DEAL

TENSA AMERICA

McNARY BERGERON & ASSOCIATES ENGINEERED CONSTRUCTION

RIZZANI DE ECCHER USA

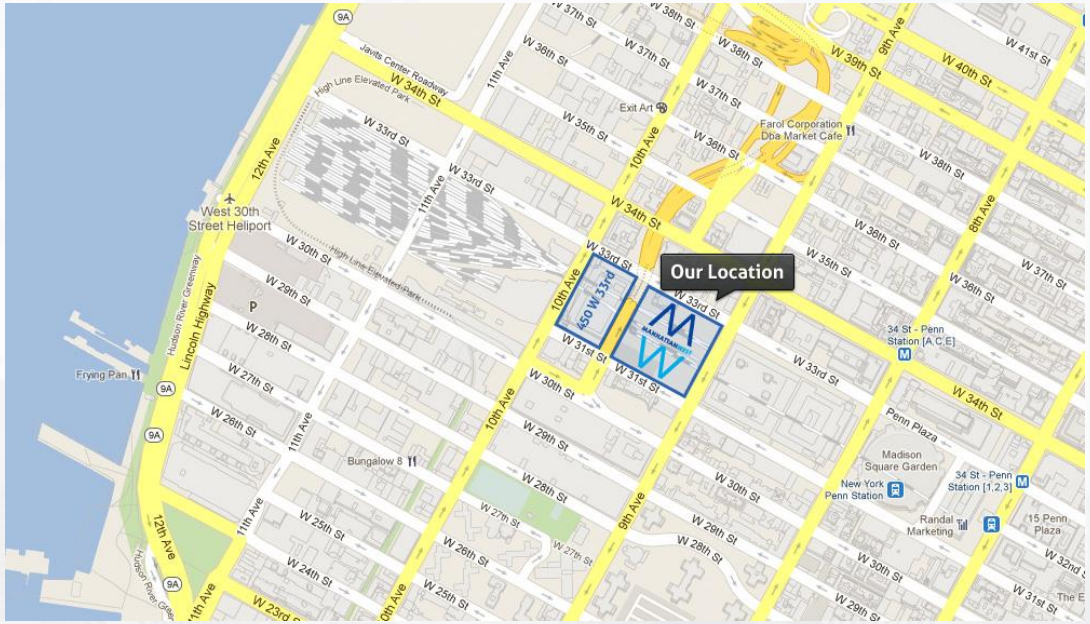
MANHATTAN WEST PLATFORM

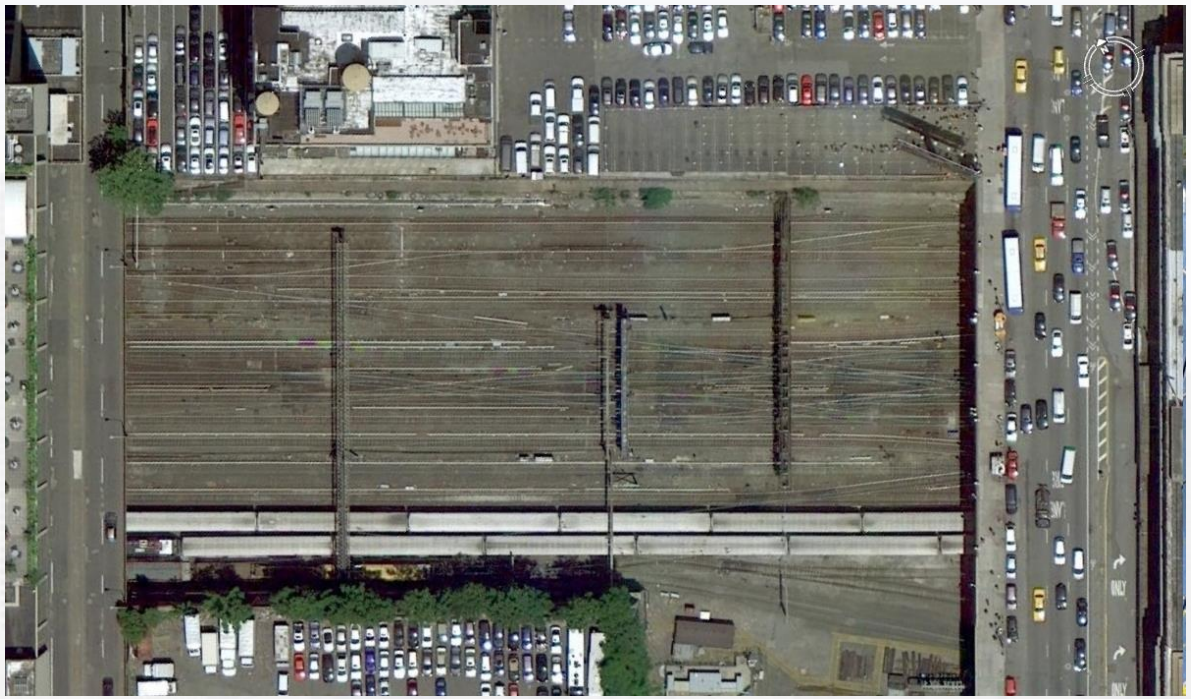
NEW YORK CITY

ANDREA TRAVANI

CEO – Tensa America

Facts





- **Brookfield** was looking for a **solution** to create a **7 million** square foot **development**
- Railway tracks are partially **uncovered** 55 ft below grade

