9th Avenue, West Manhattan project, New York City (NY)

-

the erection and post-tensioning of the platform deck

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Brief project description

Location: 9th Avenue, between 33rd and 31st street, Manhattan, NYC

Close to Penn Station, the busiest railway station in the US, with more than 1,400 trains daily going to the north east of the country

15 railroad tracks

(Amtrak, LIRR, NJ transit)

occupy more than 60% of the jobsite

Brief project description

Towers position is slightly overlapping with tracks → Foundations will be partially positioned between railroad tracks

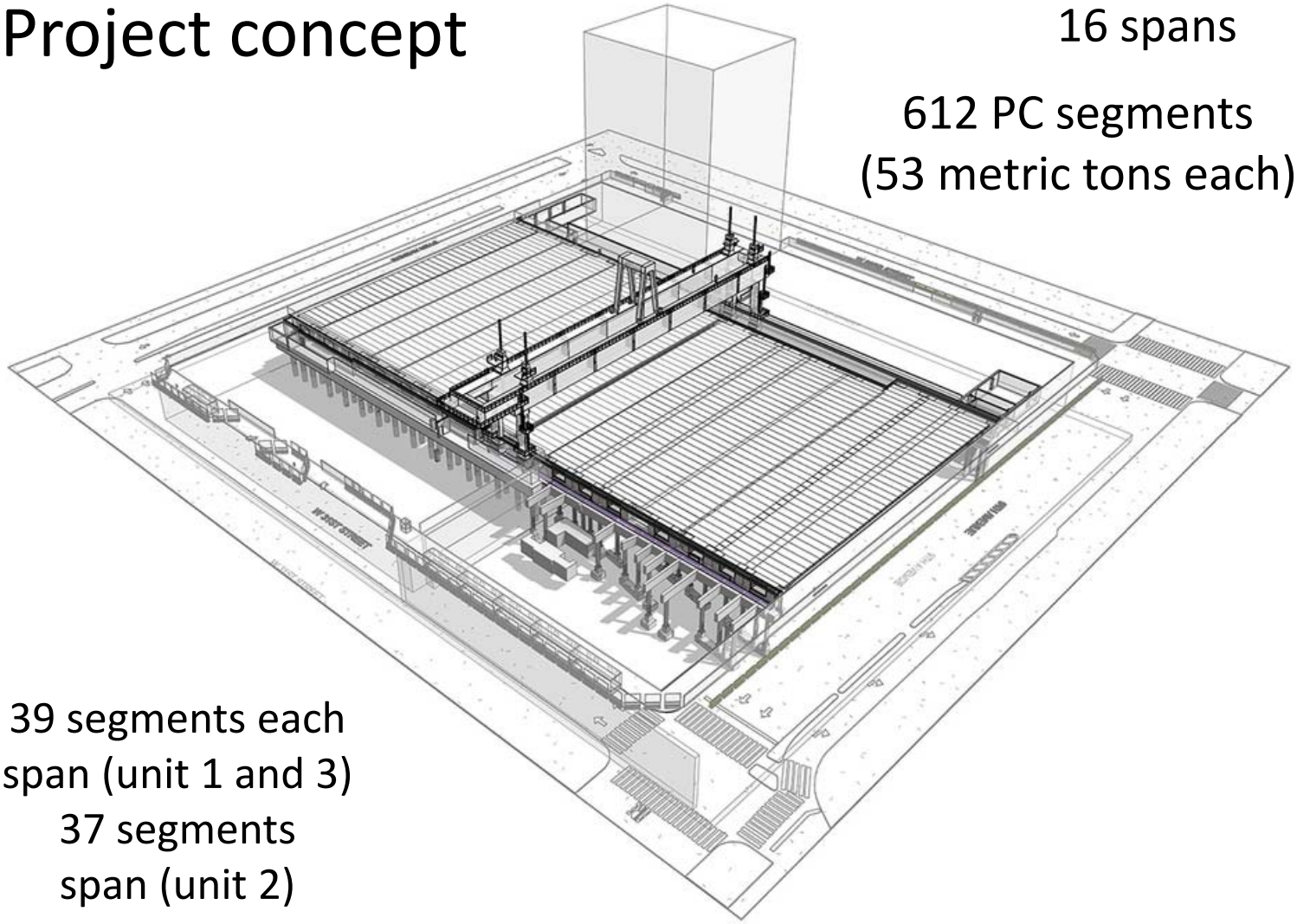
To allow towers erection, it has been necessary to create a complete platform covering and protecting the railroad tracks.

Rendering of completed project

Project concept

16 spans

612 PC segments
(53 metric tons each)



39 segments each
span (unit 1 and 3)
37 segments
span (unit 2)

