THE NEW YORK
CITY COUNCIL

COREY JOHNSON
SPEAKER

The Future of the BQE

February 2020

THE COUNCIL OF
THE CITY OF NEW YORK
CITY HALL
NEW YORK, NY 10007

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SPEAKER

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Dear Fellow New Yorkers,

The Council is pleased to be sharing the findings of its report, The Future of the BQE.

The goal of the report is to synthesize the information we have gathered about the Brooklyn-Queens Expressway and chart a direction forward for both the stretch of the BQE that is in dire need of repair – the triple cantilever – and for the broader corridor.

Infrastructure decisions can be technically complex and confusing. Our goal with this report is to summarize the trade-offs of different interventions so, as a City and State, we can make informed decisions together. To guide this analysis the Council hired Arup – a leading engineering and design firm – to bring an expert eye and a valuable perspective from working on similar projects around the world.

We are also fortunate in the Dumbo, Brooklyn Heights, and Cobble Hill communities to have significant expertise and energy. We were able to draw upon a lot of the work they have done to advance this conversation.

The BQE is a critical arterial for moving freight and people across our region but how can it better address and adapt to the needs of a 21st century New York?

How can we reduce the size and scale of the highway?

If we are going to spend billions of dollars maintaining the roadway over the course of the next decade, how do we ensure we end up with something better than what we started with?

Working closely with Arup, we have arrived at a strategy which we think presents a clear direction forward and answers some of these difficult questions.

Continuing to kick the can down the road with purely temporary fixes will not help address our long term challenges. We need to seize this moment to finally create a plan for not only improving this stretch of the BQE, but more broadly a set of strategies for re-thinking the relationship of highways with our City. This report is an important step forward in that discussion.

Sincerely,

Corey Johnson
Speaker

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Acknowledgments

The Future of the BQE was produced by the New York City Council Land Use Division. This report was written by Sam Frommer and Raju Mann with the help of the Arup team: Trent Lethco, John Karn, LJ Nassivera, Anne Patrone, Lana Potapova, James Francisco, and Greyson Clark.

Executive Summary

One of the central planning challenges of the 20th century was how to incorporate the automobile - a new mode of travel - within dense cities that were not built to accommodate them. The resulting collision of auto-oriented infrastructure with cities is a conflict that many American cities have never fully recovered from, with highways destroying the very qualities that make cities so special and creating a new set of challenges around environmental sustainability, equity, and safety.

We live everyday with the costs and risks of this legacy infrastructure through poor air quality, divided communities, traffic violence, visual blight, and noise pollution – costs which depress economic and social opportunities and disproportionately fall on environmental justice communities. And yet, along the Brooklyn-Queens Expressway (BQE) we as a City are proposing to replace this highway infrastructure in kind? In so doing, not only are we out of step with our own goals, we are re-imposing the burdens that were ignored when we built the highway system in the first place.

Can we do better?

Other American cities – San Francisco, Seattle, and Boston – have more intentionally and aggressively tried to undo the mistakes of an auto and highway centric view of mid-century planning. And New York embraces bold solutions when there has been vision, ambition, and good design: the replacement of the collapsed West Side Highway (1973) with a new surface street and Hudson River Park, the creation of the Times Square pedestrian plaza (2009), and the re-imagined Sheridan Boulevard (2019), among other examples.

Why should the BQE be any different?

A stretch of the BQE – the triple cantilever between Atlantic Avenue and Sands Street in Brooklyn – is in desperate need of repair. As a critical route for the movement of people and goods, the BQE cannot just be removed, and we cannot delay in its replacement.

How can we use this opportunity to rethink not just the triple cantilever, but the entire I-278 corridor to achieve a range of goals beyond just moving over 150,000 vehicles a day through our dense and vibrant city?

In an effort to answer these question the City Council commissioned Arup – a leading design and engineering firm – to help clarify viable design and policy solutions that would create a path forward for this beleaguered project.

After months of careful study, Council and Arup have identified recommendations for the triple cantilever – where the need to fix the highway is most acute – that can be applied to the corridor to reflect the convictions and values we have today about the kind of city we want in the future.

How do we get there?

The Council believes the following ingredients are essential to the success of the project:

A Real Governance Strategy
A City-State partnership that moves us beyond the gridlock and enables a better project.

A Shared Vision for the Future
We need to convene key stakeholders and create a consensus approach – we're not expecting unanimity.

Genuine Community Engagement
A process that includes neighborhoods from conception to completion.

Sophisticated Physical Planning and Engineering
Design solutions that solve multiple policy objectives while correcting past mistakes.

New Funding Approaches
Financing that enable investment in the City's future.

The money, time, and disruption that would have resulted from the construction method put forth by New York City Department of Transportation in September 2018 requires that we seriously consider alternatives that have previously been dismissed by the State and City.

Only by working across governmental and agency divides can we build a better project that incorporates best practices, provides opportunities for improved public spaces, and internalizes current externalities – air quality, access across barriers and to open space, noise, pollution, health, and safety – through a major capital investment.

Working with Arup the Council evaluated seven physical planning options and narrowed them down to two preferred scenarios that range in scale and ambition. Much more detail about our analysis is in this report, but the conclusion is that for the stretch of the cantilever we need to advance one of the approaches the Council has identified as viable options:

Scenario 1 - Capped Highway: This scenario is based on the Mark Baker Tri-Line and Bjarke Ingels Group Brooklyn-Queens Park concepts, in which the highway is reconstructed at-grade and then capped with an expansion of Brooklyn Bridge Park.

Scenario 2 - Tunnel Bypass with Surface Boulevard: Construct a bypass tunnel from the Gowanus Expressway to Bedford Avenue in South Williamsburg, allowing for the reconstruction of the BQE from Cobble Hill to Clinton Hill as a surface street and new open space, transforming the entire area.

So how do we move this work forward?

1. Pass **legislation** in Albany this session (by June 2020) to create a new I-278 corridor governing body which, as a first step, should **focus on implementing one of the two approaches described above**.
    a. The legislation should create equal partners in the City and State, and identify broad goals for the corridor related to transportation, community engagement, the public realm, and sustainability.
2. The **new governing body** must begin its work in haste.
    a. Create a robust regional transportation model to aid in the assessment of alternatives, and to test various road pricing schemes and other demand management strategies to create a viable pathway to a smaller future roadway for the entire corridor.
    b. Work with State and City partners to identify a corridor wide phasing plan to identify subsequent segments of the BQE that will need to be replaced. The plan should integrate current work with the long-term vision.
    c. Create design guidelines and standards for the corridor that align with the vision and can help communities shape local decision making and replacement schemes as their segment of the BQE is reconstructed.
3. Maintain **safe operations** of the triple cantilever for the near-term.
    a. Continue to monitor the structure and do necessary maintenance and repair work.
    b. Work with State elected officials to implement automatic enforcement of overweight vehicles using weigh in motion (WIM) technology and cameras.
    c. Convert the roadway to two-lanes in each direction consistent with what the Mayor's panel on the BQE recommended.

This document proposes a path forward for the immediate and long-term needs of the BQE, aspiring for a better highway that does more than just move people and goods between places, but also unites communities and creates a model for the large-scale replacement of legacy infrastructure in New York City. The time to act is now.

1. History

Figure 1: Original construction of the triple cantilever.

1.1 Original Construction

Planning for the Brooklyn-Queens Expressway (BQE) began in 1936, and forms the segment of the I-278 corridor from Hamilton Avenue in Red Hook to the Grand Central Parkway in Queens. It was built to connect the proposed Verrazzano-Narrows Bridge (which opened in 1964), the already existing Gowanus Parkway (which later became the Gowanus Expressway), and the Triborough Bridge to create a single, limited-access highway that connected four of the five boroughs.

Like many large public works of the time, Robert Moses helped to plan and construct the BQE, including one of its most distinctive feature, the triple cantilever, which opened in 1954. This 0.4-mile stretch was an innovative way to stack the highway to skirt Brooklyn Heights, saving the neighborhood from being bisected along Hicks Street, while creating one of the City's most iconic open spaces: the Brooklyn Heights Promenade.

The BQE opened two-years before the creation of the Interstate Highway System in 1956, meaning that it was not designed to interstate standards. While many sections have since been reconstructed to newer standards, the triple cantilever remains essentially the same as it did in 1954 when it opened.

The triple cantilever was originally designed to accommodate 47,000 vehicles – it now serves more than three times that amount daily.

The unique stacked design of the triple cantilever created a series of 21 bridges, generally with 50-foot spans, which were constructed using a variety of methods. Unlike a typical bridge, the triple cantilever is anchored on only one side (see Figure 3) – which when combined with its age, narrow lanes, lack of shoulder, heavy traffic flow, and the many physical constraints along the corridor – makes rehabilitating or reconstructing this stretch of highway extremely challenging.

1. History

Figure 2: An early view of the triple cantilever after it opened to traffic.

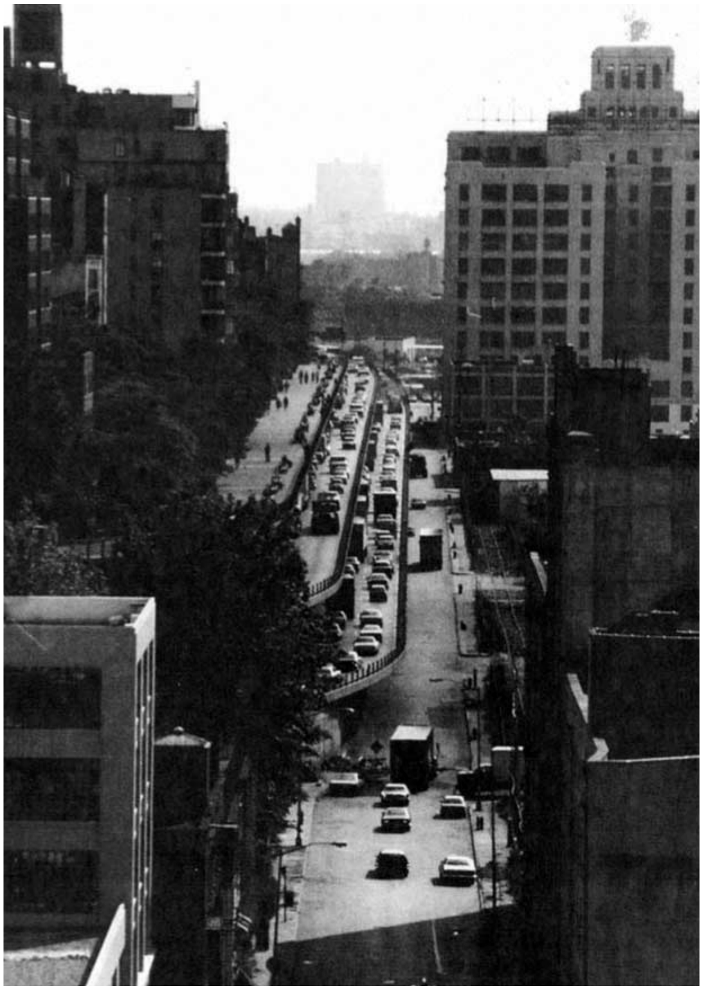
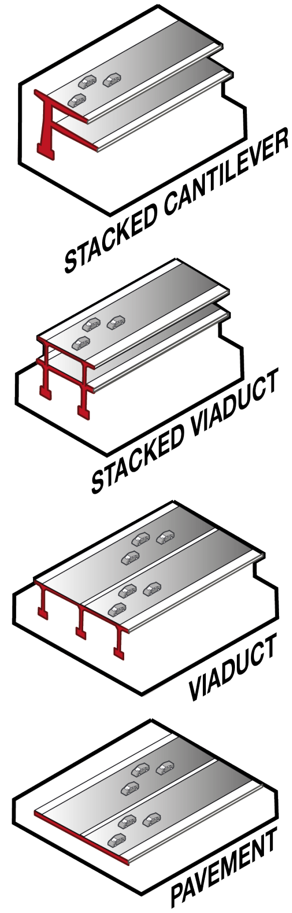


Figure 3: A typical roadway is at-grade, a viaduct is supported on columns across its width, and a cantilever is supported on one side and then hangs from that point.



1.2 Role of the BQE and Regional Transportation

I-278 in Brooklyn and Queens consists of a series of elevated, at-grade, and trenched segments from the Verrazzano-Narrows Bridge to the RFK Triborough Bridge that serves tens of thousands of motorists a day, is a significant regional link for vehicular traffic and goods movement through Brooklyn and Queens, and can also be a barrier in the same neighborhoods it connects. Varying portions of the highway have been rehabilitated or reconstructed in a piecemeal fashion to meet modern standards and needs. As Brooklyn's only interstate highway, the BQE falls under both state and federal regulations. Accordingly, the City and State share responsibility for maintaining its safe operation and function.

Regional Freight and Congestion

I-278 makes numerous connections to regionally important highways and industrial areas. It is one of the most heavily traveled roadway in New York City, seeing around 153,000 vehicles on a typical weekday, including up to 25,000 heavy vehicles (16%), making it critical for regional goods movement. During weekday morning peak, there can be up to 1,100 trucks per hour on the BQE.

The BQE is the only interstate in Brooklyn and the primary connection to the ports and highways to the south and west in New Jersey for all of Long Island (including Brooklyn and Queens) due to truck restrictions on the East River crossings and Hudson River tunnels. The next available Hudson River crossing for most trucks is the George Washington Bridge, which is a 25-mile drive to

1. History

Figure 4: The arterial and highway systems meeting current state and federal standards (in red), and existing or proposed main routes that have not been upgraded to current state and federal standards (in blue), including the triple cantilever.

the north along truck routes. No similar parallel route exists through Brooklyn for freight movement to and from Staten Island and New Jersey.

> ***The BQE is the only interstate highway in Brooklyn.***
> - ***153,000 vehicles/day***
> - ***1,100 trucks/peak hour***
> - ***The next available Hudson River crossing for most trucks is the George Washington Bridge (25-miles away)***

The heavy volume of cars and trucks on the triple cantilever leads to multi-hour congestion in both directions during the weekday afternoon and evening hours. The average speeds are below 30 miles per hour for 17-hours a day in the Queens-bound direction and for 13-hours in the opposite direction. Crashes and incidents are common and up to ten times higher than a typical roadway in the State. Emergency response times are constrained by the lack of shoulders, narrow lanes, and heavy congestion, meaning a crash can result in more severe disruptions than as compared with a roadway conforming to modern highway design standards. This often causes vehicles to back up on local streets as well.

> ***Crashes and incidents are* ten times *more common on the triple cantilever than a typical road in the State.***

Travel patterns on the triple cantilever differ by vehicle type and time of day. The peak travel in both directions occurs during the morning peak period, which features a large share of eastbound traffic that is bound for the Brooklyn and Manhattan Bridges. About one-third of eastbound traffic from the triple cantilever exits to the Brooklyn Bridge to get to Manhattan.

Around 25% of Queens-bound traffic and 35% of Staten Island-bound traffic is not trying to access any of the entrances or exits between Atlantic Avenue and Sands Street – meaning that it is through traffic for this area. A bypass tunnel from the Gowanus Expressway to South Williamsburg would remove this through traffic from the triple cantilever and decrease travel times.

Toll Imbalances

The BQE is the primary north-south vehicular corridor in western Brooklyn and Queens, connecting Long Island to the South Bronx, Manhattan, and Staten Island via six bridges and two tunnels. Traffic imbalances on I-278 and these crossings are in part a result of the different

1. History

Table 1: The BQE is one of the most heavily traveled roadways in the City. It carries more vehicles than many comparable highways despite having a substandard design and the same number of lanes or fewer.

