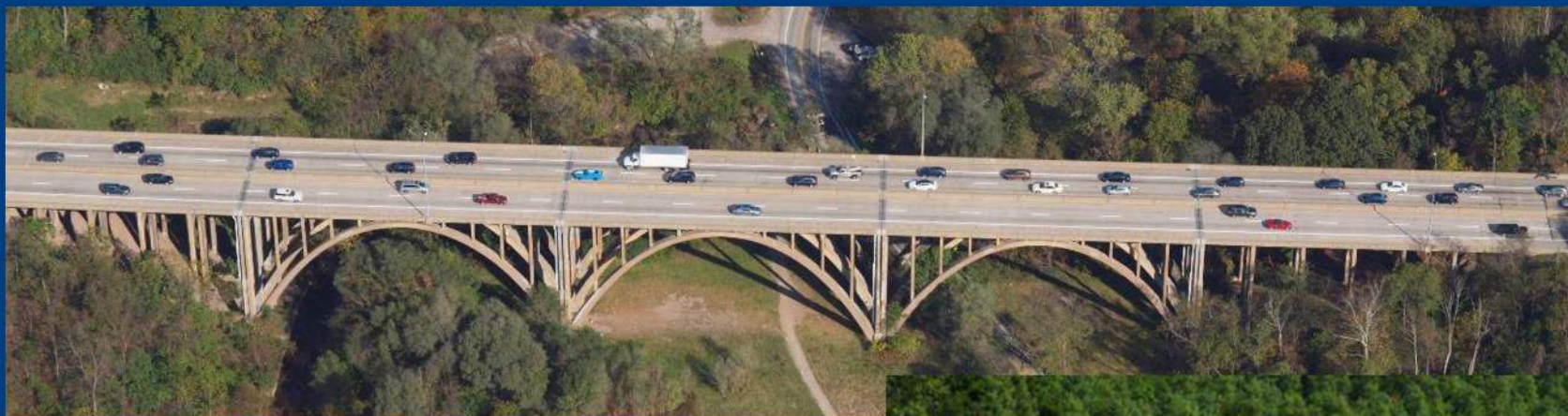


COMMERCIAL STREET BRIDGE REPLACEMENT

Replacement of the I-376 Commercial Street Bridge over Nine Mile Run, Frick Park,
and Commercial Street
City of Pittsburgh, Allegheny County



2025 TRANSPORTATION FORUM

NICK PALMIERI – PENNDOT DISTRICT 11-0

DAVE MATELAN – JB FAY / S&B USA

NICK BURDETTE - HDR



PRESENTERS



Nick Palmieri
PennDOT District 11
Sr. Civil Engineer
Supervisor



Nick Burdette, PE
HDR
Sr. Bridge Engineer



Dave Matelan
Fay, S&B USA
Project Manager

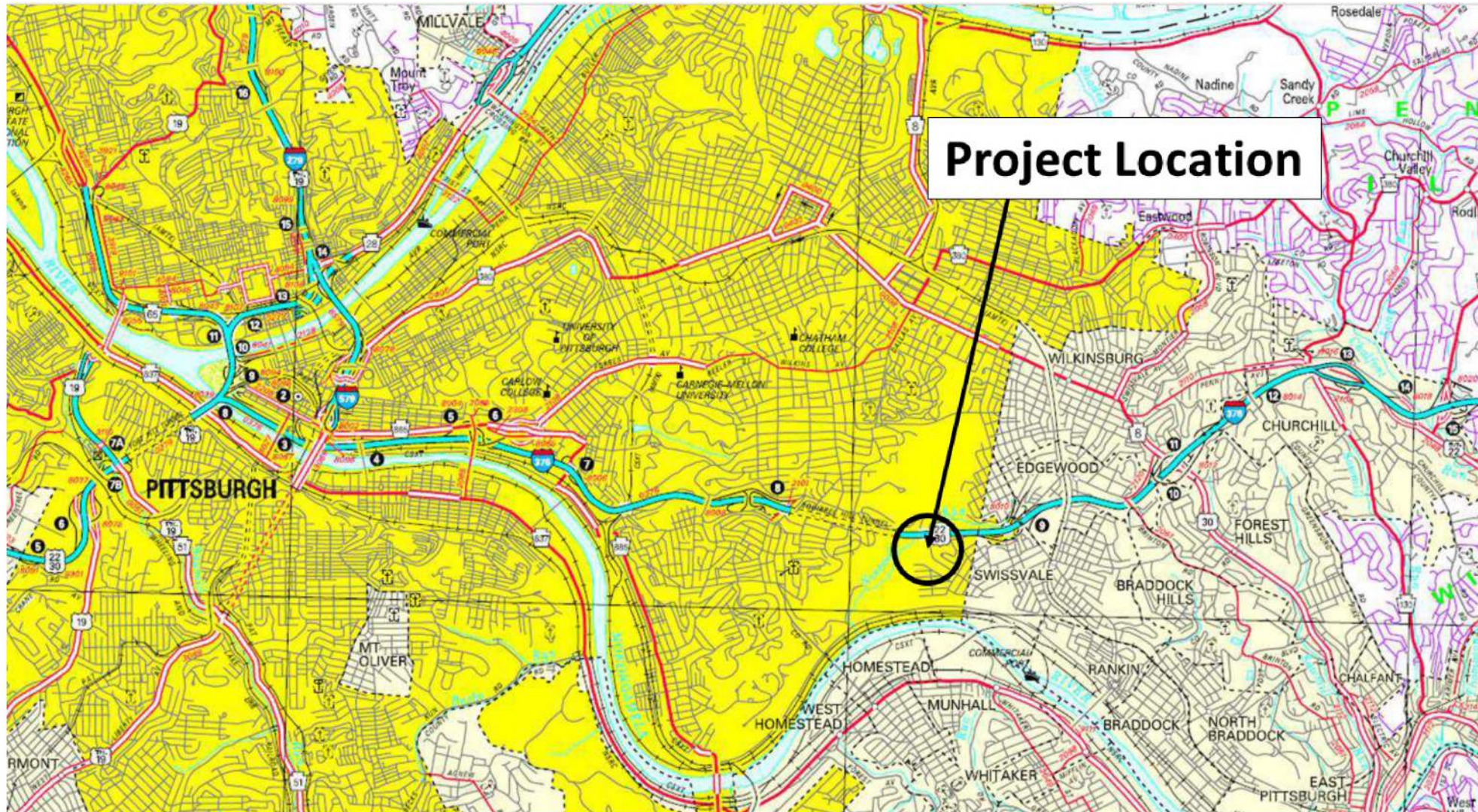


PRESENTATION OUTLINE

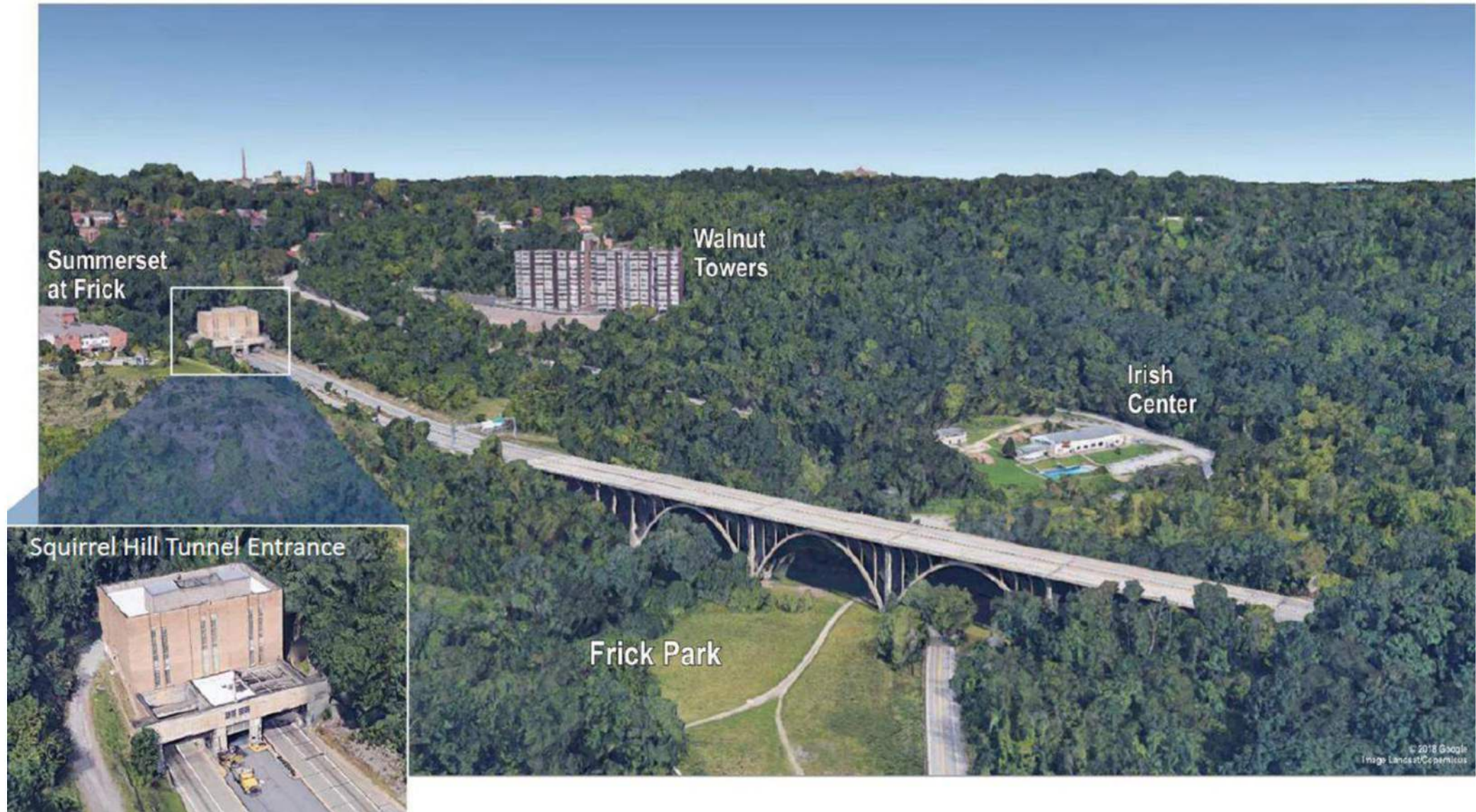
1. Project Site & Existing Bridge
2. Design
 - a. Bridge Replacement Alternatives
 - b. Design Details
 - c. Accelerated Replacement
3. Construction
 - a. Progress to date
 - b. Plans to completion



REPLACEMENT OF I-376 COMMERCIAL STREET BRIDGE



REPLACEMENT OF I-376 COMMERCIAL STREET BRIDGE



EXISTING BRIDGE OVERVIEW

Completed in 1951, the Commercial Street Bridge is 73 years old.

