



FINAL DESIGN PARTNERS.

**HNTB**

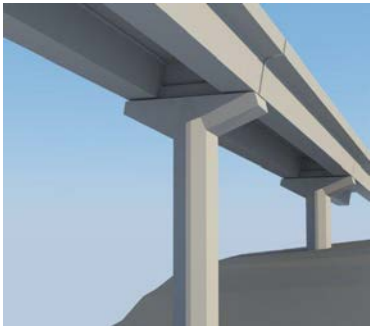
**JACOBS**

 Hatch Mott  
MacDonald

# Design of East Link Aerial Guideway Jerry Dorn

**Western Bridge Engineers'  
Seminar**

**September 5th, 2013**



# East Link Extension Overview

**Length:** 14 miles

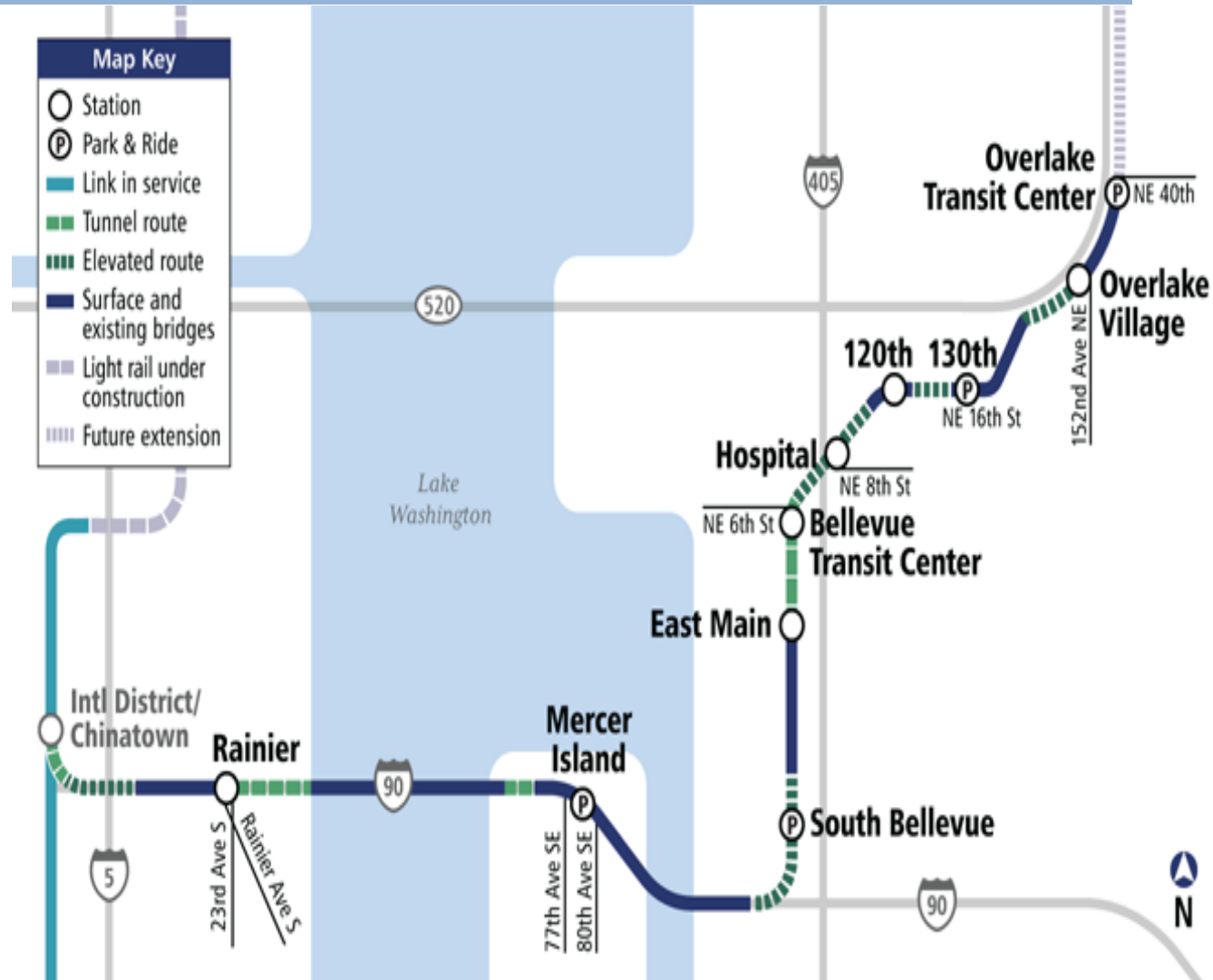
**Rider projection:**

50,000 daily by  
2030

**Budget:** \$2.8 billion  
(2010\$)

**Start of Service:**

Targeted 2023



East Link Extension

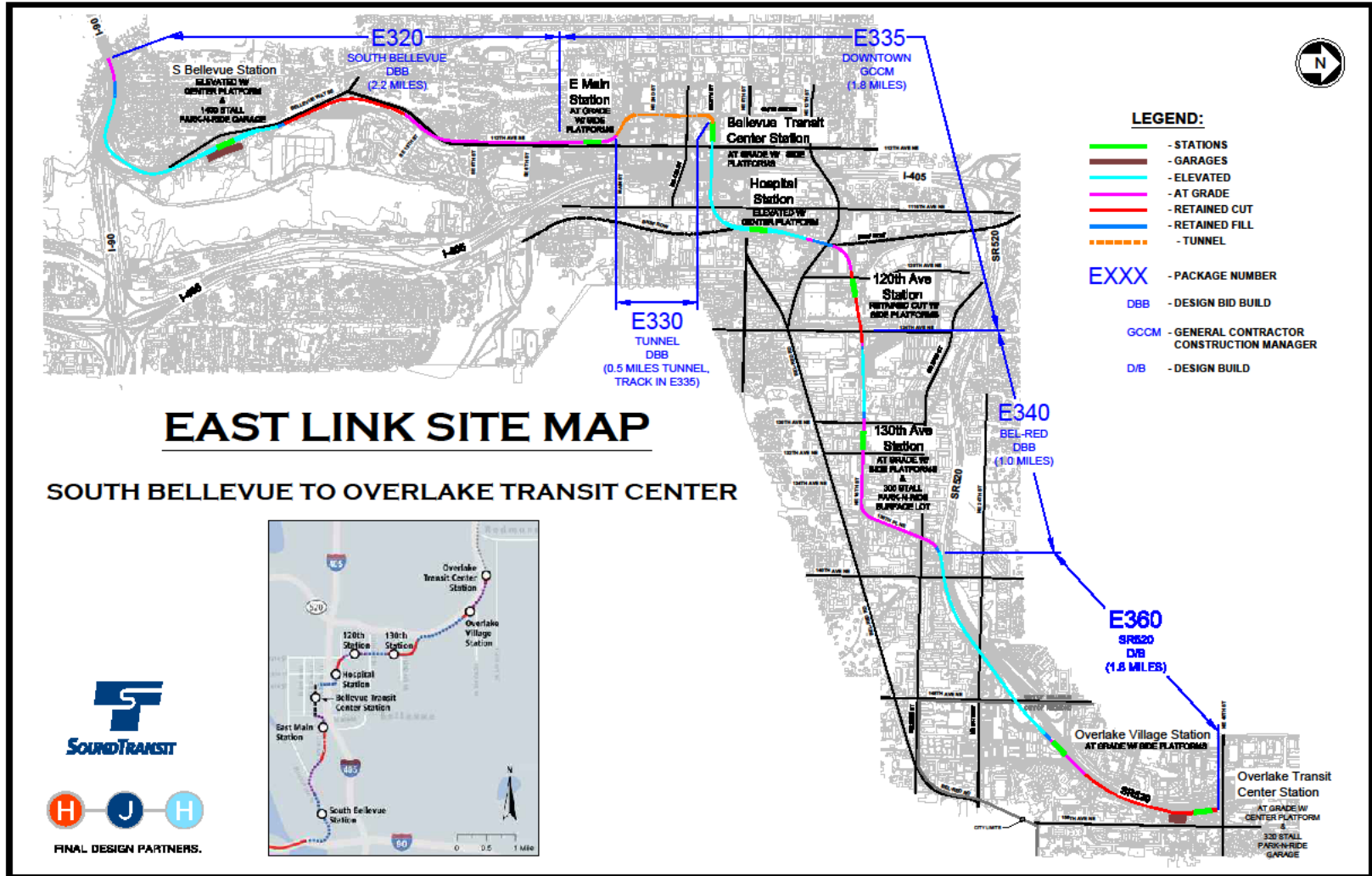


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# East Link Extension Timeline



