Collaboration for Success

Temp Support of NSTM Pier Cap
MDOT JN 218323

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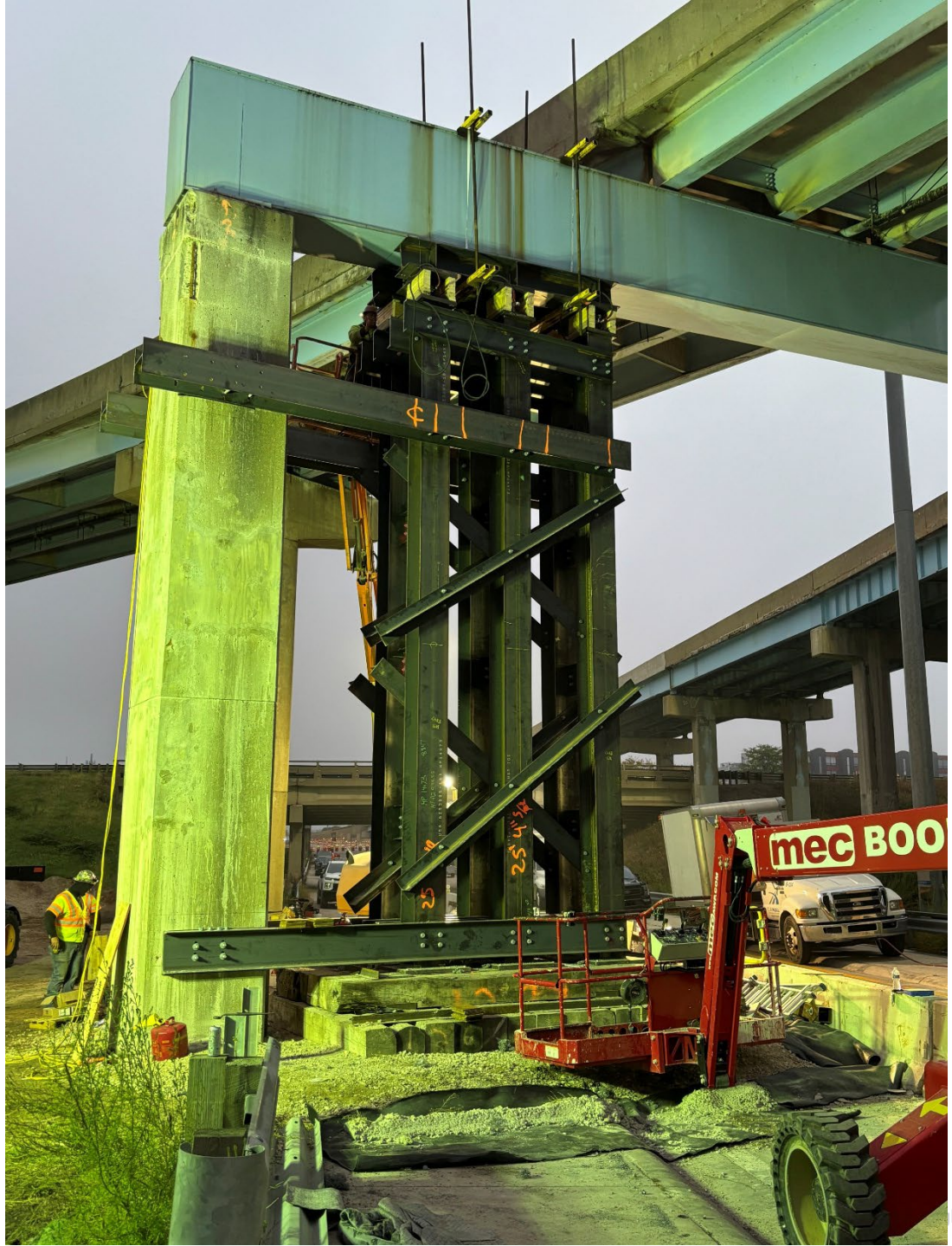
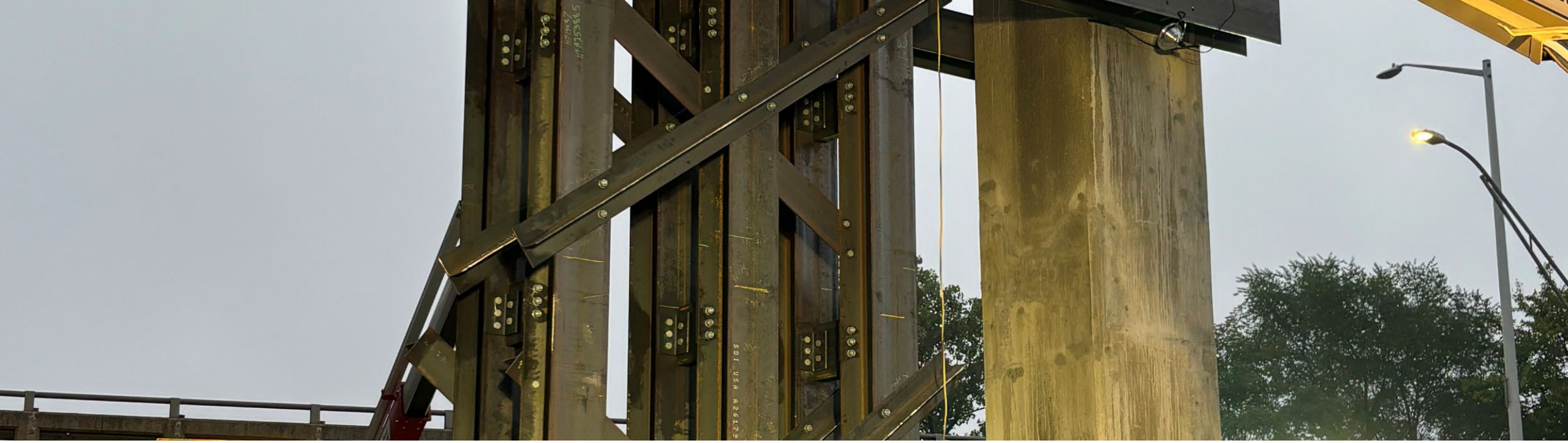




