MacArthur Bridge West Approach Span Replacement

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TEAM Conference 2024

Presentation Outline

1. Bridge Description and History
2. Project Description
3. Contracting Overview
4. Bridge Design
5. Bridge Construction
6. Roadway Bridge Demolition

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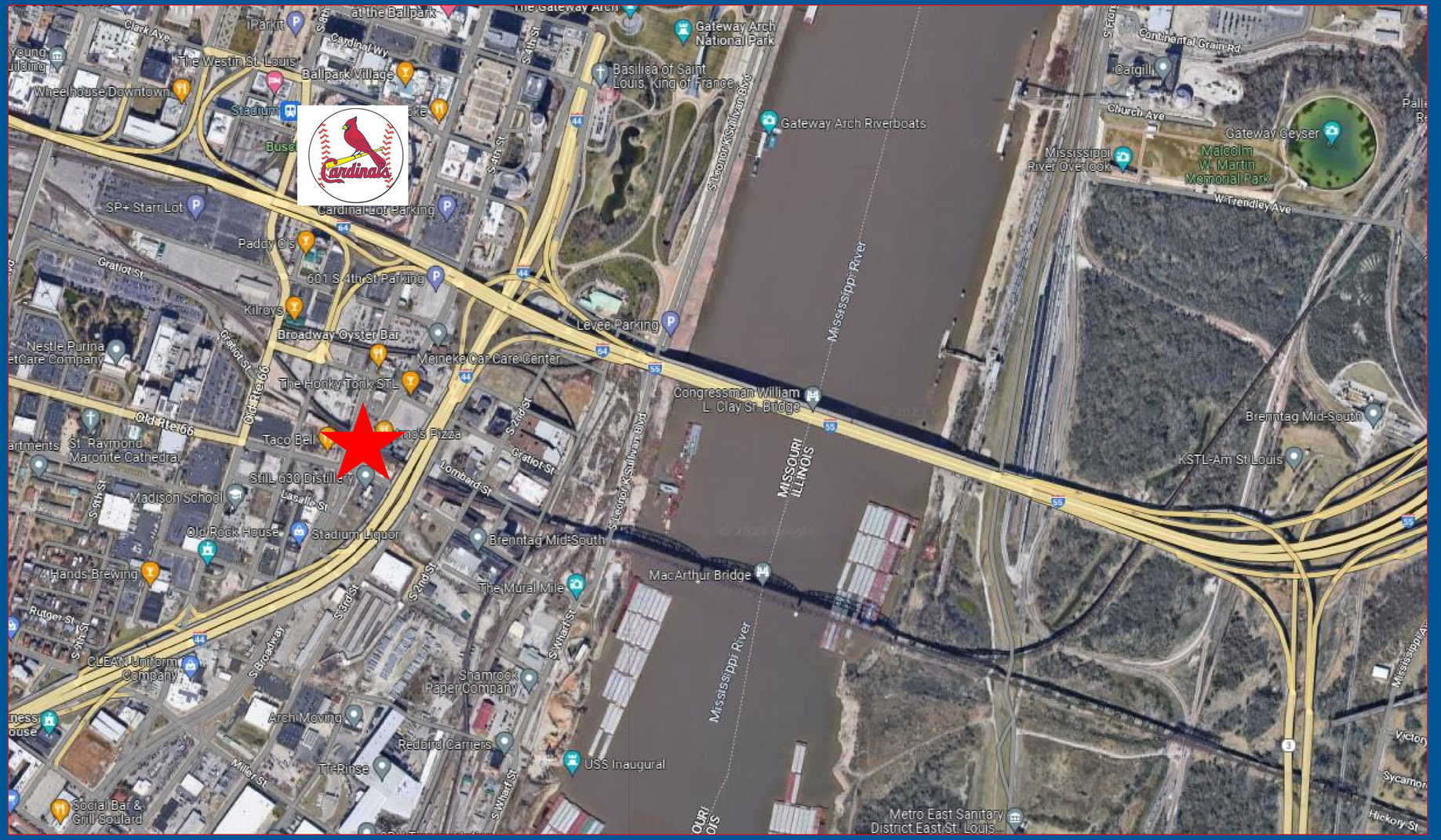
Bridge Location



