



GRESHAM SMITH | KIEWIT | HDR

BROADWAY BRIDGE



This Photo by Unknown Author is licensed under [CC BY-NC-ND](https://creativecommons.org/licenses/by-nc-nd/4.0/)

Project Scope - Location

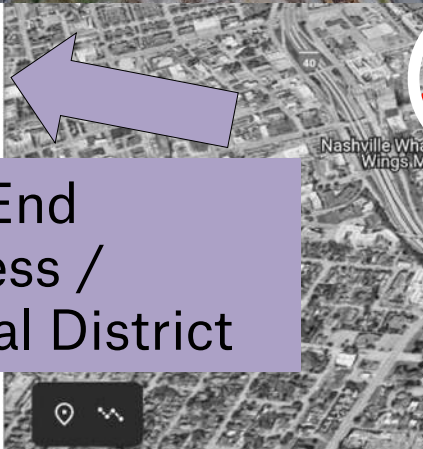


This Photo by Unknown Author is licensed under [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/)



Business

Downtown



West End
Business /
Medical District



Bridge History



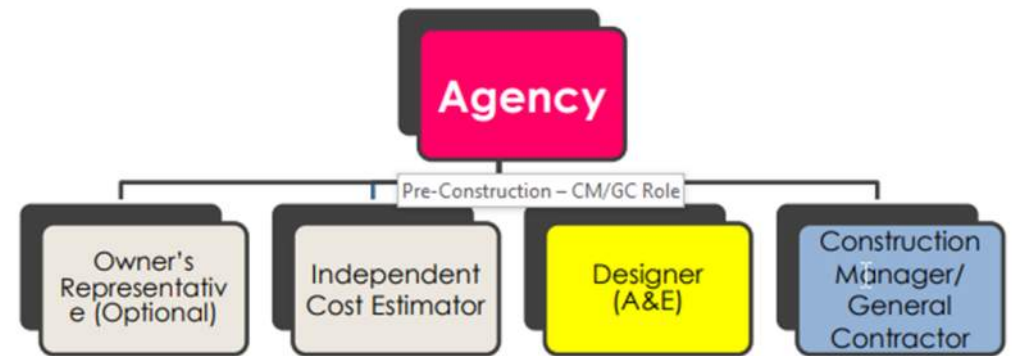
Project Scope - Need & Delivery

- Bridge is near end-of-life cycle
- Substandard vertical clearances
- A gateway bridge to downtown
- Construction time is crucial
- Delivery Method
 - Construction Manager – General Contractor (CMGC)
 - Accelerated Bridge Construction (ABC)

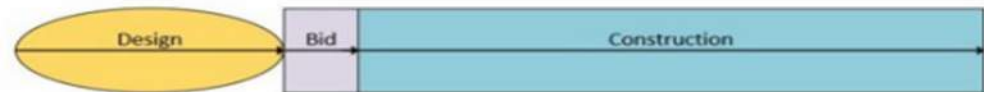


Project Scope - CM/GC Role

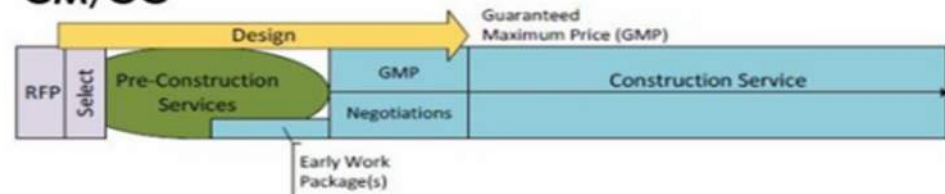
- Constructability
- Approach
- Innovation
- Estimate
- Schedule
- Risk



Design-Bid-Build



CM/GC

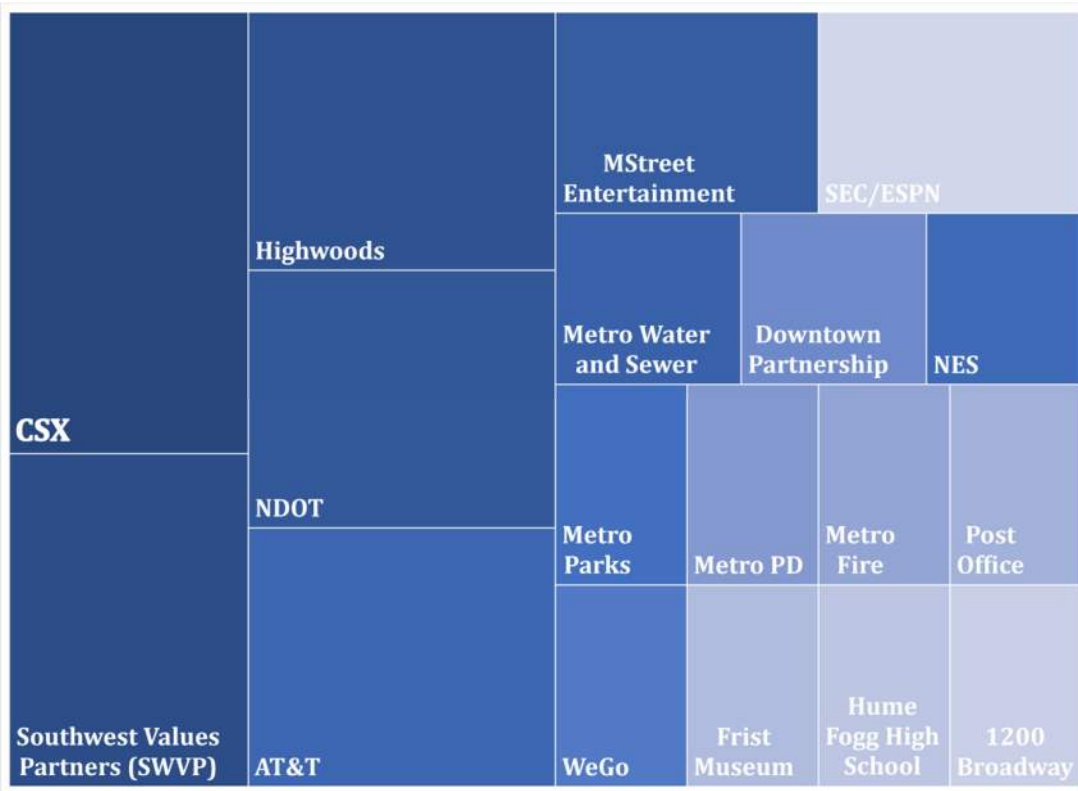


Project Scope - Closure

- An 8-week full closure
- Detour Routes
- Maintain access to adjacent businesses
- At the end of the closure, at least two lanes in each direction (4 lanes total) must be opened to traffic



Project Scope - Stakeholders



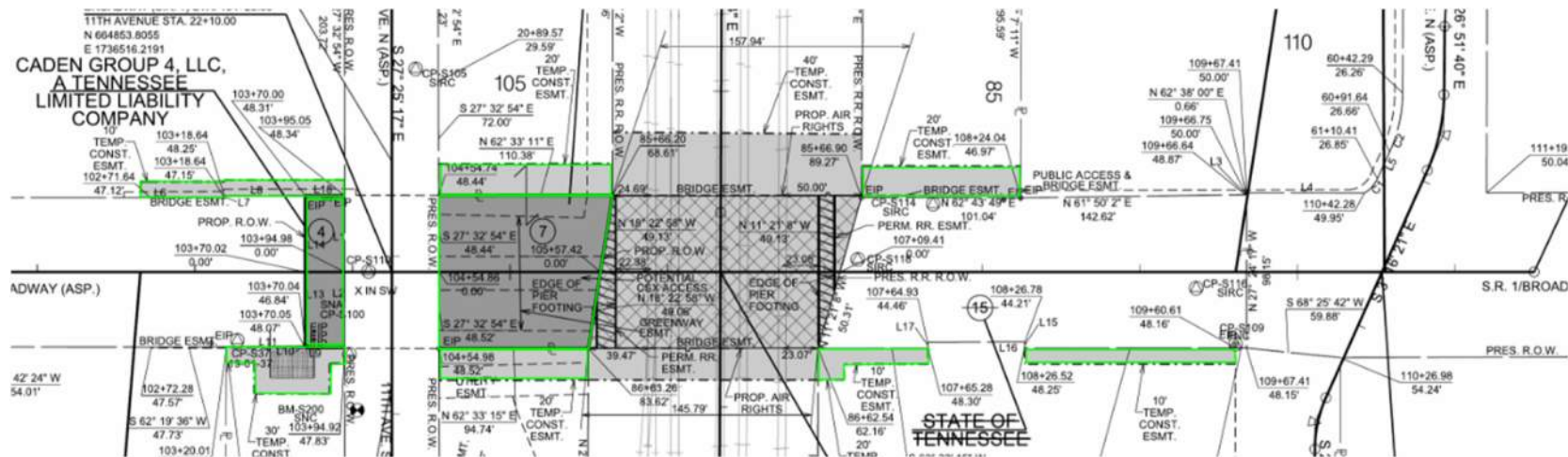
- Early Engagement
 - Design Coordination
 - Railroad

- ROW & Utilities

- Construction
 - Railroad
 - Traffic Impacts

Project Schedule - Pre-Construction

- Construction Manager (CM)
- ROW Plan Design
- Construction Plan Design
- ROW & Utility Coordination
- Early Work Packages
- GMP Contract Award



Project Schedule - Challenges/Issues

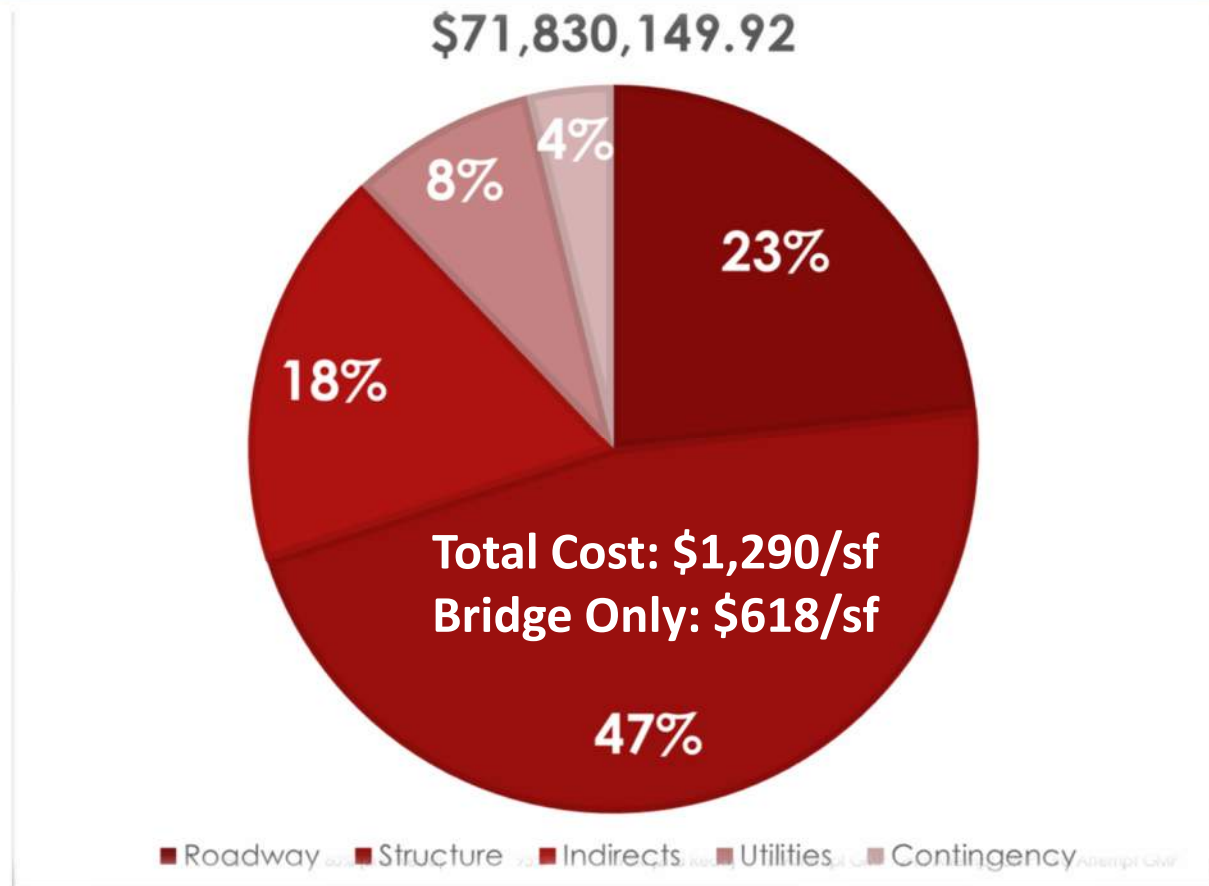
- Scenario Analysis

Independence Day
CMA Festival
Labor Day

CMGC04 Broadway	8/1/2022	8/8/2022	8/15/2022	8/22/2022	8/29/2022	9/5/2022	9/12/2022	9/19/2022	9/26/2022	10/3/2022	10/10/2022	10/17/2022	10/24/2022	10/31/2022	11/7/2022	11/14/2022	11/21/2022	11/28/2022	12/5/2022	12/12/2022	12/19/2022	12/26/2022	1/2/2023	1/9/2023	1/16/2023	1/23/2023	1/30/2023	2/6/2023	2/13/2023	2/20/2023	2/27/2023	3/6/2023	3/13/2023	3/20/2023	3/27/2023	4/3/2023	4/10/2023	4/17/2023	4/24/2023	5/1/2023	5/8/2023	5/15/2023	5/22/2023	5/29/2023	6/5/2023	6/12/2023	6/19/2023	6/26/2023	7/3/2023	7/10/2023	7/17/2023	7/24/2023	7/31/2023	8/7/2023	8/14/2023	8/21/2023	8/28/2023	9/4/2023	9/11/2023	9/18/2023	9/25/2023	10/2/2023	10/9/2023	10/16/2023	10/23/2023	10/30/2023	11/6/2023
The Miracle	GMP Bid / Award		ROW - ROE		Pre-Closure Substructure Work										Closure Window (8 Wks)								Post Closure Work																																												
Pause Button	ROW Process - Negotiation										Pre-Closure Substructure Work										GMP Bid / Award										Pre-Closure Substructure Work																																				
Risky Business	GMP Bid / Award		ROW Process - Negotiation / Condemnation		Pre-Closure Substructure Work										Closure Window (8 Wks)								Post Closure Work																																												
Riskier Business	GMP Bid / Award		ROW Process - Condemnation (120 Day AG)		Pre-Closure Substructure Work										Closure Window (8 Wks)								Post Closure Work																																												
Shut Her Down	GMP Bid / Award		Pre-Closure		Preparation		Closure Window (20 Wks)										Post Closure Work																																																		
ReMix	GMP Bid / Award		Pre-Closure		Substructure Work										Closure Window (12 - 16 Wks)								Post Closure Work																																												
	ROW Process - Condemnation (120 Day AG)																																																																		