The bridge cannot carry Permit Loads on Interstate 376.

The structure carries approximately 100,000 vehicles per day.

Accelerating deterioration/Recurring maintenance not cost-effective.



DESIGN

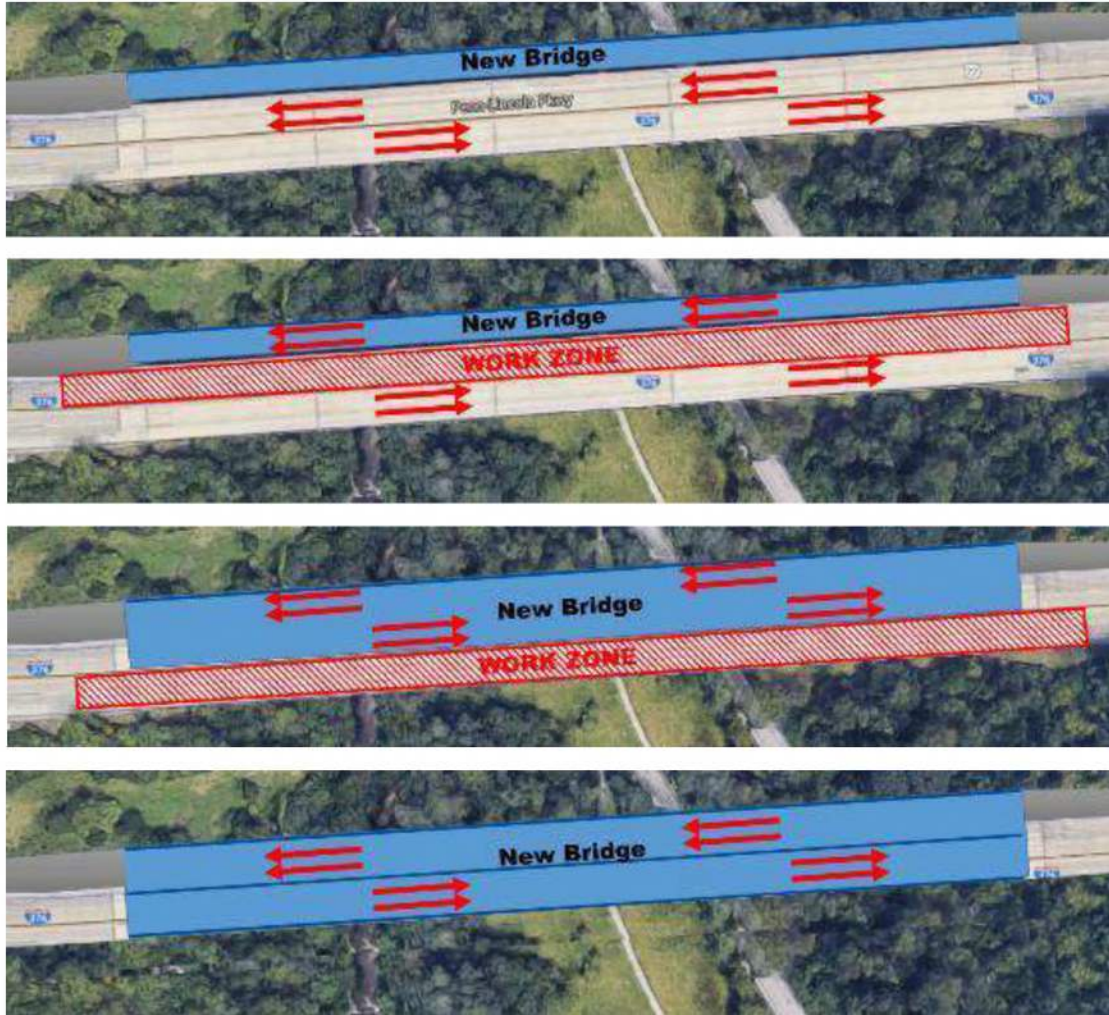


REPLACEMENT CONSIDERATIONS & NEW BRIDGE

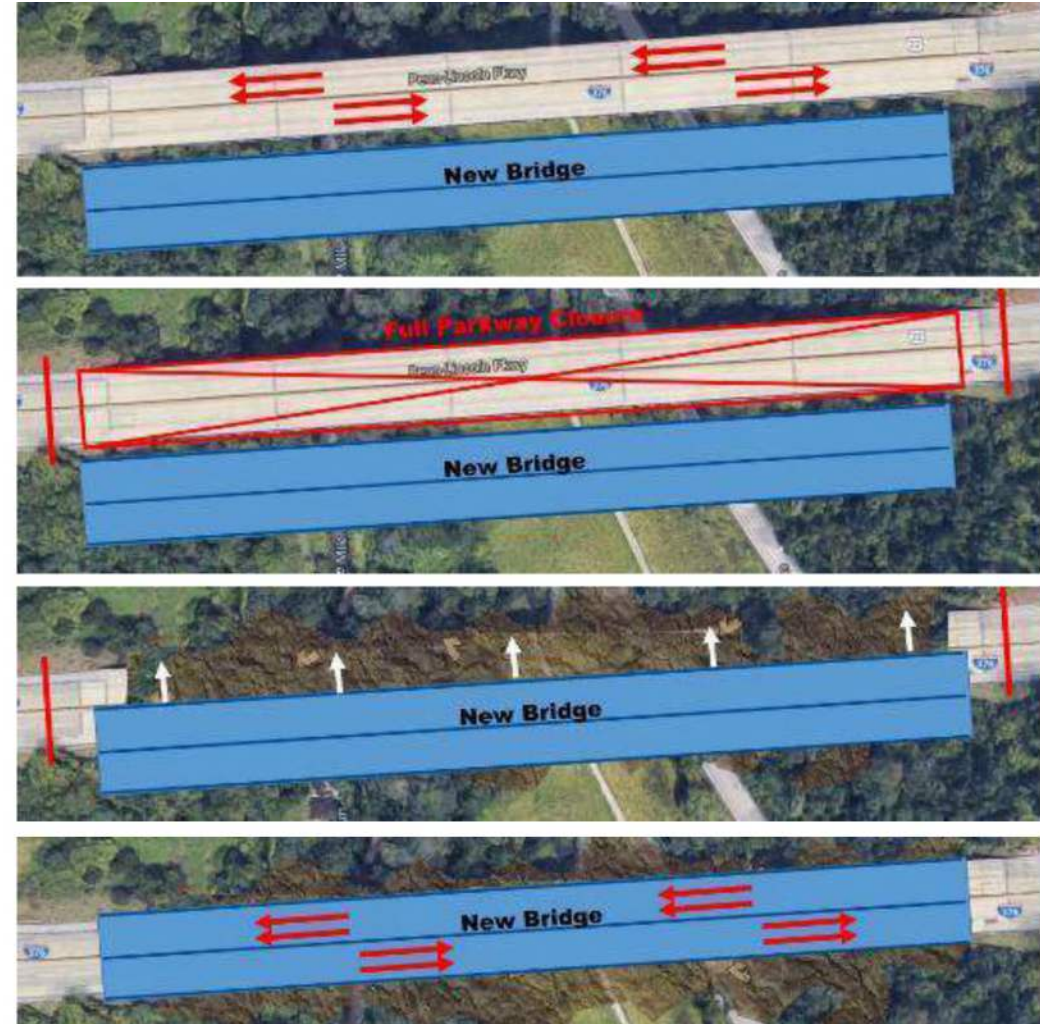


REPLACING EXISTING BRIDGES

Staged Construction

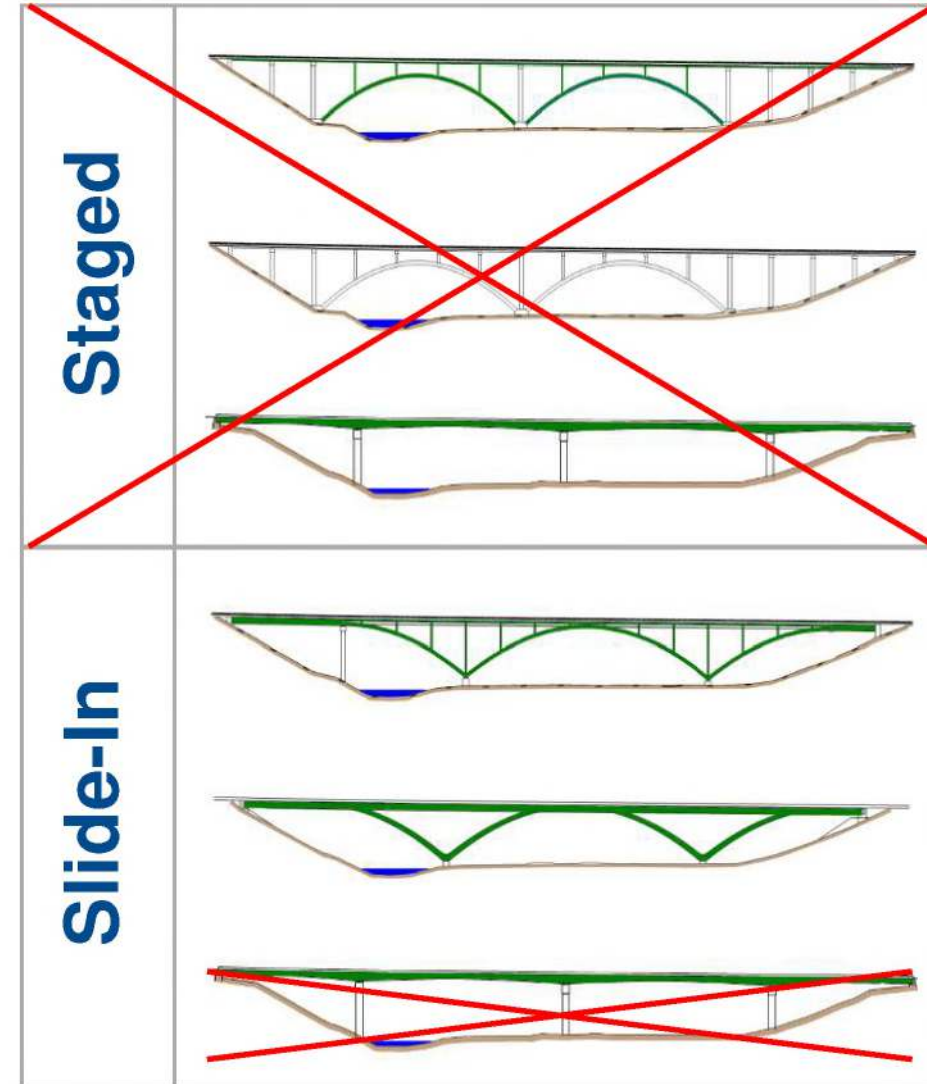


Slide-In Construction



ALTERNATIVES ANALYSIS