# Project Packages



# South Bellevue

- Serves south Bellevue in a trench along Bellevue Way and an at-grade alignment along 112<sup>th</sup> Ave
- Stations at South Bellevue and East Main
- Approximately 7,000 daily boardings (2030)





# South Bellevue Station (~30%)



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# Downtown Bellevue

- Serves downtown Bellevue and medical district and Wilburton area
- Tunnel and elevated alignment
- Stations at Bellevue Transit Center and at Hospital Station
- Approximately 8,500 daily boardings (2030)



# Bellevue Transit Center Station (~30% design)



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# Bel-Red

- At-grade, elevated and retained cut alignment
- Stations at 120<sup>th</sup> and 130<sup>th</sup> Ave NE
- Planning for future development and street improvements
- Approximately 7,000 daily boardings (2030)



# Overlake

- Stations at Overlake Village and the Overlake Transit Center
- Bike/Pedestrian bridges at both stations
- Approximately 5,500 daily boardings (2030)



# Aerial Guideway



- 9,400 ft of Aerial Guideway



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# Structure Type Selection

- Precast Prestressed Concrete Tubs
  - Cost
  - Dual Track / Single Track
  - Aerial Station
  - Construction Access
  - Availability





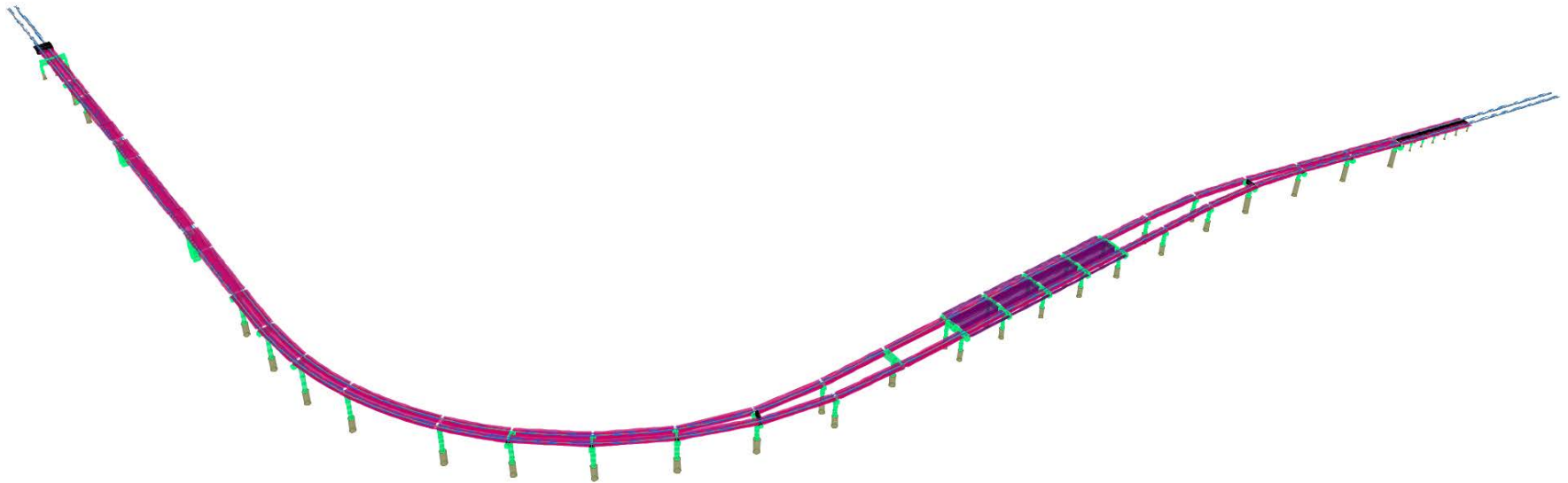




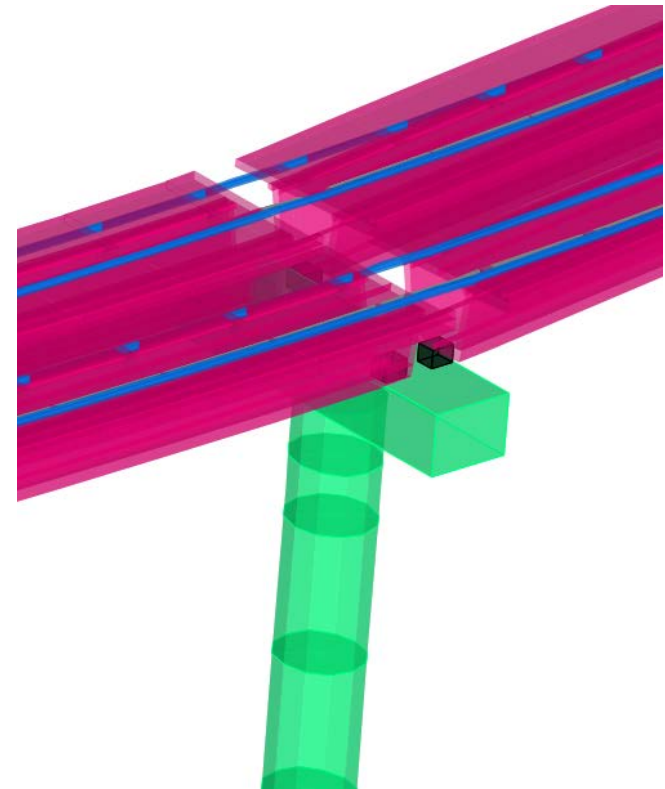
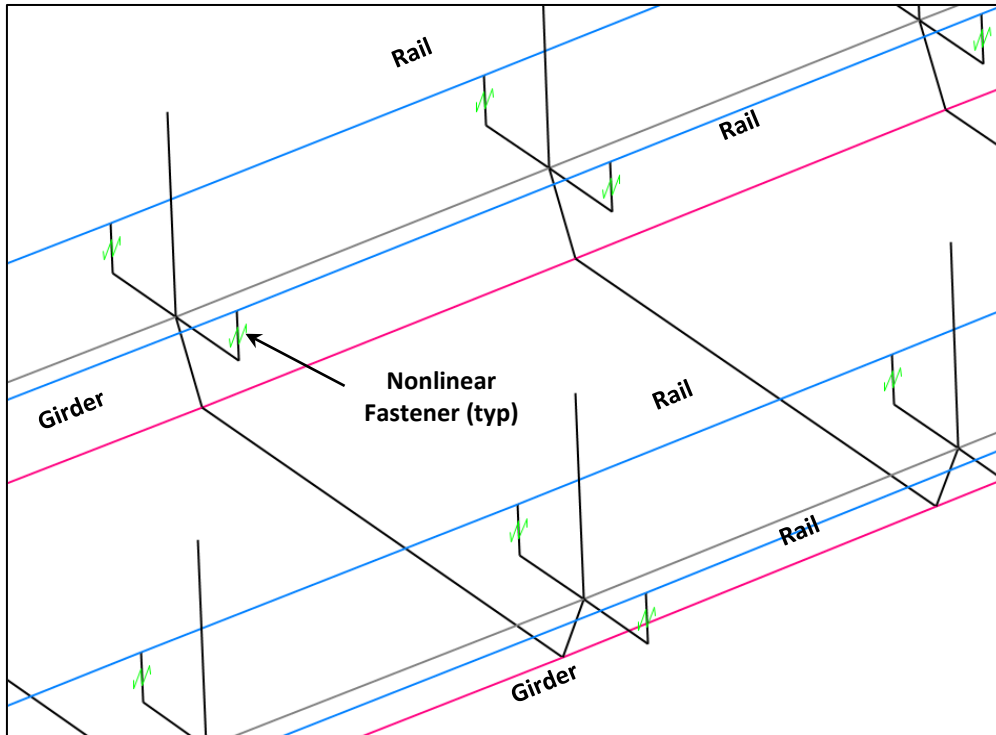
# Key Design Criteria