Challenges

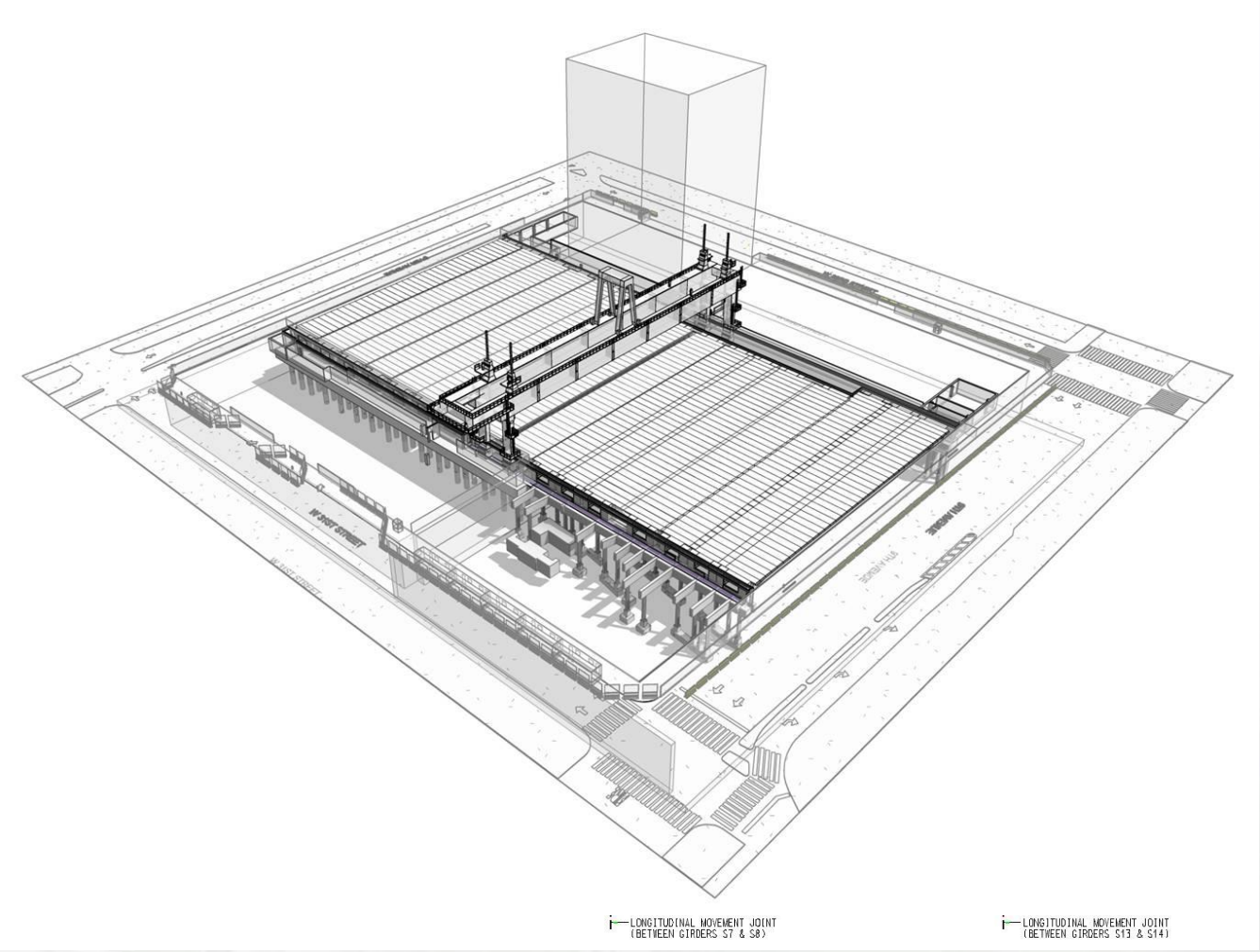
- Working in the heart of Manhattan over one of the **busiest railway** tracks in the World
- **Avoid touch down** at track level
- **Outages** available of **less than 2 hours**

And the solution is….

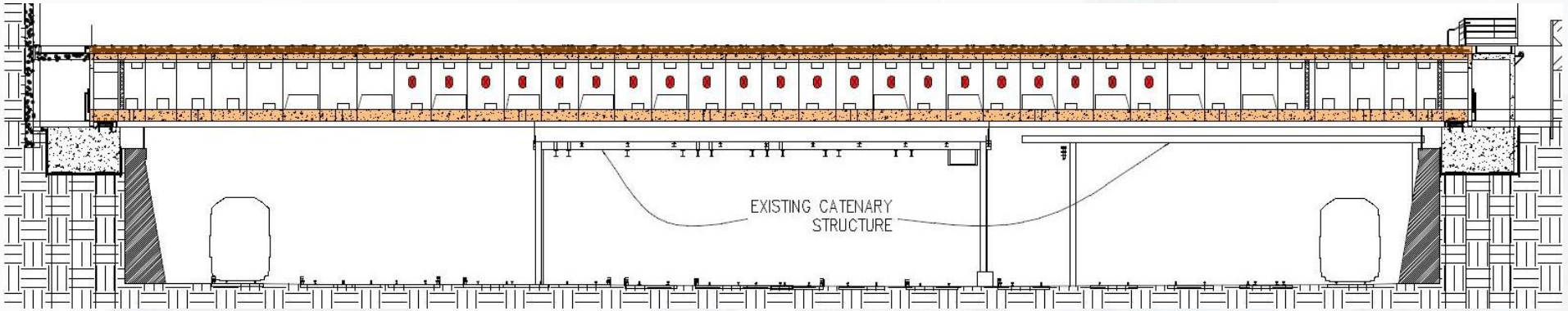
"… a <u>Post Tensioned segmental platform</u> that allows to bridge the gap without any columns or supports built at the track level"

Design Features

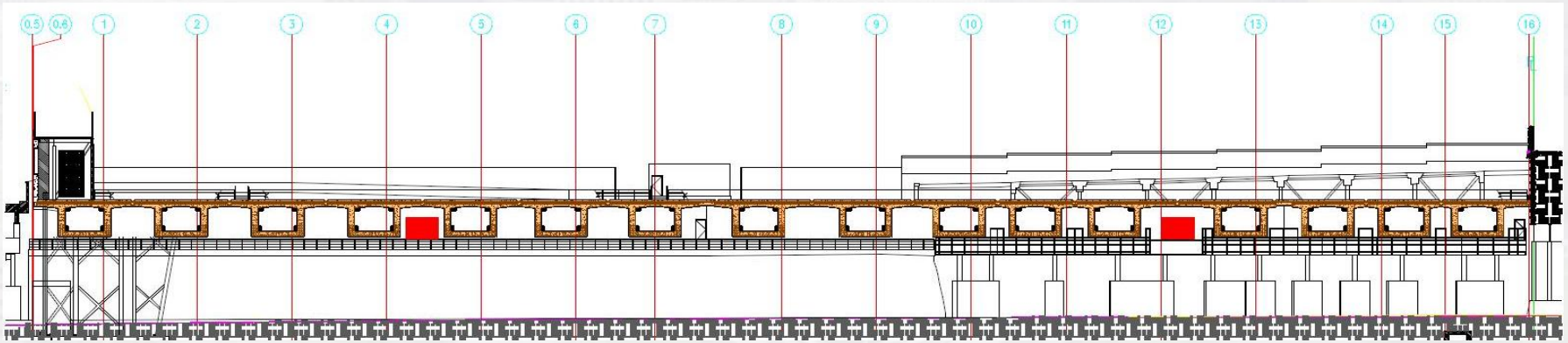
- **110,000 SQUARE FEET** OF SEGMENTAL PLATFORM
- 38 PRE-ENGINEERED **FUTURE COLUMN OPENINGS**
- **3 UNITS** SEPARATED BY MOVEMENT JOINTS
- **NOTCH** FOR FUTURE BUILDING
- 6" STRUCTURAL SLAB
- DUAL PURPOSE AS **FIRE VENTILATION** SYSTEM
- STRADDLES CATENARY STRUCTURES
- SUB LEVEL FOR **PLAZA**



