



Construction of the #7 Line Subway Extension Project New York

September 17, 2018

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AGENDA

- **Project Overview**
- **Project Budget**
- **Schedule Control**
- **Challenges & Lessons Learned**
- **Q&A**



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PROJECT OVERVIEW

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HOW IT STARTED...

- **Original proposal for Jets Stadium & NYC's 2010 Olympics bid, failed to receive approval**
- **Loss of 2010 Olympic bid turned into Urban Planning Adventure**



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HOW IT STARTED...

- **Rezoned into vibrant, transit-oriented, pedestrian-friendly, 50-million-SF, multipurpose district**
 - **Apartments & hotels**
 - **Offices**
 - **Cultural & community facilities**
 - **Public open space**

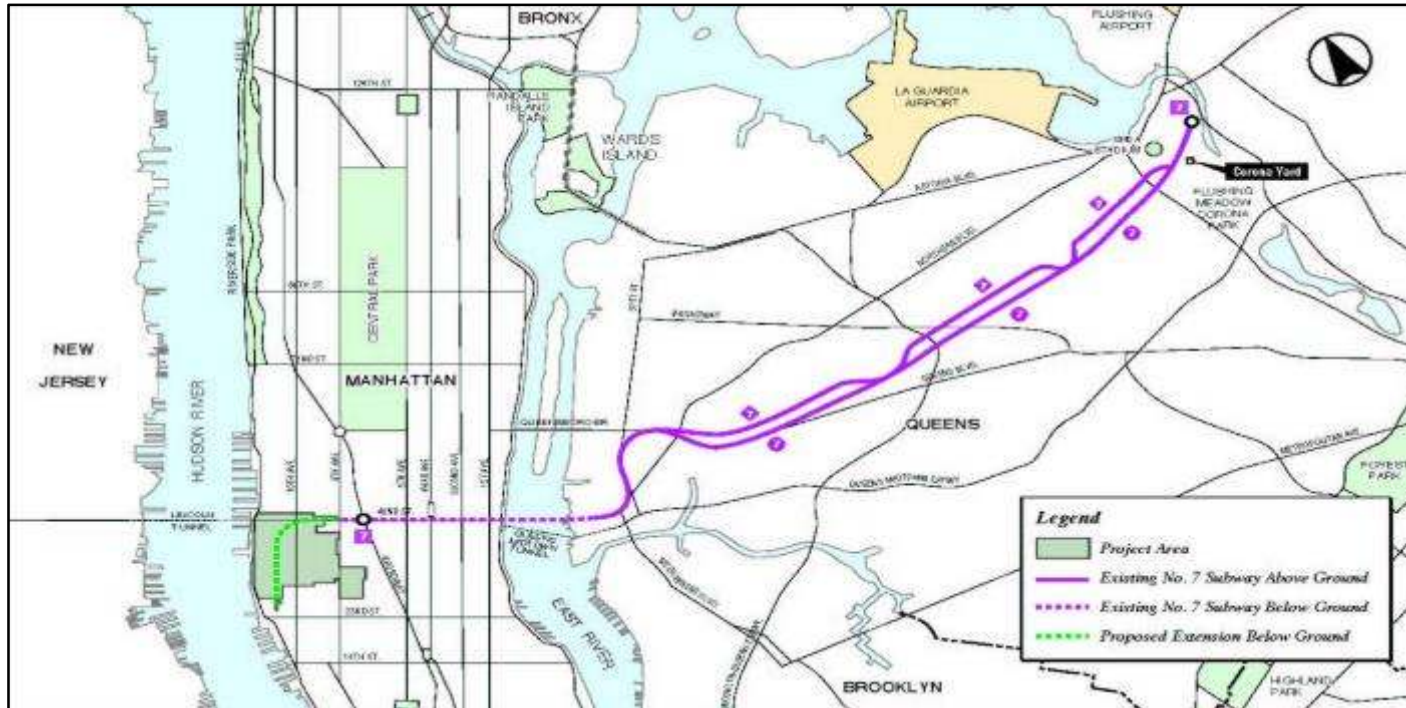


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PROJECT ALIGNMENT



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PROJECT ALIGNMENT



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NO. 7 LINE SUBWAY – PROJECT FACTS

- **1.5 miles of tunnels**
 - **Terminal at 11th Ave & 34th Street**
- **Funded by New York City – Hudson Yards Development Corp.**
- **Cost: \$2.4B**



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NO. 7 LINE SUBWAY – PROJECT FACTS

- **Construction began December 2007**
- **Completed tunneling April 2012**
- **Opened for revenue service September 2015**
- **Secondary entrance is under construction at 11th Ave & 34th St.**



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PROJECT PARTNERS

- Parent Agency – MTA
- Project Manager – MTACC
- Owner/Operator/Maintainer – NYCT
- Design Consultant – PB (WSP)
- Construction Management – HLH7
 - **Hill International**, LiRo & HDR



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STAKEHOLDERS

- **City Representatives – Hudson Yards Dev. Corp.**
- **Funding – Hudson Yards Infrastructure Corp.**
- **Community Boards**
- **Developers**
- **NY City & State Agencies**
- **Jacob Javits Convention Center**
- **Amtrak**
- **Consolidated Edison**
- **Others**



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FUNDING

- **Hudson Yards Infrastructure Corp. issued \$3B bonds, project fully funded**
 - **\$2B subway construction**
 - **\$100M contingency**
 - **\$900M parks, streets, property acquisition**
- **Funded by the City of New York**



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FUTURE DEVELOPMENT

- **Due to 2005/2009 re-zonings, Hudson Yards can hold:**
 - **25-million SF of new office development**
 - **20,000 units of new housing**
 - **2-million SF of new retail**
 - **3-million SF of new hotel**