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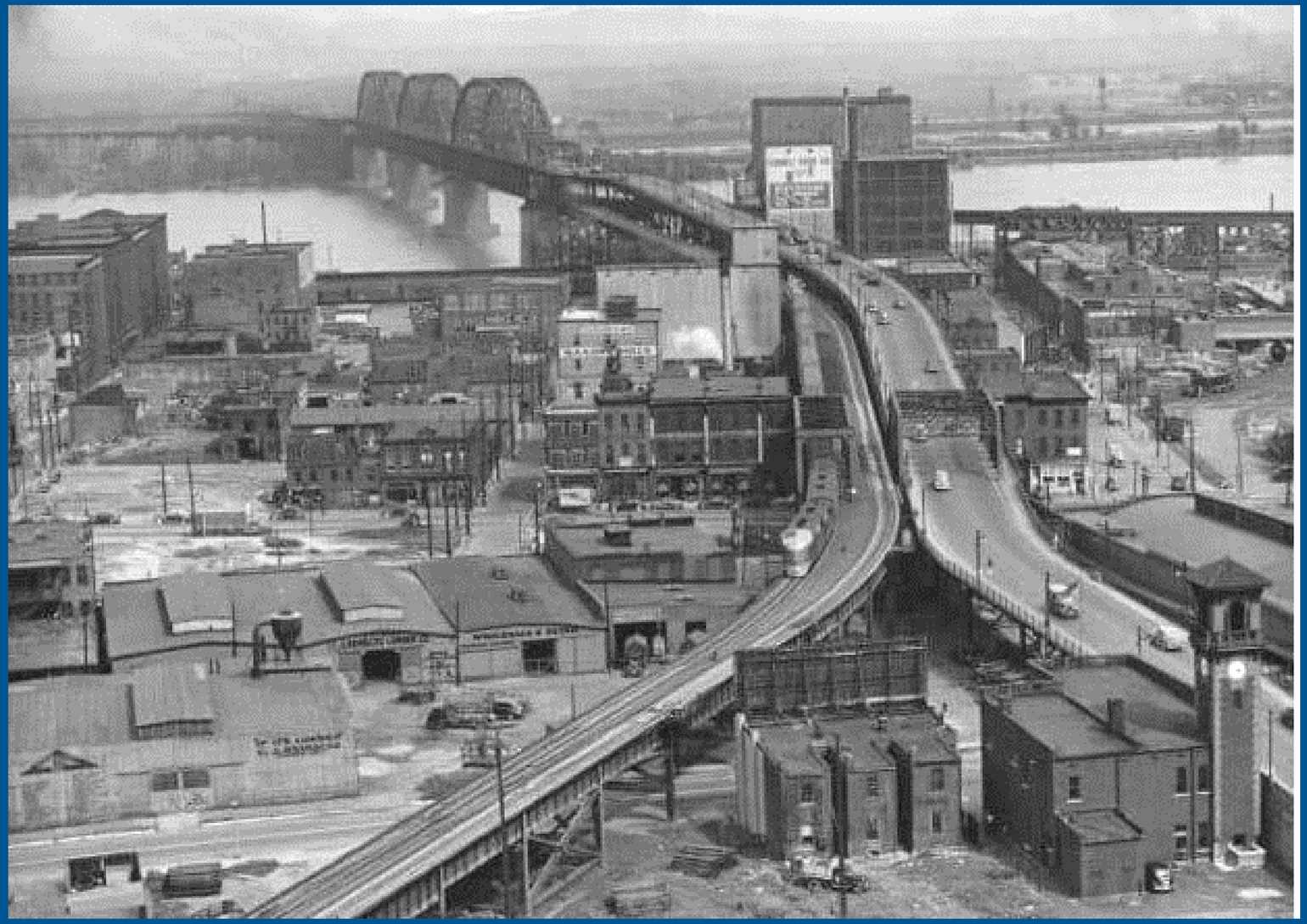
Bridge Location



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Bridge Description - Westbound Track

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Bridge Description – Abandoned highway truss

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Bridge Description – Eastbound Track and Highway Truss

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Project Goals

A. Upgrade aging structure
B. Increase effective car width from 13’4” to 15’-0”
C. Allow at least 20 dimensional loads per year to travel the most efficient route
D. Minimize impact to rail traffic
E. Ballast deck over Broadway Ave
F. Maintain vertical clearance over Broadway Ave