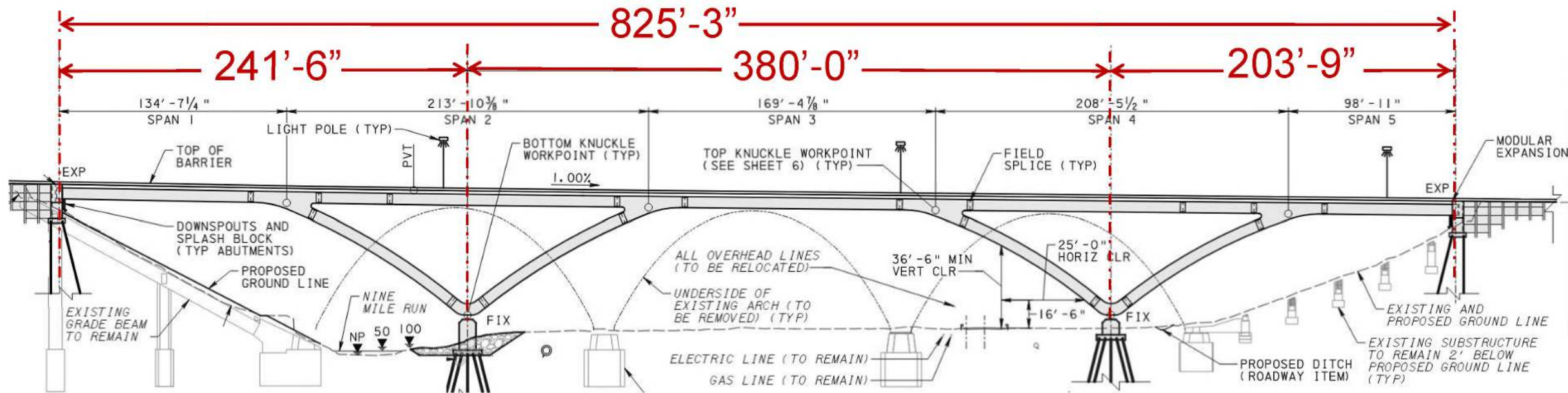
- Start with Six Options
- Slide-In Construction method selected:
 - Reduce traffic impacts
 - Less construction near traffic
 - Limit approach work and permanent impacts
- Provide Arched Appearance
 - Replacement of Historic Arch Bridge through Section 106 process



ALTERNATIVES ANALYSIS

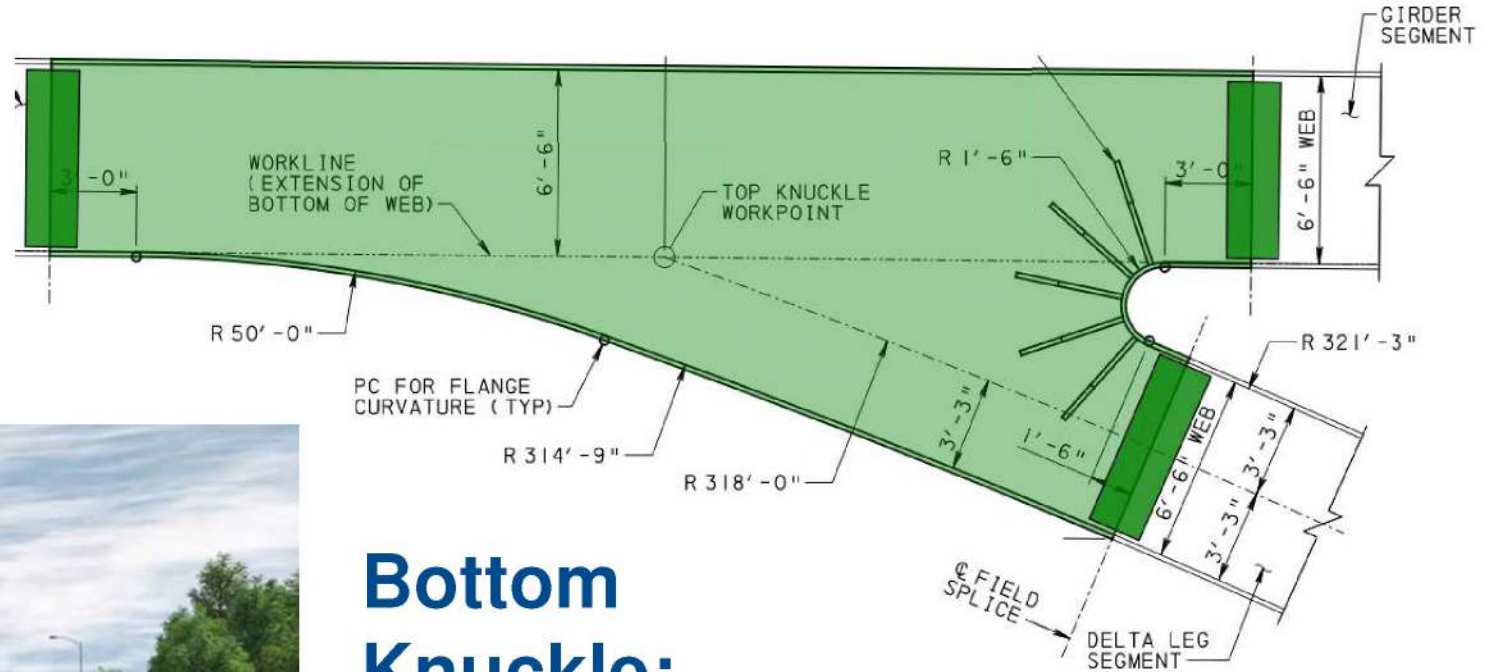


ARCHED DELTA FRAME

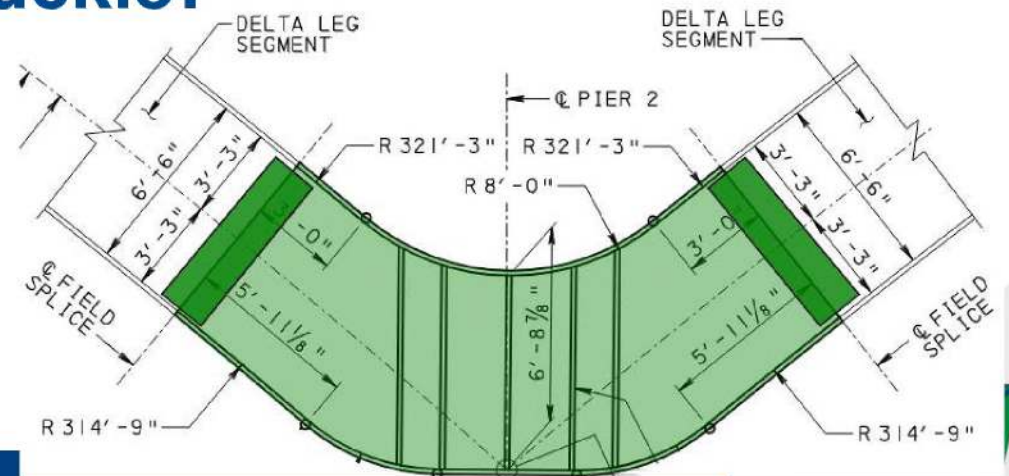


ARCHED DELTA FRAME

Top Knuckle:

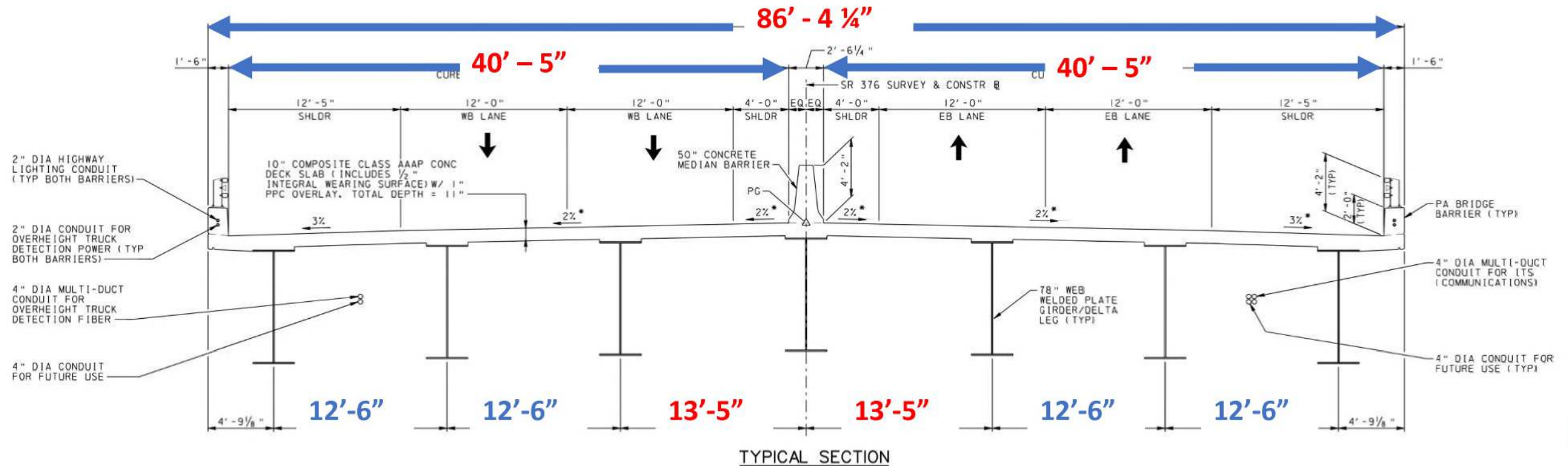


Bottom Knuckle:



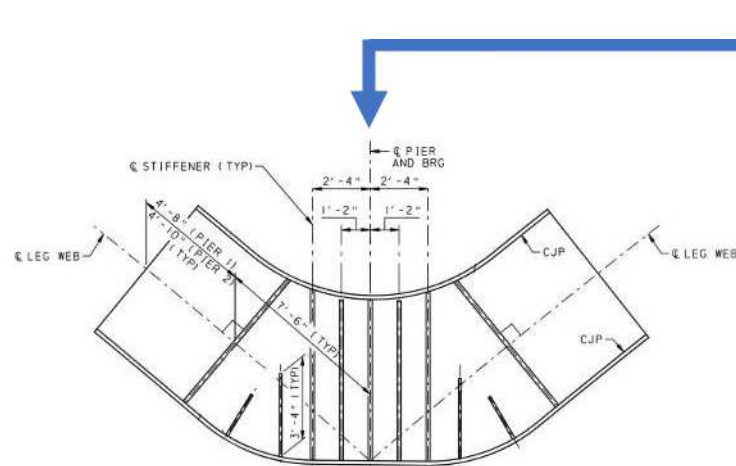
PROPOSED BRIDGE: SECTION

- 7 lines of steel, composite plate girders
- Girders with 78" deep webs, 10" composite deck
- 2 lanes each direction (EB & WB)

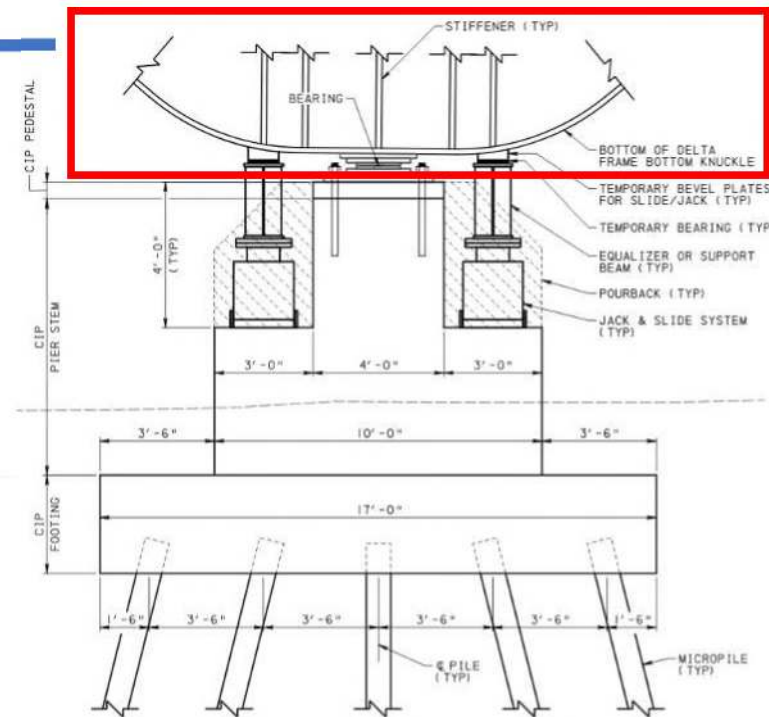


PROPOSED BRIDGE: FOUNDATIONS

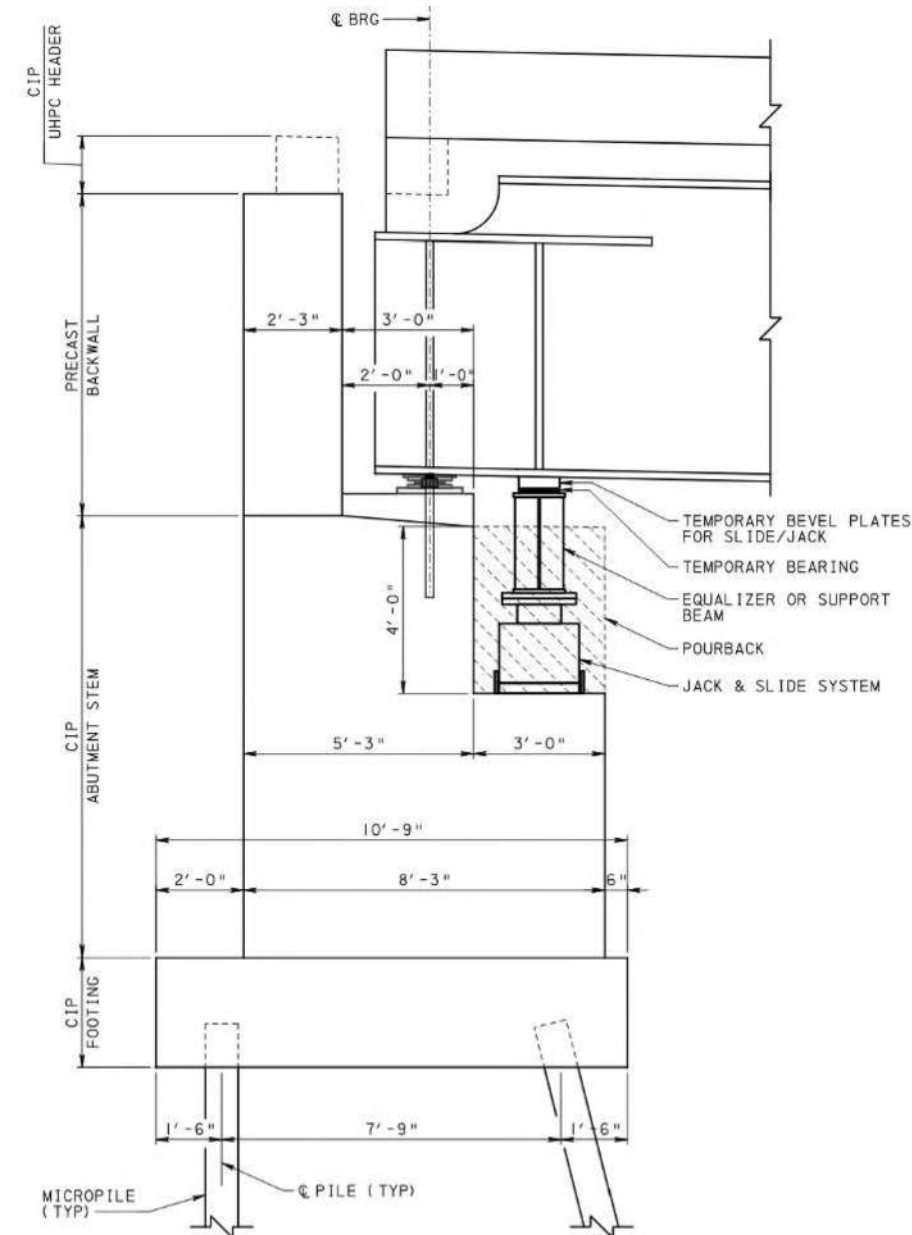
- Cantilever abutments founded on micro piles
- Short wall piers on micro piles
- Bottom 'knuckle' supports on HLMR disc bearings