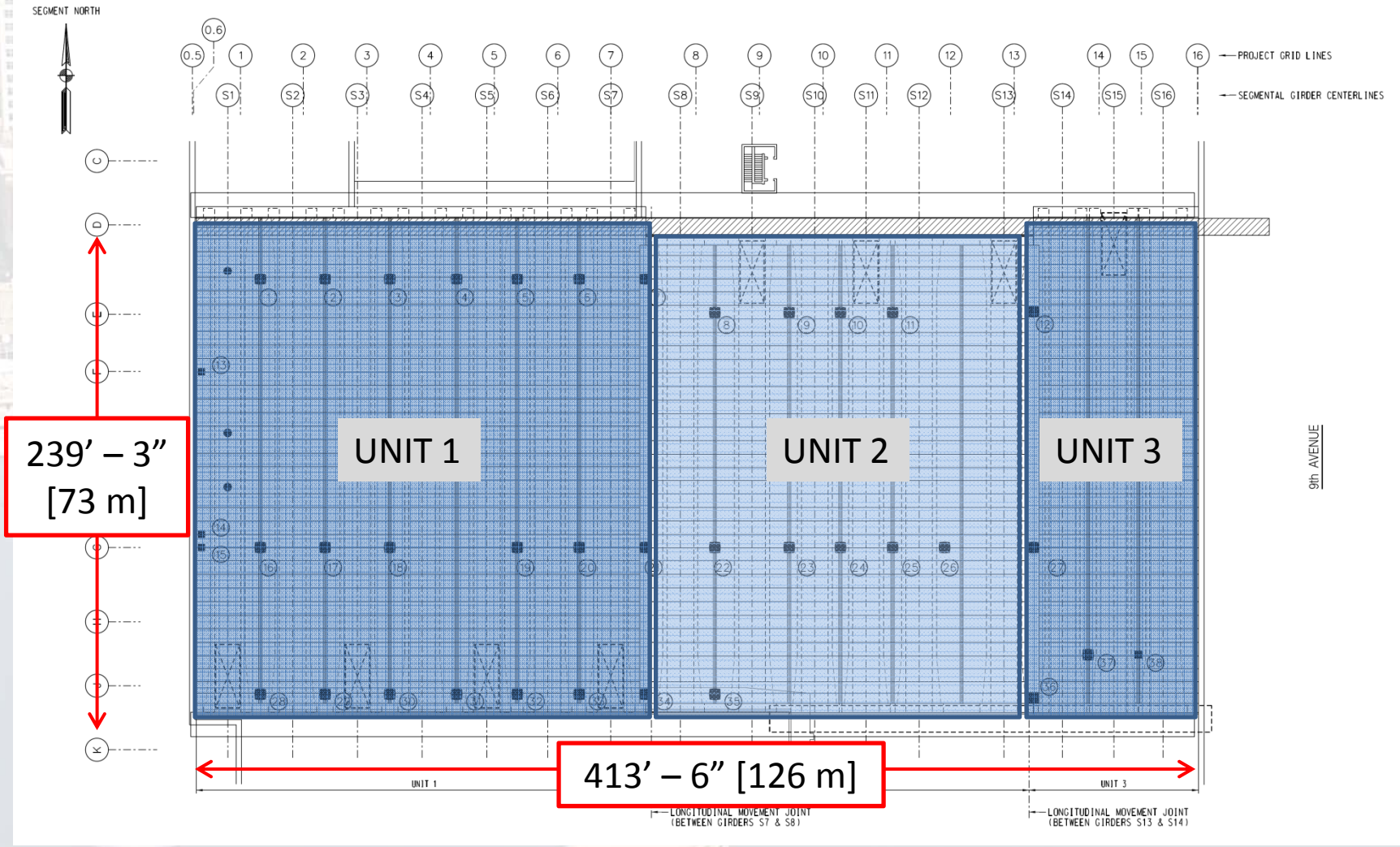
Project concept

Segments' reduced weight depending on transport limitation within Manhattan, being the precast yard in New Jersey and on limited space availability in the jobsite

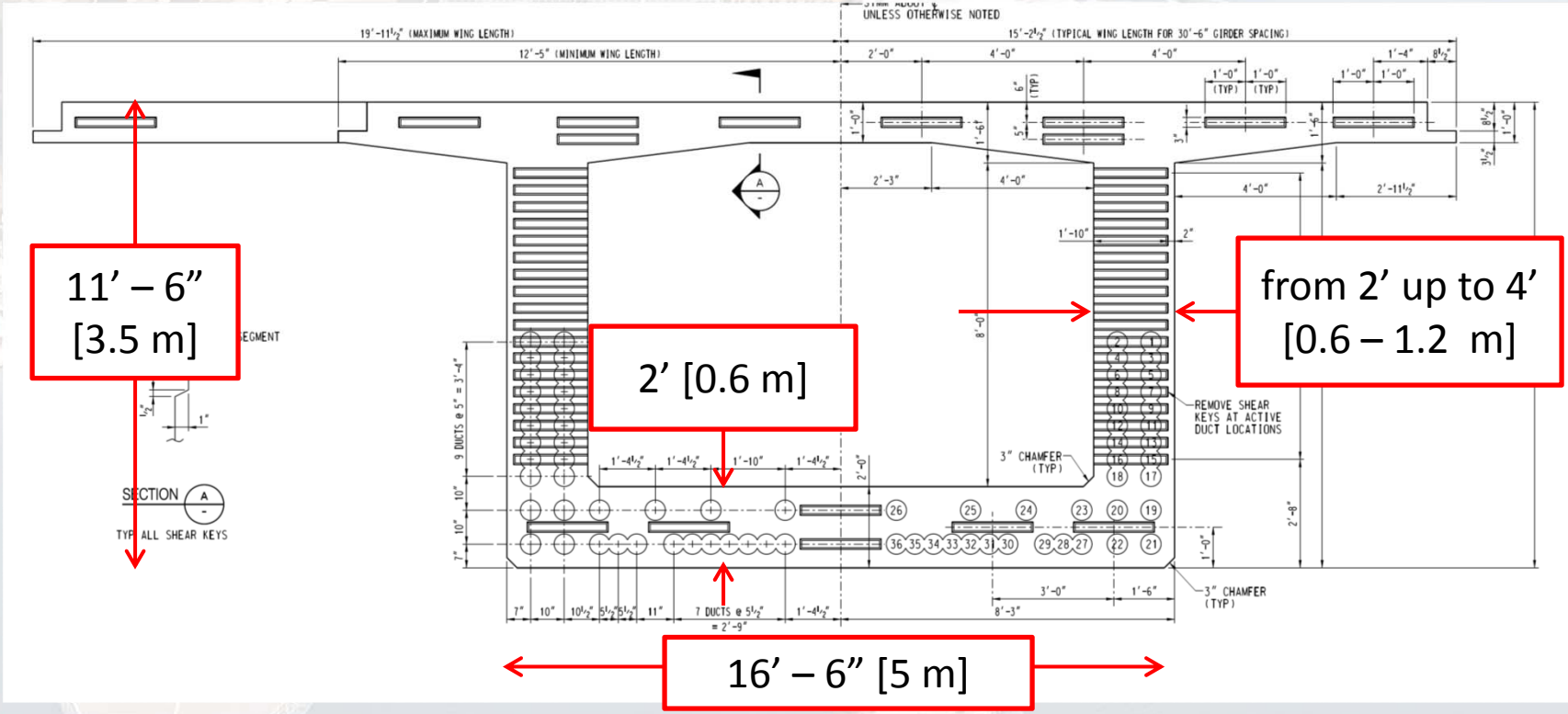
Each span has about 90 MT of post-tensioning and weights about 2,200 MT

PT ratio 3 times higher than any similar project

Project design – key plan



Project design – cross section



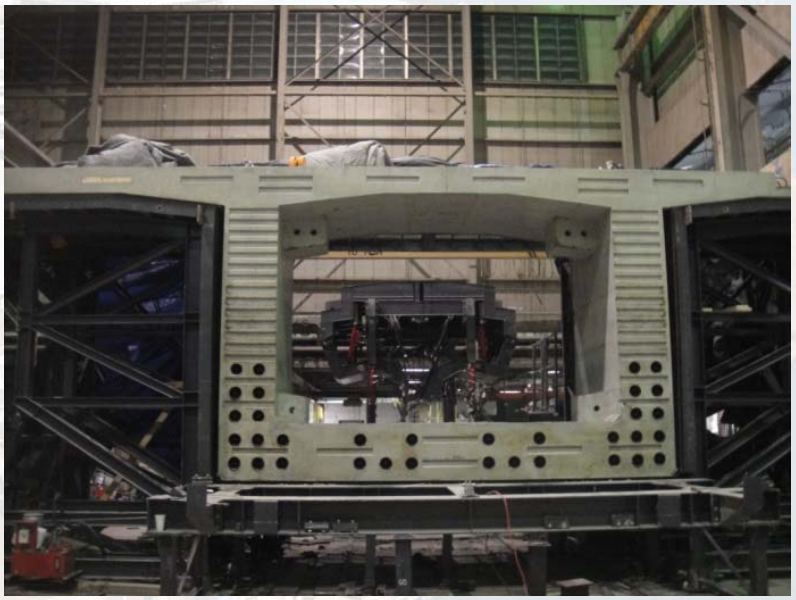
Typical mid-span cross section

Prefabrication

Segments' prefabrication made in
New Jersey with
No. 3 moulds for typical segments
No.1 for end segments

"short line" method

Segments moved to site with
special flat bed trucks.