- **Demand for development will result in full build-out by 2041**



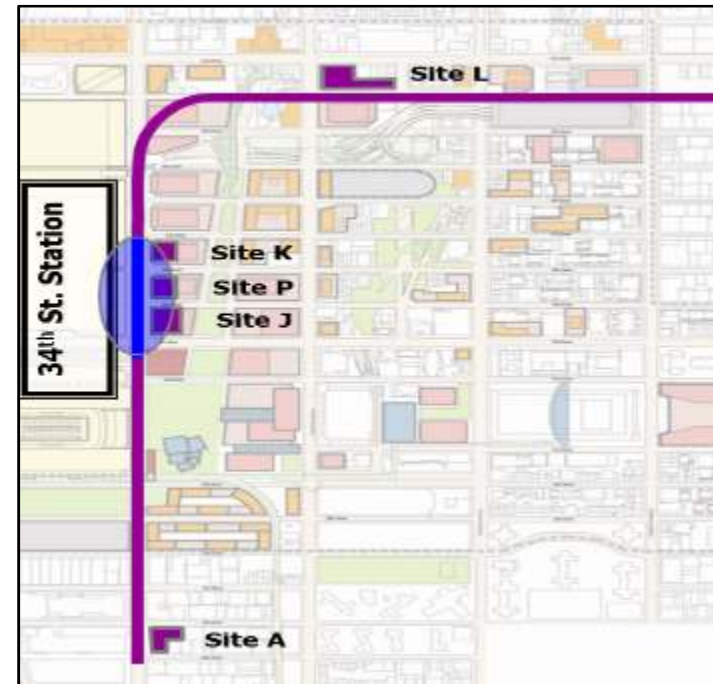
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CONTRACT PACKAGING

- Running Tunnels
- Site L Ventilation Building
- Site J Ventilation Building & Station Entrance
- Site K Ventilation Building
- Systems & Finishes
- Secondary Station Entr. (Site P)



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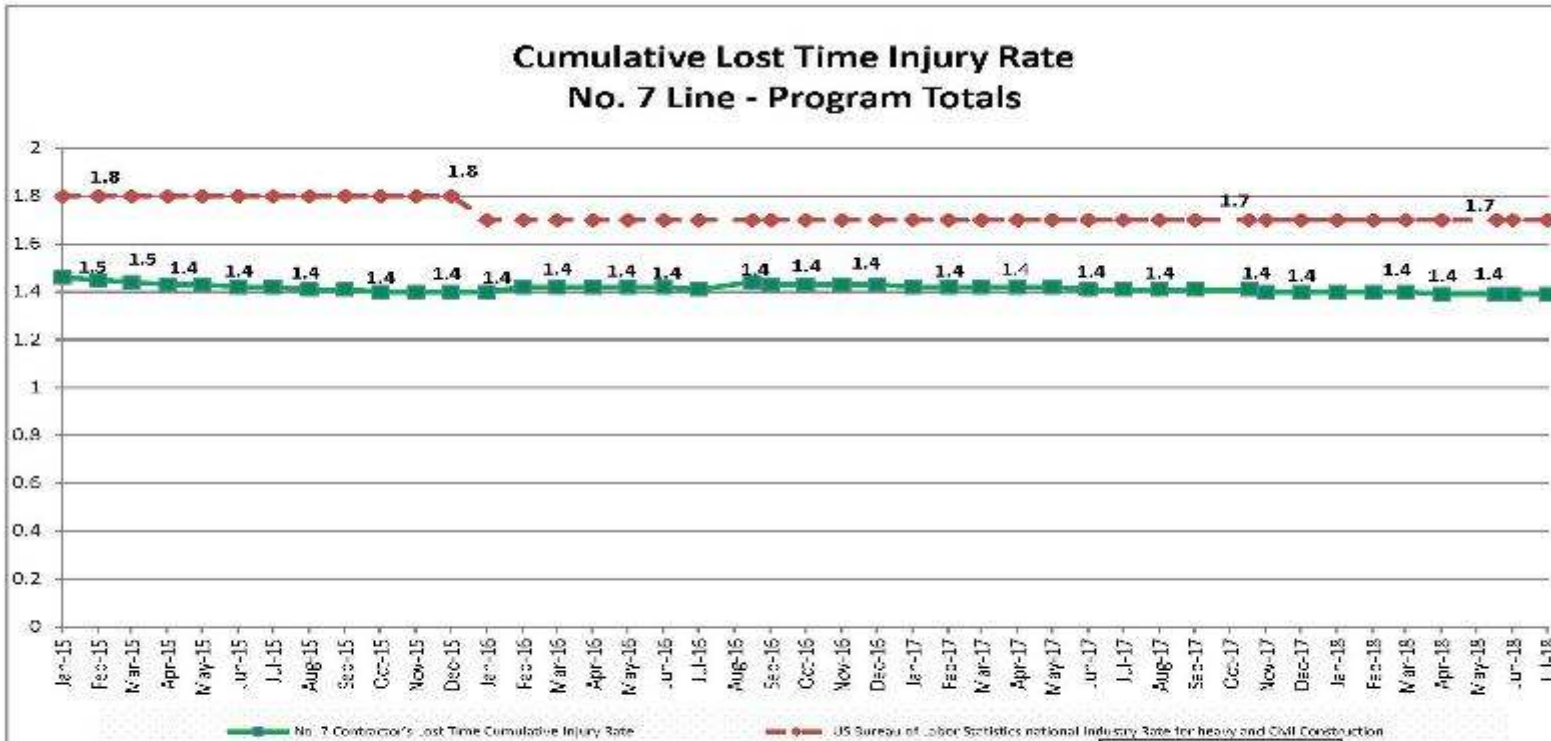
DELIVERY METHOD