Typical Bottom Knuckle



PIER TYPICAL SECTION

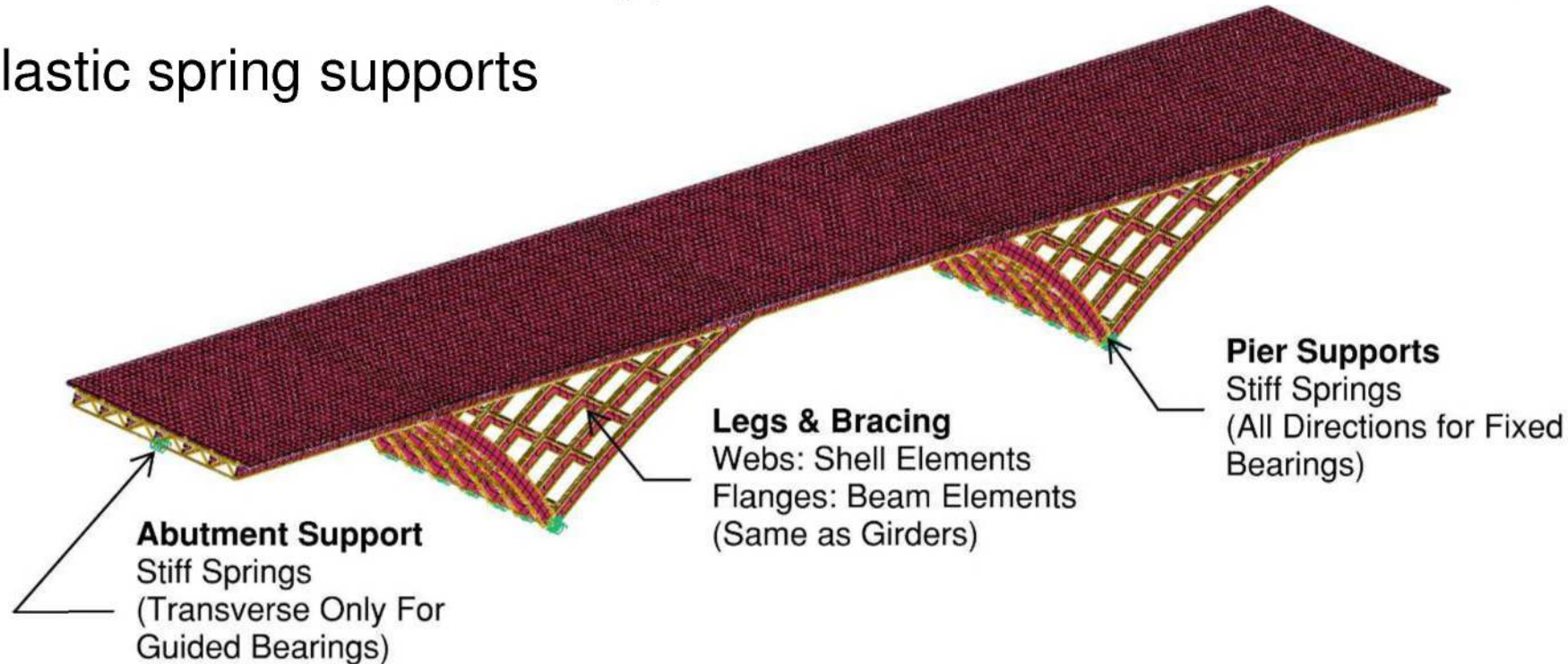
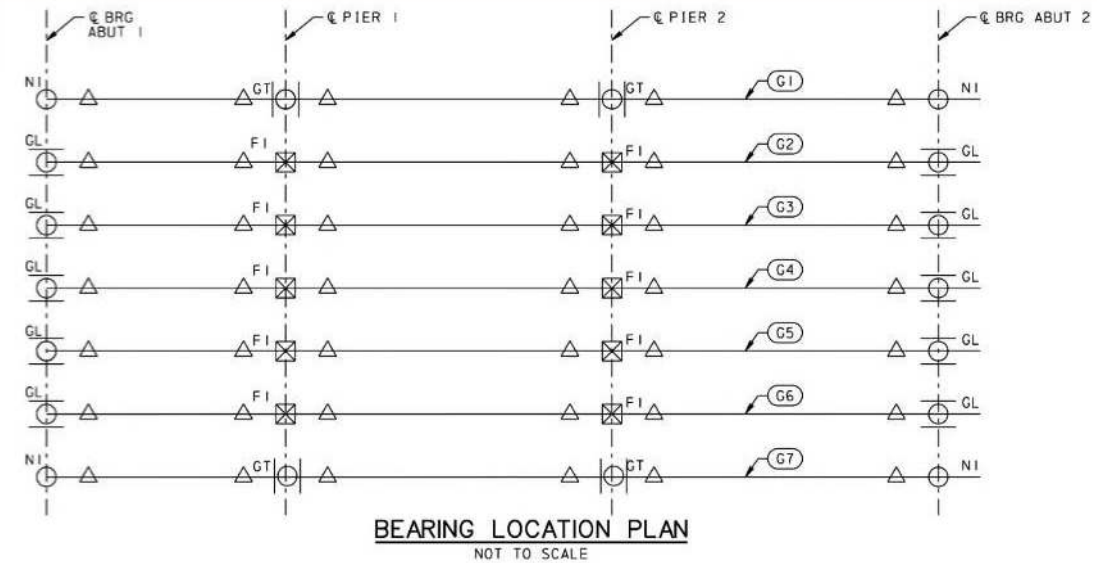


ABUTMENT TYPICAL SECTION

FEA MODEL

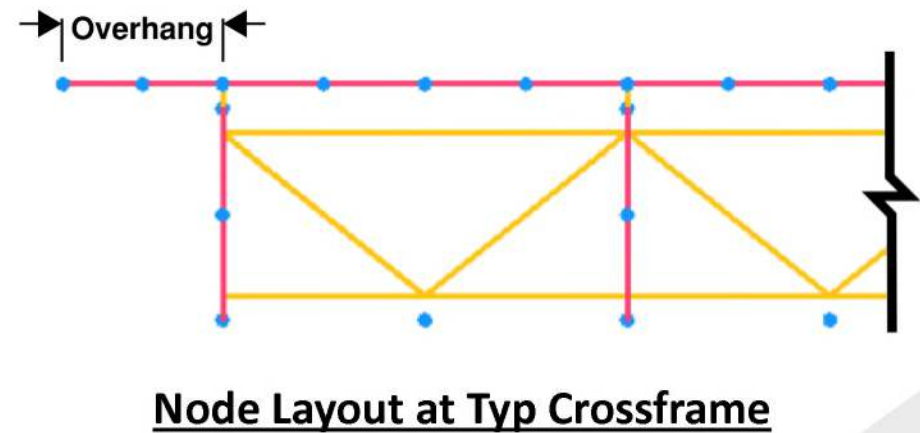
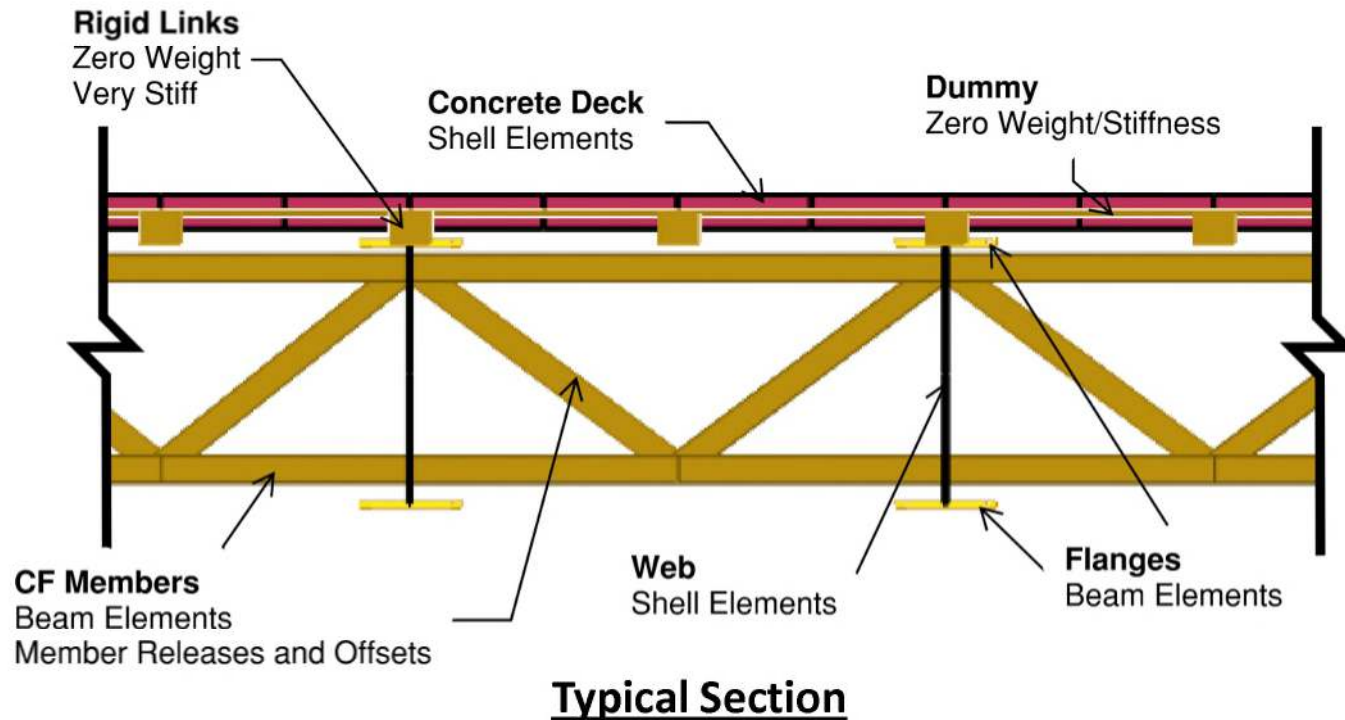