Collaboration for Success – Temp Support of NSTM Pier Cap

1 The RFA

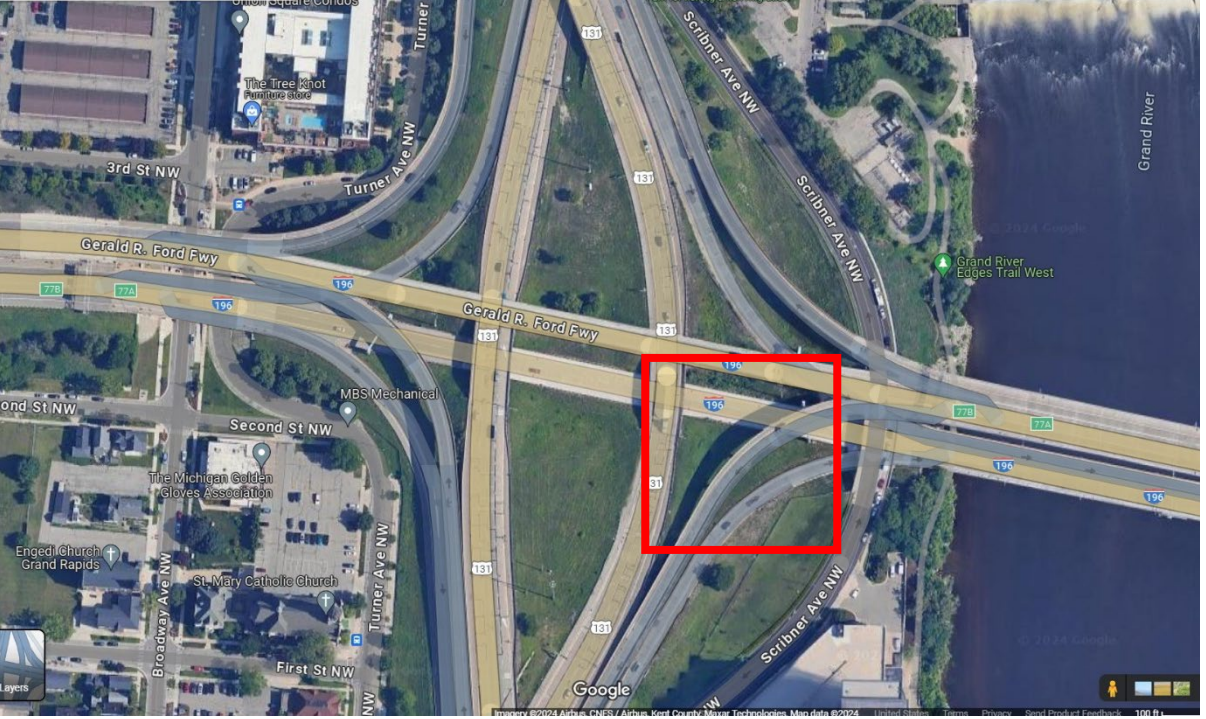
2 Alternatives Collaboration

3 Design Collaboration

4 Pre Mobilization Collaboration

5 Construction Collaboration

6 Questions



I-196 WB to US-131 SB over I-196 EB (Ramp F)

- B01-6 of 41027
  - Built 1964
  - 8-Span, Multi-Stringer, Composite Steel Superstructure
  - 445 Feet Long x 24.6 Feet Wide
- Pier F7
  - 4 Foot Square RC Columns
  - 38 Feet top of footing to top of column

I-196 WB to US-131 SB over I-196 EB (Ramp F)

- Pier F7 – NSTM Box Girder Cap
  - 60” x 3/8” Webs
  - 34” x 1-1/2” Top and Bottom Flange
  - 1/2” Internal Diaphragms
  - Design Fix-Fix

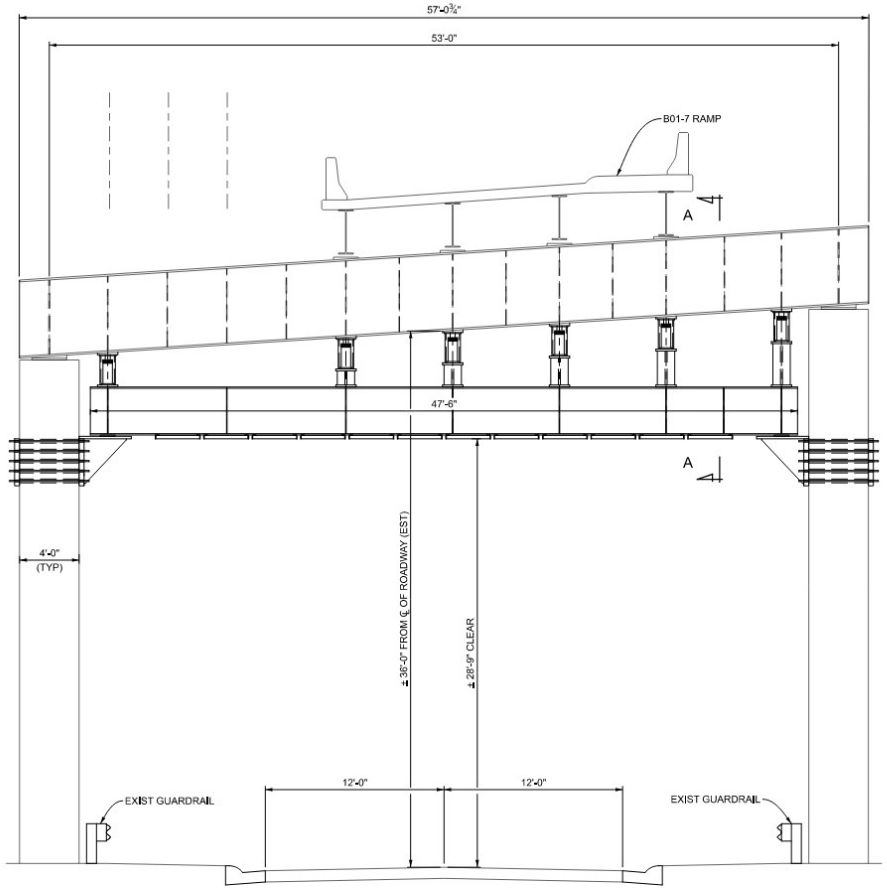
The RFA

- 9/17/2022
  - 17” delamination / incipient spall projecting beyond anchor bolt.
  - Previously patched
  - RFA Committee Comment

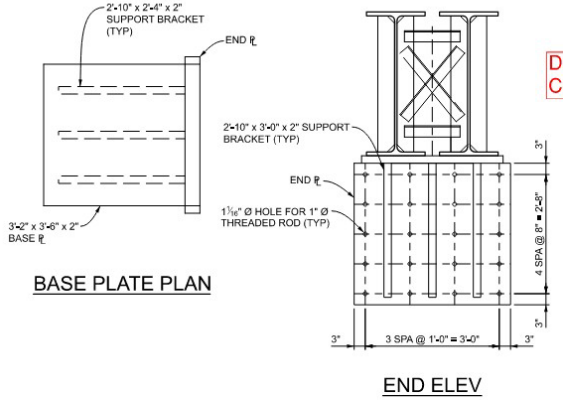
Suggest protecting the columns with waterproofing coating and investigate carbon fiber wrap with Dr. Grace. Epoxy injection of cracks possibly. Assign intermediate to Jason DeRuyver for developing a repair strategy. Committee suggests scaling off the loose concrete and sounding remaining concrete to determine soundness as part of the repair. (Mike Halloran - 09/20/2022)