Assembly and Erection

Segments temporarily placed in jobsite area,

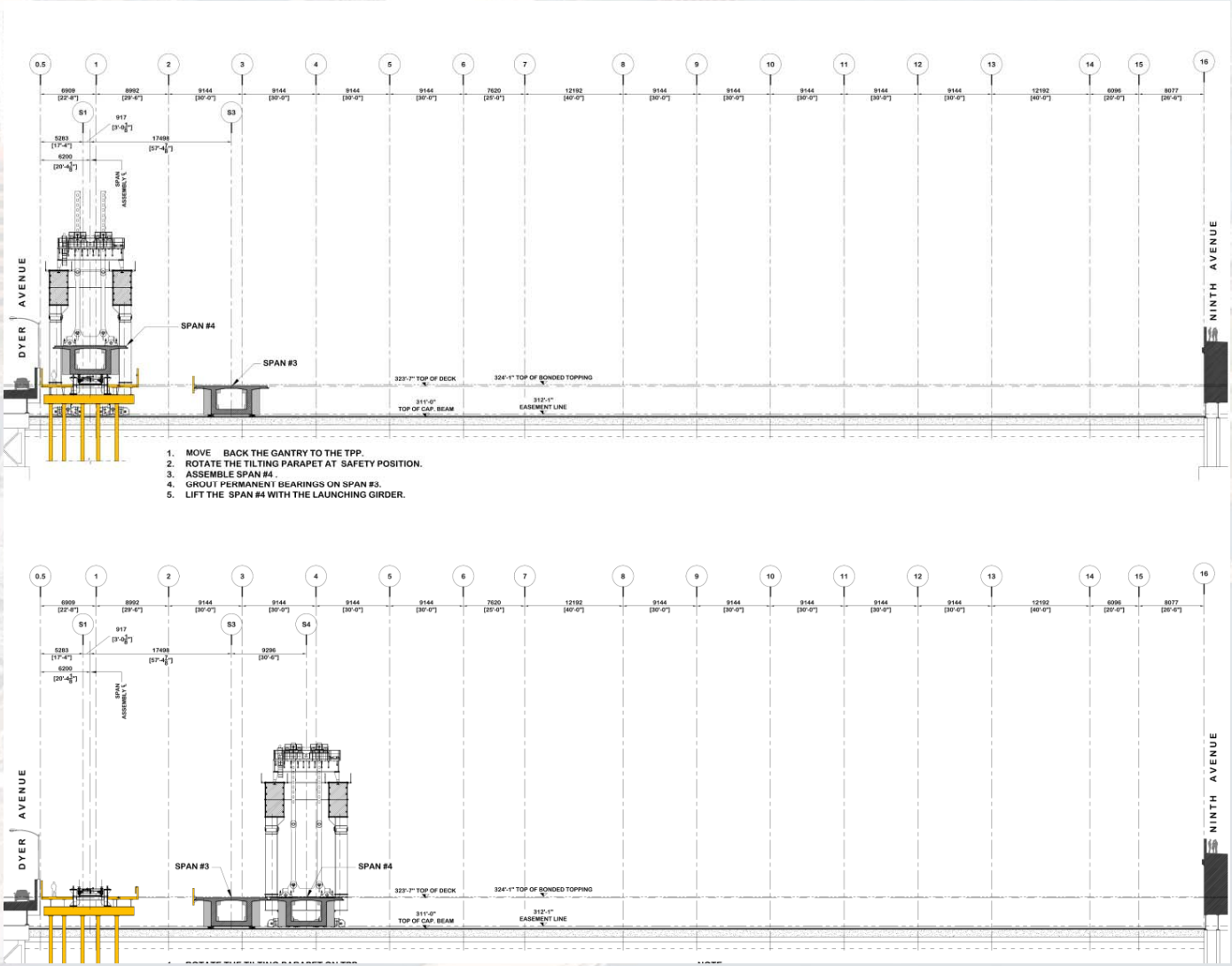
moved close to launching girder with a straddle carrier,