- 100 year life
- AASHTO LRFD
- Rail/Structure Interaction
  - Continuous Welded Rail
  - Non-linear Rail Fasteners
  - Rail Break, 2" gap
- Seismic
  - Operating Design Earthquake (ODE) 150 yrs, elastic
  - Maximum Design Earthquake (MDE) 2500 yrs, life safety, plastic hinging
- Vibration and Deflection Control
  - Frequency 3.0 hz
  - LL Deflection  $L/1000$

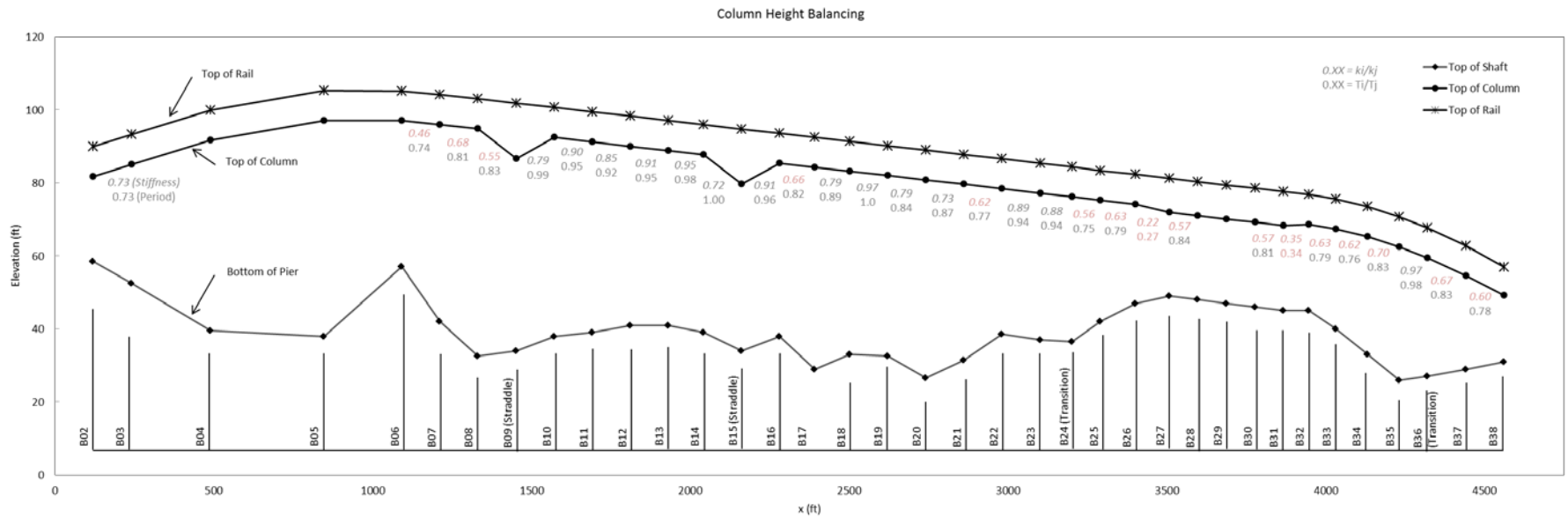
# Analysis – Global Model



# Analysis – Rail/Structure

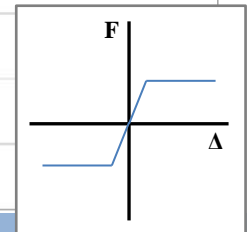
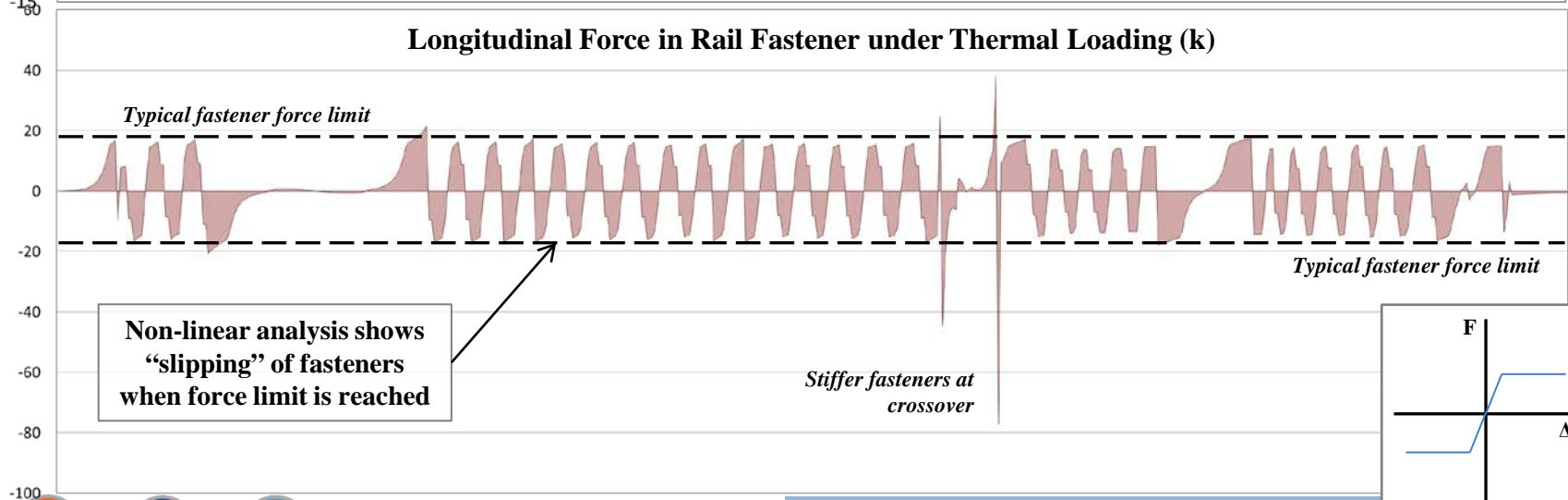
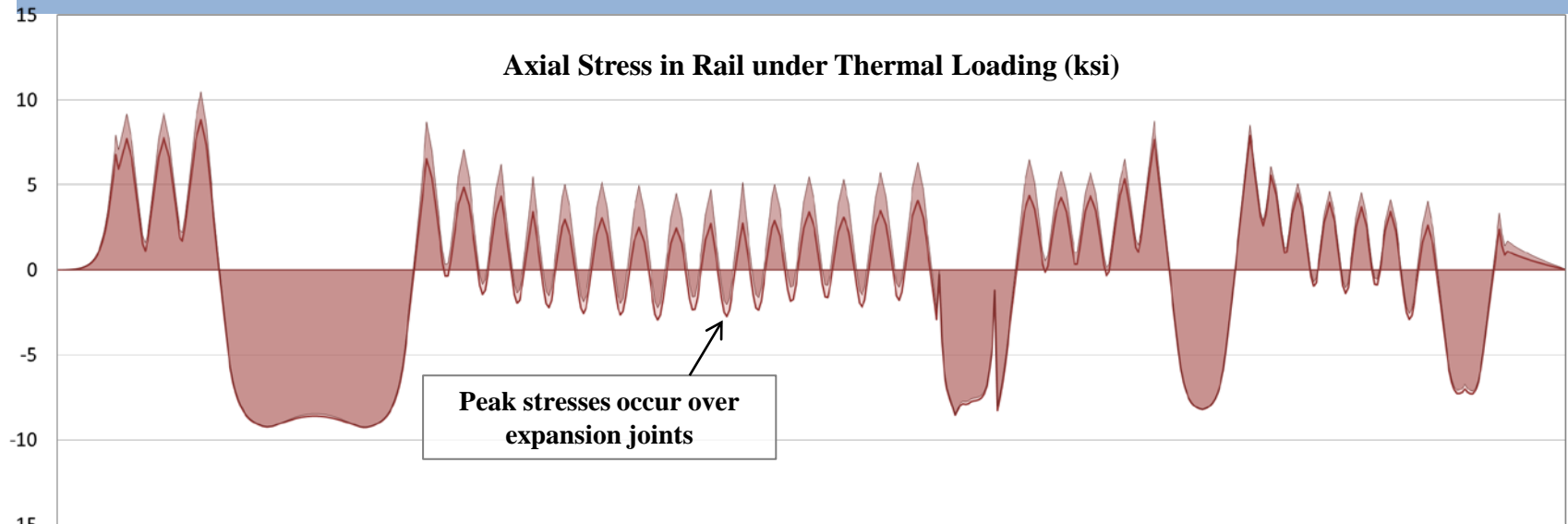