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Terminal Railroad Coordination

1. Amtrak daily schedule
2. Normal rail traffic
3. Merchants Bridge construction traffic

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City of St Louis Coordination

1. Permit required with plan review
2. Maintain traffic on Broadway Ave
3. Broadway Ave could not be closed during St Louis Cardinals home stands or equivalent events

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Design Build Team

Prime Contractor

Project Management

Pier Construction

Utility Coordination

Agency Coordination

Lead Designer

Construction Quality and Safety

Pier and foundation design

Existing bridge connection

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Project Timeline

October 2020 – RFP Issued
January 2021 – Project team selected
September 2021 – Construction began
July 2022 – Span replacement complete
March 2023 – Project complete

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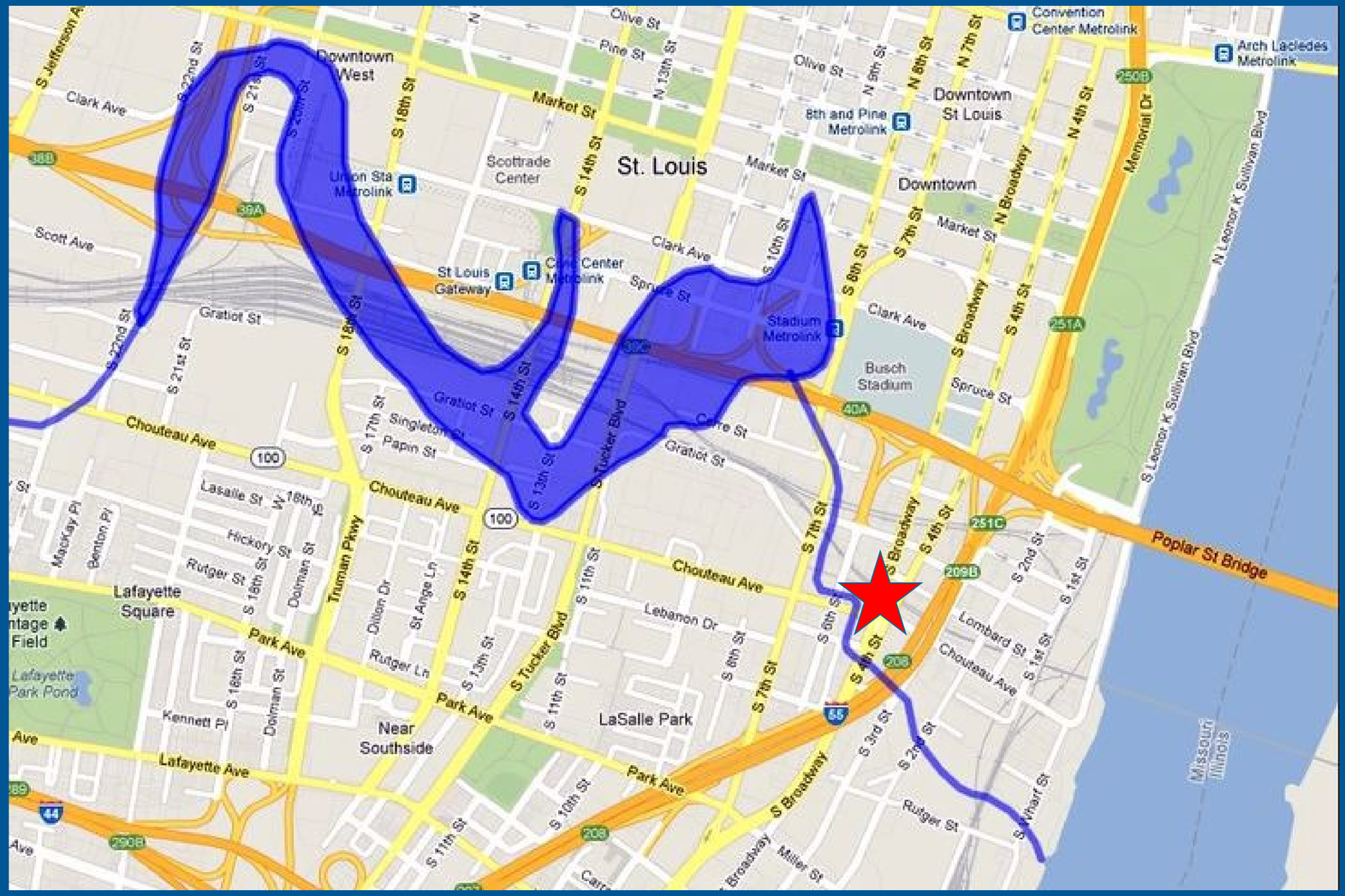
Geotechnical Investigations

