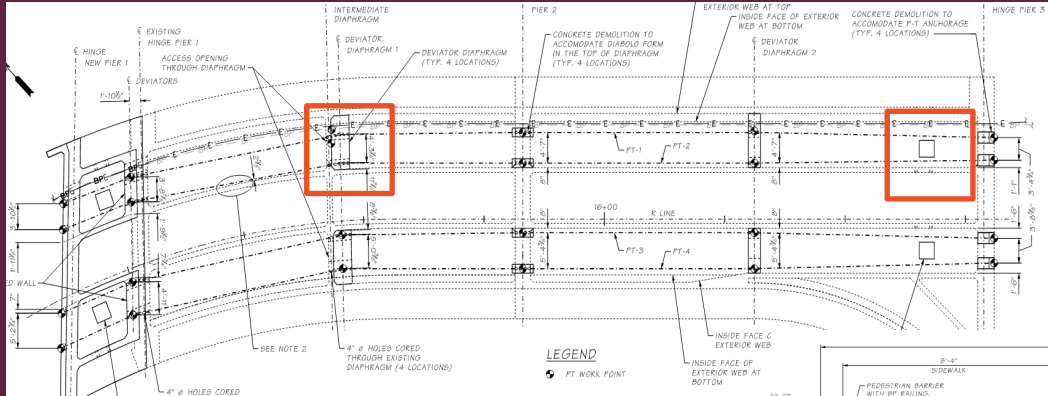


Superstructure Design Concepts



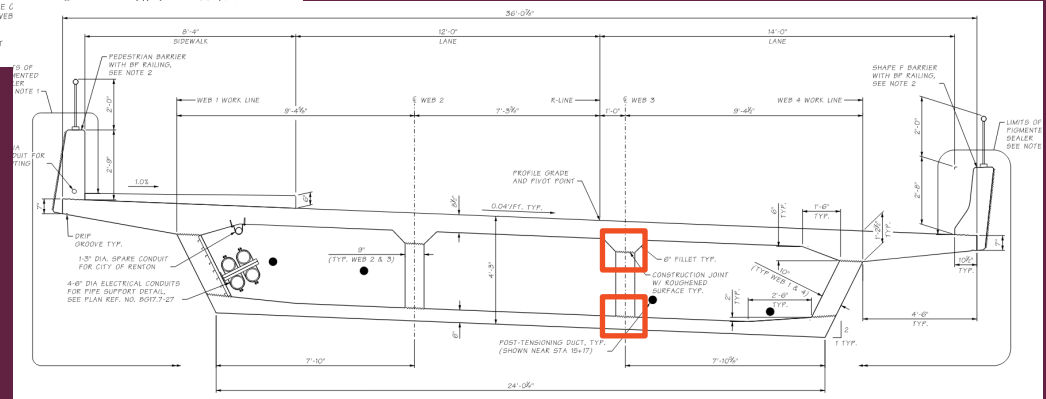
- External post-tensioned tendons
- Deviators & diaphragms
- Temporary openings in top slab & modification of existing diaphragms
- Permanent openings in bottom slab