# Stiffness Adjustment



- Column heights
- Column diameter

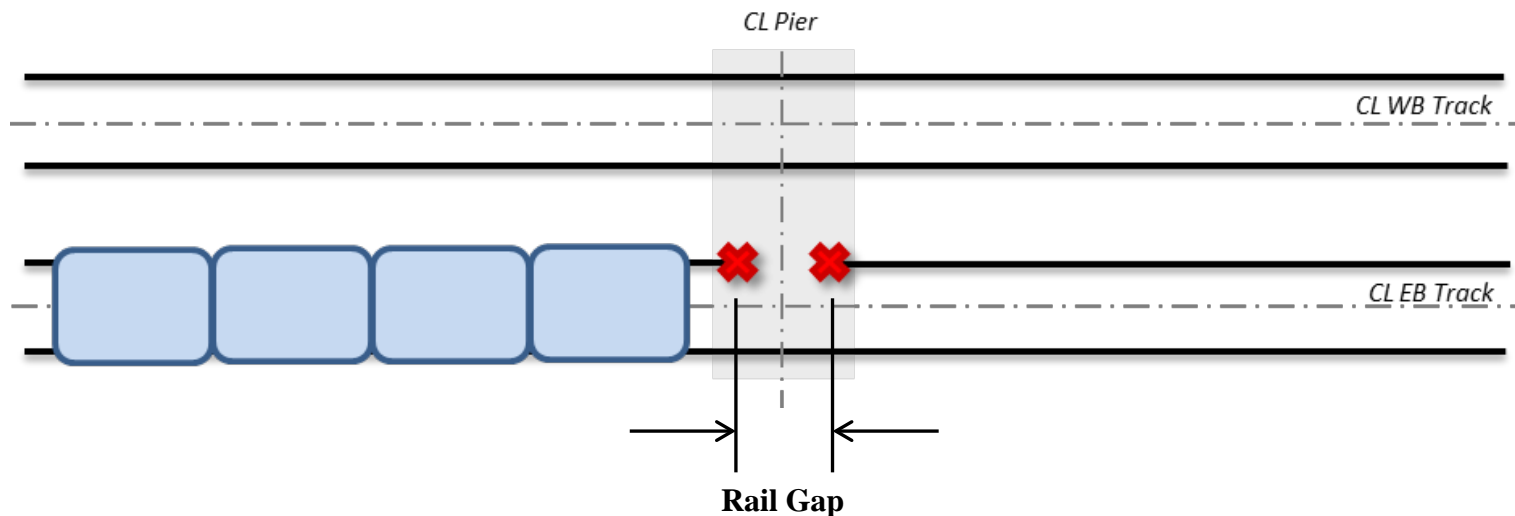
# Rail Performance





# Rail Break

- Rail Break at joint
- Measure rail movement

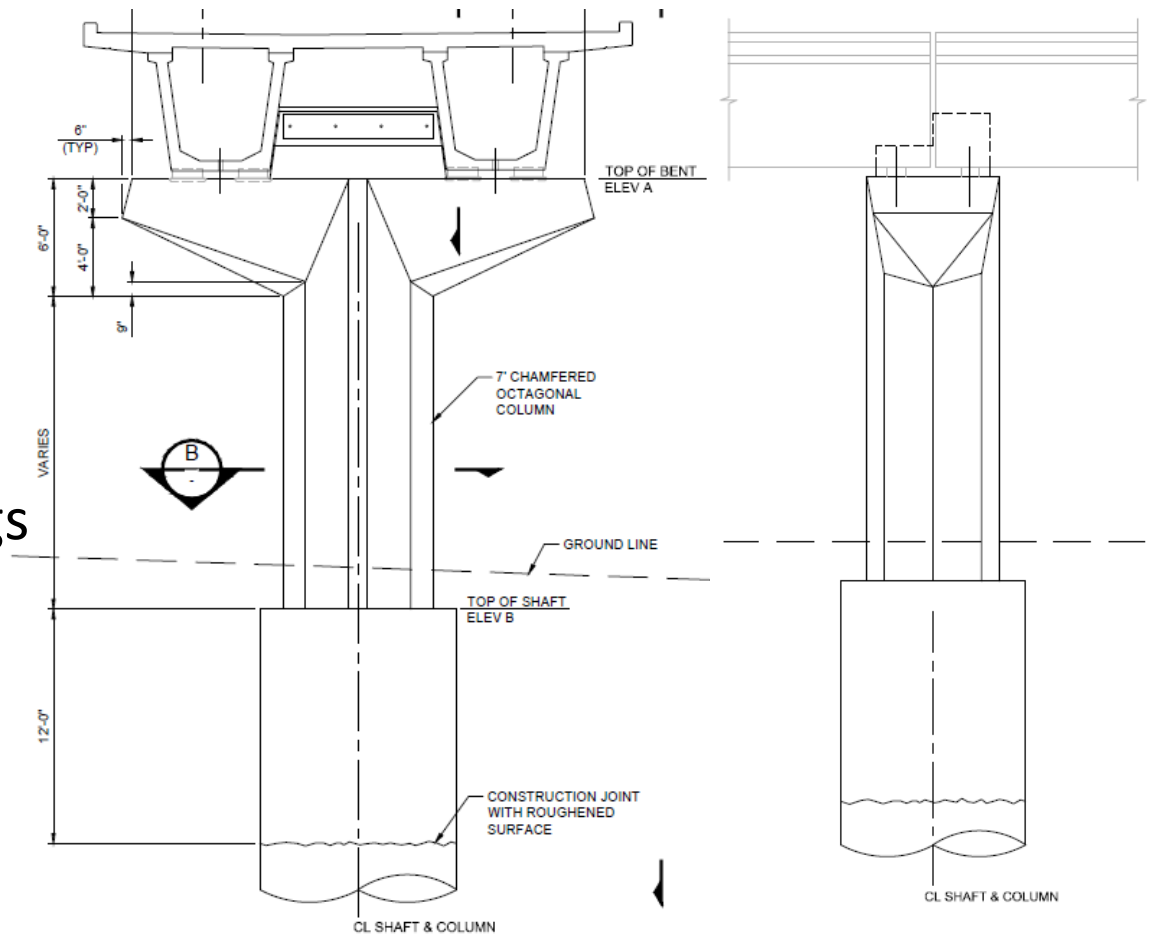


# East Link Structure Types

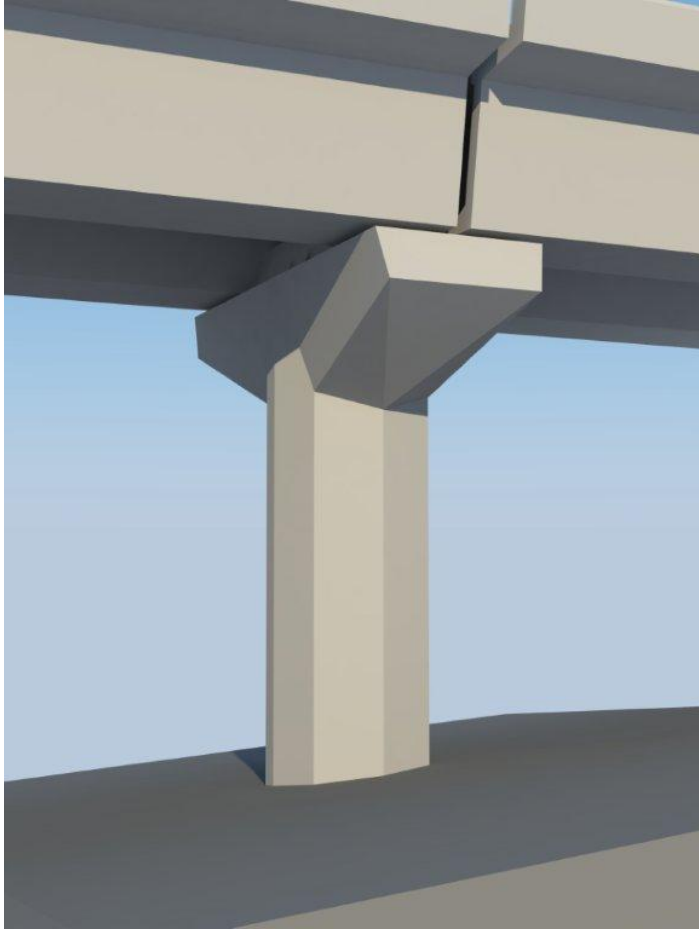
- Simple Span Prestressed Tub
- Long Span CIP Segmental Concrete
- Continuous Prestressed Tub at Stations
- Continuous Post Tensioned Tub at NE 116th
- Prestressed I Girder
- Sequential Excavation Method Tunnel
- Trench