Design Collaboration -Temp Support Alternatives

- Option 2
  - Minimize Traffic Disruption
  - Requires large steel beams and unconventional construction
  - Requires Core Drilling and Through Bolting Existing Column (Reason for rejection)

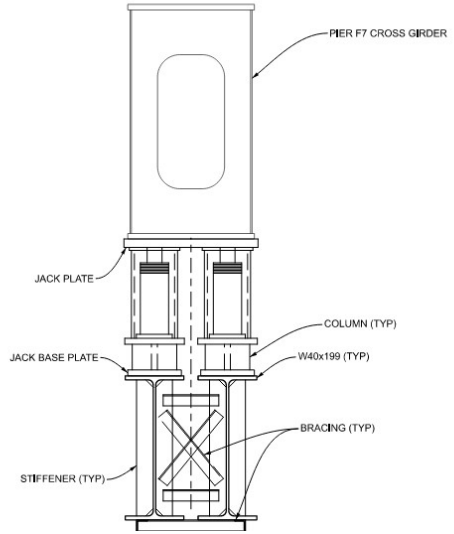


PIER F7 ELEVATION



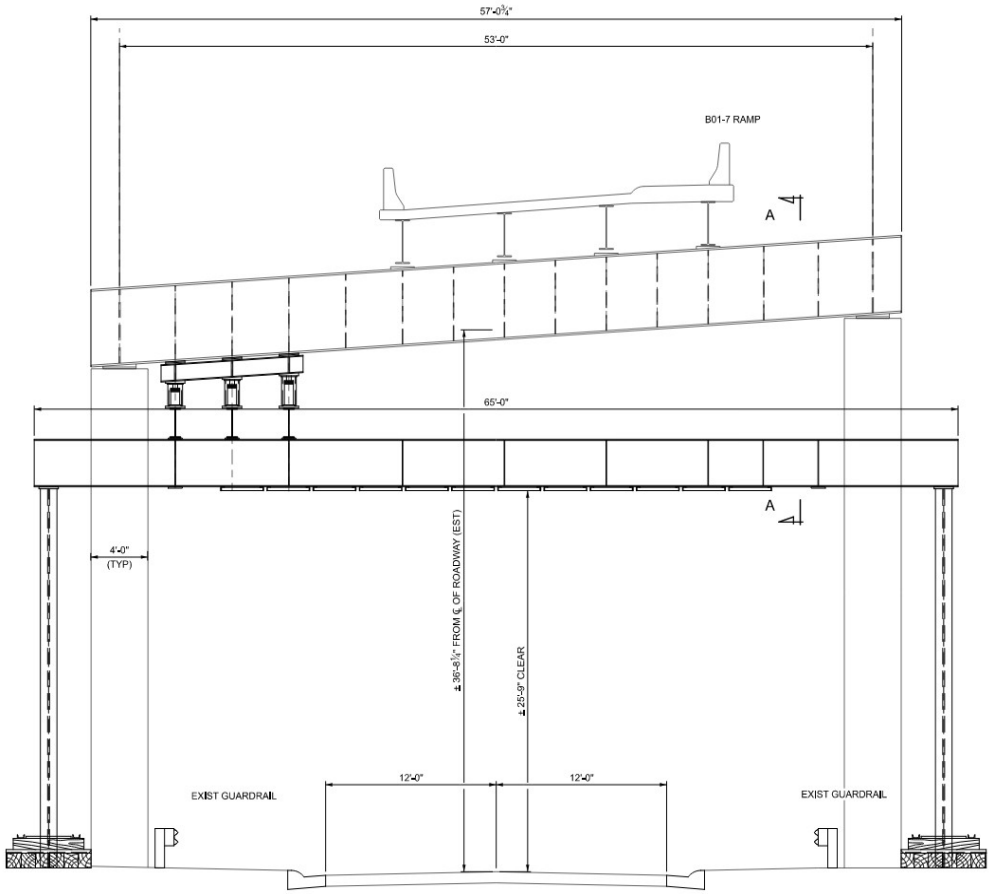
BASE PLATE PLAN

END ELEV

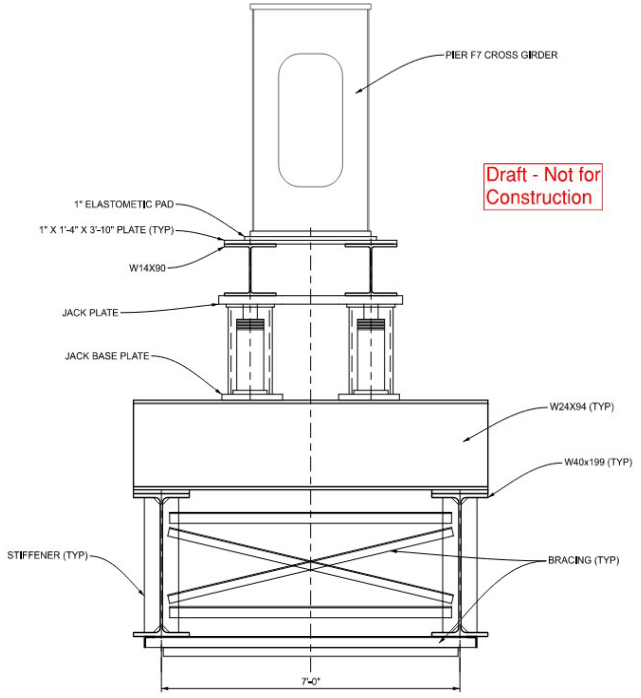


Design Collaboration -Temp Support Alternatives

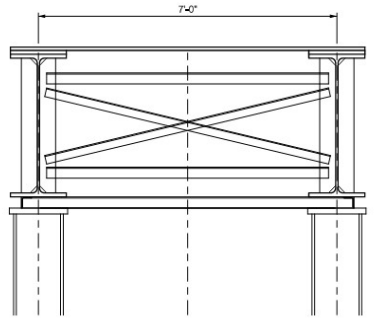
- Option 3
  - Minimize Traffic Disruption
  - Requires large steel beams and unconventional construction
  - Requires Large Footprint
  - Unconventional Support led to rejection