Mill Creek Valley (no longer exists on the surface)

Alluvial soils – soft to medium clays

Depth to bedrock varied from 54’-74’



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Foundation – Helical Piles vs Micropile (for this project)

Helical Piles

a. Low overhead application
b. Small diameter pipe
c. No ground vibration
d. High compression capacity
e. Battered Pile
f. Lower Cost

Micropile

a. Low overhead application
b. Small diameter pipe
c. Minimal ground vibration
d. More tensile capacity
e. High compression capacity

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Helical pile – railroad approval

1. Helical Pile had not been used as a bridge foundation per our research

2. Owner TRRA approved the use as long as test piles were performed

3. BNSF, Union Pacific and Amtrak all approved the use of helical pile

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Helical Pile

Bearing and Uplift Capacity

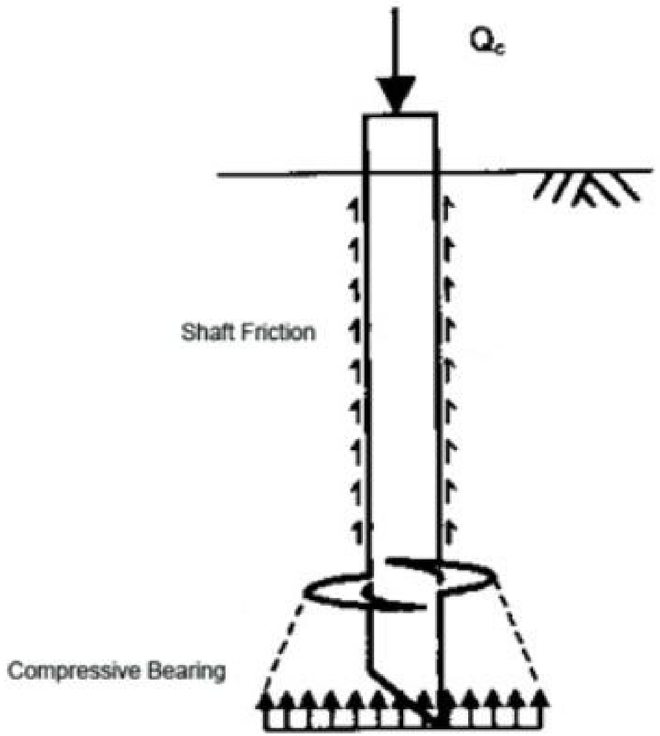

Figure 5.1 Compressive Pier Loading[1]

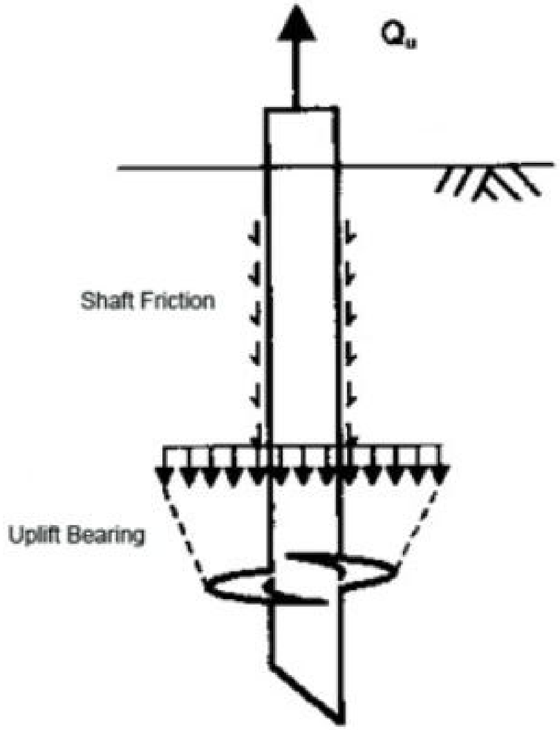

Figure 5.2 Pier Loading in Tension[1]