placed into position over TPP,

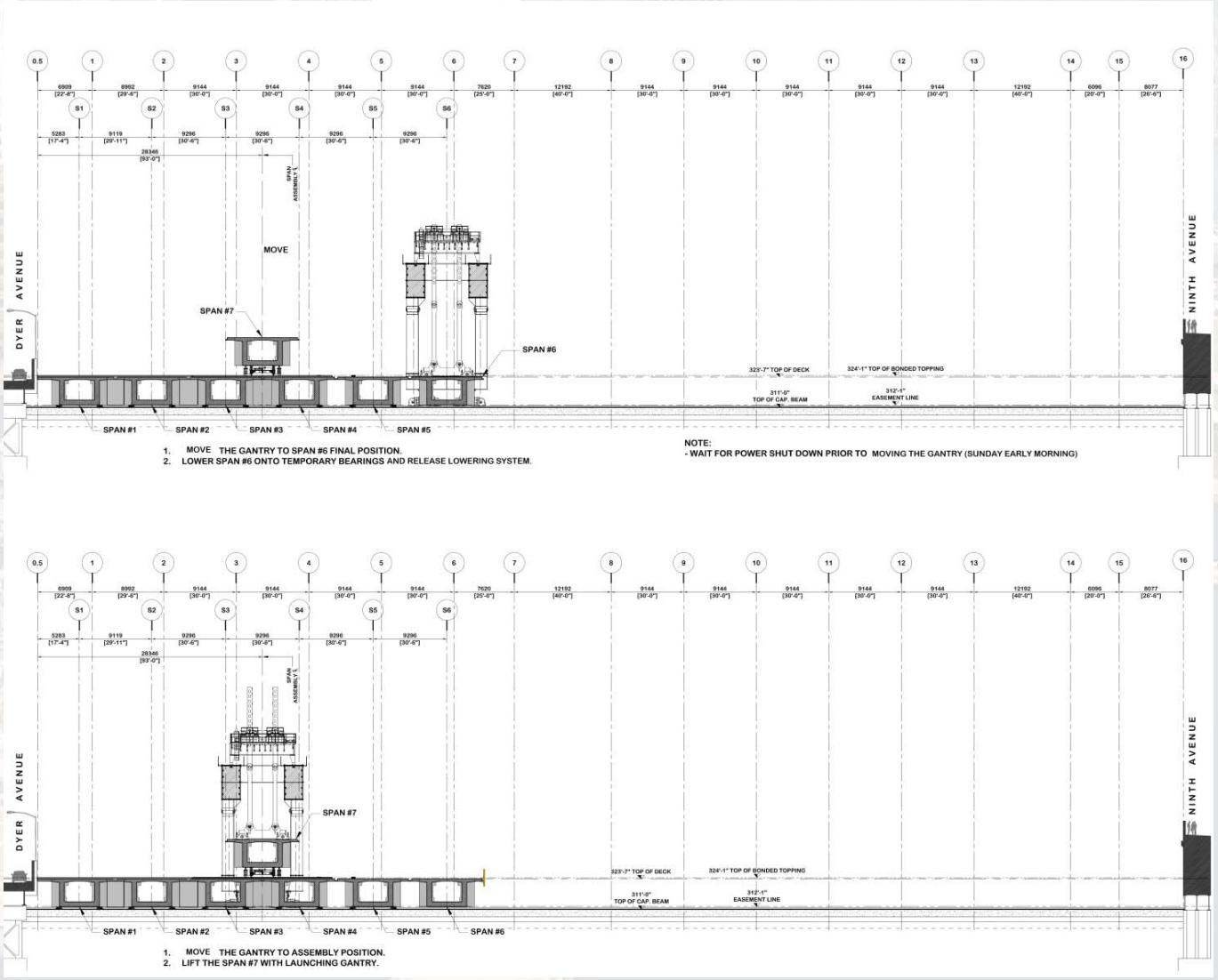
stitched with resin and post-tensioned,

span placed into final position

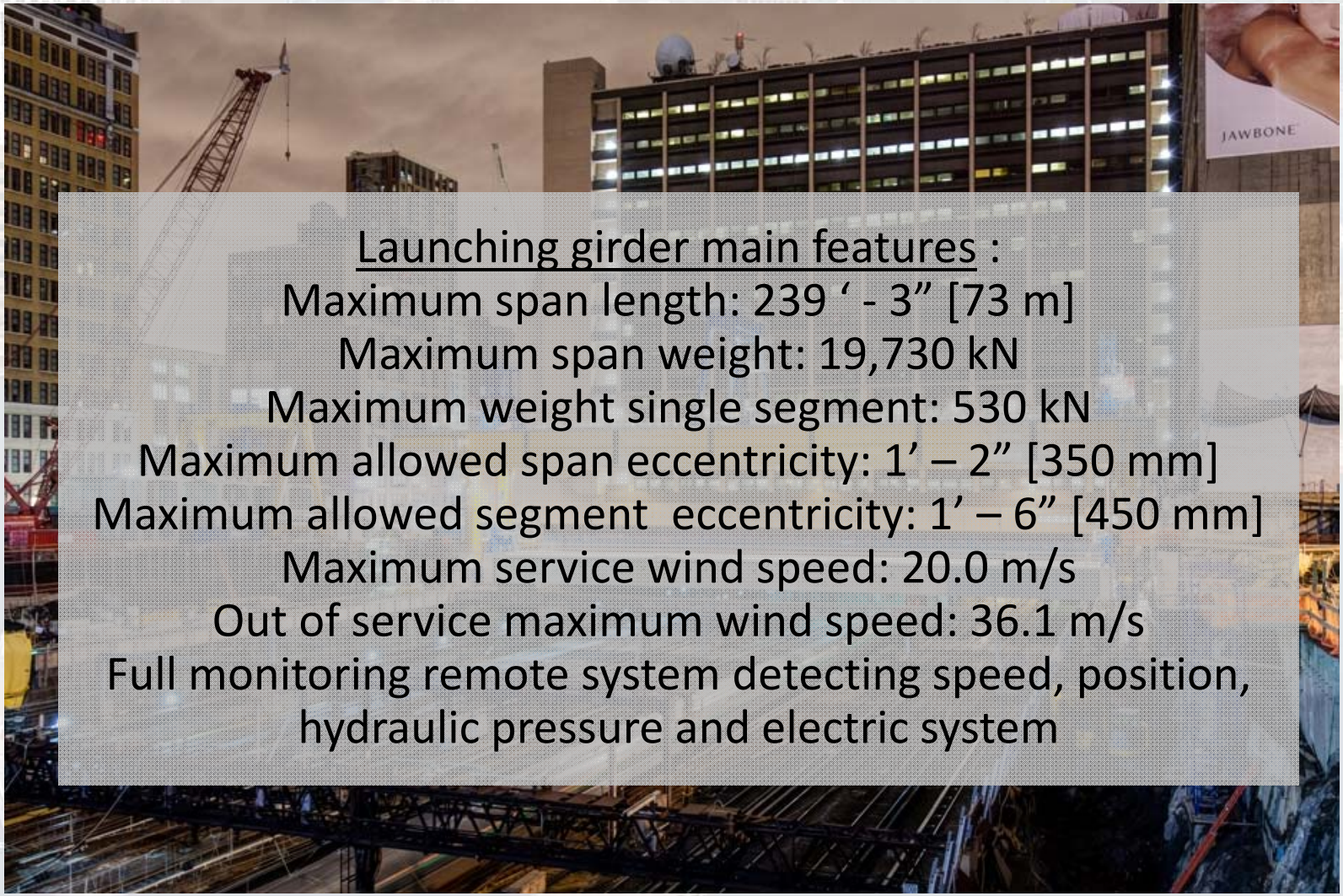
Erection



Erection


DYER AVENUE
NINTH AVENUE
MOVE
SPAN #7
SPAN #6
SPAN #1
SPAN #2
SPAN #3
SPAN #4
SPAN #5
323'-7" TOP OF DECK
324'-1" TOP OF BONDED TOPPING
311'-0" TOP OF CAP. BEAM
312'-1" EASEMENT LINE
1. MOVE THE GANTRY TO SPAN #6 FINAL POSITION.
2. LOWER SPAN #6 ONTO TEMPORARY BEARINGS AND RELEASE LOWERING SYSTEM.
NOTE:
- WAIT FOR POWER SHUT DOWN PRIOR TO MOVING THE GANTRY (SUNDAY EARLY MORNING)
DYER AVENUE
NINTH AVENUE
SPAN #7
SPAN #1
SPAN #2
SPAN #3
SPAN #4
SPAN #5
SPAN #6
323'-7" TOP OF DECK
324'-1" TOP OF BONDED TOPPING
311'-0" TOP OF CAP. BEAM
312'-1" EASEMENT LINE
1. MOVE THE GANTRY TO ASSEMBLY POSITION.
2. LIFT THE SPAN #7 WITH LAUNCHING GANTRY.

