



Design and Construction of the Chicago Transit Authority's First Segmental Bridge  
Update # 3 – Stage B Construction  
ASBI Webinar – May 29, 2024



**RED AHEAD**  
Moving Ahead to a Better Red



# Purpose and Learning Objectives

## Purpose:

The 2023 Convention provides an educational forum that will focus on a few of the latest innovations and technologies in the construction industry.

At the end of this presentation, you will be able to:

- Explain the importance of design integration for transit structures during construction
- Explain the advantages of precast segmental in a long lead-time environment
- Explain how challenges of constricted urban construction can be mitigated

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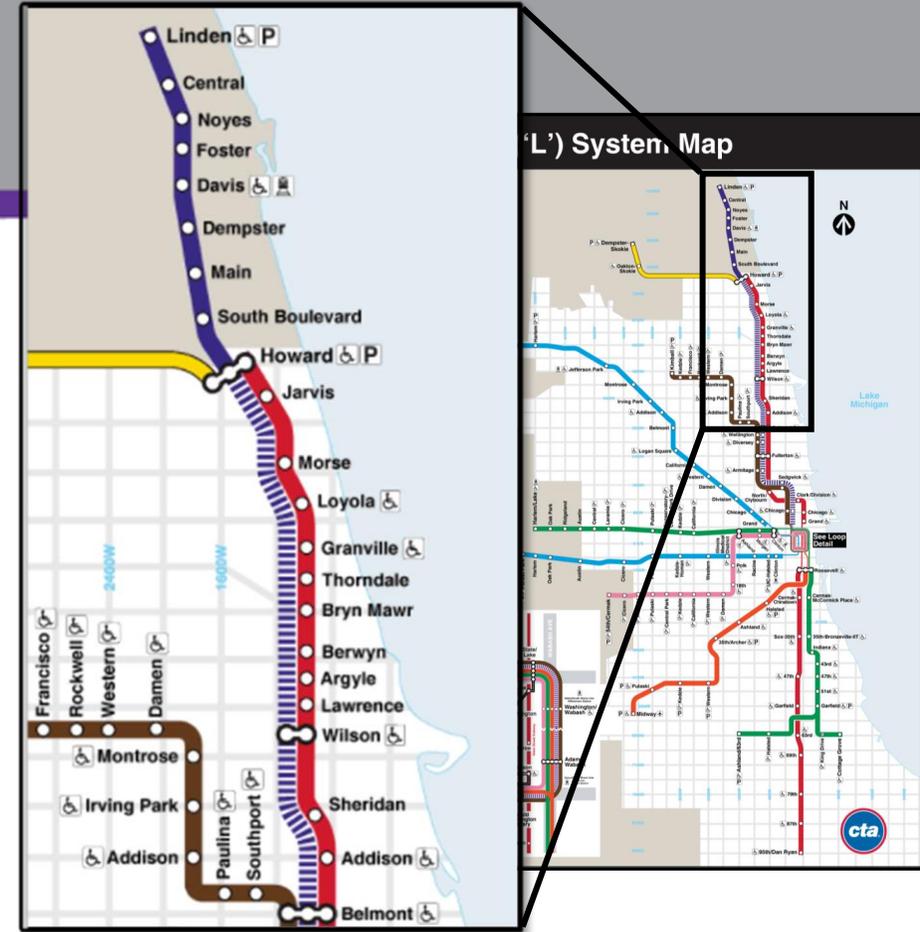
# Project Overview

PRESENTED BY: Ben Soule



# What is RPM?

- Red and Purple Modernization Program
  - Largest capital project in CTA history
  - Multi-billion dollar multi-phased program
  - 9.6-mile stretch of CTA's Red and Purple Lines from Belmont to Linden
  - Existing infrastructure is over 90 years old
  - 21 current stations
  - Carries over 20% of CTA train rides
  - Began over 10 years ago



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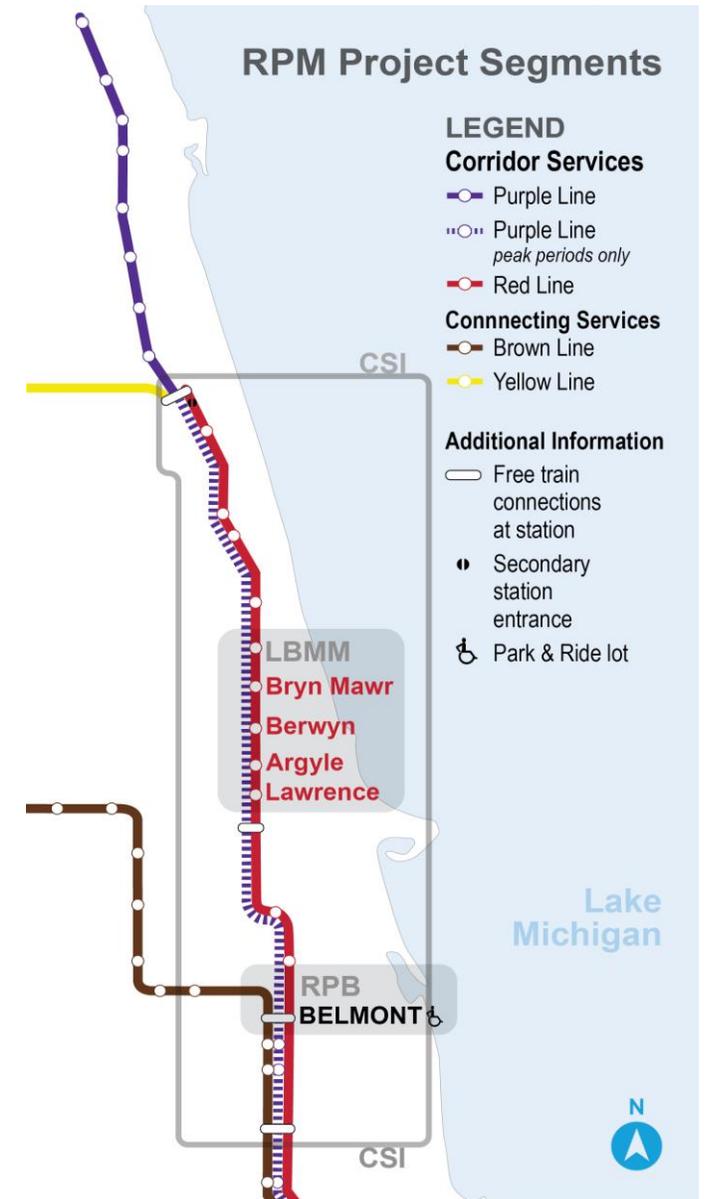
# RPM – LBMM

## LBMM – Lawrence to Bryn Mawr Modernization

Begins slightly north of Leland, structure ends on north side of Ardmore.

North and south ends include short lengths of steel viaducts where clearance is low.

The majority of the track structure in this area is segmental concrete.



# RPM - Flyover

- Red-Purple Bypass Project
  - Construction of a grade-separated bypass for the Brown Line to increase speed, reliability, and capacity in the corridor
  - Modernization and realignment of approximately 1.4 miles of associated mainline tracks from Belmont station on the south to Cornelia Avenue on the north

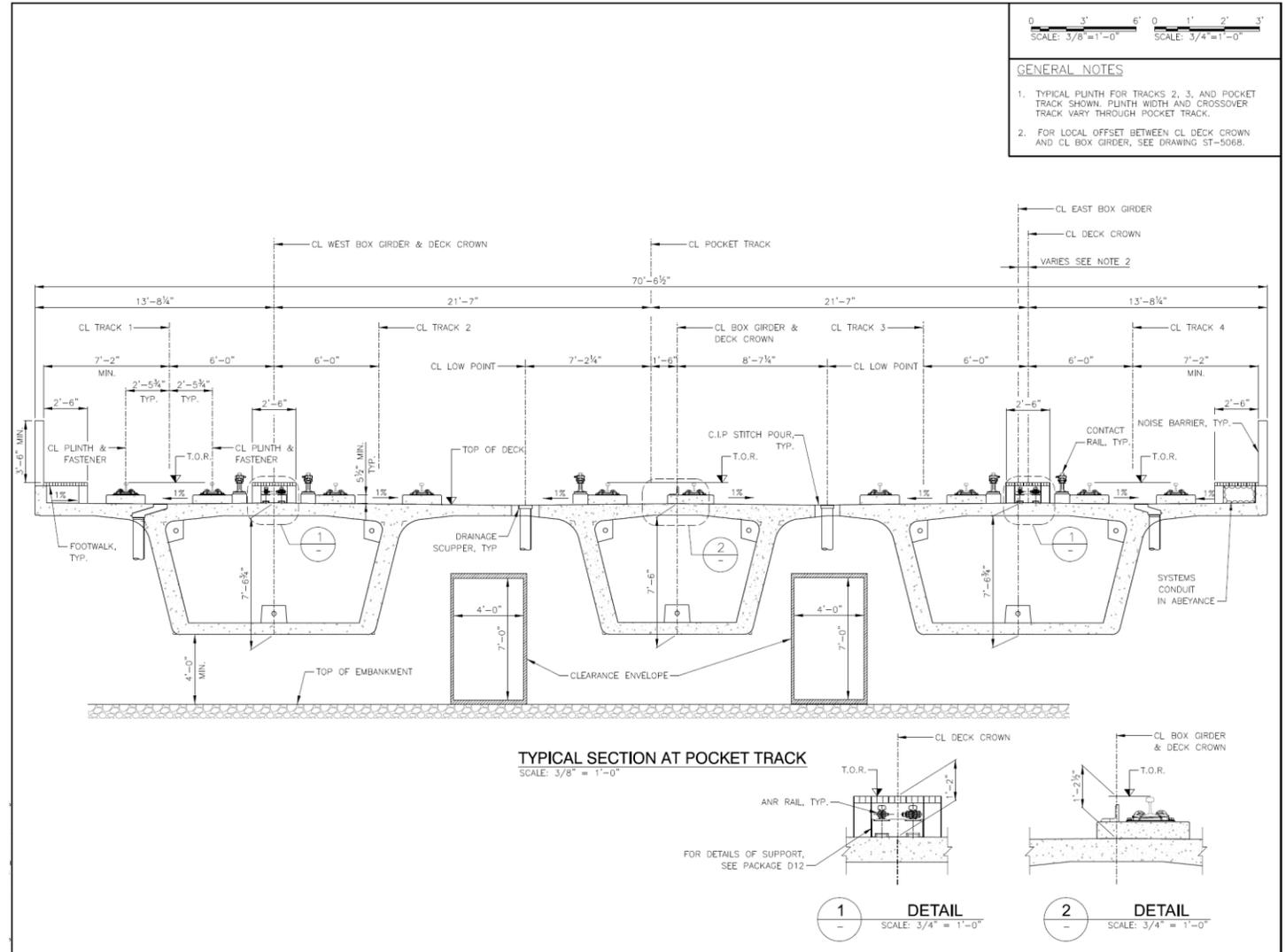




# LBMM – Alignment and Section

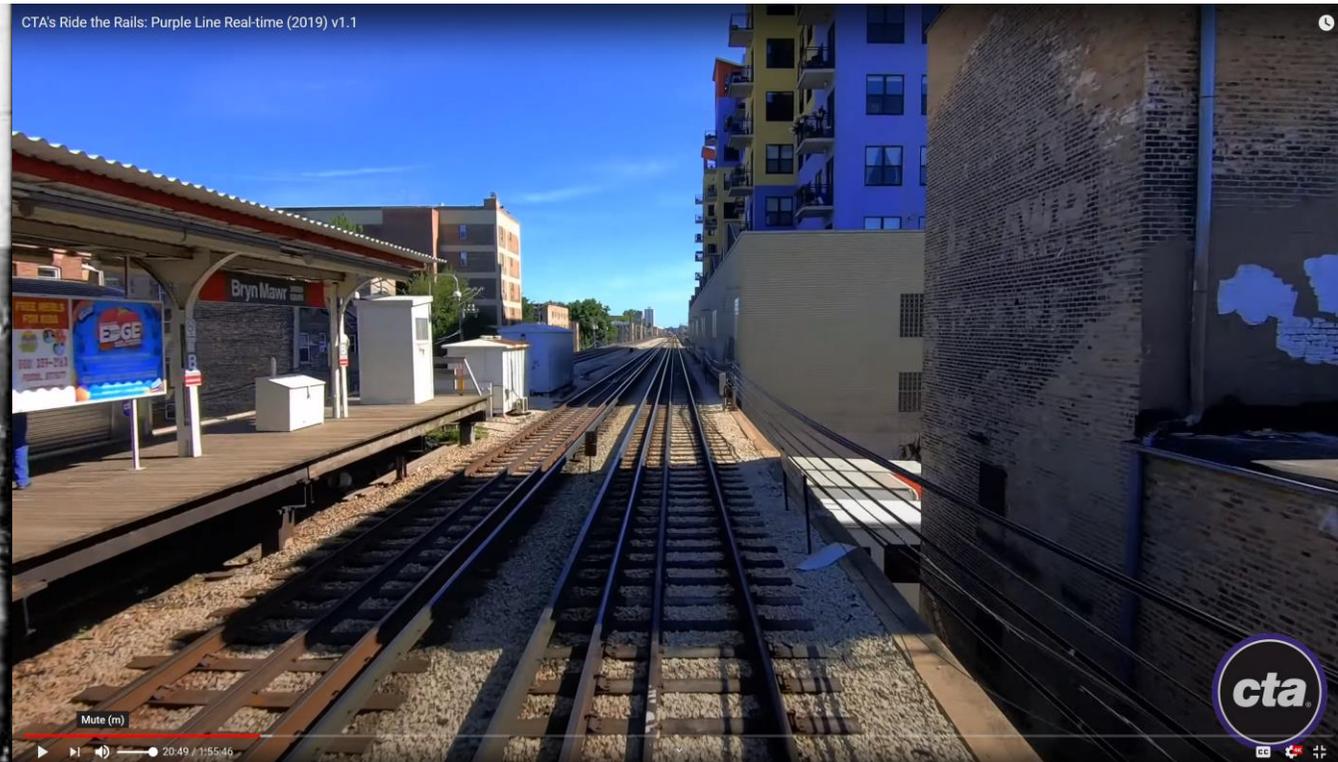
A pocket track with crossovers will be built between Argyle and Berwyn stations.

In this area, a third box girder will be built between the typical two, and the wing tips connected with a cast-in-place closure.



