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

UNIT 1

UNIT 2

UNIT 3

239’ – 3” [73 m]

413’ – 6” [126 m]
Project design – cross section

11’ – 6” [3.5 m]

2’ [0.6 m]

16’ – 6” [5 m]

from 2’ up to 4’ [0.6 – 1.2 m]
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

1. Move the gantry to theropp.
2. Remove the tensioner at the safety position.
3. Assemble span in.
4. Unlock tensioner, spanning up span.
5. Lift the span in with the launching girder.
Erection

1. Move the gantry to span 1 initial position.
2. Lower span 1 onto temporary bearings and release lowering system.

Note: Wait for power shut down prior to moving the gantry (diagram is slightly blurry).
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
Post-tensioning – design features

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

Plastic ducts: higher corrosion protection available

Grout: playing a key role in increasing cross section compression strength during span launching

Future tendons: 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

No. 8 tendons 31 – 0.6”

No. 4 future tendons 31 – 0.6”

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