- **Running Tunnels – Single Bid, Negotiated**
- **Site L Ventilation Building – Low Bid**
- **Site J Ventilation Building & Station Entr. – Low Bid**
- **Site K Ventilation Building – Low Bid**
- **Systems & Finishes – Low Bid**
- **Secondary Station Entr. (Site P) – Low Bid**



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Cumulative Lost Time Injury Rate No. 7 Line - Program Totals



Note:
Lost Time Injury Rate = Number of Injuries per 100 Full Time Workers

$$= \frac{\text{Number of Injuries} \times 200,000 (1)}{\text{Total Hours by all Employees}}$$

(1) Base for 100 equivalent full-time workers, working 40 hours/week for 50 weeks/yr

LTA 2013	7
LTA 2014	9
LTA 2015	0
LTA 2016	2
LTA 2017	0
LTA 2018	0



BUDGET & COST CONTROL

PROJECT BUDGET

- 2006 Budget (Subway Only) - \$2.1B
- 2017 Additional Non-Subway Work - \$300M

Total Budget - \$2.40B



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PROJECT BUDGET

Major Categories	% of Project Cost
Construction	83%
Design	7%
Construction Management	6%
Contingencies	4%
Total	100%

Subway Related Cost - \$2.1B

Non-Subway Related Cost - \$300M



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CONTRACTS

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21



IN CONSTRUCTION				
CONTRACT	DESCRIPTION	COST (millions)	% COMPLETE	Notes
C-26503	RUNNING TUNNELS	\$1,144	100%	Completed 5 months early & \$600M under budget
C-26504	SITE L (Vent. Building Structure)	\$58	100%	Completed Under Budget
C-26511	SITE K (Vent. Building Structure)	\$58	100%	Completed 3 months early and Under Budget
C-26510	SITE J (Vent. Building & Main Station Entrance Structure)	\$121	100%	Completed Under Budget
C-26505	FINISHES & SYSTEMS	\$562	100%	Sept. 13, 2015 (Revenue Service)
Sub-total	Revenue Service	\$1,943	100%	
C-26512	Site P (Structures and Systems, Secondary Entrance)	\$101	100%	Revenue Service August 31, 2018
	TOTAL	\$2,044	100%	

MEASURE & MONITOR EXPENDITURES

- **\$2.3B+ disbursed to date**
- **Prompt payment for each invoice**
- **Peak monthly payment - \$50M to contractors**
- **Negotiate changes of \$65M, includes credits**
- **4-of-6 construction contracts completed under budget**
- **Develop baseline budget & cash flow for each line item**



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MEASURE & MONITOR EXPENDITURES

- Track actual against plan
- Perform trend analysis
- Revise budget allocation, based upon trend
- Forecast “Estimate-At-Completion” (EAC)