Superstructure Detailed Design

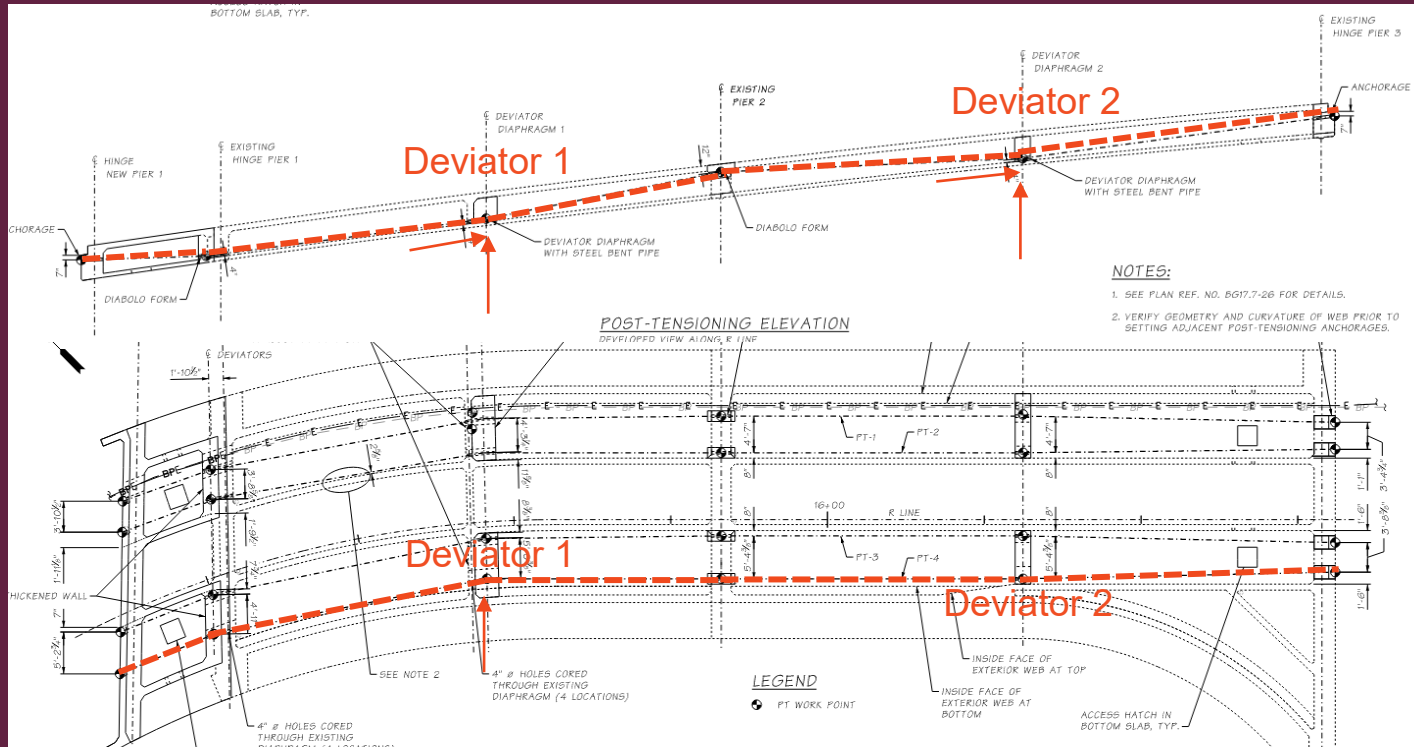


- Longitudinal flexural and shear
- Flexural check at openings
- Interface shear check

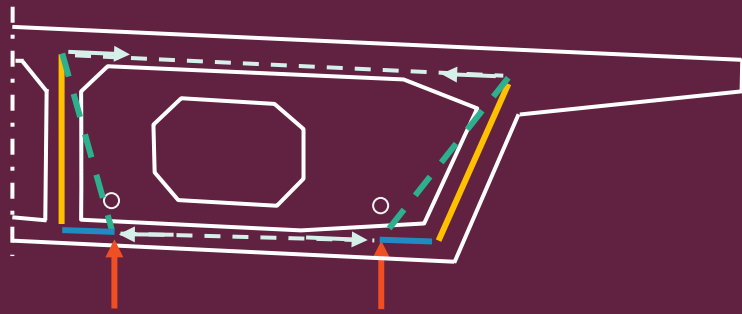
- Transverse check for top slab, overhang, web, and bottom slab



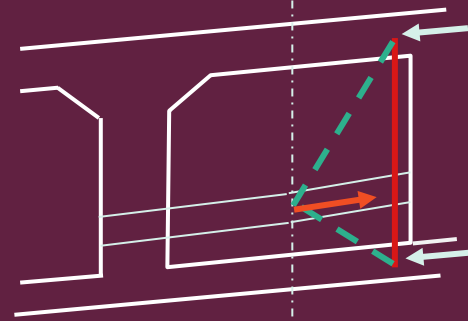
Superstructure Detailed Design



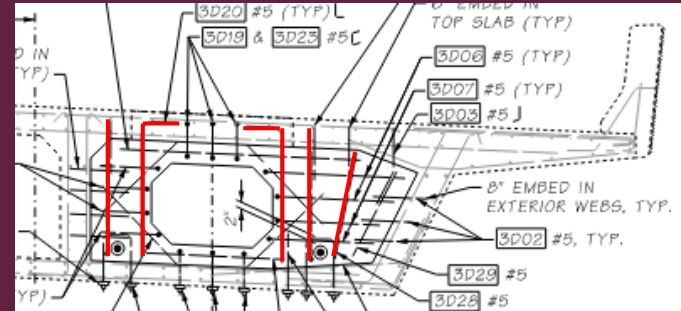
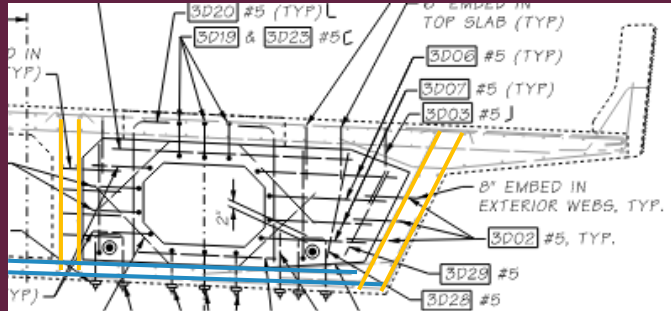
Superstructure Detailed Design



