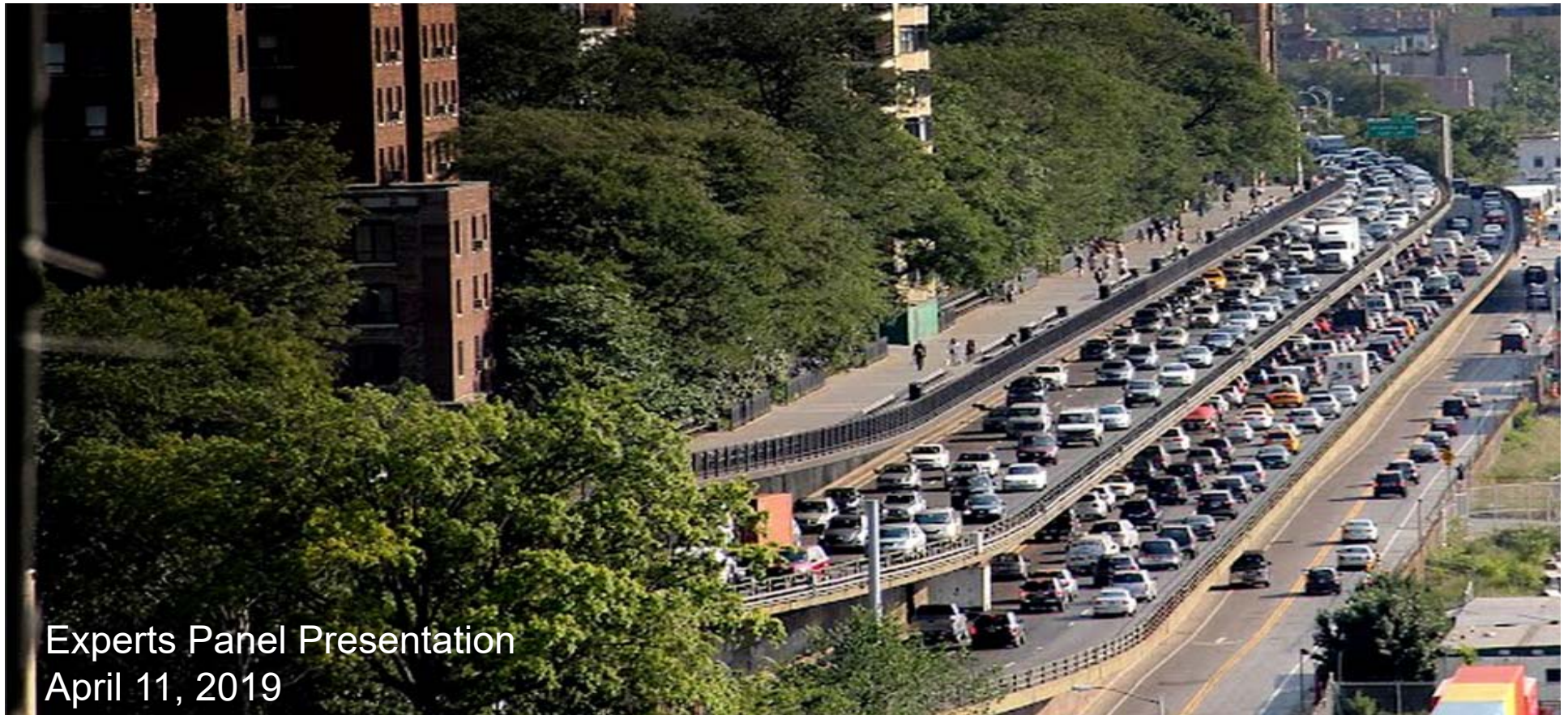


# Brooklyn-Queens Expressway

Atlantic Avenue Interchange to Sands Street Vicinity



Experts Panel Presentation  
April 11, 2019

# BQE History



BQE under construction, 1948

- Robert Moses built the BQE beginning in 1944, intended to connect the Gowanus Parkway and RFK Bridge.
- The Triple Cantilever, a unified structure with two levels of traffic and Promenade, was a concession to Brooklyn Heights community groups, after they rejected the original plan for a standard six-lane highway along Hicks Street, which ran through many other Brooklyn neighborhoods.

# BQE – Key Dates

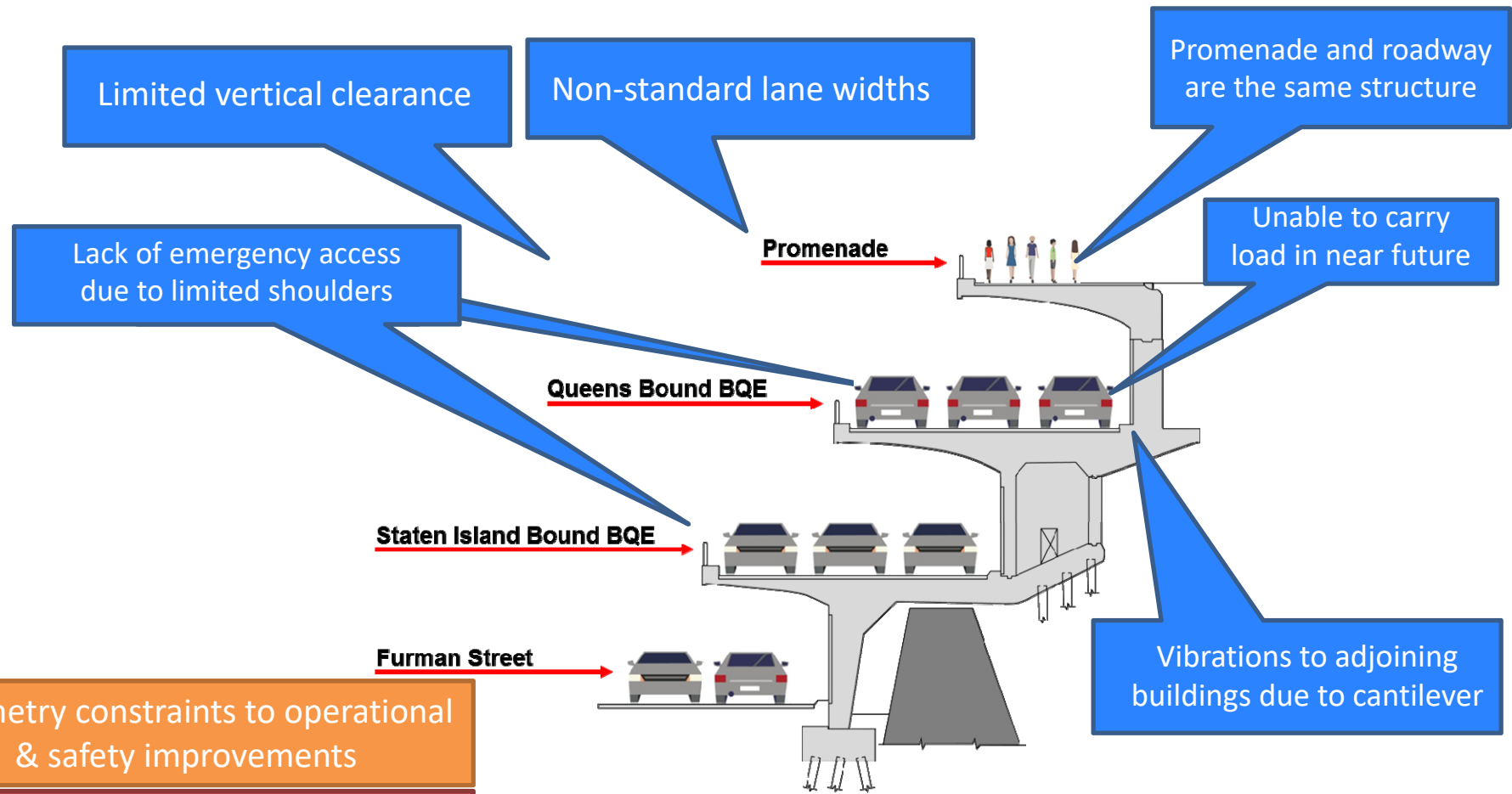


<b>2006</b>	NYSDOT convenes Design and Construction Workshop
<b>2009</b>	NYSDOT identifies six tunnel alignments
<b>2010</b>	NYSDOT study ends without selection of a preferred alternative
<b>2011</b>	NYSDOT suspends environmental process
<b>2012-2013</b>	Ongoing NYSDOT & NYCDOT project discussions
<b>2014</b>	NYCDOT puts first capital funds into project and begins studies
<b>2015</b>	NYCDOT conducts charrette with experts from across the country
<b>2016</b>	NYCDOT performs Tunnel Feasibility Study and Origin & Destination Study
<b>2016-2017</b>	NYCDOT conducts In-Depth Inspections
<b>2026</b>	Trucks may need to be removed from BQE due to deterioration
<b>2036-2040</b>	All vehicles may need to be removed from BQE due to deterioration

# Project Corridor



# Existing Roadway



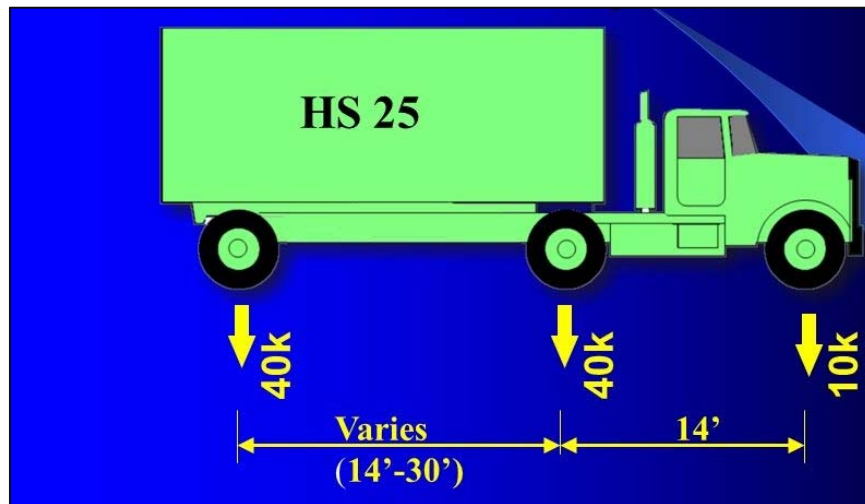
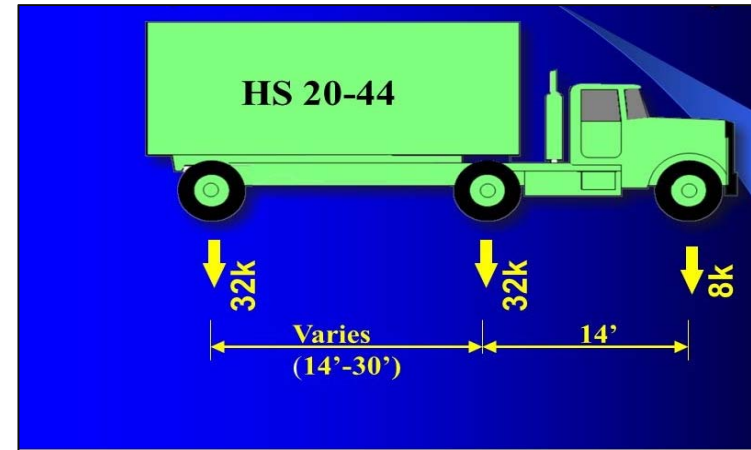
Geometry constraints to operational & safety improvements

Crash rate up to or exceeding 10 times the statewide average

**Triple Cantilever Cross Section**

# Design Loads

- Based on A.A.S.H.O. 1941 Specifications
- H20-S16 (AKA HS-20) Vehicular Loading
- 100 PSF Promenade pedestrian loading
- 30 PCF Equiv. Fluid Pressure soil loading
- 3000 PSI allowable concrete strength
- 18 KSI allowable reinforcing steel strength
- Piles 30 ton compression capacity



Trucks on BQE actually more likely to be HS-25

Legal loads 80,000 lbs

# The BQE Today: Heavy Usage



The BQE is one of the most heavily traveled roadways in NYC; a typical weekday sees up to 155,000 vehicles, including up to 18,000 heavy vehicles.

I-93 (the Big Dig, Boston):	200,000 vehicles
Queensboro Bridge:	170,000 vehicles
<b>BQE:</b>	<b>153,000 vehicles</b>
Tappan Zee Bridge:	140,000 vehicles
FDR Drive:	136,000 vehicles
Cross Bronx Expressway:	115,000 vehicles
Alaskan Way Viaduct (Seattle):	110,000 vehicles
West Side Highway:	105,000 vehicles



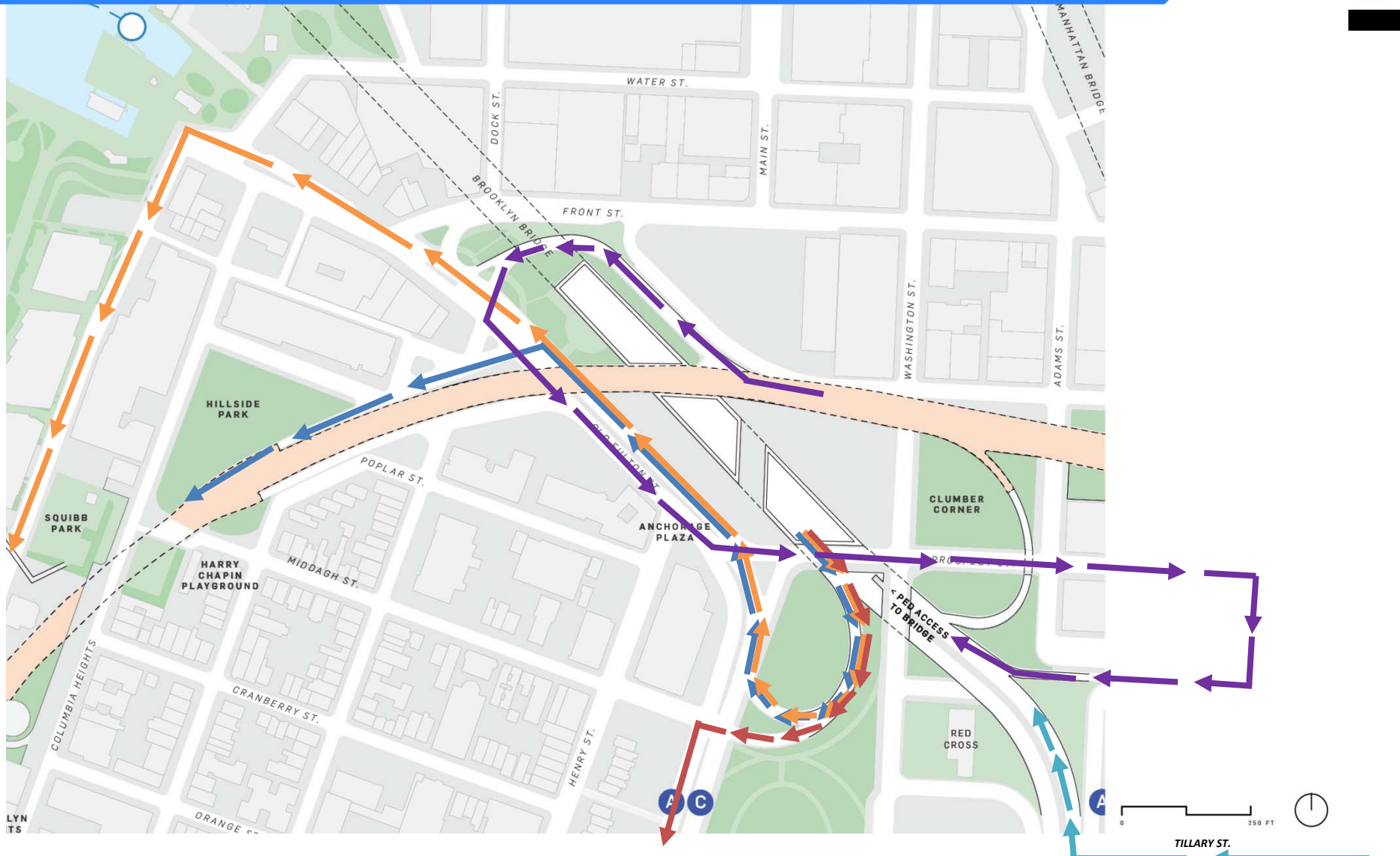
Key freight route: peak volume of up to 1,100 trucks per hour (500-600 per direction) during weekday mornings.