Roadway	Daily Volume (vehicles)	Number of Lanes
I-93 (Boston)	200,000	8-10
Queensboro Bridge	170,000	9
BQE	**153,000**	**6**
Mario M. Cuomo Bridge (formerly Tappan Zee)	140,000	8
FDR Drive	136,000	6
Cross Bronx Expressway	115,000	6
Alaskan Way Viaduct (Seattle)	110,000	6*
West Side Highway	105,500	6

* The viaduct was six-lanes before it was torn down and replaced by a four-lane tunnel.

toll structures as people "shop" for the cheapest route; namely, from Staten Island to Manhattan and then to New Jersey and not pay a toll.

The dynamic of toll shopping plays out on the triple cantilever as Queens-bound drivers whose destination is Manhattan skip the tolled Hugh L. Carry (HLC) Tunnel (which has spare capacity) and continue north in favor of the toll-free Brooklyn and Manhattan Bridges.

Correcting this tolling disparity through congestion pricing will relieve some of the pressure on the triple cantilever and the East River bridges by rebalancing some regional traffic to use tolled directions of travel.

Recent Congressional legislation will restore split tolling on the Verrazzano-Narrows Bridge, and the State's central business district (CBD) tolling (congestion pricing) will toll most traffic crossing the now 'free' East River bridges. Split tolling is expected to be implemented this year by the MTA, and CBD tolling could take effect as early as 2021.

According to the Mayor's Panel on the BQE (see Section 1.7), the changes to Verrazzano-Narrows Bridge could reduce pressure on the Queens-bound (east) direction, in particular heavy vehicles, whose tolls can reach over $100 depending on size. The effects of congestion pricing are difficult to discern at this point because information about toll rates and exemptions have not yet been determined. The Mayor's Panel on the BQE estimates a 7-14% reduction in traffic volumes during the peak hours on the BQE between the Hugh L Carey Tunnel and the Manhattan Bridge.

*Table 2: Tolls for East River and Verrazzano-Narrows crossings for cars with E-ZPass (non-Staten Island resident)**

Crossing	Owner	East	West
Verrazzano-Narrows Bridge	MTA	-	$12.24
Hugh L. Carey Tunnel**	MTA	$6.12	$6.12
Brooklyn Bridge	NYCDOT	-	-
Manhattan Bridge	NYCDOT	-	-
Williamsburg Bridge	NYCDOT	-	-
Queens Midtown Tunnel	MTA	$6.12	$6.12
Ed Koch Queensboro Bridge	NYCDOT	-	-
RFK Triborough Bridge	MTA	$6.12	$6.12

* Staten Island residents pay a reduced toll on the Verrazzano-Narrows Bridge. On all tolled crossings, vehicles without E-ZPass pay more and trucks pay an escalating toll depending on size. All PANYNJ crossings (those between NY and NJ) are $13.75 for E-ZPass cars in the peak hours in the New York bound direction only – New Jersey bound traffic is not tolled.
** The official name of the Brooklyn-Battery Tunnel since 2012.

1.3 Atlantic Avenue to Sand Street (Triple Cantilever)

The primary area of focus for the BQE reconstruction planning has been the 1.5-mile segment from Atlantic Avenue to Sands Street which includes the triple cantilever. While relatively short, this part of the BQE has varying structures as well as over a dozen ramps, is heavily trafficked, does not meet modern safety standards, and is deteriorating. Regular maintenance and redesign and construction efforts are further complicated by several constraints along the corridor.

Area Context

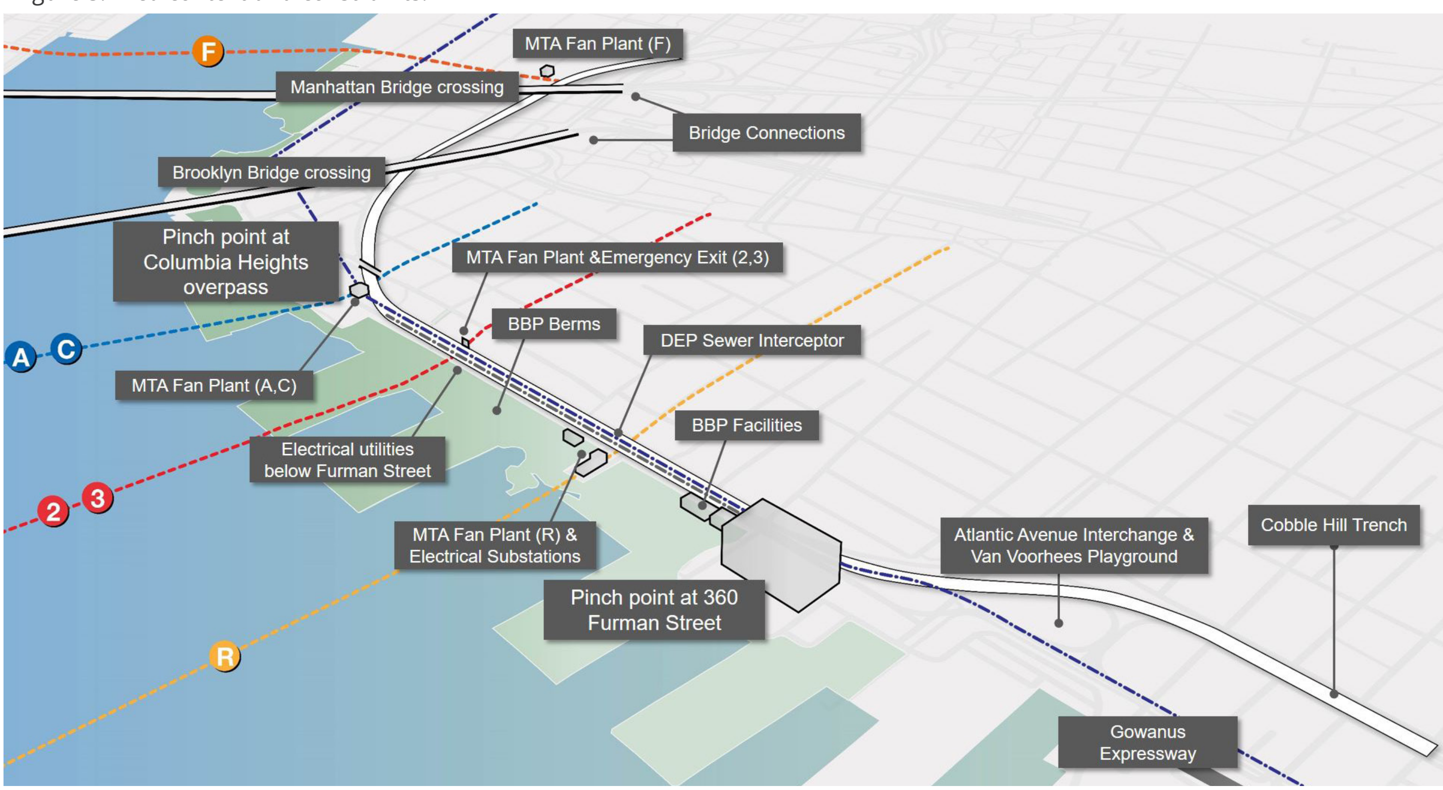
The origin of the triple cantilever was to minimize the impacts of the highway by stacking it along Brooklyn Heights. This created the Brooklyn Heights Promenade (the third tier of the cantilever), which is a protected viewshed and represents the western edge of the Brooklyn Heights Historic District. In addition to those designations, the project corridor is constrained by utilities, parks, and other pinch points.

These constraints have narrowed the focus of past planning processes, in part because they involve a range of City and State agencies and entities, including the Metropolitan Transportation Authority (MTA), Department of Environmental Protection (DEP), Department of Parks and Recreation (DPR), Brooklyn Bridge Park Corporation, and both City and State DOTs. Of particular concern has been avoiding MTA fan plants and substations, an 8-foot DEP interceptor sewer* that runs roughly along the centerline of Furman Street, encroaching on Brooklyn Bridge Park (BBP), and minimizing alienation of DPR parkland.

The primary physical constraints, from north to south, are illustrated in Figure 5 and explained below.

These constraints are no doubt challenges for the project, however, infrastructure can be altered with appropriate cooperation and funding, and open space can be altered to create both better parks and highway. As a baseline, NYCDOT was proposing to spend between \$3.2 and \$4 billion to replace this segment of the BQE by

Figure 5: Area context and constraints.



* An interceptor sewer is a large sewer that receives flow from a number of sewers and conducts the wastewater to a treatment plant. It is among the larger lines of a sewer system.

1. History

staying within their jurisdiction as much as possible . This approach is overly constrained and offers little value beyond rebuilding a six-lane highway in place. Better intergovernmental cooperation, particularly between NYSDOT, MTA, NYCDOT, and DEP, would expand the range of possibilities for a future BQE.

- *Manhattan Bridge*: The highway is side by side as it passes under this bridge.
- *Brooklyn Bridge*: The highway is stacked under this landmarked bridge.
- *Columbia Heights Bridge / Harry Chapin Playground*: This bridge creates challenging vertical and horizontal clearance issues for the highway and the playground is partially supported on the bridge.
- *MTA A/C fan plant*: The Staten Island-bound lanes are at-grade as they pass under the Columbia Heights Bridge and abut this fan plant.
- *Brooklyn Heights Promenade*: Cantilevers over the BQE, spanning 1,800-feet from Orange Street to Remsen Street, is owned by NYCDOT and has a protected viewshed. To the east is the Brooklyn Heights Historic District.
- *Utilities under Furman Street*: There is an 8-foot DEP interceptor (sewer), as well as electric utilities, under Furman Street that serves the Red Hook Wastewater Treatment Plant in the Brooklyn Navy Yard.
- *Brooklyn Bridge Park (BBP)*: The park's berms, parking lot, operations and maintenance (O&M) building, and offices are all located along Furman Street. The park is an entity of the state and its physical plan and governance are controlled by its general project plan (GPP), which could require New York State action to change.
- *MTA 2/3 fan plant and emergency exit*: These are contained behind the wall on the east side of Furman Street.
- *MTA R fan plant and two substations*: These front onto Furman Street and are surrounded by BBP.
- *360 Furman Street*: This residential building sits less than 30-feet from the triple cantilever. The first two floors do not contain apartments.
- *Atlantic Avenue / Van Voorhees interchange*: This series of ramps bisect Van Voorhees Park, have tight geometries that creates unsafe highway merges, and there is a high volume of vehicles, pedestrians, and bikers in the area. Atlantic Avenue is a truck route and terminates at the entrance to BBP and the Red Hook Container Terminal, which is owned by the Port Authority of New York and New Jersey (PANYNJ).

As a baseline, NYCDOT was proposing to spend between $3.2 and $4 billion to replace this segment of the BQE by staying within their jurisdiction as much as possible. This approach is overly constrained and offers little value beyond rebuilding a six-lane highway in place. Better intergovernmental cooperation, particularly between NYSDOT, MTA, NYCDOT, and DEP, would expand the range of possibilities for a future BQE.

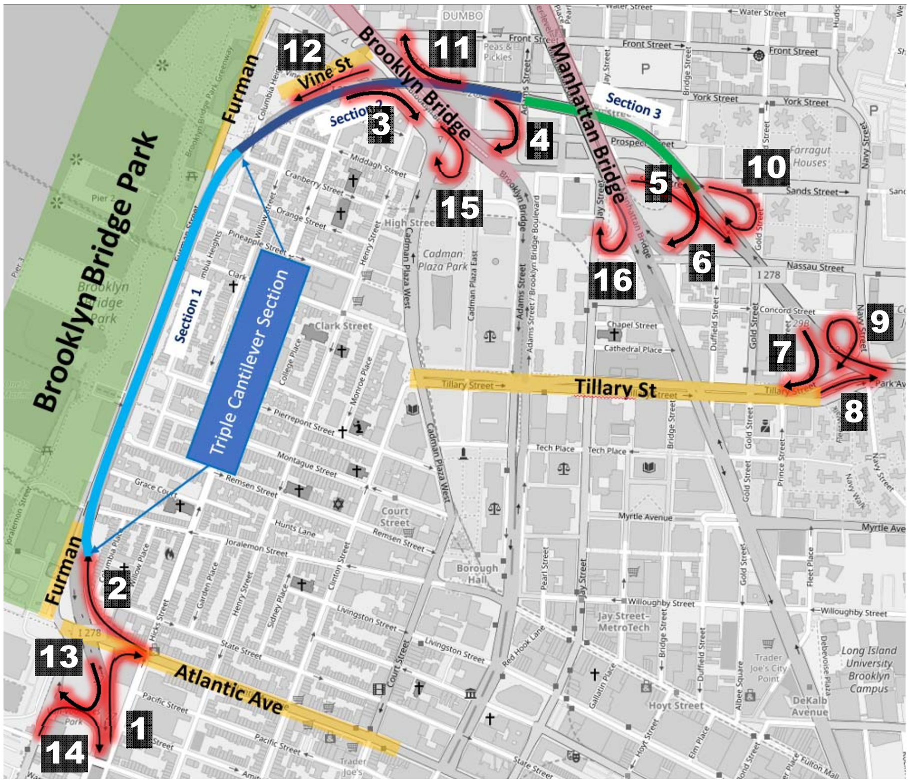
1. History

Figure 6: The triple cantilever ends around Orange Street, where the double-stacked highway then passes under the Columbia Heights Bridge, rises to pass over Old Fulton Street, and then ducks under the Brooklyn and Manhattan Bridges.

Figure 7: A view from the Queens-bound level as the highway passes under the Columbia Heights Bridge. The narrow lanes and low bridge create horizontal and vertical clearance issues (Google Maps).

1. History

Figure 8: The 1.7-mile section of the BQE from Atlantic Avenue to Tillary Street has 14 ramps, an atypically high number for an interstate highway (NYCDOT).



I-278 E/B (Queens-bound)

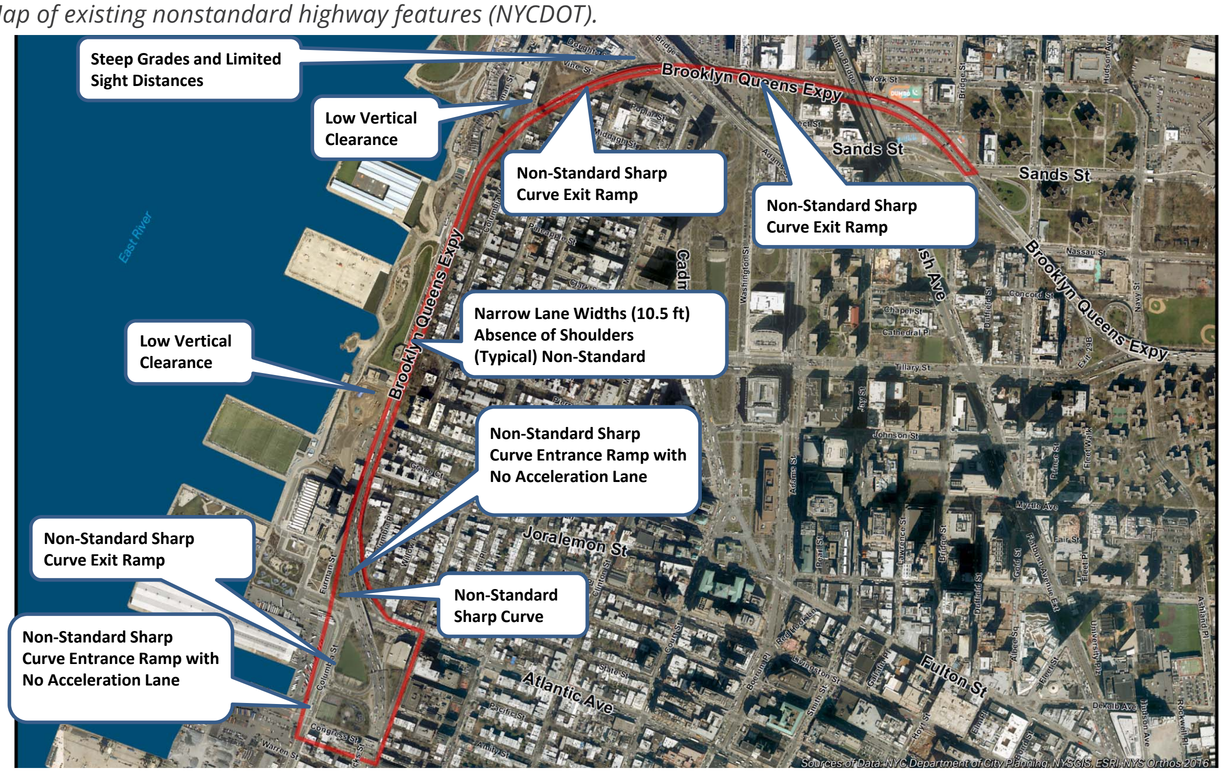
1. Off-ramp Diverge
2. On-ramp Merge (stop control)
3. Off-ramp Diverge
4. Off-ramp Lane Drop
5. Off-ramp Lane Diverge
6. On-ramp Lane Add
7. Off-ramp Lane Drop
8. On-ramp Lane Add

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

Figure 9: Map of existing nonstandard highway features (NYCDOT).