Project Budget

- \$50,000,000
 - Roadway
 - Bridge
- Utilities
- GMP Award
 - ≤10%



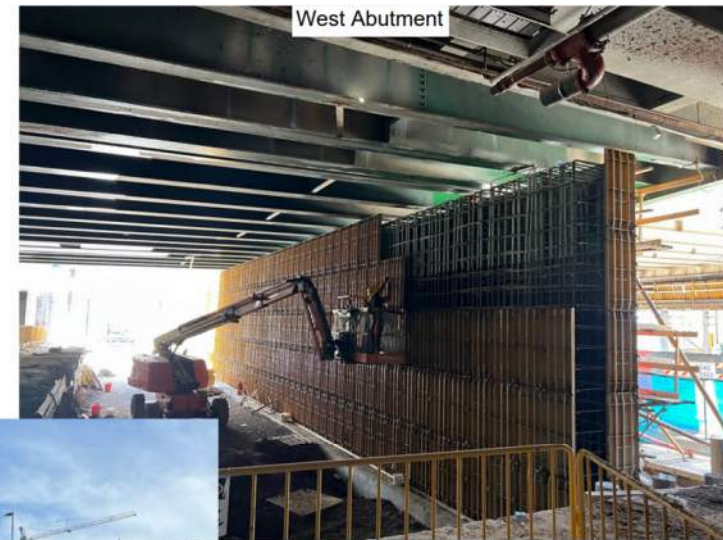
Construction – Critical Elements

- Lack of Access & Downtown Construction
- Adjacent Stakeholders
 - CSXT Railroad Tracks
 - AT&T Active Utilities
- Accelerated Schedule & Early Work Packages
 - Bridge Girder Procurement
 - Precast Panel Procurement
 - Early Utility Work
 - Critical Yards



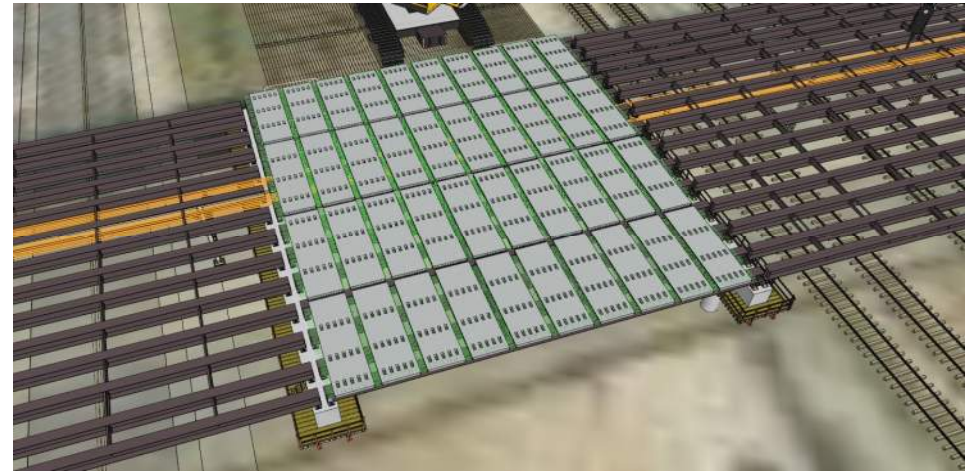
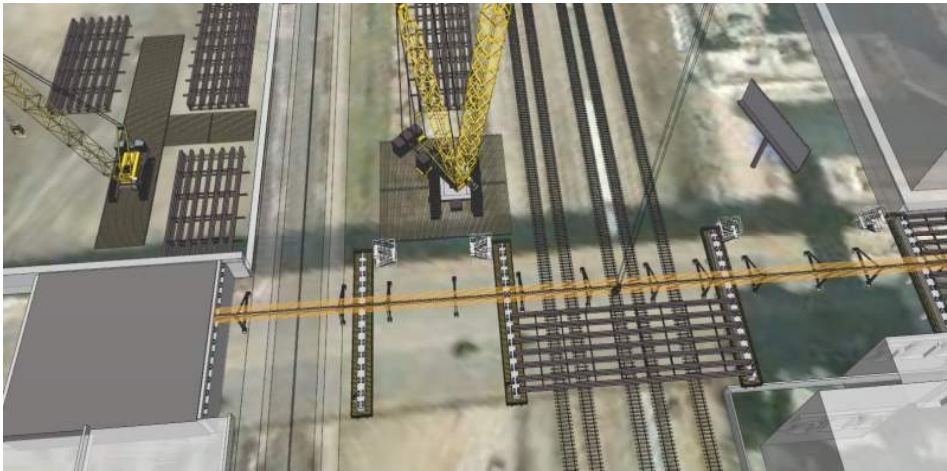
Construction – Pre-Closure Work

- Pre-Closure Work
(January – June)
 - Utility relocations
 - Substructure Construction
 - Partial Demo – Sidewalk, Parapet, Etc.
 - Shift traffic to four (4) lanes



Schedule – Closure Construction

- Closure Window (July 7, 2023 – September 1, 2023*)
 - Superstructure Demo / Erection
 - SEC Media Days* (Extended to September 8, 2023)

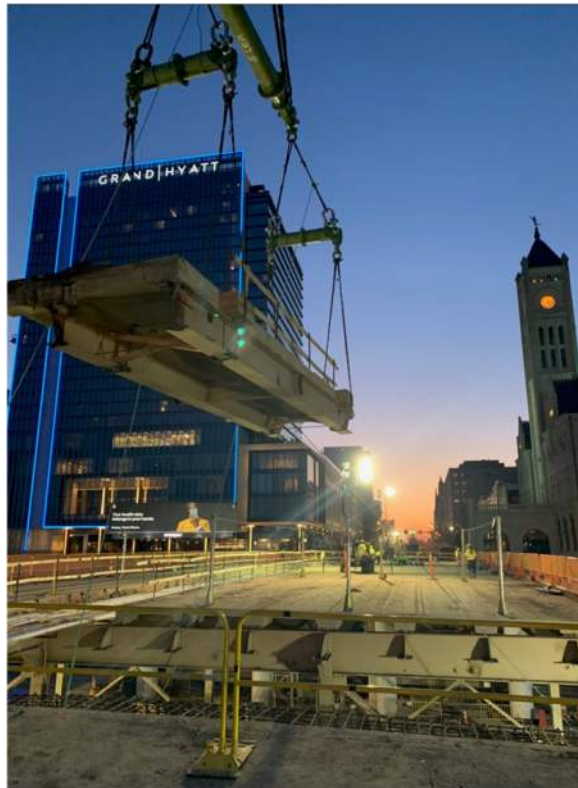


Closure - Demo

AT&T PANEL DEMO



STRINGER PACK DEMO

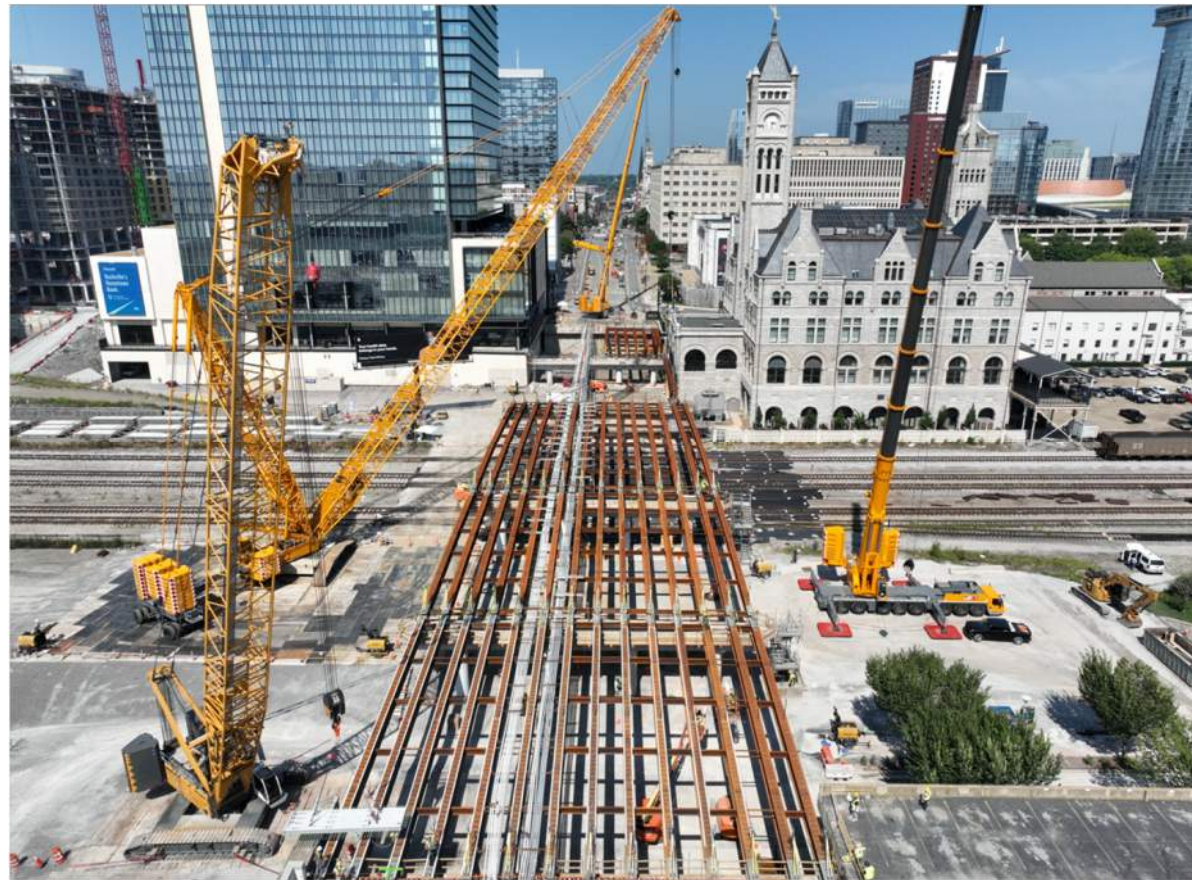


CONVENTIONAL DEMO



Closure – Superstructure Steel

- 70 EA Girders
- Simple Span Configuration
- AT&T Transfer



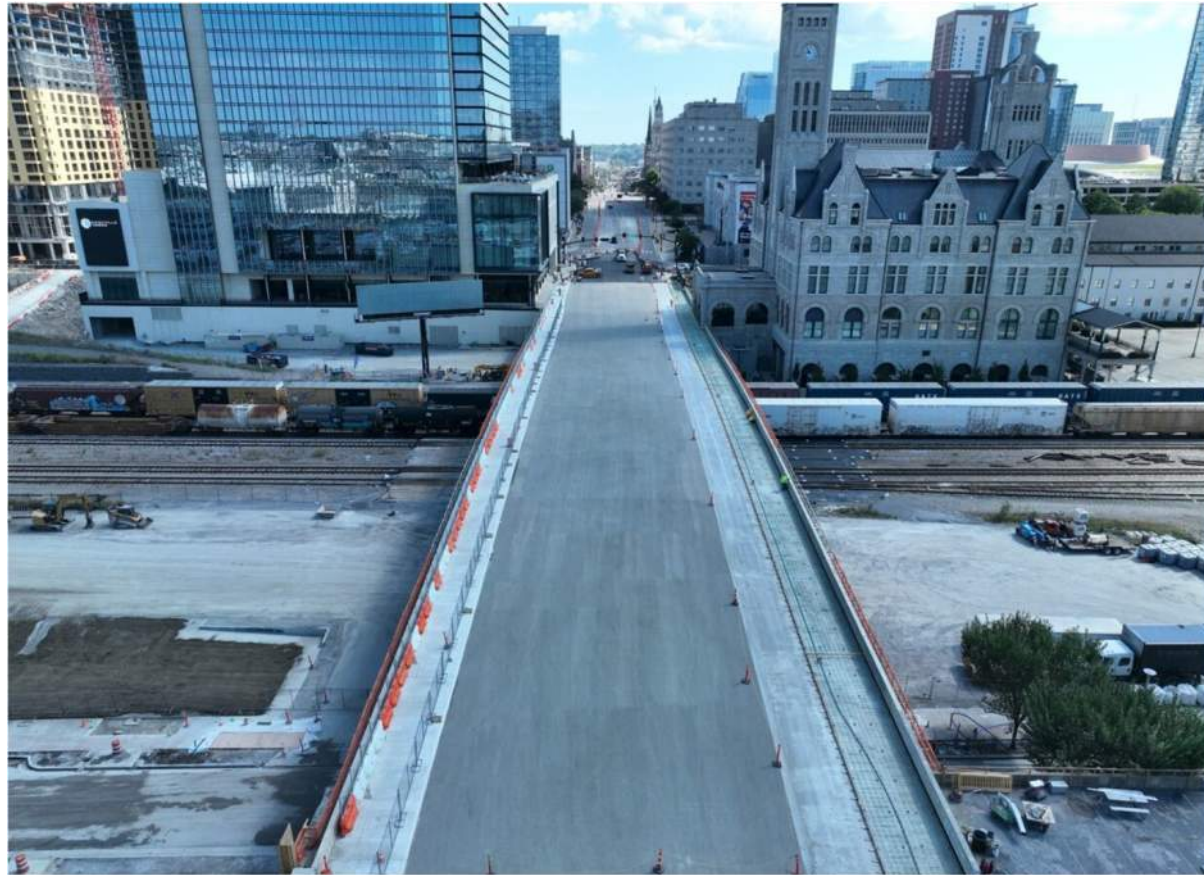
Closure – Precast Panels

- 276 EA
- Typical 8' x 25'
- Typical 25,000 lbs / panel



Closure – Deck Finishes

- Closure Pours
- Diamond Grinding
- Epoxy Overlay
- Bridge Parapet
- Bridge Sidewalk
- Roadway Tie-ins
- Asphalt Paving