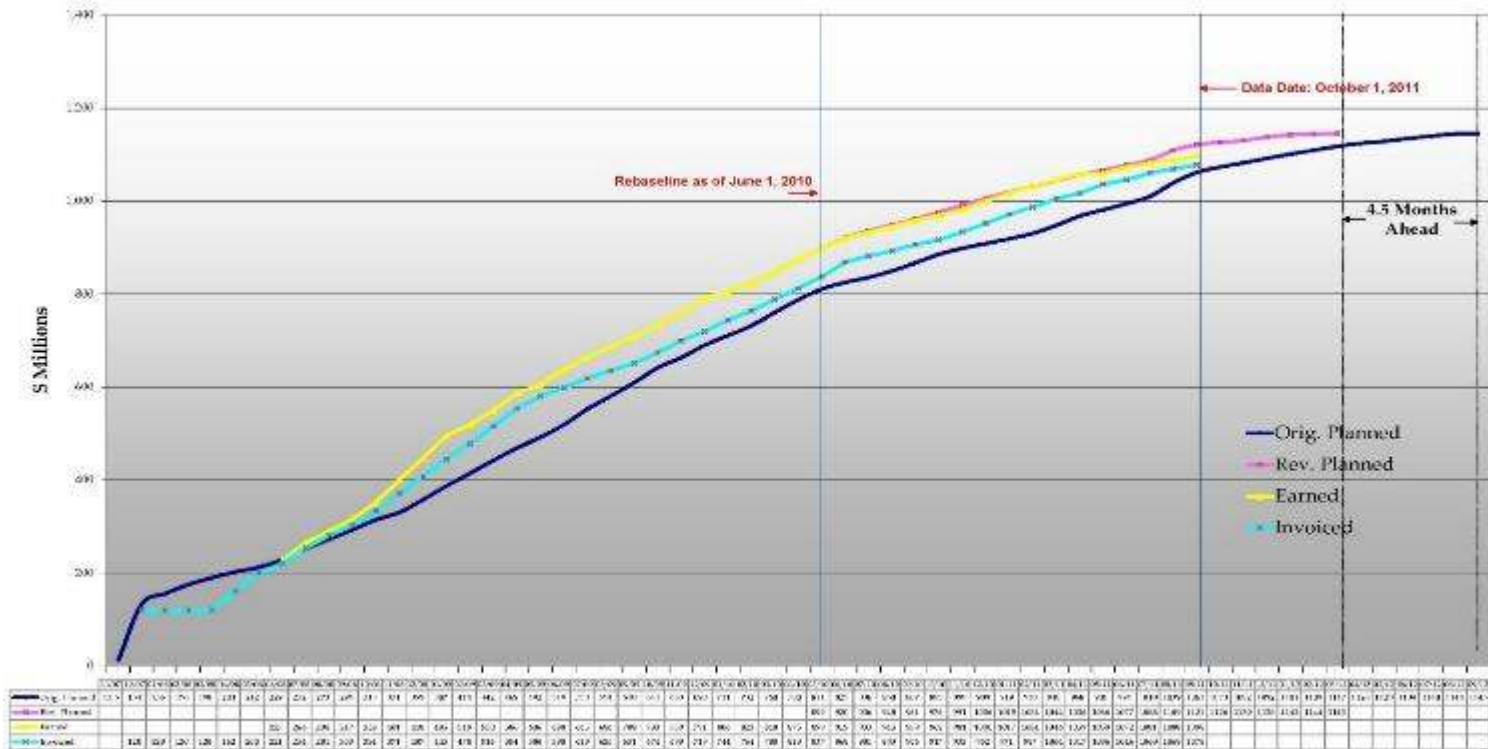


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24



Progress by Expenditure
 Orig. Planned - Rev. Planned - Earned - Invoiced



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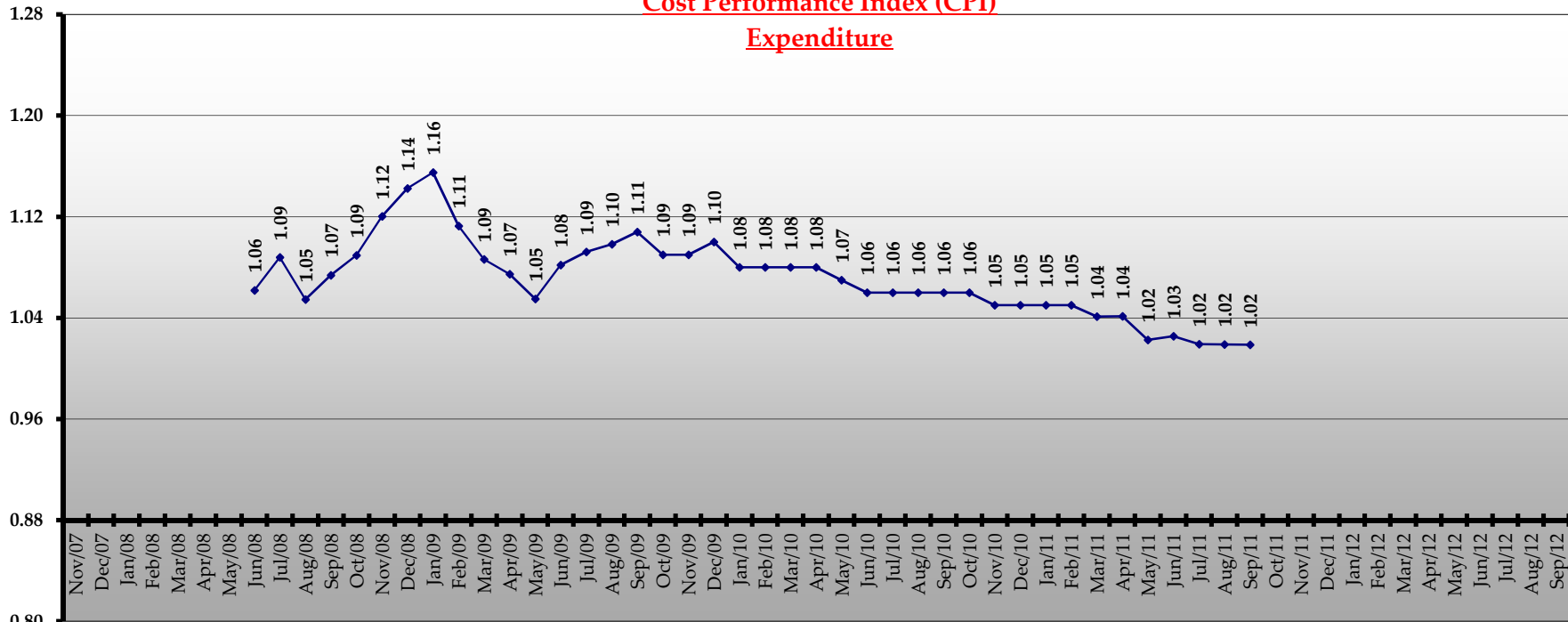
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**Construction of Running Tunnels and Station Structures
Number 7 (Flushing) Line Extension - "A" Division (IRT)
Borough of Manhattan**

Cost Performance Index (CPI)

Expenditure



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CHANGE ORDERS

- Number of change orders 360 (approx.)
- Total change order value \$65M (approx.)
- Change order % vs. Construction cost 3.25% (approx.)



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CHANGE ORDERS

Change Order Keys:

- Identify potential change orders/RFIs
- Evaluate each change was warranted
- Negotiate each change order
- Track each credit change order
- Minimize time impact claims



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SCHEDULE CONTROL

OVERALL SCHEDULE

- **Original duration – 78 months**
- **Revenue service achieved – 9/13/15**
- **No schedule contingency**
- **No additional time added for:**
 - **Late property acquisition**
 - **Non-subway work (\$300 Million)**
 - **Developers changing their requirements that impacted the Subway work**



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OVERALL SCHEDULE

- **Integrated project schedule (IPS)**
- **Included all aspects of work**
- **Schedule for each contract**
- **Largest schedule 7,000+ activities**
- **Updated weekly & monthly**



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OVERALL SCHEDULE

- Identify critical paths
- Identified Opportunities
- Identify delays, potential delays, & mitigation measures
- Created “what-if” schedules