1. History

Project Need

There are a range of factors that, when considered in aggregate, necessitate the replacement of the BQE between Atlantic Avenue and Sands Street. While many of the problems stem from the original design, the various factors form a negative feedback loop that make operating and maintaining this segment of the highway very challenging.

First, the unique design for the triple-cantilever was developed in the 1940's, before the creation of the interstate highway system in 1956 and its accompanying standards. This section of highway is considered substandard (see Figure 9), leading to an array of operational and maintenance issues, including high incident rates and reduced throughput as compared with similar roadways built to modern standards. In other words, the highway was built for a different time when vehicles were smaller, lighter, and less common.

Second, the roadway is old and has not undergone major structural work since it opened nearly 70 years ago. Its age, when combined with substandard features that limits some maintenance activities such as paving and patching, has led to structural deterioration of the steel reinforced concrete. As the structure degrades, more salt can penetrate and cause further corrosions, especially at the deck joints. This increases cracking of the roadway surface, which is further impacted by heavy trucks, allowing for further salt intrusion.

Third, the high traffic volumes, and in particular trucks, compounds the first two factors and makes diversions and partial or full road closures more difficult. These are required to perform maintenance and to monitor the health of the structure.

When these factors are combined with the local constraints explained in the previous section, it becomes clear that not only does the highway need to be replaced but that doing so is extremely challenging and will require the cooperation and coordination of government agencies, elected officials, and the affected communities.

Why does this section of the BQE need to be replaced?

1. ***Sub-standard features contribute to high incident rates and hours of congestion***
    - b. *Narrow lane widths*
    - c. *No pullover shoulders*
    - d. *Sharp curves*
    - e. *Short ramp lengths and merges*
    - f. *Limited sightlines*
    - g. *Low vertical clearances*
2. ***70-year old, degrading, multi-tiered structure***
    - a. *Salt intrusion*
    - b. *Deteriorating deck joints (every 50 feet)*
    - c. *Structural deterioration of steel reinforced concrete*
    - d. *Non-smooth roadway surface*
    - e. *Poor freeze-thaw performance*
3. ***Heavy traffic flow***
    - a. *153,000 daily vehicles, including up to 25,000 heavy vehicles*
4. ***Maintenance issues***
    - a. *Unique structure and heavy congestion limit access, limiting when and how maintenance and monitoring activities can occur*

1.4 NYSDOT Attempts to Advance a Project (2006-2011)

The need for the project was also clear to the New York State Department of Transportation, which in 2006 began the lengthy planning process to replaces the triple cantilever, only to abruptly suspend the project in 2011. It was argued then, as now, that the BQE needed to be replaced because it was beyond its useful life.

NYSDOT began the project through a Federal Highway Administration (FHWA) program called the Accelerated Construction Technology Transfer (ACTT), which convened national experts to participate in a design and construction workshop. The goal of the ACTT workshop was to share best practices and apply them to the triple cantilever to reduce project cost and timeline. The workshop did not reach a final recommendation on a particular alternative but did confirm the need for a more comprehensive examination of alternative rehabilitation or reconstruction options.

At least three panels of experts have been convened to evaluate the triple cantilever project:
1. ***2006 by NYSDOT***
2. ***2015 by NYCDOT***
3. ***2019 by Mayor de Blasio***

NYSDOT began the environmental review process in 2009, identifying the need for government partners and outreach through an Agency Coordination Plan and Public Involvement Plan (both of which were required by federal law). A stakeholder advisory committee was formed and held eight meetings and one workshop before the project was canceled.

A draft alternatives evaluation memo was prepared and released in January 2011. Of the four surface roadway and seven tunnel alignments studied, only two were recommended for further study (see Figure 10):

1. Rehabilitate within current alignment (Alternative R-1): This alternative would maintain all existing geometry (lane widths, ramp alignments, shoulder widths, etc.) and rehabilitate all pavement and bridges.
2. Context Sensitive Corridor (Alternative CS-1): This alternative is similar to NYCDOT's alternative in that it would reconstruct the highway, to the extent possible, to meet modern highway standards. The proposed widening of the roadway would require modification of the triple-cantilever structure to a stacked framed structure that would extend to the sidewalk on the western side of Furman Street (see Figure 3 – stacked viaduct).

Construction methods were not discussed.

The stakeholder advisory committee and community members were surprised when in November of 2011, NYSDOT announced that they were suspending the project due to budget constraints and potential community opposition. No preferred alternative was selected and New York City DOT was left to continue to maintain and operate the triple cantilever.

Figure 10: Summary of the alternatives evaluation from the I-278 EIS Downtown Brooklyn Draft Alternatives Evaluation Technical Memorandum, released in January 2011. The table indicates that only R-1 and CS-1 passed the initial alternatives screening.

	Alternatives											
	R-1	**CS-1**	**S-1**	**S-2**	**T-1**	**T-2**	**T-3**	**Transit-TSM/ TDM**	**W-1**	**W-2**	**W-3**	**W-4**
Alternative Name	Rehab w/ Current Alignment	Context Sensitive Corridor	Standard Alignment - North	Standard Alignment - South	Under Downtown Brooklyn Tunnel	Existing BQE Corridor Tunnel	Outboard Tunnel	(see detailed Transit-TSM/TDM table)	T-1 modificatio n/extension	Straight-line tunnel between Exits 24 and 30	Outboard tunnel connecting Sunset Park and Exit 33	4th Avenue/outboard tunnel between Exits 24 and 30
Within established Project Limits?	Yes	Yes	Yes	Yes	Substant ially with limits	Substa ntially with limits	Substan tially with limits	N/A	Substanti ally outside limits	No	No	No
Ability to meet goals and objectives[29]	●	●	○	○	○	○	○	○	○	○	○	○
Potential Effects on Environmental Justice Populations?	Unlikely	Unlikely	Likely	Likely	Likely	Likely	Likely	Unlikely	Likely	Likely	Likely	Likely
Construction cost as % of anticipated funding for 2010—2035 RTP Fiscally Constrained Projects in New York City	2%	7%	20%	22%	19%	31%	38%	N/A	38%	43%	136%	58%
Advanced for further evaluation?	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**

1.5 NYCDOT Attempts to Advance a Project (2014-2019)

The need for the project continued to grow, and in 2014, New York City DOT took the lead on the triple cantilever project. The potential risks that the highway posed to public safety and to local and regional movement could not be ignored.

NYCDOT began the project similarly to NYSDOT, by convening experts and conducting workshop in 2015. They also conducted a Belt Parkway Truck Access Study in 2015 and a tunnel feasibility study in 2016, both of which concluded that these alternatives were infeasible due to cost and other technical factors. Tunneling technology has since improved, making this method more economical and requiring less space for ventilation and egress facilities. For example, the Madrid Rio project constructed over 35-miles of tunnels in three-years and for less than $5.1 billion. The tunnel option is discussed in greater detail in the Recommendations section of this report.

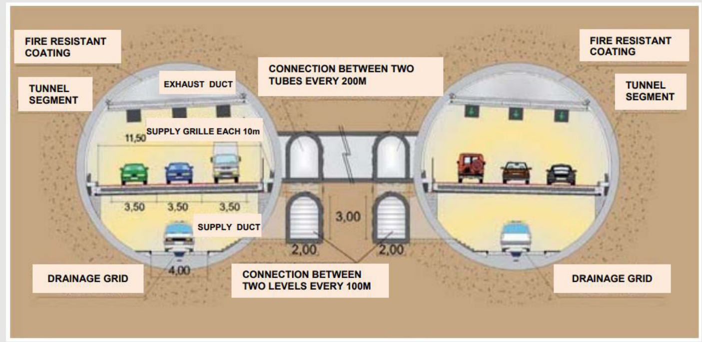
In-depth inspections of the structure were conducted in 2016 and 2017, and design-build authority was granted by the State in 2018 to provide an opportunity for a more innovative and efficient project.

Highway Case Study: Madrid Rio (Calle 30), Madrid, Spain

Calle 30 is an inner ring road of Madrid and was considered a barrier in the areas through which it ran, however it was a necessary road and could not just be torn down. In 2004, work began to refurbish the roadway, which was badly in need of structural work, and reroute large sections of it through a series of cut-and-cover trenches and twin tunnels dug by TBMs to accommodate three lanes of travel in each direction. The recovered surface area was redeveloped into parks, bike paths, and affordable housing, and the adjacent neighborhoods were reunited with the Manzanares River. Of the 62 miles of roadway re-built, 35 miles of it is covered.

The scale, speed, and cost of this project highlights how effective the Spanish authorities were at conceiving and constructing a new replacement highway in a dense urban environment.

Cross section of the Calle 30 tunnel, with three-lanes and emergency access below. Two tunnels were built to serve each direction of travel.



Calle 30 cut Madrid off from the Manzanares River until it was buried in a series of tunnels and replaced by new parkland.

1. History

Assumptions

With responsibility for the project devolved from the State to NYCDOT, new constraints were added to the project. Local-control meant that the City had to finance the project and that inter-governmental cooperation would be more difficult. In developing their project scope and alternatives, NYCDOT was operating under the following constraints and assumptions:

1. Consider only the segment from Atlantic Avenue to Sands Street.
2. Rebuild generally in the same footprint and within NYCDOT jurisdiction, given the surrounding geographic constraints.
3. Rebuild as much of the highway as possible to modern standards.
   a. 12-foot lanes
   b. Shoulders where possible
   c. Improve vertical clearances
   d. Improve ramps and merges where possible
4. Current travel patterns and mode choices will remain similar into the future.
5. Maintain the existing traffic capacity and local connections in the final design, and minimize disruptions to traffic throughput during construction.
6. Local control dictates that City roads and bridges that have previously received federal funding cannot be tolled without an exception from FHWA.
7. Minimize the involvement of other agencies and incursion on their property.

Alternatives Presented

After reviewing various alternatives, NYCDOT concluded that the highway should be reconstructed in its current footprint and to modern standards where feasible. This was the same as NYSDOT's alternative CS-1 (see Figure 10), which was recommended for further study in 2011. Rebuilding the roadway would require a disruptive

Figure 11: The packed BQE town hall at Plymouth Church in Brooklyn Heights on April 3, 2019.

construction process, and NYCDOT presented its two alternatives for doing so to the public in September 2018. The “Traditional” method would rebuild the highway, lane-by-lane, requiring regular road closures, and would take a minimum of eight years. The “Innovative” method would construct a six-lane, temporary highway over the current structure, replacing the Brooklyn Heights Promenade for up to six years. NYCDOT preferred the Innovative method, arguing that it would minimize construction time, impacts, risk, and cost. The cost of the project ranged from $3.2 to $4 billion.

There was an immediate backlash to the presented plan by community members and elected officials. They objected to the temporary loss of the promenade as well as the narrow scope of the project, arguing that it missed an opportunity to rethink the highway. The communities organized and called for a new plan, and as a response, the project was put on hold and Mayor de Blasio convened the Expert Panel on the BQE. The City Council also began its process to rethink the project, bringing in the engineering firm Arup to help clarify options and best practices.

1.6 Community Activism

Widespread rejection of the NYCDOT alternatives resulted in a groundswell of community engagement and activism, including the formation of A Better Way (ABW) the following month.

In April 2019, a large town hall was organized by the Brooklyn Heights Association (BHA) and ABW. The town hall was attended by hundreds of residents and several elected officials, including Council Speaker Corey Johnson, Council Member Stephen Levin, Borough President Eric Adams, Comptroller Scott Stringer, State Senator Brian Kavanagh, State Assemblymember Jo Anne Simon, and a representative for U.S. Representative Nydia Velazquez. During the town hall, three alternative proposals for the BQE were presented by the architecture firm Bjarke Ingels Groups (BIG), the urban designer Marc Wouters, and Comptroller Scott Stringer.

This activism led the Mayor to create the Expert Panel on the BQE (also in April 2019) to explore acceptable solutions for the BQE. After the community groups met with the Mayor's Panel on the BQE in April, they formed a coalition comprised of the BHA, ABW, and the Cobble Hill Association (CHA), and in June 2019, released a unified vision statement to the Expert Panel. By November, the coalition had grown to include twelve community groups and they released and updated statement.

Community Coalition

1. *Brooklyn Heights Association*
2. *Cobble Hill Association*
3. *A Better Way*
4. *360 Furman Street*
5. *Boerum Hill Association*
6. *Cadman Towers*
7. *DUMBO Action Committee*
8. *DUMBO Neighborhood Alliance*
9. *Fulton Ferry Landing Association*
10. *North Heights Neighbors*
11. *Vinegar Hill Neighborhood Association*
12. *Willowtown Association*

The unified community vision states: “The end result of the BQE reconstruction process must be a transformative, sustainable solution that will permanently change the relationship of the expressway to our adjacent neighborhoods. That solution must protect our neighborhoods and parks, emphasize our neighborhoods’ historic character, and enhance pedestrian connectivity and green space.” The statement then details what is desired of the design, the process, and what should be avoided.

Activism changed the course of the similar Doyle Parkway project in San Francisco, where a local community member developed a plan to cover a roadway with a park (see the case study on the next page for details). The design was advanced by the good governance group SPUR, eventually selected, and then built.