# Existing Conditions

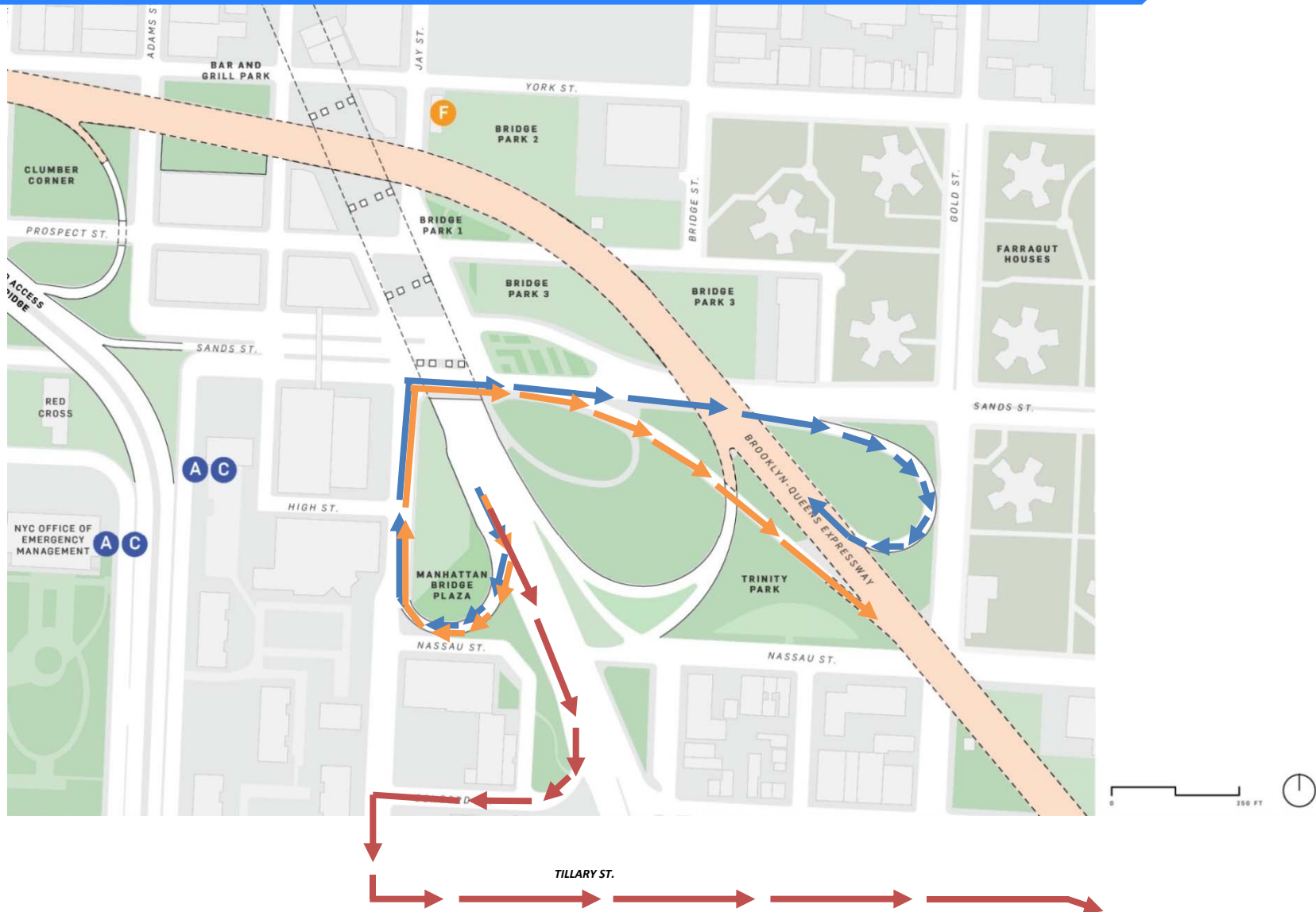




# Brooklyn Bridge



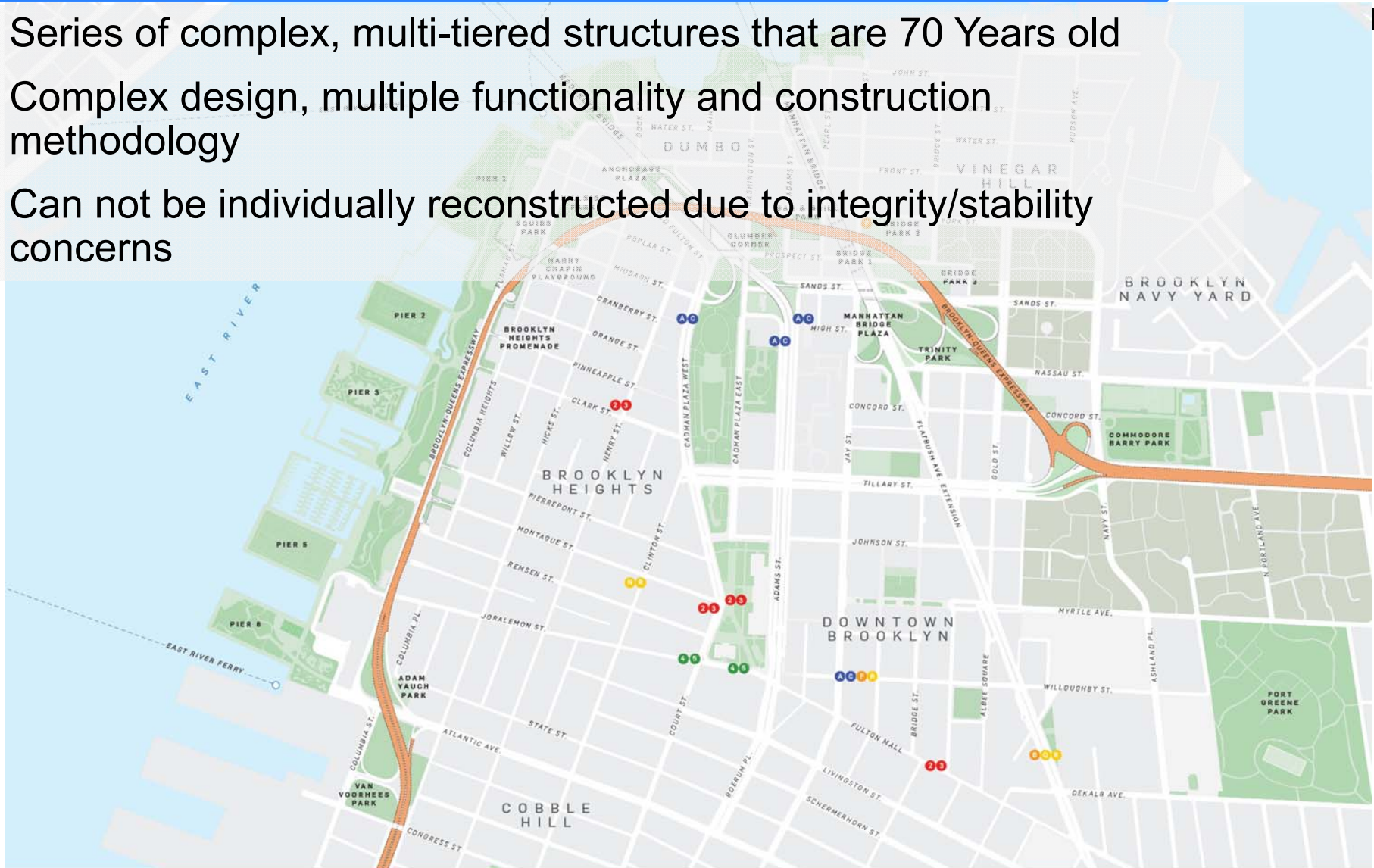
# Manhattan Bridge



# Structure Types



- Series of complex, multi-tiered structures that are 70 Years old
- Complex design, multiple functionality and construction methodology
- Can not be individually reconstructed due to integrity/stability concerns