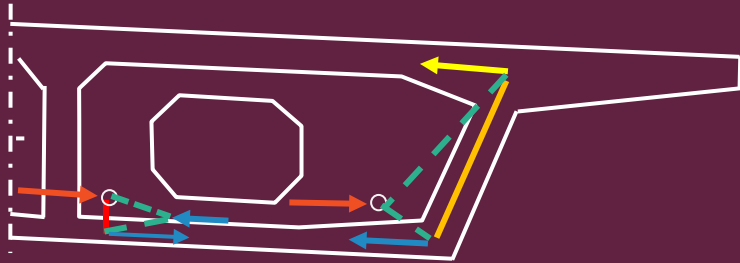
▪ Section View



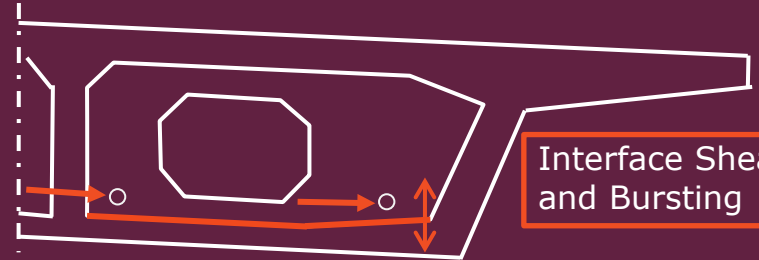
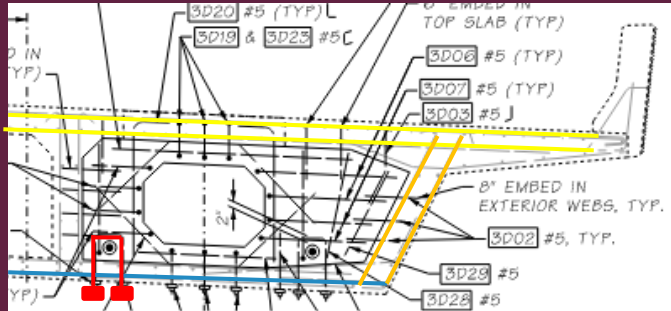
▪ Longitudinal View