PIER F7 ELEVATION



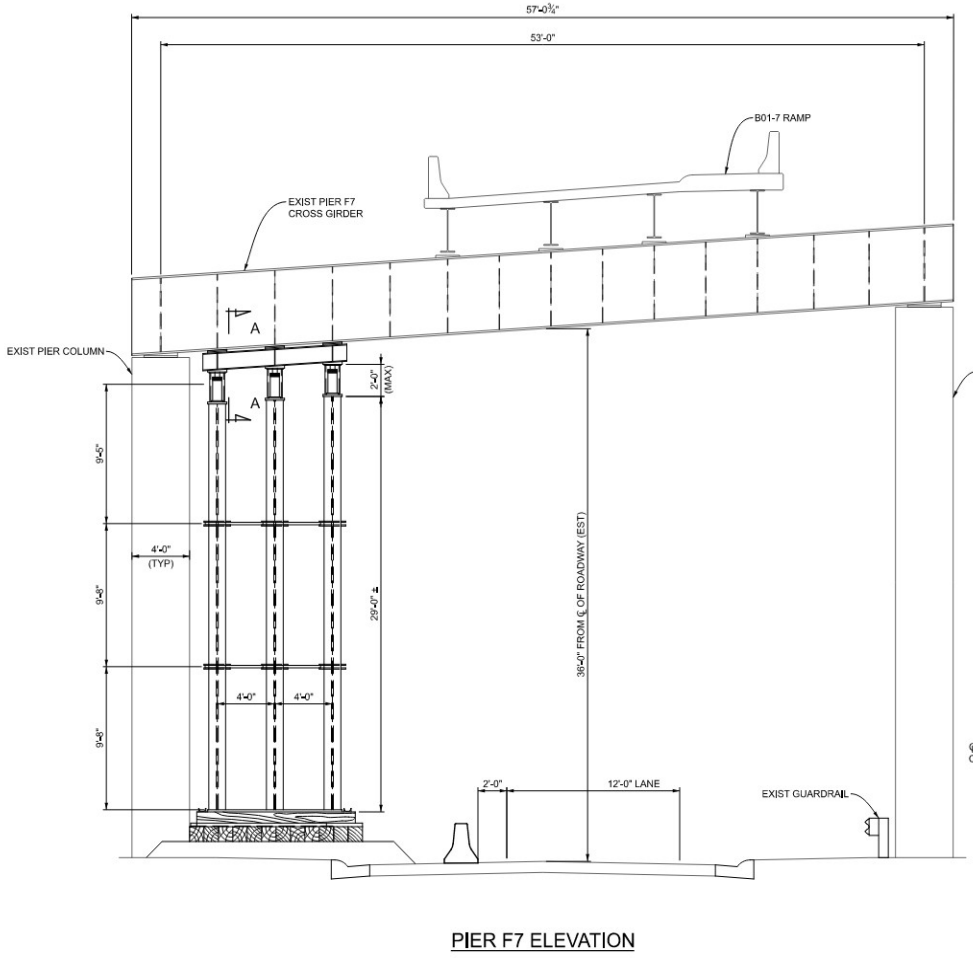
SECTION A-A



END ELEV

Design Collaboration -Temp Support Alternatives

- Option 1 (Chosen)
  - Lane closure with 40-minute delay
  - Standard temp support sizes
  - Conventional methods



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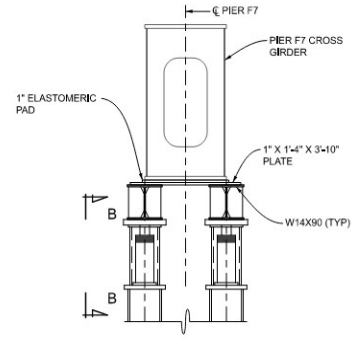

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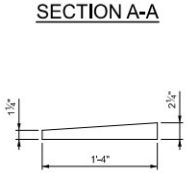
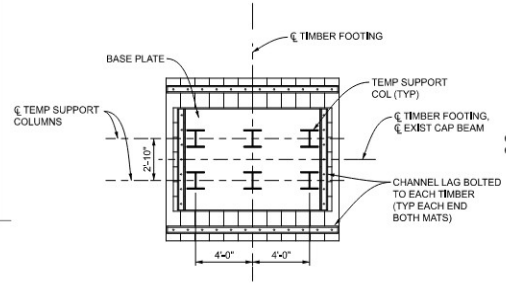
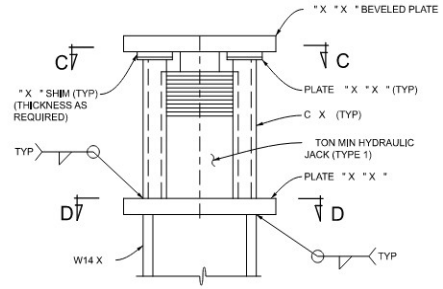


BEVELED PLATE DETAIL

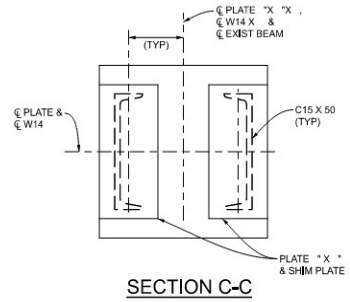


TIMBER FOOTING PLAN

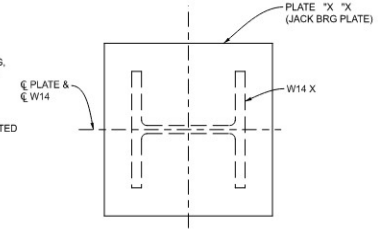


SECTION B-B

Draft - Not for Construction



SECTION C-C



SECTION D-D

Design Collaboration
Field Visit 6/12/24

- Project Scope – Remove and replace top 2 feet of column.
- Remember
  - Previously failed patches and fix-fix bearing design
- RFA Project Philosophy
  - ALWAYS - Look for items causing the RFA and other ancillary damage.
  - Project Success = Closure of RFA
- Previous retrofit - Slotting bolt holes not meant to be slotted.

Design Collaboration
Field Visit 6/12/24

- Project Scope – Remove and replace top 2 feet of column.
- After field visit
  - Replace bearings
- After column design checks
  - Add steel jacket and column overcast – similar to adjacent bridge (Pictured to right)