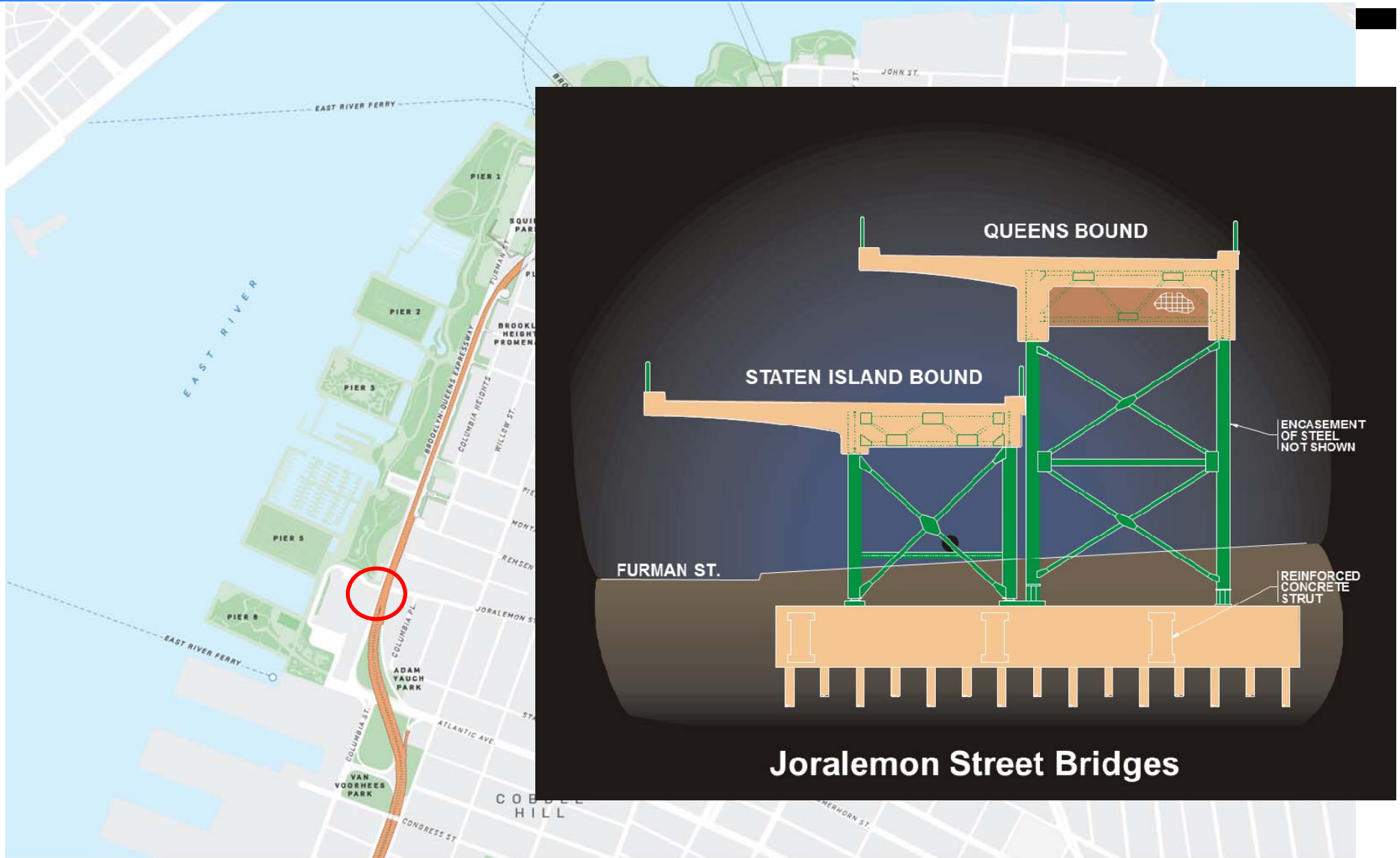


# Structure Types

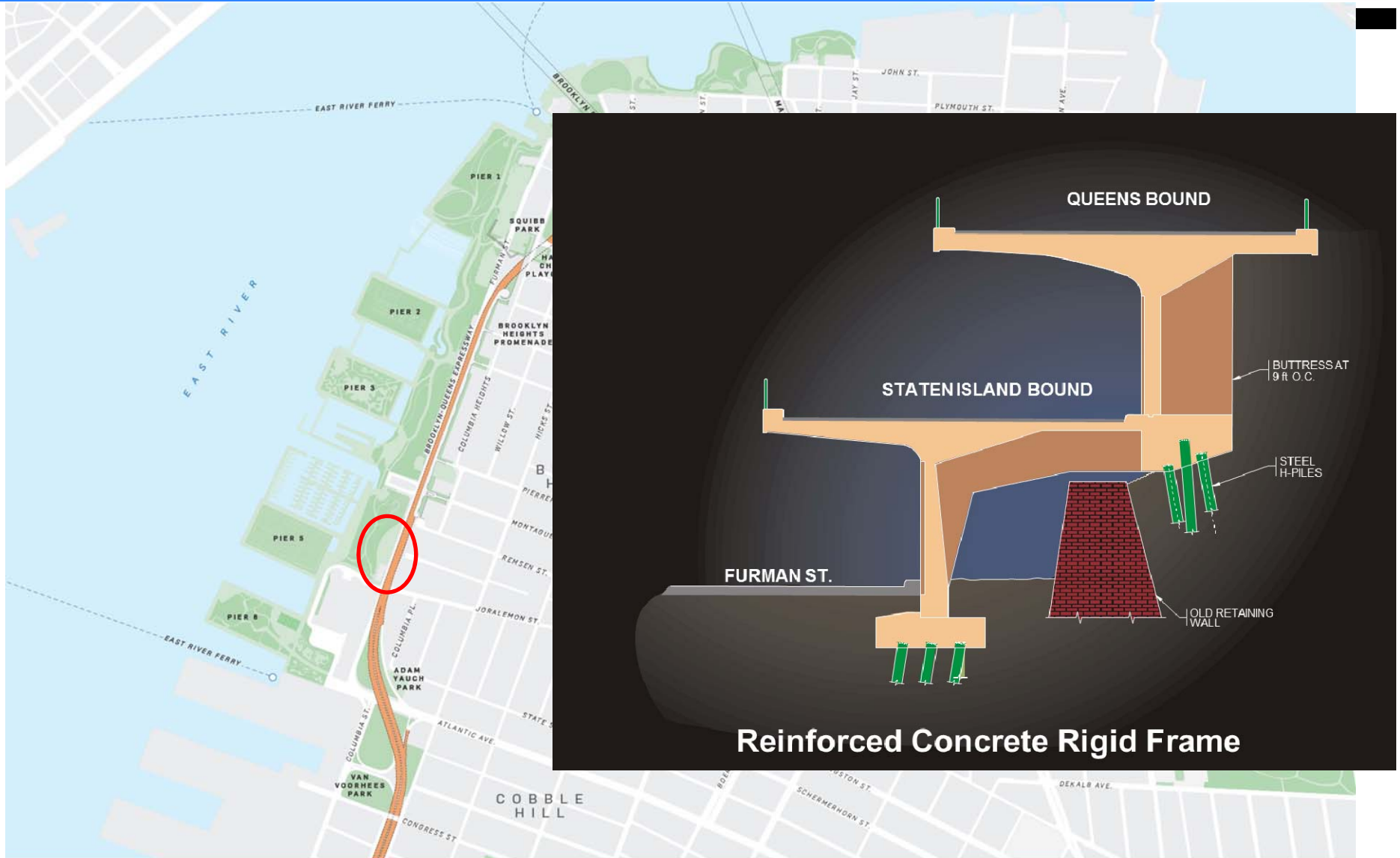


**Reinforced Concrete Rigid Frames**

# Structure Types



# Structure Types

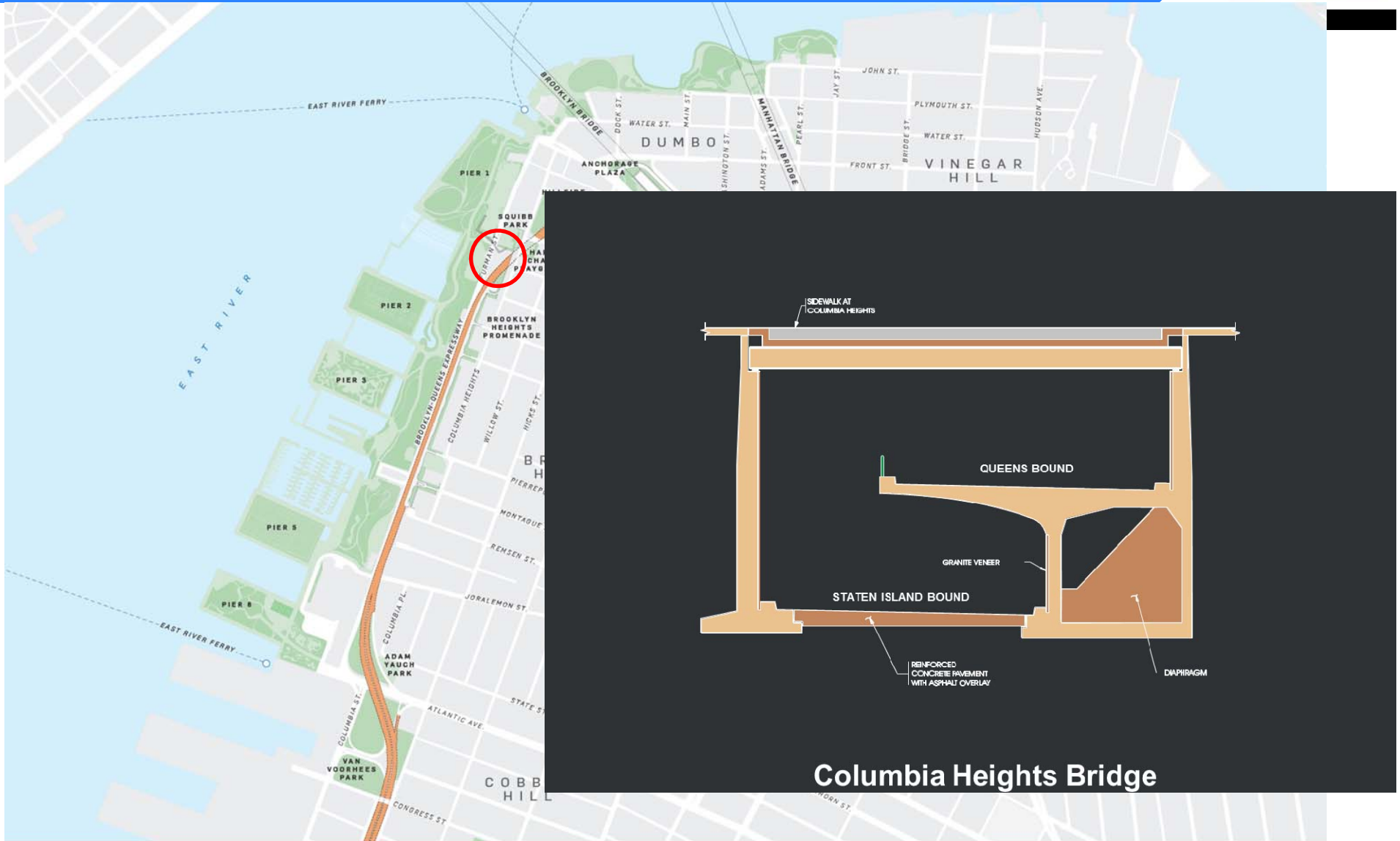


# Structure Types



**Reinforced Concrete Rigid Frame Cantilever – Retaining Wall**

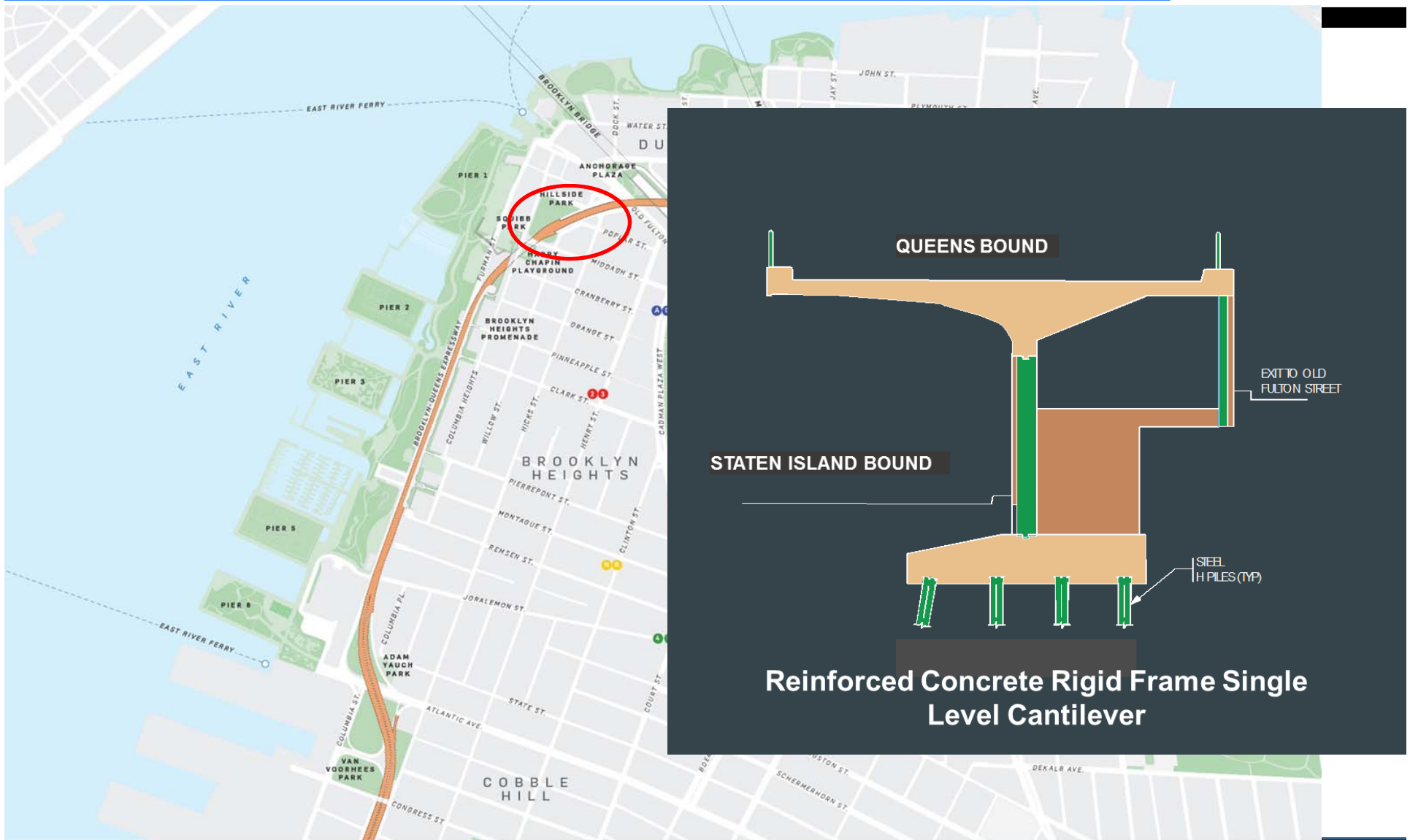
# Structure Types



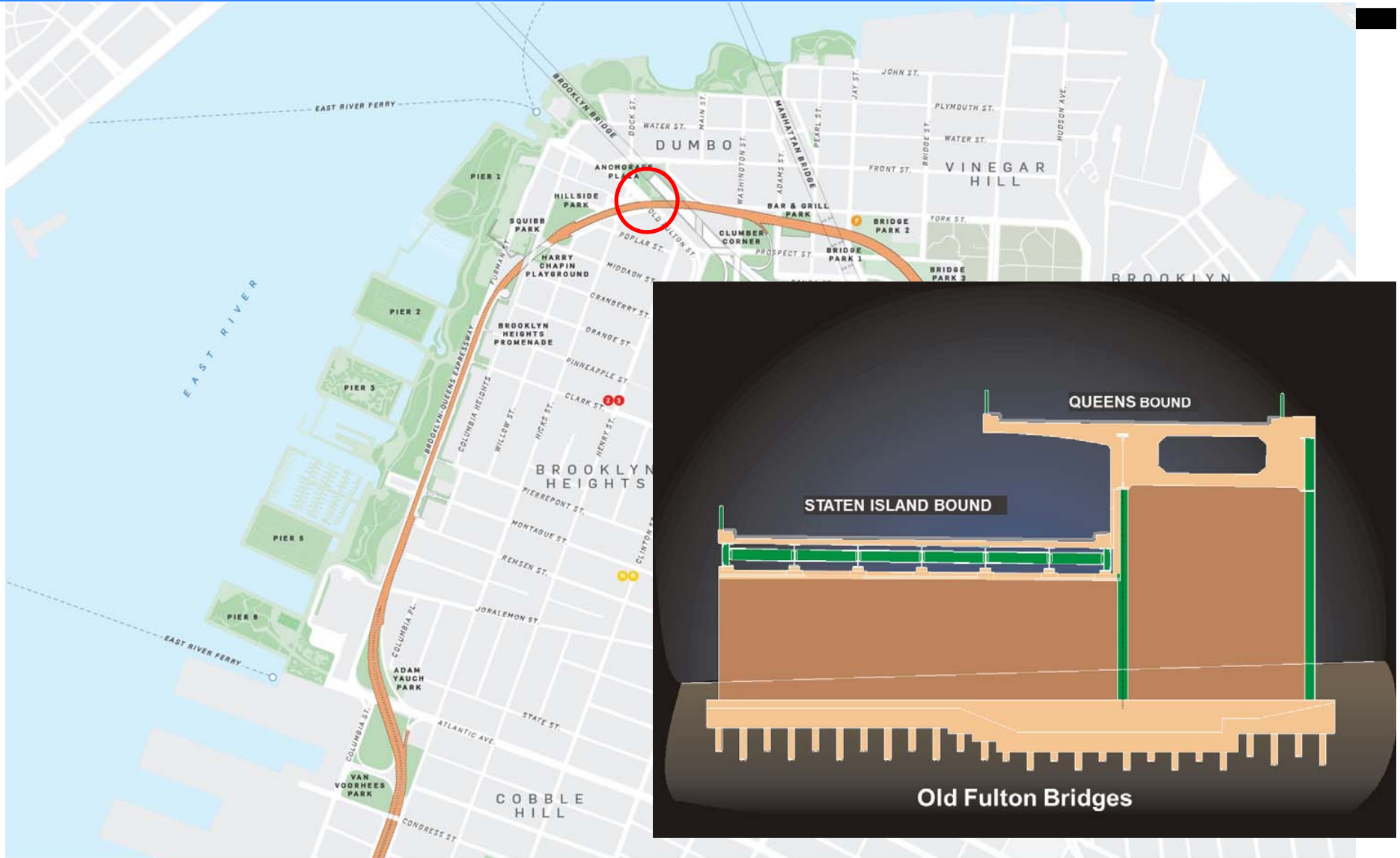
Columbia Heights Bridge



# Structure Types



# Structure Types



# Structure Types



# TRAFFIC ON THE BQE

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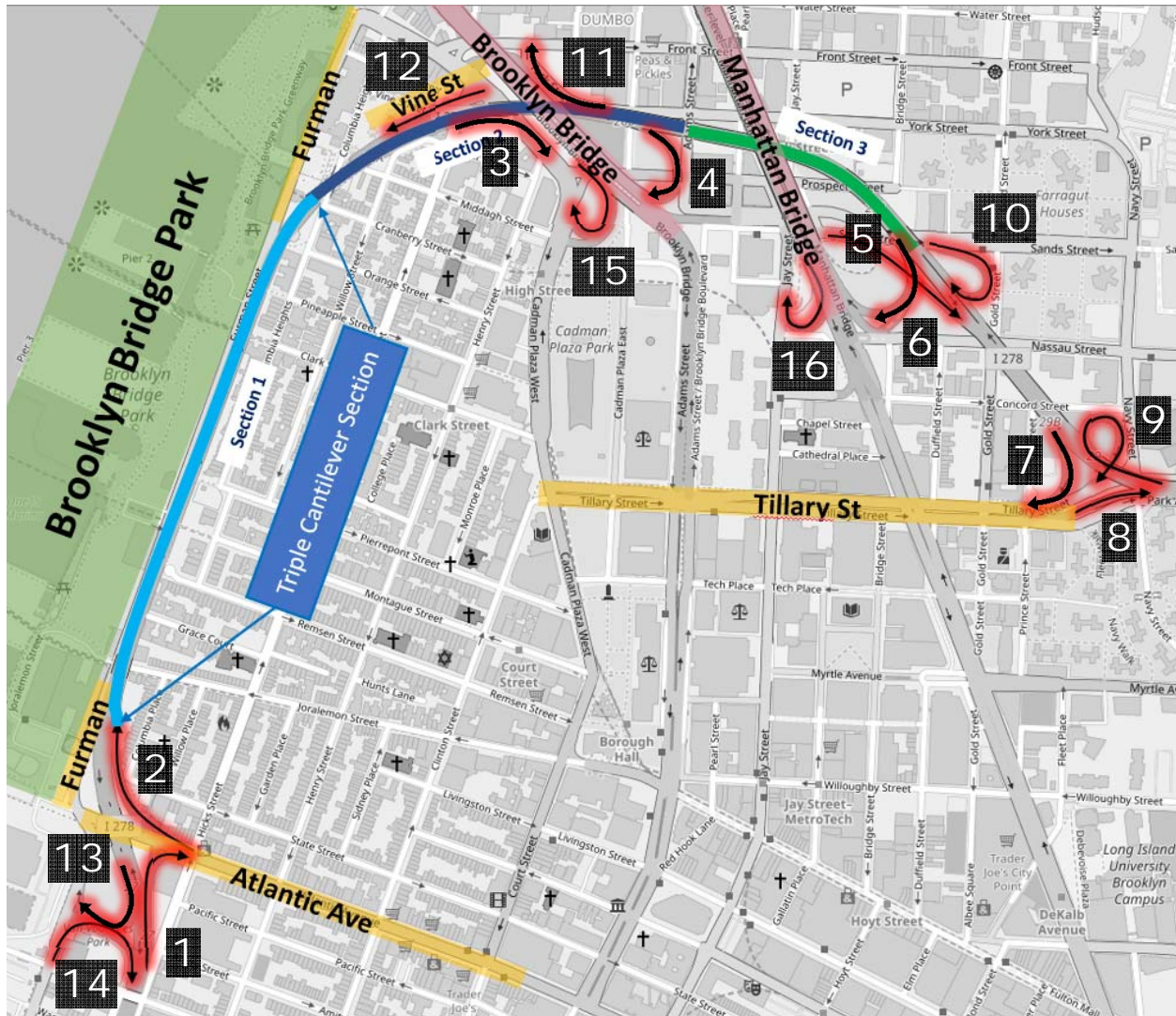


# Traffic on the Triple Cantilever



- A typical weekday sees up to **155,000** vehicles, including up to **18,000** heavy vehicles.
- The average throughput is **1,500 vehicles per lane**. This is influenced by lane widths, lack of shoulders/lateral clearances, ramp spacing, lane add/drops, fleet mix and incidents.
- Multi-hour congestion, queuing and reduced throughput are present in both directions during weekday afternoon and evening hours.
- Because one Queens-bound lane exits to Brooklyn Bridge, which prohibits trucks, the remaining two through lanes carry all of the heavy vehicle traffic past the ramp.