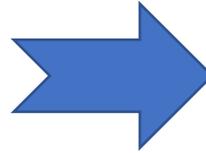
# LBMM – Existing Conditions

- Lawrence to Bryn Mawr Modernization Project
  - Original viaduct on retaining walls built about 100 years ago
  - Neighborhood has grown right up against it, making it a tight site with clear advantages for segmental



# LBMM - The Base Case...

- The Base Case
  - Concrete closed deck with Direct Fixation trackwork
  - Steel superstructure
  - Cast in place concrete substructure



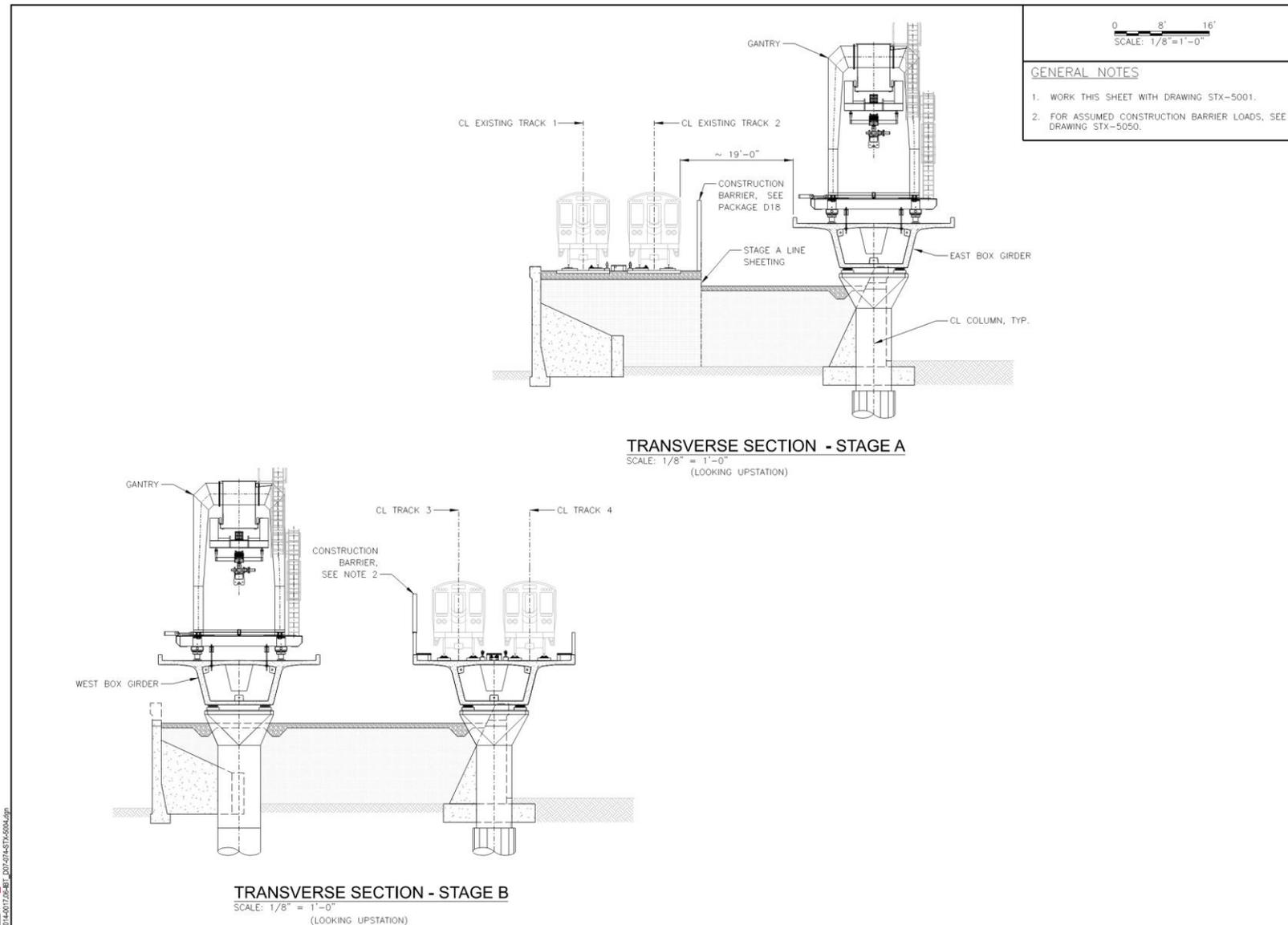
# LBMM - Segmental ATC

- Arrangement was initially prohibited in the RFP
- Revised concept allowed after months of vetting



# LBMM – Staging

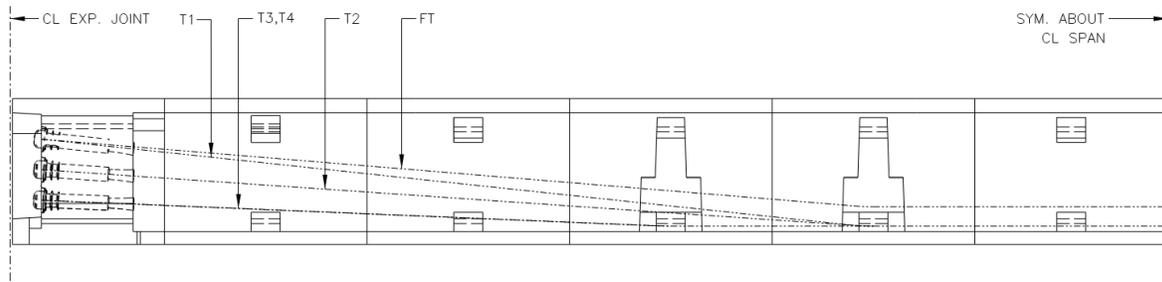
- Trains remain in service
  1. Close eastern tracks
  2. Eastern two tracks demolished
  3. Eastern and pocket track boxes constructed
  4. Switch trains to new box
  5. Western two tracks demolished
  6. Western box constructed
  7. Full service



# Construction Engineering

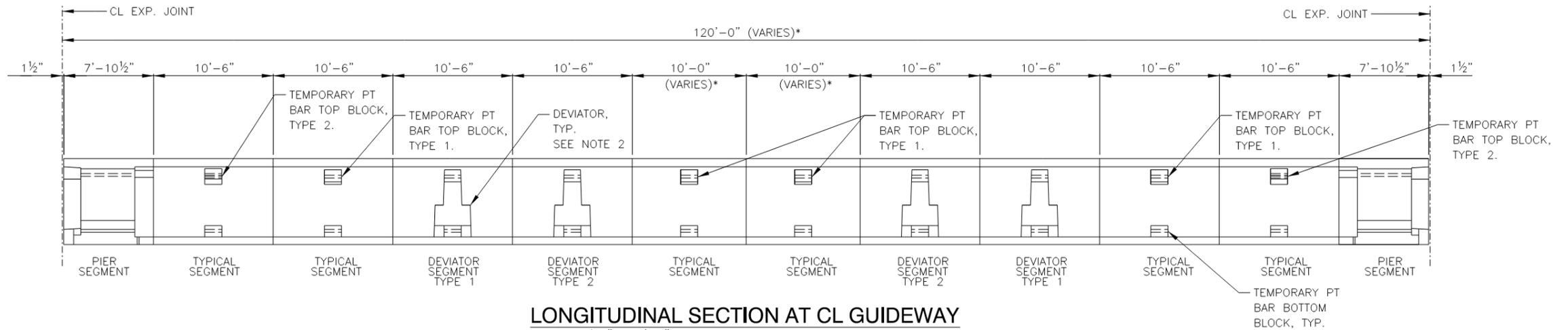
PRESENTED BY: Ben Soule

# Design Development



**LONGITUDINAL SECTION AT CL GUIDEWAY**  
SCALE: 1/4" = 1'-0"

- Structural Design
  - 120' Simple Spans
  - Relatively high PT ratio.



**LONGITUDINAL SECTION AT CL GUIDEWAY**  
SCALE: 3/16" = 1'-0"

# Design Development

- Simple means Simple

There are some big loads to check, but the overall system is not complex

Transverse offsets take the most attention for concentrated loads



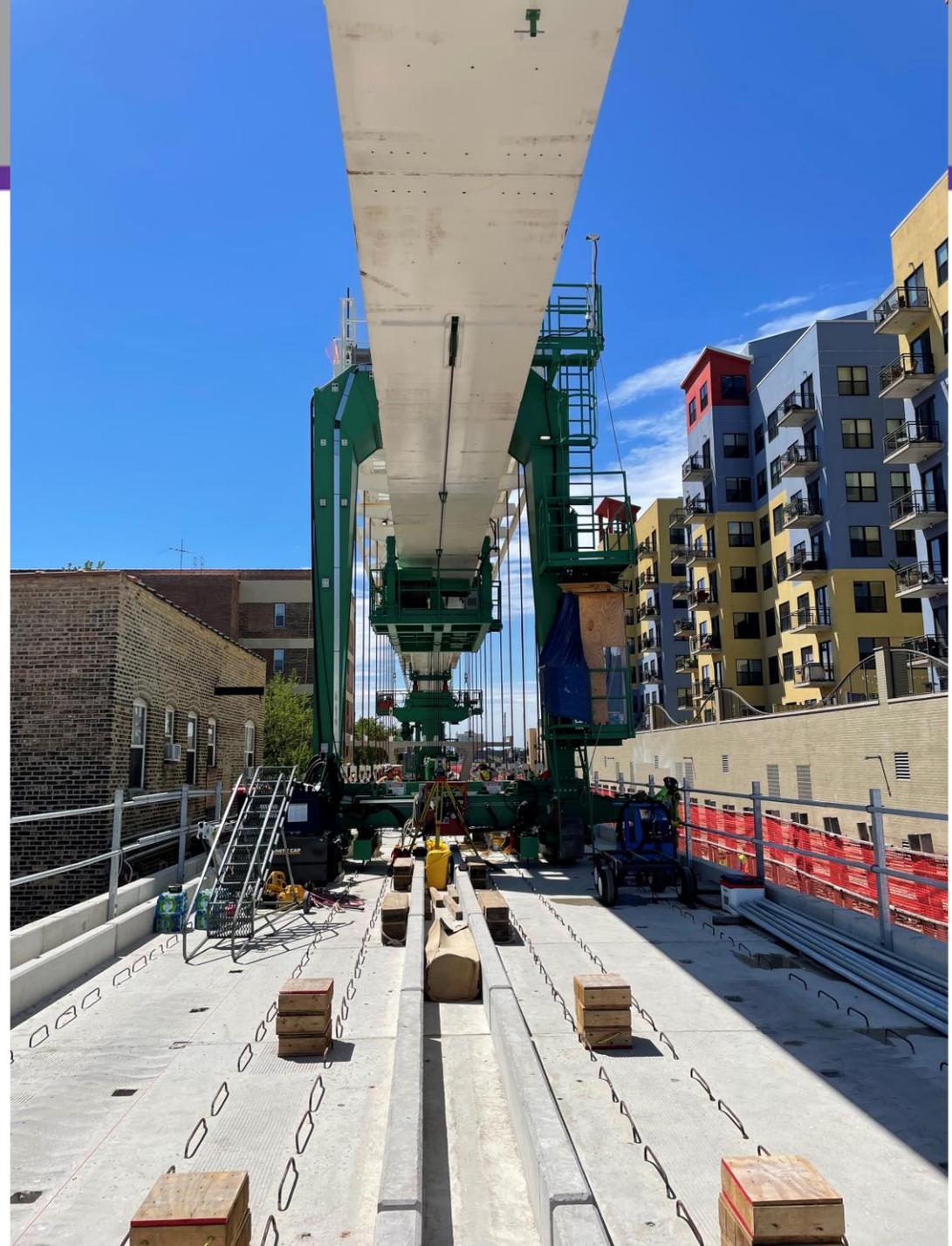
# Design Development

- Gantry

The gantry holding a span is always the biggest load.

We were fortunate – the straight alignment allowed a relatively light gantry.

It weighed in at less than 2/3 the weight of comparable gantries



# Design Development

- Systems

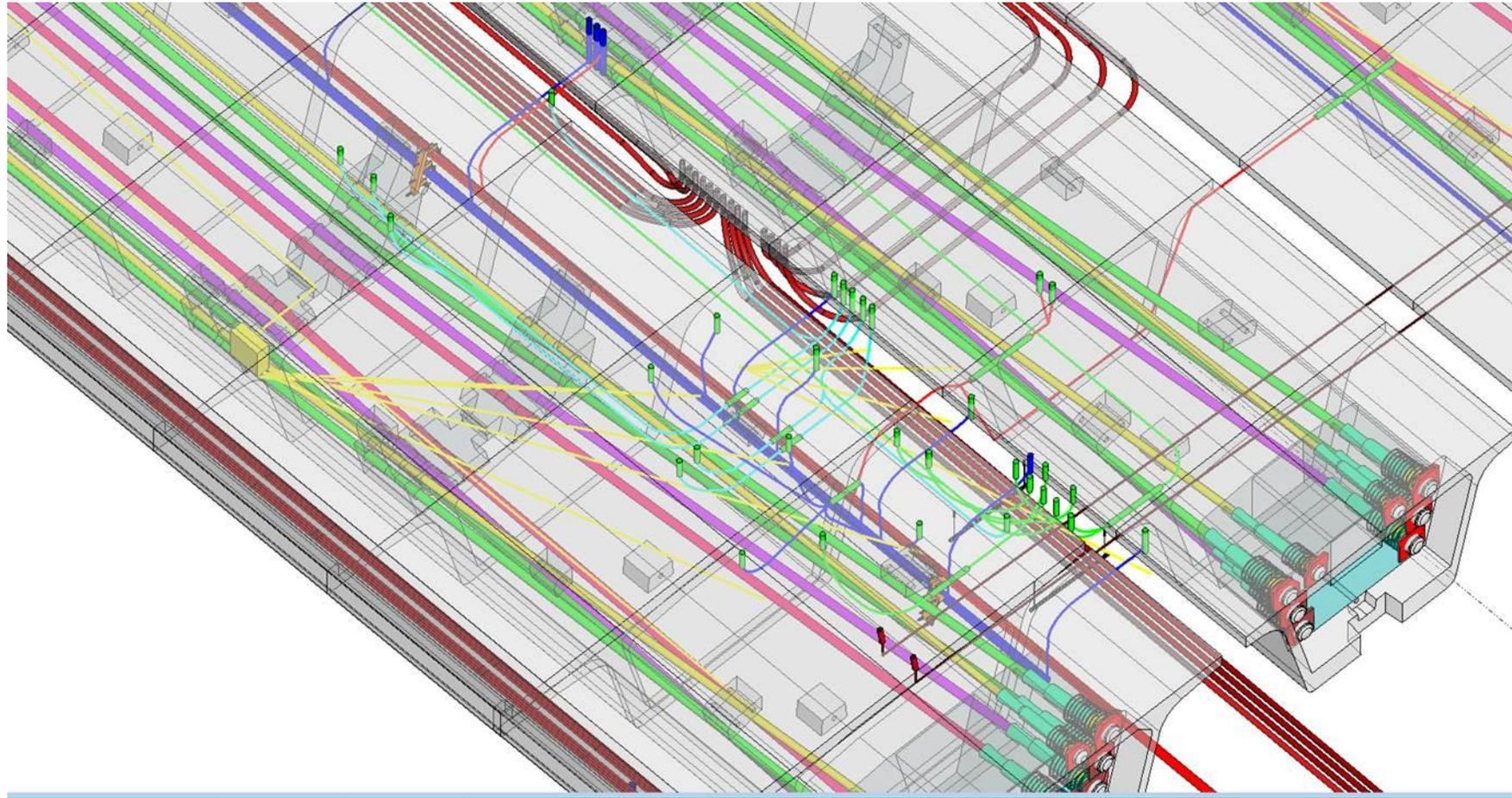
There are a lot of things on the deck, particularly near crossovers