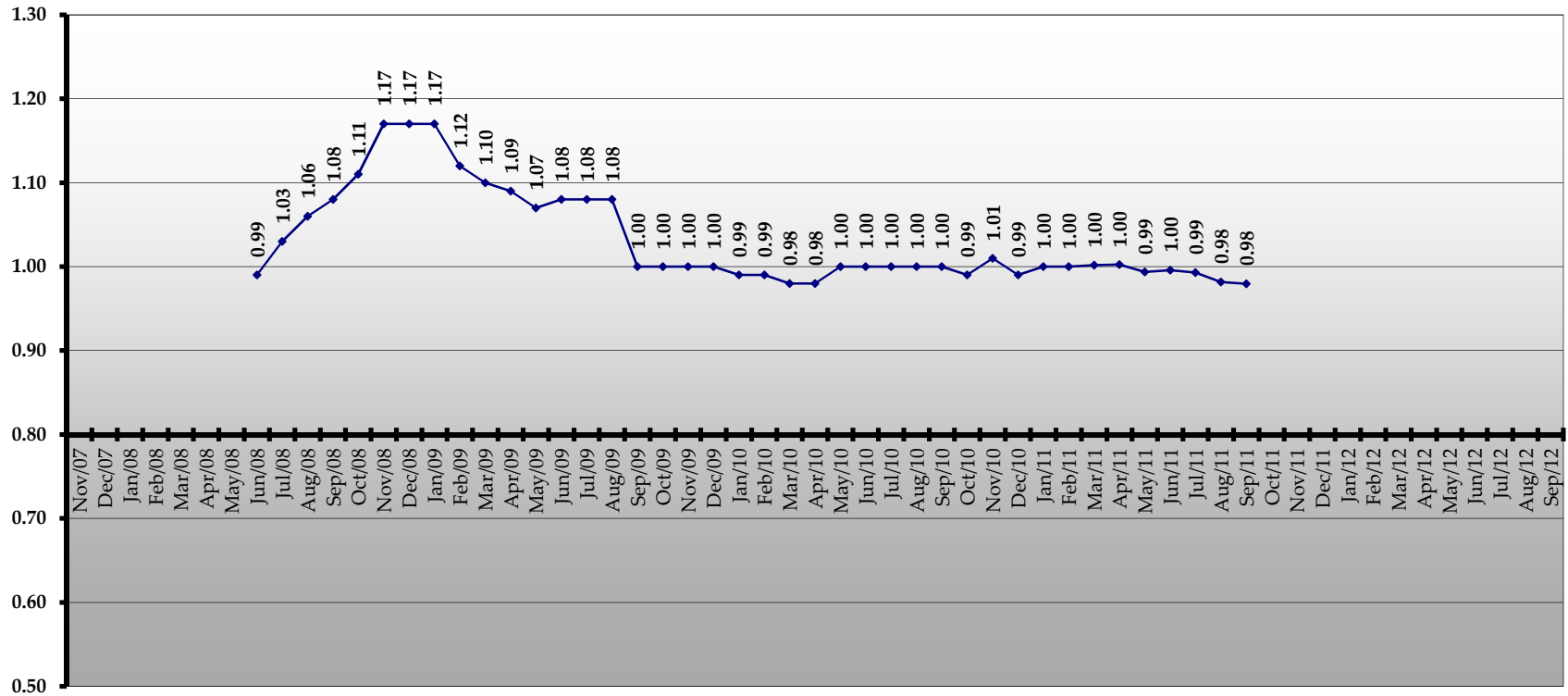
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32

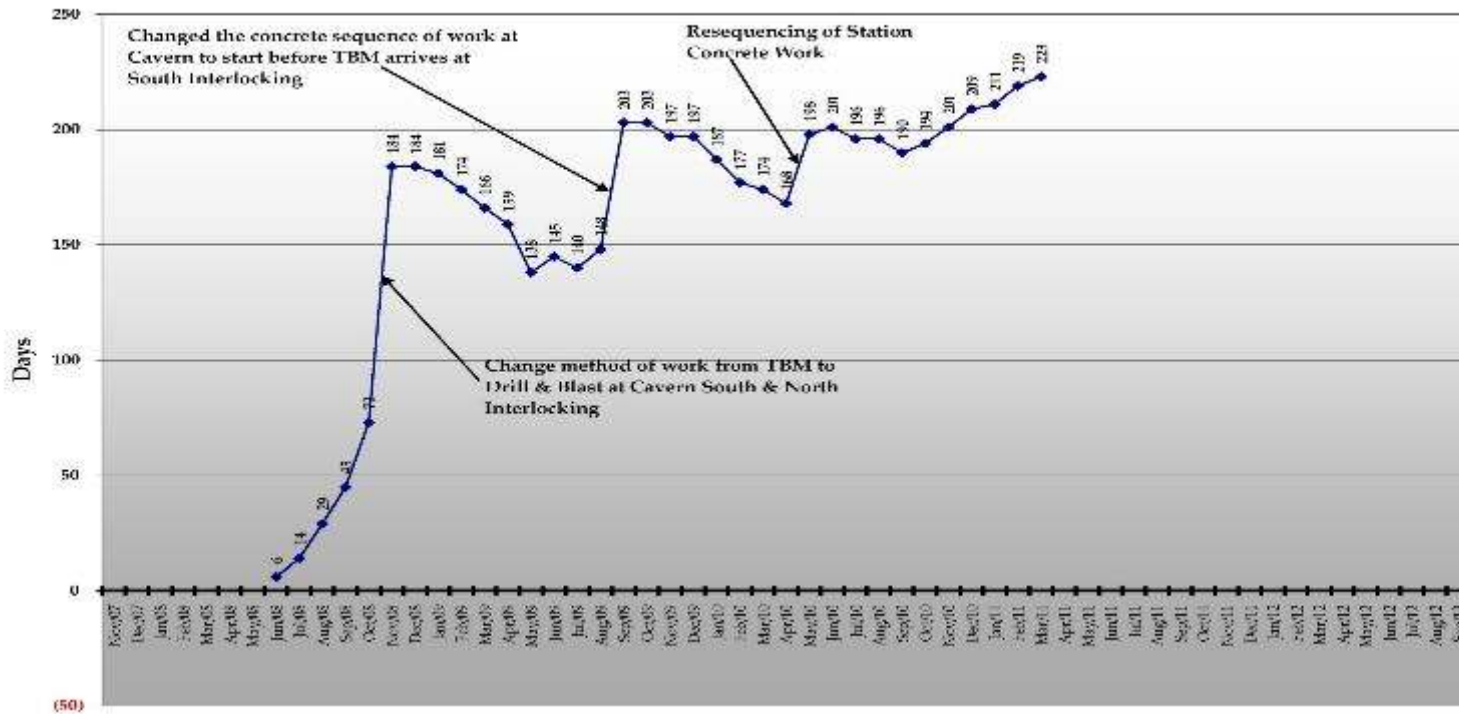


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**Schedule Performance Index (SPI)
Expenditure**