# 1.7-Mile Section/14 Ramps



## I-278 E/B (Queens-bound)

1. Off-ramp Diverge
2. On-ramp Merge (stop control)
3. Off-ramp Diverge
4. Off-ramp Lane Drop
5. Off-ramp Lane Diverge
6. On-ramp Lane Add
7. Off-ramp Lane Drop
8. On-ramp Lane Add

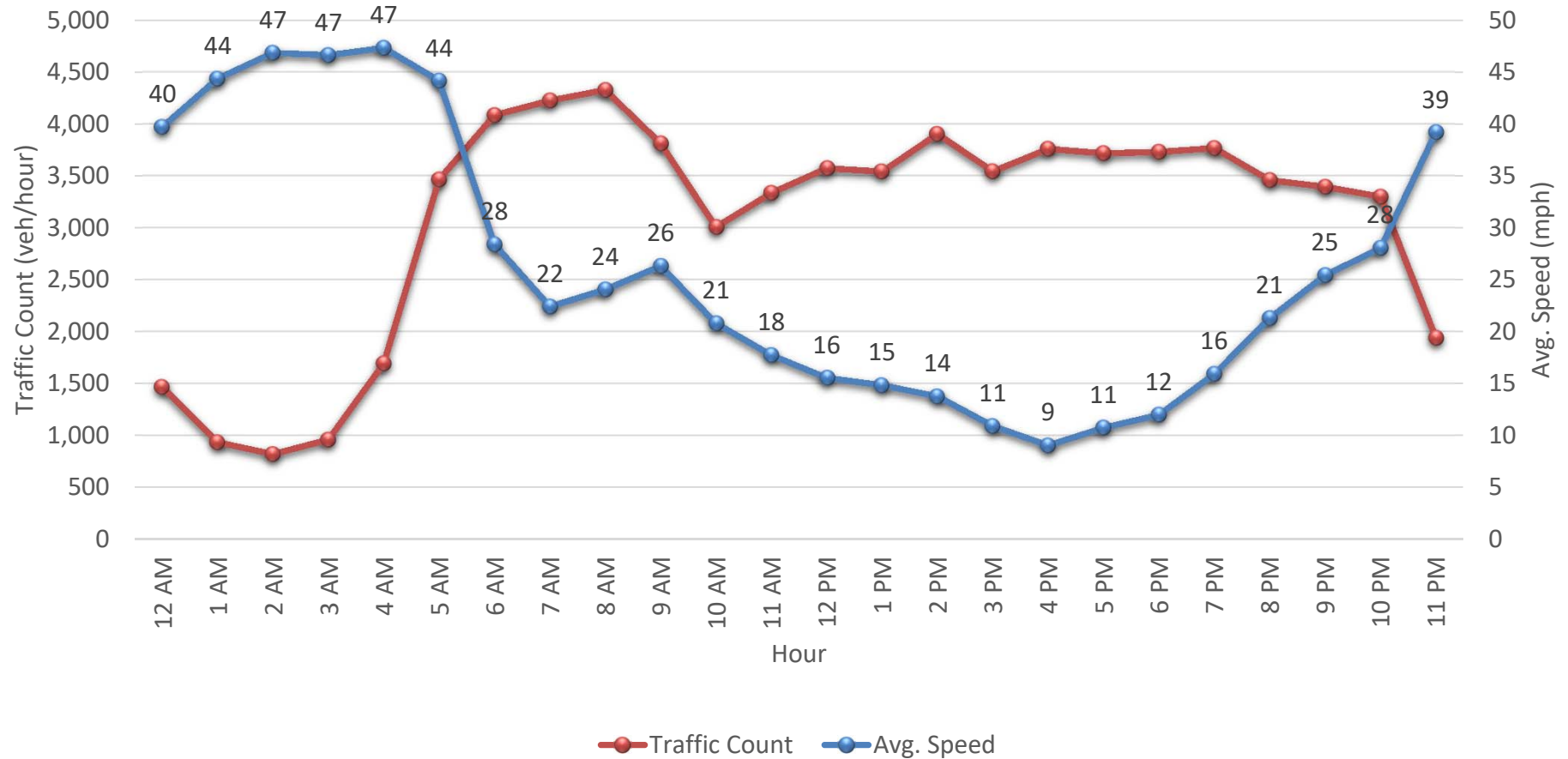
## I-278 W/B (S.I.-bound)

9. Off-ramp Lane Drop
10. On-ramp Lane Add
11. Off-ramp Lane Drop
12. On-ramp Lane Add
13. Off-ramp Diverge
14. On-ramp Merge (stop control)
15. Off-ramp from Brooklyn Bridge to local street-BQE route
16. Off-ramp from Manhattan Bridge to local street-BQE route

# Weekday on Queens-Bound Triple Cantilever



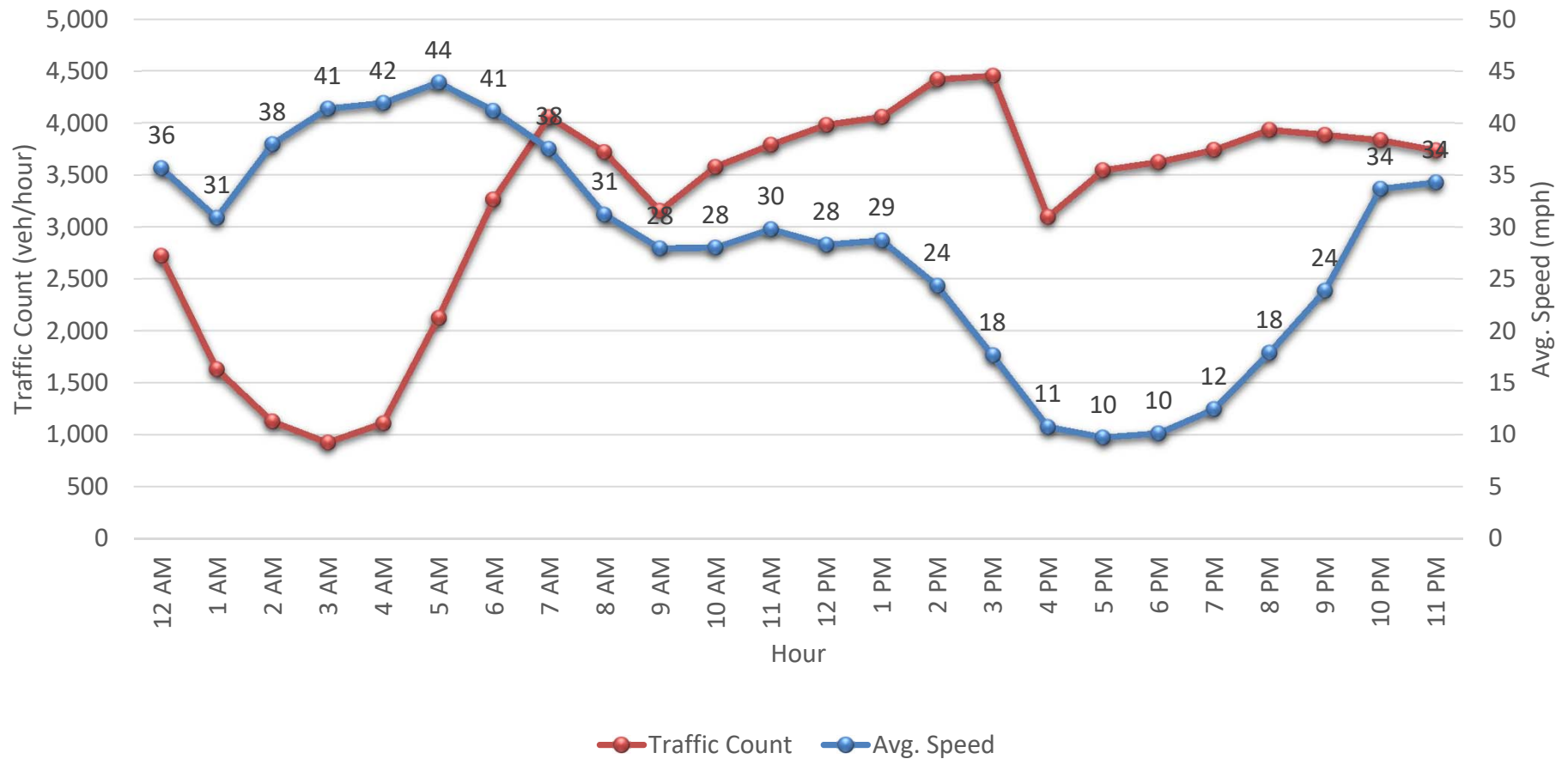
## Weekday on Queens-bound Triple Cantilever



# Weekday on SI-Bound Cantilever

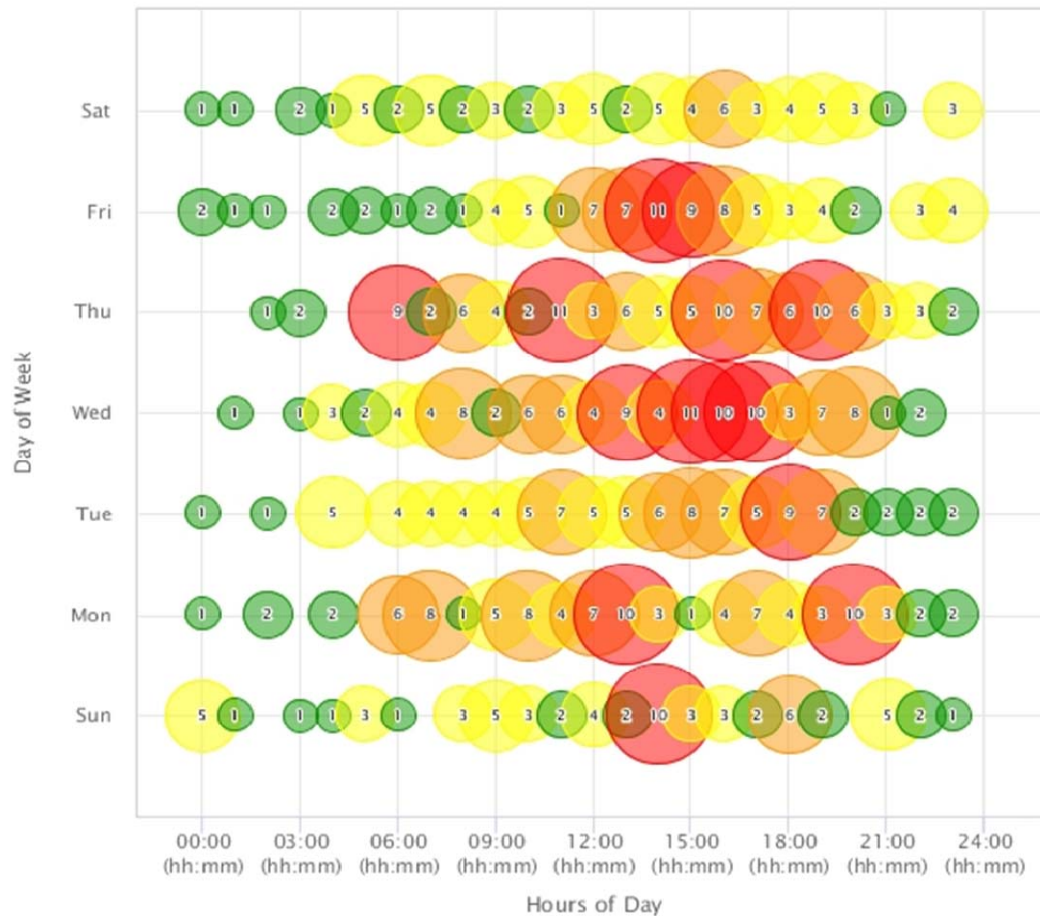


## Weekday on Staten Island-bound Triple Cantilever





# Incidents on Triple Cantilever



Crash	56%
Disabled Vehicle	31%
Disabled Truck	10%
Emergency Response	3%
Other	1%

Most Incidents		Event Count				
Hour	Day	Hour/Day	0-2	3-5	6-8	9-11
16-17	Wednesday	11-12,14-15,15-16/Thursday,Friday,Wednesday				