Design Features



- **16 GIRDERS**, SIDE BY SIDE – 480' TOTAL WIDTH
- **11'-6" DEPTH** PLUS 6" CIP STRUCTURAL SLAB
- **240' SIMPLE SPAN**, 2400 TONS/GIRDER
- **9500 PSI** CONCRETE
- **100 TONS** OF POST-TENSIONING PER GIRDER
- **20 x 37-STRAND** & **14 X 31-STRAND** TENDONS

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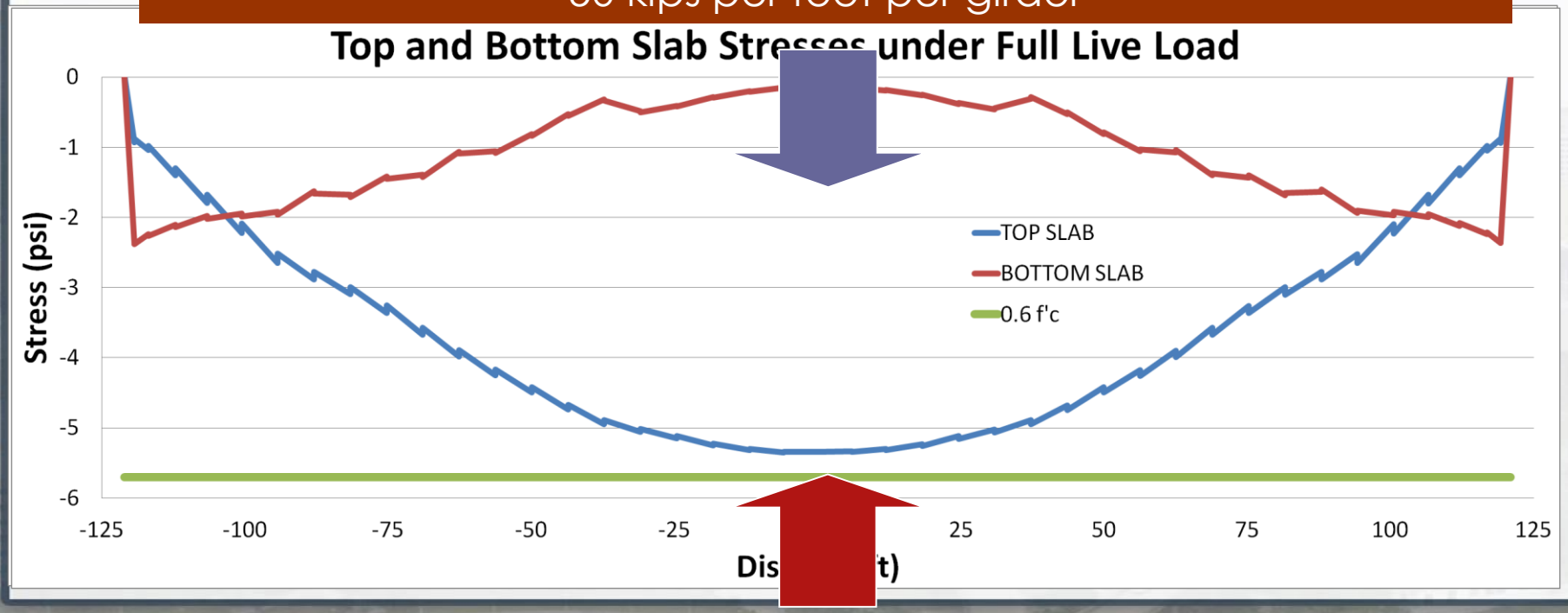
Design Challenges

COMPRESSIVE STRESS LIMITS:

- **5600 psi COMPRESSION** IN BOTTOM SLAB DURING CONSTRUCTION
- COUNTERWEIGHT DURING POST-TENSIONING & GROUTING
- **5500 psi COMPRESSION** IN TOP SLAB WITH FULL LIVE LOAD
- **NEAR ZERO COMPRESSION** IN BOTTOM SLAB WITH FULL LIVE LOAD

50 kips per foot per girder



Design Challenges

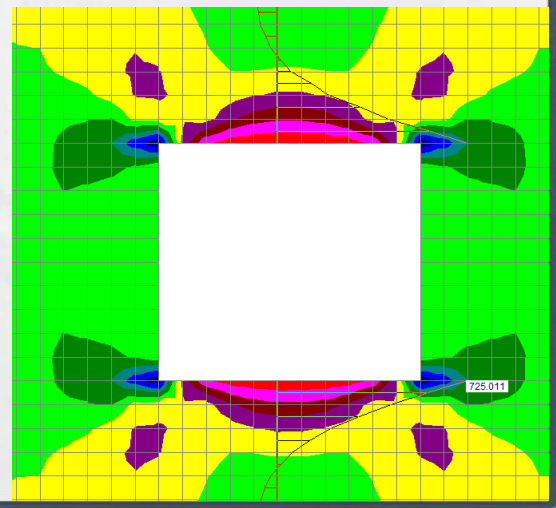
END ANCHOR SEGMENT INTEGRATION:

- **4'-2"** LONG, **56 TON** SEGMENT
- 20 x 37-STRAND ANCHORS
- 6 x 31-STRAND ANCHORS
- 4 x 7-STRAND TRANSVERSE TENDONS
- 12 x 1.25" DIA PERMANENT PT BARS
- 8 x 3" DIA BARS FOR LIFTING
- BEARING RECESS
- **9000 LBS** (350 lbs/CY) REBAR
- **OVER 200** FORM-SAVERS / T-HEADS

Design Challenges

FUTURE COLUMN OPENINGS:

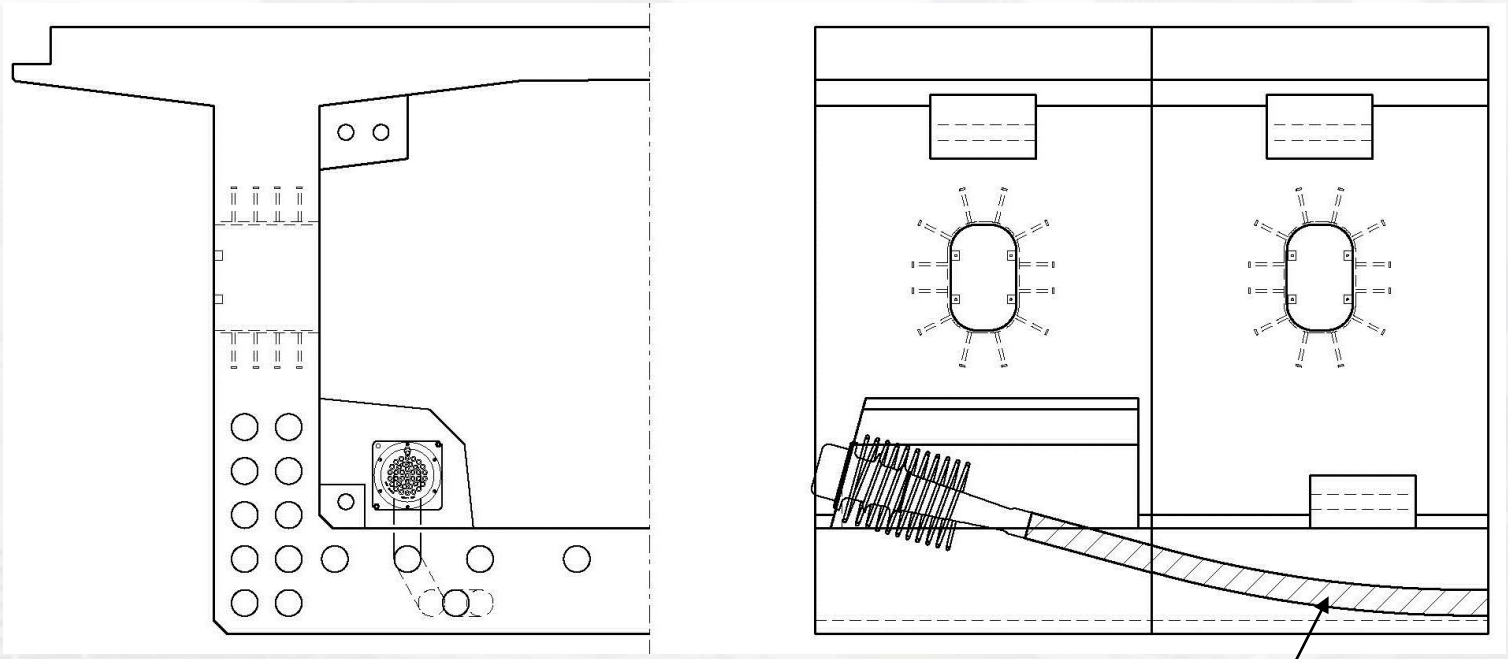
- EXTREME COMPRESSION IN TOP SLAB
- **5' X 5'** CLEAR OPENINGS FOR COLUMNS
- ALIGNED WITH CLOSURES BETWEEN GIRDERS
- 1.5" STEEL PLATE WITH NELSON STUDS
- PLATES **SPLICED** ACROSS SEGMENT JOINTS
- **12 - #9 BARS** TO RESIST SPLITTING
- MECHANICAL BAR-LOCK COUPLERS
- FULL-PEN FIELD WELDS
- DEBRIS PLATE
- TOLERANCE



Design Challenges

BOTTOM TENDON ANCHORAGES:

- **31-STRAND** TENDONS ANCHORED IN **6' LONG** SEGMENTS
- ANCHOR IN ONE SEGMENT AND DEVIATE IN THE NEXT
- **20' DIA** BEND RADIUS USING **TIGHT-RADIUS PLASTIC DUCT**

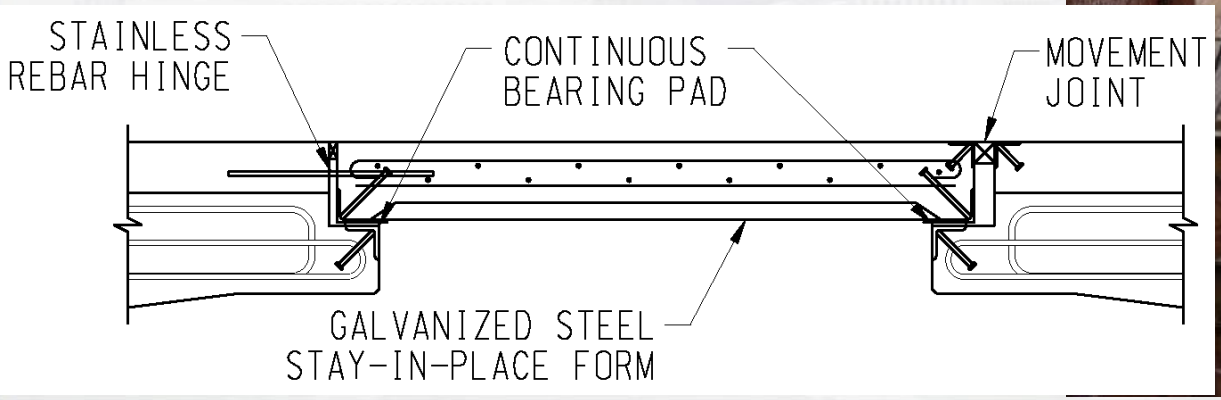


TIGHT RADIUS PLASTIC DUCT

Design Challenges

MOVEMENT JOINTS:

- +/- 3" DIFFERENTIAL DEFLECTION
- +/- 3½" LONGITUDINAL MOVEMENT
- +/- 1 ½" LATERAL MOVEMENT
- STAY-IN-PLACE DECK FORMS
- CAST-IN ANGLE ARMORING
- ELASTOMERIC BEARING WITH TEFLON & STAINLESS SLIDING SURFACE
- FIRE BREAK



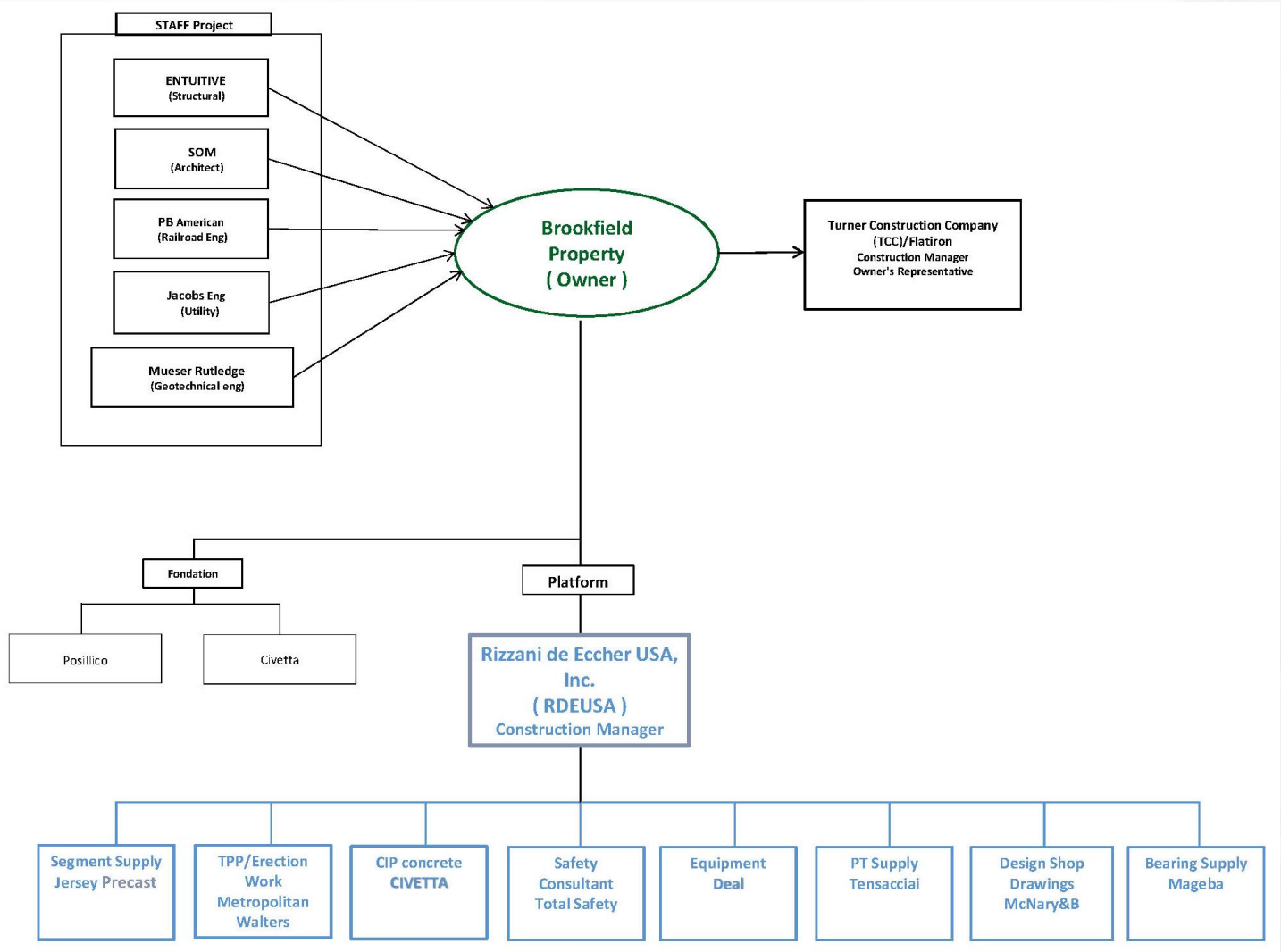
Construction Management

All the work on site has been **subcontracted** to **local** companies

MANAGEMENT ROLE:

- Provide **the know-how** and **technical support** for the execution of **segmental works**
- Ensure the **highest standard of quality** in all the operations