# Design Development

- **Systems**

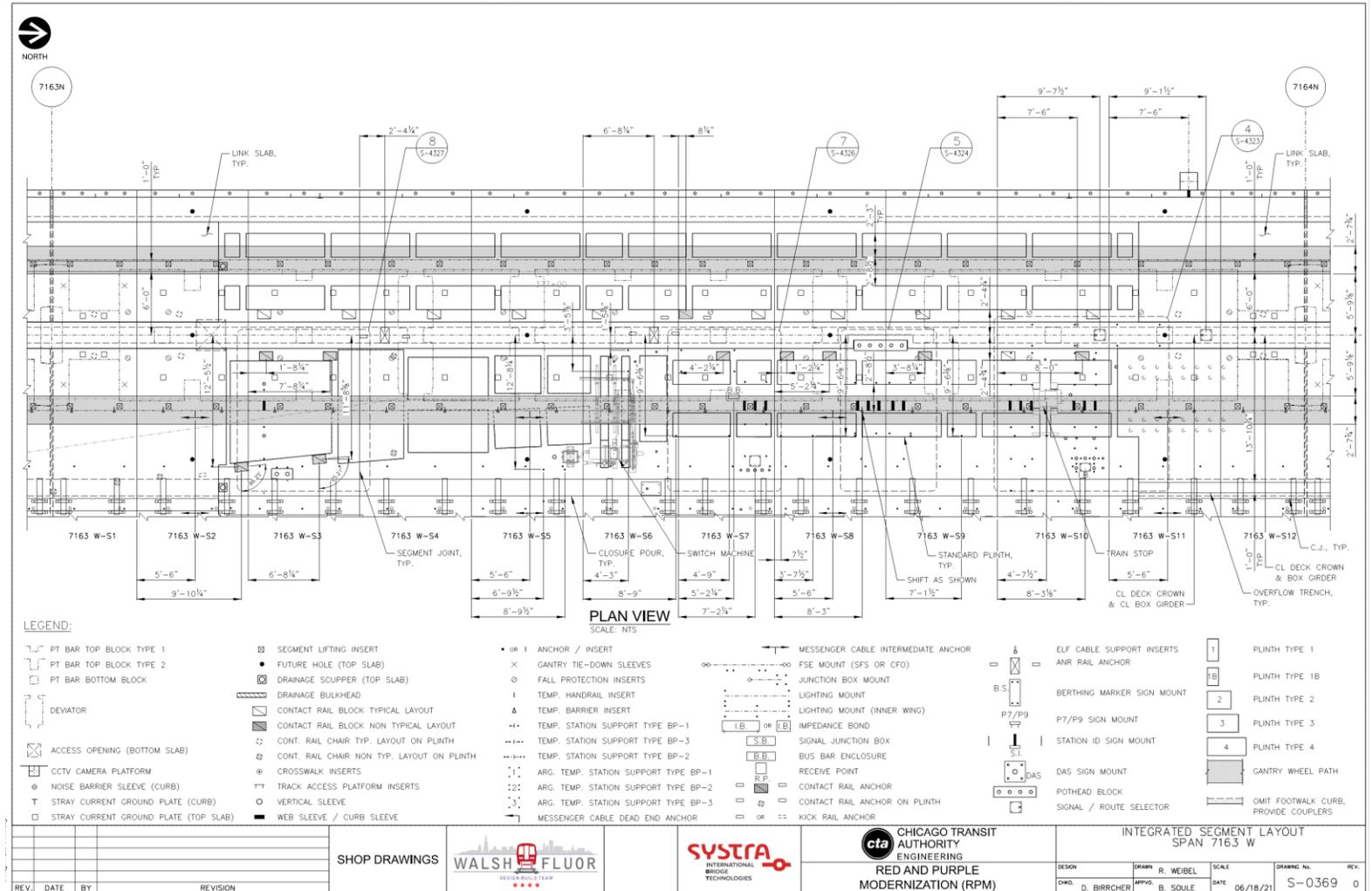
- Equipment is complex, requires supports and penetrations.
- Segments are cast far in advance of work on site.
- Requires careful planning and coordination, including 3D tools.



# Design Development

## • Systems

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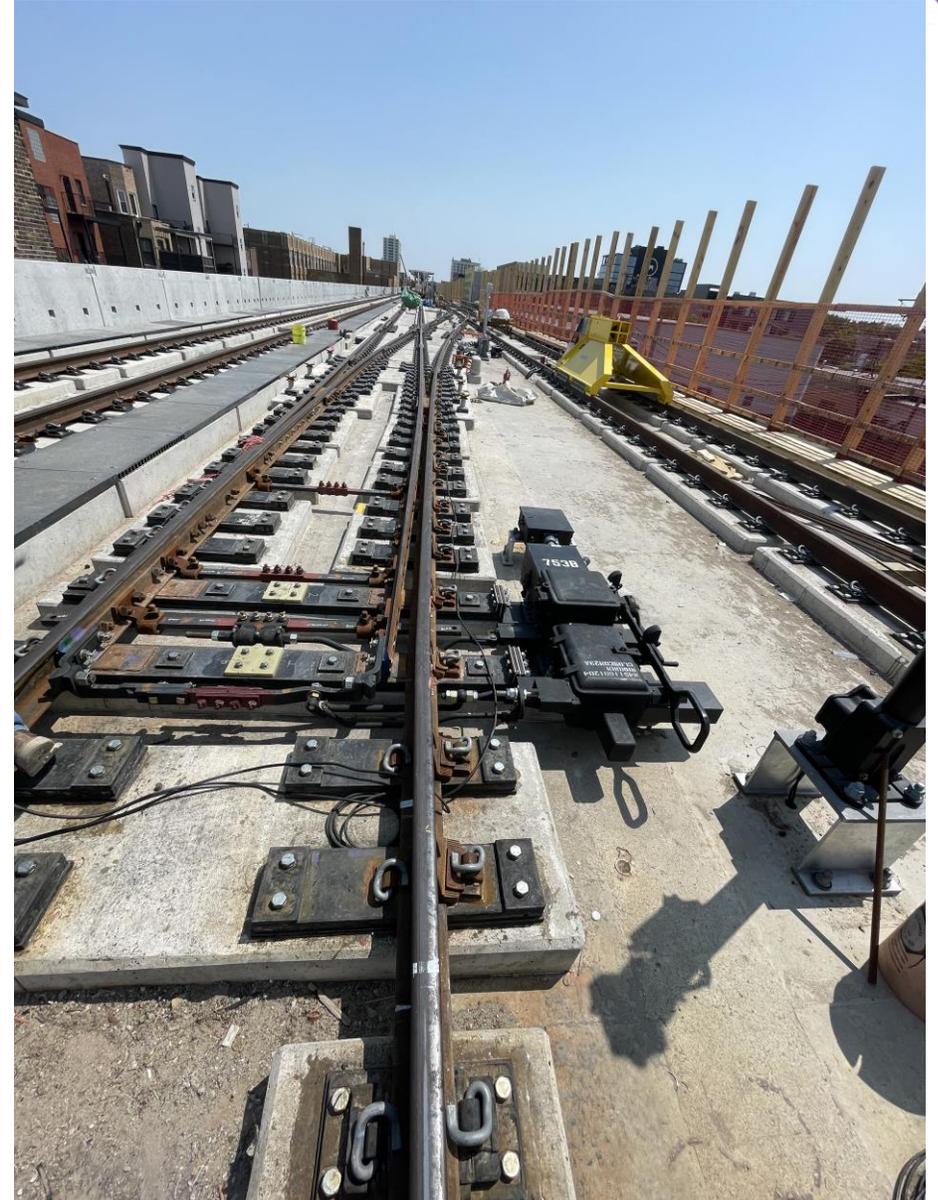
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# Design Development

- **Systems**

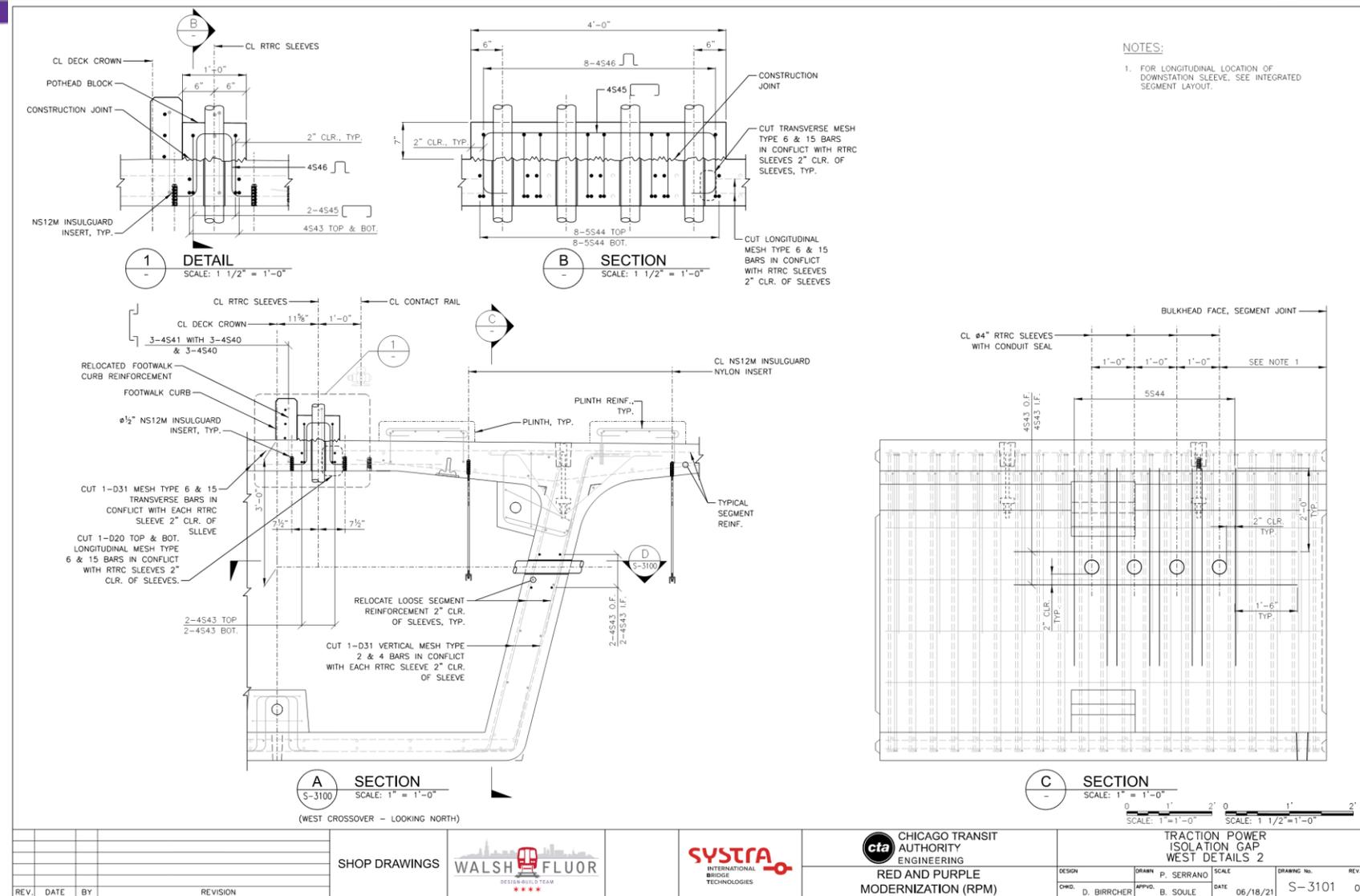
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# Design Development

These have been included in great detail in an integrated BIM model that draws on several disciplines.

These are then integrated with the structural drawings for a completely integrated picture.



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# Design Development

The girder is real estate that a lot of people would like to claim.



# Design Development

- Rail Installation

It is easy to overlook the forces developed by the rails.

Do not do this!

Let's talk about rail-structure interaction for a moment.



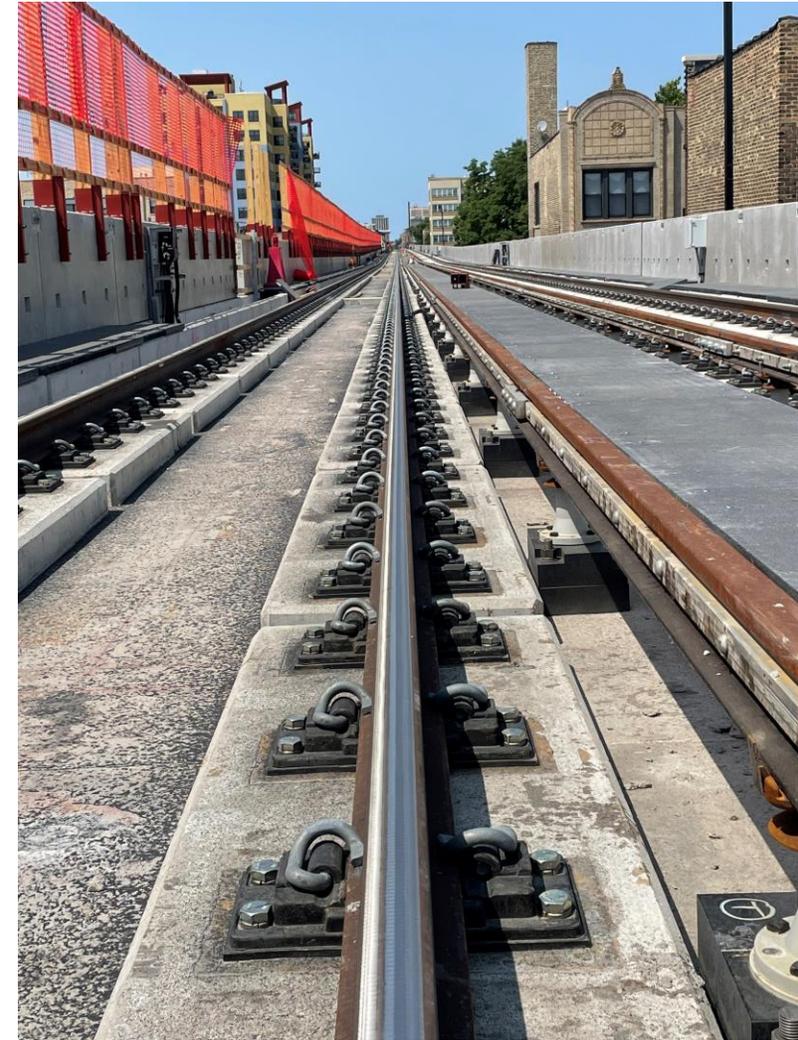
# Design Development

- Rail Installation

Rails are usually continuous for a long way, as in miles.