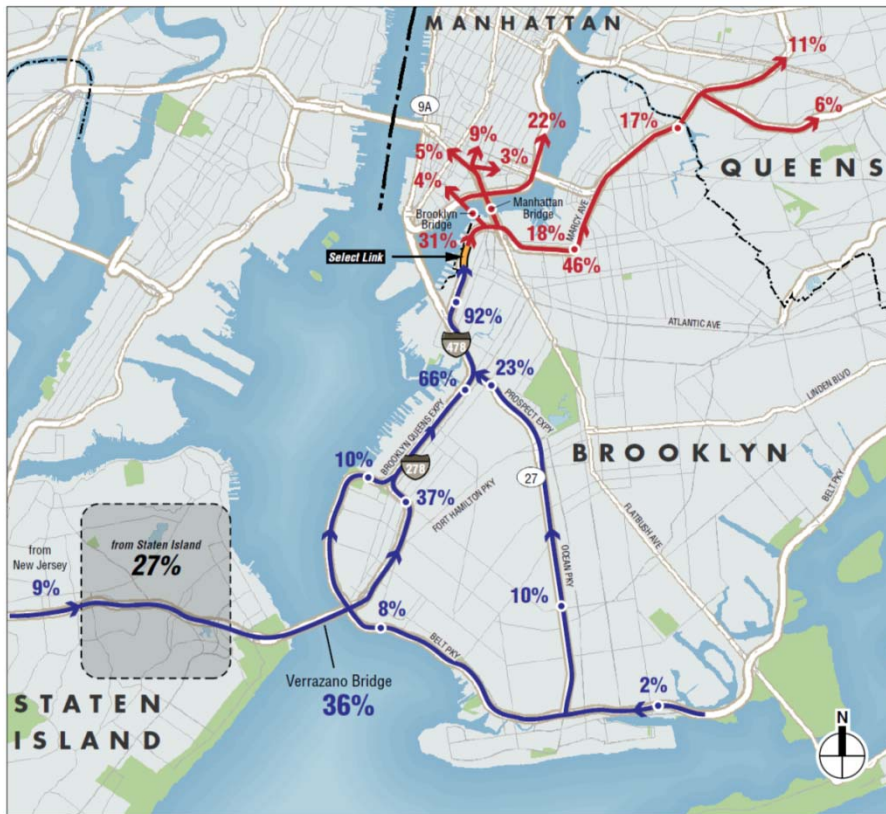
# Queens-Bound Auto and Trucks



## Weekday Mornings

Autos

Trucks



- Origins to Select Link
- Select Link Destinations
- Select Link Analyzed



- Origins to Select Link
- Select Link Destinations
- Select Link Analyzed

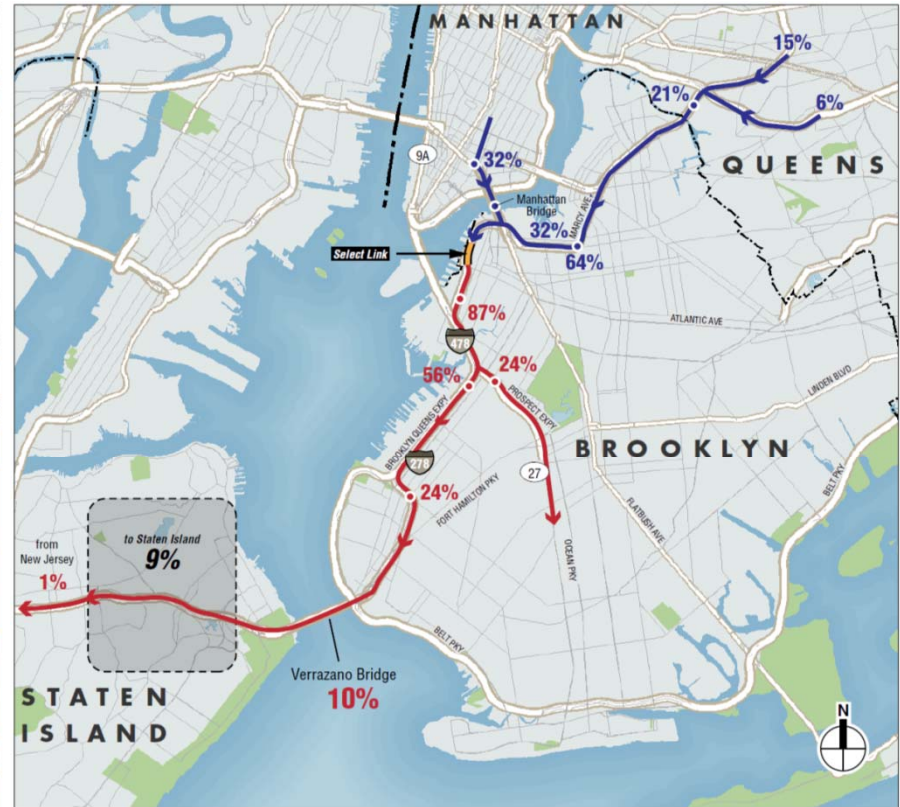
# SI-Bound Autos and Trucks



## Weekday Evenings

Autos

Trucks



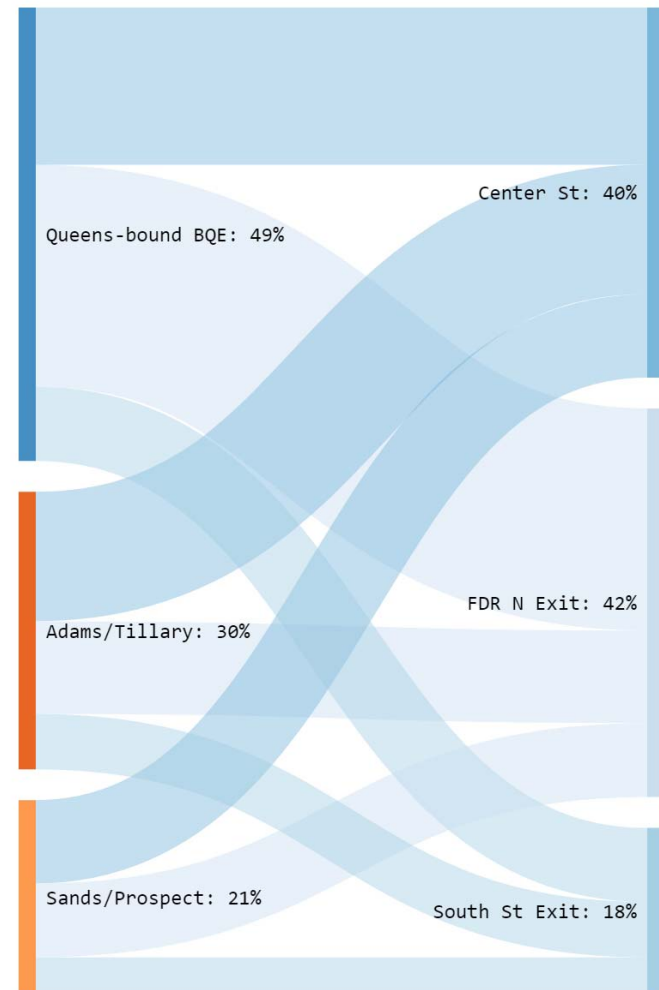
- Origins to Select Link
- Select Link Destinations
- Select Link Analyzed

- Origins to Select Link
- Select Link Destinations
- Select Link Analyzed

# Traffic to Brooklyn Bridge

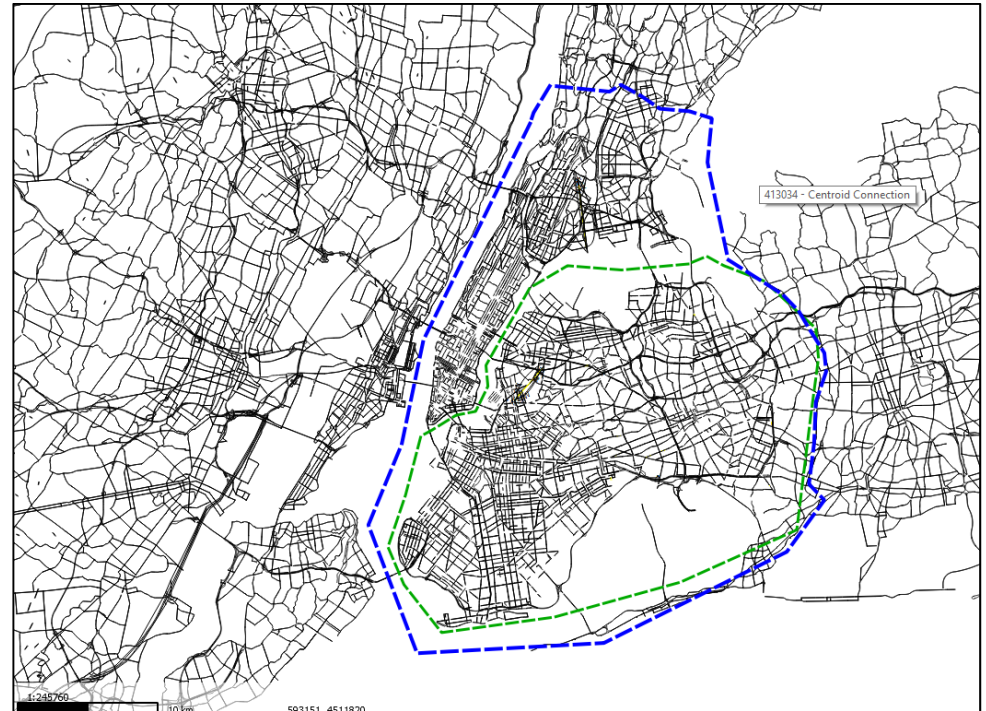
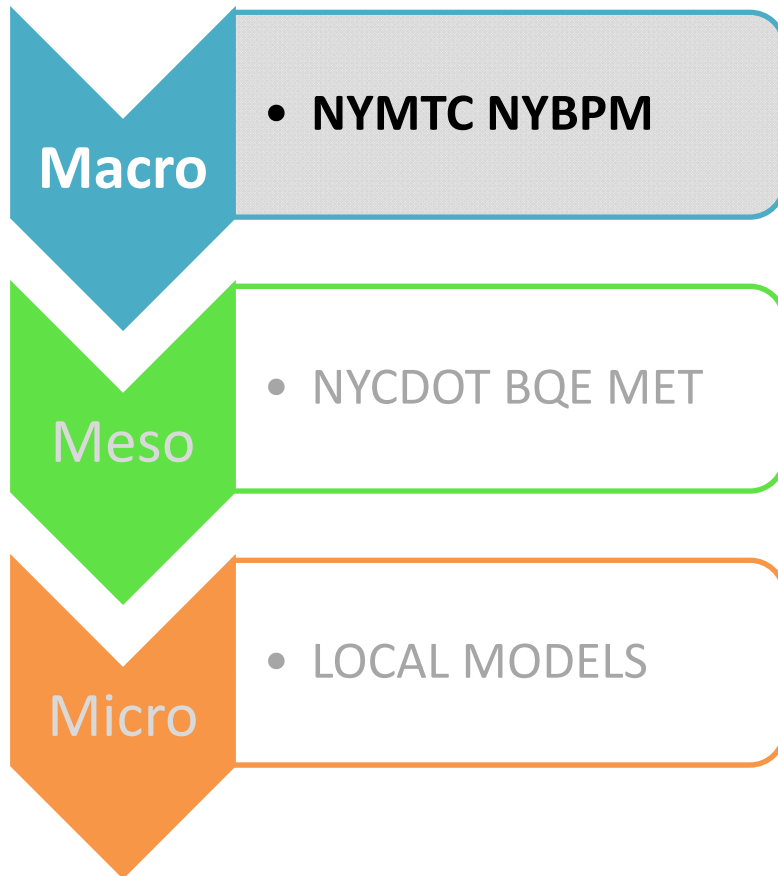


- About 1/3 of Queens-bound Triple Cantilever weekday traffic (25K/75K) exits to the Manhattan-bound Brooklyn Bridge.
- This represents nearly 1/2 of the total daily Manhattan-bound Brooklyn Bridge traffic.
- Of that traffic from BQE ramp, 1/2 travel to the northbound FDR Drive.



Source: StreetLight

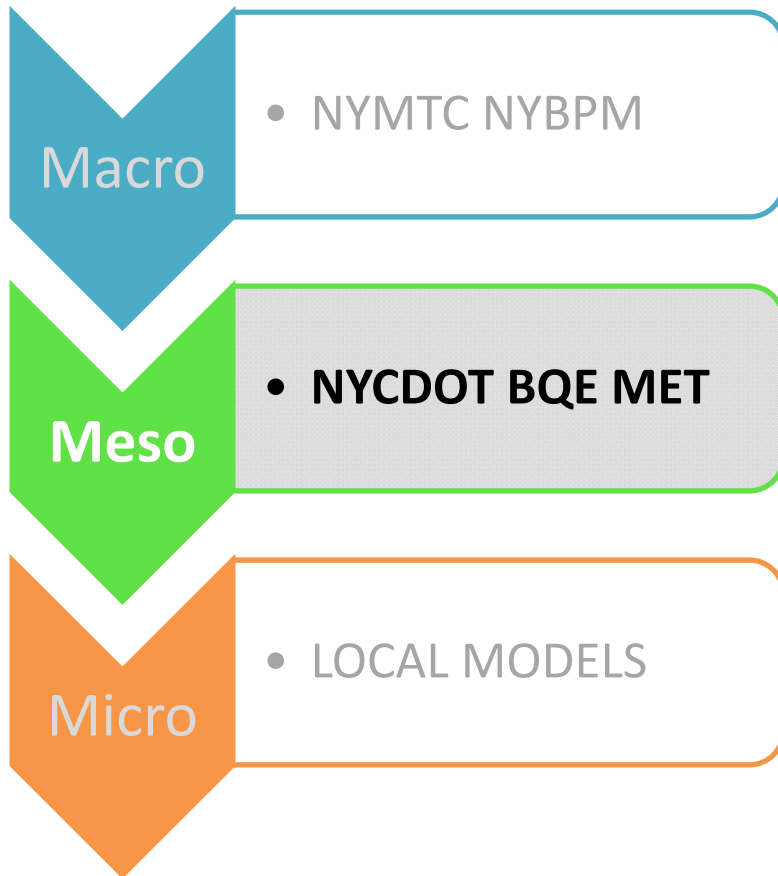
# Traffic Analysis Scope Regional and Local



Used for: 24-hour weekday regional and multi-modal travel demand; traveler choices such as mode and time; responses to tolls, HOV, transit policies, etc.

**Limitations: not capacity-constrained; no hourly and 15-minute volumes; missing local roadways**

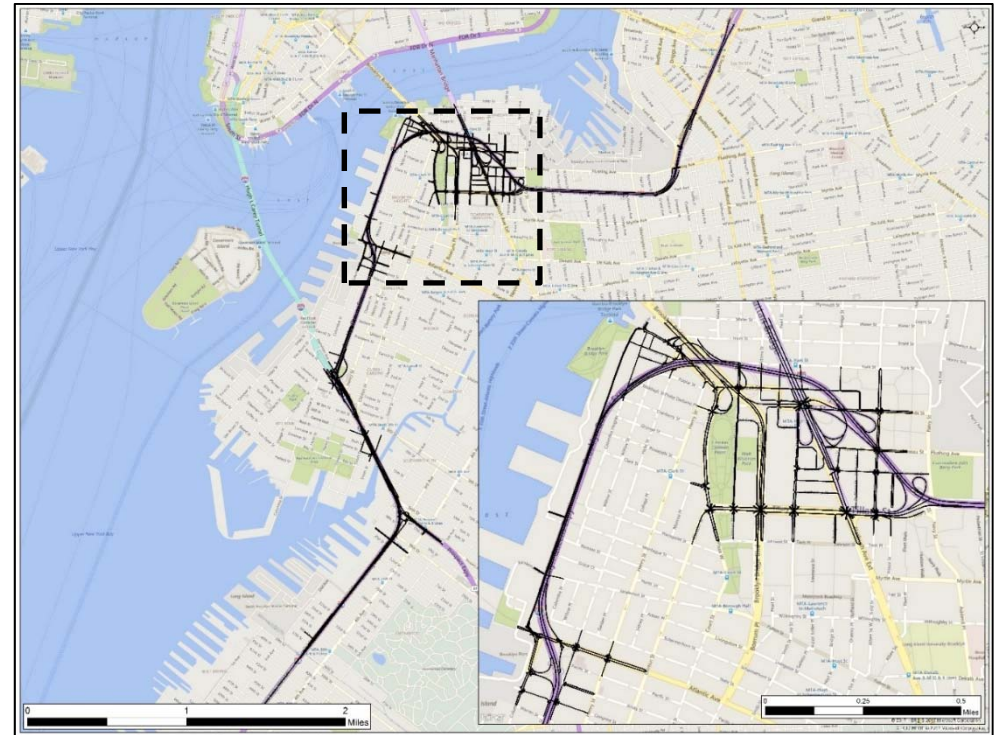
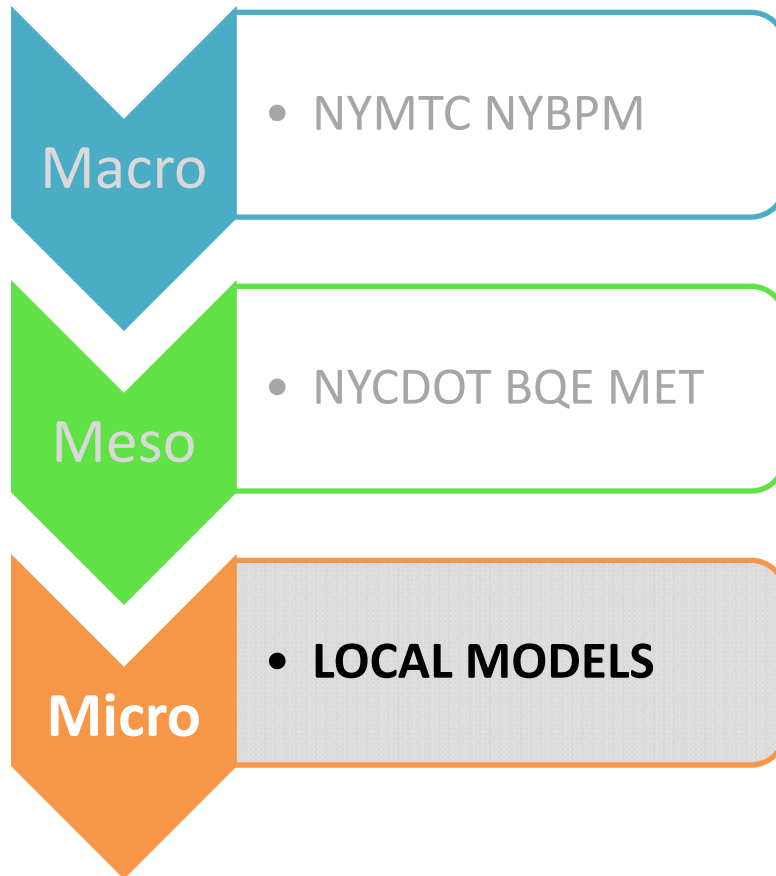
# Traffic Analysis Scope Regional and Local