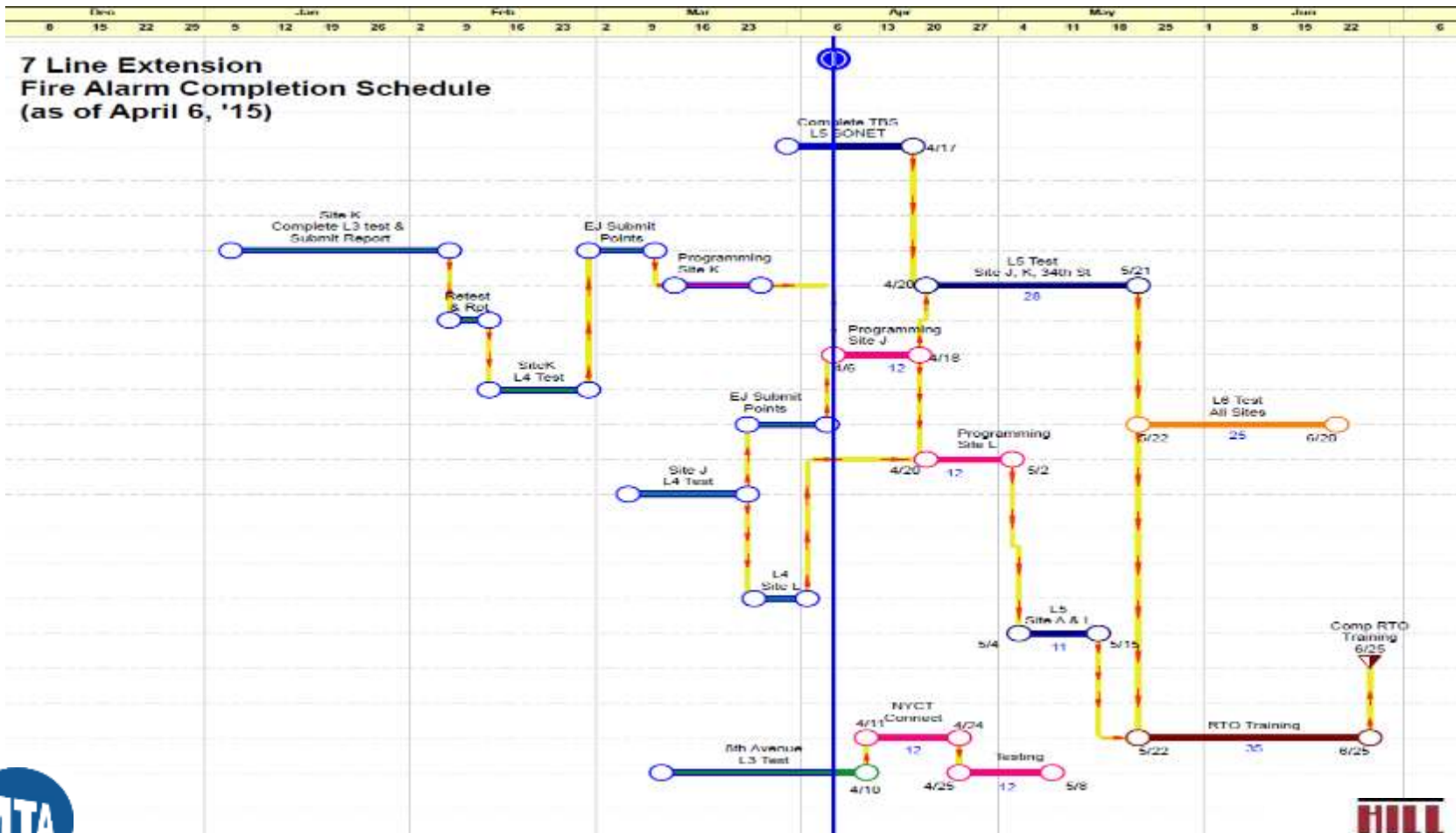


Construction of Running Tunnels and Station Structures
 Number 7 (Flushing) Line Extension - "A" Division (IRT)
 Borough of Manhattan
Total Float Trend