1.7 Mayor’s Panel on the BQE

After the strong and vocal opposition to NYCDOT’s reconstruction plan from many communities, Mayor de Blasio convened a panel of experts in April 2019. The Mayor's Panel on the BQE was originally tasked to identify options for replacement of the triple cantilever, which they ultimately did not, instead focusing on more immediate actions to maintain roadway safety and operations. Made up of 17 professionals from the design, transportation planning, engineering, public realm, and construction industries, as well as civic and business leaders, the Mayor's Panel on the BQE met regularly for eight months and engaged with City and

1. History

Governance Case Study: Doyle Drive (Presidio Parkway), San Francisco, CA

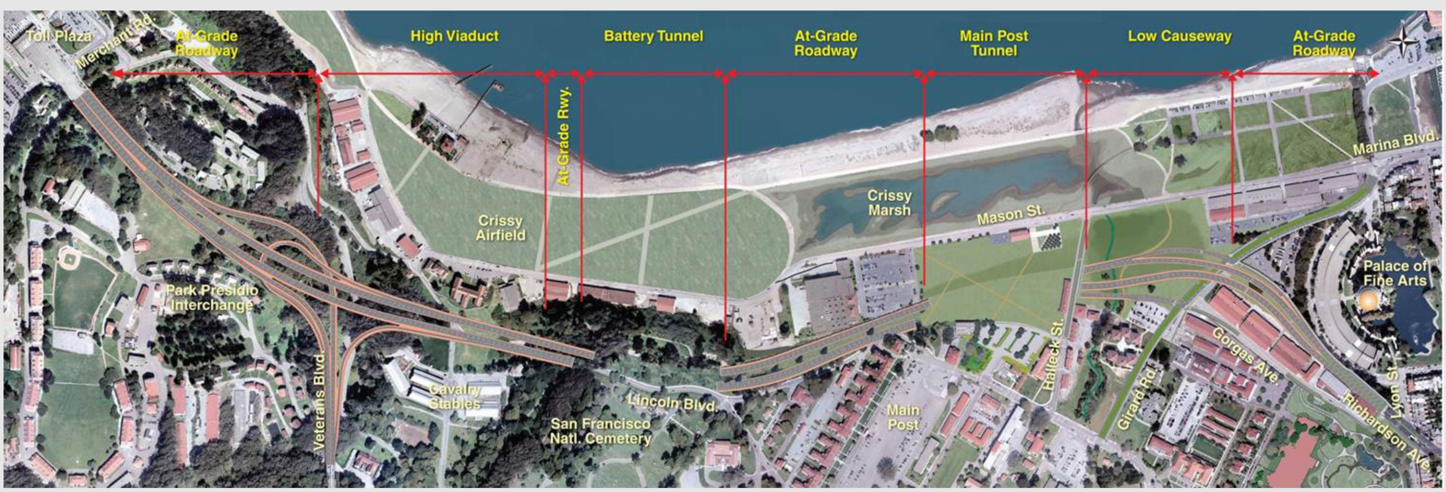
Doyle Drive, the south access road to the Golden Gate Bridge, was found structurally and seismically deficient by Caltrans (the state DOT) in 2009. The road ran through the Presidio, a national park and former military fort on the waterfront. Caltrans initially started with a traditional highway redesign, which was not favored by either the National Park Service or the city. Michael Painter, a local landscape architect, brought a context-sensitive idea to SPUR (a good government group focused on planning and research). Caltrans and its consultants, Parsons Brinckerhoff, who had been progressing four replacement designs, dismissed the Painter plan as infeasible and too expensive.

The San Francisco County Transportation Authority (SFCTA) led the city's interests and supported the Painter plan. To convince Caltrans it could work, SPUR hired Arup, a member firm, to examine feasibility and cost. Arup concluded Painter's plan could be built with fewer impacts on the national park. SFCTA ensured the Painter plan was included as one of the options in the Doyle Drive Draft EIS. It proved successful, winning out over the Caltrans alternatives.

The project was divided into two phases to speed delivery and shorten the overall schedule. Phase I of construction used a design-bid-build procurement method for portions of the project, completed in April 2012.

Phase II was delivered through a public-private partnership, the first project in California to operate under the authority of new legislation (Senate Bill X2 4). The selected developer (Golden Link Concessionaire) will design, build, finance, operate and maintain the project for 30-years. This is the first time Caltrans has handed responsibility for one of their assets to a private company.

Similar to the BQE, this project involved multiple jurisdictions, including the National Park Service, and a design that was rejected by the community at large. Through creative thinking, advocacy, and intergovernmental coordination, the project became a success.



State agencies, experts, and community groups. The Expert Panel released its final report on January 30, 2020, recommending near-term solutions to keep the roadway safe and the need for a long-term vision and physical plan for the entire corridor from Staten Island to Queens .

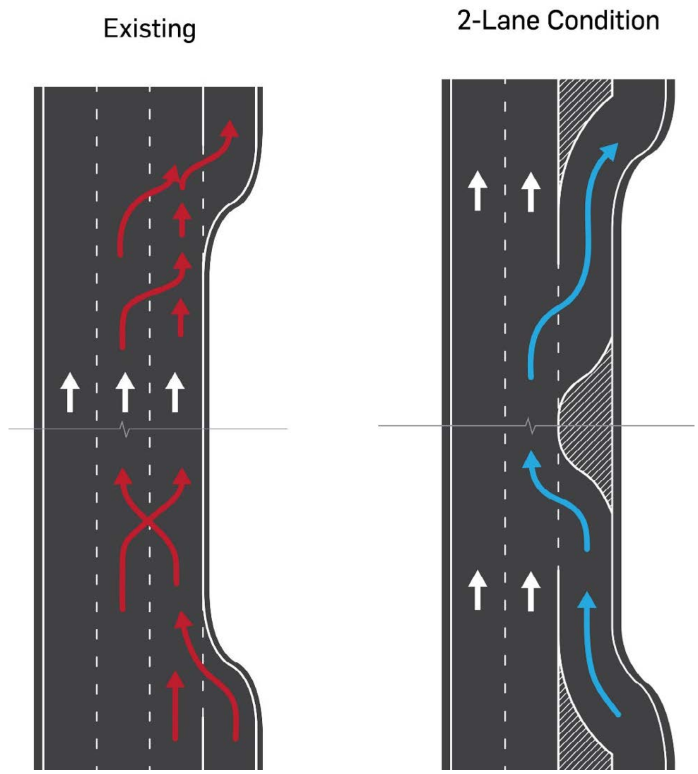
The Expert Panel report emphasized the need for immediate interventions to keep the roadway safe, as new data revealed the presence of more overweight trucks than previously known and faster-than-expected deterioration of the structure. The Expert Panel asked NYCDOT to conduct additional testing of the structure and projected that certain segments of the roadway may become unsafe and require diversions within five years. Recommendations for immediate implementation were:

1. History

- Intensive monitoring and maintenance of the triple cantilever to guide decision making for future maintenance and repairs, and to understand how other interventions affect the structure.
- Enforcement of existing restrictions on overweight trucks to reduce the strain on the structure. The City should seek to use automatic enforcement using weigh in motion (WIM) technology and cameras. This latter action may require State legislation.
- Reduction from three to two through lanes in each direction from Atlantic Avenue to Sands Street.
  - A reduction in overall traffic volumes by 15-20% could be achieved through diversions, user fees, and new transit options. Their report has a list of transportation demand management (TDM) measures but notes that they do not explicitly endorse any of them.
  - The appendix, written by transportation consultants Sam Schwartz, argues that a well-designed two-lane highway with dedicated acceleration and deceleration lanes and shoulders for incident response would reduce crash rates. The proposed configuration was projected to carry 500 fewer vehicles per hour than the current substandard one, but would likely have more reliable operations, fewer and shorter delays from incidents, reduce spillover of traffic onto local streets, and would allow for some flexibility to conduct repair work.
- Creation of a transportation management plan (TMP) to help manage regional traffic for planned and unplanned disruptions to traffic.

The Expert Panel rejected the idea of constructing a temporary highway at the Brooklyn Heights Promenade or in Brooklyn Bridge Park, as well as adding additional parkland, pedestrian walkways, tunnels, or other features that would make the project more expensive without first addressing the immediate needs. While acknowledging that the "transformative" ideas for reconstruction warrant further study, they also see embracing such an approach as being at odds with the need to act expeditiously and raises questions of fairness and equity – issues beyond the Expert Panel's mandate.

Figure 12: Conceptual drawing of a proposal from the Mayor's Panel on the BQE report to reduce the triple cantilever and adjacent BQE segments from three to two lanes, allowing space for shoulders and improved ramps.



Finally, the Expert Panel called on community, City, State, and Federal stakeholders to work together to create a 20-year vision for the length of the I-278 corridor and its feeder highways, bridges, and tunnels. This vision should include plans to replace the Gowanus Expressway and Cobble Hill Trench, both of which, according to the Expert Panel, are also nearing the end of their useful lives. The vision should espouse modern transportation and sustainability ideals.

The day after the report was released, Mayor de Blasio announced plans for several structural repairs and signed an executive order to increase overweight truck enforcement on the BQE. The Mayor declined to endorse the reduction of through lanes from three to two in each direction.

1.8 City Council

The City Council, responding to the backlash to NYCDOT's plan for the triple cantilever, wanted to conduct an independent review of the project and its assumptions, and provide clarity on what was possible and how a better project could be achieved. To aid in this process, City Council hired the international engineering and design firm Arup in August 2019, to conduct a technical review of NYCDOT's work, assess the community-developed and NYCDOT alternatives, provide technical assistance and best practices, and to help to develop a realistic path forward for the project.

Since August, City Council and Arup have worked to identify solutions for the immediate needs of the triple cantilever and how that can be leveraged to improve project delivery and form a broader vision for the I-278 corridor. The Council and Arup met with the affected community groups, NYCDOT, the architects Bjarke Ingels Group, and the urban designer Marc Wouters; did a site visit of the triple cantilever led by NYCDOT; and received un-redacted versions of their engineering reports for review by Arup (see Section 2). The Council and Arup evaluated seven alternatives for the triple cantilever and narrowed them down to three scenarios for further study (see Section 3), ultimately developing a range of recommendations that hinge on better project governance and conception (see Section 4).

By clarifying what is possible, identifying planning solutions that should be further explored, and developing policy recommendations, it is the hope of the Council to move the project beyond the current stasis.

City Council Goals

1. Establish a new model for project planning, development, and delivery that sets a new standard for major infrastructure projects in New York City.
2. Demonstrate how a transparent and collaborative project planning approach delivers higher value for the City.
3. Rebuild the BQE in a matter that meets existing and future needs while harmonizing the facility with the surrounding environment, leaving them in a better condition than before.

City Council Approach

1. Take a comprehensive view of the project beyond narrow jurisdictional constraints.
    a. Apply best practices and learn from examples locally and elsewhere.
    b. Create a set of corridor ambitions that can be applied to the Atlantic-Sands segment now, and applied as a model for other segments when appropriate.
    c. Have project costs reflect the value gained while recognizing the needs of competing capital projects.
2. Plan for a 21st century city and climate change
    a. Create modern infrastructure that is right-sized for future needs and prioritizes mass modes and freight.
    b. Reconnect communities that have been divided by highway infrastructure in a graceful manner.
3. Balance short-term community impacts with long-term benefits
    a. Develop construction plans and demand management strategies that allow for safe operations throughout the construction period while minimizing impacts on communities up and down the corridor.
    b. Ensure the highest quality public realm along, underneath, and across the corridor for walking, biking, and open space.

2. Engineering Review

Arup's review of the materials provided by NYCDOT led them to conclude that NYCDOT's analysis was thorough and appropriate, and that the life of the bridge without traffic restrictions could likely be extended *with continuing maintenance and monitoring*, but not indefinitely.

Arup provided City Council with an engineering and best practices review of NYCDOT documentation and materials to develop a general understanding of the condition and load capacity of the BQE structure. The review was also used to determine if truck traffic should be restricted by 2026 and to provide commentary on NYCDOT's analysis and results. This review was based on the un-redacted version of the 2016 Brooklyn Queens Expressway (BQE-278) Inspection and Load Rating Report, produced by Parsons Brinckerhoff; NYCDOT bridge inspection reports; NYCDOT truck data; various photos, profiles, and surveys from NYCDOT; and a guided site visit with NYCDOT and MTA.

This review did not include the new tests or engineering assessments conducted in 2019 at the request of the Mayor's Panel on the BQE. As of the writing of this report, NYCDOT's new structural and corrosion reports are still undergoing internal review, and then will undergo NYSDOT and Federal Highway Administration (FHWA) review. Since the BQE is an interstate highway and NYSDOT and FHWA have concurrent jurisdiction as well as special expertise on highway maintenance, they are being included as partners in the analysis of the raw data. Additionally, NYCDOT will be partnering with them on this project and require their approval for many aspects of it, so they are being included as part of the review process. City Council does not anticipate receiving the updated structural and corrosion reports for review before publication of this document. City Council and Arup did receive 2019 weigh in motion (WIM) raw data in January 2020, which, as the Expert Panel discusses in their report, shows a higher occurrence of overweight trucks than previously known.

The triple cantilever was never designed to accommodate even today's legal truck weight, let alone the many overweight trucks that traverse it each day.

In 2016, NYCDOT and their consultants conducted an inspection and load rating assessment of the structures within the section of the BQE corridor which includes the triple-deck cantilever structure. Based on that assessment and other factors, NYCDOT has concluded that if significant repairs and replacements are not made by 2026, vehicle-weight limits and truck diversions may be necessary beginning in that year.

Arup found that the assessments were detailed and rigorous, but they did not specifically recommend restricting the triple cantilever to truck traffic in 2026. However, the assessment of the triple cantilever structure involves a degree of inherent uncertainty which led NYCDOT to conclude that restrictions will be necessary in a similar time frame. The factors that contribute to the uncertainty in the assessment of the structure are:

1. A non-uniform and unique structure that is nearly 70 years old and has not undergone a significant structural overhaul since original construction.
2. Bridge deterioration (corrosion) data derived from statistical projections dependent on a single point in time testing (2016). Corrosion is rarely uniform and may follow other trajectories than the prediction model. Additional tests over time would decrease uncertainty.
3. Truck overload resulting from illegal trucks, lack of enforcement, and changes in NYSDOT policy to determine the threshold for restricting truck traffic to bridges.

On point two, the results of the new structural and corrosion testing, once available, will add greater certainty to the assessment of the structure and the need to restrict truck traffic.

On point three, NYCDOT is in conversations with NYSDOT on revisions to the standard that governs the allowable loads for highway bridges and when to restrict truck traffic (Engineering Instruction EI 5-034). NYCDOT has produced draft calculations responding to some of the truck overload concerns, however they are not ready to share the results until NYSDOT issues an expected revision to EI 5-034. Neither agency has provided a time frame for when the guidance or the results of further studies will be ready for release.

Diversion of illegal trucks may be avoidable beyond 2026 with appropriate maintenance and monitoring; however, the roadway still presents near-term safety risks and hazards to motorists, including:

1. Substandard features: The structure does not meet modern roadway standards. This is inherent to its original design and is independent of the other risk factors. Substandard features include narrow lanes, no shoulders, tight merges (near the triple cantilever), low clearances, tight turns (near the triple cantilever), and poor sight lines. NYCDOT noted an abnormally high crash rate on this stretch of the BQE; particularly, the lack of a shoulder delays a timely emergency response, further exacerbating crash related congestion.
2. Age: the structure is nearly 70 years old and is degrading. Areas of concrete on the underside of the structure are at risk of detaching and falling onto the Staten Island-Bound (SIB) BQE and Furman Street traffic; mesh was installed to trap the concrete and ongoing replacement of broken mesh is needed. The asphalt is continuously cracking near bridge joints, which are spaced every 50 feet, allowing roadway salt to access and further degrade critical structural components, and requiring patch repairs which create an uneven roadway surface.

Figure 13: The stop-controlled on-ramp at Van Voorhees Park for Staten Island bound traffic (left) and Atlantic Avenue for Queens bound traffic (right) do not have acceleration lanes, have tight merges, and have poor site lines to see oncoming traffic. As a result, these are high crash locations (Google Maps).

2. Engineering Review

Figure 14: The Queens bound roadway passing under the Columbia Heights Bridge shows several substandard features that are common along the triple cantilever: narrow lanes, no shoulders, and low vertical clearance.

Figure 15: Structural deterioration is evident along the triple cantilever. NYCDOT has placed mesh to trap loose concrete to prevent it from falling.

2. Engineering Review

The logistics of performing critical corrosion testing and maintenance activities (spall and roadway crack repairs) are complex because they require lane closures on a structure that has heavy traffic at all hours of the day, and the window for repair without traffic disruption is very narrow.

Figure 16: Concrete inside the structure has fallen off, revealing the reinforcement.

During the meetings with NYCDOT, they indicated that when all factors (see box) are aggregated together, their conclusion is that the balance of risk points towards replacement of the structure.

Arup concluded that the 2016 inspection reports and corresponding load capacity assessments were thorough and appropriate, and that the life of the bridge without traffic restrictions could likely be extended *with continuing maintenance and monitoring*, but not indefinitely. Arup agrees with NYCDOT that additional studies are required to check and validate the rate of deterioration and the potential for truck overloading so that these factors can more reliably be included in NYCDOT's analyses and decisions concerning the structure. NYCDOT is in the process of conducting these further studies, after which they will have a clearer idea of the need for truck diversions and overall life of the structure. NYCDOT has not provided a time frame for when the results of these further studies will be ready for release.