Used for: Hourly and 15-minute weekday traffic volumes; dynamic, capacity-based rerouting of traffic due to roadway modifications; local roadways

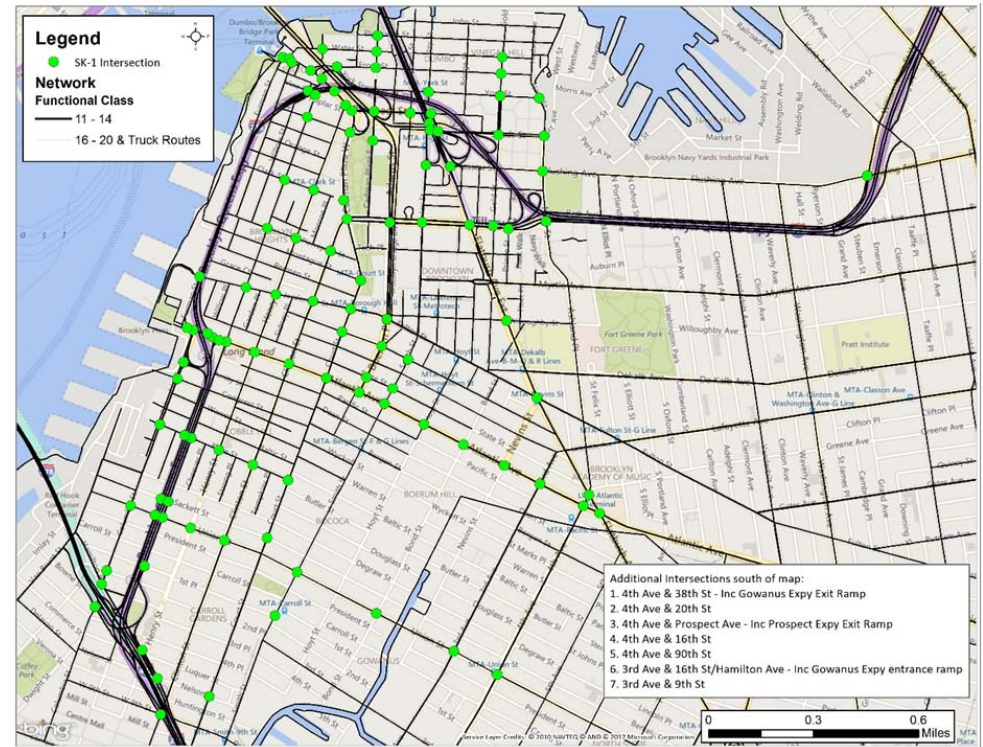
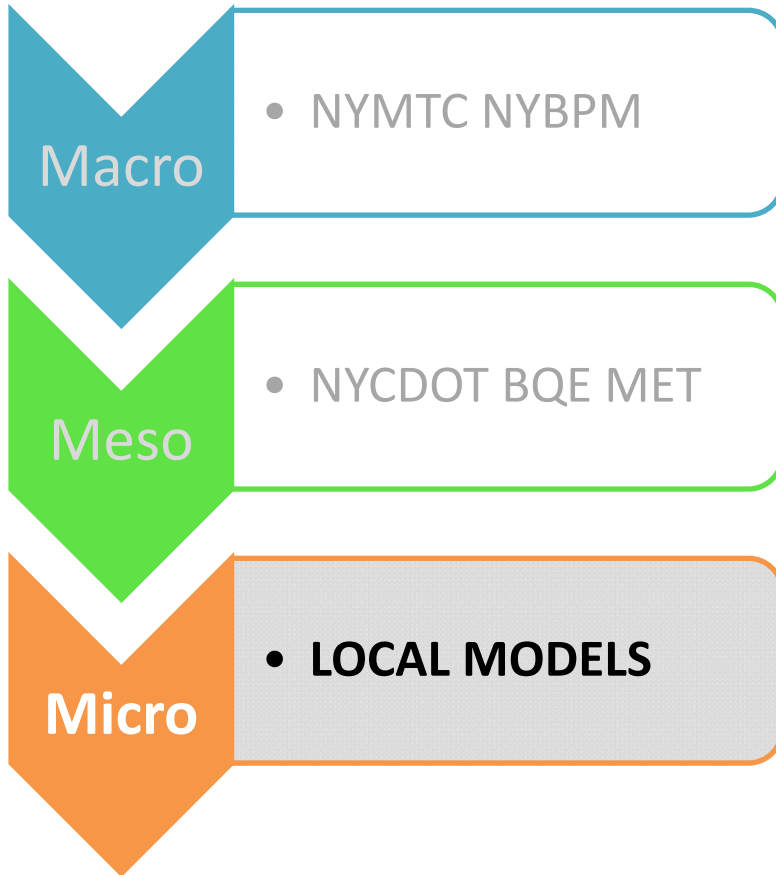
**Limitations:** run-time of dynamic assignment; does not simulate individual vehicles or traffic operations

# Traffic Analysis Scope Regional and Local



Used for: Animation of individual vehicles, traffic behavior at highway ramps and local intersections; congested speeds and queues; traffic operations

# Traffic Analysis Scope Regional and Local



Used for: Intersection-level capacity, delay and level-of-service for environmental review for study locations in green

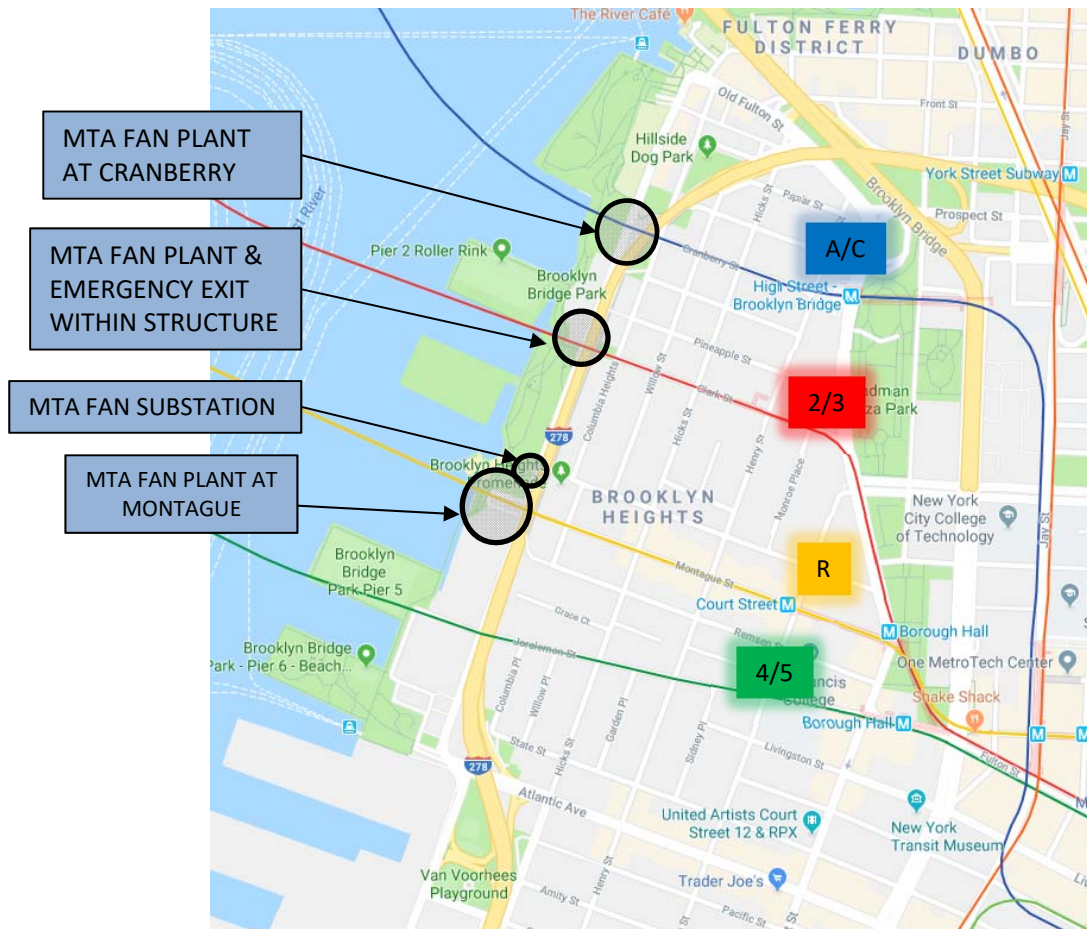


# SITE CHALLENGES

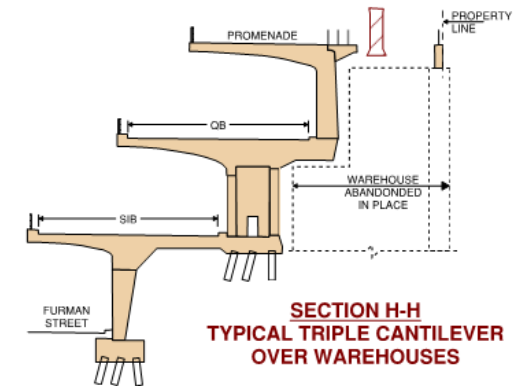
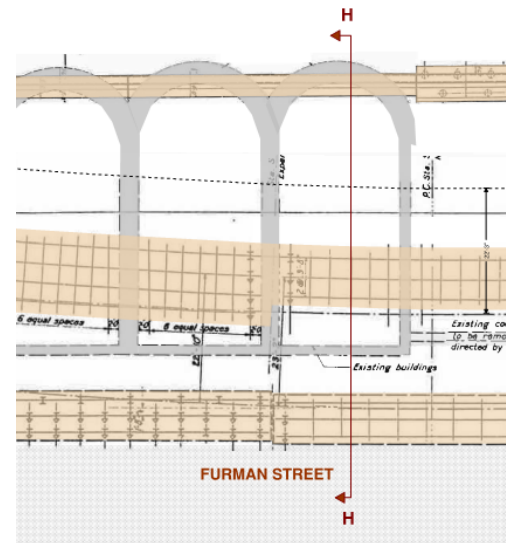
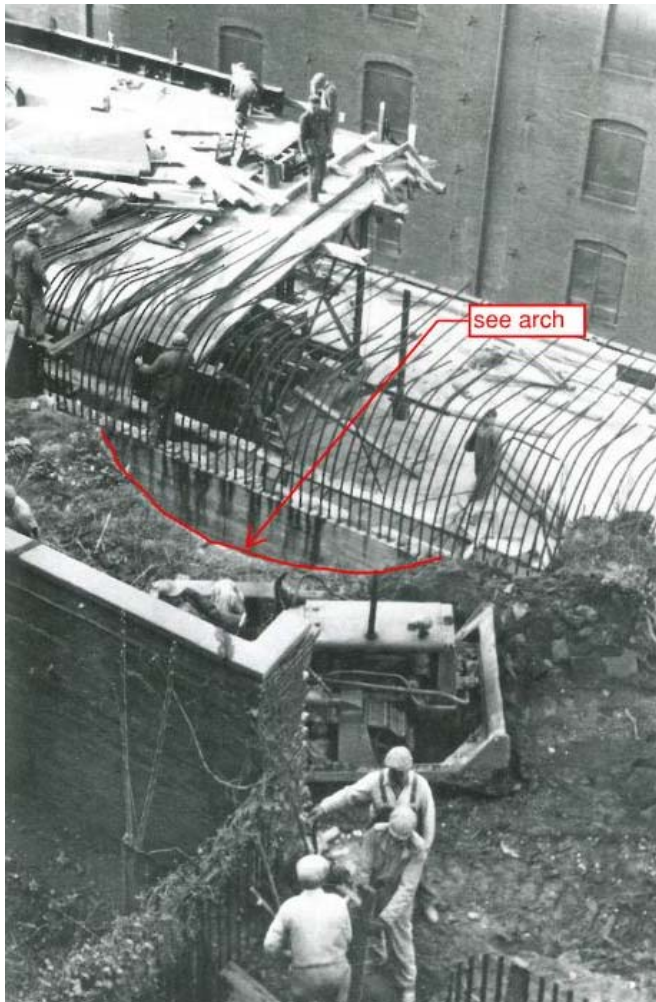
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# TA Facilities



# Structure Remnants at Promenade



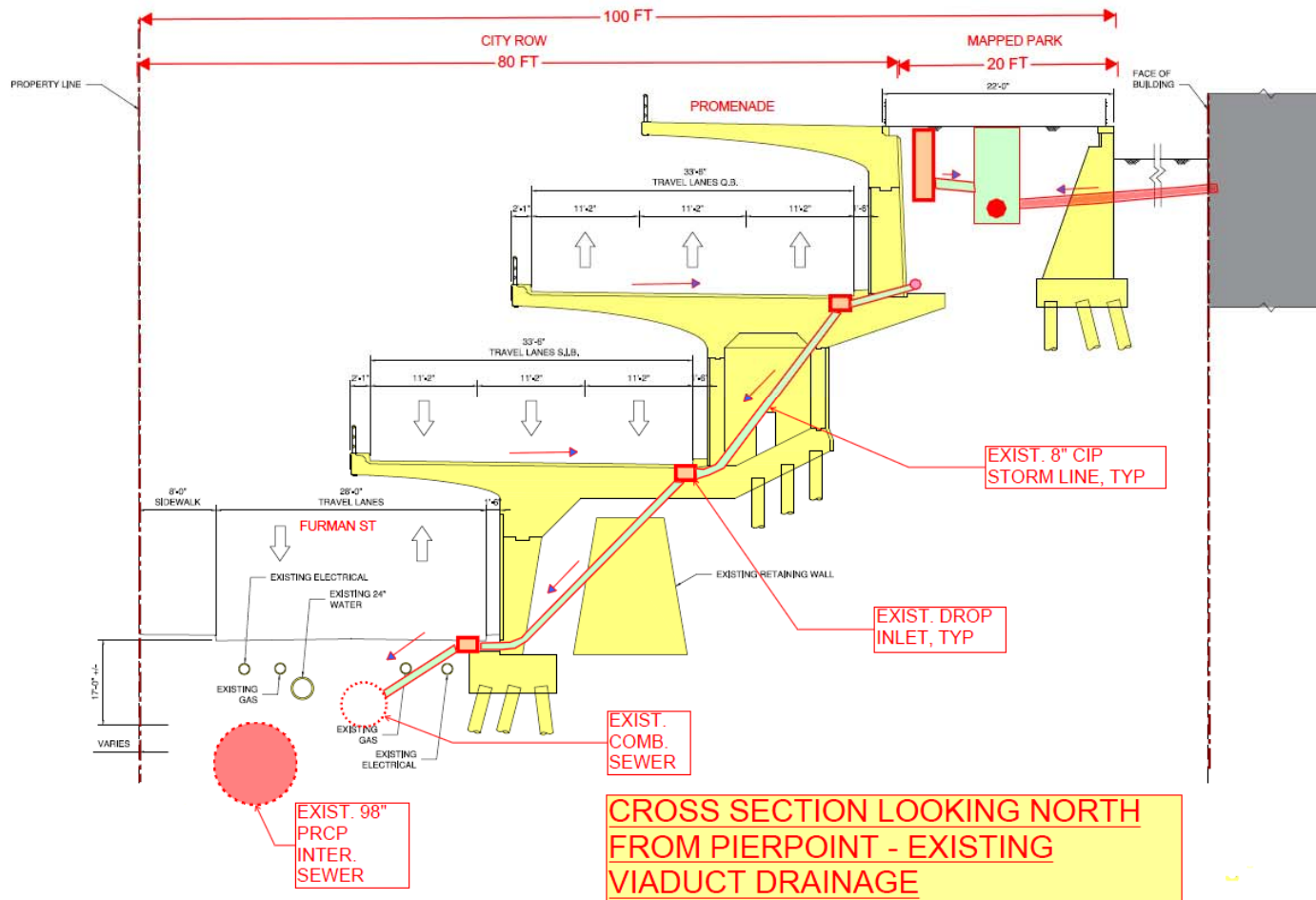


# NYCT Crossings- Clark Street



Redacted for security reasons

# DEP Interceptor Sewer



# Atlantic Avenue Interchange



## Atlantic Avenue Structure:

- New York State rehabilitated - 1998
- Rated in good condition in 2014

## Interchange Needs

- Ramp improvements
- Improve pedestrian connectivity
- Van Voorhees Park Configuration