# Dual Track

- Precast Prestressed Tubs
- Octagon column
- Shear Blocks
- Slack Restrainers
- Elastomeric Bearings



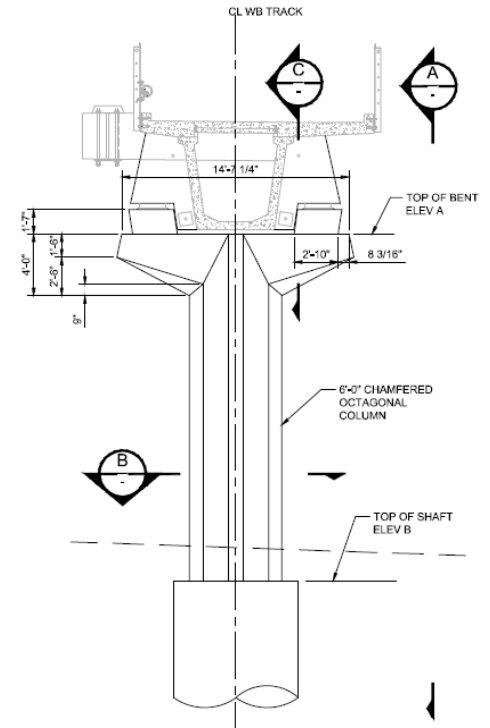
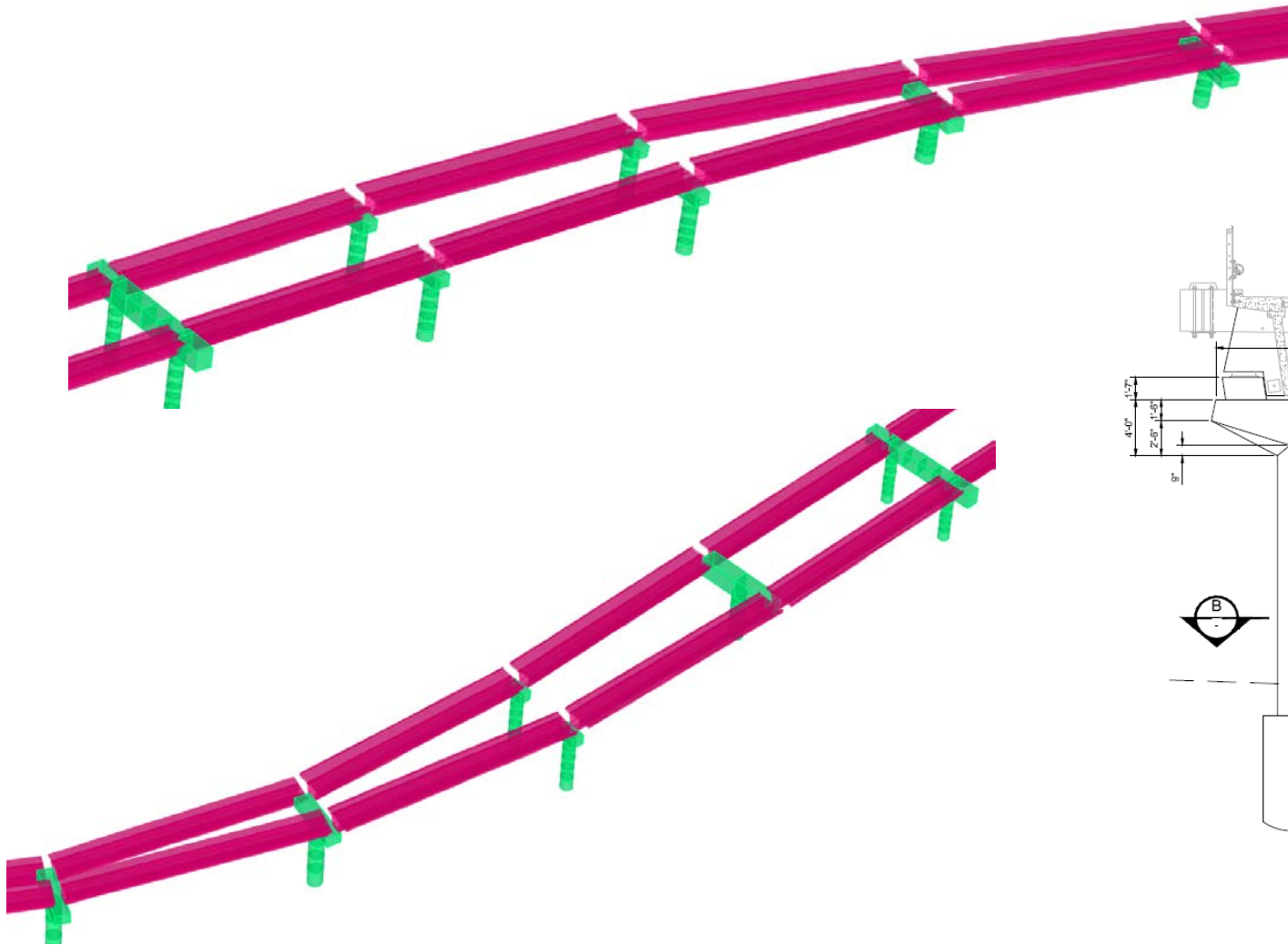
# Dual Track Bent



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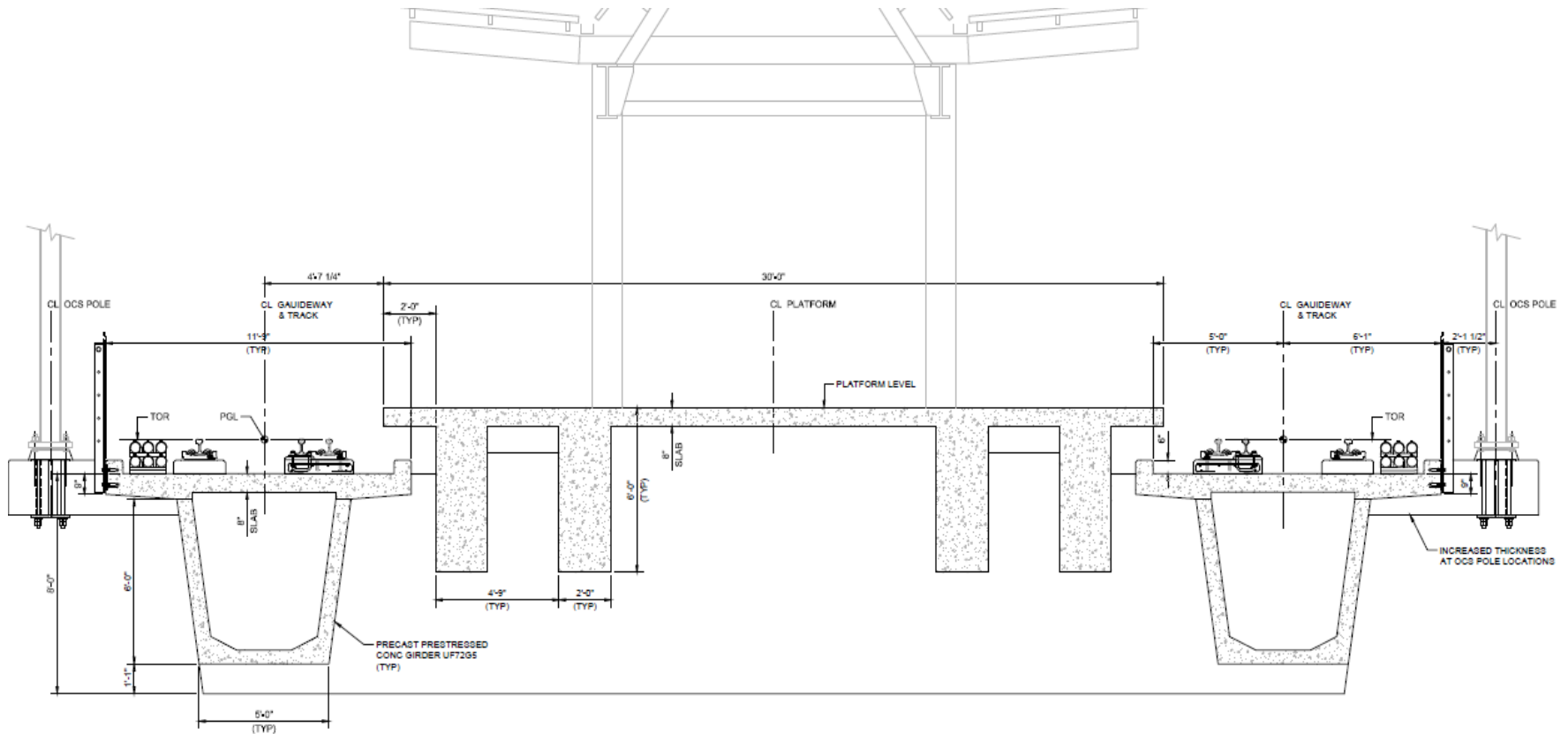
# Single Track