This means that they don't move as temperatures change – but the bridge does.

The fasteners you see here slip, transferring a force. Most of the time it's pretty manageable.

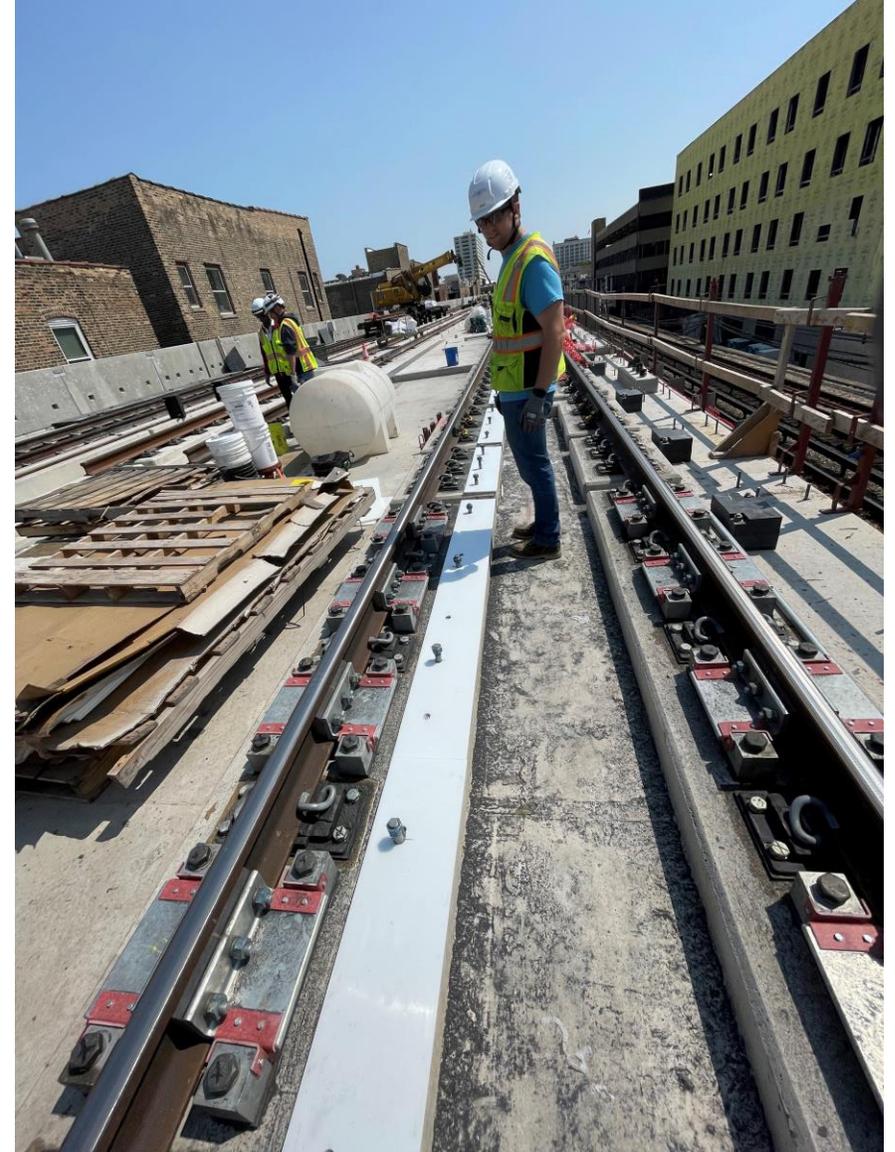


# Design Development

- Rail Installation

This is not true at a rail anchor, where the rail is fixed to the deck.

These forces are an entirely different magnitude, and need to be accounted for.



# Design Development

- Rail Installation

You usually have anchors where you have “special” trackwork.

“Special” as in complicated.



# Design Development

- Rail Installation

OK, but why would an erection engineer care about this?

It is because rails are stressed when they are installed.

Rails have a “neutral temperature”, around 85 degrees. If it is colder than that (say, 40) they are pulled to have stress equal to a 45 degree temperature fall.

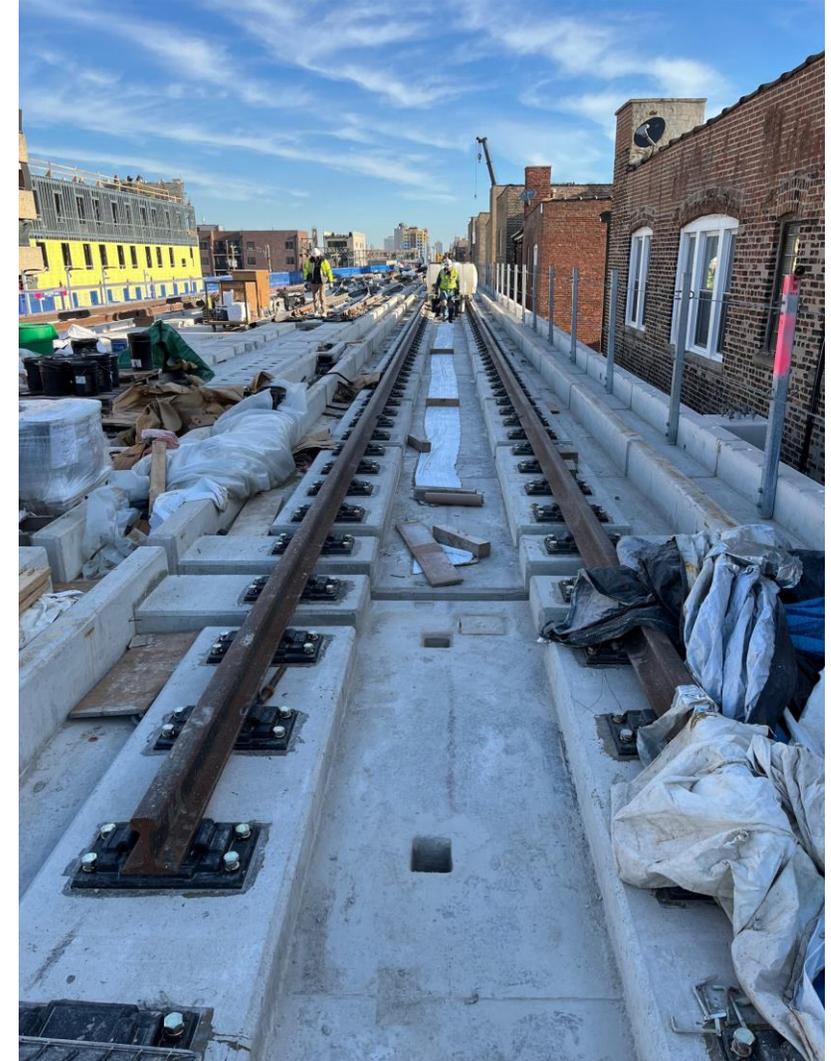


# Design Development

- Rail Installation

Add to that – the free end of any rail at the end of this stressing operation becomes an anchor for the day.

That means a big force at the end of the string.



# Design Development

- Rail Installation

Which means a big force going into your structure – somewhere.

It is important to plan for this.

Your rail installer will look at you like you have two heads.

Keep pushing – if unaddressed, it can cause problems with bearings, shear keys or columns.



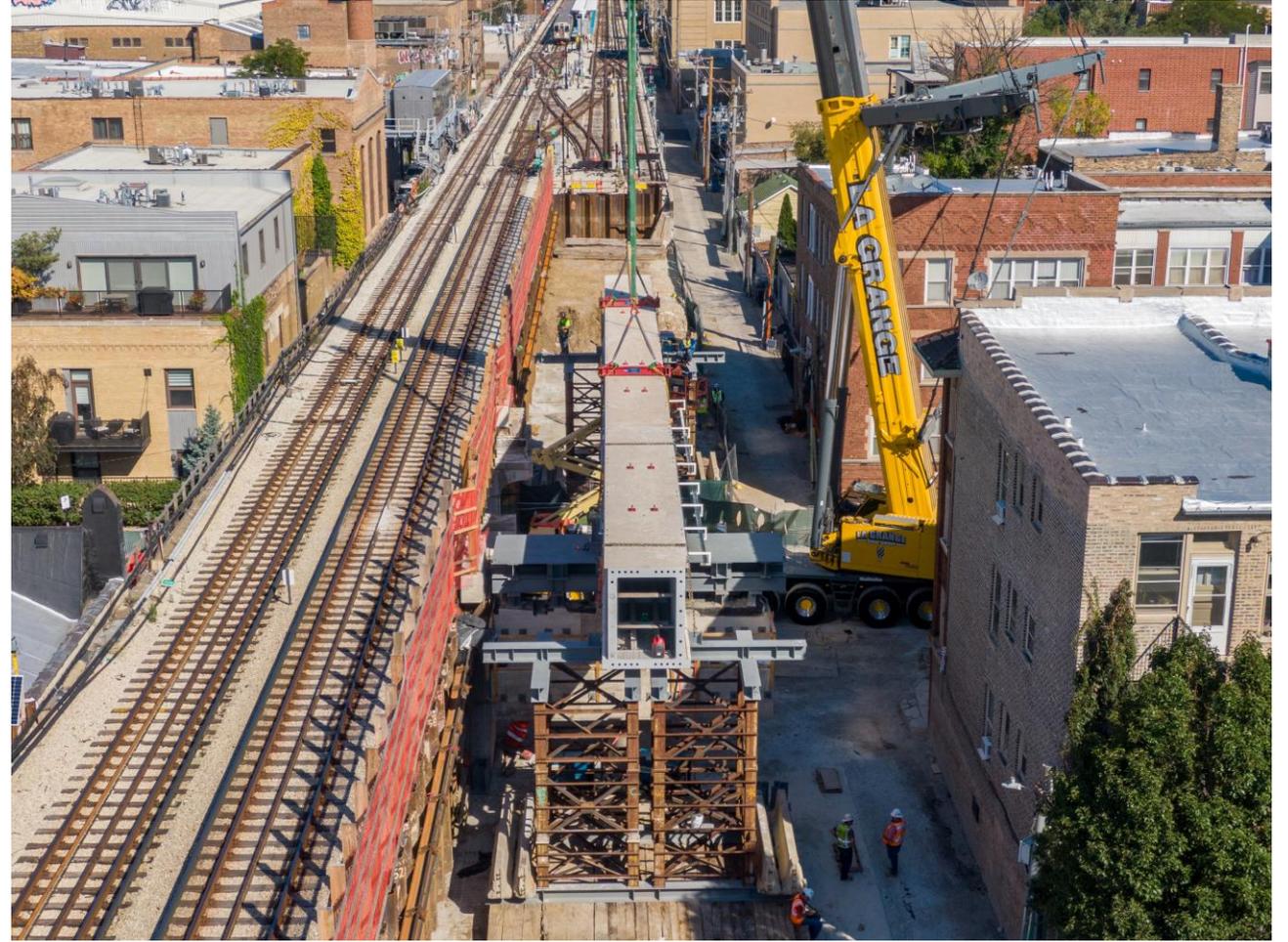
# Construction Activities

PRESENTED BY: Kevin Buch

# Site Conditions and Constraints



Who says a 550T Crane Can't Fit in the Neighborhood??