# INSPECTION FINDINGS

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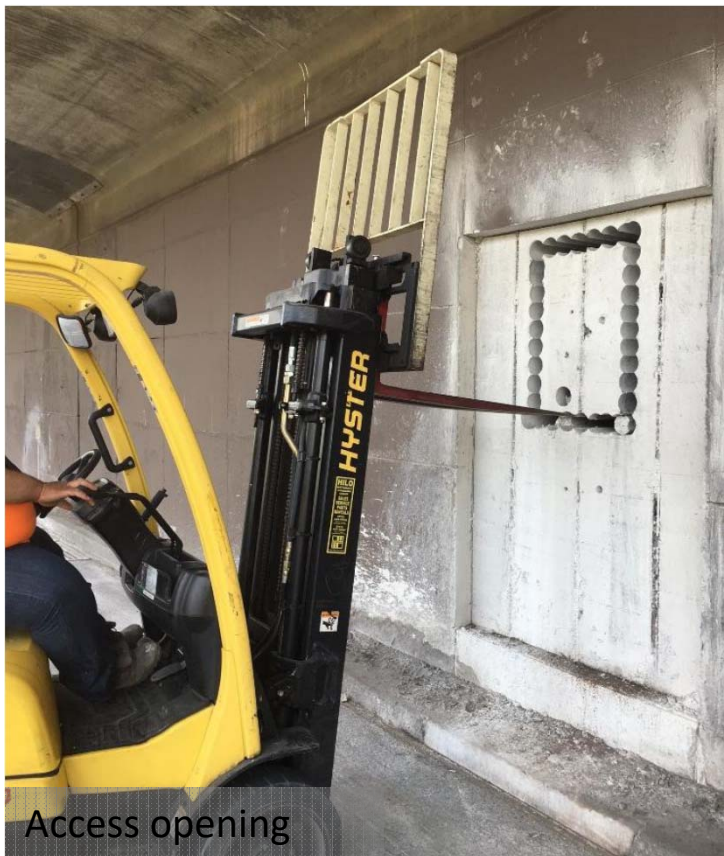




# In-Depth Inspection

## Inspection Process

- Hands-on inspections
- Testing of concrete cores and few rebars
- Load carrying capacity analysis



Access opening



Concrete coring

# Non-Destructive Testing



**Non-Destructive Testing\***: Various measurements which provide indication of corrosion rates cracks and moisture penetration



**Pavers were removed for testing on the Promenade then replaced once completed**



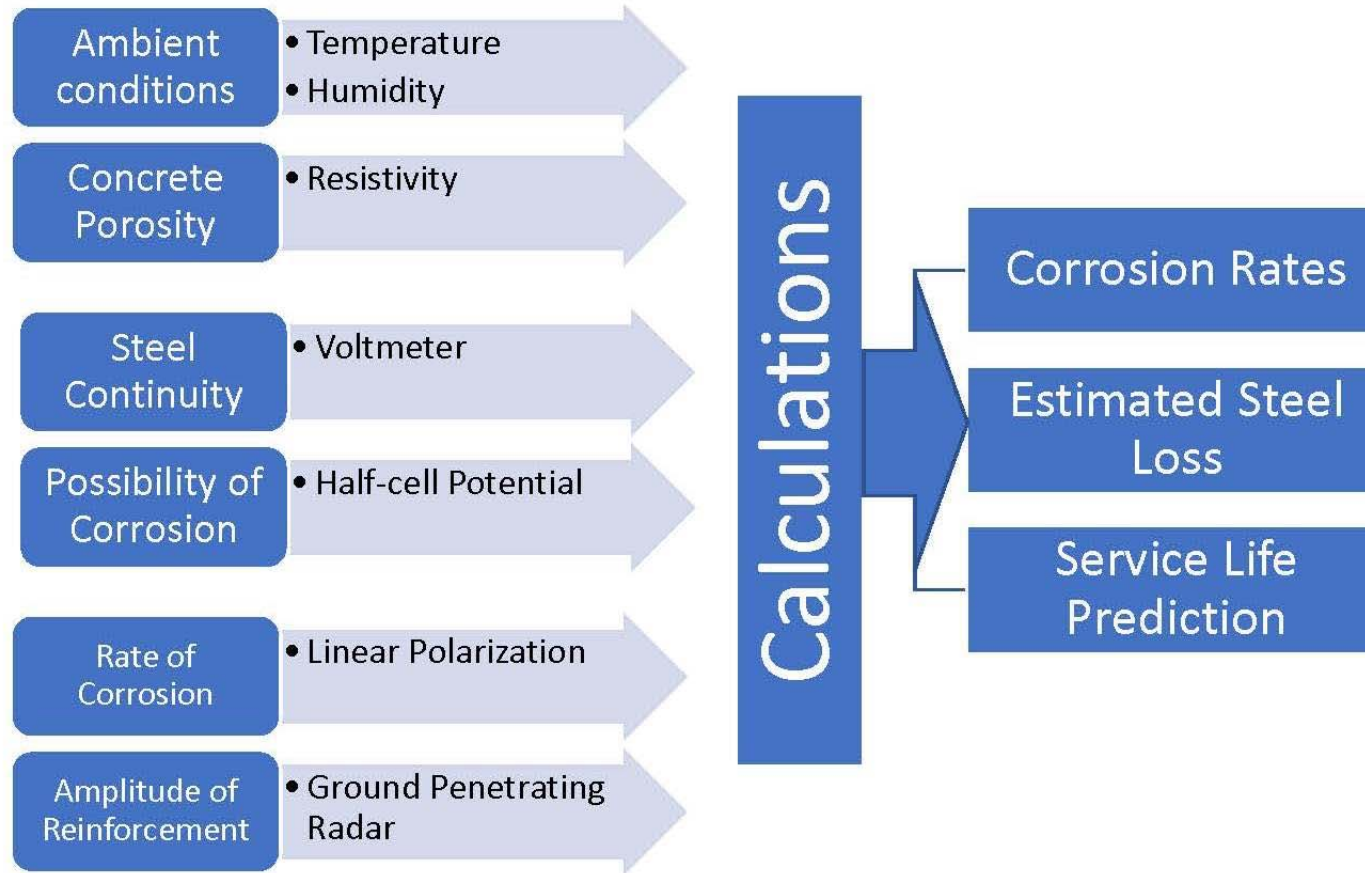
**Ground Penetrating Radar**



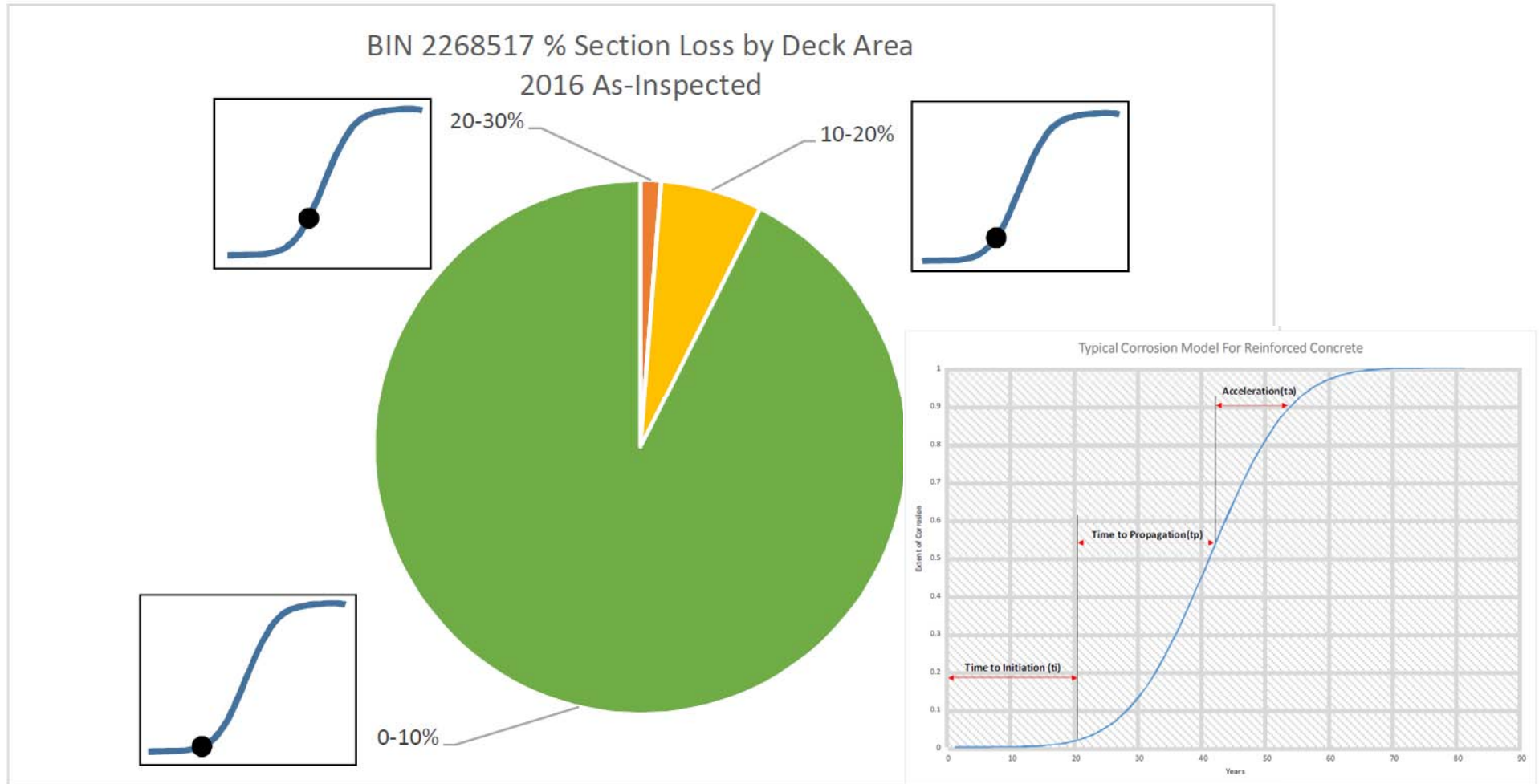
**Linear Polarization Resistance**

\*Focused in Triple Cantilever Area

# NDT To Results Flow



# Interpretation Of Results

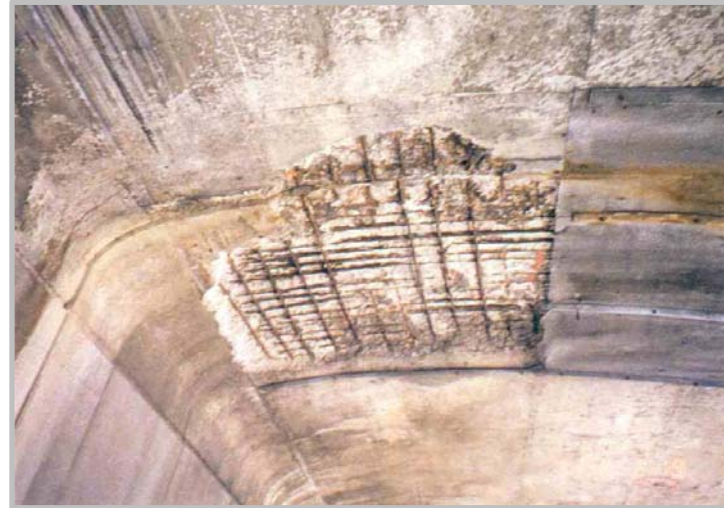


\*Focused in Triple Cantilever Area

# Structural Deficiencies



- Significant chloride content (deck/walls)
- Nonstandard load rating < HL-93
- Poorly performing deck joints
- Structural deterioration (spalls/efflorescence)
- Nonstandard railings
- Seismically deficient
- Poor freeze thaw performance
- Hazmat (asbestos and lead)
- Poor riding surface



# PREVIOUS STUDIES

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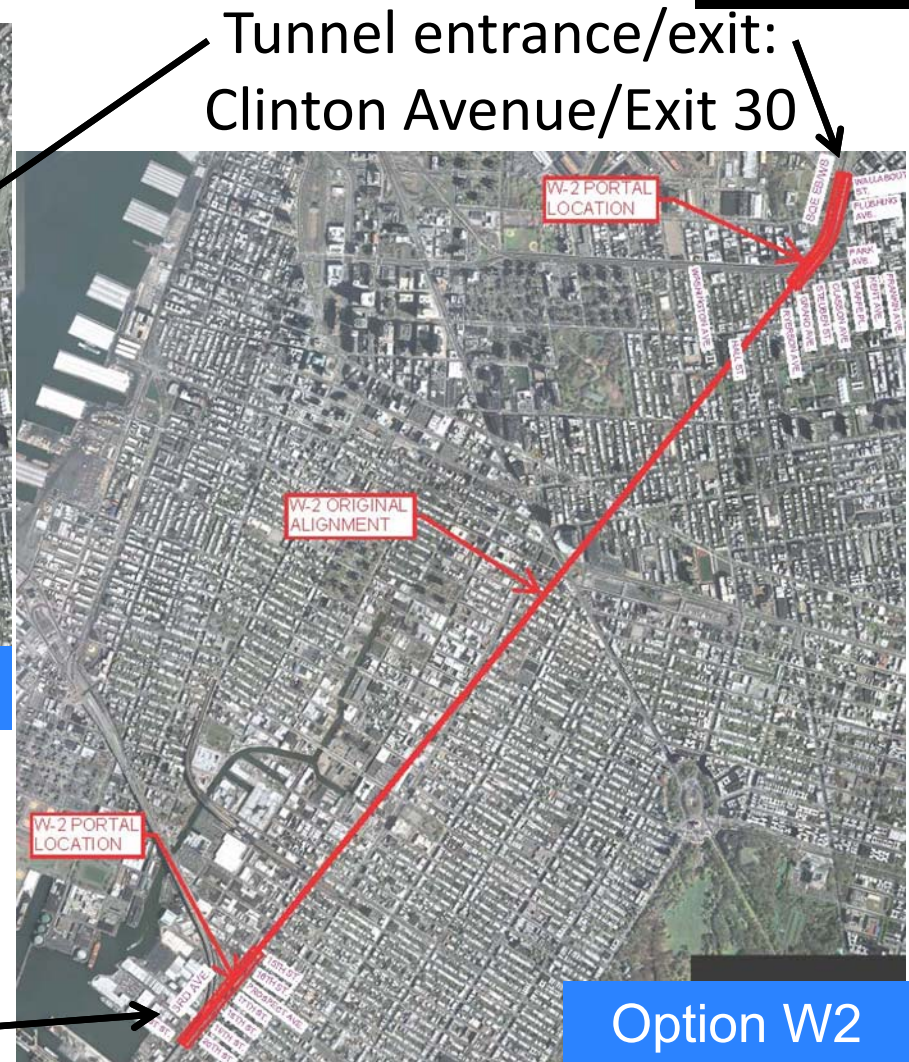
# Tunnel Study Results