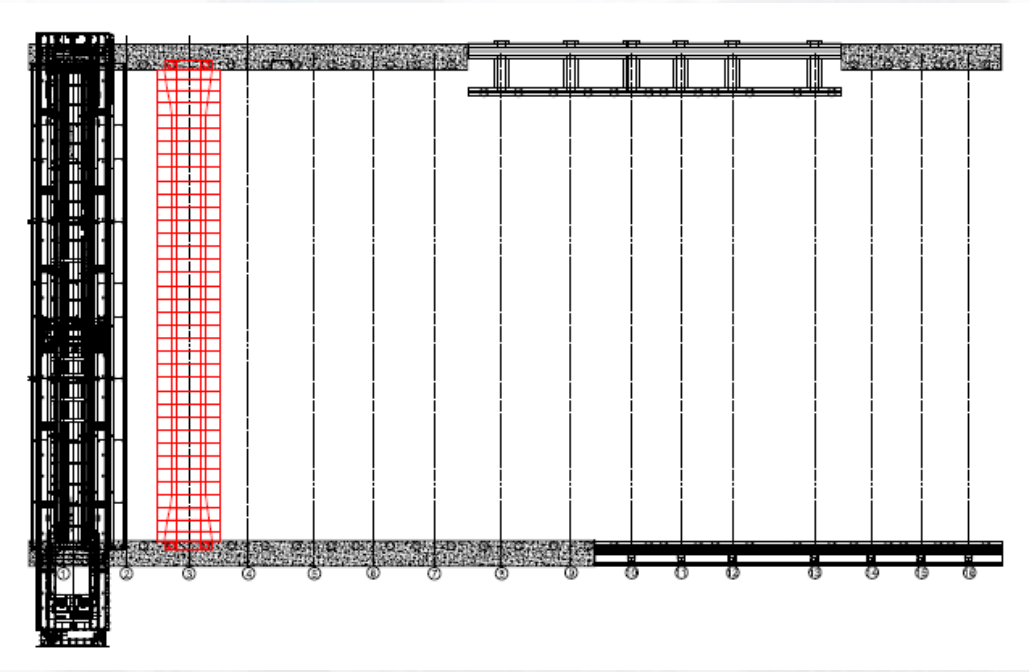
Key stake holders



- **DEAL** is the designer and manufacturer of all the specialized equipment
- **TENSA** is supplying all the material, equipment and supervision for PT and grouting operations
- **McNARY BERGERON** is the Engineer of Record
- Platform erection in partnership with **METROPOLITAN WALTERS**
- **JOHN CIVETTA & Sons** is providing all cast in place operations

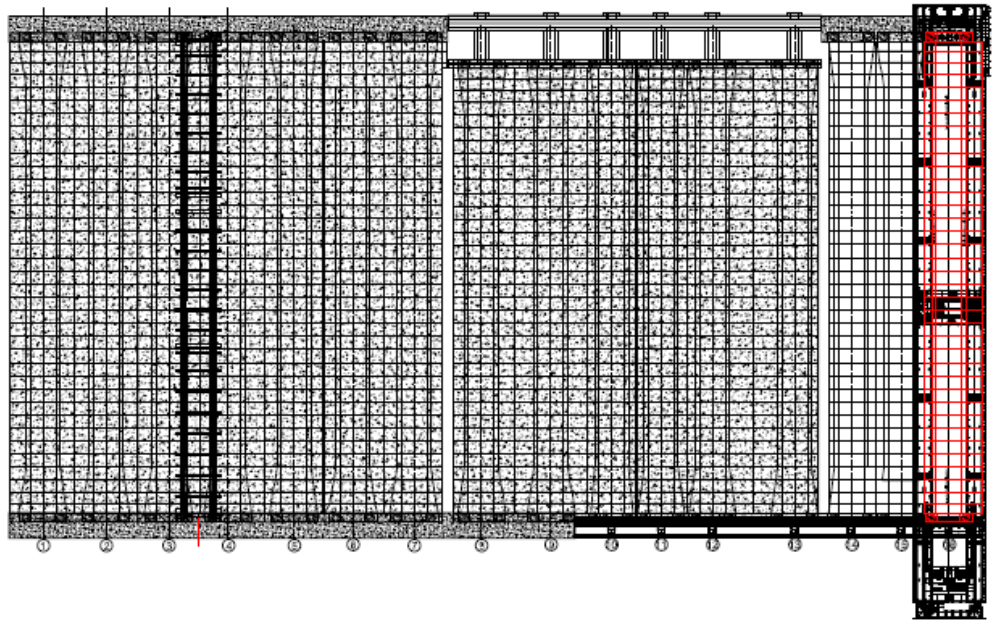
Construction Sequence

1. Precast Operations
2. Temporary Protection Platform installation (Only column touch down at track level!)
3. Launching Gantry & Straddle Carrier Assembly
4. Span 3 & 4 assembly over TPP



Construction Sequence

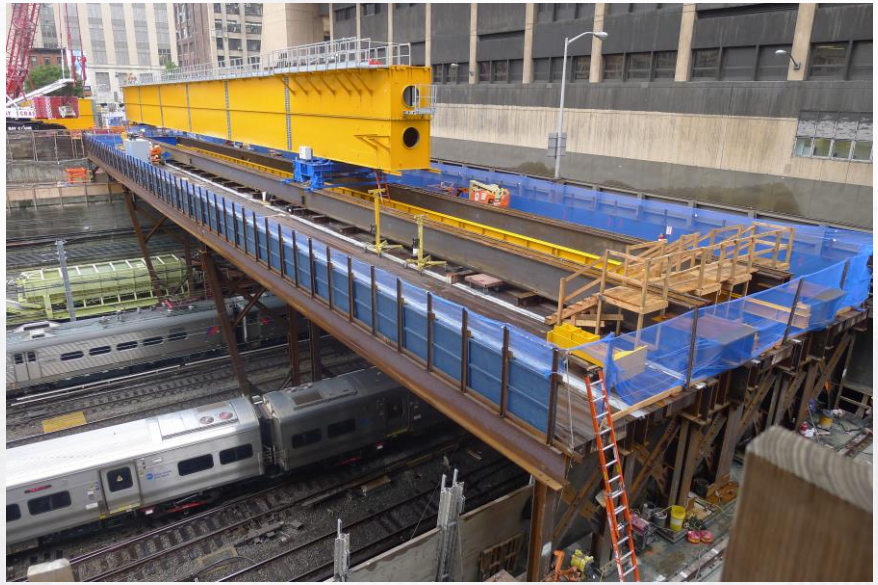
5. Top Slab and Diaphragm Cast in Place
6. Relocation of underslung bed over Span 3&4
7. Removal of TPP
8. Erection of remaining Spans and Completion of Cast in Place