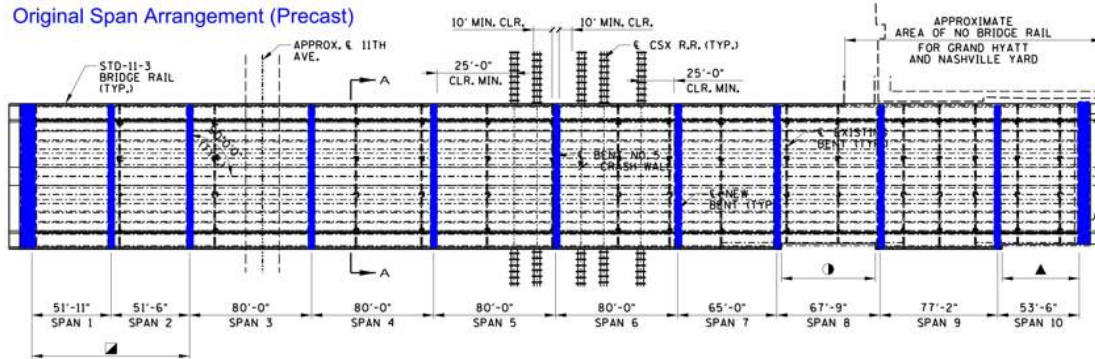


Closure – Opening

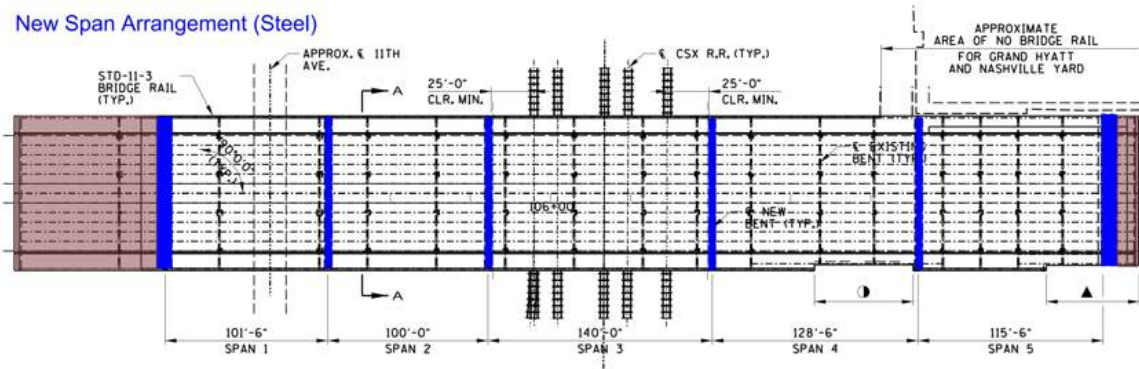


Bridge Design And Constructability

Original Span Arrangement (Precast)



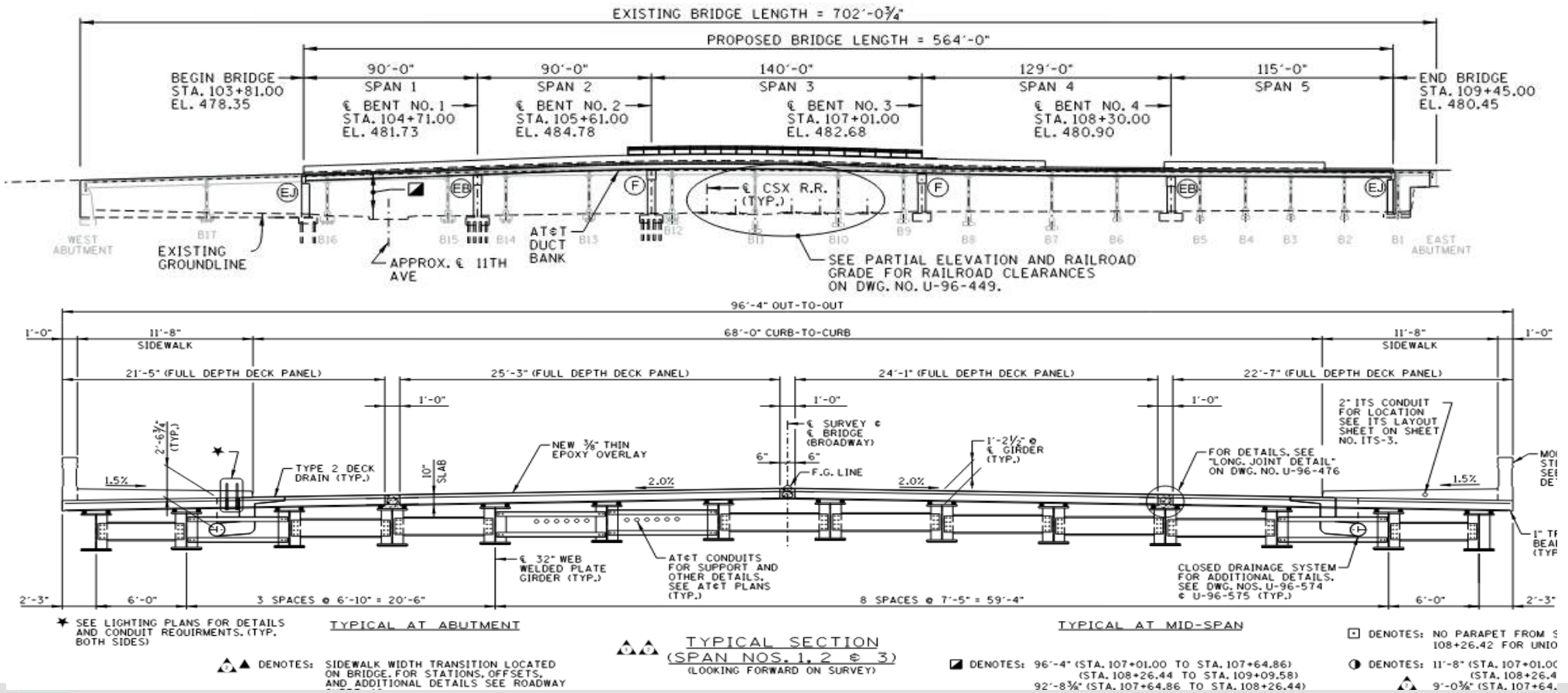
New Span Arrangement (Steel)



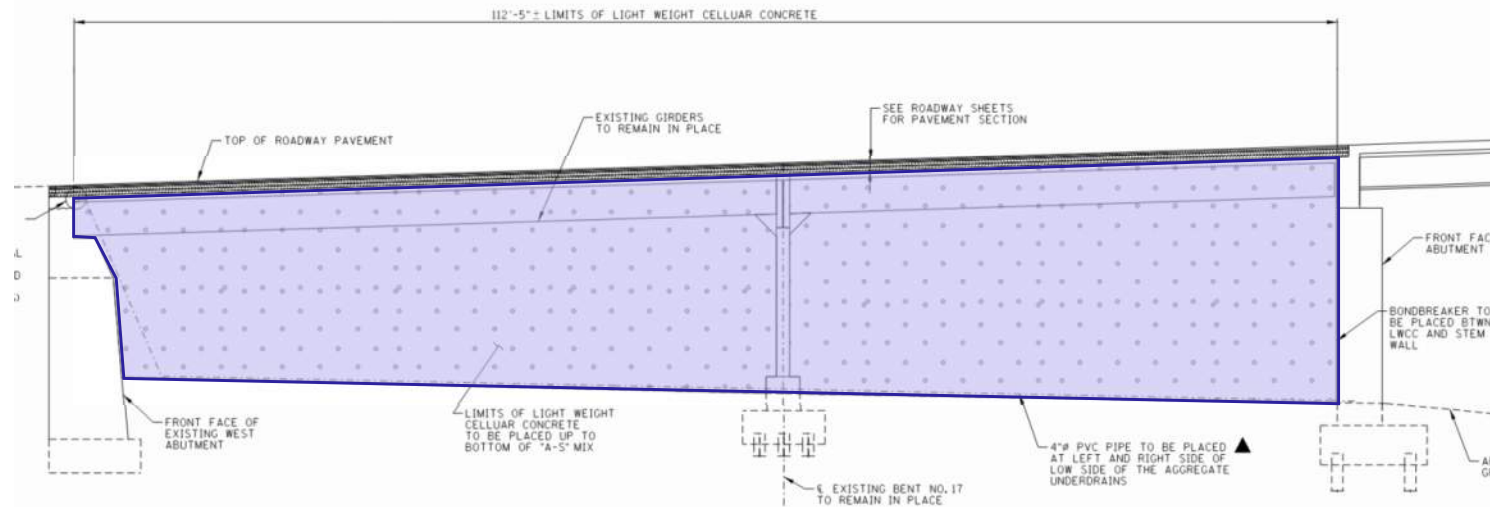
Span Arrangement Details:

- Factors
 - Construction schedule
 - Construction approach
 - RR clearances
 - Adjacent buildings
 - Existing substructure and foundations
 - Utilities
- Design Solutions
 - Steel girders
 - Eliminated bent between RR tracks
 - Eliminated crash walls
 - Permit reduction
 - Unsymmetrical cross-section