- LARSA 4D
- Staged construction analysis
- Dead, temperature, wind and live loads
- Shell and beam member types
- Elastic spring supports



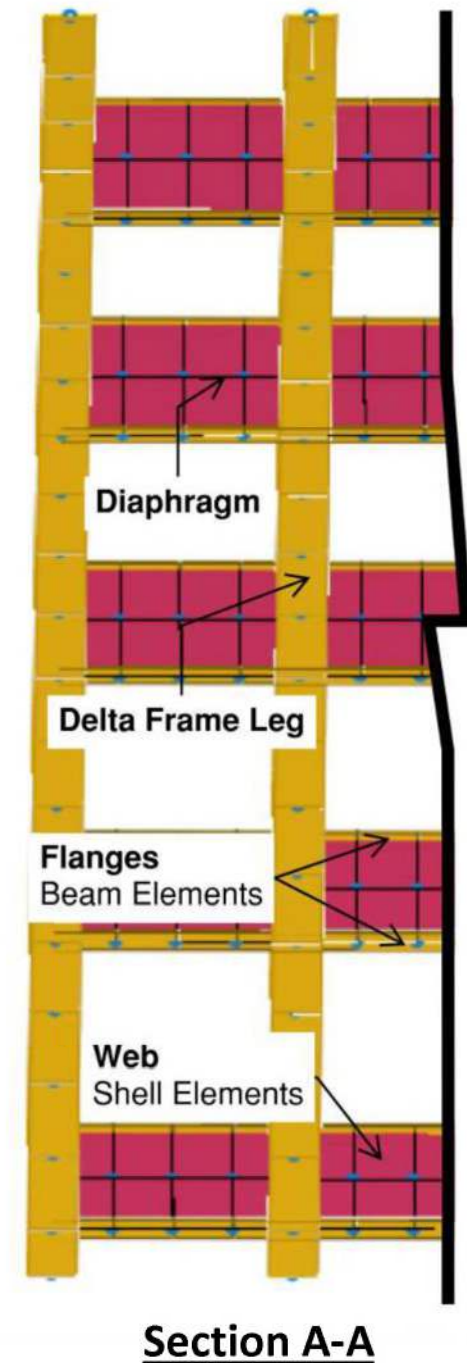
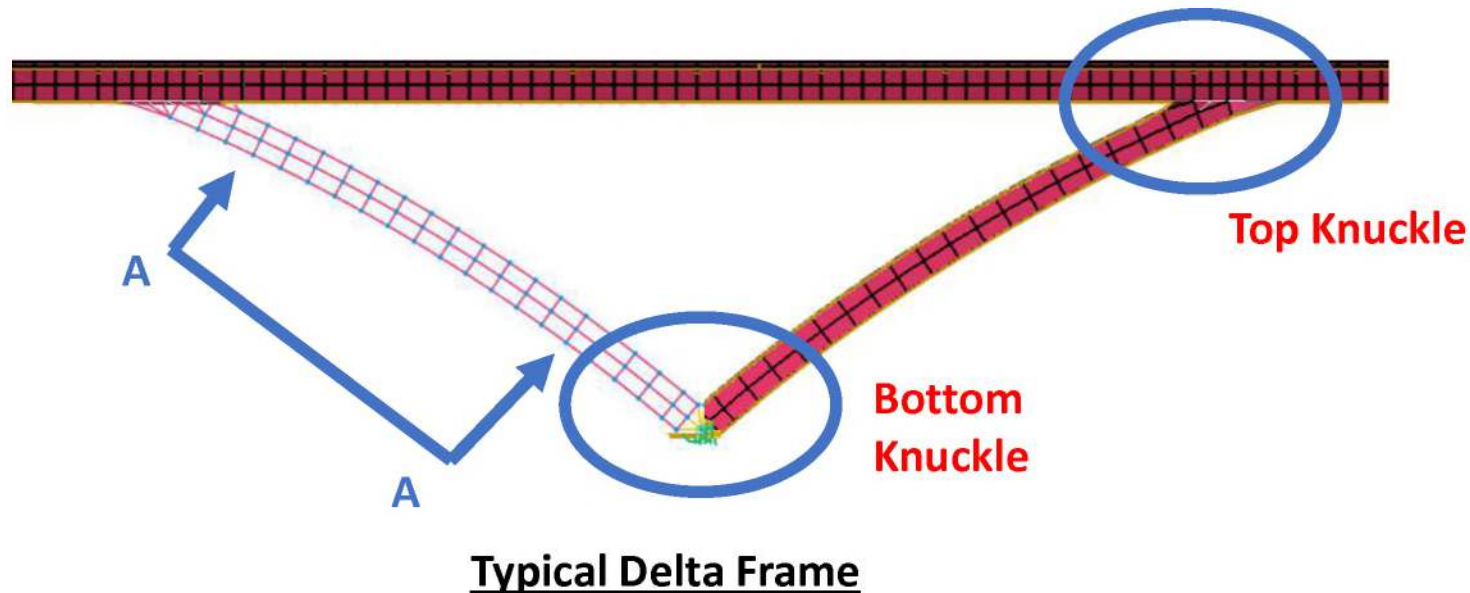
MODEL DETAILS

- Webs: two shells deep
- Rigid links connect top flange to deck
- Dummy members between deck nodes (displacement control prior to activating deck)



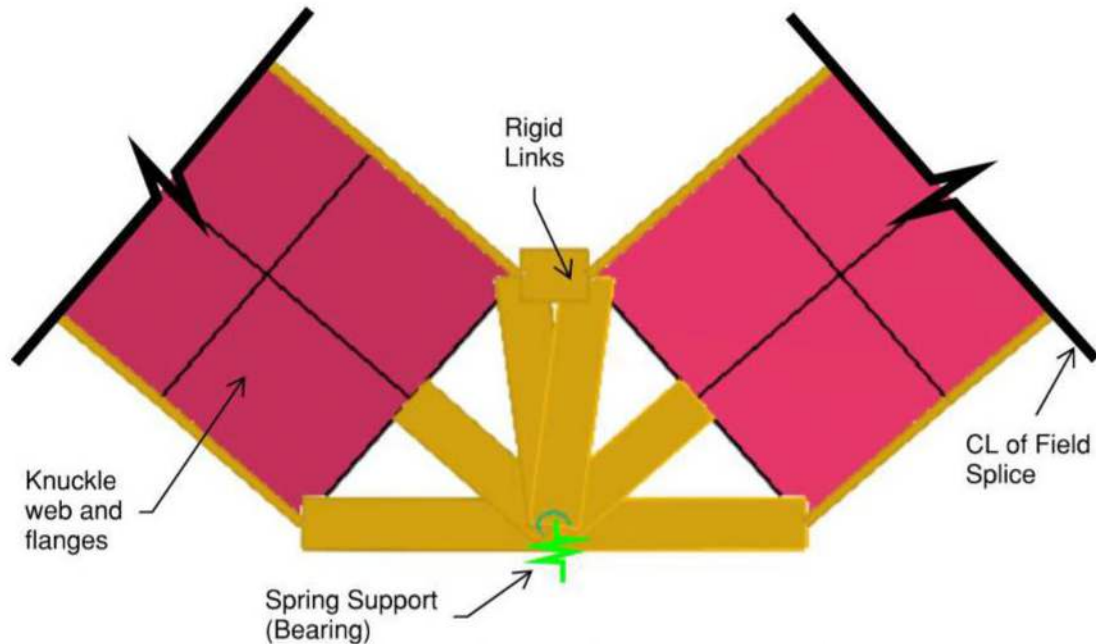
DELTA FRAMES

- Curvature approximated with ~6ft line segments
- Legs and diaphragms modeled with shells (web) and beams (flanges)
- Vierendeel truss behavior between diaphragms (moment connections)

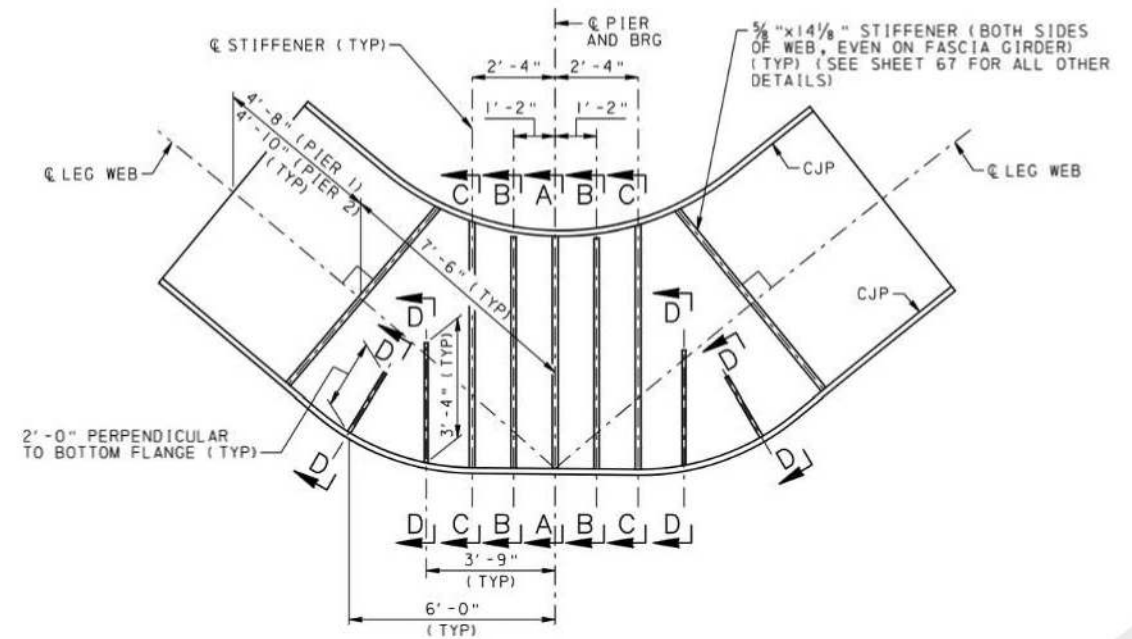


KNUCKLES

- Knuckle defined between adjacent field splices
- Thicker web ($\sim 1 \frac{3}{4}$ ") and 70ksi steel for webs and flanges
- Bottom knuckle region idealized into series of rigid links
- Initial capacity checks performed using global model during girder design
- Top knuckle global design used similar approach