Precast operation

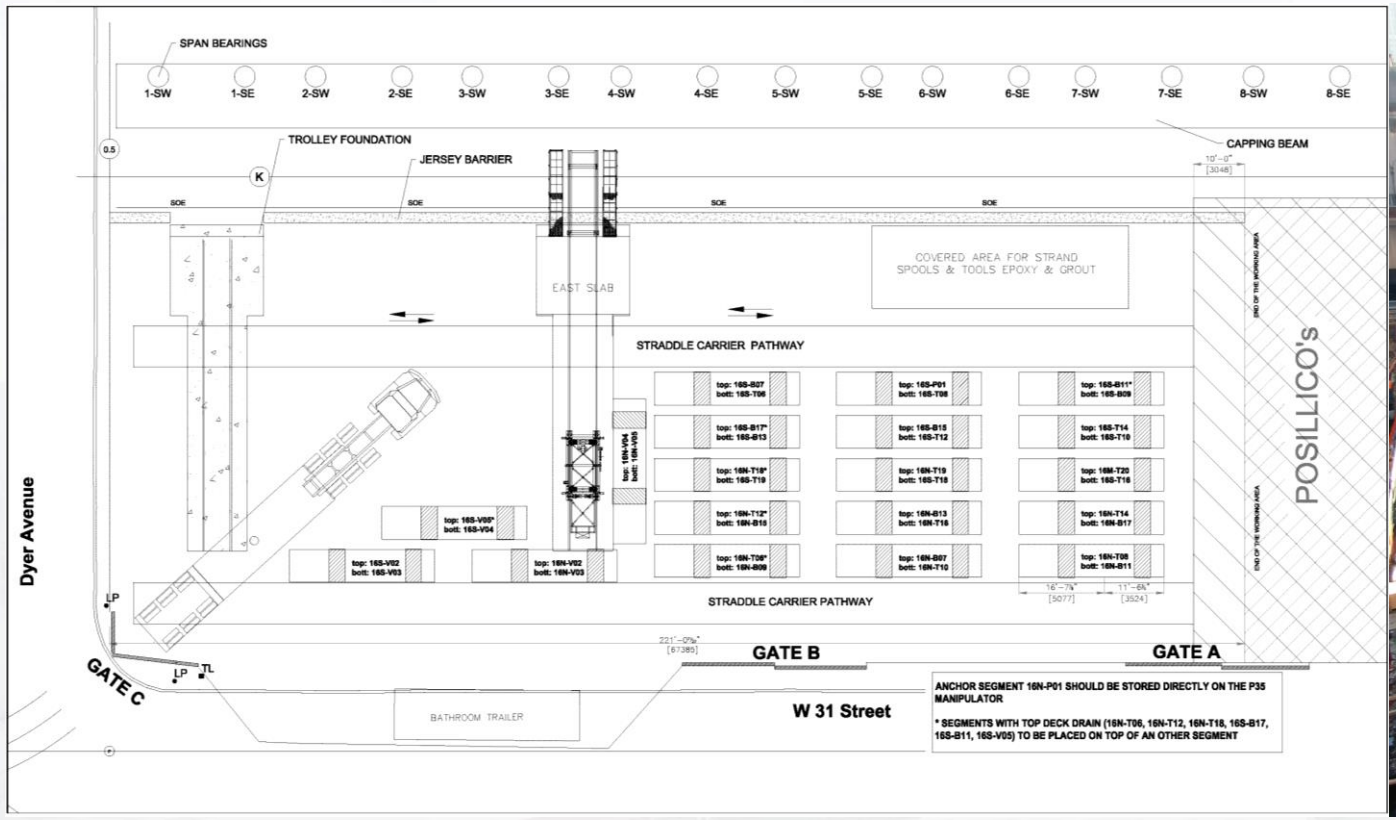
- **Precast operations** subcontracted to **JERSEY PRECAST**
- **Permanent supervision by RdE** at the manufacturing plant
- **Molds and geometry control** provided by **DEAL**

Temporary Protection Platform



- Provided initial protection for the railway tracks
- Served as underslung bed for LG assembly, and Span 3 & 4 erection

Erection Site Layout



- Up to **39 segments** stored in a **6,100 square feet yard**(145'x42')
- New York Real Estate..! → **Tight spaces** for material handling

Winch Gantry & Underslung System

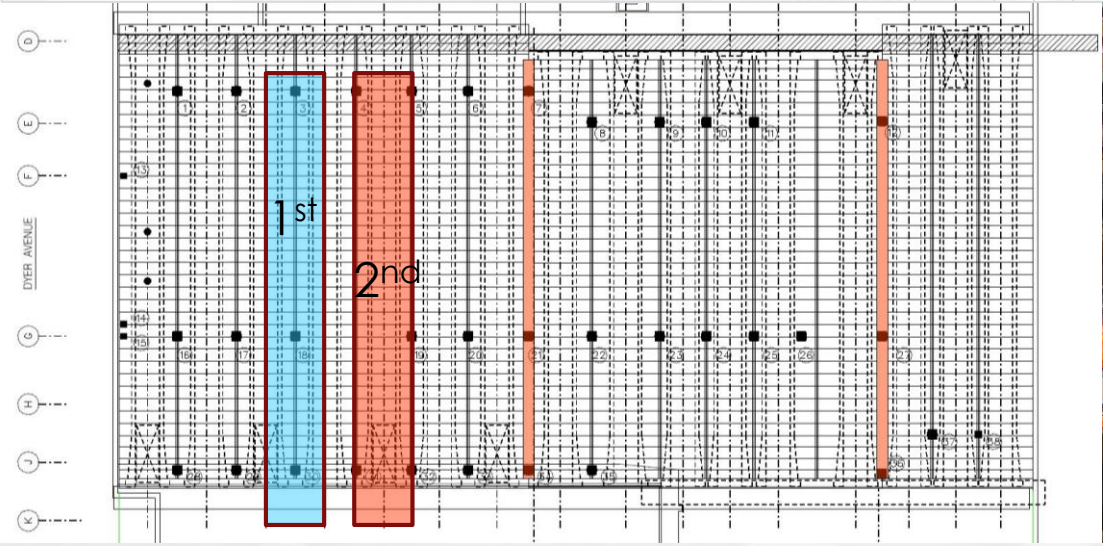
- Picks up segments by means of the **C-hook**
- **Places segments** on top of the underslung equipment
- **Each segment** temporary seats **on 3 screw jacks**