Design Challenges

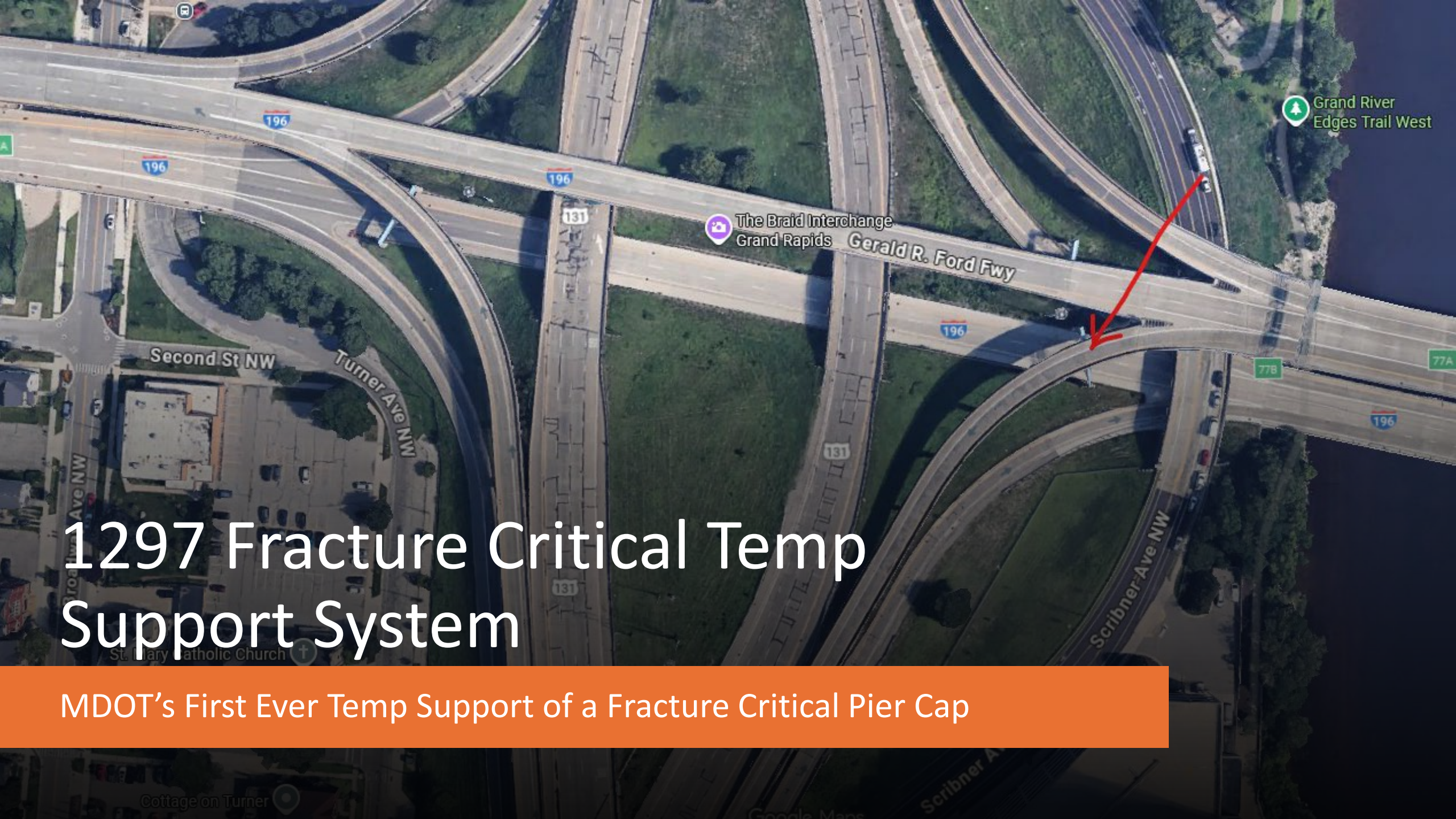
- Load
  - 180-kip vertical dead load
  - 23-kip longitudinal thrust
  - 5-kip perpendicular to cap
  - Height
  - Thin Internal Diaphragms
- Unknowns
  - Box is sealed – no inspection ports
    - Interior box condition unknown
    - No external signs of internal distress

Design Challenges

- Temp Support System Special Provision
  - Synchronized Jacks
  - Fracture Critical Endorsement for Fabrication Shop
  - MDOT 2020 Specification
    - 707.03.C – Any element connected to a fracture critical element will be fabricated per fracture critical requirements.

Pre-Mobilization Collaboration

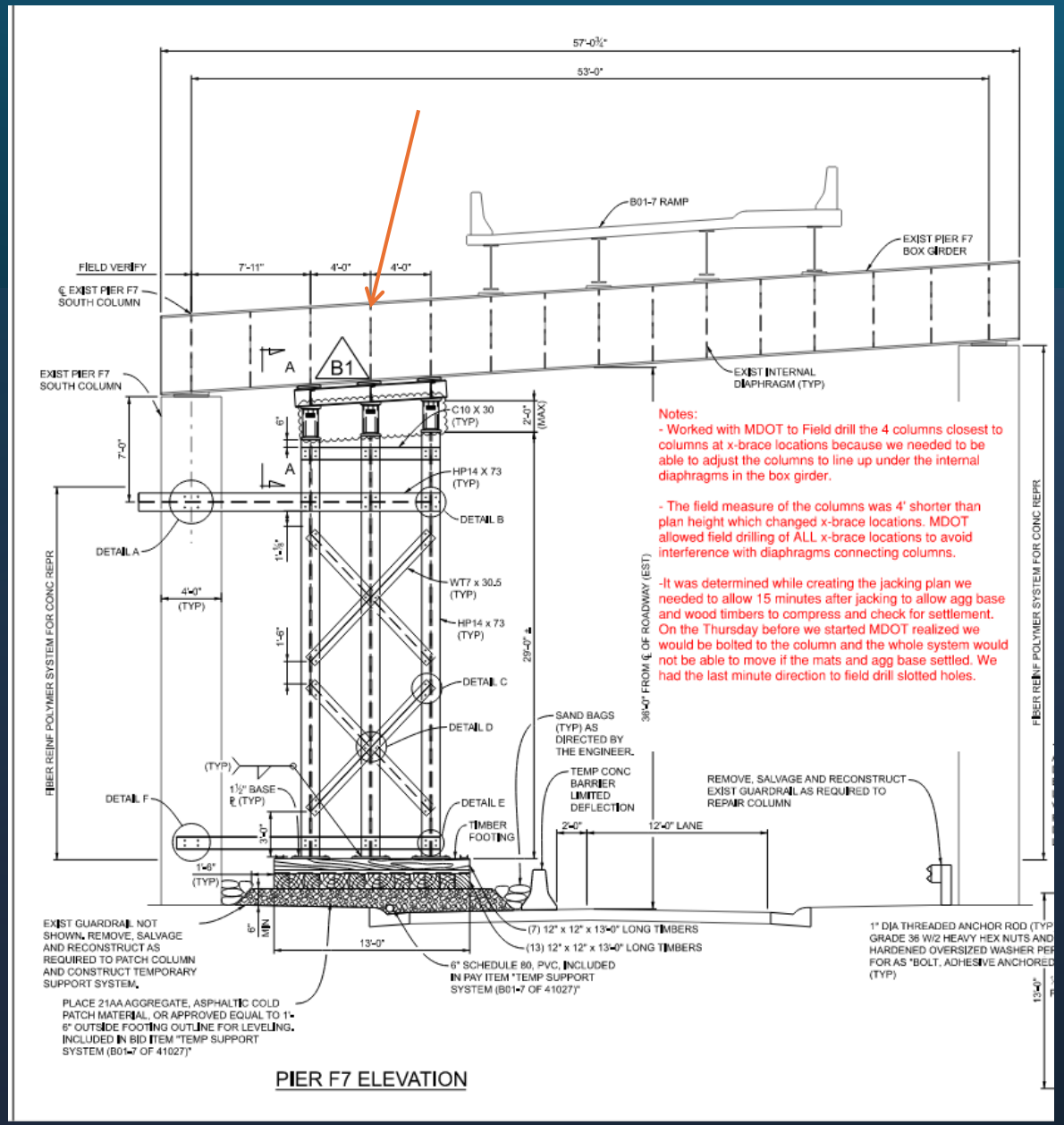
- Design Assistance During Construction
  - All items below treated as drop and do.
    - 13 RFI’s prior to mobilization
    - Phone calls from C.A. Hull, Cardinal Fabricating, Grand Rapids TSC, BOBS, and Consultant CEI.
    - Welcomed scrutiny of design plans AND design calculations.
  - Shop Drawings
    - Multiple iterations of what bolts could be field drilled versus shop drilled
    - Multiple iterations of piece sizes based on availability and Charpy V notch test results.
    - Original Plan Bust - Original Plans Showed 29’ from ground to bottom of cap – Field measured 24’