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Foundation – Helical Pile Tension Test

Three tension tests
Three locations

40-200 Kips - Tension

One compression test

700 kips - Compression

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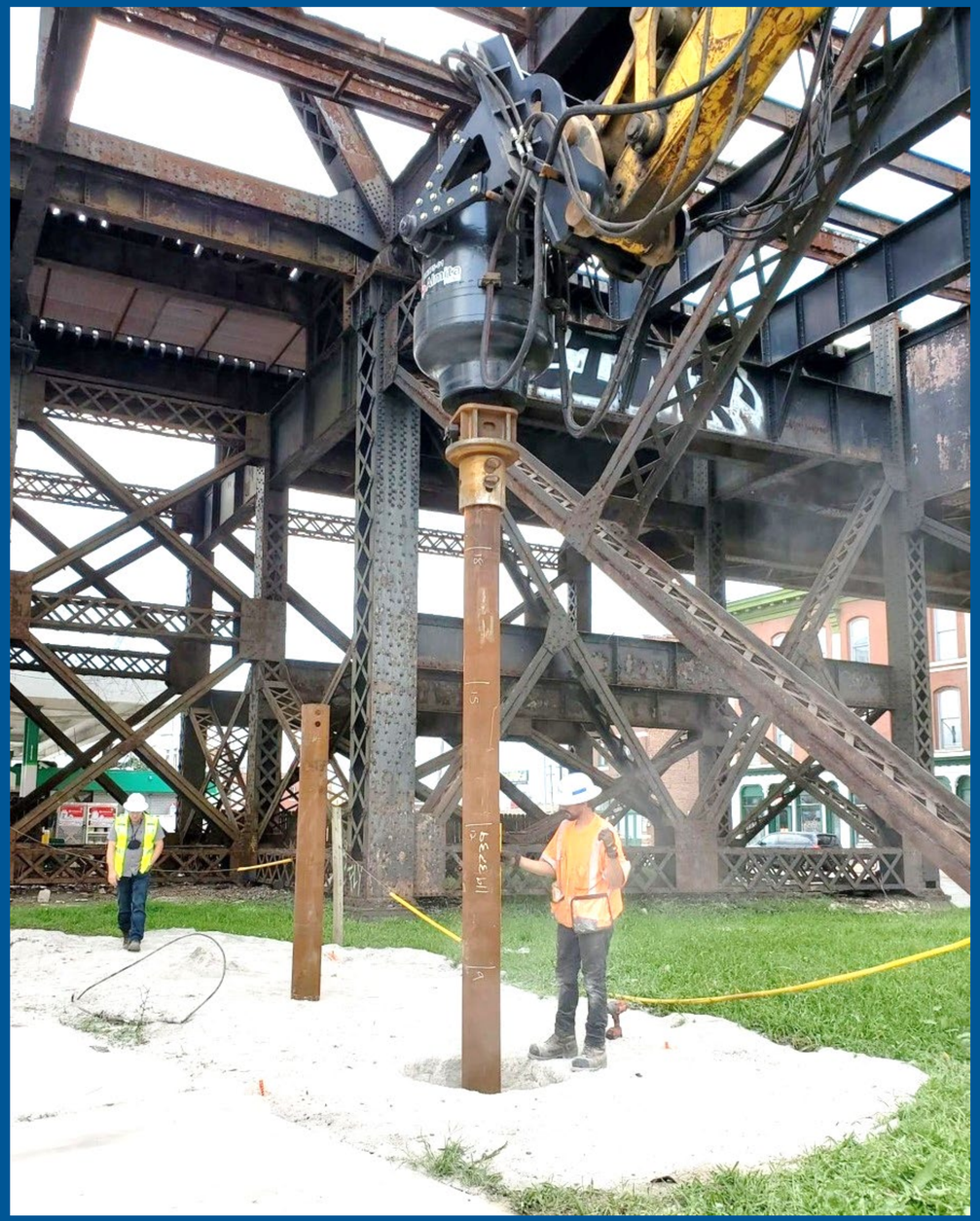
Helical Pile Install – discussion points

1. Torque motor
2. Torque measured to confirm bearing
3. Pile came in 20’ sections connected with pins
4. Pile tip bearing bedrock



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Helical Pile Installation

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Pier Construction

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Change Out – New spans delivered