Erection



Launching girder main features :

Maximum span length: 239 ‘ - 3” [73 m]

Maximum span weight: 19,730 kN

Maximum weight single segment: 530 kN

Maximum allowed span eccentricity: 1’ – 2” [350 mm]

Maximum allowed segment eccentricity: 1’ – 6” [450 mm]

Maximum service wind speed: 20.0 m/s

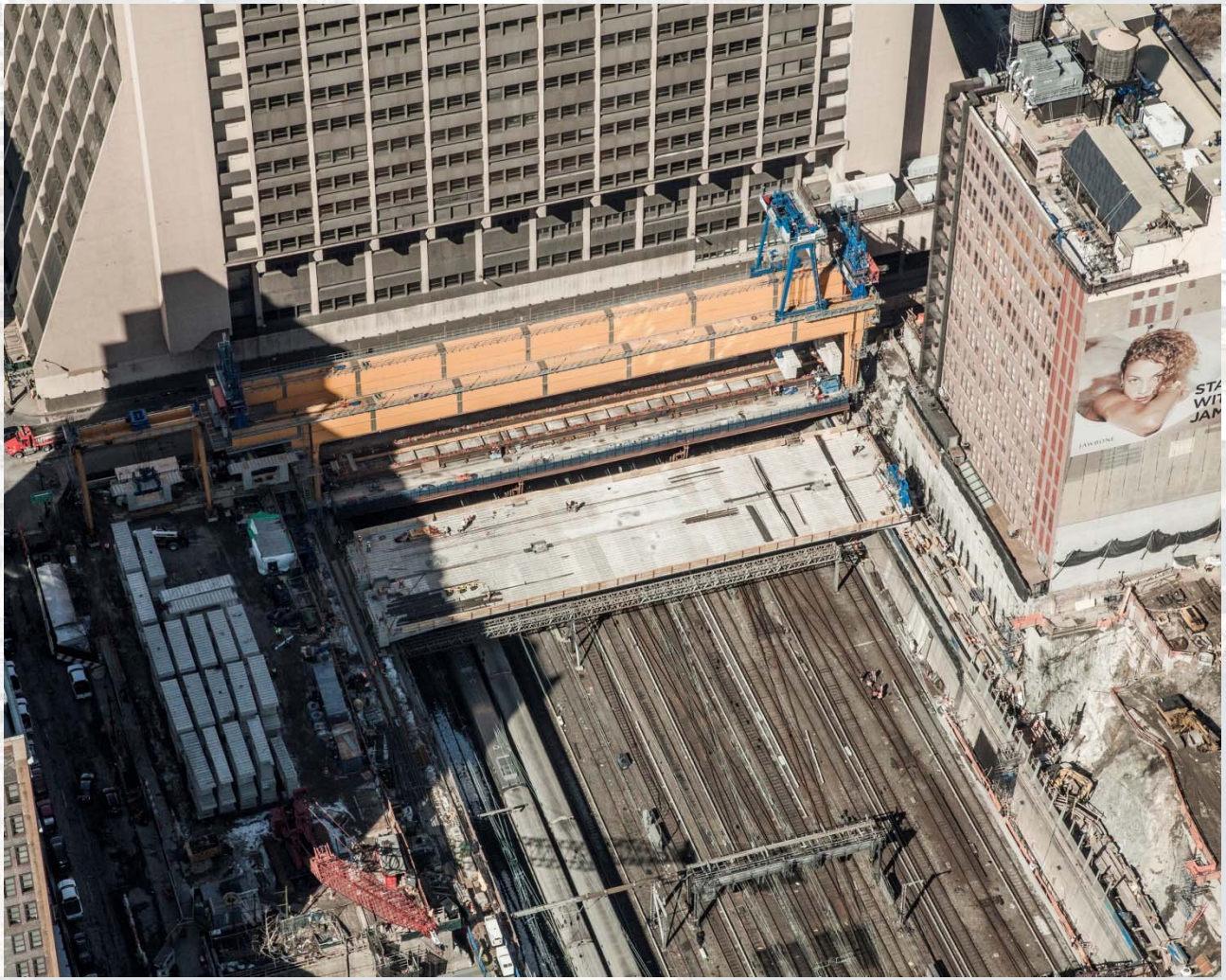
Out of service maximum wind speed: 36.1 m/s

Full monitoring remote system detecting speed, position, hydraulic pressure and electric system