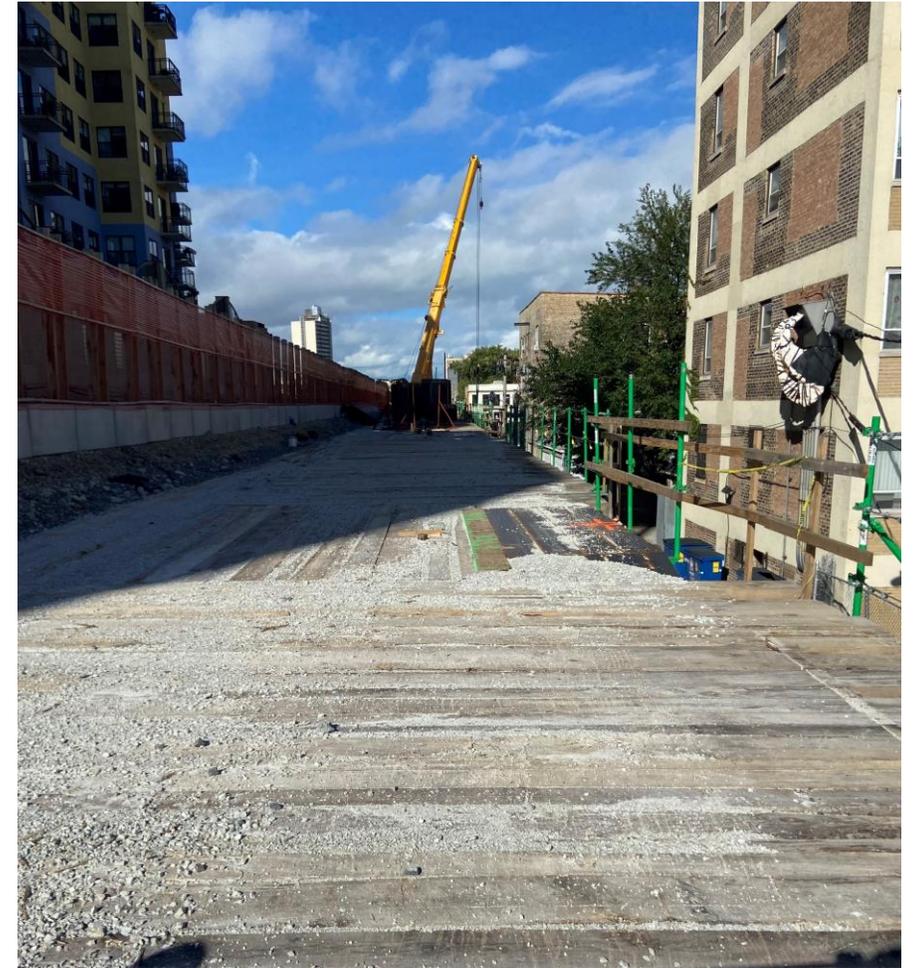
# Embankment Demo / Ramp Construction



Embankment Excavation & Wall Demo



Material Loadout



Working Surface for Drill

# Foundation Installation



Working Next to live Tracks



LTR1220 Crane, Oscillator & Drill

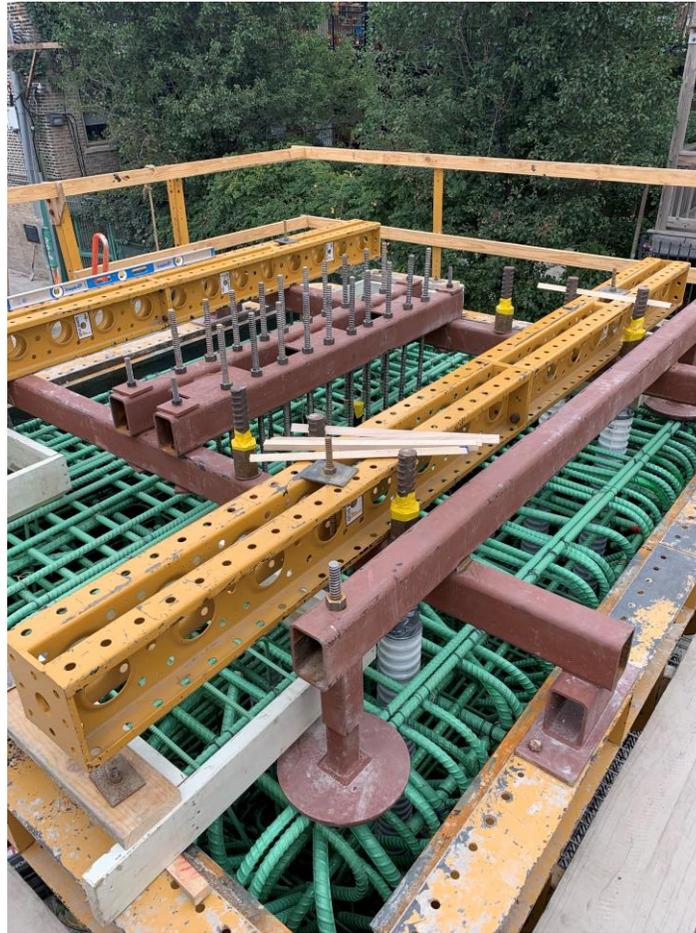


Clearance to Barrier & Adjacent Buildings

# Substructure Installation



Standardize & Pre-Tie Rebar Cage

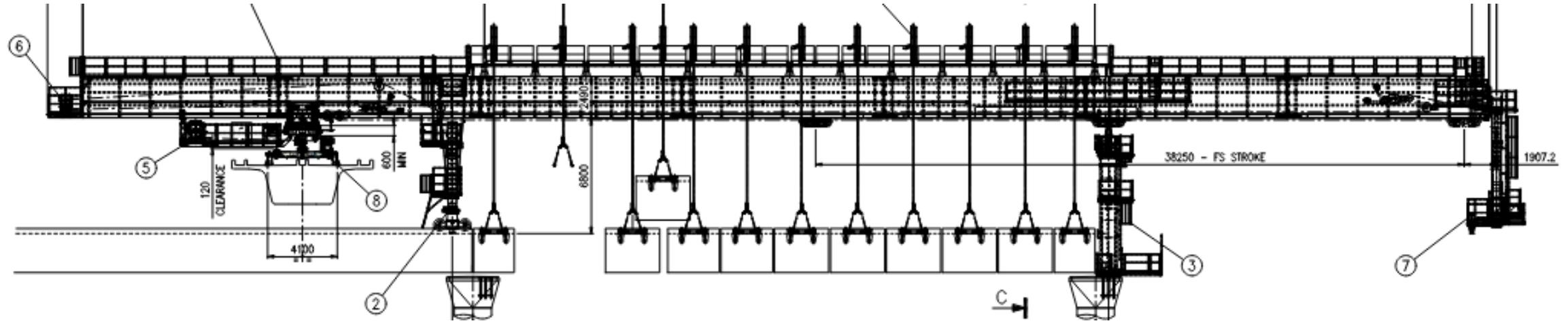


Ensure Proper Geometry

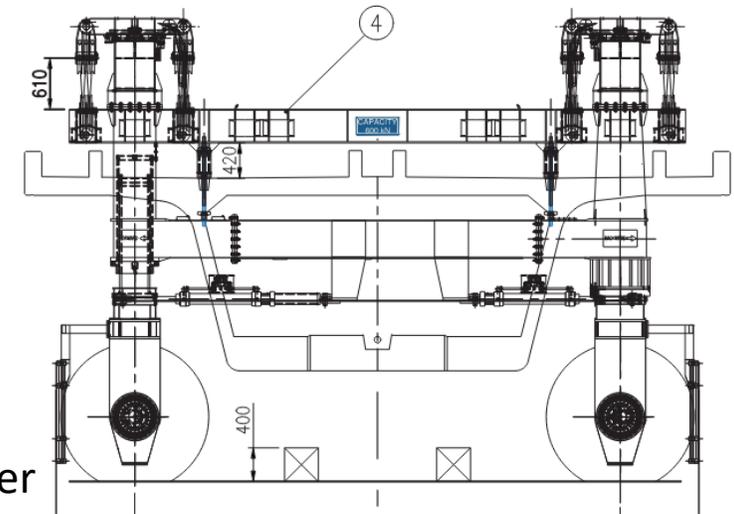


Finished Product

# Erection Equipment Overview



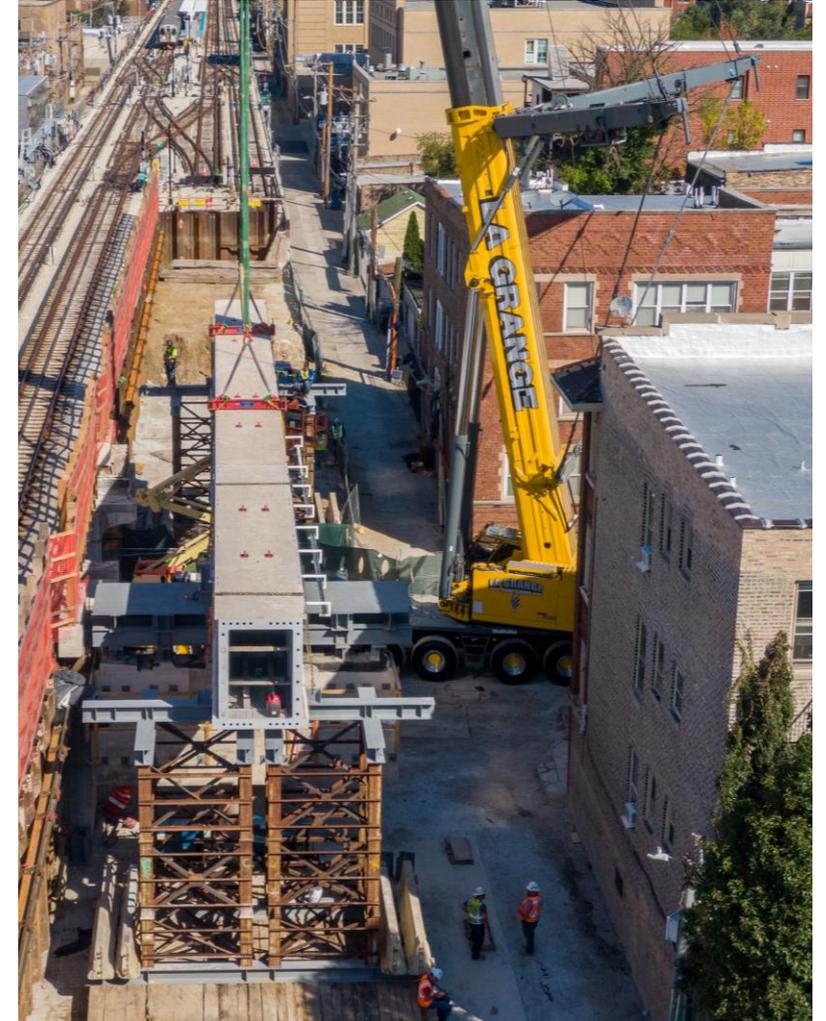
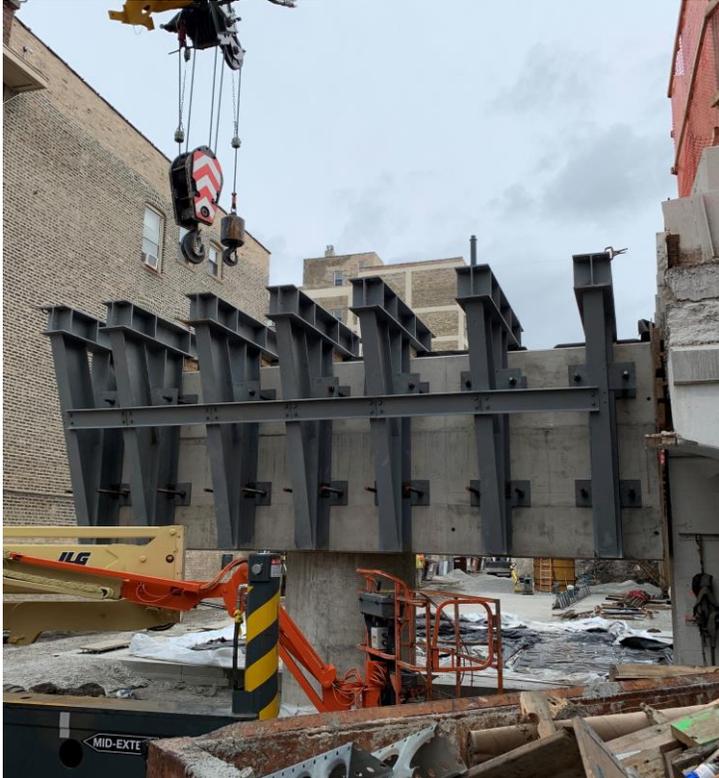
Rear Feeding Single Box Girder Design



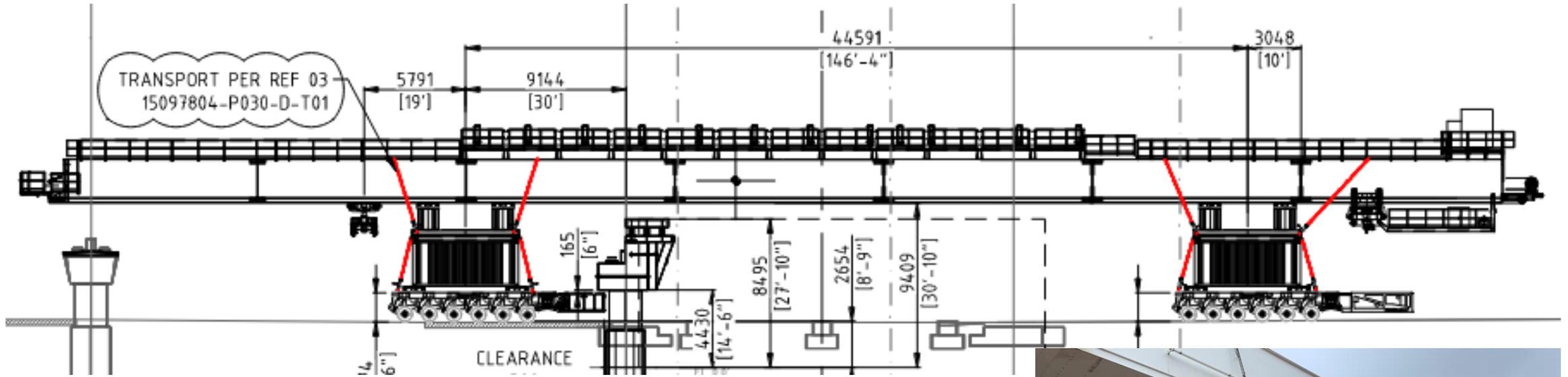
Segment Transporter

# LG Assembly

1. Install Temp/Perm Substructure & Falsework
2. Erect Main Girder (MG)



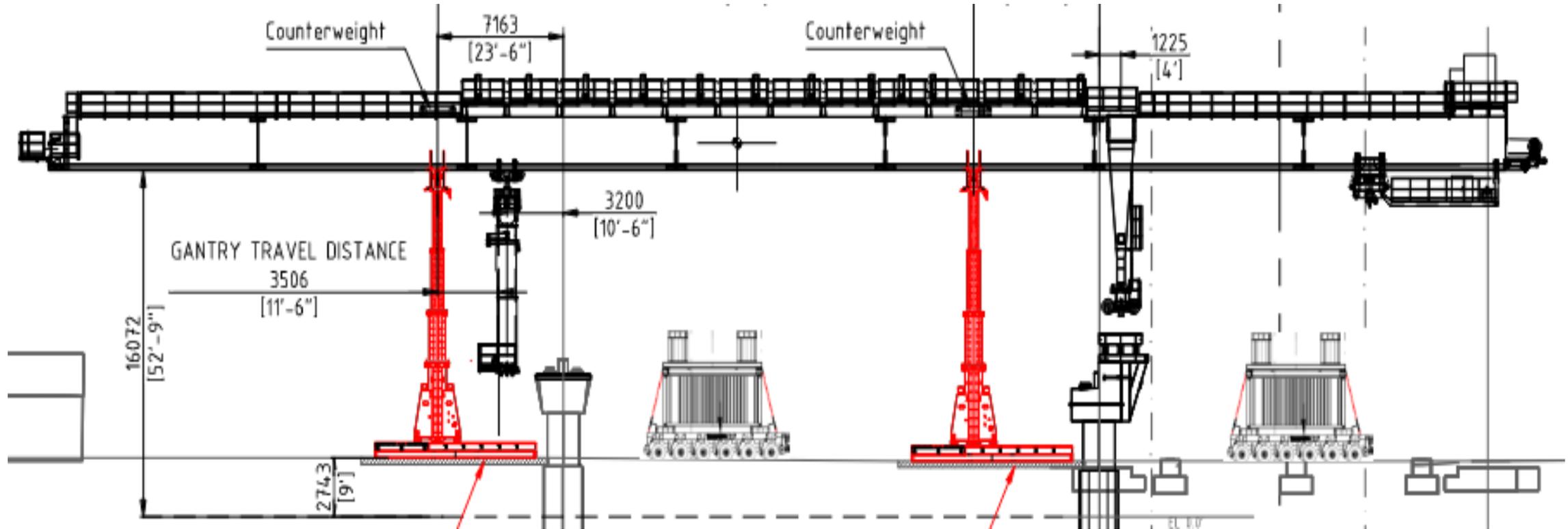
# LG Assembly (cont.)