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# Center Platform Station



**ELEVATED STATION SECTION**

SCALE: 1/2" = 1'-0"

**NOTE:**

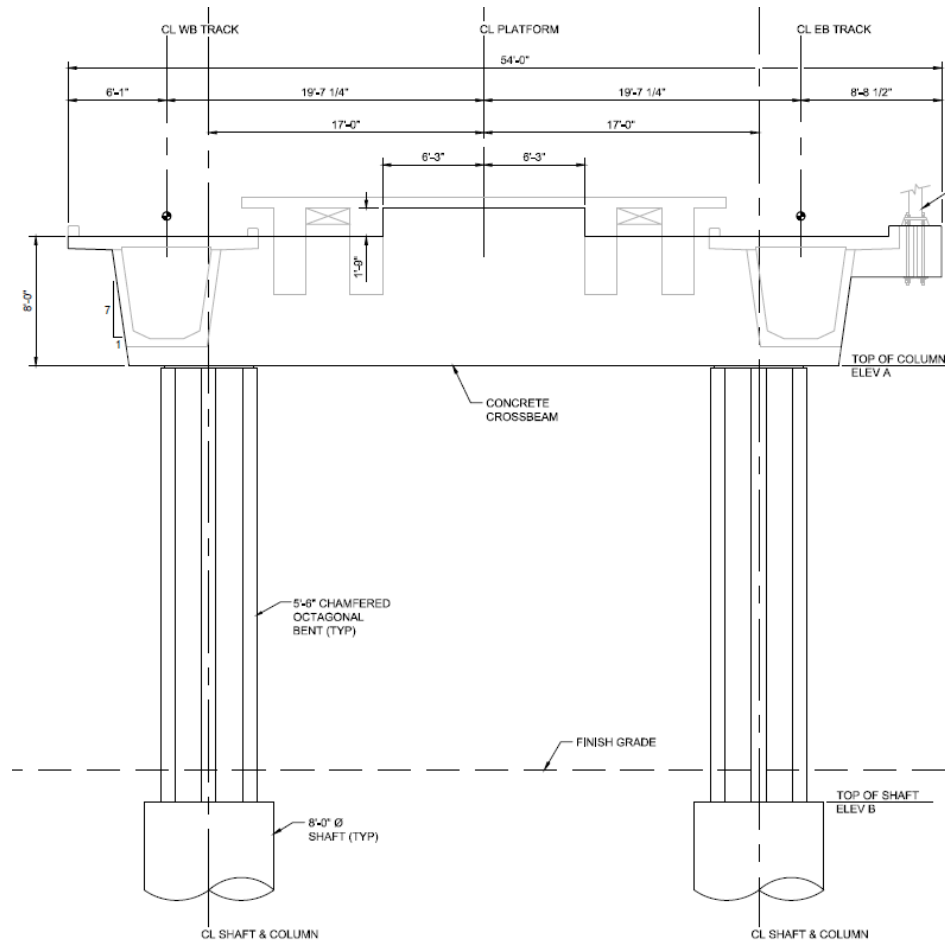
1. SECTION TAKEN AT MIDWAY THROUGH STATION.



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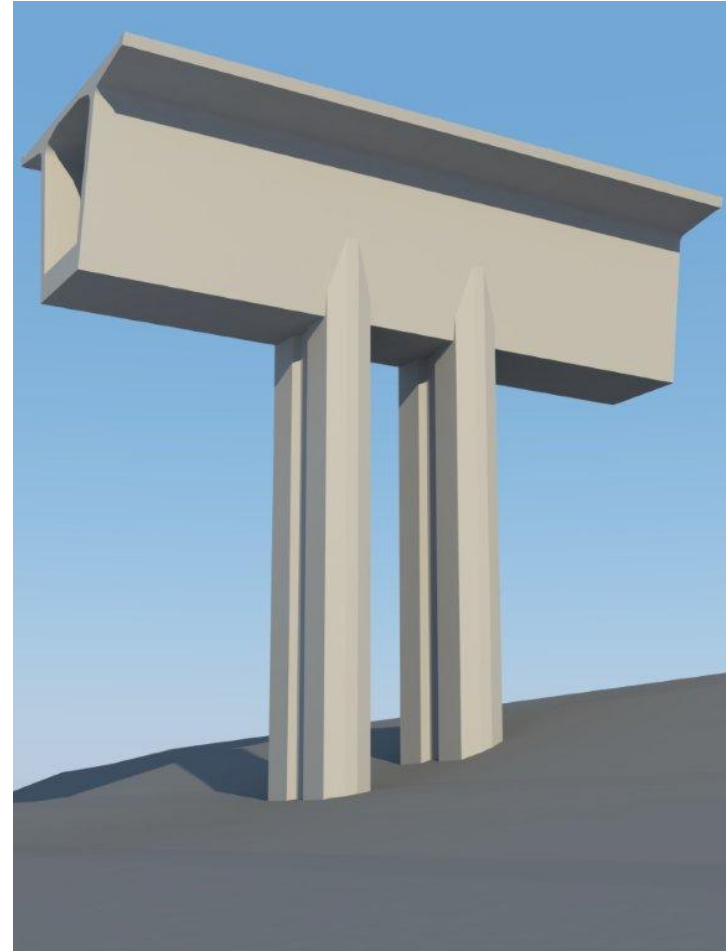
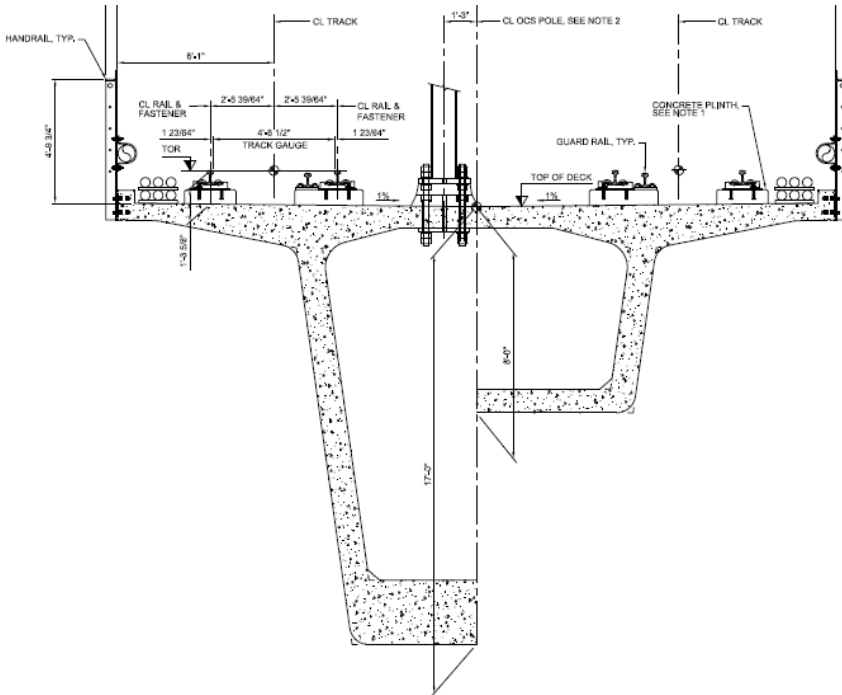
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# Bent at Center Platform Station