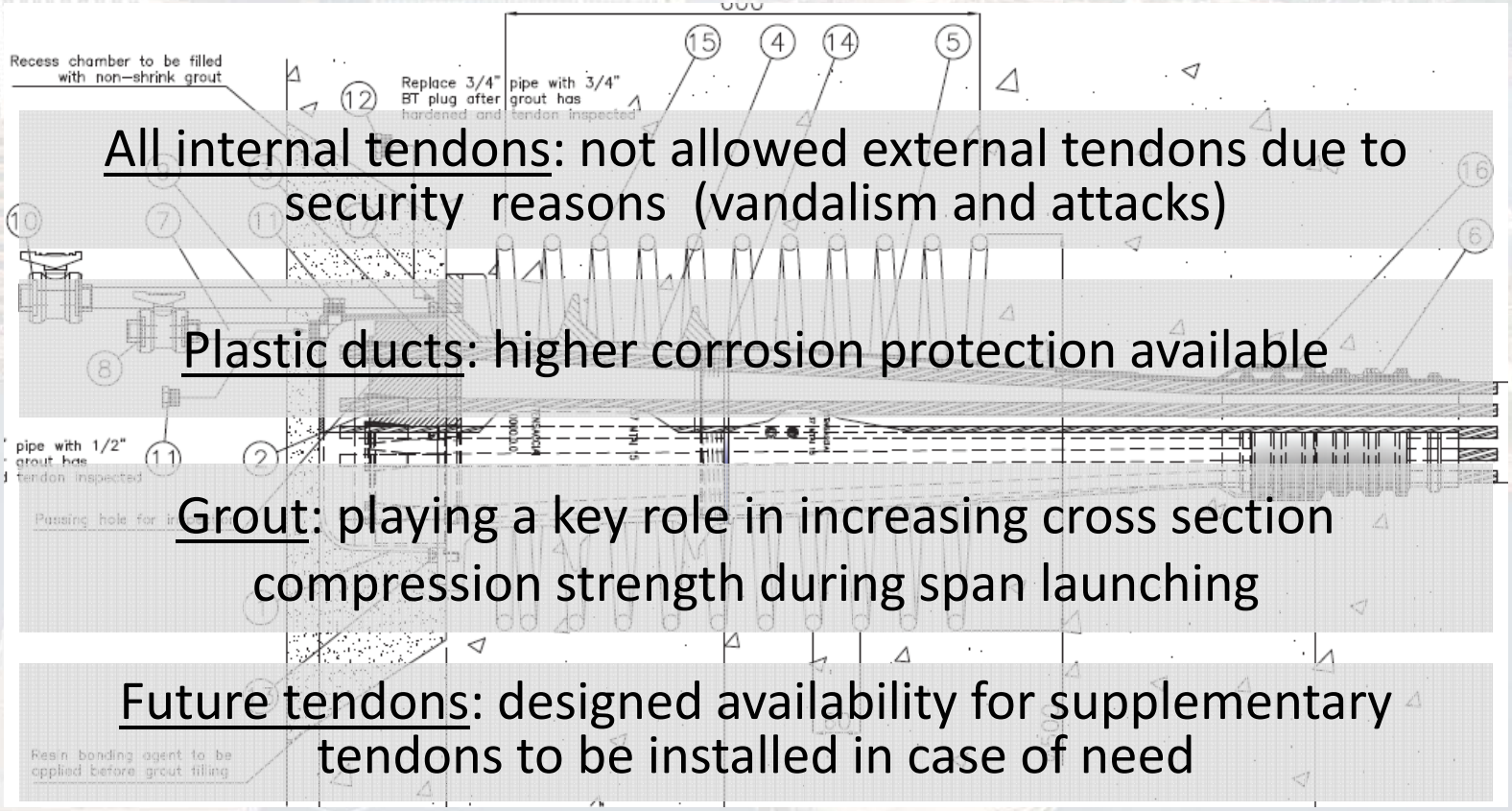
Erection

Erection

Erection



Post-tensioning – design features



<u>All internal tendons</u>: not allowed external tendons due to security reasons (vandalism and attacks)

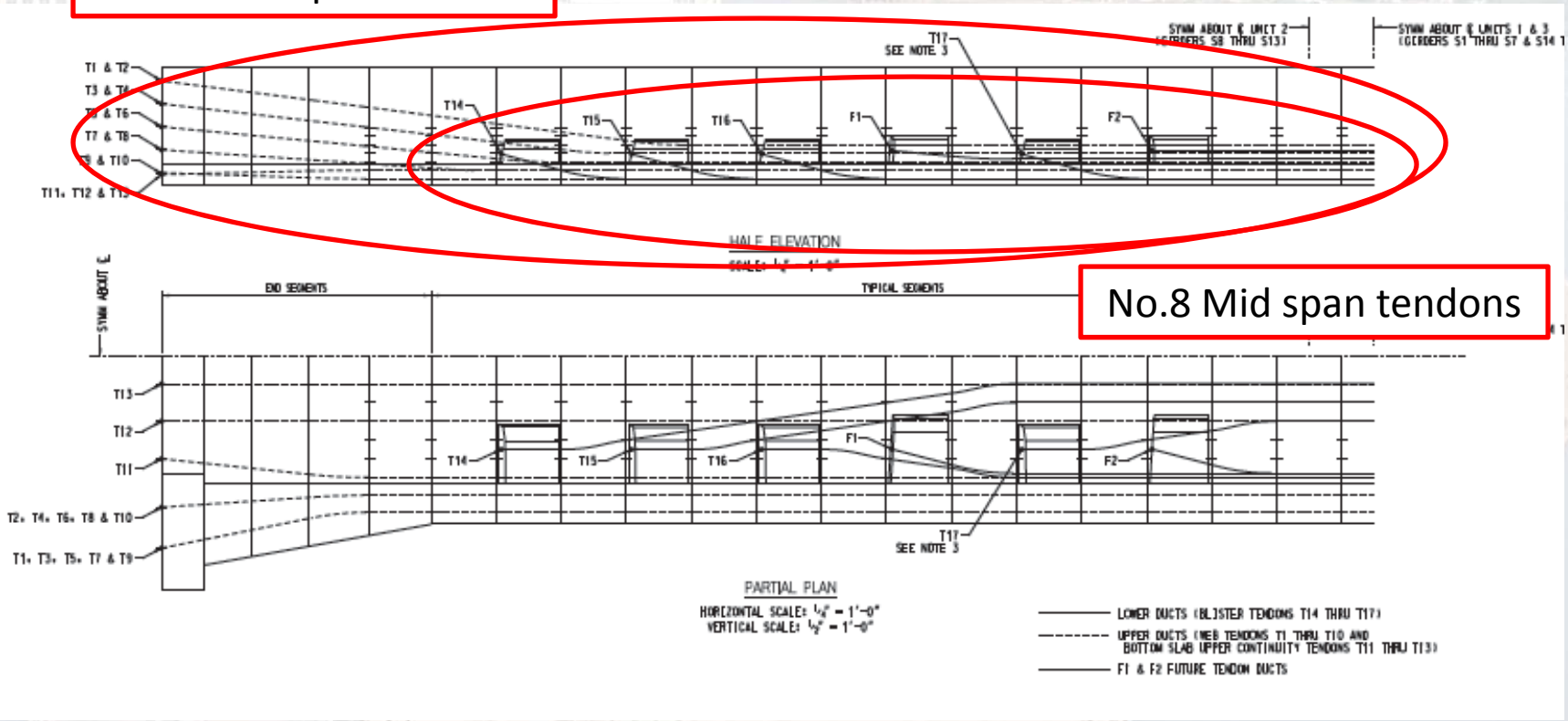
<u>Plastic ducts</u>: higher corrosion protection available

<u>Grout</u>: playing a key role in increasing cross section compression strength during span launching

<u>Future tendons</u>: designed availability for supplementary tendons to be installed in case of need