As the condition of the structure is variable along the BQE corridor, a cascading reduction in rating for truck loads across the various segments of the bridge is likely to develop over a number of years. In other words, while some parts of the structure may continue to operate normally, others may require immediate fixes and/or truck diversions. The weakest link will therefore help to determine what interventions are needed, where, and when.

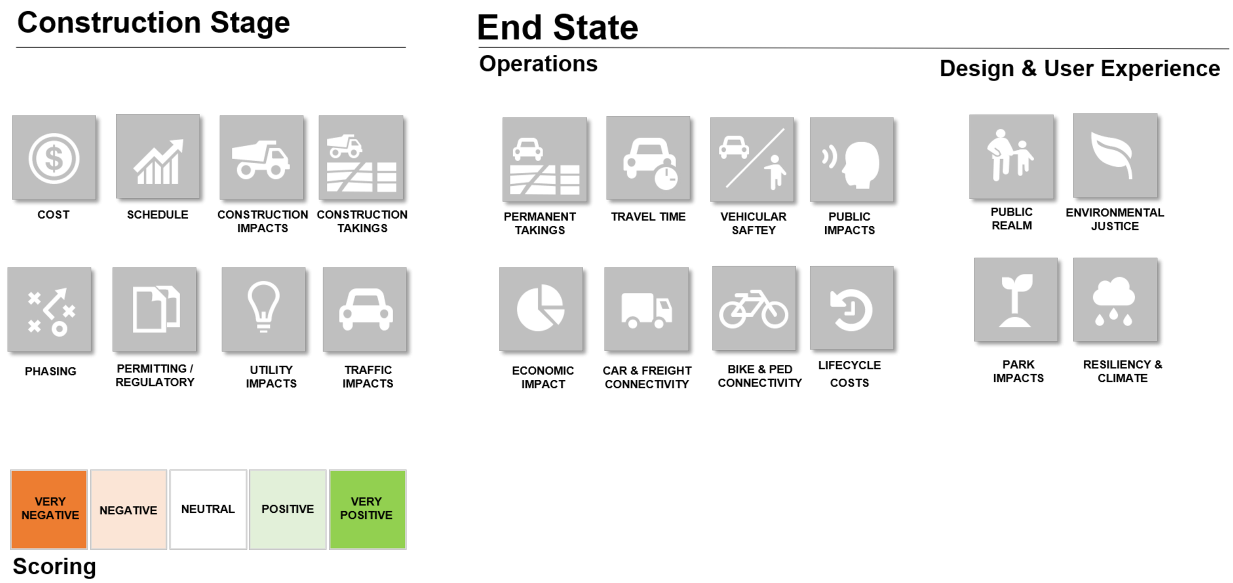
Why does the triple cantilever need to be replaced?

- ***Age and structural degradation***
- ***Substandard roadway features***
- ***Continuous repairs and maintenance required to eliminate immediate hazards to traffic***
- ***High vehicles volumes***
- ***Presence of overweight trucks***
- ***Inherit uncertainty in structural analyses***
- ***High crash rates***

The revised load rating which NYCDOT is preparing should include predictions beyond 2026. Arup has recommended that the Council continue to follow up with NYCDOT to obtain a copy of the revised load ratings, once available, which should point with more certainty to a year when the triple cantilever bridge should be restricted to truck traffic; these ratings should be based on an updated NYSDOT EI 5-034, capturing truck overload and deterioration as reconfirmed by the ongoing studies.

In their report, the Mayor's Panel on the BQE highlighted the presence of overweight trucks, based on the new WIM data, which stress the structure, shorten its life, decreases its reliability, and reduces the safety factor used to calculate the allowable load for the structure. This fact, combined with the unique qualities of the structure, has led the Expert Panel to assess that two of the 50-foot spans that make up the 0.4-mile long triple cantilever structure will need to be addressed within the next five years; the details of the works are still being reviewed by NYCDOT and NYSDOT and are not yet available. As a result, NYCDOT has expanded its monitoring and inspection program and will begin maintenance of certain sections of the cantilever as early as spring 2020. They have warned that closure of the road for extended periods may be necessary to complete these repairs efficiently and to achieve the most durable results.

3. Evaluation of Public Options



Widespread concerns with the alternatives NYCDOT proposed in September 2018 resulted in a groundswell of community engagement and activism, including the formation of A Better Way (ABW) and the large town hall they co-organized with BHA in April 2019 (see section 1.6 Community Activism).

This activism was driven by the belief that the narrow focus of the NYCDOT alternatives did not assess the BQE in its wider context, respond to community concerns, address fundamental changes along the Brooklyn waterfront and throughout the city, and that the solutions proposed were not in step with best practices today. The affected communities felt left out of the planning process and were encouraged by the range of design proposals that had emerged since NYCDOT's original September meeting. However, they lacked the technical ability and resources to fully evaluate each plan on its individual merits.

City Council and Arup have worked together to evaluate the viability of the various proposals, understand their strengths and weaknesses, and establish the engineering, planning, and policy moves that would be required to advance these proposals. This in turn has influenced City Council's own position about the future of the BQE.

3.1 Alternatives

The Council has considered seven potential alternatives using a range of evaluation criteria that reflect technical and policy goals. The alternatives evaluated are:

1. *NYCDOT Traditional*: Lane-by-lane closures and overnight work to replace the triple cantilever in-kind but to modern standards where feasible.
2. *NYCDOT Innovative*: Replaces the promenade with a six-lane, temporary, elevated bypass highway while the triple cantilever is replaced in-kind but to modern standards where feasible.
3. *BHA / Marc Wouters*: Primarily a variation on construction methods that places a temporary parallel bypass west of the existing triple cantilever, partially within Brooklyn Bridge Park, to enable reconstruction. This method could be used to construct a variety of final state outcomes.
4. *BIG / Mark Baker*: Brooklyn-Queens Park: Would reconstruct the BQE at-grade on what is now Furman Street and cap the roadway with a local access road and an extension of Brooklyn Bridge Park. The triple cantilever structure could then be repurposed as expanded open space.
5. *Comptroller*: Use the Staten Island-bound level of the triple cantilever as a two-way expressway limited to buses and trucks. The rest of the triple cantilever could then be used for expanded open space and general traffic would be diverted elsewhere.
6. *Bypass Tunnel*: Build a four-lane highway bypass tunnel from the Gowanus Expressway to South Williamsburg with a surface boulevard that follows the current route of the BQE for local access.

7. *Teardown*: Would completely remove the highway segment from the Hugh L. Carey (HLC) Tunnel to Park Avenue and replace it with a surface boulevard.

3.2 Criteria

Responding to the public planning process as it has been conducted so far, the City Council proposed a broader, holistic set of evaluation criteria more suitable to large projects of citywide importance. These criteria were developed to ensure alignment with City Council goals and priorities. Instead of focusing simply on narrow measures of performance, a fair evaluation must capture the full extent of the effects of the project. This allows for a larger, system-wide evaluation of project proposals.

The evaluation criteria are divided into three sections: Construction Stage, End State – Right-of-Way and Operations, and End State – Design and User Experience. The first focuses on the implementation and delivery of the project, and the latter two focus on the anticipated outcomes of the project after it is fully implemented. When applied to the BQE alternatives, these groupings are useful because multiple options may arrive at the same end state (e.g. a replacement in-kind of the current structure) but use different methods to reach that end state. It also clarifies the trade-offs between short-term negatives caused by construction and long-term benefits, allowing evaluators to understand that a better end state may have greater negative impacts during construction. Each category of criteria is broadly defined below:

- *Construction stage*: Evaluate the impacts and opportunities present during the construction stage of the project. These must be considered given the magnitude of disruption for drivers, freight movement, express buses, and the surrounding communities, and the costs associated with construction stage activities on the local road and regional highway network.
- *End state operations*: Evaluate the end-state outcomes pertaining to the operation of the BQE and the wider highway network, the property and cost impacts of the project, and the community and user impacts.
- *End state design and user experience*: Evaluate the end-state outcomes pertaining to the public realm, the environment, and how people experience the finished project.

A description for each criterion is provided in the following tables.

3. Evaluation of Public Options

CONSTRUCTION STAGE EVALUATION CRITERIA	
Cost	How expensive is the project?
Schedule	How long will the project take to complete?
Construction impacts (e.g. noise, emissions, vibrations)	Will the construction of the project create noise, emissions, vibration, or other impacts?
Construction takings	Does construction require the temporary taking of land? If so, how much and what type?
Phasing	How is the project phased? Is the phasing efficient and sensible?
Permitting / regulatory	What are the approvals that the project requires? Are there regulatory or permitting barriers to the project?
Utility impacts	Are utilities in the project area affected? What is the extent of this? Includes the taking/ required relocation of DEP and other utility assets.
Traffic impacts	Will construction result in excessive congestion? Does the project divert traffic from the BQE onto local streets and other roads?

END STATE EVALUATION CRITERIA	
End state operations	
Permanent takings	Does the project and/or construction require the use of eminent domain, and to what extent? Includes the taking/ required relocation of MTA assets.
Travel time	What are projections of vehicular travel time [and/or] person throughput for the final result? Are travel times improved or degraded?
Vehicular safety	Does the final result comply with standard design criteria? For example, does it eliminate poor sightlines, improve the ease of use, and reduce the risk of a crash?
Public impacts (e.g. noise, air quality, vibrations, visual impact)	Does the final result create unacceptable levels of noise, emissions, vibrations, or other public impacts?
Economic impact	Does the final result create opportunities to recoup the costs of the project? What are the property value impacts of different alternatives? How does the alternative impact the local and regional economy?
Car and freight connectivity	Does the final result improve the ability of cars and trucks to access desired destinations? How are the quality of these connections improved or degraded?
Bike and pedestrian connectivity	Does the final result improve the ability of pedestrians and bicyclists to access desired destinations? How are the quality of these connections improved or degraded?
Lifecycle costs	How do lifecycle costs – the costs across the entire existence of the infrastructure – compare across alternatives, particularly operation and maintenance of structures from NYCDOT’s perspective?
End state design and user experience	
Public realm	Does the final result improve the public realm? This includes the adjacent neighborhood, local businesses, and urban design.
Environmental justice	Does the final result contribute to the detriment or advancement of environmental justice principles? Who benefits from the end state outcomes?
Park impacts	Does the final result affect nearby parks? Does it improve or degrade connections to these? Does it require alienation of parkland or the permanent takings of park facilities?
Resiliency and climate	Is the project resilient to unexpected shocks and ongoing stresses? Will it be susceptible to hazards such as flooding and other effects of climate change?

3. Evaluation of Public Options

3.3 Evaluation Results

The application of these criteria allowed for a relative comparison of each of the alternatives, highlighting the main benefits and drawbacks of each.

A Note on Cost Estimating

A direct comparison of costs for the alternatives investigated for this report is difficult, as the cost estimates are from separate entities and the assumptions regarding the sequencing of the work, risk management, cost escalation, soft costs (such as design, engineering, project management, legal, environmental fees, etc.), and overall scope inclusions are not clear at the level of detail that was provided. The costs for the new options included in this report should be understood as indicative, until such point as a unified, more detailed study is able to be undertaken by the proposed BQE governing entity.

Figure 17: Summary of evaluation of the seven alternatives.

		Construction Stage Evaluation Criteria								End State Evaluation Criteria											
										End state operations								End state design and user experience			
#	Alternative	Cost	Schedule	Construction impacts	Construction takings	Phasing	Permitting / Regulatory	Utility impacts	Traffic impacts	Permanent Takings	Travel time	Vehicular safety	Public impacts	Economic impact	Car and freight connectivity	Bike and ped connectivity	Lifecyle costs	Public realm	Environmental justice	Park impacts	Resiliency and Climate
1	DOT Traditional: lane closure and overnight work	Neutral	Very negative	Neutral	Positive	Very negative	Neutral	Positive	Negative	Very positive	Positive	Negative	Negative	Neutral	Very positive	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
2	DOT Innovative: promenade as highway	Neutral	Neutral	Very negative	Positive	Neutral	Neutral	Very positive	Positive	Very positive	Positive	Negative	Negative	Neutral	Very positive	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
3	BHA / Marc Wouters: temporary parallel bypass	Neutral	Neutral	Neutral	Neutral	Neutral	Negative	Neutral	Positive	Very positive	Positive	Negative	Negative	Neutral	Very positive	Neutral	Neutral	Positive	Neutral	Positive	Positive
4	BIG: Brooklyn-Queens Park	Negative	Neutral	Negative	Negative	Neutral	Very negative	Very negative	Neutral	Positive	Positive	Very negative	Very positive	Very positive	Positive	Very positive	Positive	Very positive	Very positive	Very positive	Very positive
5	Comptroller: Truck/bus only with linear park	Positive	Positive	Positive	Positive	Neutral	Negative	Positive	Very negative	Very positive	Very negative	Neutral	Negative	Neutral	Very negative	Positive	Positive	Negative	Negative	Positive	Positive
6	Tunnel: Bypass from Gowanus to Park Ave	Very negative	Negative	Negative	Very negative	Neutral	Very negative	Very negative	Neutral	Very negative	Very positive	Negative	Positive	Positive	Positive	Positive	Negative	Positive	Very negative	Neutral	Neutral
7	Teardown: Highway to boulevard	Positive	Positive	Negative	Negative	Neutral	Negative	Neutral	Negative	Negative	Very negative	Positive	Neutral	Very negative	Negative	Positive	Very positive	Neutral	Neutral	Negative	Negative

SCORING

Very negative	Negative	Neutral	Positive	Very positive

3. Evaluation of Public Options

NYCDOT Traditional

This alternative relies on traditional construction methods and conducting construction completely within NYCDOT's right-of-way. The alternative, however, creates a considerable amount of disruption to the surrounding community during the construction stage. It requires long periods of lane closures that might force traffic onto local roads and nighttime work that could negatively impact local neighborhoods and close the promenade during the construction period. Building new direct connections to the Brooklyn and Manhattan Bridges would not be possible in this scenario without extensive additional closures. The end state rebuilds the triple cantilever with increased safety and improved standards where feasible but makes no significant improvements to waterfront and park access for the local neighborhoods.

Ease of implementation makes this an attractive alternative; however, it merely replaces the BQE "as is" and does not offer meaningful improvement along the corridor to adjacent neighborhoods or parks. According to NYCDOT presentations, this option would cost $3.4-4 billion and take a minimum of eight years to construct. This would be a huge investment of City funds to maintain the status quo.

NYCDOT Innovative

This alternative minimizes interaction with other infrastructure in the area by conducting construction completely within NYCDOT's right-of-way and has one of the shortest construction durations of all the alternatives. However, it perhaps has the greatest construction impacts of any alternative, placing a six-lane temporary highway at the level of the promenade, allowing refurbishment of the triple cantilever while traffic runs uninterrupted on the new temporary structure. This alternative creates a significantly negative impact on the neighborhood for the entire duration of construction due to the closure of the promenade and the proximity of the temporary roadway to a residential area.

This is the 'easiest' alternative to implement for NYCDOT, but merely replaces the BQE as is and does not offer meaningful improvement along the corridor. Has extremely disruptive construction impacts that result in an essentially status-quo outcome. According to NYCDOT presentations, this option would cost $3.2-3.6 billion and take six years to construct. This would be a huge investment of City funds to maintain the status quo.

Figure 18: NYCDOT Traditional approach with construction phase (top) and a possible final condition (bottom).

Figure 19: NYCDOT Innovative Approach during construction.