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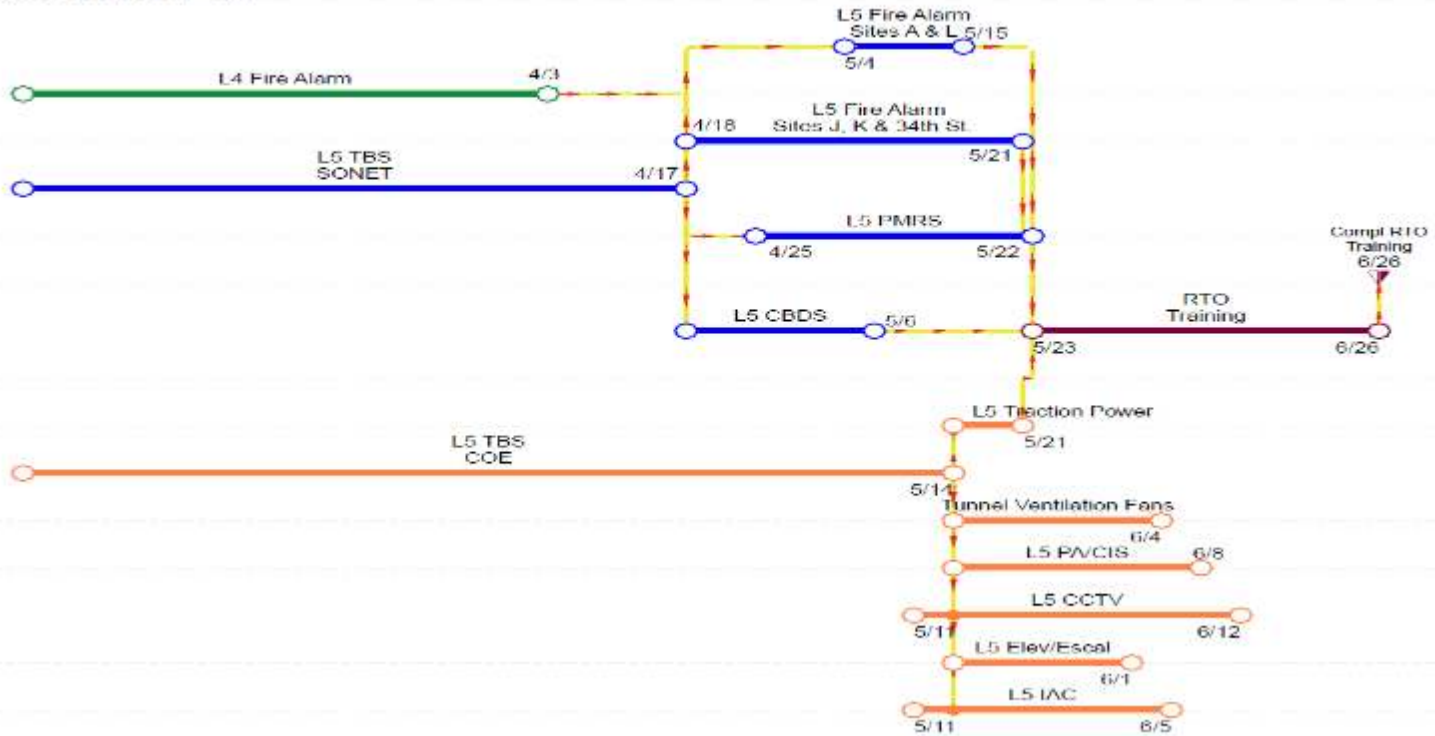


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**7 Line Extension
Level 5 Summary Schedule
(as of April 6, '15)**



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IMPORTANT MEASURES

- All schedules were cost & resource loaded
- Developed Testing & Commissioning (T&C) schedule
- T&C schedule was included with bid solicitation
- T&C schedule allowed time for MTA Reps to witness test
- 6 levels of tests for each equipment
- Measured progress on Physical % Complete & Earned Value



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IMPORTANT MEASURES

- **Contractor's monthly payment conditioned upon monthly schedule update**
- **Coordinated using BIM – 4D modeling**
- **Mitigation strategies:**
 - **Fast tracking or concurrent activity**
 - **Crashed durations when possible**
 - **Created additional float in schedule**
 - **OT, weekends, double & extended shifts**



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RESULTS

- Tunnel contract completed 5 months ahead of schedule
- Ensured follow-on “Systems & Finishes” contractor had on-time or early access



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39



UNIQUE STEPS TAKEN

- Added bonus sharing feature for accelerated completion
- Minimized changes
- Dispute Resolution Board for tunnel contract
- Developed “What-if” contracting & construction scenarios during contract packaging



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40



LESSONS LEARNED

- **Begin with project end in mind**
- **Manage by measuring**
- **Treat contractors/vendors/consultants as extended family**
- **Involve Operations & Maintenance from the start**
- **Limit last minute changes**



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DEVELOPMENT IS ONGOING IN A BIG WAY



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42



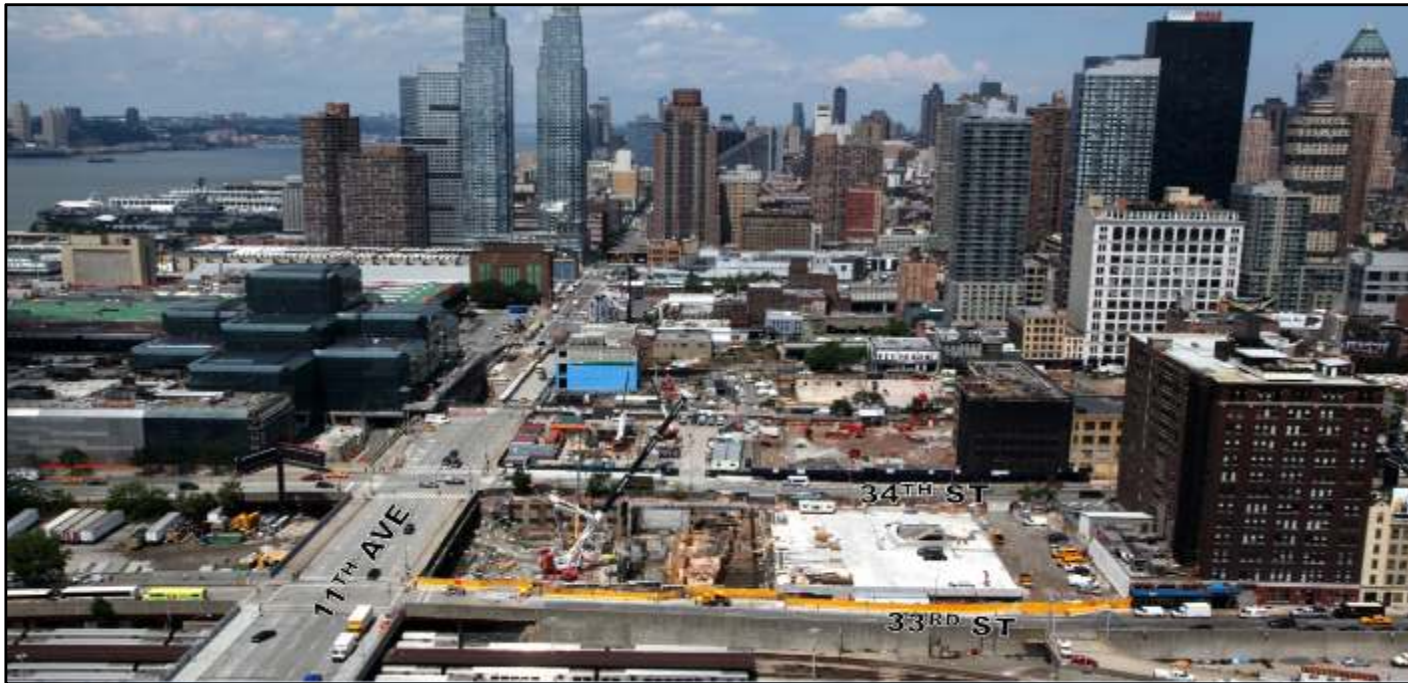
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ABOUT 10 YEARS AGO