3. Transport w/ 2ea SPMT's (Mammoet)

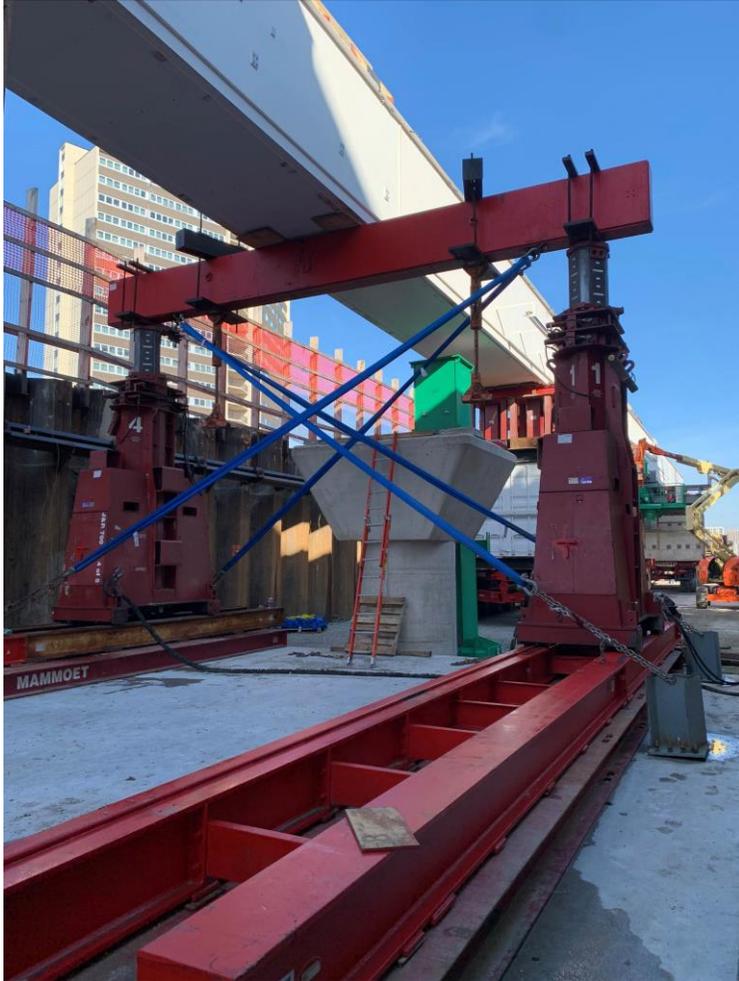


# LG Assembly (cont.)

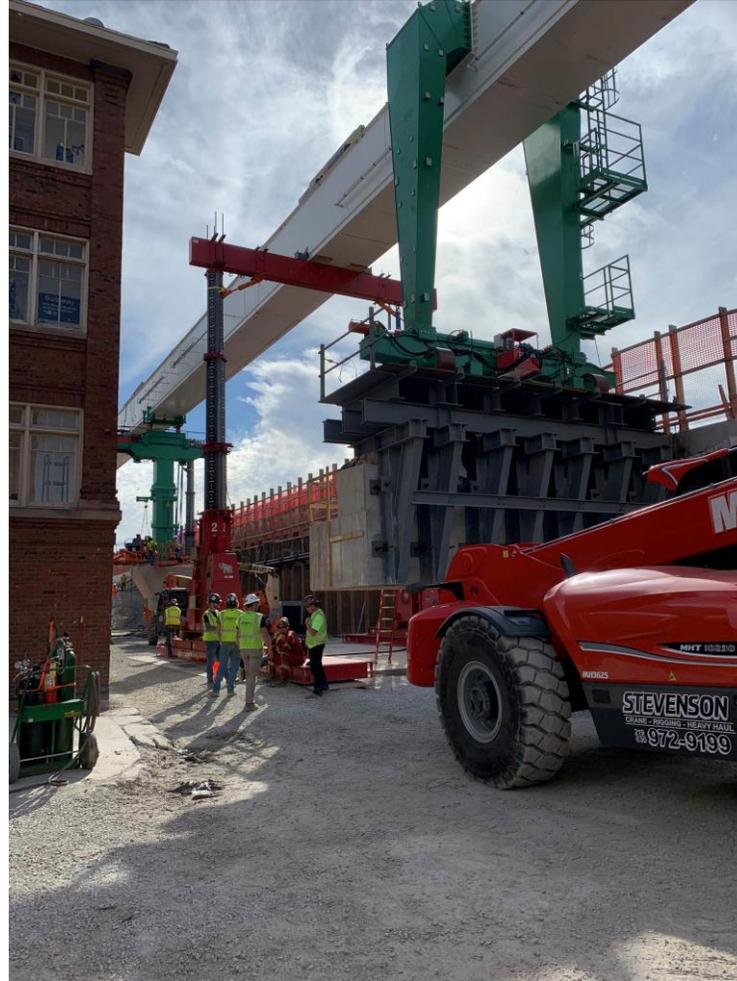


4. Lift then Slide w/ 4ea 700T Mammoet Gantries
5. Land on Substructure

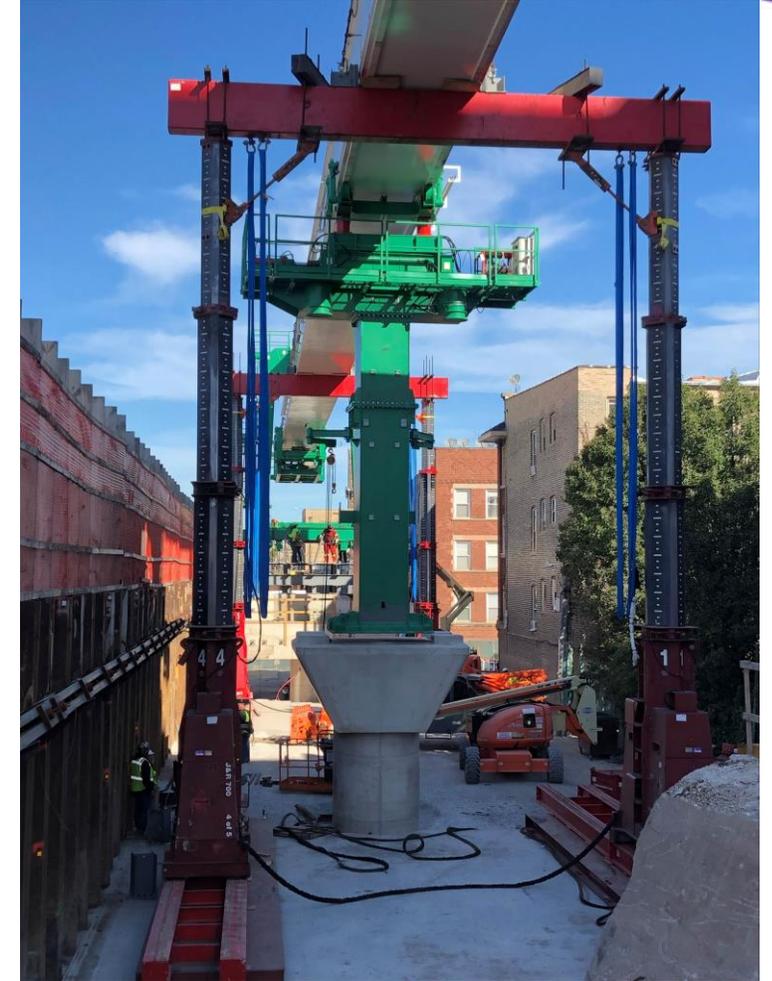
# LG Assembly (cont.)



Wind Bracing (Prior to Lift)

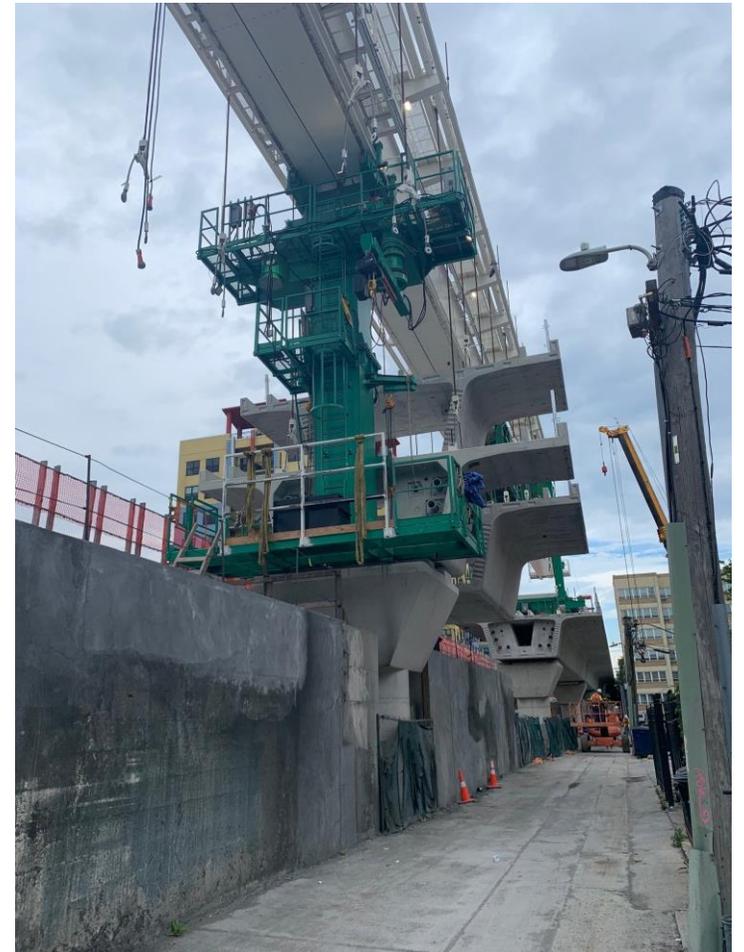


Landing Rear Support on Pier Bracket

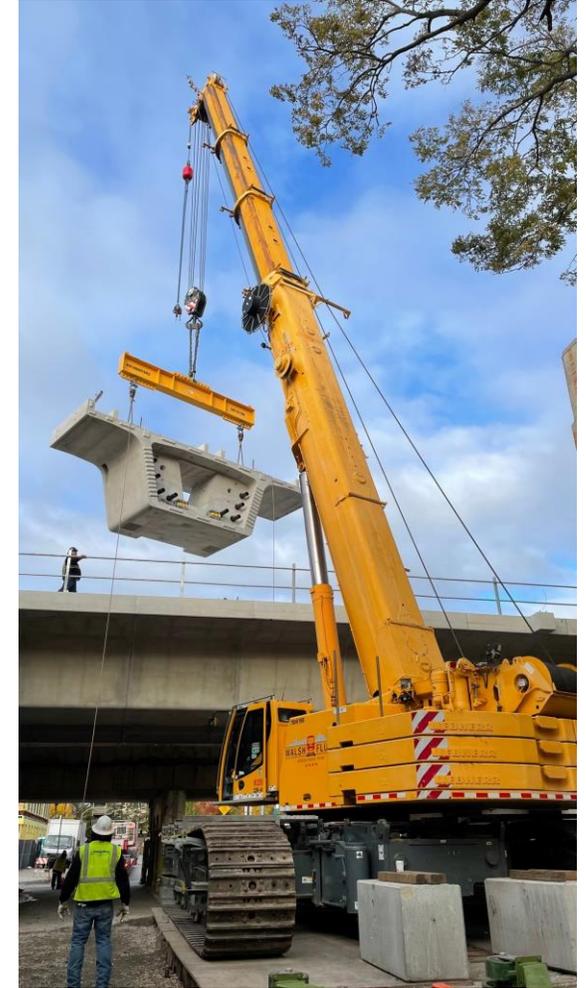
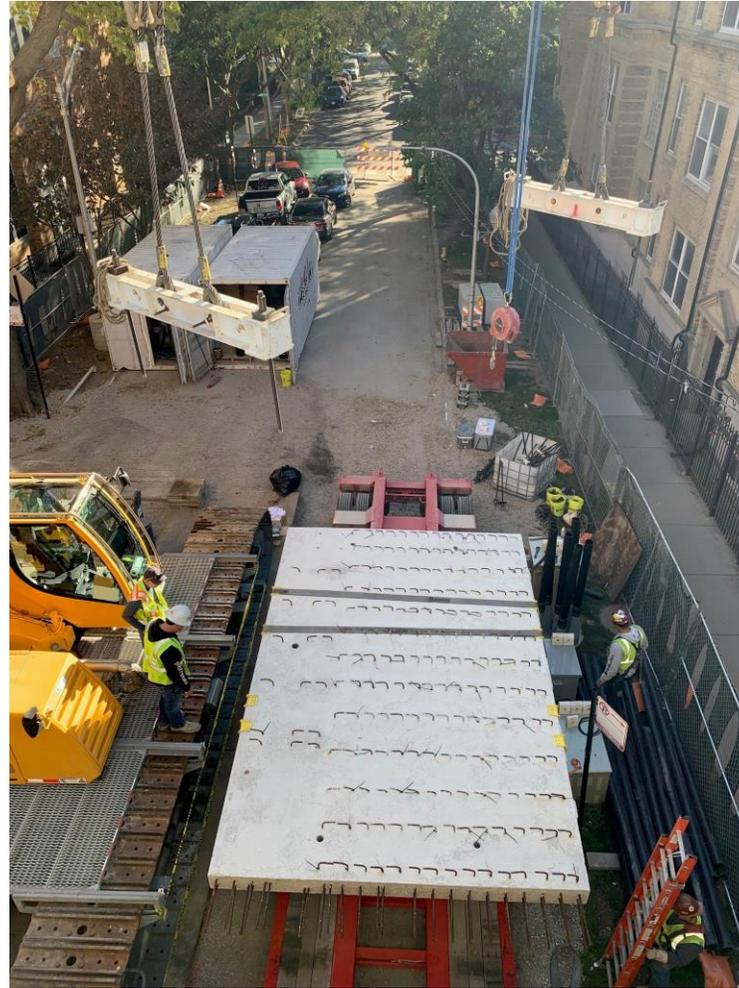