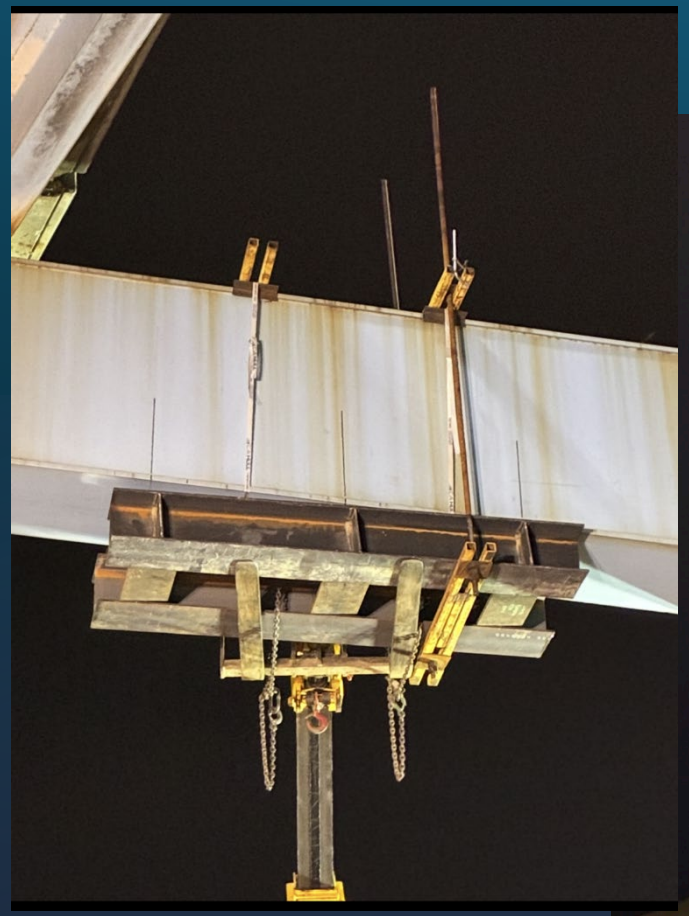
1297 Fracture Critical Temp Support System

MDOT's First Ever Temp Support of a Fracture Critical Pier Cap


Site


57'-0¾"
53'-0"
B01-7 RAMP
EXIST PIER F7 BOX GIRDER
FIELD VERIFY
℄ EXIST PIER F7 SOUTH COLUMN
7'-11"
4'-0"
4'-0"
A
B1
EXIST PIER F7 SOUTH COLUMN
EXIST INTERNAL DIAPHRAGM (TYP)
C10 X 30 (TYP)
2'-0" (MAX)
6"
7'-0"
A
HP14 X 73 (TYP)
DETAIL B
DETAIL A
1'-5½"
WT7 x 30.5 (TYP)
4'-0" (TYP)
HP14 x 73 (TYP)
1'-6"
29'-0"
DETAIL C
DETAIL D
SAND BAGS (TYP) AS DIRECTED BY THE ENGINEER.
(TYP)
1½" BASE ℄ (TYP)
TEMP CONC BARRIER LIMITED DEFLECTION
DETAIL F
DETAIL E
TIMBER FOOTING
REMOVE, SALVAGE AND RECONSTRUCT EXIST GUARDRAIL AS REQUIRED TO REPAIR COLUMN
2'-0"
12'-0" LANE
1'-6" (TYP)
6" MIN
13'-0"
EXIST GUARDRAIL NOT SHOWN. REMOVE, SALVAGE AND RECONSTRUCT AS REQUIRED TO PATCH COLUMN AND CONSTRUCT TEMPORARY SUPPORT SYSTEM.
(7) 12" x 12" x 13'-0" LONG TIMBERS
(13) 12" x 12" x 13'-0" LONG TIMBERS
6" SCHEDULE 80, PVC, INCLUDED IN PAY ITEM "TEMP SUPPORT SYSTEM (B01-7 OF 41027)"
PLACE 21AA AGGREGATE, ASPHALTIC COLD PATCH MATERIAL, OR APPROVED EQUAL TO 1'-6" OUTSIDE FOOTING OUTLINE FOR LEVELING. INCLUDED IN BID ITEM "TEMP SUPPORT SYSTEM (B01-7 OF 41027)"
1" DIA THREADED ANCHOR ROD (TYP GRADE 36 W/2 HEAVY HEX NUTS AND HARDENED OVERSIZED WASHER PE FOR AS "BOLT, ADHESIVE ANCHORED (TYP)
FIBER REINF POLYMER SYSTEM FOR CONC REPR
FIBER REINF POLYMER SYSTEM FOR CONC REPR
36'-0" FROM ℄ OF ROADWAY (EST)
Notes:
- Worked with MDOT to Field drill the 4 columns closest to columns at x-brace locations because we needed to be able to adjust the columns to line up under the internal diaphragms in the box girder.
- The field measure of the columns was 4' shorter than plan height which changed x-brace locations. MDOT allowed field drilling of ALL x-brace locations to avoid interference with diaphragms connecting columns.
-It was determined while creating the jacking plan we needed to allow 15 minutes after jacking to allow agg base and wood timbers to compress and check for settlement. On the Thursday before we started MDOT realized we would be bolted to the column and the whole system would not be able to move if the mats and agg base settled. We had the last minute direction to field drill slotted holes.
PIER F7 ELEVATION