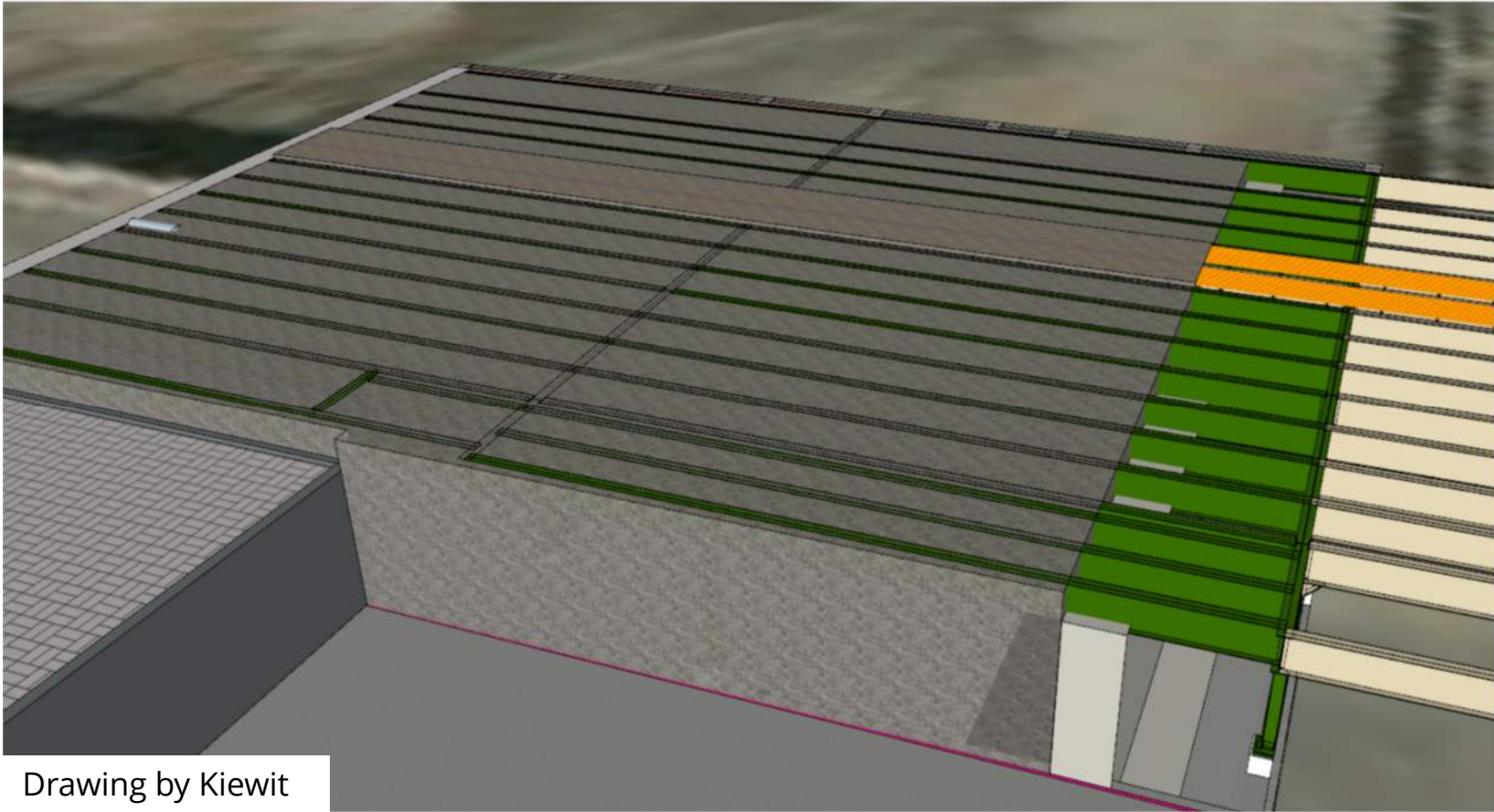
Bridge Design And Constructability



Tennessee Room



Tennessee Room

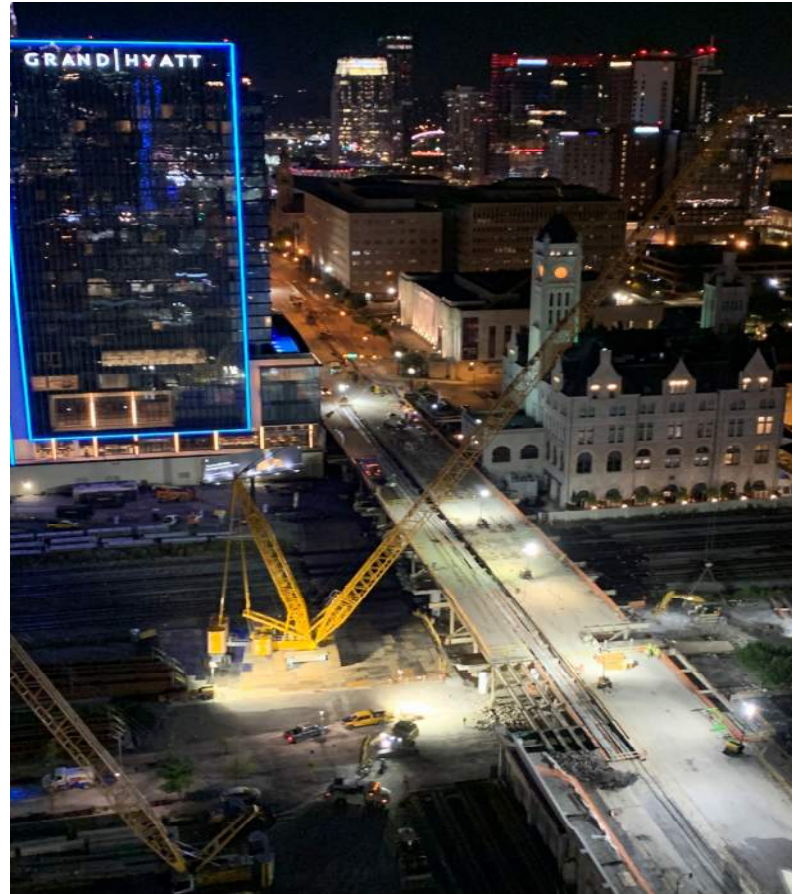


Drawing by Kiewit

Tennessee Room



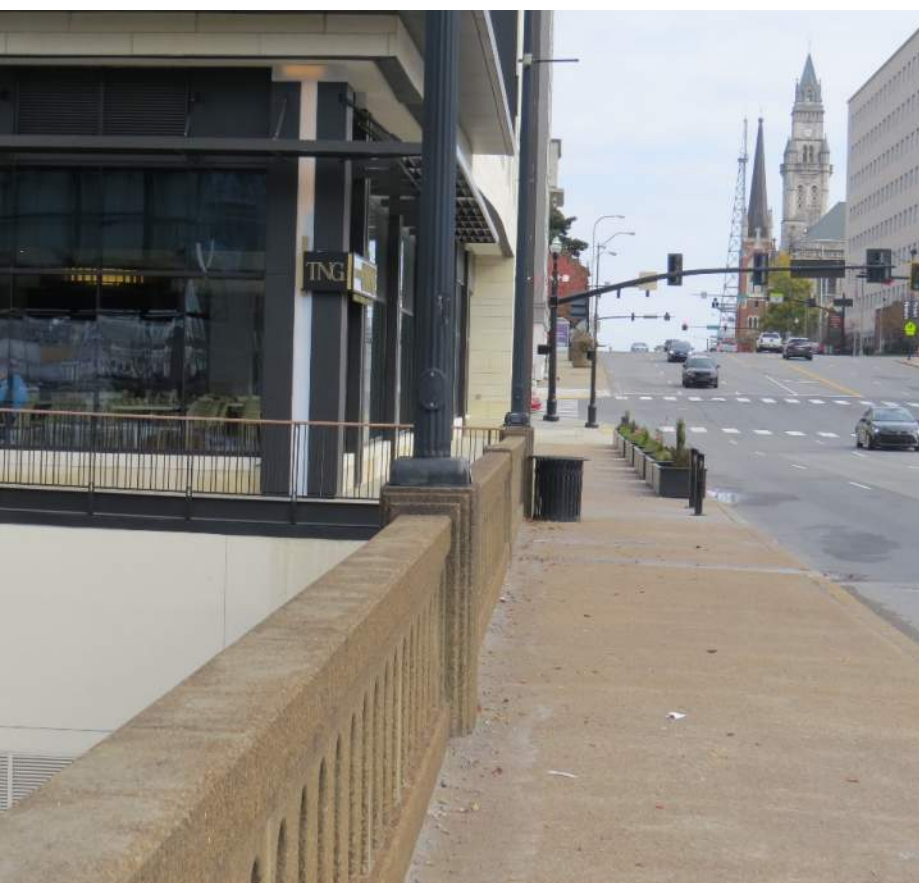
Vertical Constraints – Overall View



Vertical Constraints - Union Station Tie-In

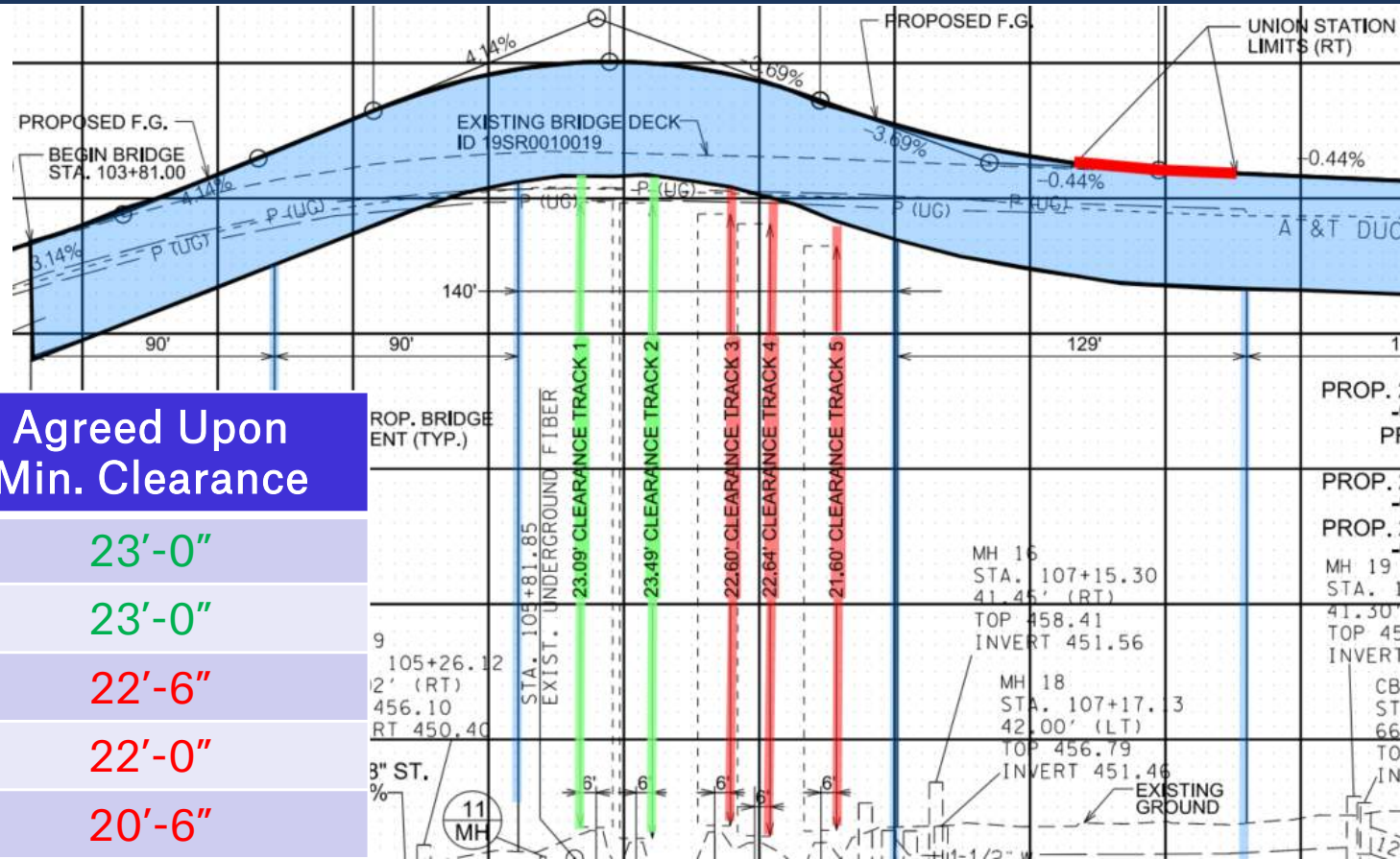


Vertical Constraints – Grand Hyatt Tie-In



Vertical Alignment

CSX Required Min. Vertical Clearance = 23'-0"

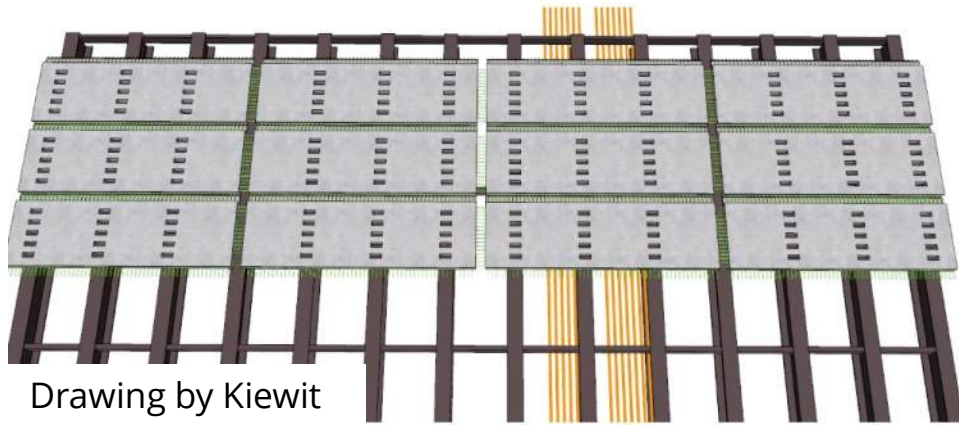


Track #	Ex. Min. Clearance	Agreed Upon Min. Clearance
1	20'-10"	23'-0"
2	21'-3"	23'-0"
3	20'-7"	22'-6"
4	20'-1"	22'-0"
5	19'-6"	20'-6"

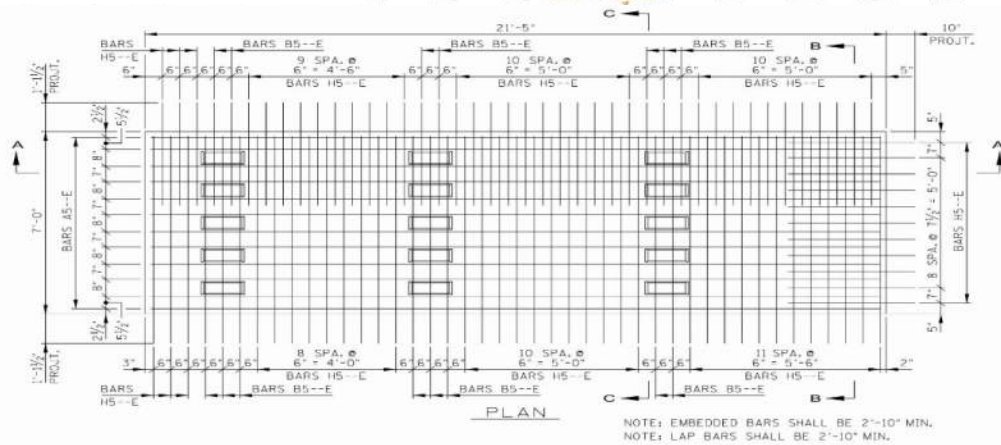
Vertical Alignment



Precast Deck Panels



Drawing by Kiewit

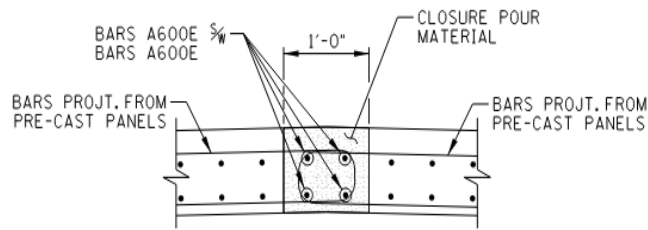


Use of Full Depth Precast Deck Panels

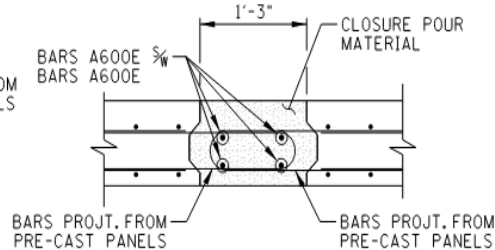
Deck Panel Details:

- Impactful decisions
 - Final riding surface will be a thin epoxy overlay
 - Closure pour material: UHPC vs. TDOT High Strength Mix
- Challenges
 - Shear stud pockets
 - Geometric anomalies
 - Panel fit up – critical driver for panel details
- Design Solutions
 - Use of Transverse Panels

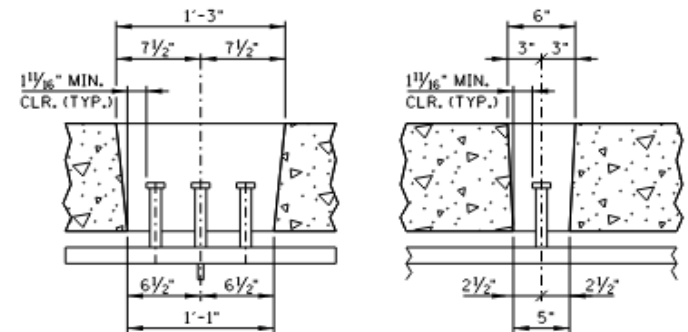
Precast Deck Panels



LONGITUDINAL CONNECTION
(PANEL TO PANEL)



TRANSVERSE CONNECTION
(PANEL TO PANEL)



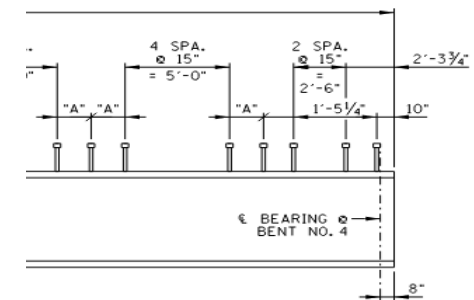
SECTION D-D

SECTION E-E

SHEAR POCKET DETAILS

Key Details:

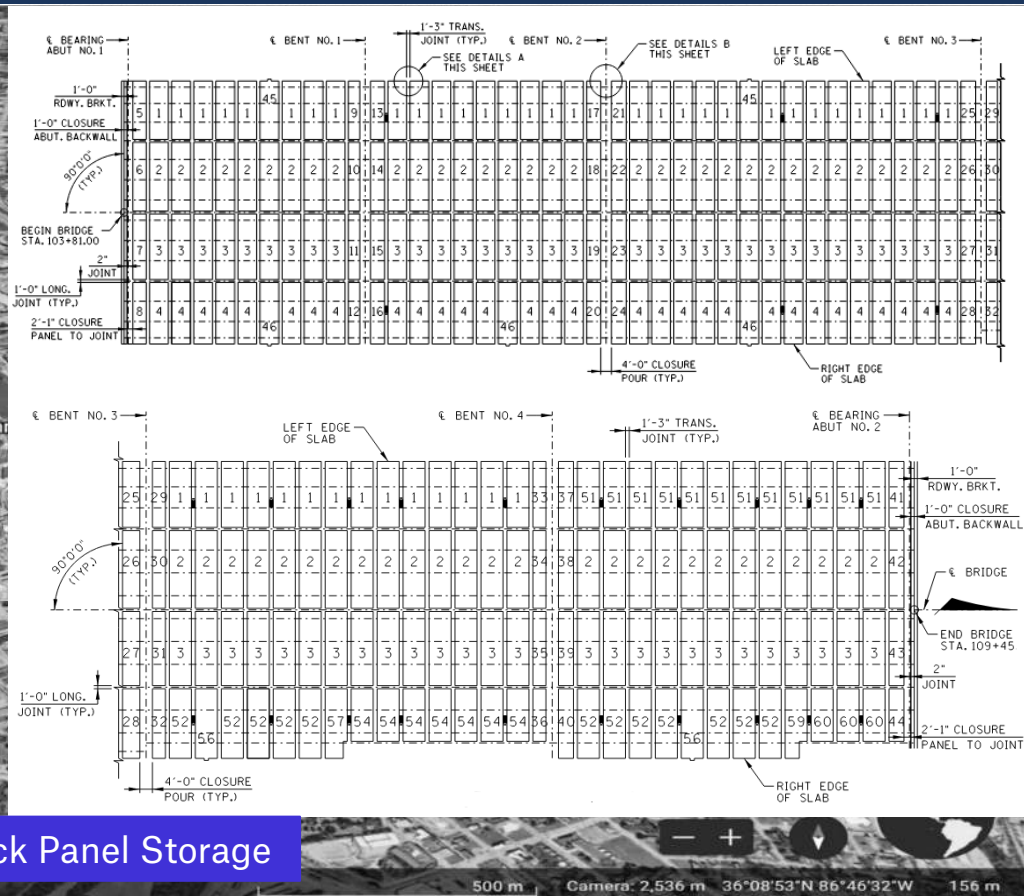
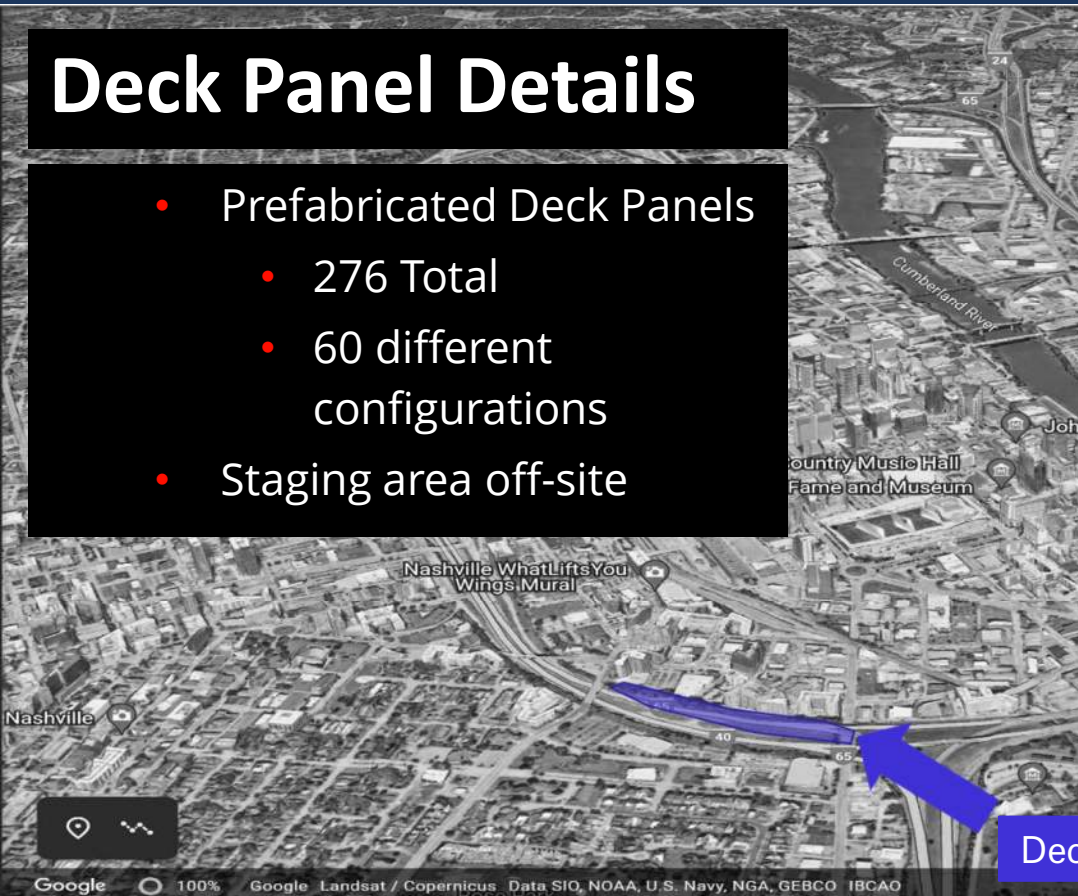
- Tied together via projecting bars with closure pours
- Made composite with girders via shear studs inside shear pockets
- Deck drains placed between panels inside closure pours



Precast Deck Panels

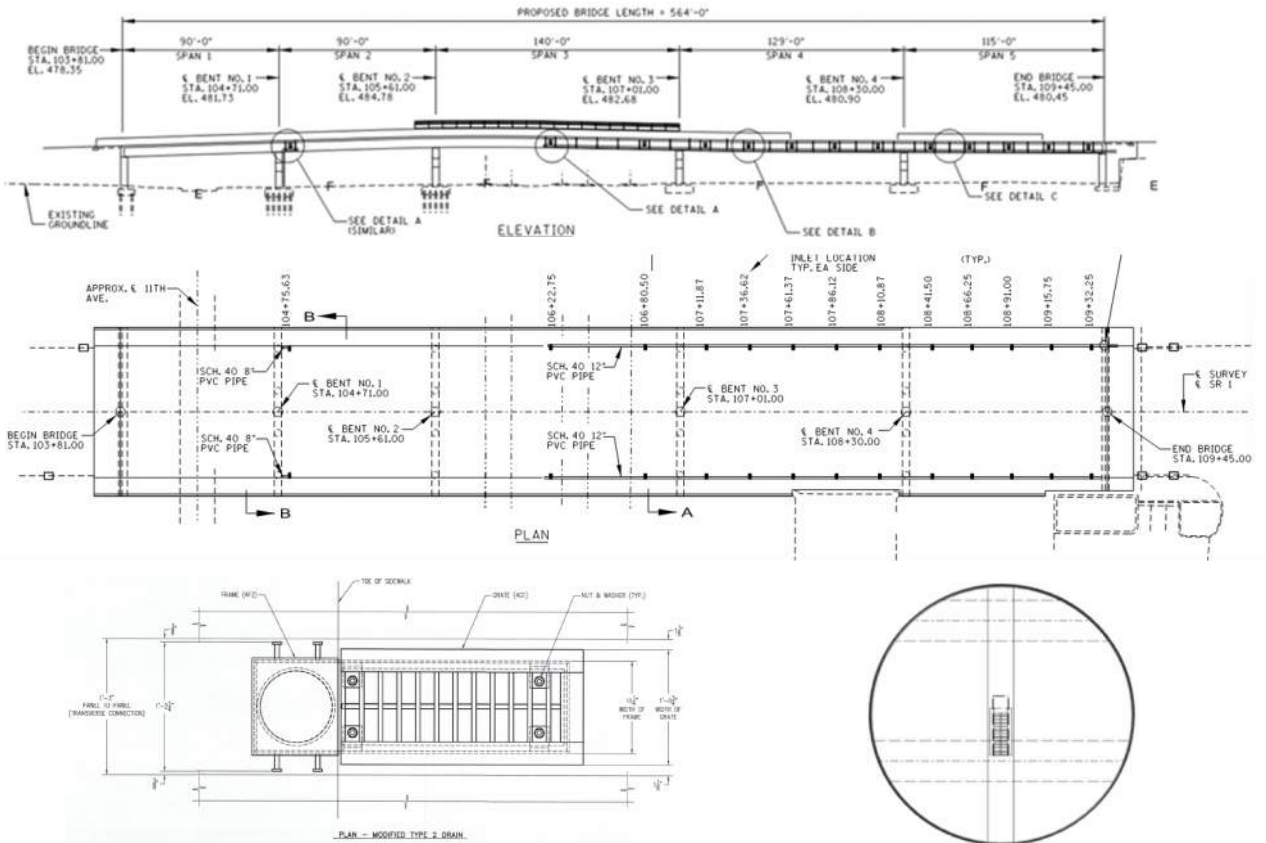
Deck Panel Details

- Prefabricated Deck Panels
 - 276 Total
 - 60 different configurations
- Staging area off-site



Deck Panel Storage

Deck Drains and Closed Drainage



Key Details:

- TDOT STD-1-2SS Deck Drains Modified to fit in 1'-3" closure pours
- Vertical Curve creates large amount of water east end
- Drain can't empty on CSX Right-of-Way
- West end drains back to Bent No. 1 and into existing stormwater sewer
- East end drains forward into new catch basins

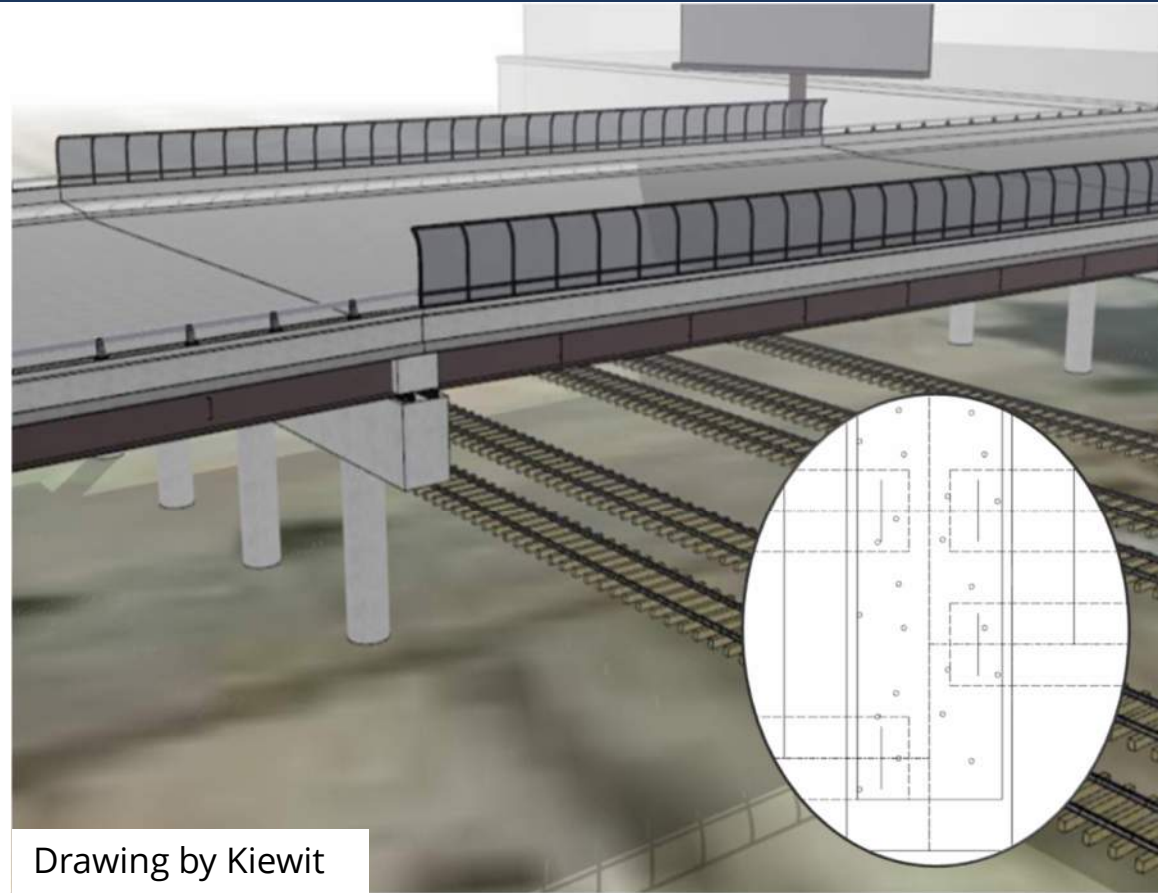
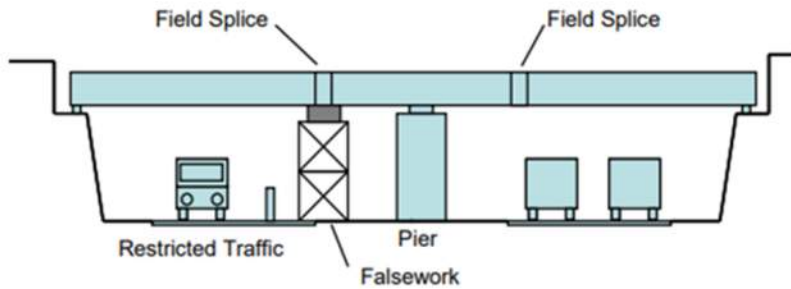
Steel Girder Placement

Challenges:

- Splicing Girders over Railroad
- Providing falsework or crane support until girders are spliced
- Forming around Union Station

Design Solutions:

- Utilize simple span girders



Steel Girder Details

Girder Details:

- Shallow, inefficient girders
- 32" Web, 35"-36" total depth
- Span-to-Depth Ratio very high

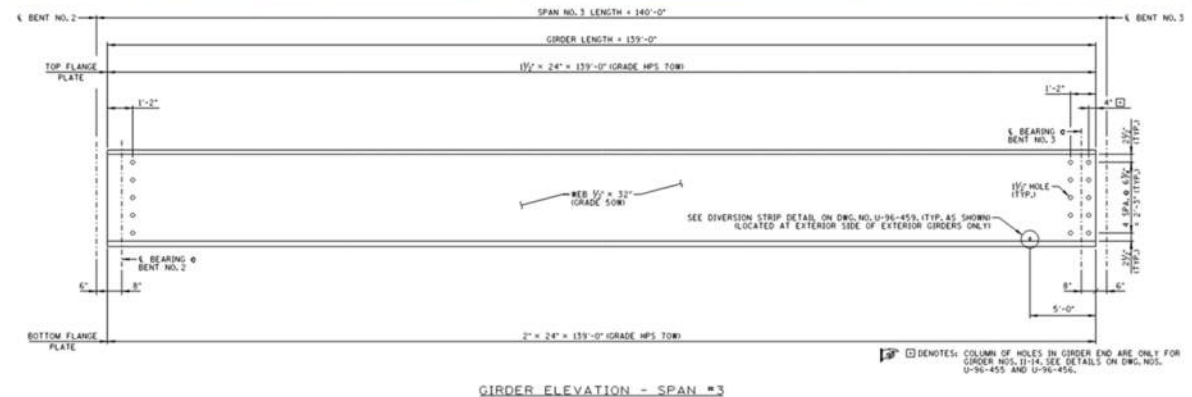
Challenges:

- Large live load deflections

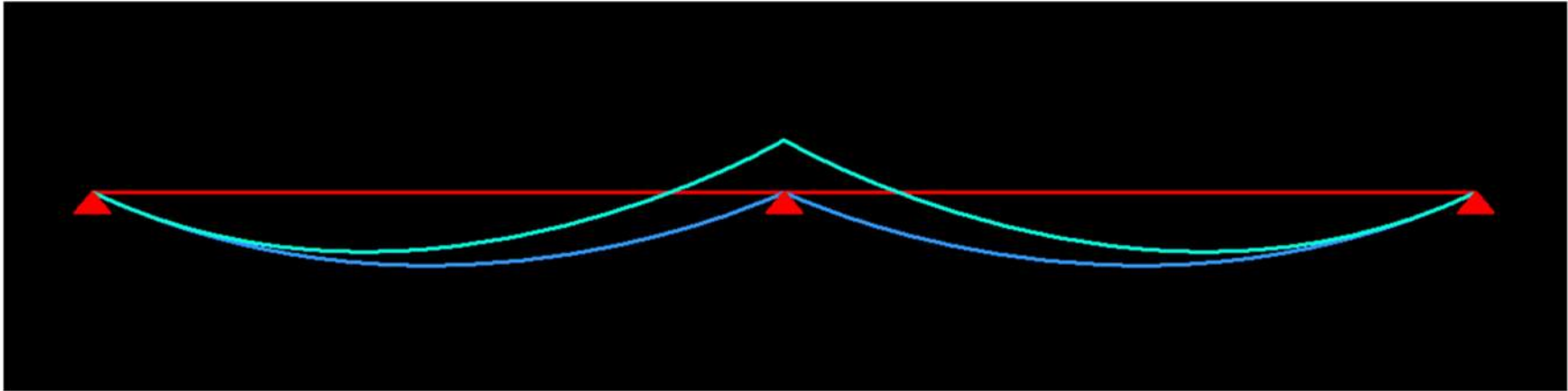


Design Solutions:

- Create detail to make continuous for live load
- Utilize high performance, Grade 70, steel flanges

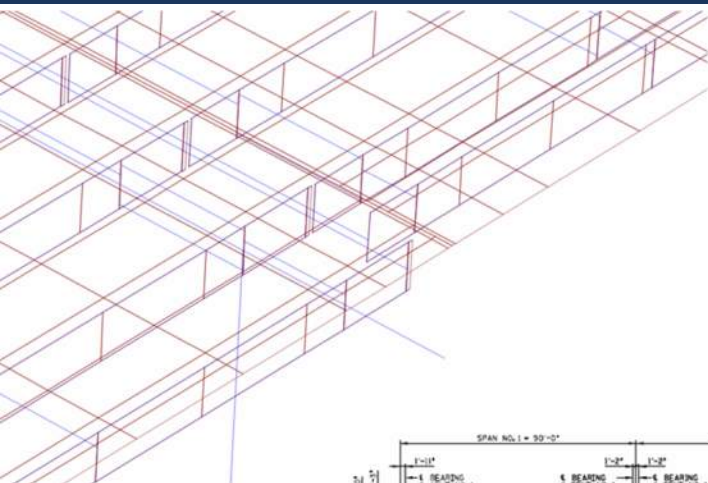


Simple Dead Load-Made Continuous for Live Load



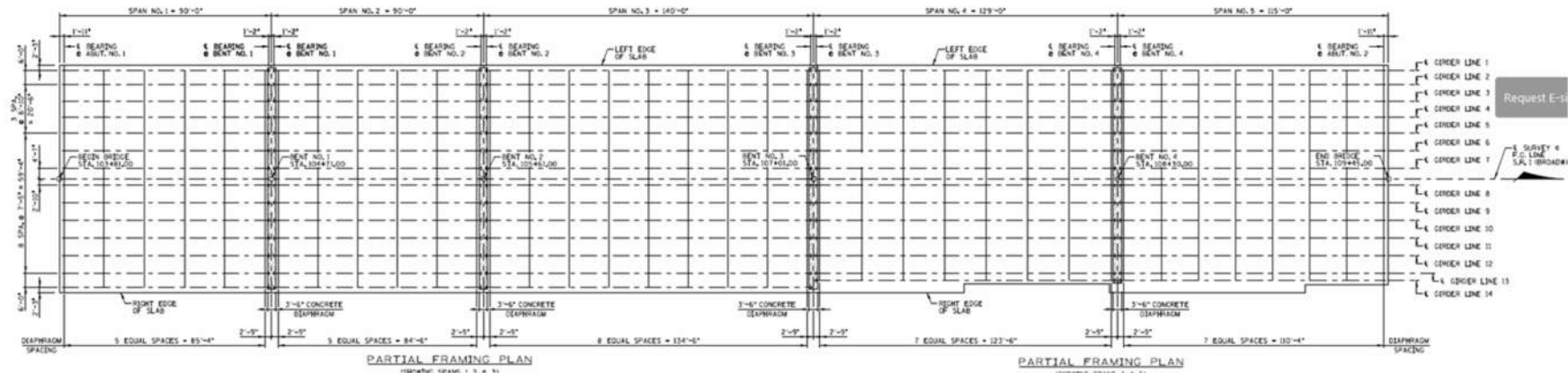
1. Girders are simply supported spans when the deck is cast (placement of panels)
2. Girders are tied together over the supports using diaphragms after placement of the panels.
3. Continuity is established with diaphragms after panel closure pours and diaphragm concrete cures.
4. Any additional loads added after continuity establishes will produce continuous load effects on the spans.

Simple Dead-Made Continuous for Live Diaphragm

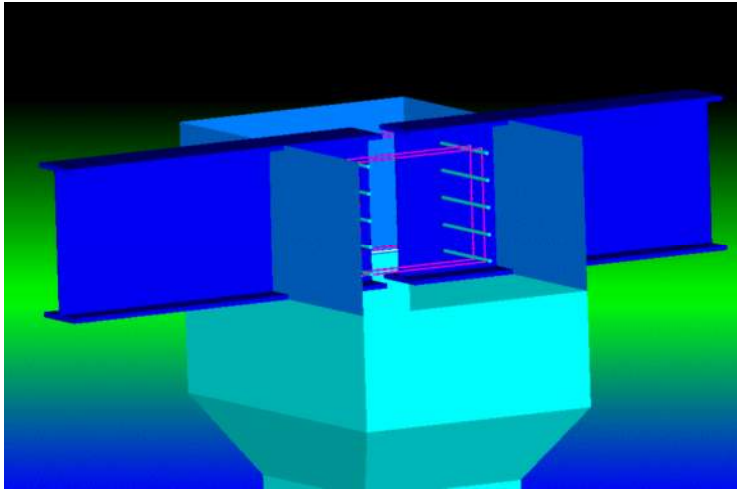


Challenges:

- Offset Girder due to Union Station
- Varying overhang widths between spans
- Increased Torsional Effects in diaphragm

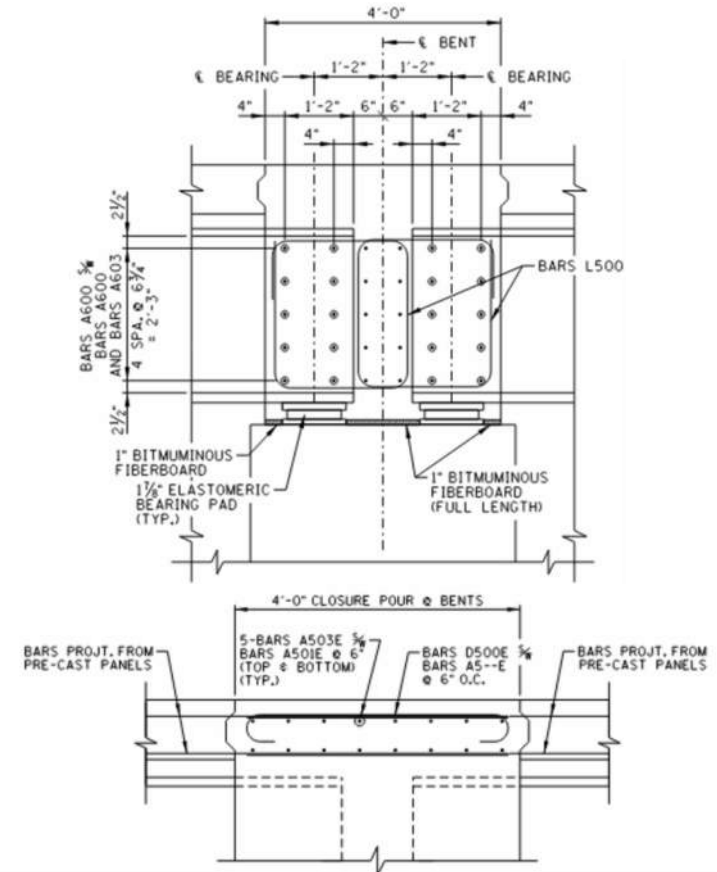


Simple Dead-Made Continuous for Live Diaphragm



Design Solutions:

- Thread bars thru drilled holes in girders, tied with stirrups
- Moments transferred via concrete compression
- Drop-In reinforcement provided for tension in slab



Substructures and Pile Footings

Challenges:

- Limited overhead and confined space
- Bridge required to be open and operational during substructure construction to meet schedule

Design Solutions:

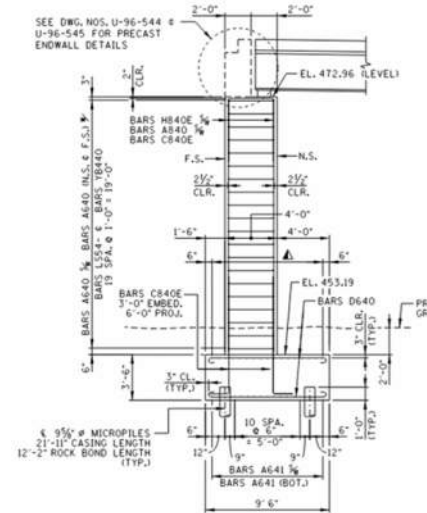
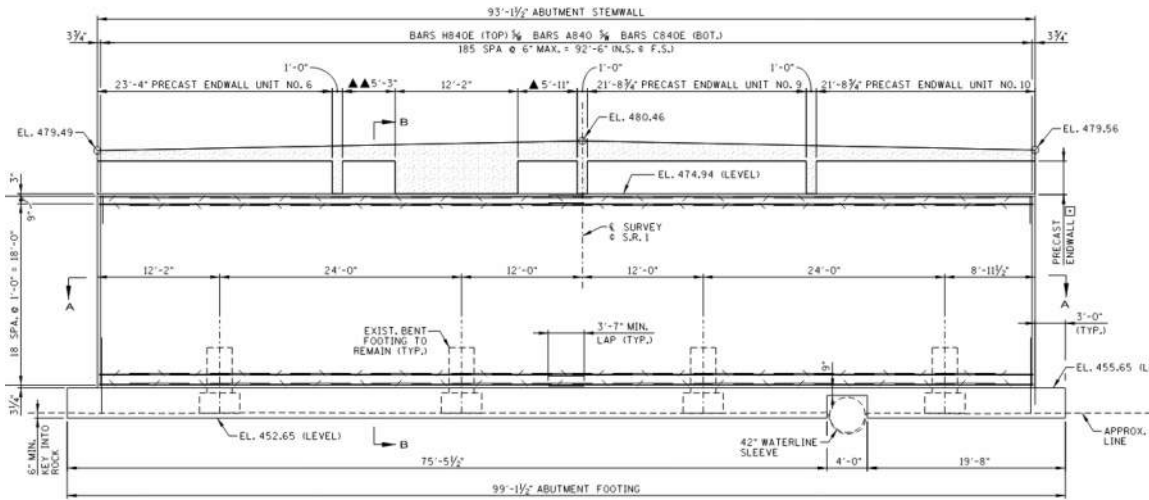
- Use of Micropiles

Micropile Benefits:

- Works in compression and tension
- Easily installed in confined spaces
- Minimal vibration and noise to surrounding area during installation
- High axial load capacity



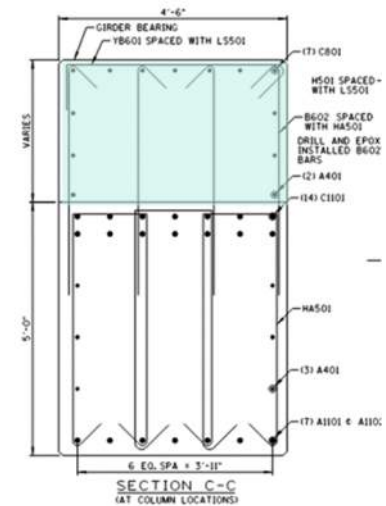
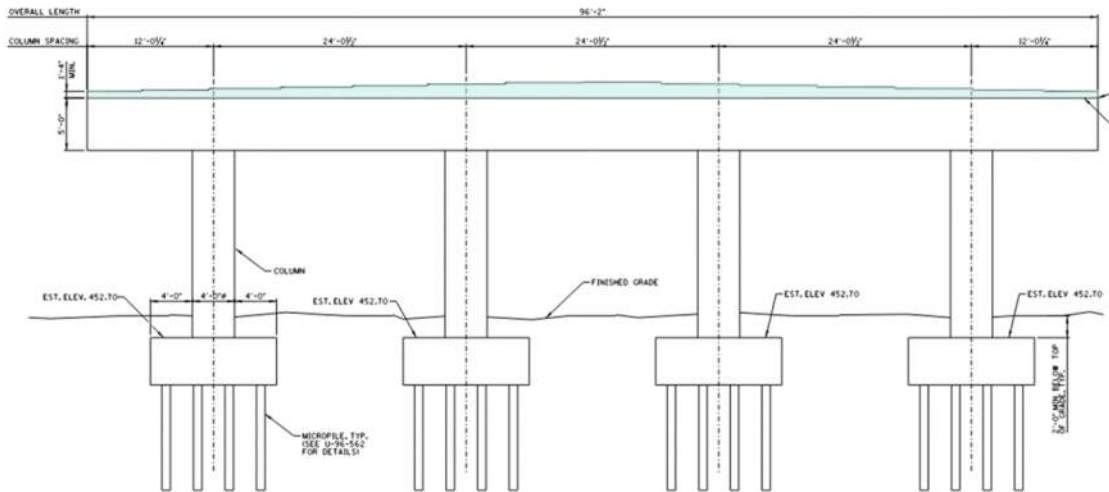
Abutments



Key Details:

- Closed Abutments on rock and on piles
- Formed around utilities remaining in place and existing bent footings
- Utilizing precast endwalls
- Top of cap designed to be 6" below existing girders
- Bearings consist of reinforced elastomeric pads on riser blocks

Bents



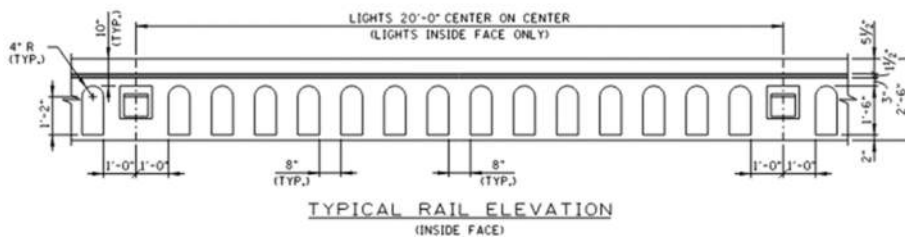
Key Details:

- 4-Post column bents with spread footings on rock and micropiles
- Top of cap poured to 6" below existing girders
- Final concrete pour to bring elevations to correct girder seats
- Bearings consist of reinforced elastomeric pads on stepped caps

Bridge Rail and Sidewalk Lighting

Key Details:

- Decorative fencing similar to Division Street bridge
- TDOT STD-11-1 parapet modified for aesthetics
- Lighting embedded inside decorative parapet
- Varying sidewalk widths due to Union Station and middle turn lane



AT&T Bridge Mounted Utilities

AT&T Details:

- One of the most critical aspects of project!