Landing Front Support on Pier

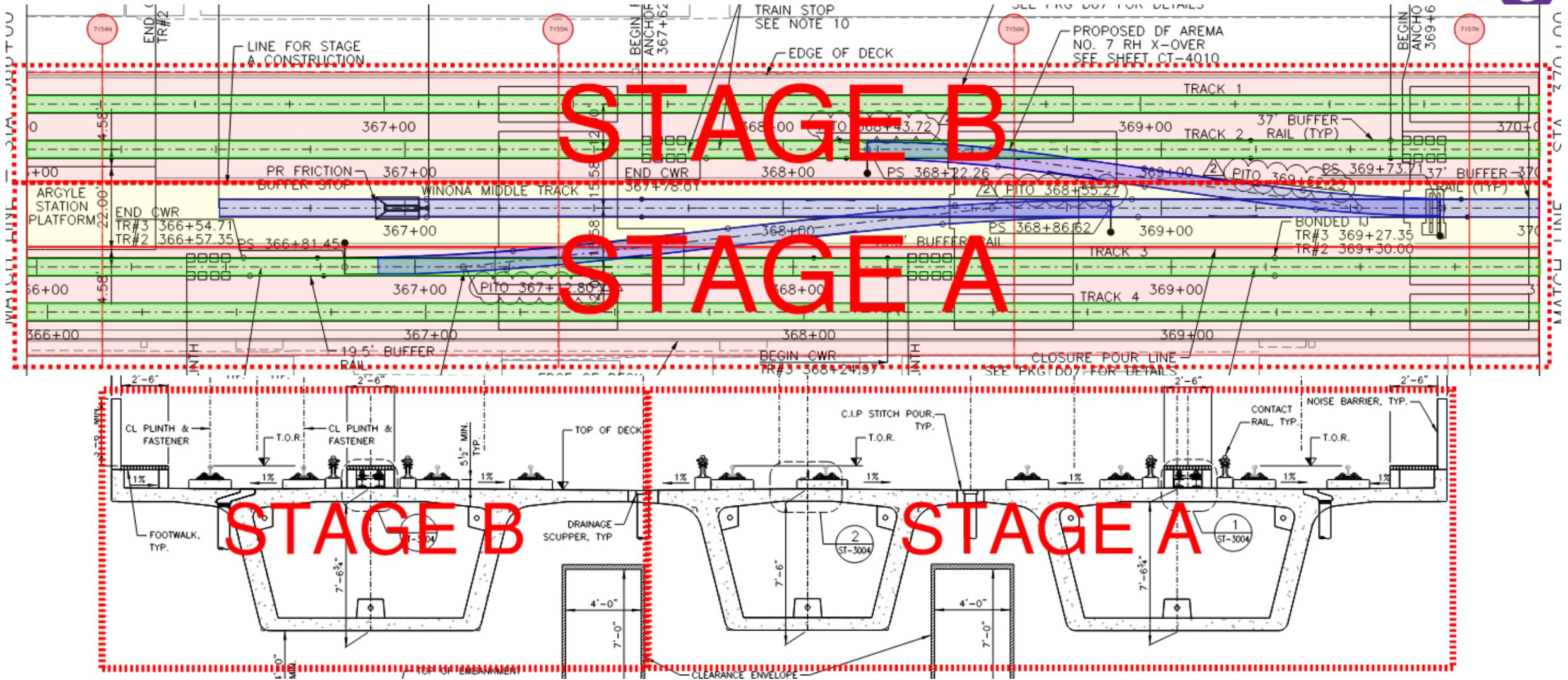
# Typical Span Erection



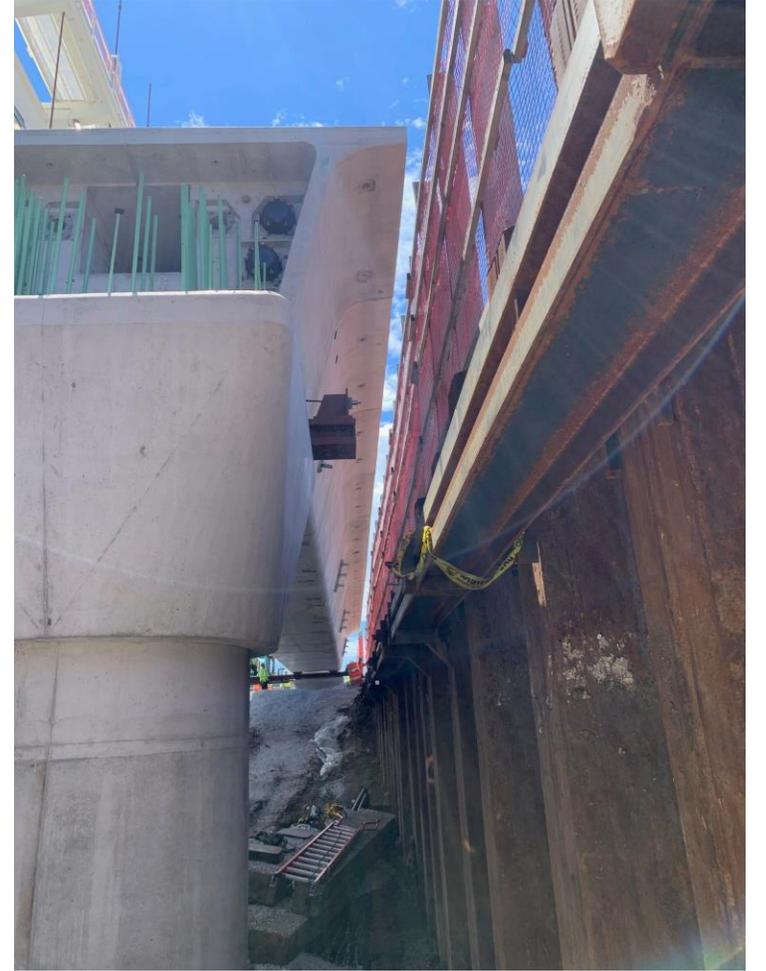
# Segment Delivery



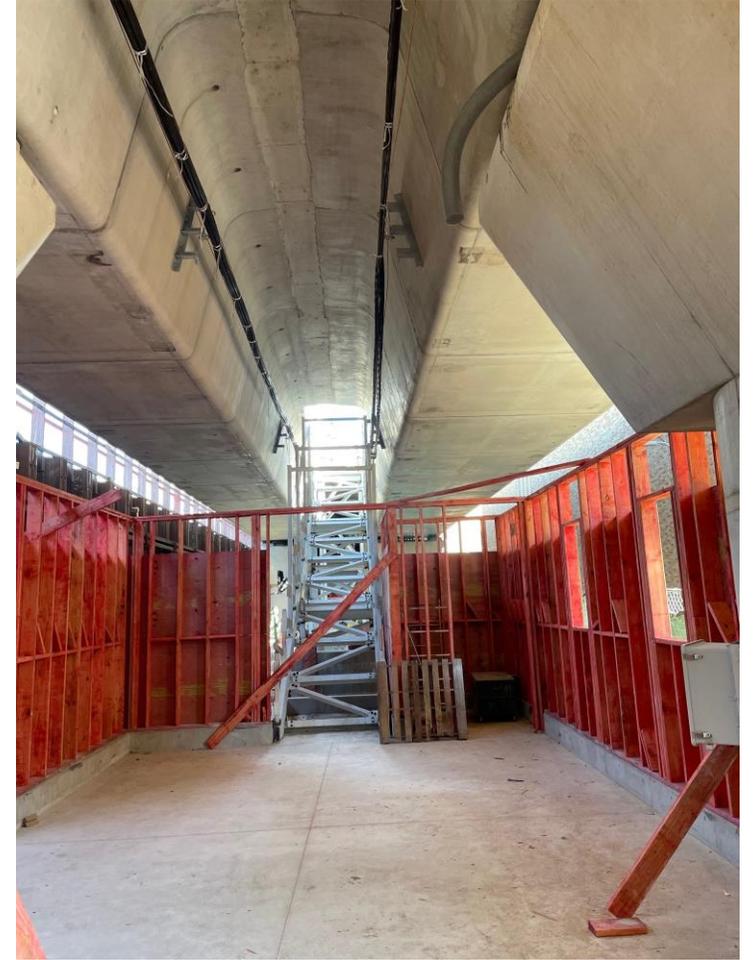
# Pocket Track Installation



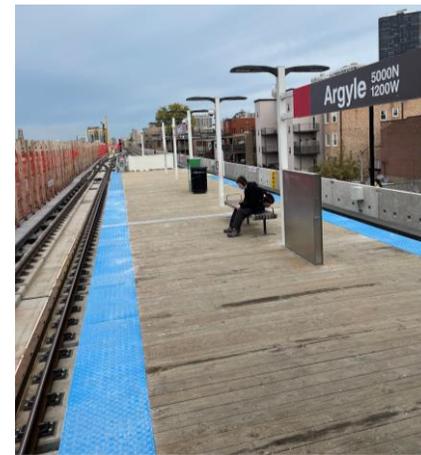
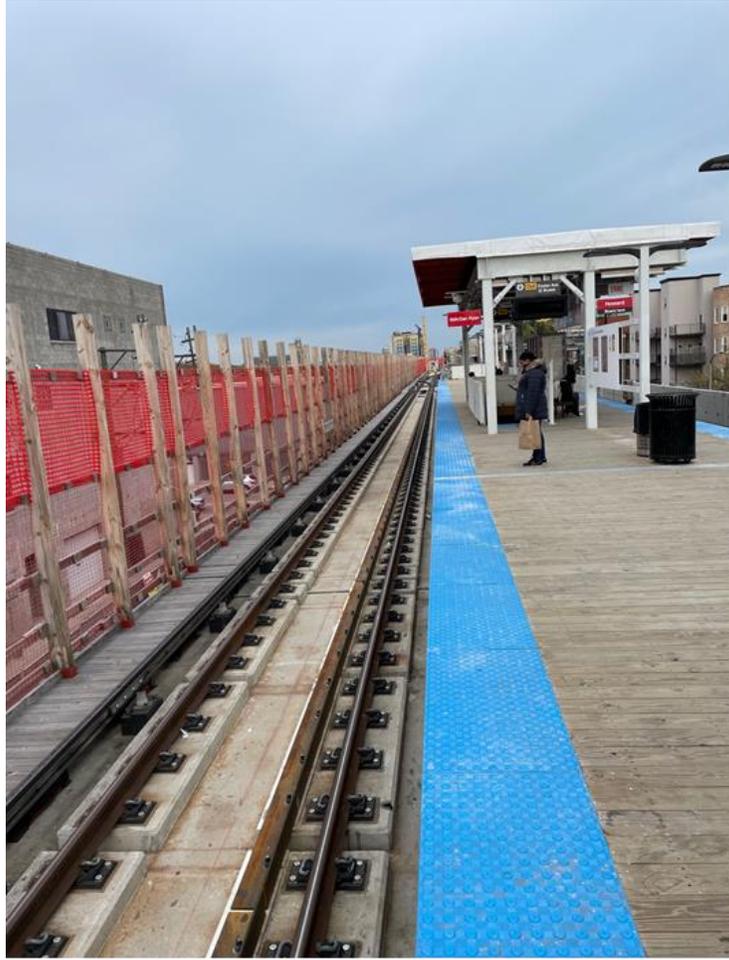
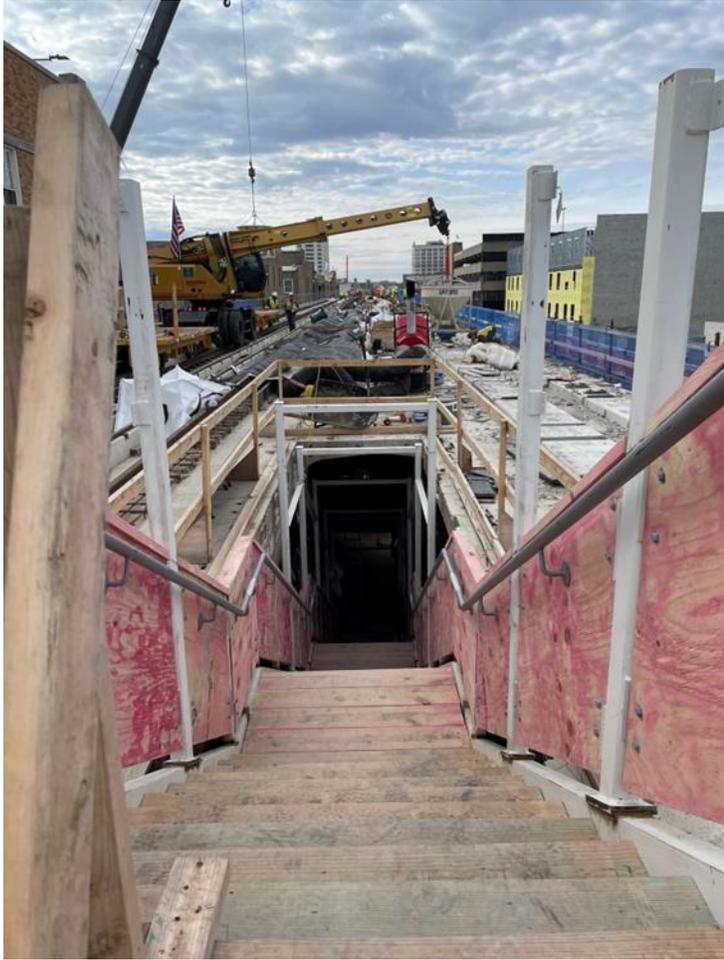
# Pocket Track Installation