Assembling Carrier Beams



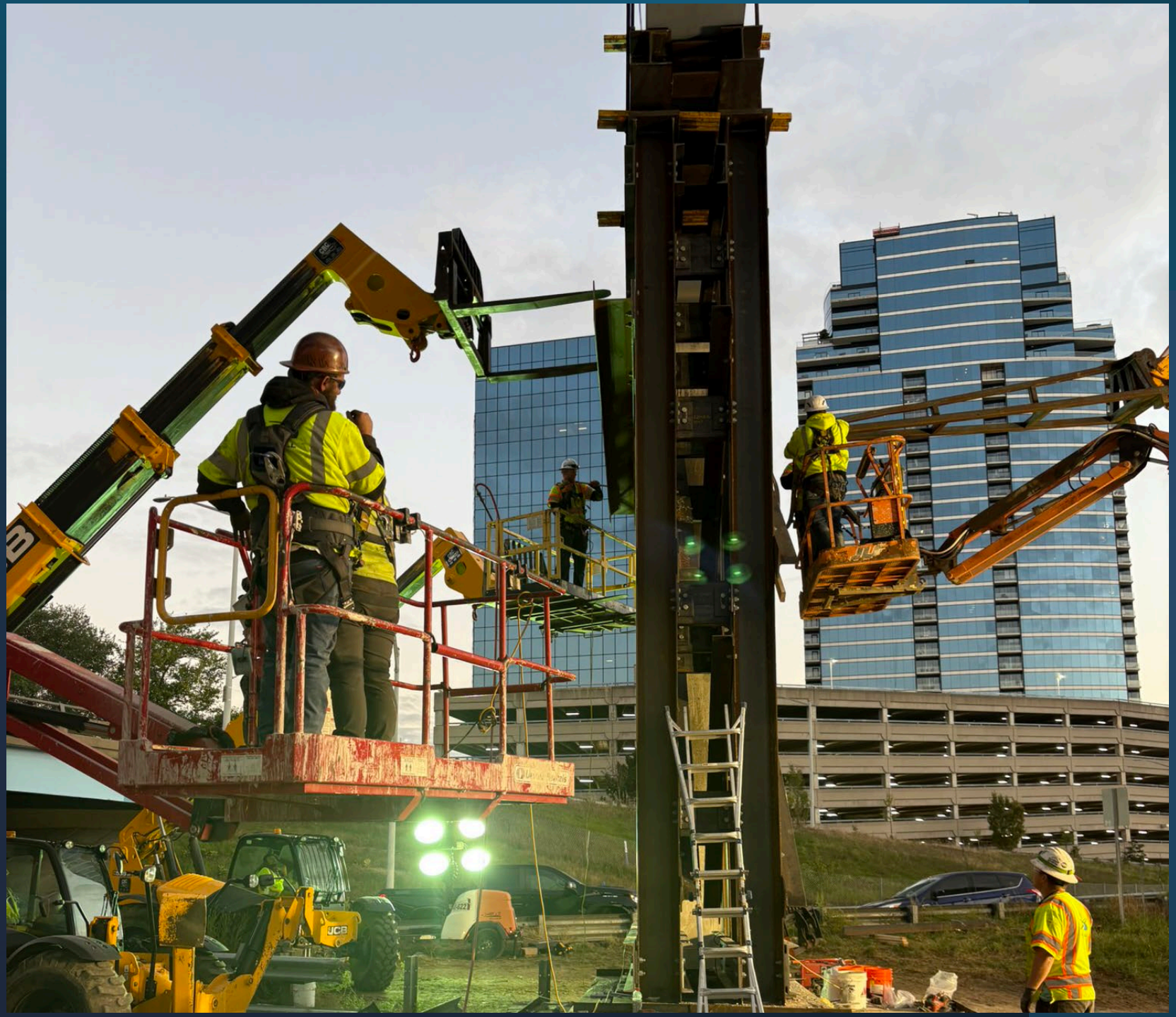
Hanging Carrier Beams

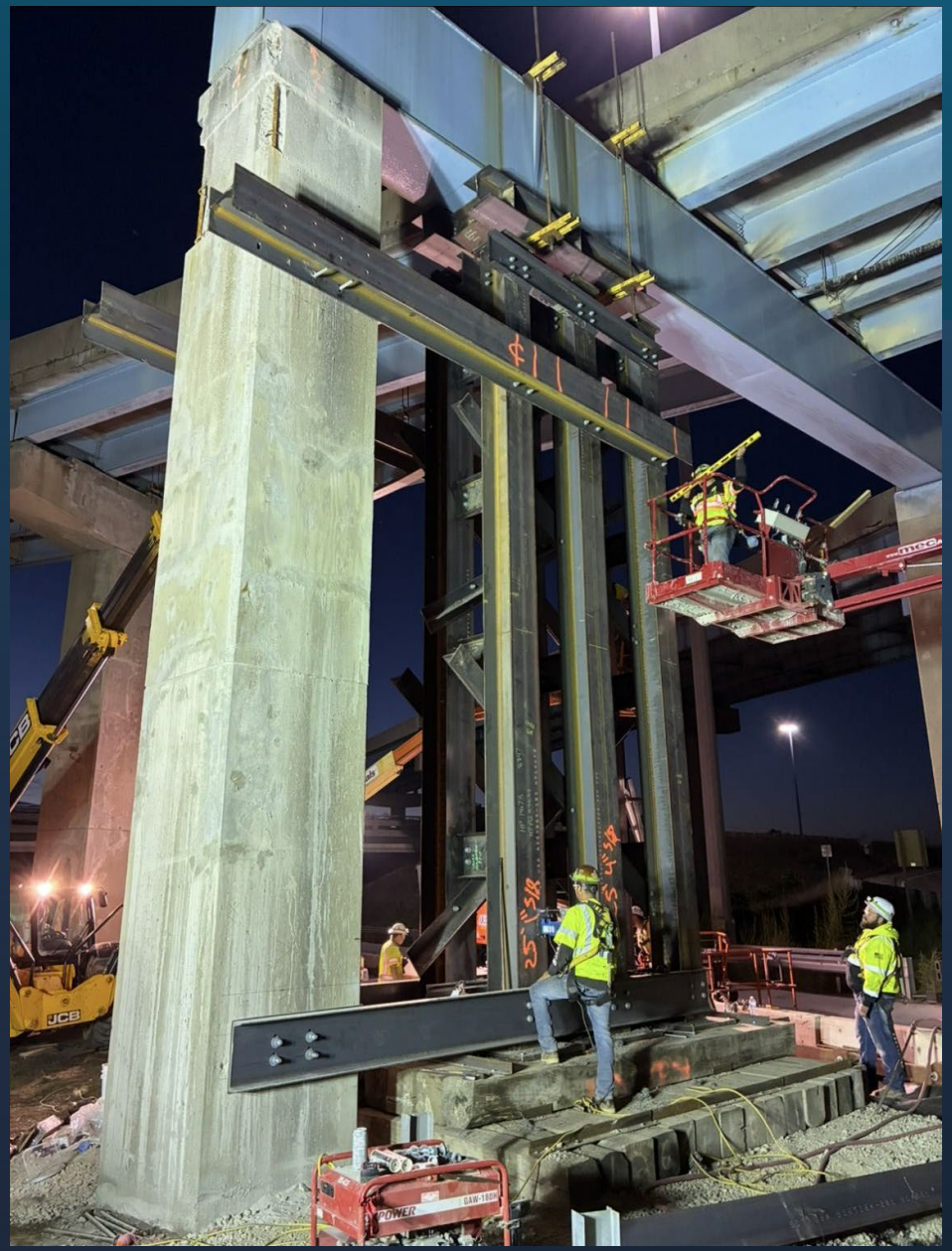
Standing up 1st of 6 support columns


CRC
14 FT 10 IN

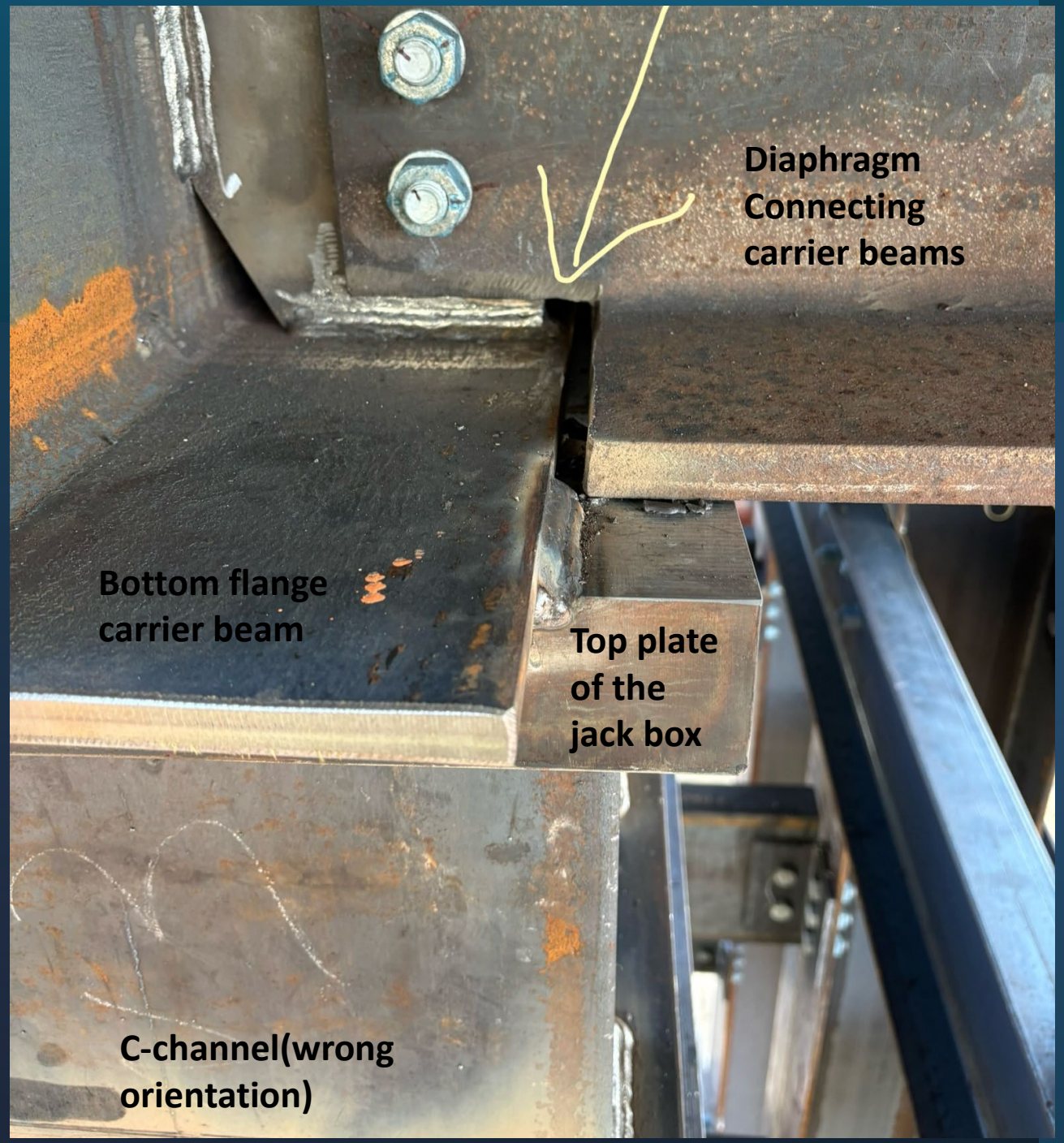
Diaphragms are installed between columns. Starting to drill cross braces inside the columns. The mag drills just barely fit inside the columns.

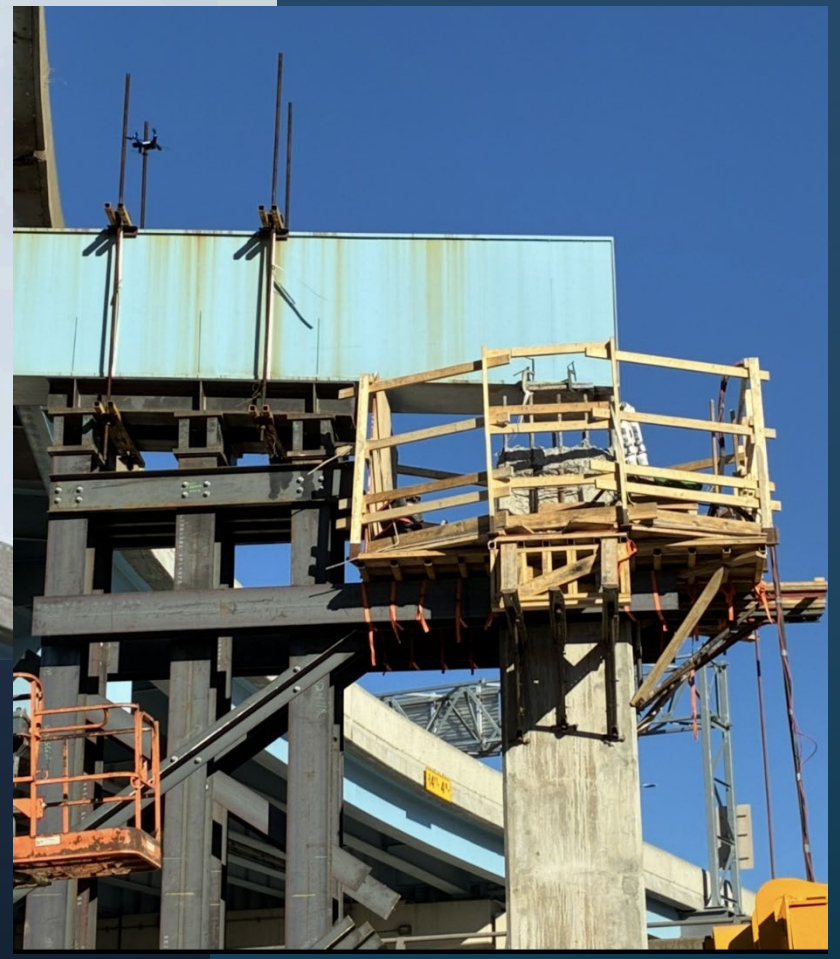
One of many messages to the designer that weekend, confirming the orientation of the cross braces.


JCB


JCB
JCB
POWER


HP14x89
FOM HT-B263830-01


Diaphragm
Connecting
carrier beams
Bottom flange
carrier beam
Top plate
of the
jack box
C-channel(wrong
orientation)



Top brace of temp support designed and positioned for use as a jacket and form support.

Bonus

Questions?

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