3. Evaluation of Public Options

BHA / Marc Wouters

This alternative was created as a direct response to NYCDOT's Innovation plan, and improves upon it by reducing the construction stage impacts to the promenade by placing the temporary structure away from Brooklyn Heights and partially into Brooklyn Bridge Park. This frees the cantilever structure from any overhead construction or obstacles, which could make work easier. It does not require very many temporary lane closures. However, it will require temporary alienation of land in Brooklyn Bridge Park during construction, and the temporary roadway will infringe on the eastern side of the park berms. The park is governed by a general project plan (GPP), which could make managing park encroachment more complicated. This construction method could enable a variety of end state outcomes, including NYCDOT's plan or a four-lane highway, as well as the creation of a linear park on the bypass structure once construction is complete.

If the BQE triple cantilever is to be rebuilt in-kind but to modern standards, this alternative seems to be the best method to minimize construction impacts. Estimates provided by Marc Wouters state this would have a similar cost to the NYCDOT Innovative plan, around $3.6 billion.

Figure 20: Rendering of the BHA / Marc Wouters temporary parallel bypass during construction.

Brooklyn-Queens Park (BIG / Mark Baker)

This alternative was developed independently by both Brooklyn resident Mark Baker and the architecture firm Bjarke Ingels Group (BIG), which then took the concept to the next level of detail. This plan offers markedly better outcomes regarding end state operations, especially pertaining to the creation of new parkland, new access routes to parks and the waterfront, and the general improvement of the user experience by capping the BQE with parkland. However, this alternative requires more complicated interfaces with existing infrastructure (MTA fan plants, substations, and emergency egresses; a DEP interceptor; and park buildings), with potential difficulties in implementation due to the amount of coordination required with other entities and agencies. Despite these complexities, building what is essentially a capped surface street offers a number of savings because there is no need for a temporary roadway (build it once), it does not involve building bridge structures (either temporary or permanent), and there is less construction risk for building a roadway at-grade.

Figure 21: BIG's rendering of their BQP plan.

This alternative provides the potential for transformative change to the Brooklyn waterfront and the removal of barriers to local neighborhoods, but with much greater coordination and skilled engineering requirements. Construction impacts at the level of Furman Street and to Brooklyn Bridge Park would need to be addressed but would lead to a much better end state. BIG has estimated the cost to be around $3.2 billion. Arup conducted a high-level cost estimate that indicated that the order of magnitude of the BIG plan cost is similar to that of NYCDOT's Innovative plan.

3. Evaluation of Public Options

Comptroller

This alternative has largely positive scores for construction costs, schedule, and required takings, as all construction activity occurs on the triple cantilever structure. It preserves the movement of trucks and buses without lane closures during construction but has major impacts on general traffic, which is diverted off the triple cantilever and would be forced to use local streets, the HLC Tunnel, or the Belt Parkway instead.

While this level of diversion may discourage some trips from being taken, this scheme does not have a plan for how to adequately accommodate the nearly 130,000 non-truck vehicles that use the BQE every day. It is anticipated that there would be significant congestion on local streets as vehicles try to make connections between Brooklyn and Queens, and to the Brooklyn and Manhattan Bridges.

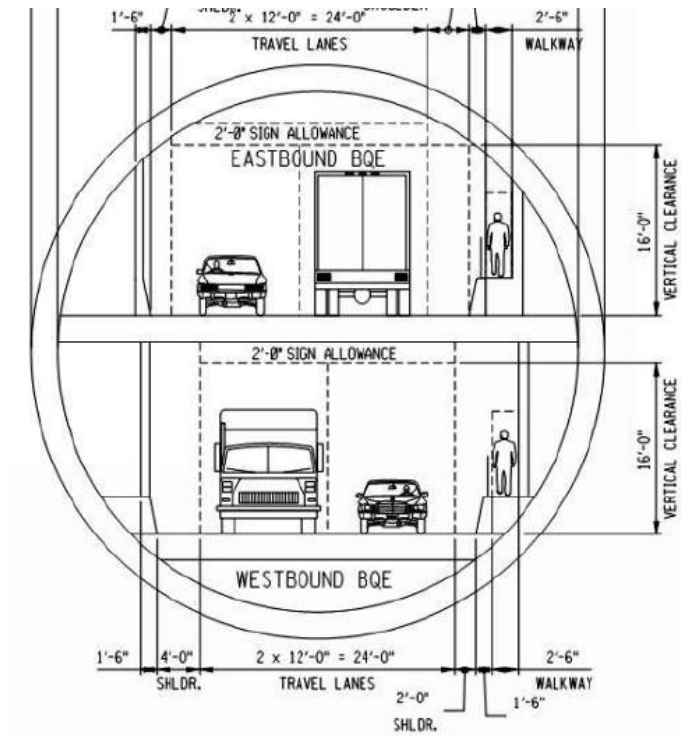
This alternative has a shorter construction schedule and more positive impacts for freight movement than for other vehicles, but it would have significant, prolonged, and unmitigated impacts on neighborhood congestion, as thousands of cars would have to find alternative routes, most likely via surface streets. While the HLC Tunnel has some spare capacity, it could not accommodate the huge volume of eastbound vehicles that would need to be diverted from the triple cantilever that are trying to reach Manhattan or Queens. Similarly, traffic from Queens would have no limited access connection to points south in Brooklyn or Staten Island, forcing them to find long alternative routes or use surface streets. This proposal would have the most serious impact to local traffic circulation and air quality.

Bypass Tunnel

This alternative has significant overall construction impacts, high estimated cost, complex construction methods, and the potential need for temporary construction and permanent takings. However, it has high end-state outcomes, balancing permanent takings at tunnel portals and for two ventilation/egress points along the route against a new, express through route for the BQE, and the potential to reduce the highway segments between Gowanus and South Williamsburg to a smaller surface boulevard that removes barriers posed by large infrastructure, reconnecting waterfront parks and neighborhoods with upland areas.

There is the potential for transformative change to the Brooklyn waterfront and adjacent neighborhoods by relieving pressure on the BQE from the Gowanus Expressway to South Williamsburg, but not without a great amount of cost, coordination, skilled engineering, and potential takings. Creative funding strategies including potentially user charges should be explored in tandem with a more expensive approach like this one.

Figure 22: Cross section of the proposed tunnel, with two lanes in each direction.



3. Evaluation of Public Options

Teardown

This alternative is expected to have less construction impacts, as it proposes to replace this segment of the BQE with a surface boulevard. However, this alternative has untenable end state outcomes due to significantly increased travel times for both general traffic and freight because of the slower speeds (and reduced throughput) of a surface street, temporary and permanent parkland alienation to accommodate the boulevard width, and the likely demand placed on local streets with what would have otherwise been highway through traffic. It would also significantly impact regional goods movement by severing highway access within Brooklyn.

This alternative would create a more human-scaled solution in the form of a surface boulevard with facilities for pedestrians and cyclists in the place of the triple cantilever; however, it would likely be constantly congested, creating a new type of barrier. Even with high user fees (tolls), this option would have wide ranging negative impacts on local roads and neighborhoods as well as the regional highway network.

3.4 Conclusions

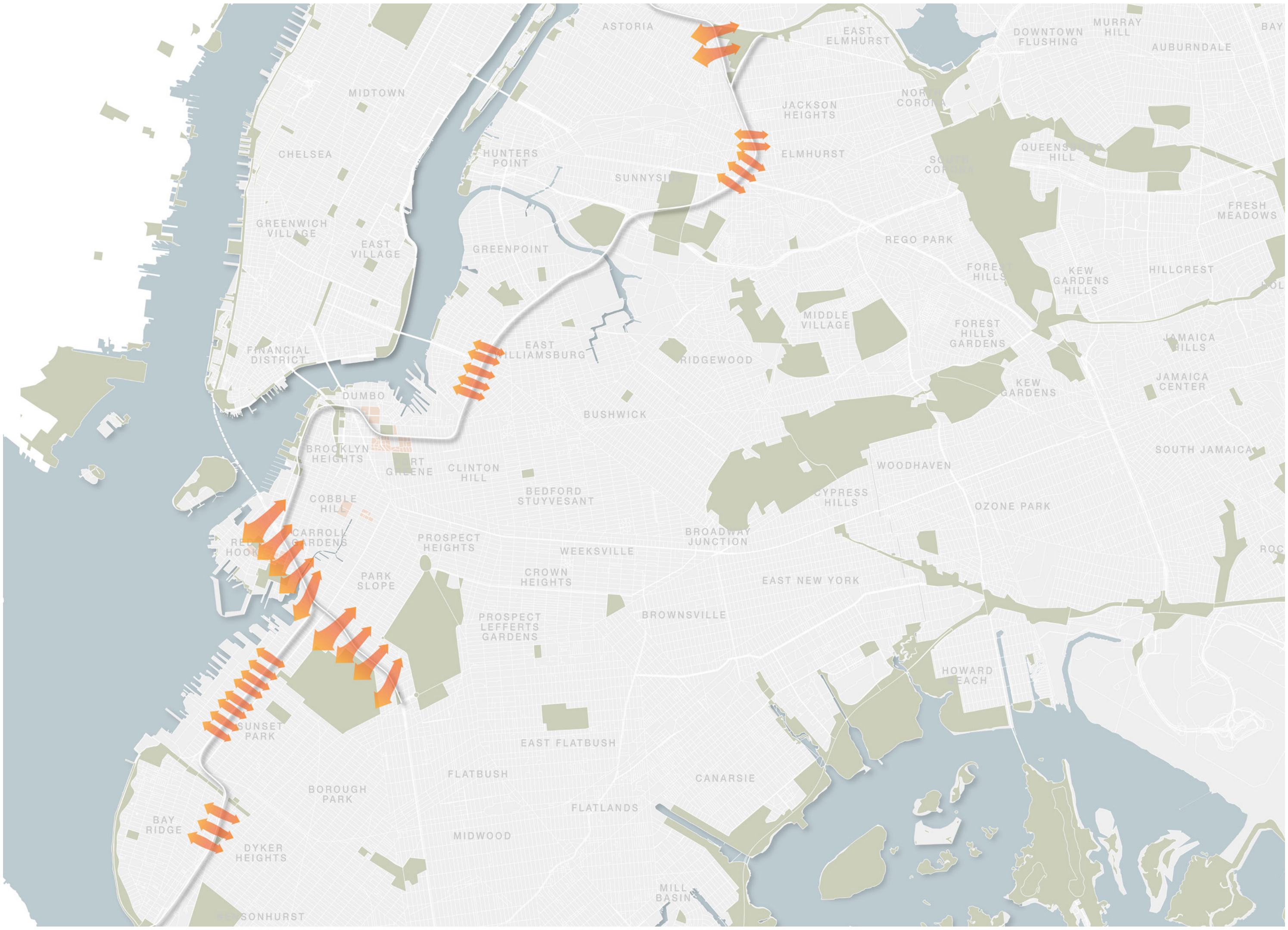
The NYCDOT Innovative plan minimized construction costs and timeline within their narrow jurisdictional purview. However, despite being "technically feasible," the plan was universally rejected by the affected communities and their elected officials. Concepts for more ambitious plans were then developed outside of the confines of the agency process, implicitly posing the question, "can we do better?" City Council, with the help of Arup, evaluated these plans on relative merits to identify ideas – some which had previously been dismissed for being "infeasible" – that were worth reconsidering. The evaluation criteria incorporated an expansive interpretation of feasibility, highlighting the need for new governance, broader planning, and transportation demand policies that would be required to make any plan possible beyond the current impasse.

The more ambitious ideas evaluated could have higher construction impacts, could cost more, and would definitively require greater cooperation and coordination between agencies and levels of government. However, the vastly improved end state of these concepts make it imperative that these ideas be more seriously considered.

- Brooklyn-Queens Park (BIG / Mark Baker) has the highest rated end state outcomes, pointing to several creative solutions for a modern urban highway, and should be further investigated.
- The bypass tunnel has many positive end state outcomes, speeding regional freight and reconnecting several neighborhoods with the Brooklyn waterfront. Despite its potential cost and complicated construction, it should be more seriously considered as a viable alternative than in the past.
- The BHA / Marc Wouters temporary parallel bypass is an improved construction method to achieve similar outcomes as NYCDOT's plans and should be seriously considered if a status-quo roadway is going to be built.

Regardless of the path forward, New York City has to improve project conception and delivery in order to build complicated infrastructure that enjoys popular support and has a greater return than the status quo. While none of the options evaluated here adopt a broader vision for the entire I-278 corridor, it is clear that that will be needed to gain support for new project governance, funding, and the ensuing construction impacts, before communities can begin to enjoy an improved outcome.

4. Recommendations



The BQE project has been a case study in New York City infrastructure replacement: narrow planning, high cost for little improved value, community opposition, and a stalled process. How can we do better?

These recommendations are meant to provide a roadmap for moving the BQE planning and construction process forward. This is not a singular recommendation for a physical planning and engineering solution, but rather a comprehensive reworking of the project approach that can make a more transformative project that enjoys local support possible. Part of that approach is recommending two strategies for serious consideration for the cantilever: a park-capped highway and a bypass tunnel.

The City Council does not have a preferred engineering approach, but rather, feels that the corridor governance and vision must first be established to break the gridlock and move the project beyond the planning stage. Concurrently, NYCDOT must take the necessary steps to ensure that the roadway can continue to be used safely without indefinitely pouring money into it. City Council recognizes that without a definitive plan and timeline, NYCDOT will continue to be left in monitoring and patch-and-repair limbo. Thus, it is imperative that a new governance structure be established by the end of the current legislative session in Albany (June 2020) and begin its work immediately. Action is needed now.

4. Recommendations

There are five components that are necessary for rethinking and advancing this project:

1. A Real Governance Strategy – City/State Partnership
2. A Shared Vision for the Future
3. Genuine Community Engagement
4. Sophisticated Physical Planning and Engineering
5. New Funding Approaches

Each is dependent on the other, and the overall success of the project is dependent on all five. While NYCDOT continues to ensure that the roadway operates safely, it is our collective responsibility – City and State elected officials and agencies and local communities – to advocate for these five elements, starting with a new project delivery model that creates an equal partnership between the City and the State.

1. Immediate Repair

NYCDOT should continue their excellent work of ensuring that the roadway is safe for its users and the adjacent neighbors. It is our collective responsibility to keep the BQE safe and operational until a long-term solution that enjoys support can be implemented. Given the time needed for project design, funding, outreach, environmental review, and construction, this could mean a minimum of 6-years, though likely longer.

The Mayor's Panel on the BQE has identified two 50-foot bridge spans in a 1.5-mile corridor that require immediate attention, and NYCDOT has already announced that they will be conducting repair work there and at the Hicks Street retaining wall this year. In some instances, these repairs may require partial or full road closures, during which every opportunity should be taken to coordinate further testing of the structure.

The City Council echoes the Expert Panel's recommendation to reduce the roadway from a six to four-lane configuration.

The City Council echoes the Panel's recommendation to reduce the roadway from a six to four-lane configuration and to enforce existing restrictions on overweight trucks. This will aid in future repair work, reduce the current load on the structure, increase user safety through the provision of shoulders and improved on-/off-ramps, and thereby reduce the frequency of crashes and other incidents that paralyze traffic. It will also increase emergency response times and effectiveness.

In combination, these efforts will make traffic flow more regular, reduce the disruption caused by incidents, and help avoid backups on local streets. Some of the travel demand policies that can help enable a four-lane configuration are split tolling on the Verrazzano-Narrows Bridge and Manhattan congestion pricing but should not be dependent on these to begin planning and implementation.

2. Project Governance and a Community Supported Vision

A new project delivery mechanism is needed for this project to succeed. NYCDOT developed a project within the constraints that they were operating, however, despite being technically feasible, it doesn't address broader public policy goals. The City needs State and Federal collaboration to identify and implement a positive solution, and a project delivery model that creates the structure for that collaboration. Without the State, the BQE will continue to deteriorate and we will have to fall back on a solution of last resort.