Post-tensioning - tendons

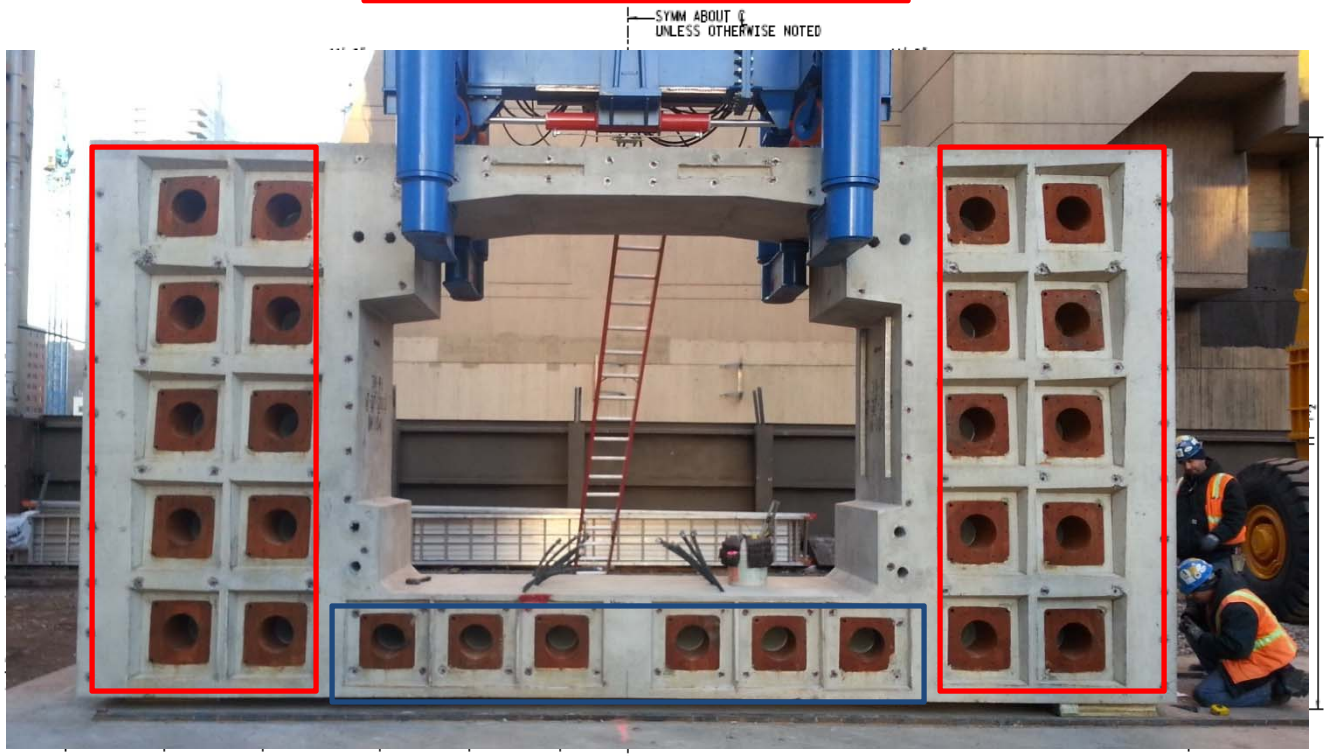
No. 26 Full span tendons



No.8 Mid span tendons

Post-tensioning - tendons

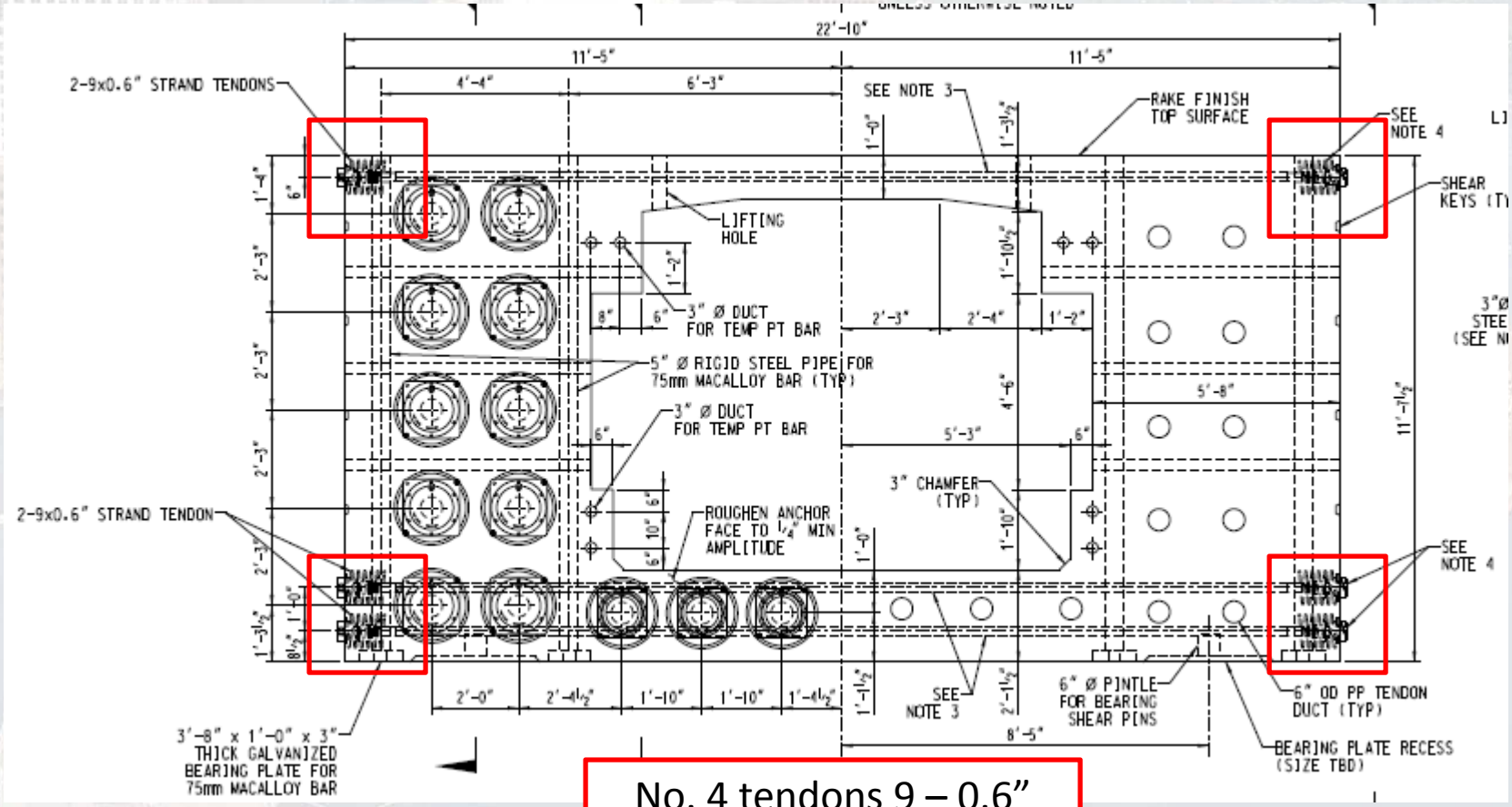
No. 20 tendons 37 – 0.6”



No. 6 tendons 31 – 0.6”