# Long Span at I90 and I405

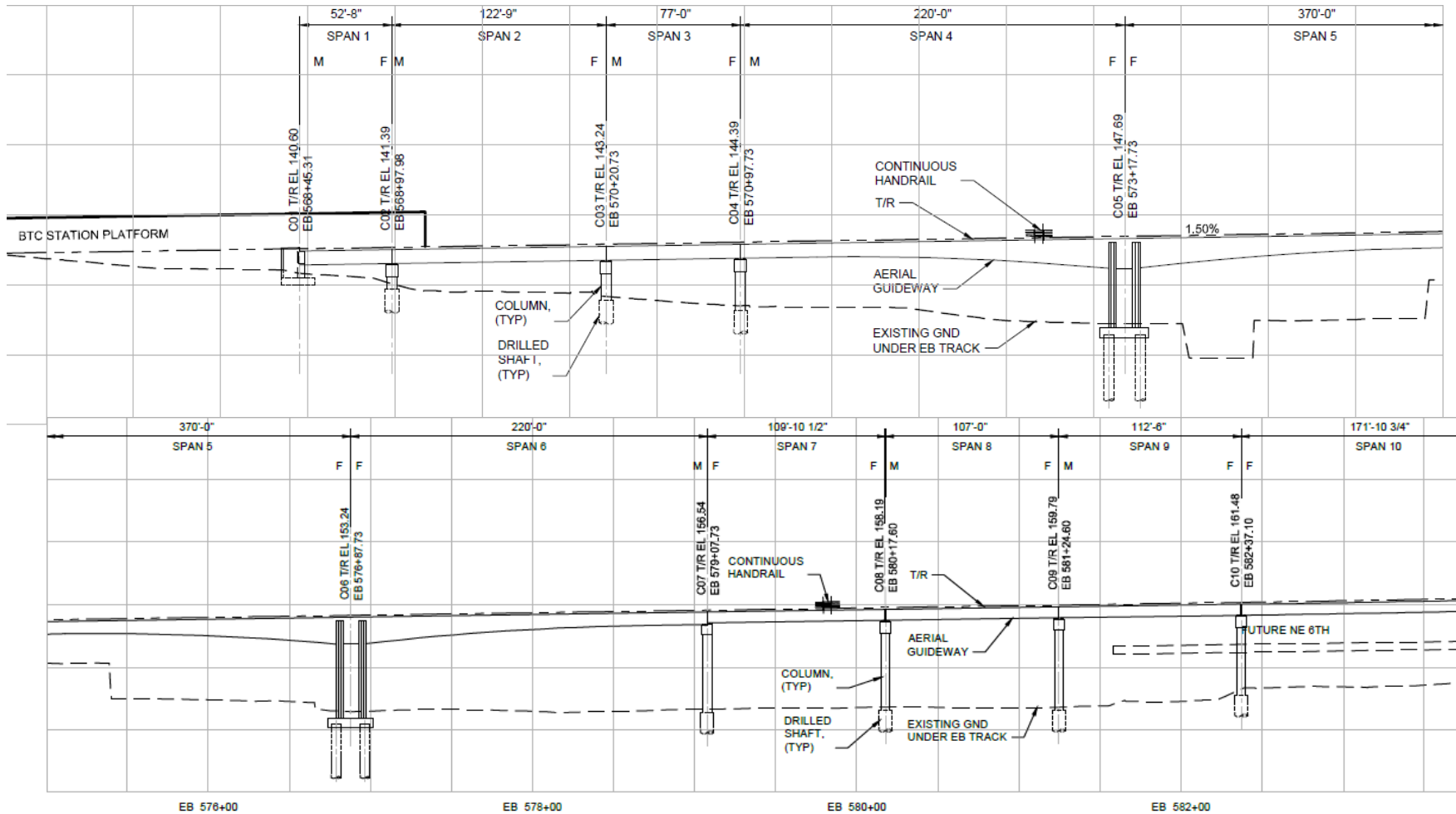
- Cast in Place  
Balanced Cantilever



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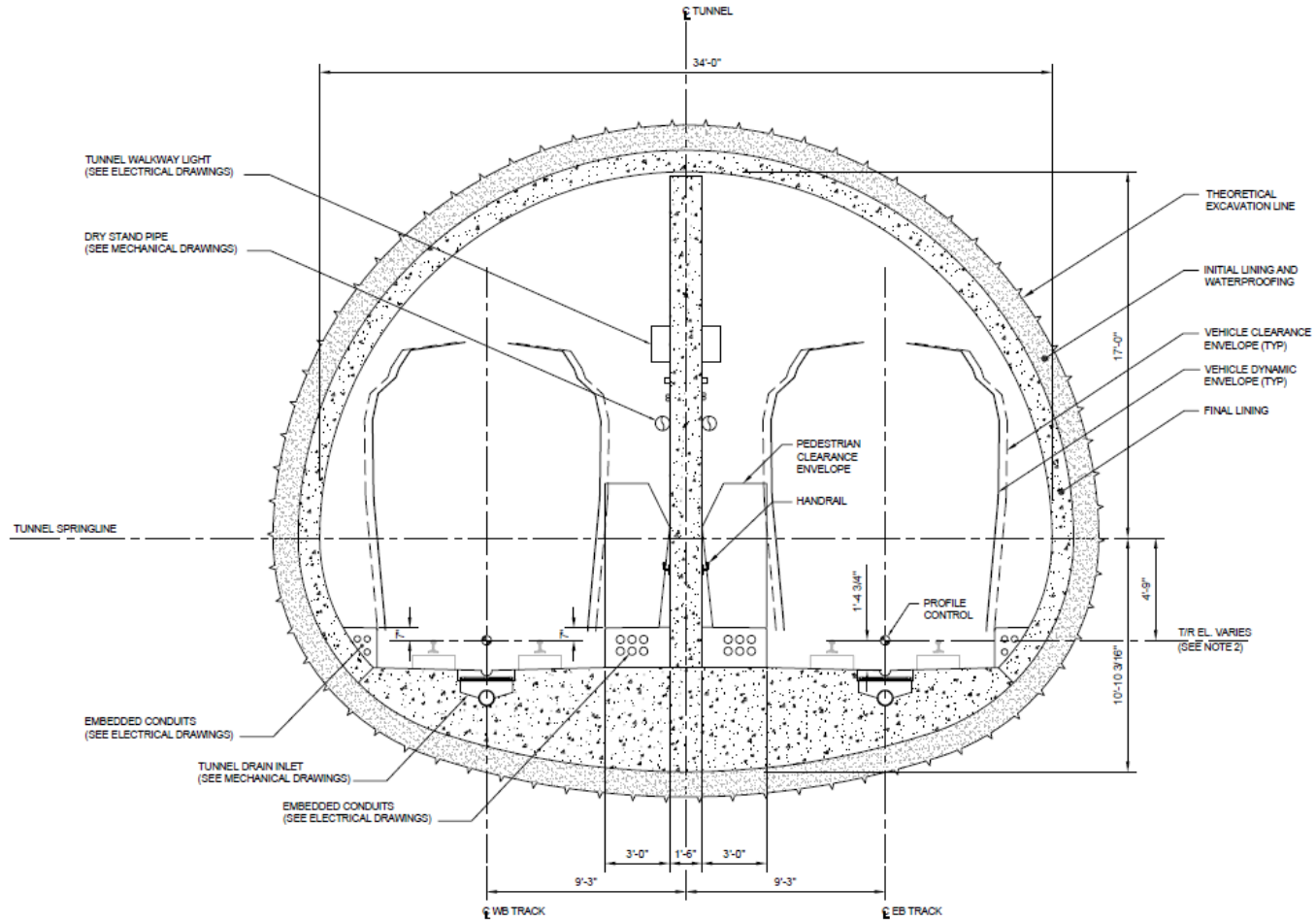
# Balanced Cantilever at I405