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Connection to the Existing Bridge – West Bent

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Connection to the Existing Bridge – East Bent

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Connection to the Existing Bridge – East Bent

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Change Out Preparation

1. Calculate dead loads
2. Determine centroid
3. Analyze existing highway truss for strength
4. Size girders to support eastbound track
5. Model site for equipment movement
6. Estimate time for each movement

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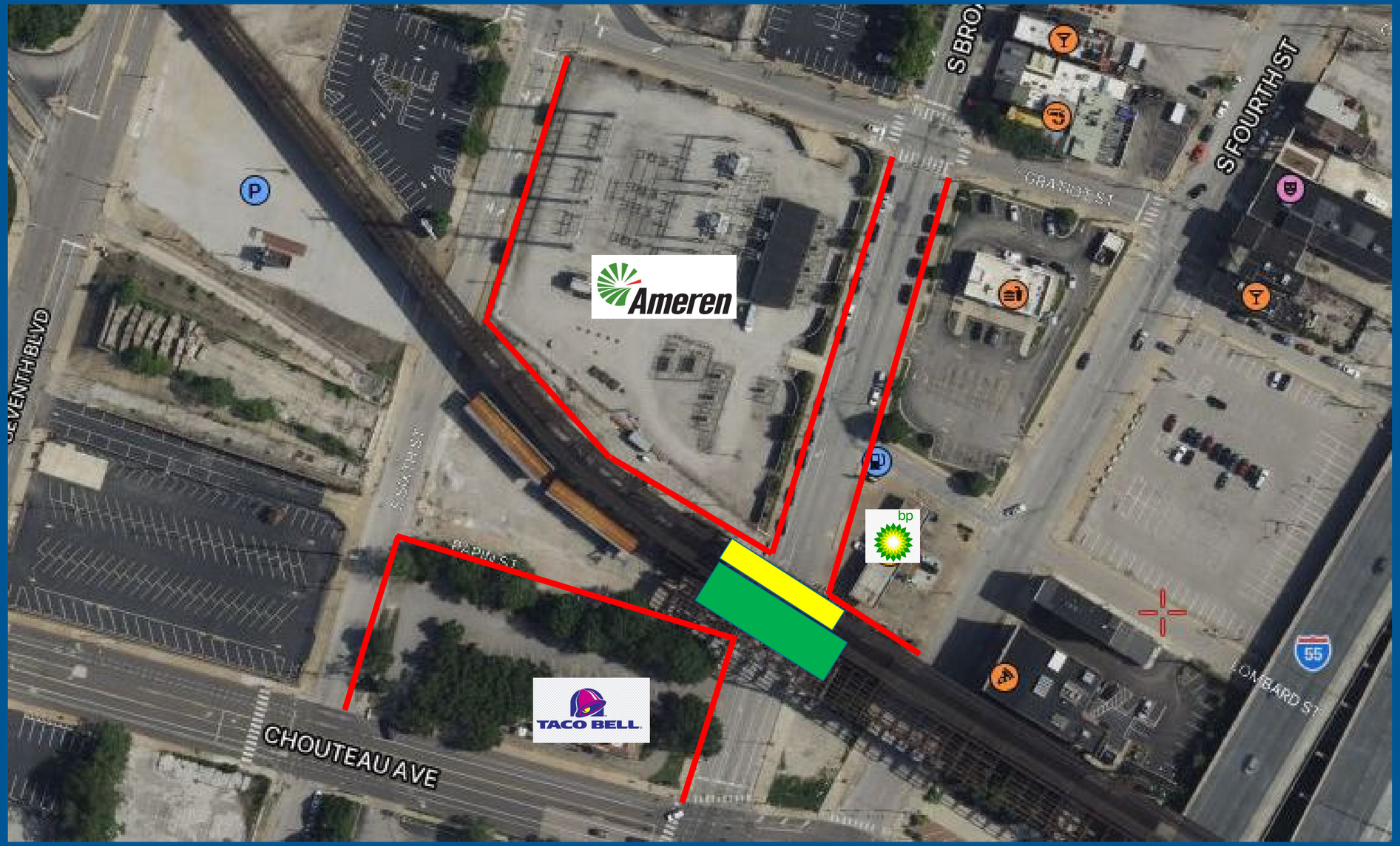
Change Out work area