Typical end span cross section

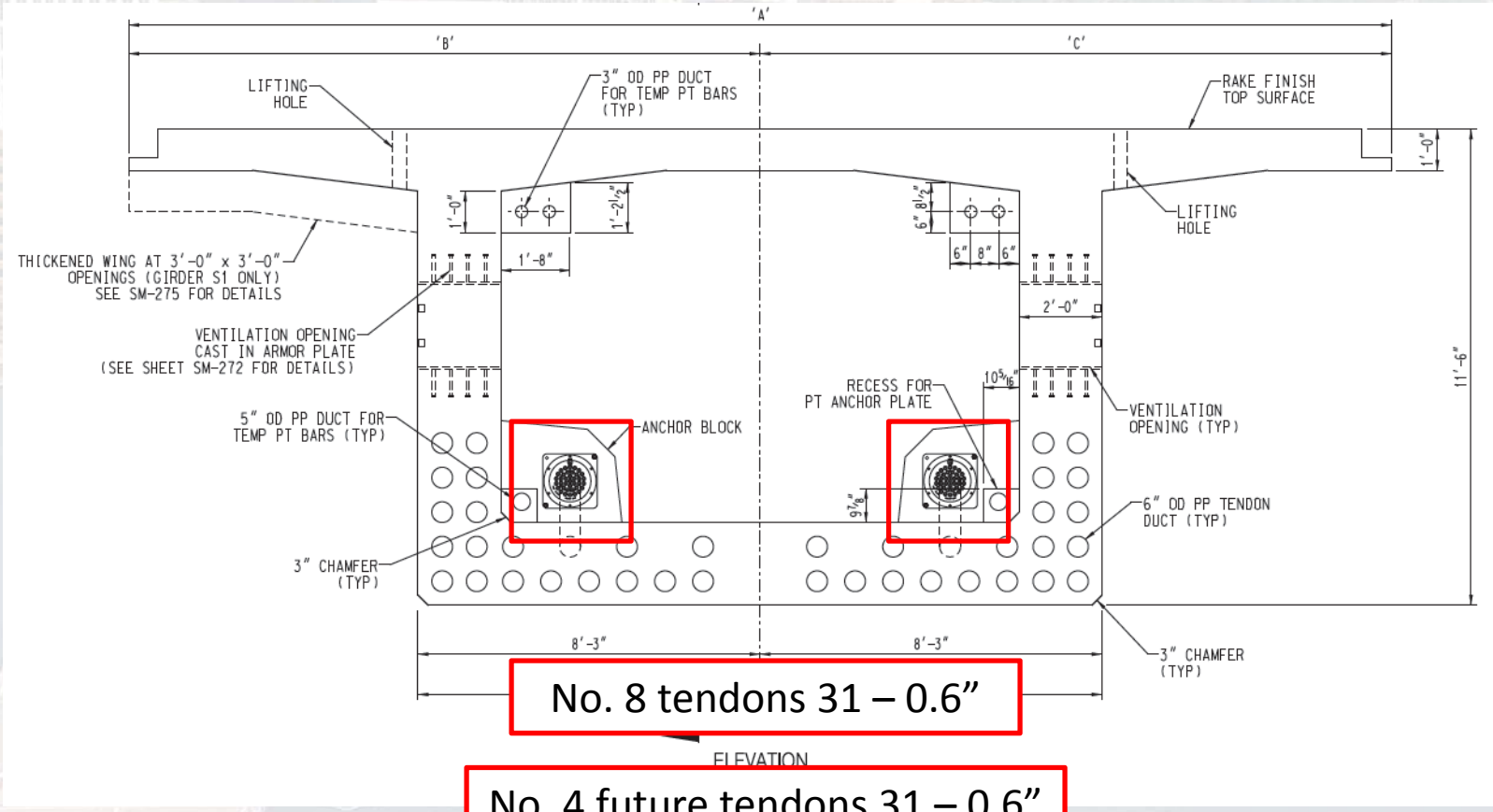
Post-tensioning - tendons



No. 4 tendons 9 – 0.6”

Typical end span cross section

Post-tensioning - tendons



Typical span cross section

Post-tensioning - testing

Load transfer test

(AASHTO LRFD Bridge Construction Specifications Paragraph 10.3.2.3 "Special anchorage device acceptance test")

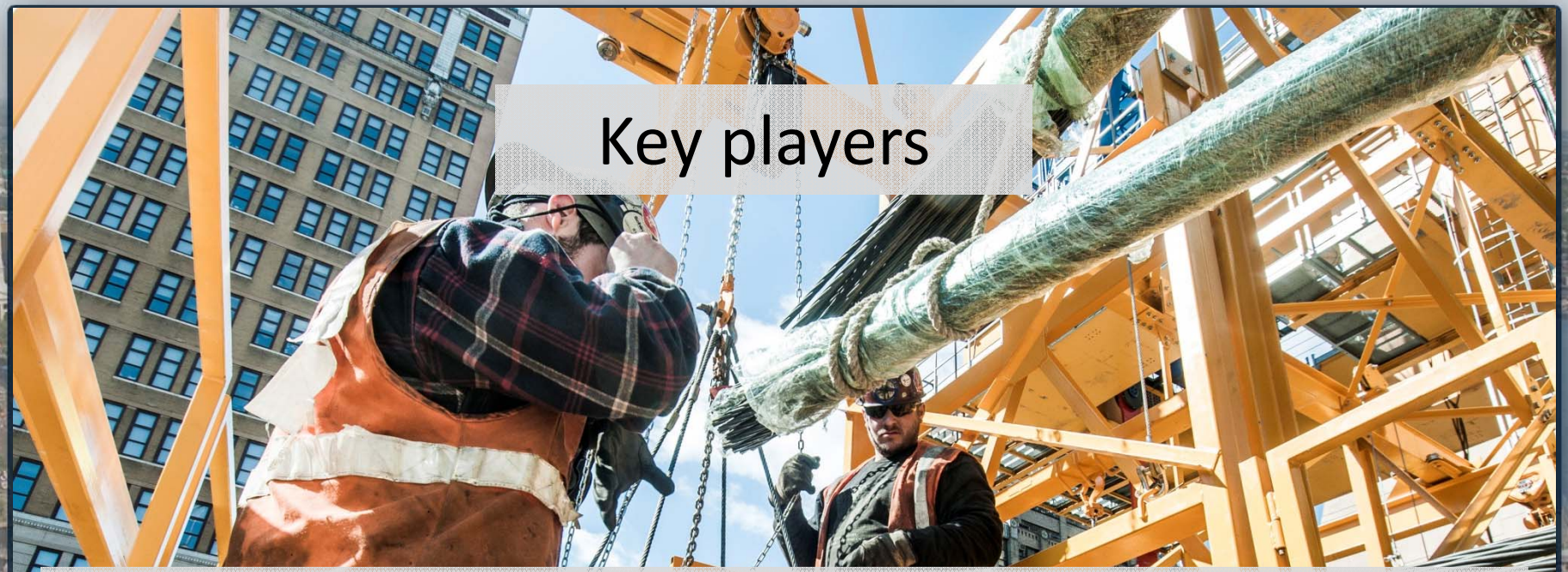
carried out in the University of Padova (Italy) over all anchorages used in the project (37MTAI15, 31MTAI15, 9MTAI15) with the same project details: concrete strength (9,500 psi) and same anchorage spacing.

Post-tensioning - testing

Load transfer test

All specimens over passed by far the minimum acceptance requirements
(cracks stabilization, minimum ultimate load at failure)

Key players



Client: Brookfield properties inc.
Architectural designer: SOM
Structural designer: Entuitive Corporation
Platform special structural designer: McNary Bergeron Associates
Construction Engineering: DEAL srl
Contractor: Rizzani De Eccher USA Inc.
Prefabrication and launching equipment: DEAL srl
Post-tensioning: Tensacciai srl