Challenges:

- Critical communication lines
- High relocation impacts
 - 4yrs. and \$6M
- Remain fully operational for duration of project
- Supported with minimal movement

Design Solutions:

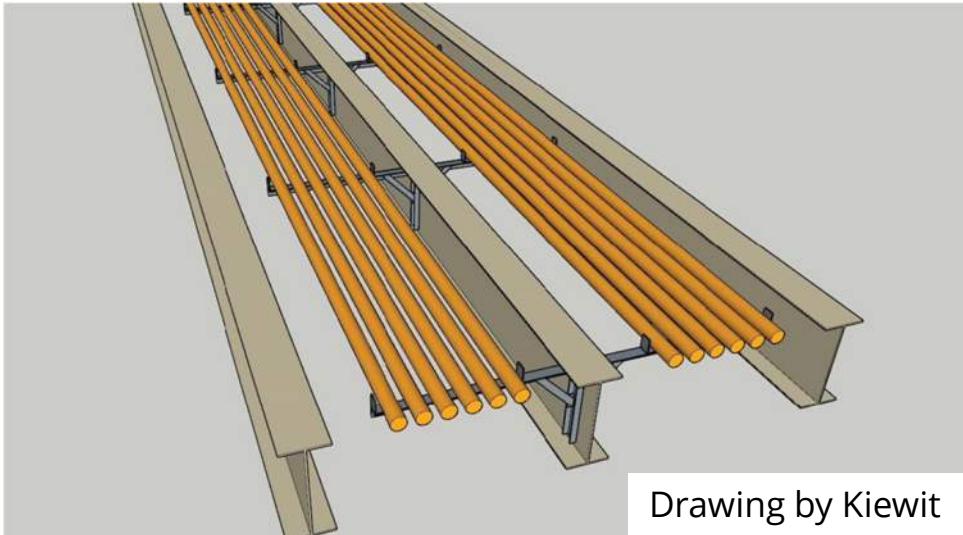
- Innovative temporary falsework
- Custom construction approach



Utility Conflicts: AT&T

Pre-closure:

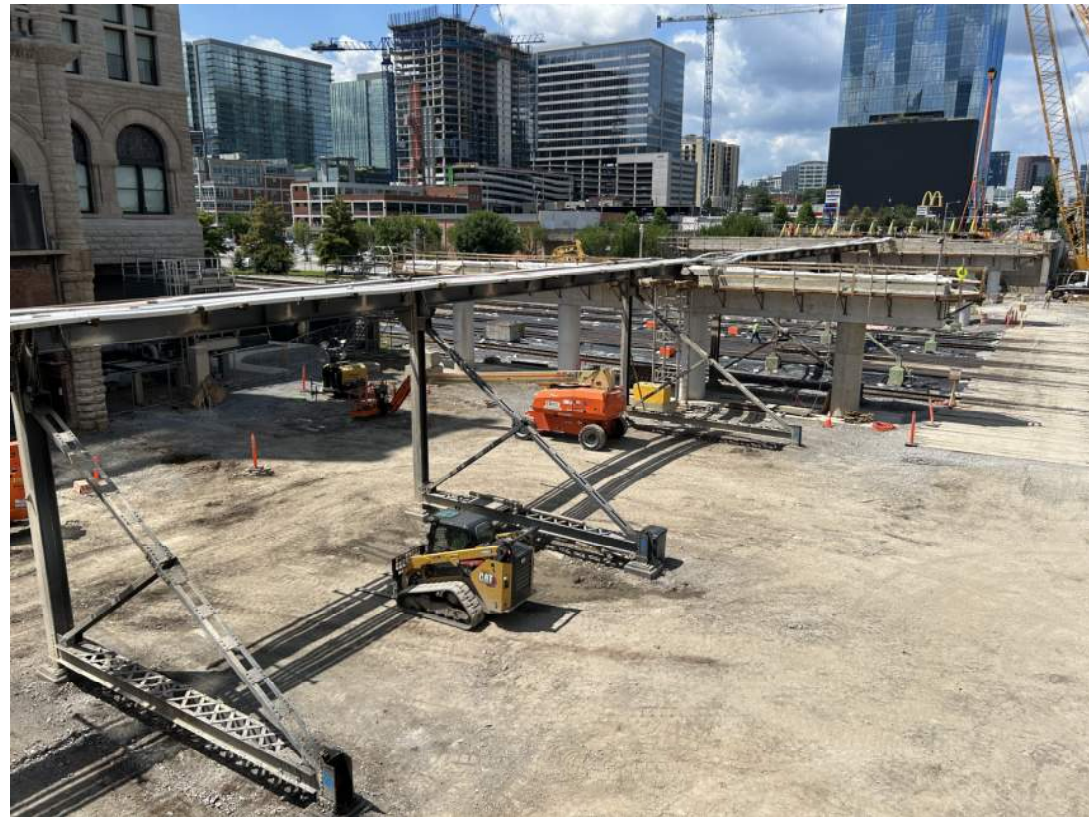
- Asbestos conduit abated
- Conduits replaced with PVC split-duct
- Install temporary brackets on existing girder



Utility Conflicts: AT&T

During closure:

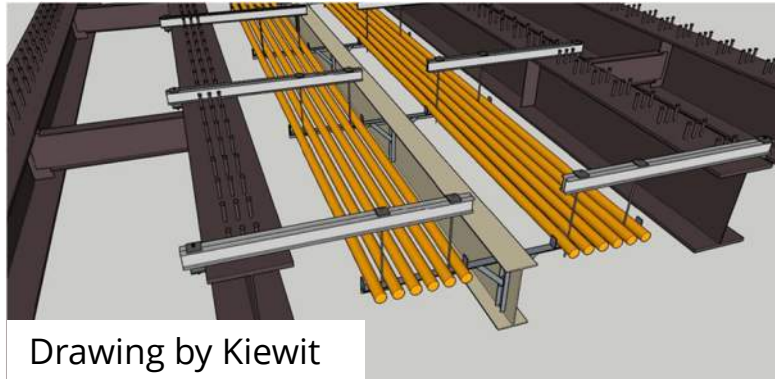
- Demolition of existing bridge
- Existing girder supporting conduit to remain in place



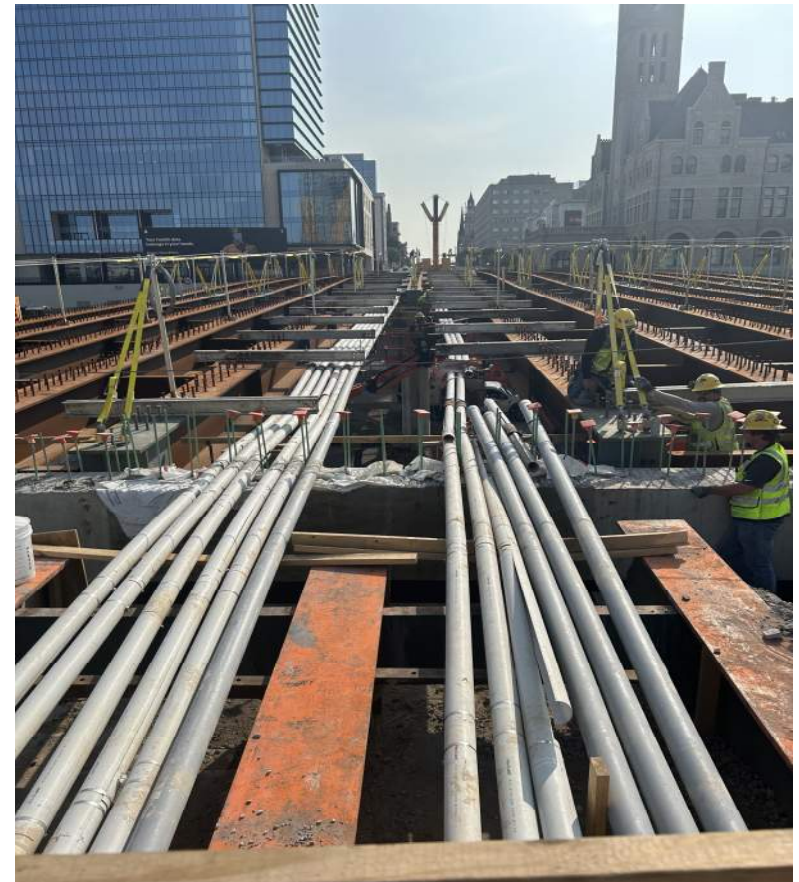
Utility Conflicts: AT&T

During closure:

- Install needle beams on new girders
- Install coil rod hangers and connect to temporary bracket
- Transfer load to needle beam
- Remove last existing girder
- Set new girder



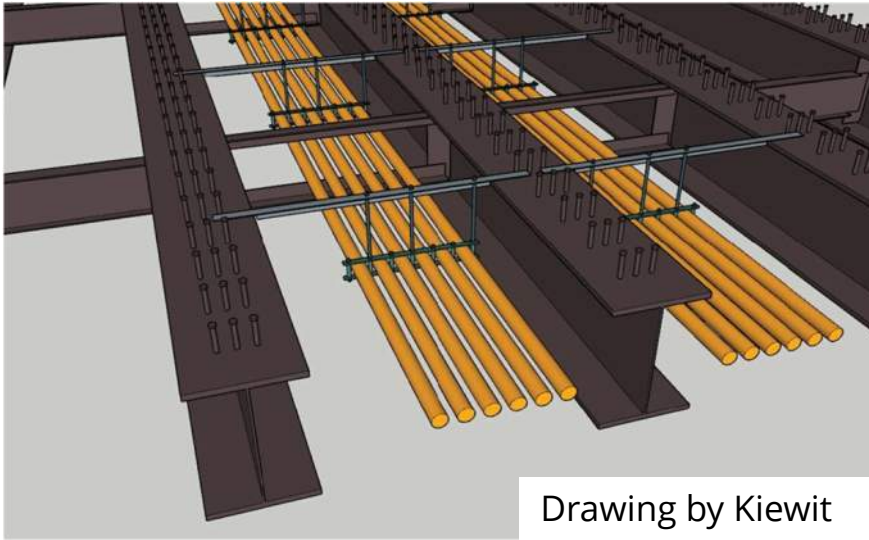
Drawing by Kiewit



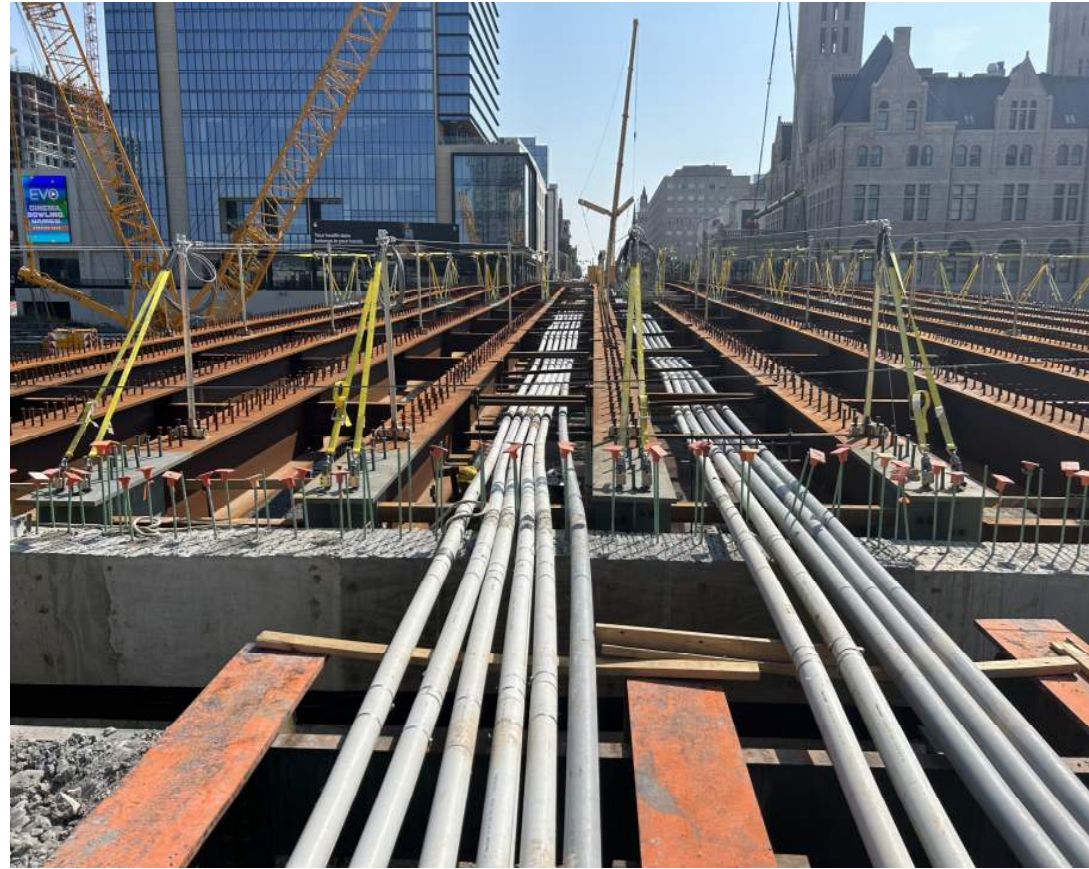
Utility Conflicts: AT&T

During closure:

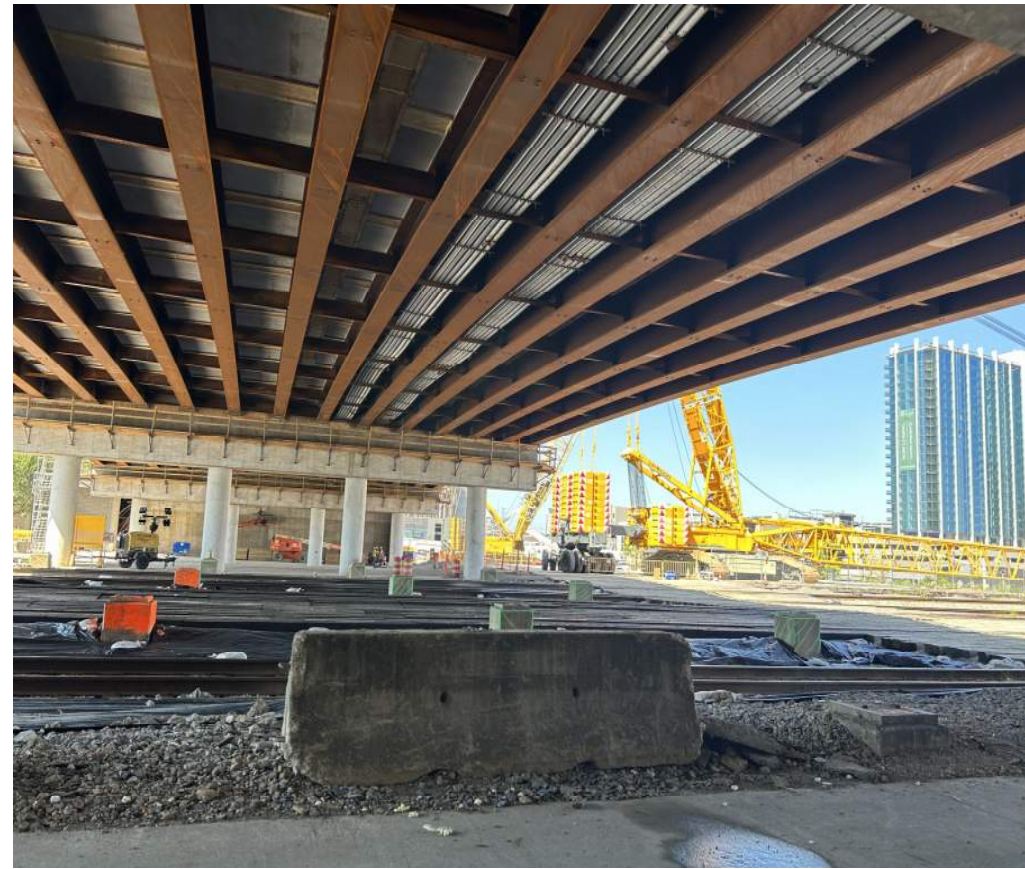
- Install permanent conduit support hangars
- Remove needle beams
- Transfer load to permanent brackets



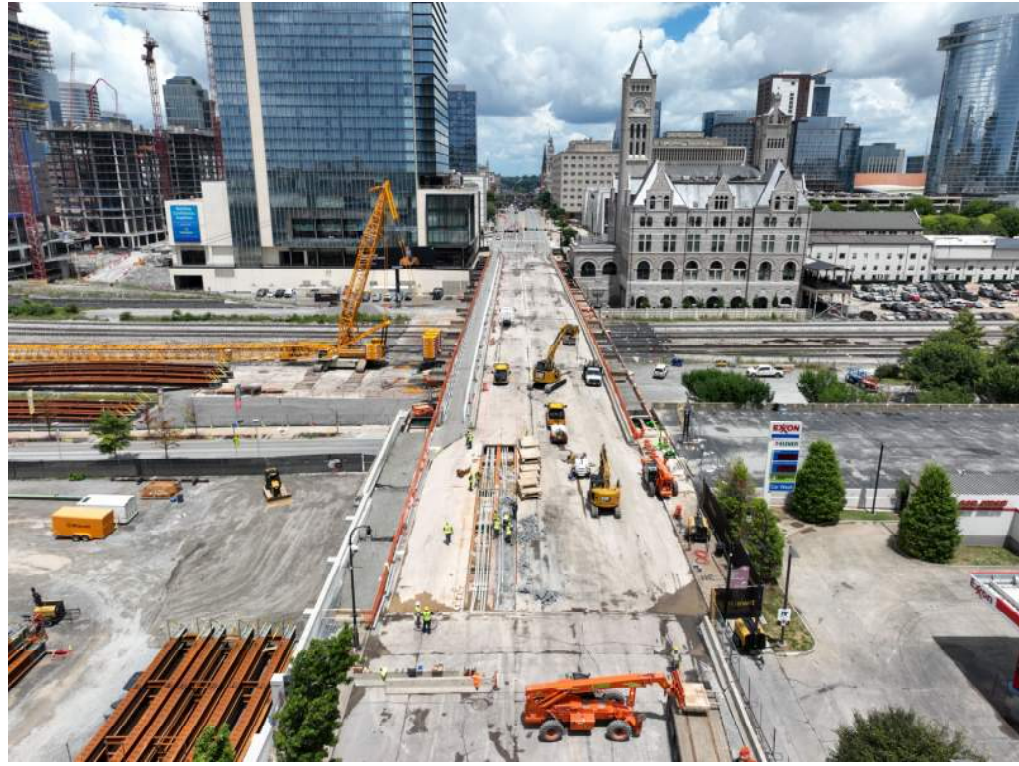
Drawing by Kiewit



Utility Conflicts: AT&T



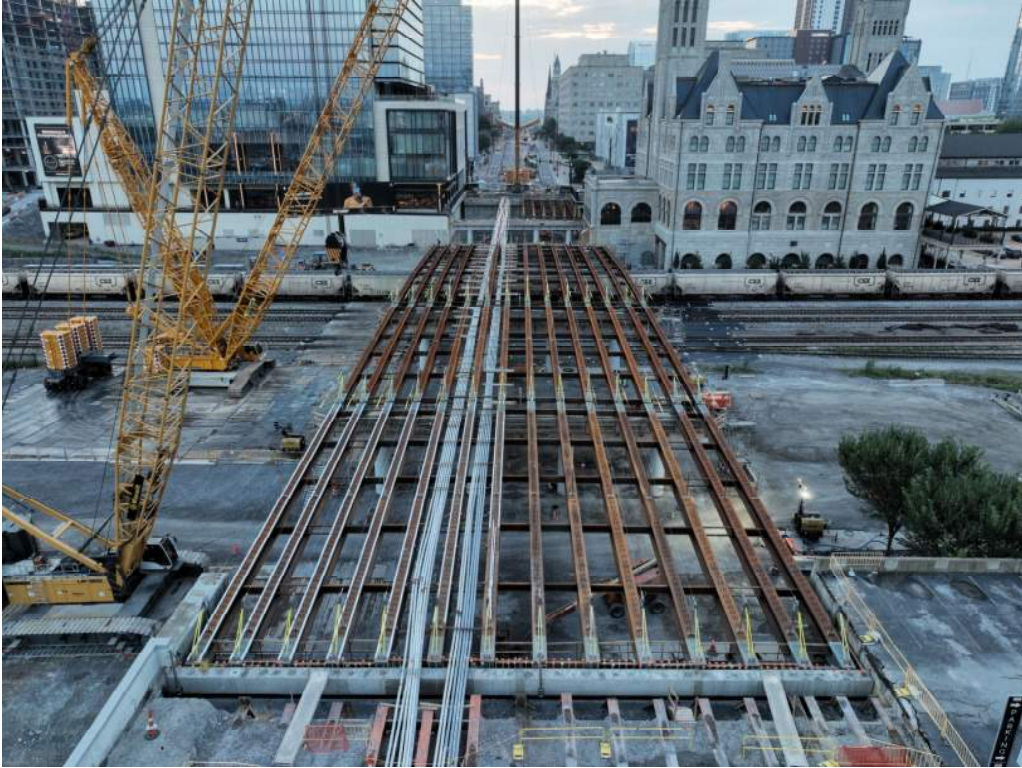
Construction Photos



Construction Photos



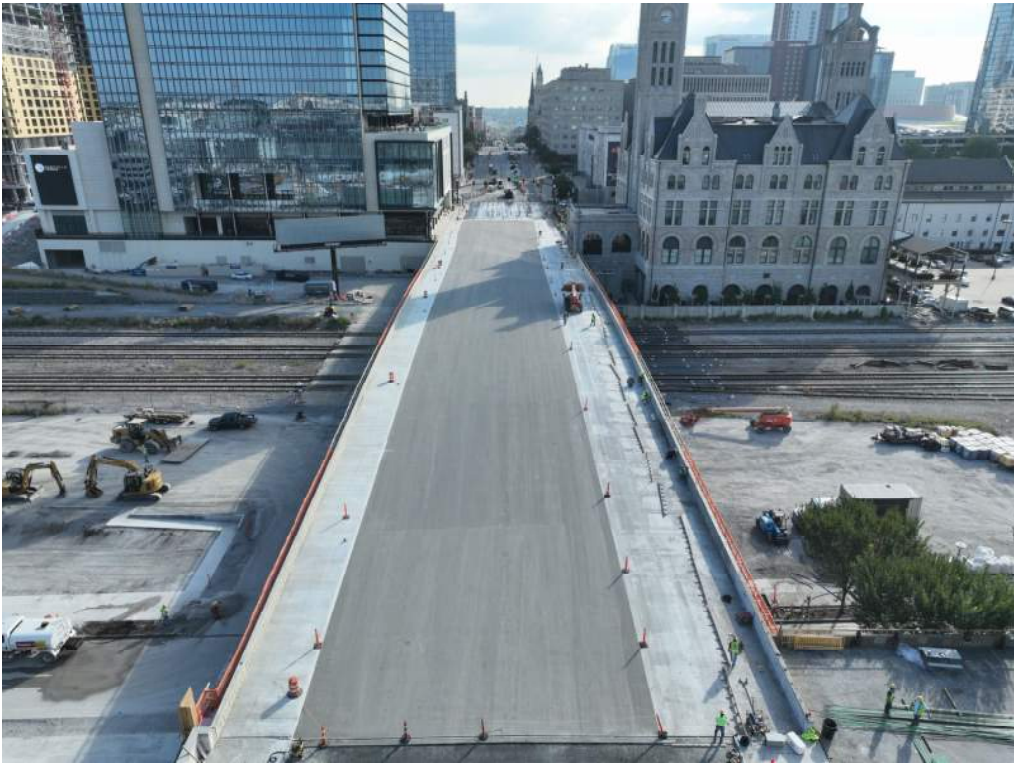
Construction Photos



Construction Photos

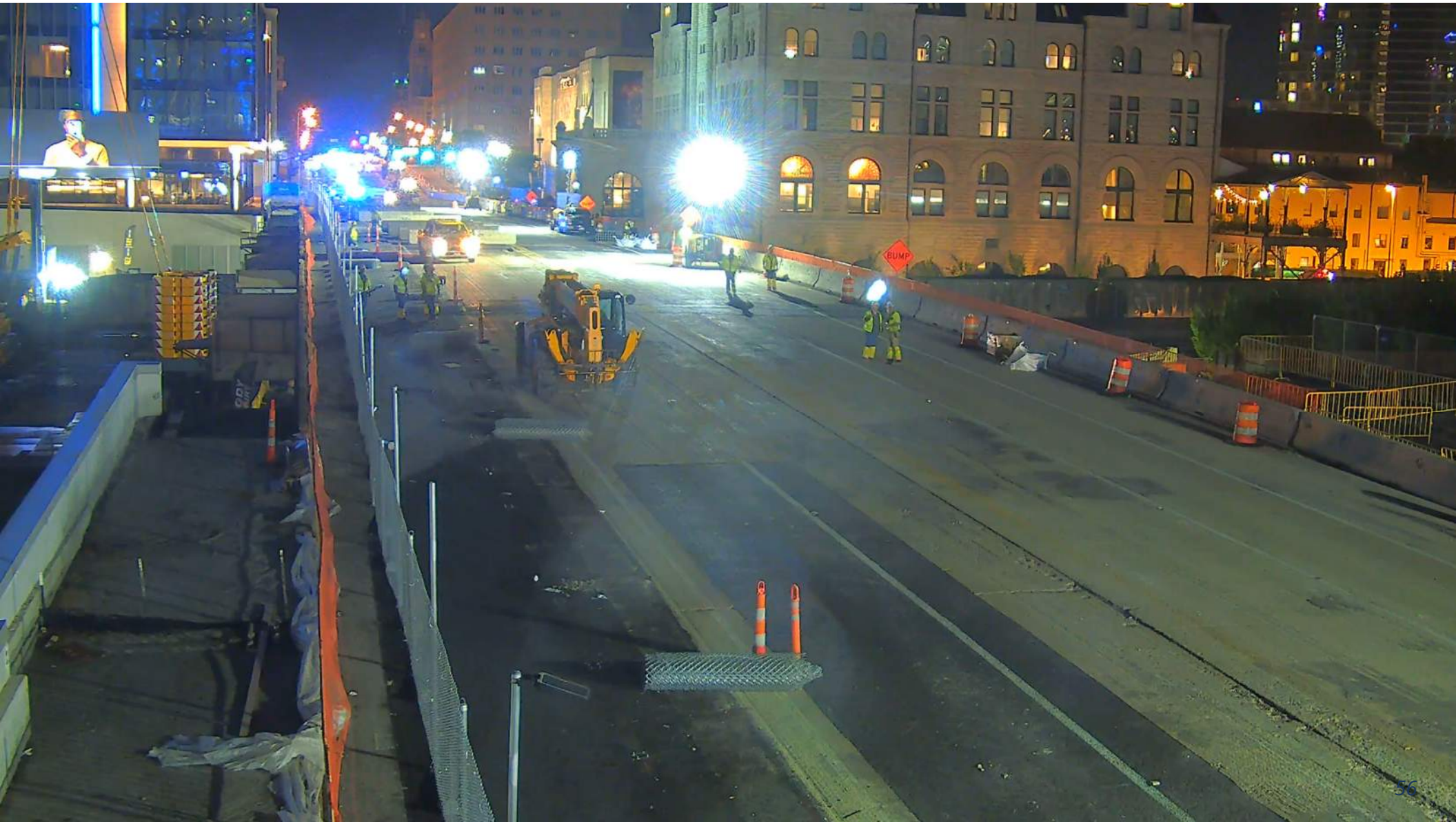


Construction Photos



Construction Photos





Broadway CM/GC