Bottom Knuckle – LARSA Model



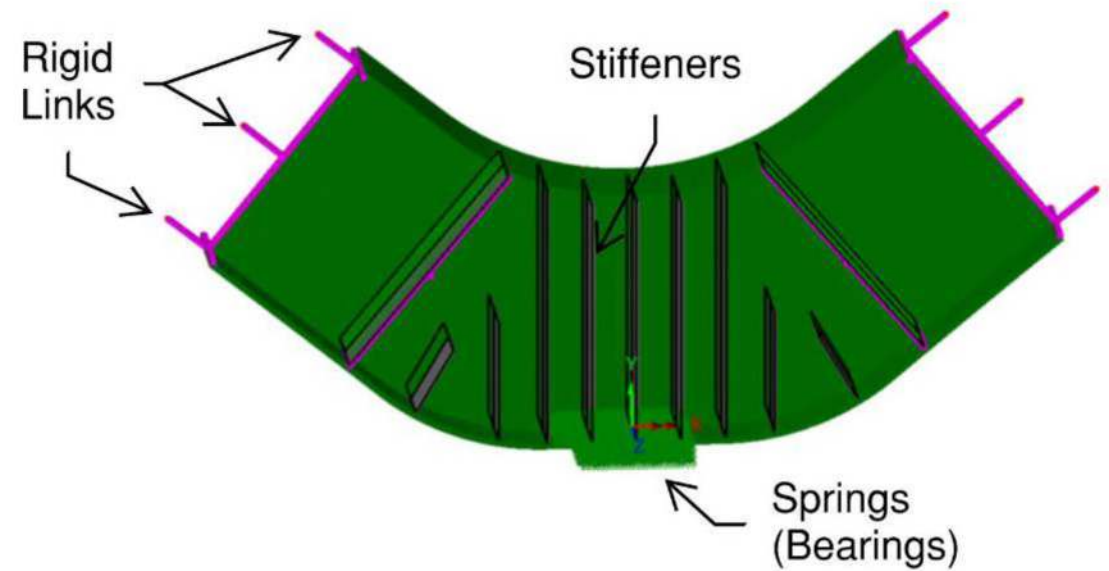
BOTTOM KNUCKLE STIFFENERS



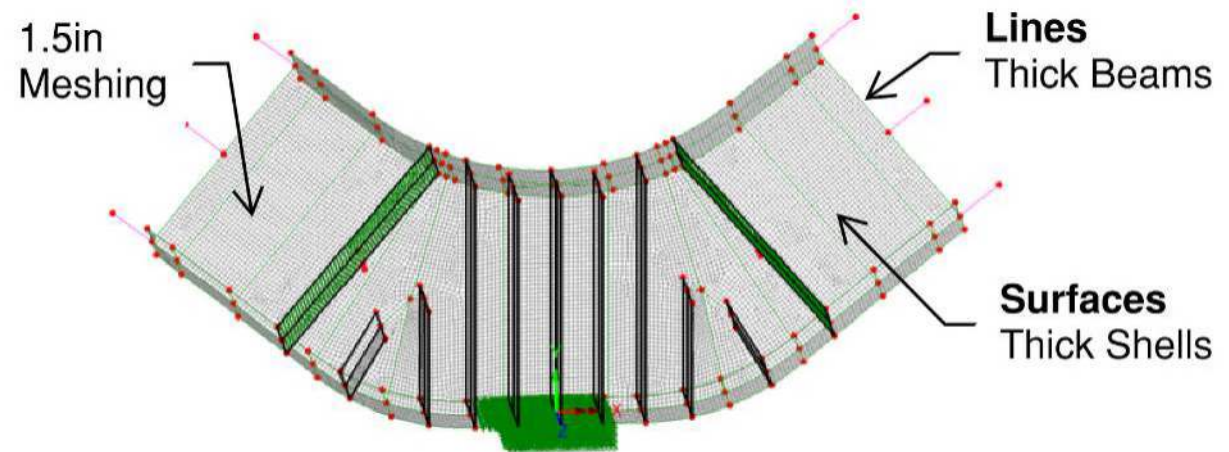
KNUCKLES

Bottom Knuckle

- LUSAS model used for local analysis of top and bottom knuckles
- Thick beam and thick shell elements used with 1.5in meshing
- Directly modeled stiffeners for stability and assess weld capacity
- Rigid links defined at flanges/webs for load application
- Spring supports (bearings) with diaphragm boundary condition



Bottom Knuckle – LUSAS Model



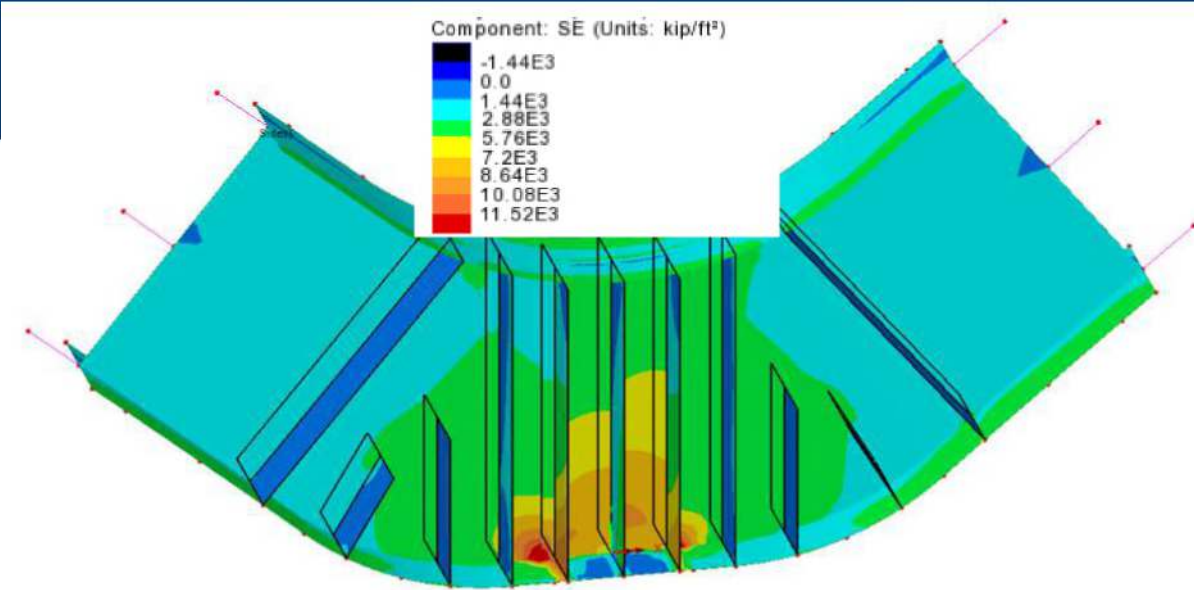
Bottom Knuckle - Meshing



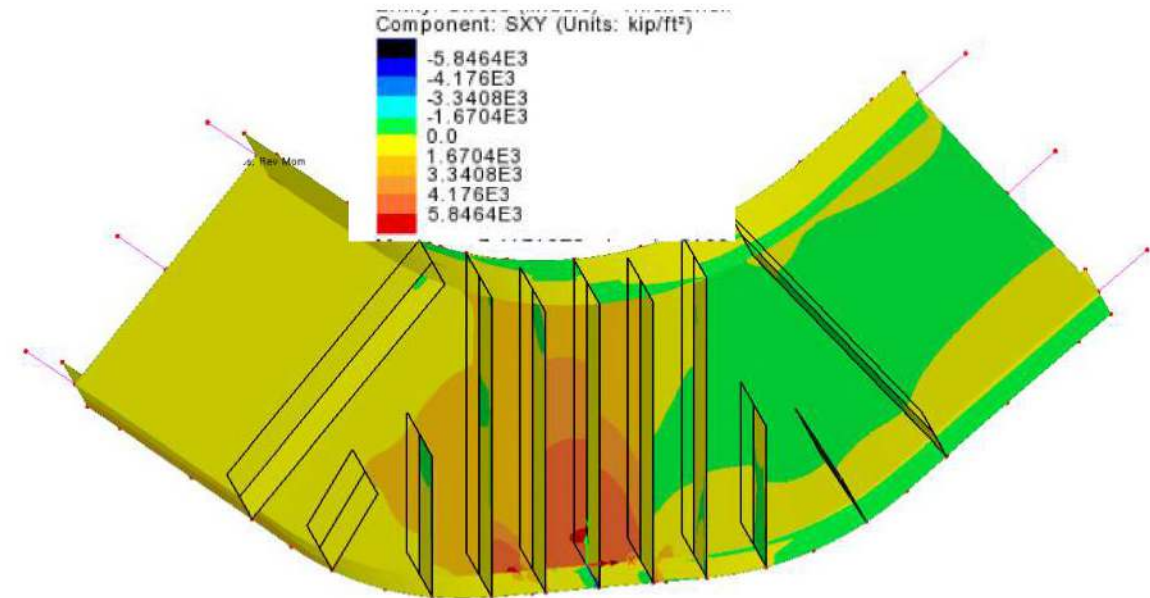
KNUCKLES

Bottom Knuckle - Results

- Leg and diaphragm Strength and Fatigue loads applied to model
- Von Mises Stress (SE) plots compared against F_y for Strength
 - AASTHO fatigue thresholds compared for Fatigue
- Shear stress (S_{xy}) plots compared against $0.58F_y$ for Strength
- Minor localized stress yielding observed near bearing edges
- Model stresses compared against local buckling capacity