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# Downtown Bellevue Tunnel - SEM



TYPICAL SEM TUNNEL SECTION  
TANGENT TRACK

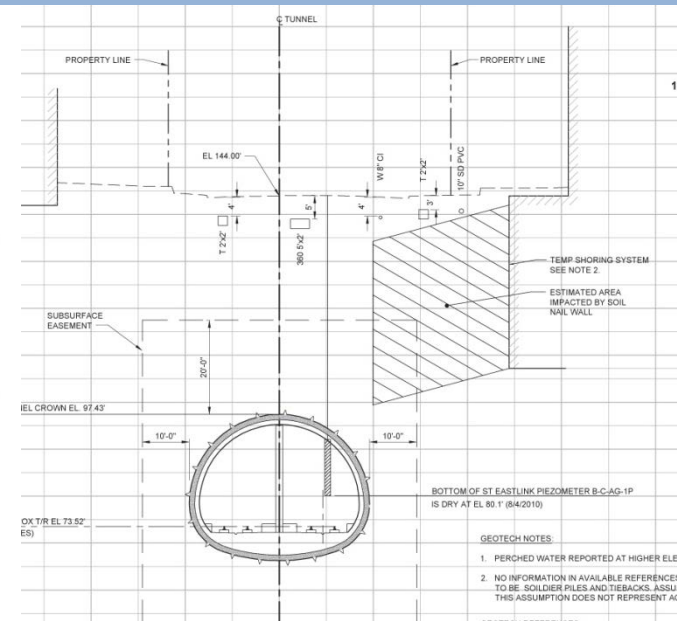
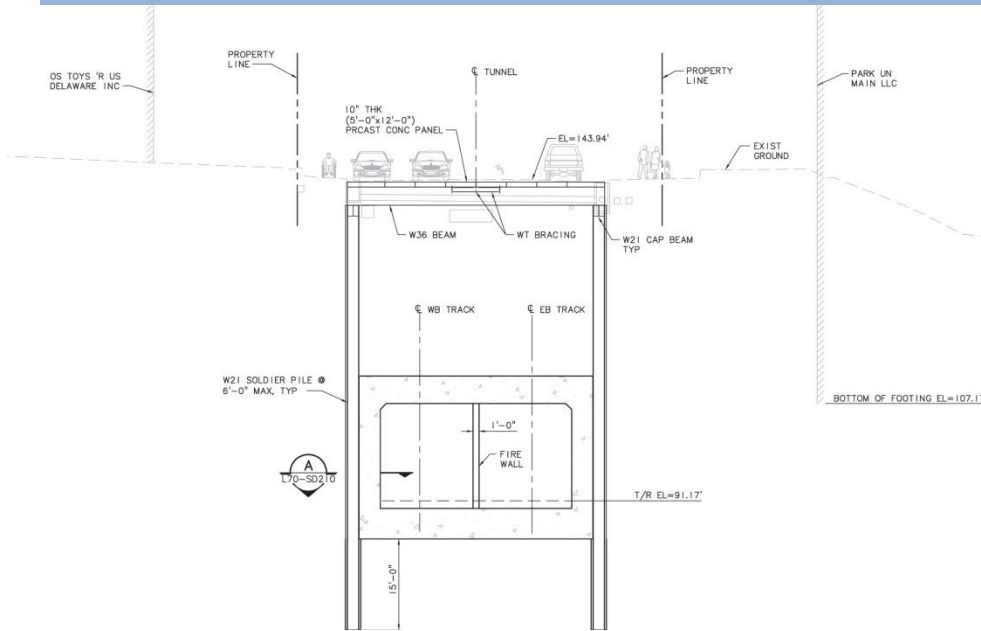


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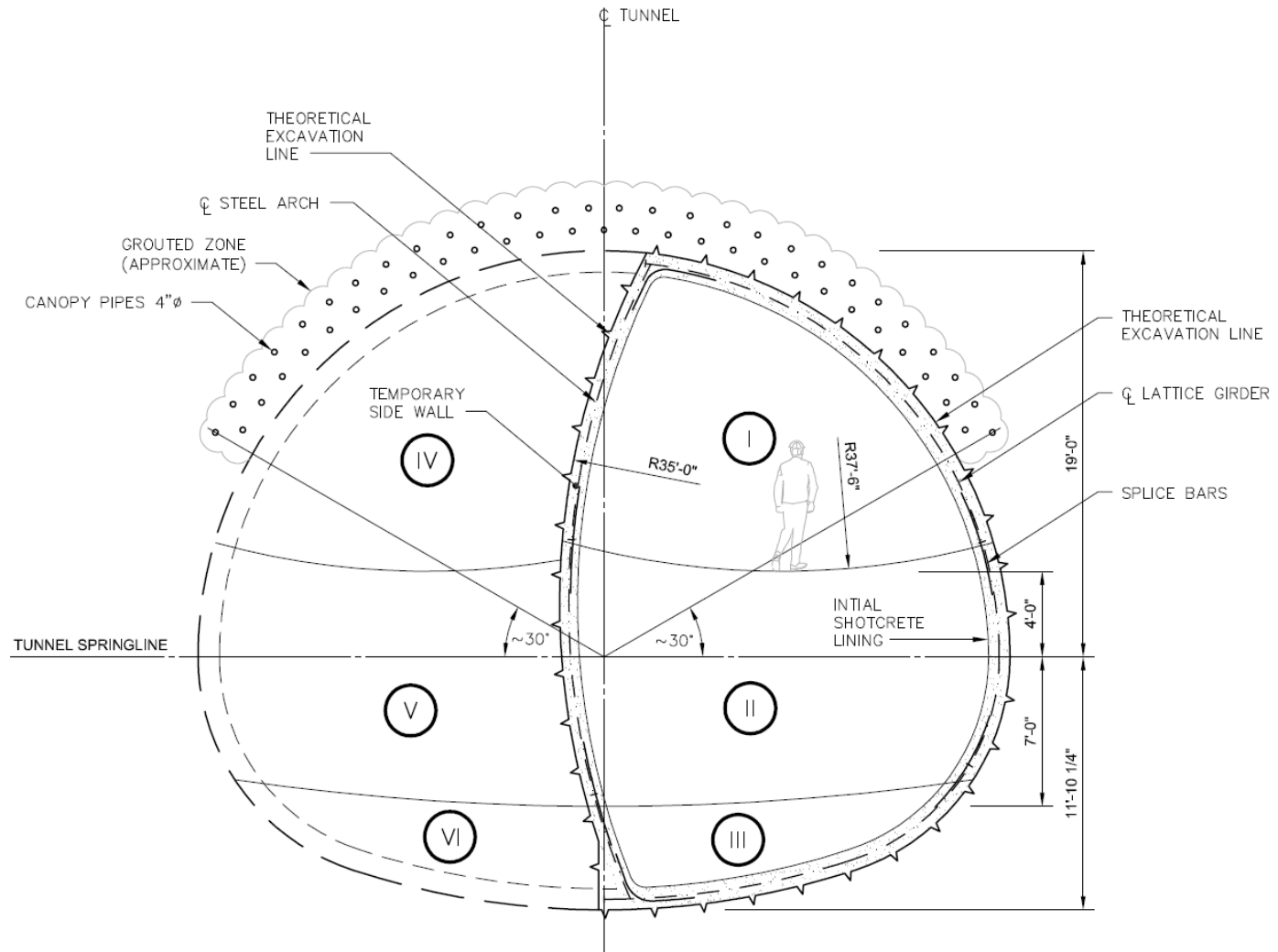


# Cut and Cover vs SEM Tunnel



- Traffic Impacts
- Temporary Decking
- Business Access
- Utility Impacts
- Shorter Construction Duration

# Sequential Excavation Method



# Acknowledgements

- Sound Transit Structures Discipline: Tanveer Sahoo
- Superstructure Design: Tie Zong
- Substructure Design: Kent Fergeson
- Foundations Design: Cory Caywood
- Modeling Analysis: Schaun Valdovinos
- Guideway Lead: Farhad Nourbakhsh
- Long Span Design: Chris Hall
- Tunnel Lead: Derek Penrice



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