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Eastbound Track Structure Support

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Eastbound Track support

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Highway Truss Support

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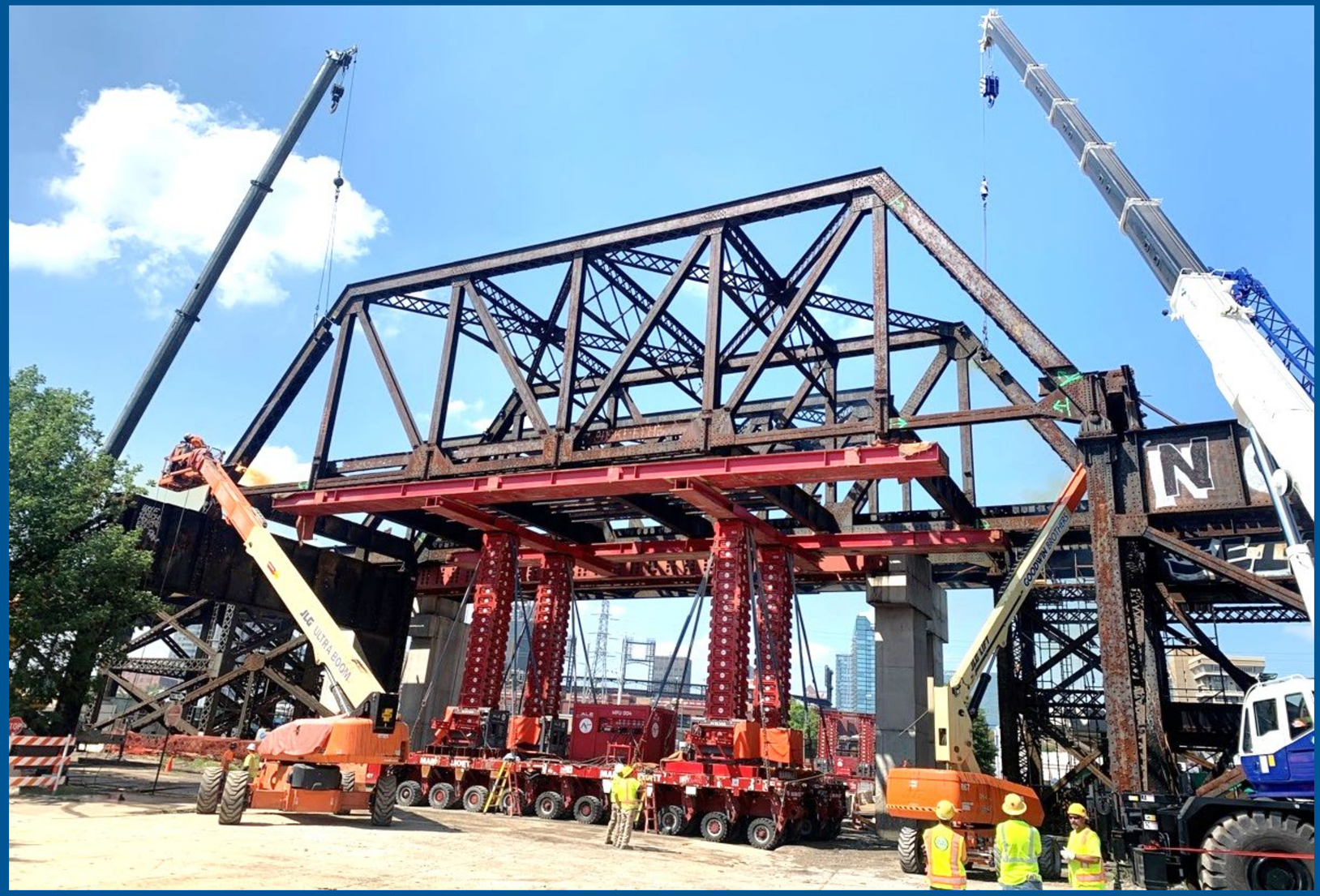
Highway Truss support



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Change out –removal of highway truss

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Change Out – Removal of Existing Highway Truss

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Installation of Eastbound Span

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Removal of Westbound Spans

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Westbound Truss - Protection of BP Gas Station

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Removal of Westbound Spans

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Installation of Westbound Spans

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Questions?

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