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ABOUT 6 YEARS AGO



Recent Development



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Recent Development



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Recent Development



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Recent Development



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Recent Development



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Recent Development



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54

Recent Development



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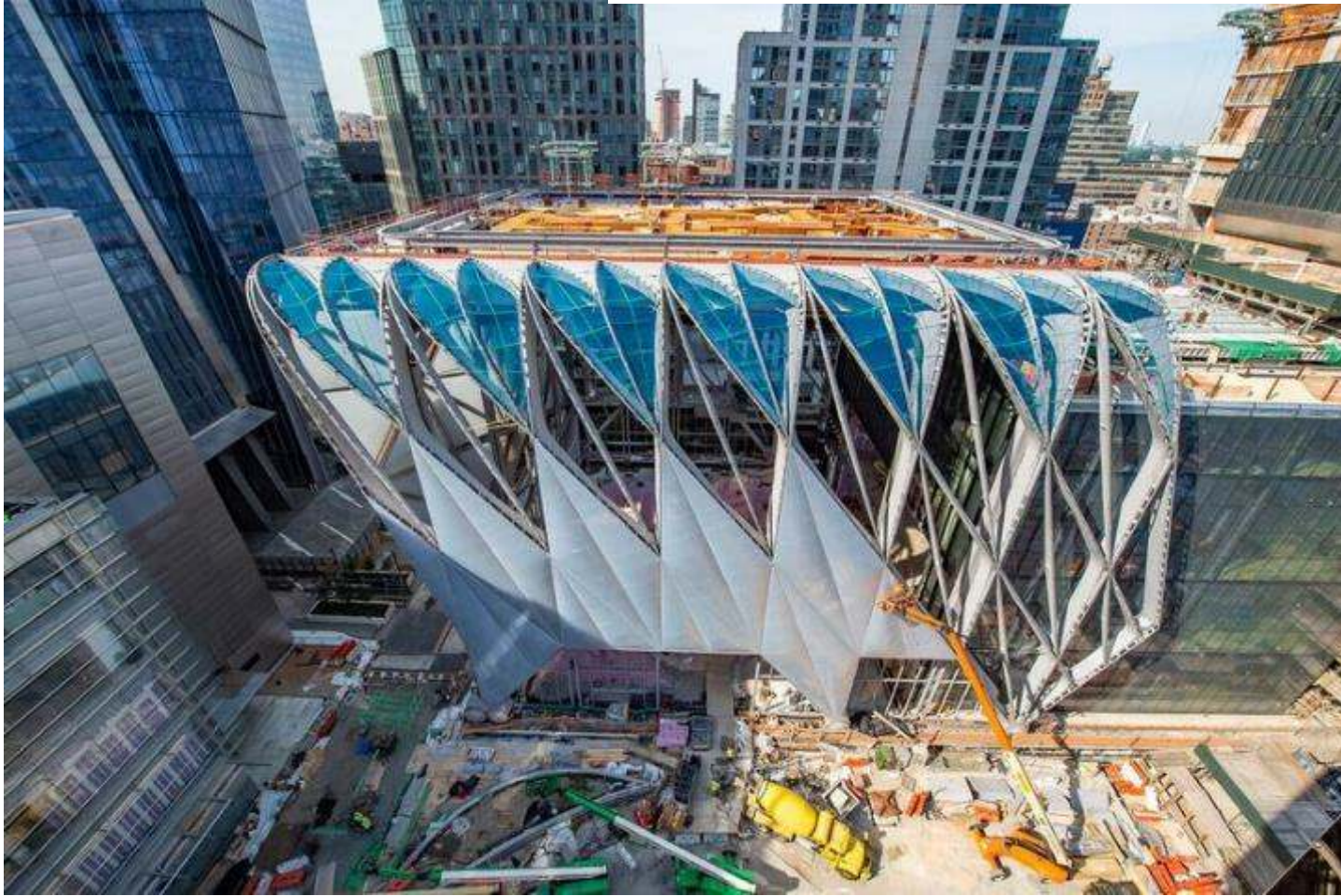
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Recent Development



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Recent Development



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57

Recent Development



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Recent Development



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59

Rendering Future Development



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FUTURE OF HUDSON YARDS



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61

QUESTIONS



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62



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THANK YOU



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