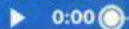


Von Mises Stress (SE)



Shear Stresses (S_{xy})

CONSTRUCTION ANIMATION





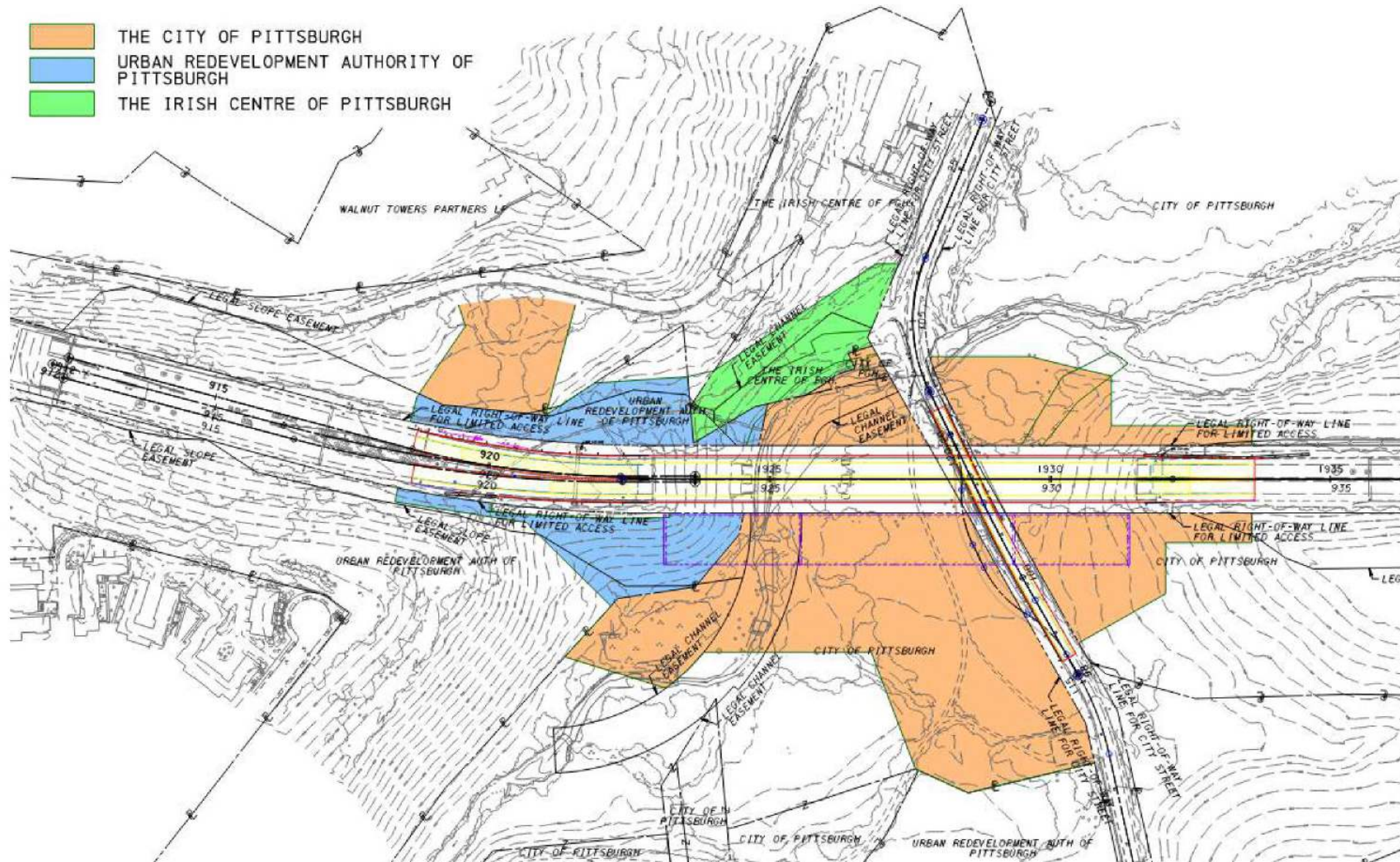
NEW BRIDGE



CONSTRUCTION



TEMPORARY CONSTRUCTION EASEMENTS



RAMP G RECONSTRUCT

- SR 8012 Ramp G (I-376 WB Off Ramp Wilkinsburg)
 - ~1500LF
- 36 Consecutive Full Day Closure
 - Incentive – 26 days full
 - Disincentive – Greater Than 36 Day
- Goal
 - Reconstruct and Lower Ramp 3' For Future Detour Route



DRAINAGE/E&S



PAVEMENT REMOVAL



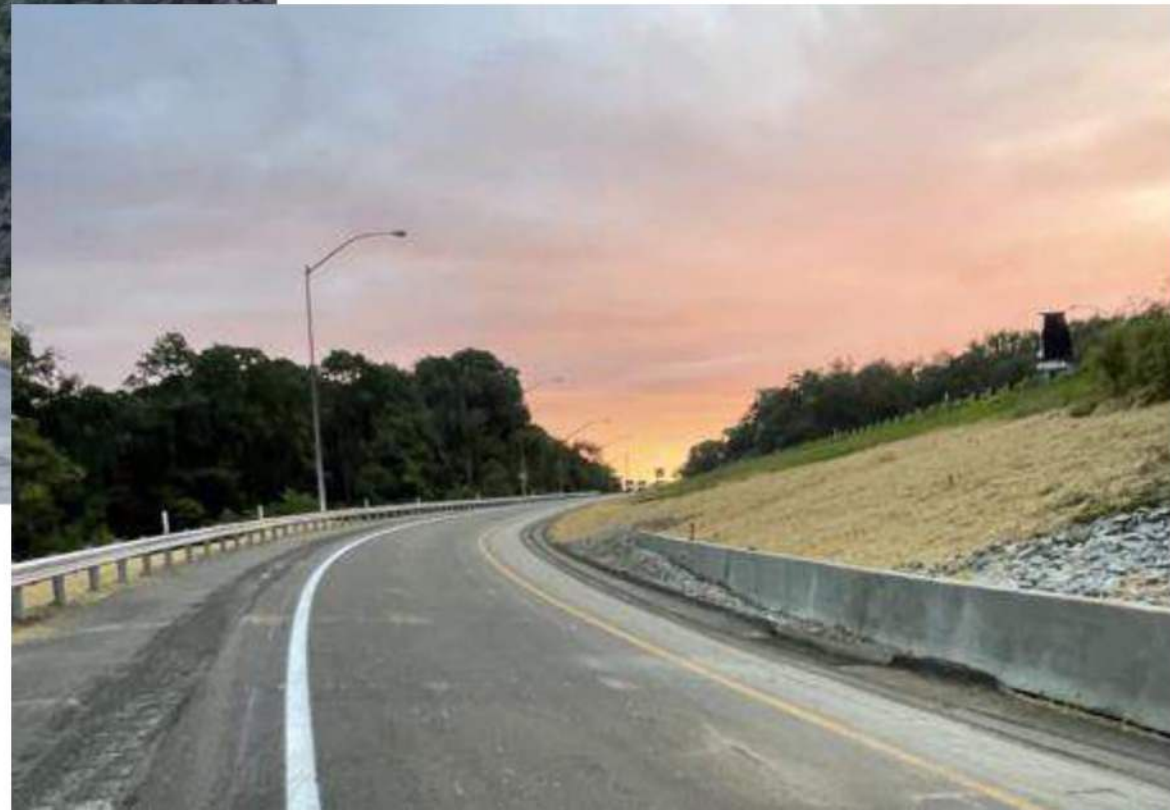
UNDERCUTS



SR 8012 RAMP G COMPLETE



- July 22 – Aug 18, 2024 (26 Days)



FALL 2024



- Clear Site, E&S
- Utility Relocation
- Relocate Commercial St. and Trail



FALL/WINTER



- 24" and 48" Sewer Line Relocation
 - Pier 1 & 2 Location



FALL/WINTER



- Temporary SOE Abutment 1 & 2



MICROPILES



CURRENT SITE OVERVIEW



ANTICIPATED SCHEDULE

2025

- Construction of Substructure of new Bridge
- One overnight lane closure of I-376 WB for ITS work
- Thirty-Five Weeknight Extended Single Lane Restrictions on I-376 EB for construction of retaining wall
- Weekend long closure of I-376 EB & WB for installation of sign structures and ITS
- Median Reconstruction East of Tunnel (Long Term Lane Shift)
- Nine overnight full closures of I-376 EB for Bridge Steel Delivery
- Erection of Bridge Steel



ANTICIPATED SCHEDULE

2026

- Construction of New Superstructure
- Ten Weekend long single lane closures for construction of shoulder widening I-376 EB
- Weekend long single lane closure of I-376 WB for shoulder reconstruction
- FULL CLOSURE of I-376 EB & WB for bridge demolition and slide
- Reconstruct Commercial Street



ANTICIPATED SCHEDULE

2027

- Establish Final Grading
- Re-establish stream
- Install post-construction stormwater management structures
- Plant trees and grass
- Current Contract Completion June 2027



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Questions?