# Argyle Temp Station



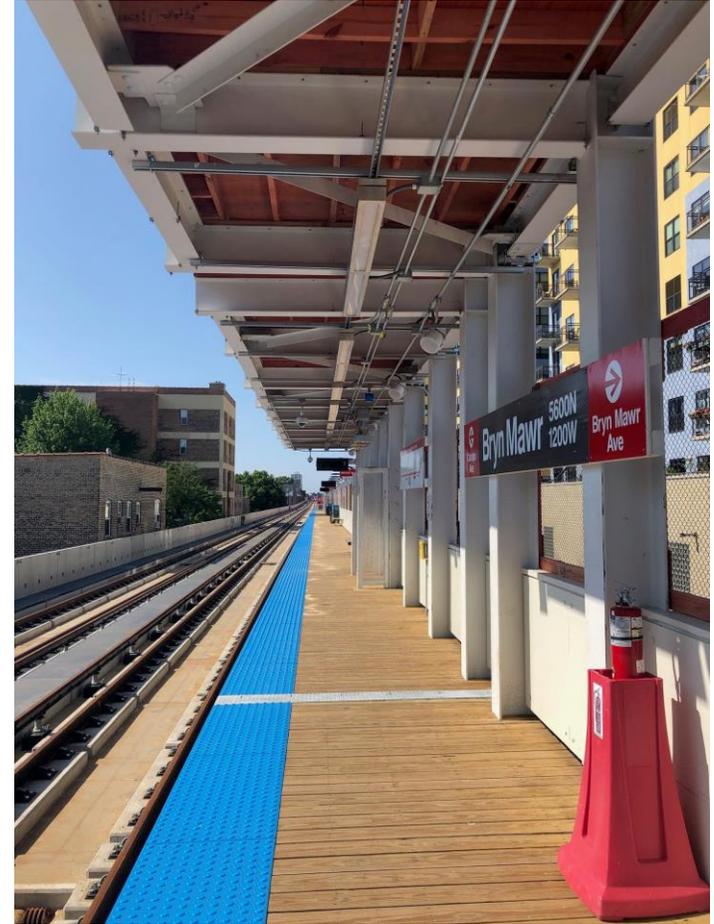
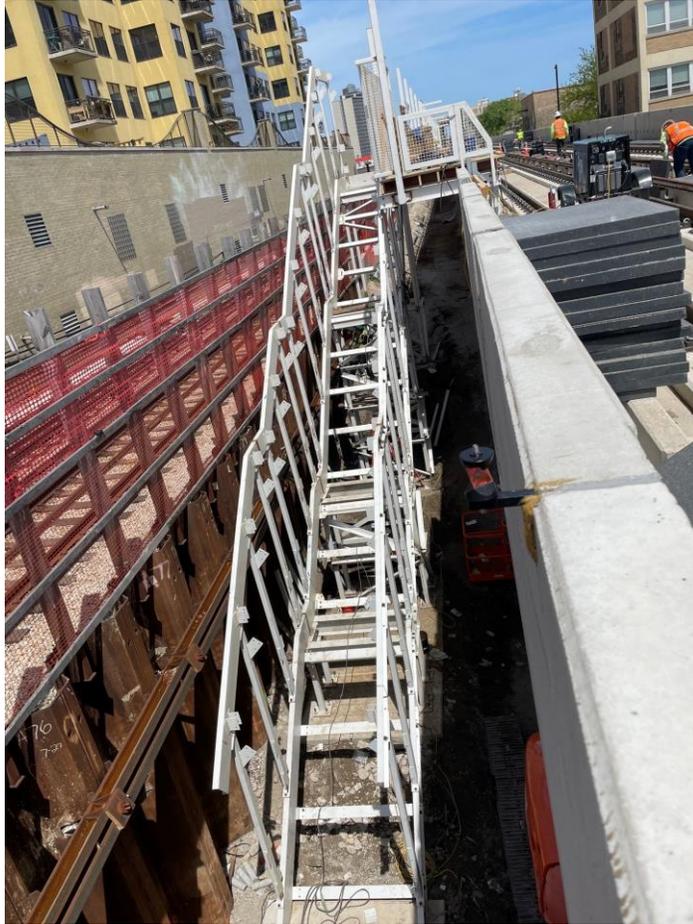
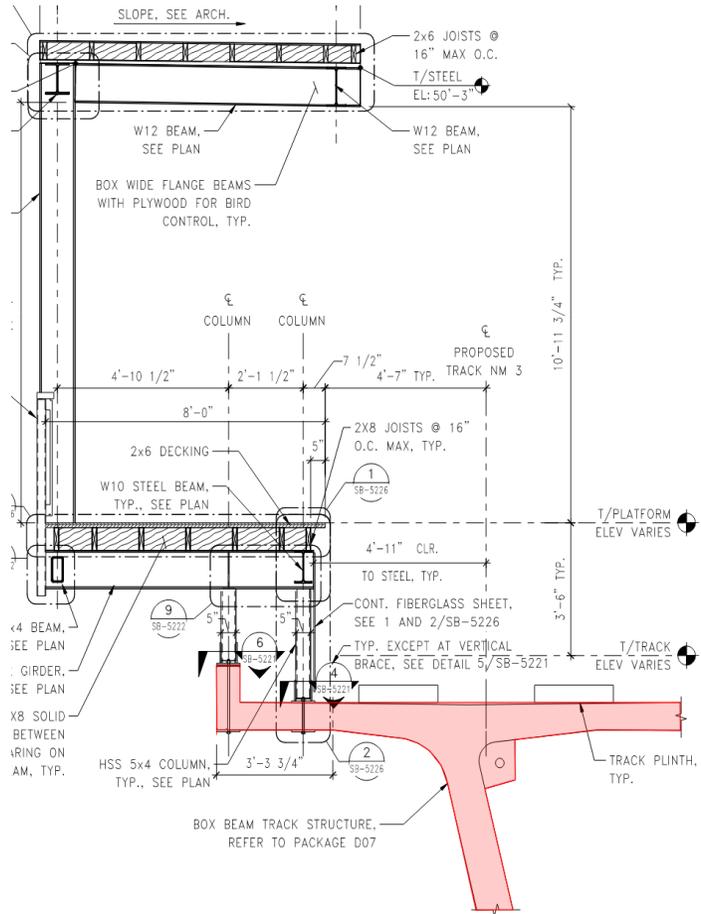
# Argyle Temp Station



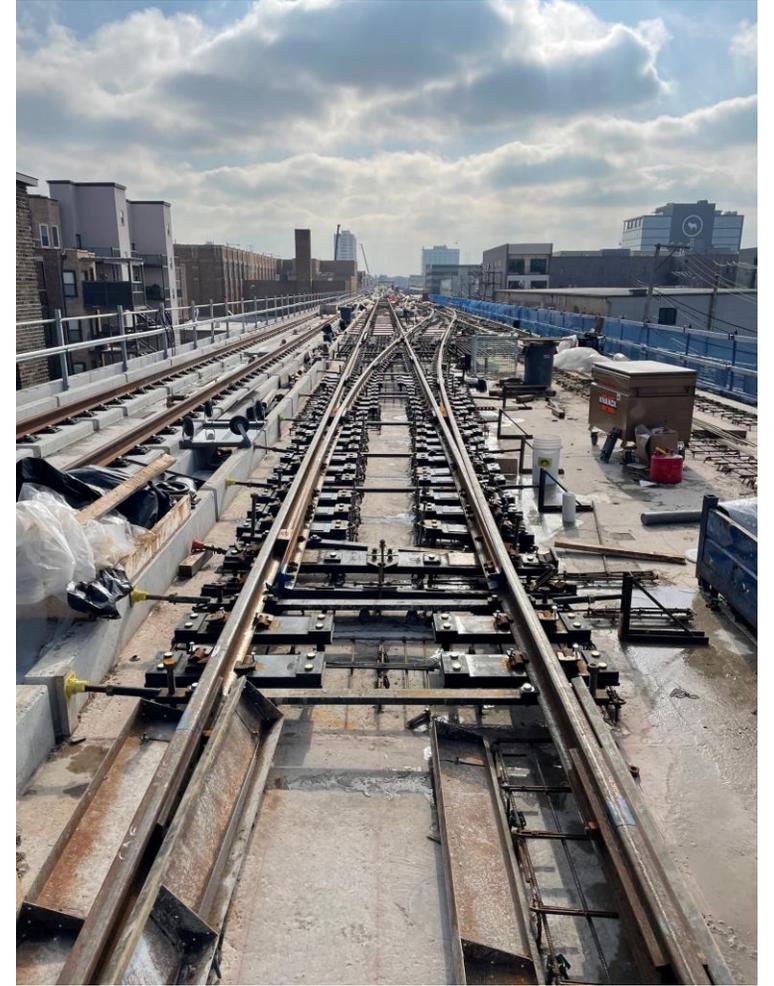
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# Bryn Mawr Temp Station



# Stage A Construction



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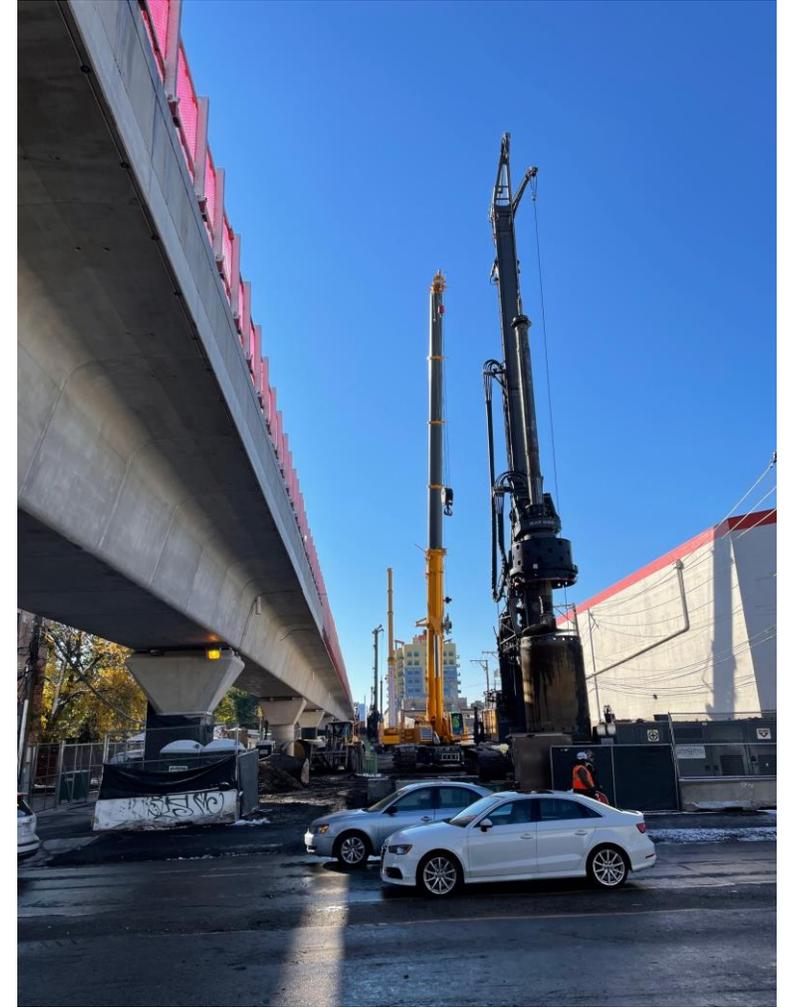


# Stage B Construction



“WALSH-FLUOR: TEAR DOWN THAT WALL!! AND WHILE YOU’RE AT IT – HURRY UP!!”

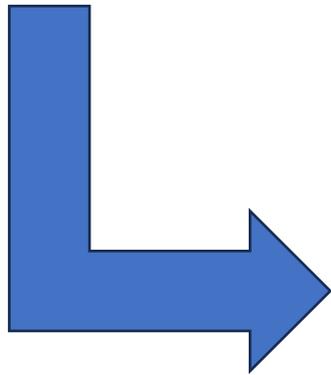
-DORVAL CARTER  
PRESIDENT, CTA



# Stage B Construction



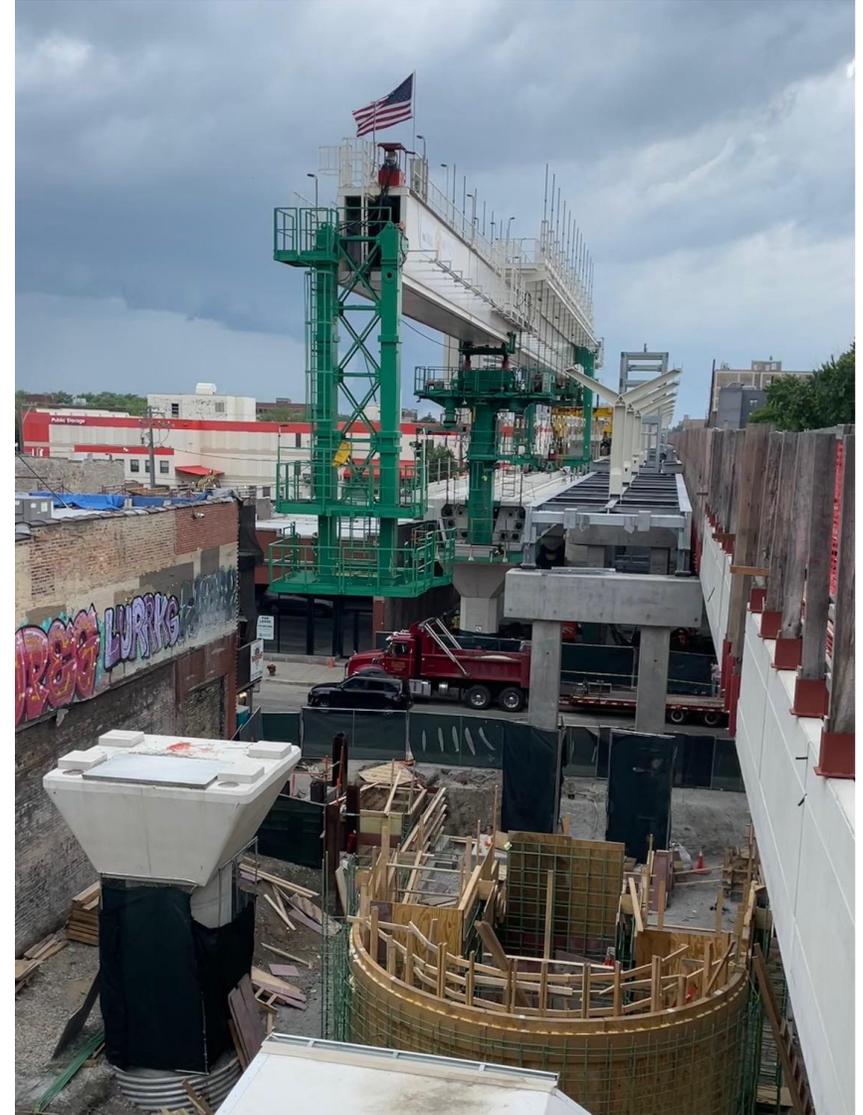
# Future Streetscape



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# Stage B Construction



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Thank you for your time!! Questions?? See you next year!!