Superstructure Detailed Design

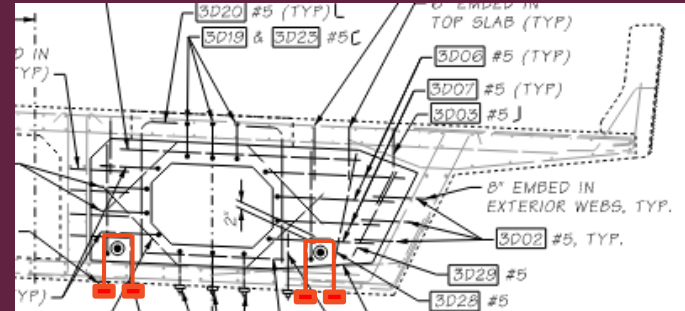


■ Section View



Interface Shear and Bursting

■ Section View





Substructure Design

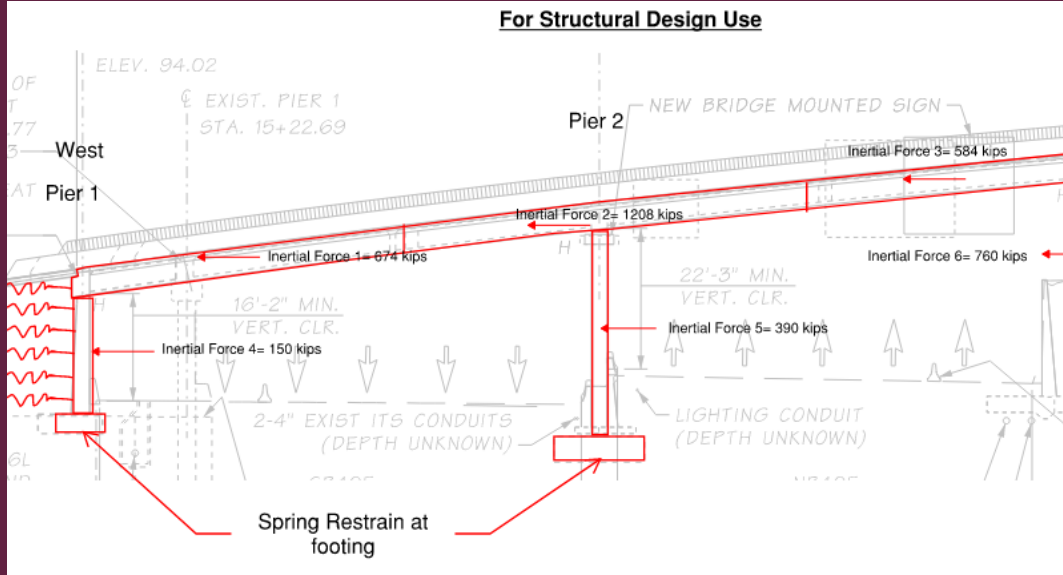


Substructure Design

- Existing west abutment
 - Tall wall on spread footing (at Cedar River Road level)
 - Soil reinforcement behind abut for Hilfiker wall beyond
- New west abutment
 - Perched spread footing (at I-405 road level)
 - Anchored to the existing abutment for tie-down resistance