Places around the country use many different delivery methods to implement large or complicated projects. Generally, the most effective methods involve agency partnerships that facilitate coordination between organizations and utilize their joint powers (with or without the private sector getting involved as a partner). In New York State, there are some alternatives for reproducing this delivery method:

- An informal joint agency undertaking. NYSDOT and the New York State Thruway Authority (NYSTA) on the planning and construction of the new Governor Mario M. Cuomo Bridge is one example.
- Signing a Memorandum of Understanding (MOU) to lay out the terms of a partnership between City and State agencies.
- The creation of a public authority designed especially for planning, funding, oversight, and delivery, like the Lower Manhattan Development Corporation (a subsidiary of the Empire State Development Corporation), formed specifically for the task of planning and distributing funding for the reconstruction of Lower Manhattan after September 11th.

4. Recommendations

An official public authority can be created by New York State to further public interests, but it needs to be put in place through legislation. The authority's powers are determined by the State legislature, as is funding, which can range from completely self-supporting to relying on State appropriations or another type of pass-through. Public authorities can oversee both public and private systems, and can issue their own debt, allowing them to take on the risk of infrastructure investments. Most authorities are authorized to issue bonds without voter approval, and some can issue their own contracts (although this can be subject to further State oversight). Public authorities are governed by a board of directors appointed by elected officials, and the division of board membership between interested parties is key to ensure adequate representation of local and state interests.

In order to build momentum for a public authority or an agency partnership for delivering the BQE, securing the support of the State is a necessary prerequisite. The City Council recommends that legislation establishing the new delivery mechanism be introduced and passed in this legislative session, which ends in June 2020.

Regardless of its exact form, the new governance structure will require a fully engaged NYSDOT over a long-term, corridor visioning, planning, and construction process. It will need to include genuine community participation and be able to span any particular administration, elected officials' tenure, or individual relationship.

Additional governance case studies are available in the Resources section of this report.

In addition to addressing the immediate safety needs of the triple cantilever, the new governing body will need to:

1. Convene stakeholders – including affected communities – to begin the work of creating a corridor wide vision. Genuine community engagement must be a pillar of future work.
2. Create a robust regional transportation model to aid in the assessment of alternatives, and to test various road pricing schemes and other demand management strategies to create a viable pathway to a smaller future roadway for the entire corridor.
3. Select an alternative for the triple cantilever – the segment most in need of immediate replacement. This report lays out the options the Council believes are most viable.
4. Work with State and City partners to identify a corridor wide phasing plan to identify subsequent segments of the BQE that will need to be replaced. The plan should integrate current work with the long-term vision.
5. Create design guidelines and standards for the corridor that align with the vision and can help communities shape local decision making and replacement schemes as their segment of the BQE is reconstructed.
6. Identify funding sources.

Without a new delivery model and vision for the corridor that people feel invested in we will continue to be limited by the constraints of local control.

Governance Case Study: Gov. Mario M. Cuomo Bridge, Lower Hudson Valley, NY

The Tappan Zee Bridge, constructed from 1952-55, was originally designed to only have a lifespan of 50 years. The reconstruction fell to the New York State Thruway Authority, a project co-sponsor with NYSDOT. A normal bidding process for design-build contractors was undertaken in 2012, but the management side of the project was different from other projects. When the bridge replacement became a state priority, there was a drive to assemble an 'A-team' of individuals to manage the contractors and ensure speedy project delivery. The Thruway was given permission to recruit NYSDOT employees who had the skills needed to supplement the existing Thruway expertise. These employees were given the option to work for the Thruway for the duration of the project and then go back to NYSDOT if they wished.

3. Genuine Community Engagement

Any plan for the BQE must include a robust and genuine community engagement component. This must go beyond the basic requirements that are typically included as part of a project's environmental review process, and should create dialogue that builds trust with affected communities. Dedicated resources will be needed to have regular, open, honest, and transparent engagement through a variety of means (online, community meetings, tabling at local events and subway stations, through established community groups and Community Boards, etc.) to keep people both informed and to receive their feedback on project planning and construction impacts. If done properly, genuine engagement can help to create an informed public and assuage concerns.

The Second Avenue Subway Community Information Center (CIC) is an excellent example of how this has been done. During construction of the first phase of the Second Avenue Subway, the CIC had a storefront location on Second Avenue on the Upper East Side (it has since moved to 125th Street in Harlem for the second phase of the project). The CIC held regular events, had rotating exhibits about the subway and its construction, held community meetings, and was open during the day for people to come and learn or express concerns.

4. Rebuild a Smaller Highway

As we plan for and rebuild this corridor, we should work to right-size it for our future needs and citywide goals – including improving the public realm and reducing our reliance on individual car use. Any preferred alternative will have to gain Federal and State approvals, including the environmental impact statement (EIS). To get there, we need realistic pathways to reduce the number of trips on the BQE and make those trips that remain more efficient. In addition to the benefits this would have for air quality, noise, and street safety, a smaller roadway will make this project less complicated and expensive to build and maintain.

As explained in Section 1, split tolling on the Verrazzano-Narrows Bridge and Manhattan congestion pricing should reduce trips on the BQE. The Mayor's Panel on the BQE report makes the case for creating a price differential between the HLC Tunnel and the East River Bridges so that it costs less to use the tunnel. The tunnel has spare capacity for much of the day and is a more direct connection to the FDR Drive and West Side Highway for many drivers on the BQE.

It is also recommended that the new project governing body explore user fees on I-278 to reduce traffic volumes, congestion, and wear on the roadway, and to create a potential revenue source to help pay for the project. This potential fee, which would require a robust regional transportation model to study, could be capped in combination with existing regional bridge and tunnel tolls as well as Manhattan congestion pricing. New user fees would be subject to FHWA approval.

The Expert Panel laid out a number of other potential transportation demand (TDM) strategies that include roadway diversion, managing trucks, and expanded transit. These ideas should be studied using a regional transportation model to understand which would be worth pursuing.

5. Scenarios for the Triple Cantilever

There is a real and urgent need to replace the triple cantilever. With a new project delivery mechanism, a vision for the corridor, and tools to build a smaller roadway, new ideas are possible. Through the evaluation of the seven options explored, two physical planning solutions emerged as viable alternatives. A third was identified as a good "Plan B" in the case that greater City and State cooperation does not produce a broader project scope. A fourth "No Plan" scenario is used as a foil to explore what could happen if we default to the NYCDOT Traditional construction method.

The NYCDOT preferred alternative, their innovative plan, should be used as a baseline when considering other alternatives. NYCDOT had proposed spending between $3.2 and $3.6 billion dollars on a six-year construction project that would have replaced the promenade with a temporary highway, while a modern, six-lane highway was constructed below it. Despite being "technically feasible," the plan was universally rejected by the affected communities and their elected officials for its construction impacts, for maintaining the 20th century highway status quo, and for not reflecting broader policy goals.

By working with Arup to understand best practices and what is technically possible, the City Council recommends the two scenarios detailed on the following pages for serious consideration and detailed study by the project's future sponsors. The descriptions are conceptual in nature, allowing for flexibility in the design, especially for the public spaces and non-highway elements. These should be viewed as opportunities for communities to work together to develop a vision for these spaces.

Highway Case Study: The Central Artery/Tunnel Project, (the 'Big Dig'), Boston, MA

The Central Artery/Tunnel Project, commonly known as the Big Dig, was a giant highway replacement project to bury I-93 through downtown Boston in a 1.5 mile tunnel. The project also included a tunnel to Logan Airport (an extension of I-90), a new bridge over the Charles River, and the Rose Kennedy Greenway, which is the open space above the now capped highway. Planning and construction took 25 years and is expected to cost $22 billion with interest when it is paid off in 2038. The project is known for how it transformed downtown Boston as well as being plagued by cost overruns, delays, leaks, design and construction flaws, litigation, and criminal arrests. Despite its flaws, the project's outcomes are nearly universally loved for having turned a reviled elevated highway into over 300 acres of new parks and open space and removing a major barrier.

The Big Dig offers many cautionary lessons for the BQE about project governance and management, as well as positive ones about urban design, project outcomes, and transforming barriers into beloved urban spaces.

4. Recommendations

Preferred Scenario 1: Capped Highway (based on BIG / Mark Baker)

This scenario is based on the Mark Baker Tri-Line and Bjarke Ingels Group Brooklyn-Queens Park concepts. In this version, the highway would stay at the level of the Cobble Hill trench and pass under Atlantic Avenue. It would then rise to the grade of Furman Street and would be capped by an expansion of Brooklyn Bridge Park. Burying the highway is a best practice for dense urban environments, as has been shown in Boston, San Francisco, St. Louis, and Dallas.

The primary elements of this concept are:

1. BQE would pass under Atlantic Avenue, unifying Van Voorhees Park (Figure 24).
2. BQE capped through Brooklyn Bridge Park (Figure 25).
3. Safety improvements at Columbia Heights Bridge: unstacking of roadway, better sightlines and easier curves (Figure 26).
4. Reconfigure ramps at the Brooklyn and Manhattan Bridges to make direct highway connections (Figure 27).
5. Public realm improvement strategies for the Cobble Hill trench and under the Park Avenue viaduct.

Figure 23: The primary elements of the capped highway plan, based on Mark Baker and BIG's work.

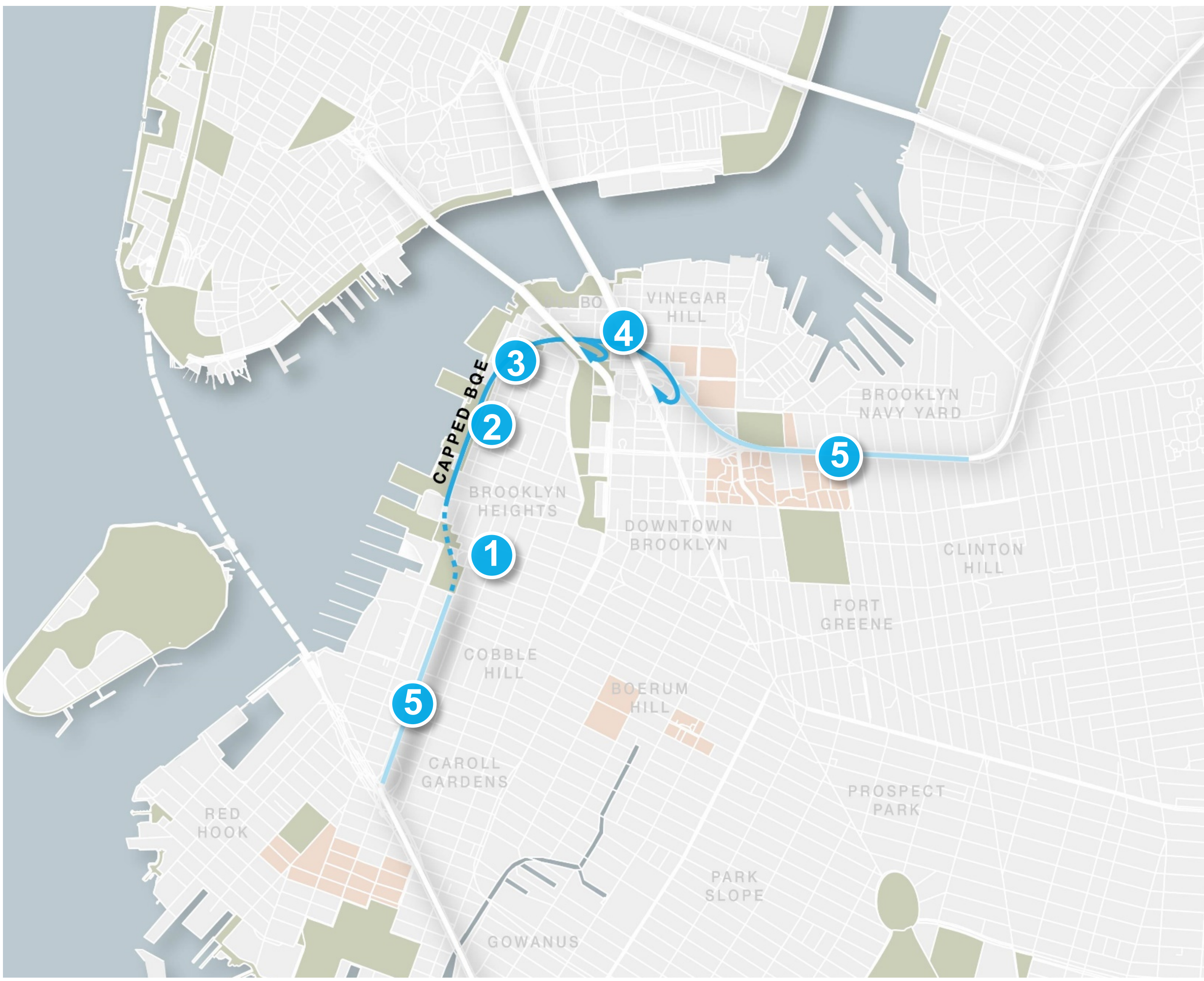
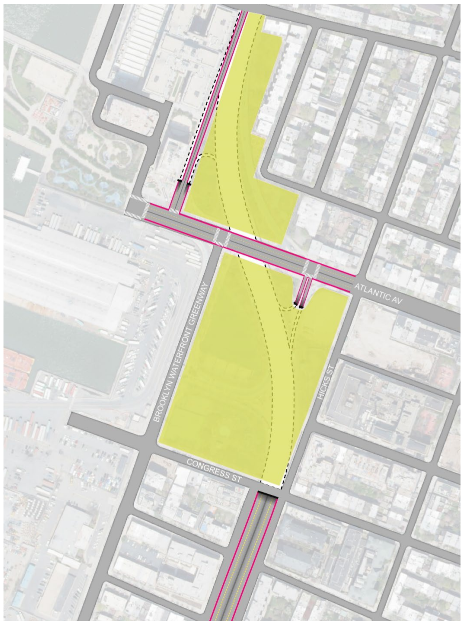


Figure 24 (top left): Conceptual drawing for the BQE passing under Atlantic Avenue while maintaining a four-way interchange.

Figure 25 (top right): BIG's rendering of the capped highway with expanded park.



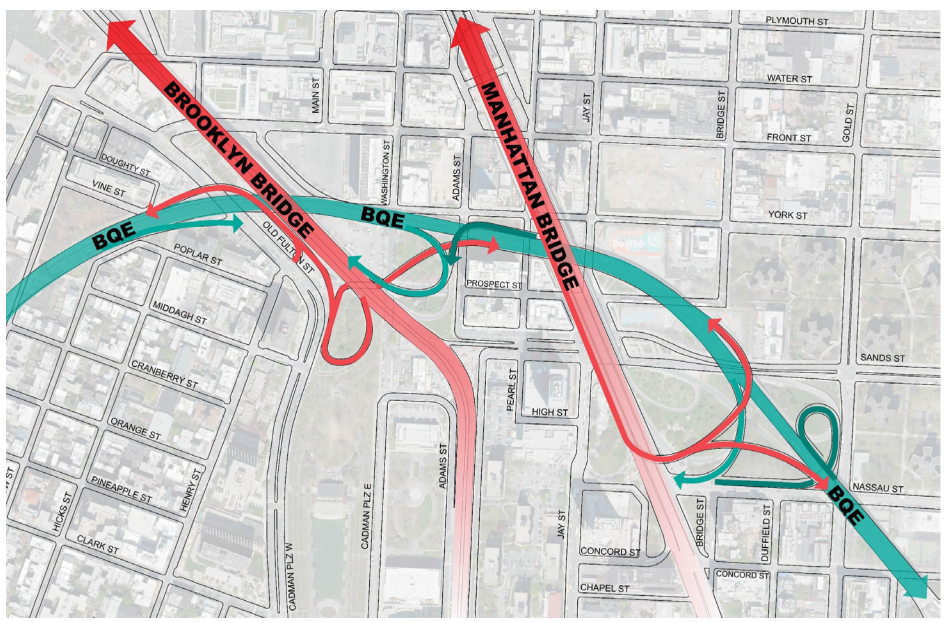


Figure 26 (bottom left): There is an opportunity to unstack the roadway under the Columbia Heights Bridge, which would improve overall roadway geometry and safety. With six lanes (shown here), there would be a 25-foot incursion on the MTA Cranberry Tube fan plant. A four-lane highway may be able to fit without affecting the fan plant.