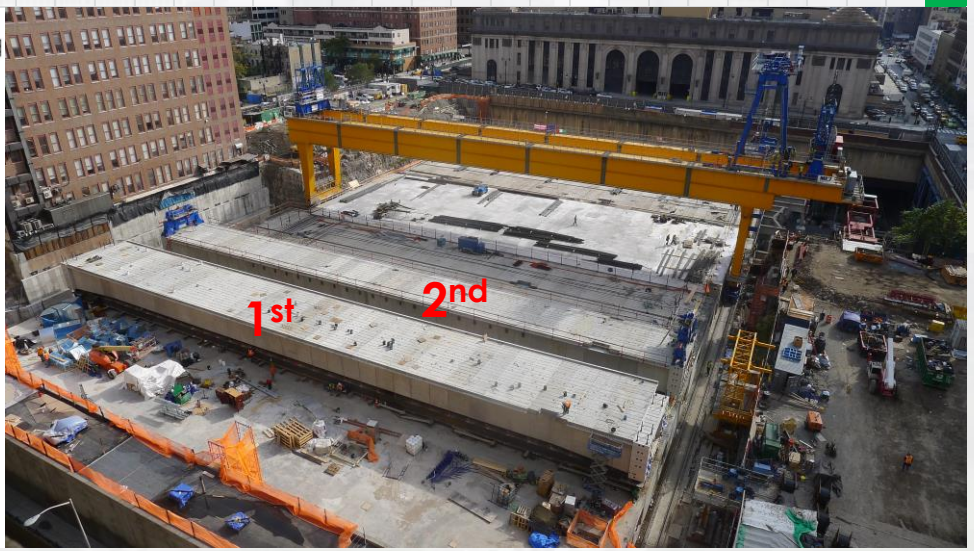
Launching Girder

- LG movement speed **10 ft / min**
- Span Lowering speed: **0.5 ft / min**
- **Lowering system** with hydraulic cylinder – pin – slotted bars system
- **3600t SWL**

Typical Span Assembly Sequence

Segment Loading of Span “n” on the underslung
Epoxy & 1st stage PT
Relocation of the Span “n” to the secondary stage area
Secondary stage PT & Grouting on Span “n”
Erection of Span “n”
Segment Loading of Span “n+1” on the underslung
Epoxy & 1st stage PT
Relocation of the Span “n” to the secondary stage area
Secondary stage PT & Grouting on Span “n+1”
Erection of Span “n+1”



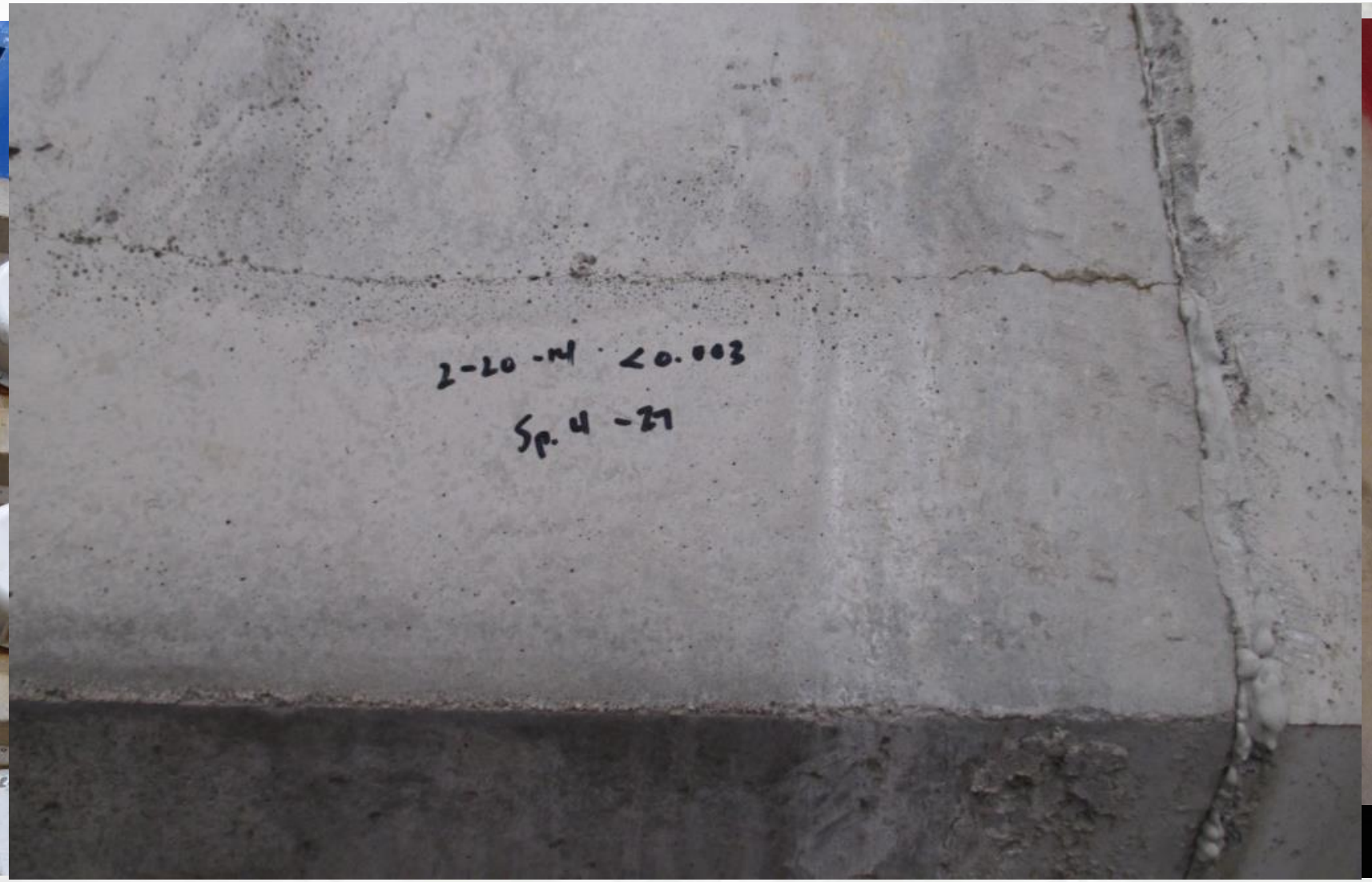


Cast in place

- All the deck is covered with a **6” CIP slab**
- CIP in between pier segments to create **3 solid structures**

Span Relocation and Load Test

The Ugly Photos



First Girder Snow Load Test

Advantages → the new frontier of the real estate development!

- **Minimal disruption** of railway traffic
- Precast concrete to allow a **100 years** design life
- Solution **customizable** to many different urban sites

- Combination of top down and precast **speeds up construction operations**
- **Fast and versatile** way of creating Real Estate

Thank you for your attention!

QUESTIONS?

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www.tensaamerica.com