Option T3

Tunnel entrance/exit:  
Rapelye Street/Exit 26

Tunnel entrance/exit:  
20<sup>th</sup> Street/Exit 24



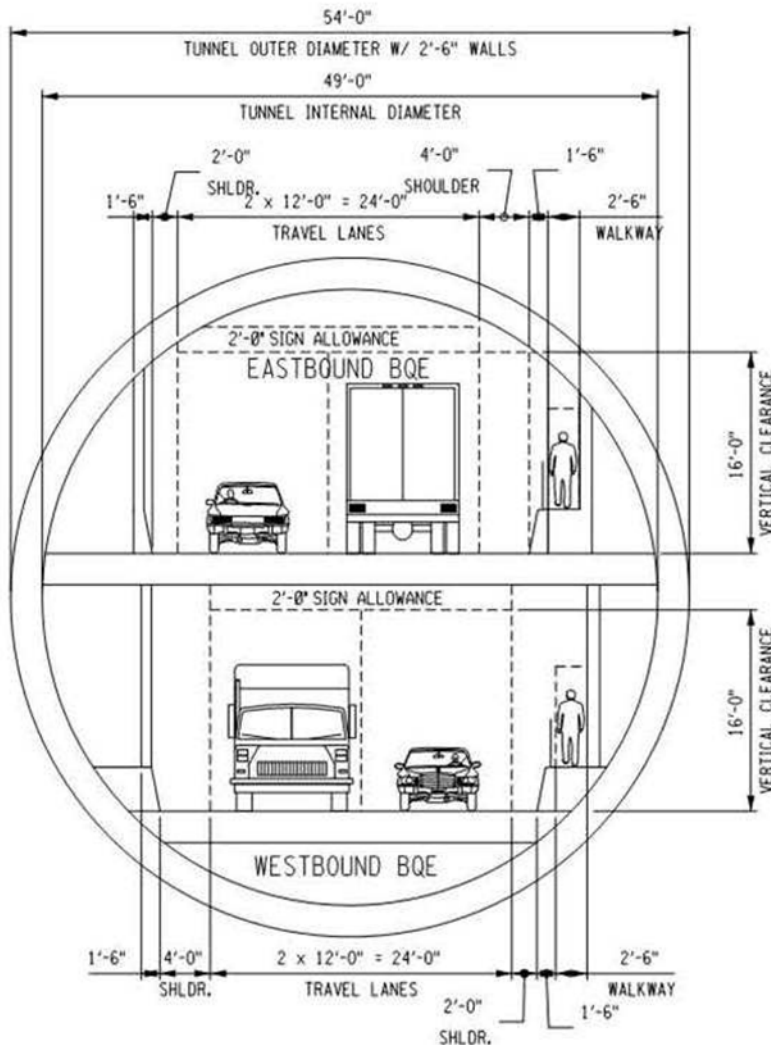
Option W2

Tunnel entrance/exit:  
Clinton Avenue/Exit 30

# Tunnel Obstacles



## Major Obstacles



- All but 2 configurations conflict with DEP's water tunnel.
- Feasible cross-section allows only two lanes of traffic in each direction.
- Tunnel requires that we also maintain the existing BQE structure:
  - To accommodate existing volume
  - To provide connectivity to the Brooklyn and Manhattan Bridges (50% of BQE traffic currently uses exits that the tunnel would not serve)
- Tunnel options are prohibitively expensive, costing at least several billion
- Would not eliminate the need for the project.



# Belt Parkway Alternative Study



DOT studied the feasibility of using the already congested Belt Parkway (over 140,000 vehicles per day) as an alternate truck route during BQE construction, but making the Belt safe for trucks could cost up to \$3 billion, take up to 10 years to fix:

- Bridges over the Belt, some of which carry subway lines, are too low for trucks
- Bridges that carry the belt were not built to carry heavy vehicles, requiring major construction projects to remedy
- Narrow lane widths and tight turns at ramps are unsafe for trucks

# Project Assumptions & Concepts



- In 2018, the City received Design-Build authority from the State, providing the opportunity for a more efficient project.
- NYCDOT has pursued this project, initially focusing on key assumptions:
  - Maintain the existing traffic capacity and local connections in order to minimize congestion and impacts to local streets and the regional transportation network
  - Rebuild generally in the same footprint, given the surrounding geographic constraints (bridges, underground infrastructure, historic Brooklyn Heights, Brooklyn Bridge Park, etc).

To date, two staging concepts have been presented:

Full replacement with Temporary Elevated Roadway & Incremental Method

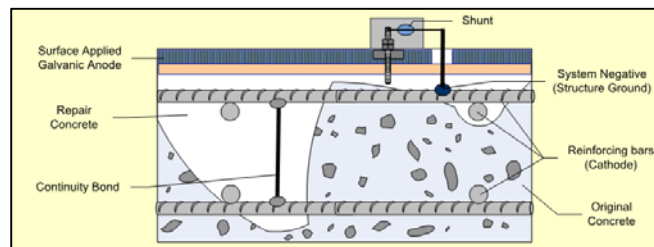
# Potential Rehabilitation Concepts

The Rehabilitation Concept:

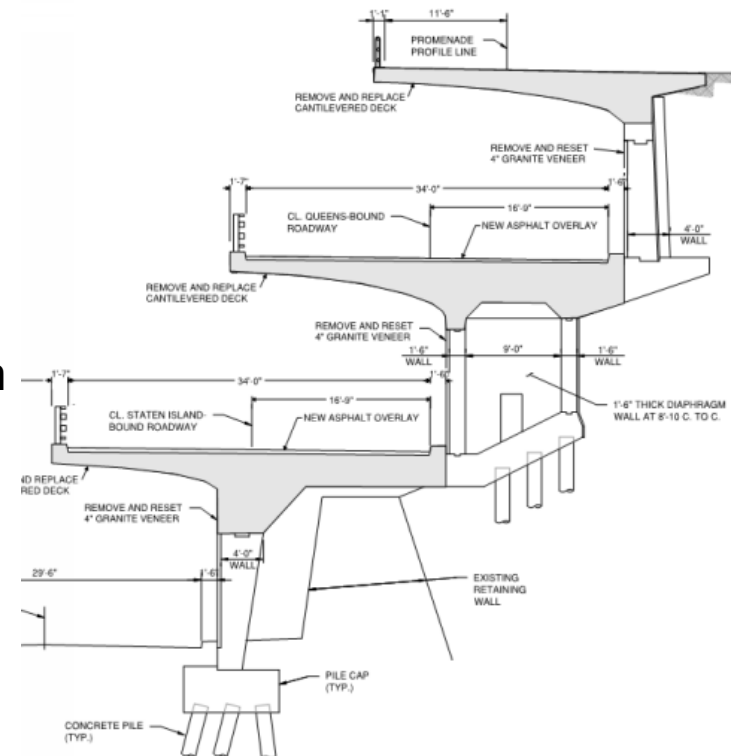
- Repairs or partially reconstructs, in the same location as the existing BQE
- Does not require use of a temporary highway structure
- In keeping with historic character

Concepts to Consider:

- Partial Depth Deck Replacement
- Full Depth Deck Replacement
- Use of composite materials
- Preservation Techniques e.g. Cathodic Protection
- Other new technologies or techniques?



Galvanic Cathodic Protection



# Potential Rehabilitation Consideration

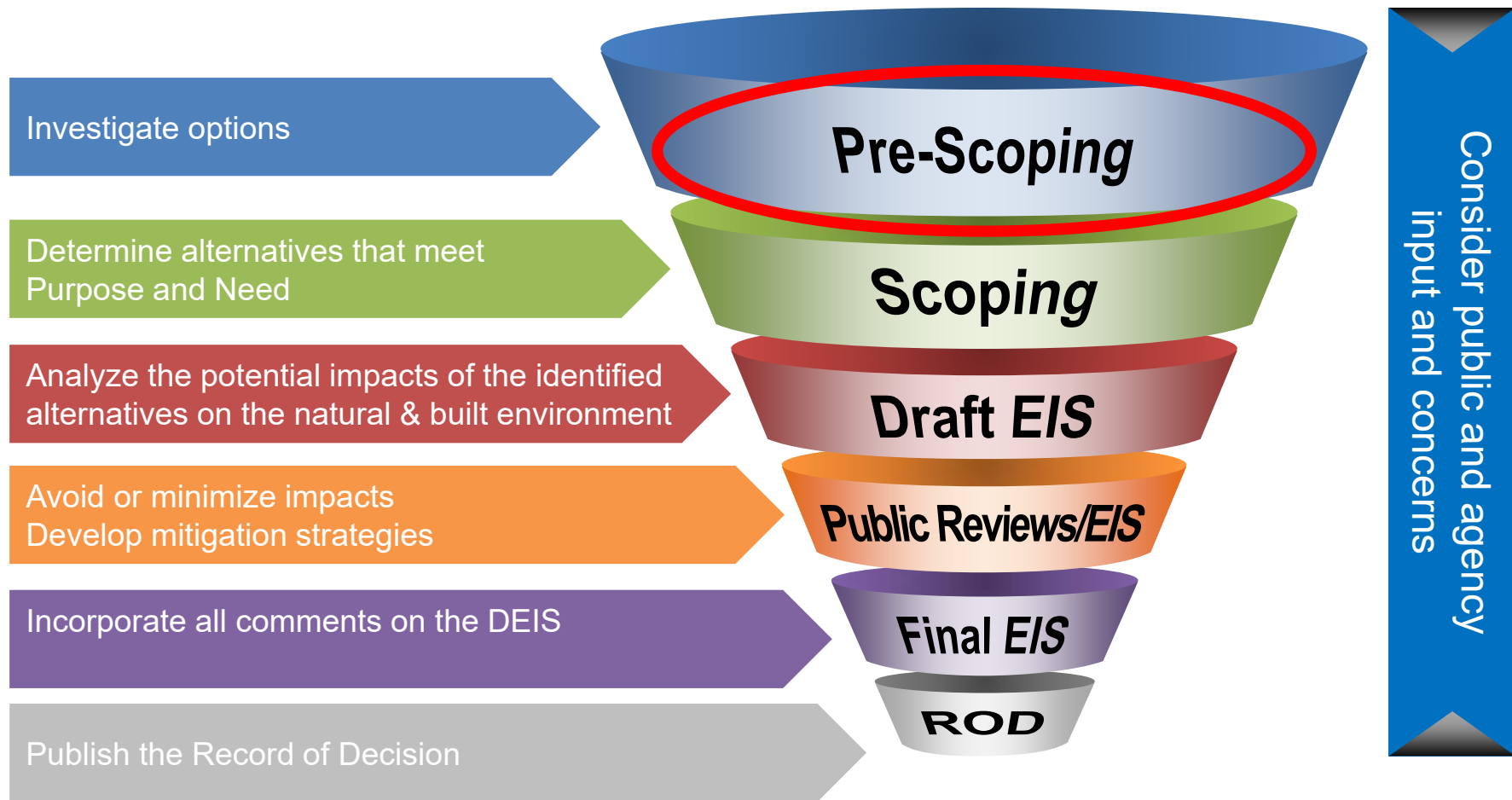


- **Rehabilitation concepts should be considered, given the project area's site constraints and infrastructure.**
  - Avoids the use of a temporary highway structure, about which the community has serious concerns
  - Stays in the existing footprint, including during construction
- **However, rehabilitation comes with trade-offs as well**
  - Increasing the load carrying capacity to match current loads while possible adds to complications
  - No major improvements to the highway (widened lanes, adding shoulders, etc.) or additional potential project benefits such as new bridge connections.
  - Work would take place at night
  - Less certainty and consistency about how long the rehabilitated highway will last (different pieces may age differently), and the project will need to be addressed again in the future
  - Does Not Address Existing foundations and Other Non-Accessible Elements

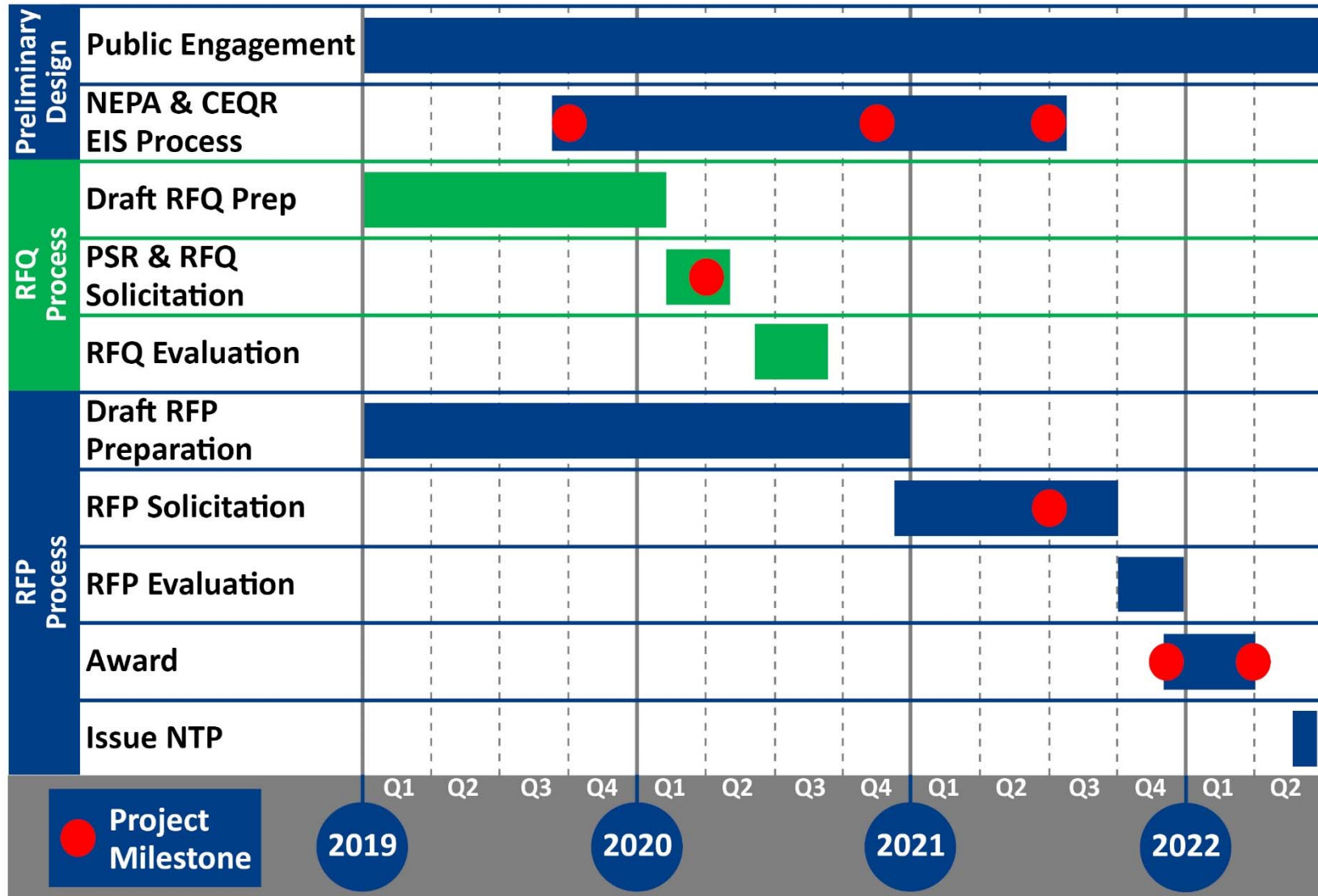
Question is what is gained by pushing off the replacement to some point in the future?

# Project Schedule

# Environmental Process Summary



# Design Build Draft Schedule



# Other Approvals



The BQE Project will also require a number of other approvals, in addition to the formal environmental process, including:

- Parks Alienation Legislation
- Uniform Land Use Review Procedure (UURP)
- Possible alterations to the General Project Plan (GPP), if project footprint impacts Brooklyn Bridge Park