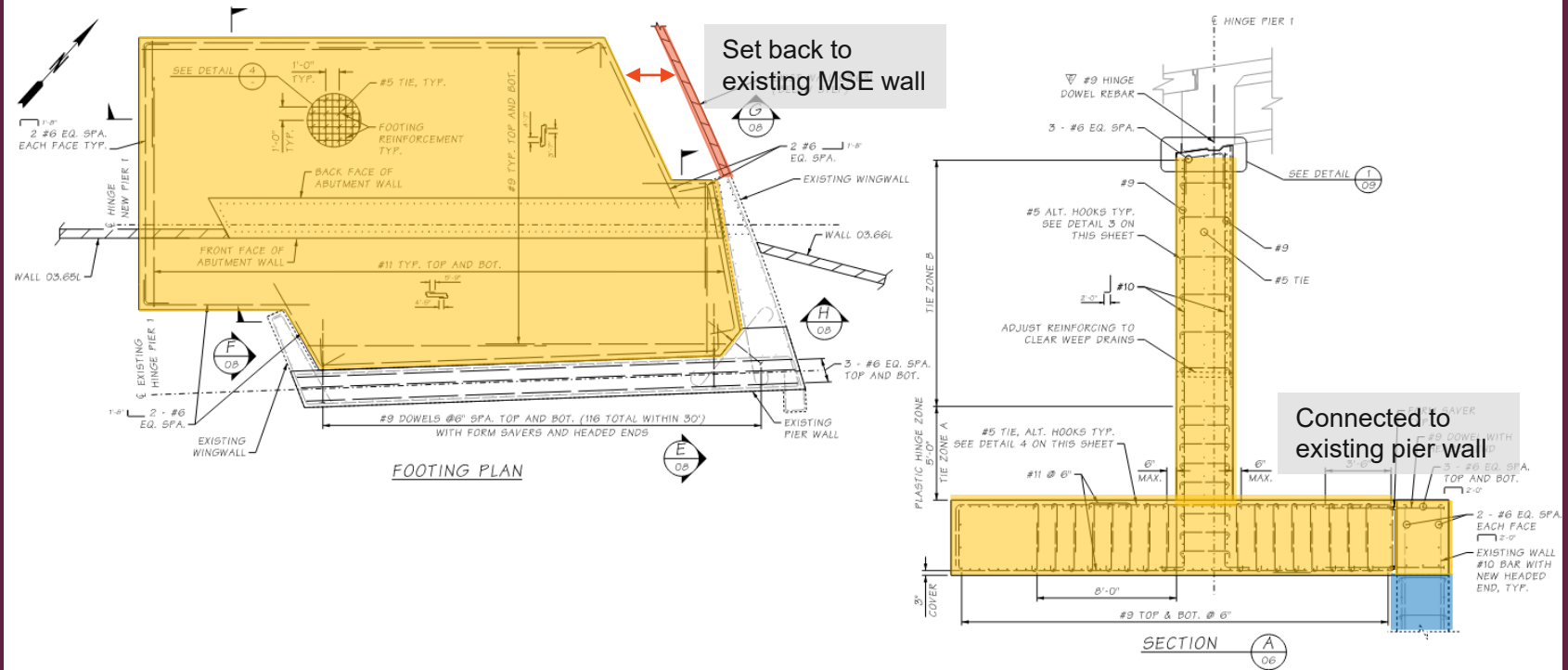
Substructure Design



East
Pier 3



Substructure Design

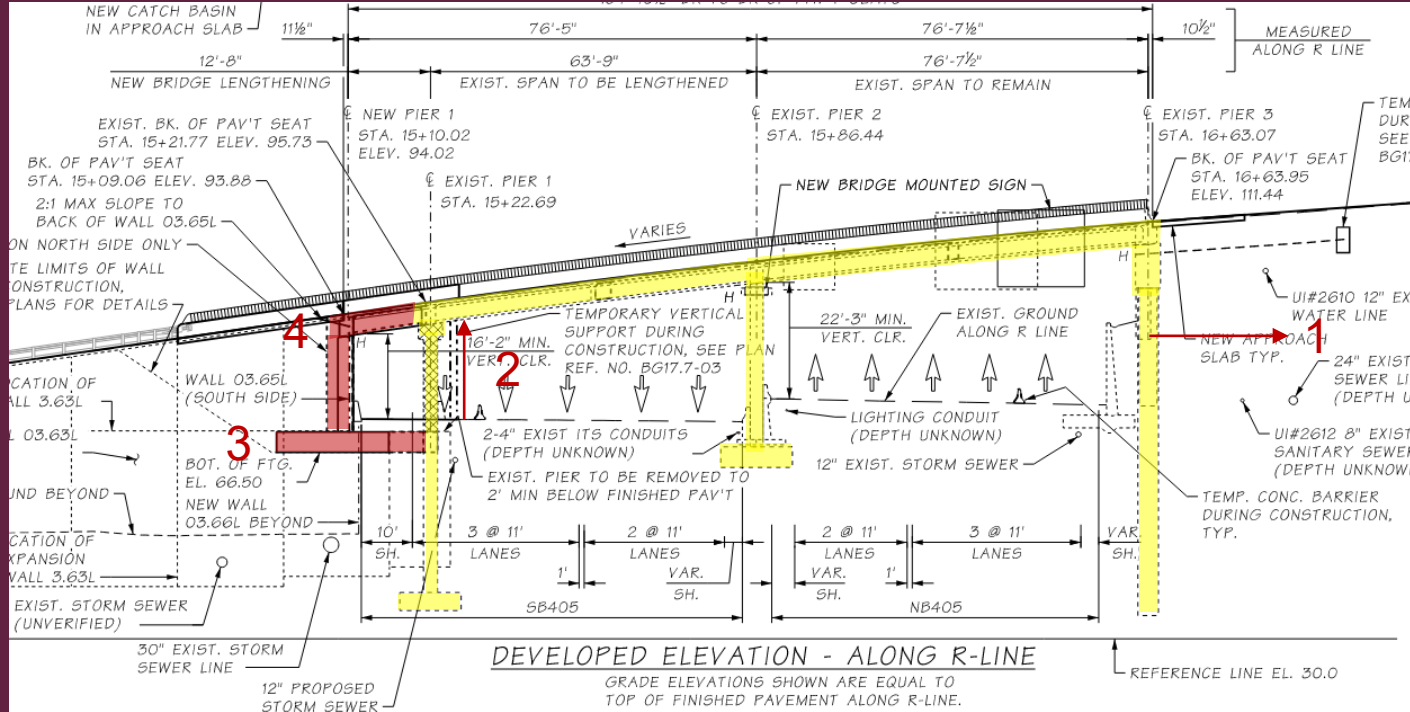




Construction Sequence



Construction Sequence



Acknowledgements

- COWI Staff:
 - Lindsey Li
 - Bo Hu
 - Tom Wilson
 - Matt Baughman
 - Franco Conde Cajas
 - Mark Aasal
 - Jennifer Milne
 - Penny Conrad
 - Karen Bungler
 - Mehdi Dastfan
 - Rashim Garg
 - Jared Ganassin
 - Chand Khushiram
 - Chu Peng
- WSP (formerly Wood)
- Flatiron-Lane JV
- WSDOT