Figure 27 (bottom right): Conceptual drawing of potential direct ramp connections between the BQE and the Brooklyn and Manhattan Bridges.

4. Recommendations

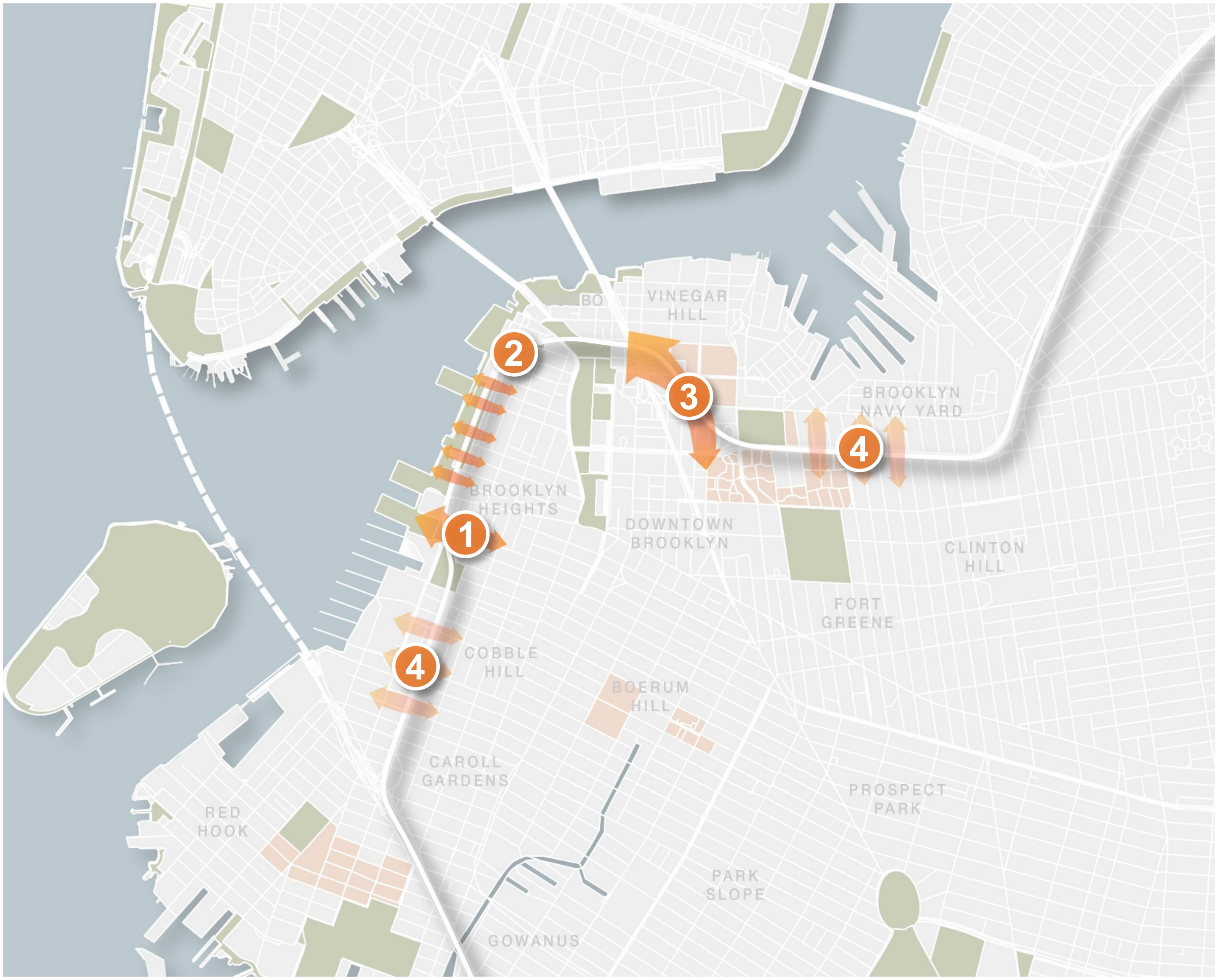
The primary benefits of this concept are:

1. A transformation of the Atlantic Avenue gateway to Brooklyn Bridge Park.
2. Enlarge Brooklyn Bridge Park and improve safety on the BQE.
3. New ramps to the Brooklyn and Manhattan Bridges create directions connections and removes traffic from neighborhood streets.
4. Public realm improvements under the Park Avenue and Hamilton Avenue viaducts.

Arup conducted a high-level cost estimate that indicated that the order of magnitude of the BIG plan cost is similar to that of NYCDOT's Innovative plan.

BIG has estimated that this plan could cost around $3.2 billion and take six years to construct. Despite the plan's perceived complexities, building what is essentially a capped surface highway offers a number of savings because there is no need for a temporary roadway (build it once), it does not involve building bridge structures (either temporary or permanent), and there is less construction risk for building a roadway at-grade. The cost estimate does not include the improved Atlantic Avenue interchange or the new ramps to the bridges.

Figure 28: Scenario 1 would improve the public realm along the BQE from the Cobble Hill trench to the Park Avenue viaduct.



4. Recommendations

There is no doubt that this plan requires much greater coordination between City and State agencies. This plan has direct impacts on MTA fan plants, substations, and emergency access and the DEP interceptor below Furman Street. While the MTA infrastructure would have to be moved or modified, it is possible that the sewer interceptor could stay in place, depending on highway width and lane configuration.

These challenges, from an engineering perspective, are not insurmountable, and the expanded park and improved public realm along the corridor warrant that this concept be jointly studied further by the City and State. Finally, bringing the highway down to grade means that maintenance of the highway will be significantly less expensive over the life of the facility.

Preferred Scenario 2: Bypass Tunnel with Surface Boulevard

This scenario envisions a deep bore, 3-mile bypass tunnel from the Gowanus Expressway at the Prospect Expressway to the South Williamsburg trench, roughly at Bedford Avenue. Through traffic would use the four-lane tunnel to bypass Downtown Brooklyn, Manhattan bound traffic from the south would be encouraged to use the HLC Tunnel, and Manhattan bound traffic from the north would be encouraged to use the Williamsburg Bridge.

The tunnel would be constructed using a tunnel boring machine (TBM), which would be deep enough to mostly eliminate construction impacts at the surface except at either end of the tunnel where the worksites would be. Modern tunnels use jet fans to eliminate the need for ventilation shafts along the tunnel alignment. Fire and life safety in modern tunnels use foam fire suppression systems and pressurized evacuation corridors. Emergency egress shafts would be required approximately every mile, meaning there would two of them. These would have a footprint of about 2,000 square feet on the surface. The use of public land would be sought for these two access points.

This proposed tunnel would be similar to the one constructed in Seattle to replace the aging Alaskan Way Viaduct. The tunnel was constructed using the largest TBM in the world at the time, and was selected as the preferred option because tunneling technology had improved to the point where it was economically and technically feasible.

Figure 29: Conceptual phasing of the current highway, construction of the tunnel, and removal of legacy infrastructure.

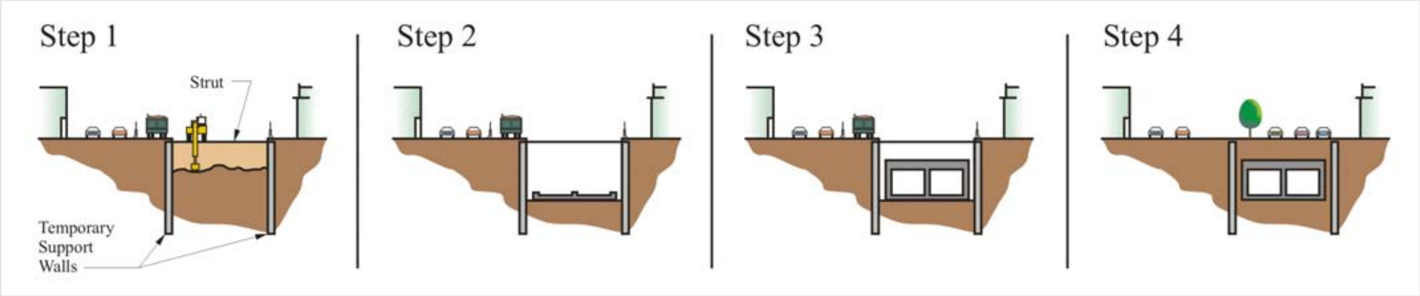
Tunnel Construction Methods

Cut-and-Cover

A method to construct a shallow tunnel whereby a trench is excavated, the underground structure is constructed, and then the trench is filled back up to surface level so that the surface can be restored to its intended use (road, park, etc.). While sometimes simpler and cheaper to construct than other tunneling methods, it has the major disadvantage of widespread disruption to the surface and near-surface level, including buried utilities. This is particularly true in dense urban areas, making the use of tunnel boring machines often preferable.

Much of New York City's subway system was constructed this way, which is why so many stations are just one or two stories below street level.

Construction of a cut-and-cover tunnel using the bottom-up construction sequence.



Tunnel Boring Machine (TBM)

TBMs are used to highly automate the excavation of tunnels, reducing tunneling costs, particularly for urban tunnels over a long distance. They can work in a variety of soil and rock conditions and have the advantage of limiting disturbance to the surface level by tunneling deep below buildings, utilities, subway lines, and other structures. Modern, large scale TBMs can reach 57 feet in diameter and automate the removal of soil and rock and the placement of tunnel support walls.

In New York, TBMs were or are being used to construct the 7-line extension, the third water tunnel, and Long Island Rail Road's East Side Access project, deep below the City's busy streets.

TBM used in the tunneling of the Long Island Rail Road's East Side Access project.

4. Recommendations

The tunnel and diversions to the HLC Tunnel and Williamsburg Bridge would remove enough volume from the portion of the BQE from Hamilton Avenue to Bedford Avenue to allow for it to be replaced with a surface street, which would provide local access. The Cobble Hill trench would be filled and brought to grade, the triple cantilever could be removed, and the Park Avenue viaduct could be torn down. In many sections, this new surface area would provide significant room to re-imagine how this space is used, and could include dedicated transit and bicycle lanes, new parks, and other public facilities. Once at grade, designing, maintaining, and making changes in the future to this roadway would become much easier and cheaper as compared with a bridge or trench.

In Rochester, a trenched highway segment that no longer carried many vehicles was filled in to create a new surface street and new open space. If a BQE bypass tunnel were built, a similar treatment could be done to the Cobble Hill Trench, providing an area over 140-feet wide that could be re-imagined through a community driven process.

Highway Case Study: Alaskan Way Viaduct, Seattle, WA

The Alaskan Way Viaduct was a 2.2-mile long, double decker, H-frame viaduct that carried State Route 99 through Seattle, cutting its downtown off from the waterfront. It was built around the same time as the BQE triple cantilever, and due to its age and seismic concerns, it needed to be replaced. Several alternatives were considered, however Washington State DOT eventually chose to construct a tunnel and replace the viaduct with a 4-lane surface boulevard, dedicated transit lanes, a two-way bike path, improved pedestrian accessibility, and new landscaping, introducing more than 500 trees and green stormwater infrastructure. The tunnel option was selected in part because it allowed traffic to continue to operate on the viaduct until the tunnel opened, at which point the viaduct was torn down.

The tunnel was constructed using a 57.5 foot diameter TBM, the world's largest at the time of construction. The 2-mile long tunnel is double decked with 2-lanes of travel in each direction.

4. Recommendations

Highway Case Study: Inner Loop East, Rochester, NY

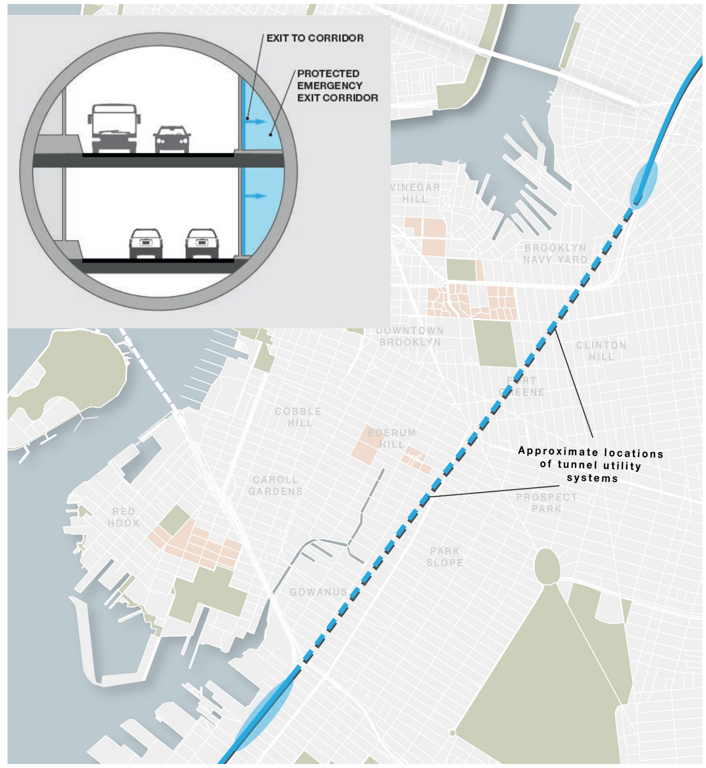
Rochester's Inner Loop, is a sunken 4-lane expressway that cuts off downtown from adjacent neighborhoods, creating long blocks of empty frontage roads that discourage walking and biking. Due to its low traffic volumes and age, the City starting to fill the eastern portion of it to create new open space, affordable housing, and other development. A portion of the highway was replaced with a surface street, eliminating 4-lane miles of expressway and three bridges – allowing for lower operating costs and more flexibility in design now and into the future. The project has been so successful that the City is seeking to convert some or all of the remaining Inner Loop to an at grade street.

This project is similar to the BQE in that it was developed after the highway reached the end of its useful life. Instead of replacing it in-kind, the Inner Loop project, with the support of local businesses and community groups, looked for a solution that would be less expensive, address traffic safety concerns, improve links between divided neighborhoods, and promote redevelopment. Unlike the BQE, the former highway didn't carry a large amount of traffic, making it a relatively easy choice to convert it to a surface boulevard.

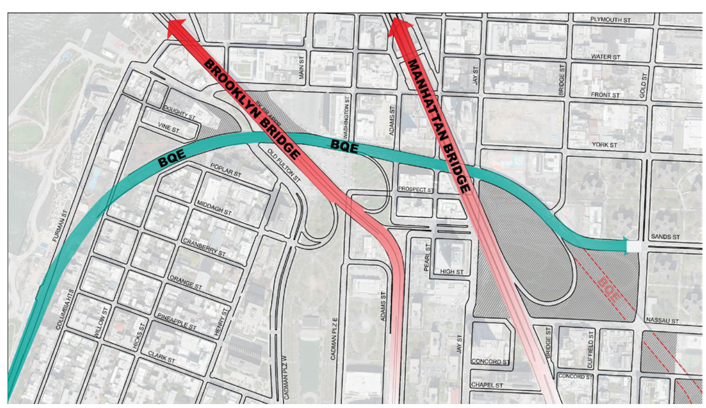
Figure 33 (right): Conceptual drawing of the new at-grade boulevard at the Brooklyn and Manhattan Bridges.

Highway access to the HLC Tunnel (the viaduct above Hamilton Avenue) would have to remain to accommodate the high volume of vehicles going to and coming from Manhattan.

Figure 30: Conceptual tunnel alignment, portal and egress locations, and tunnel cross section with four-lanes of traffic.



To be sure, a tunnel is complex, but is technically feasible, is a best practice used in cities like Seattle and Madrid, and would create a larger benefit along the corridor for more communities. Beyond the issues of governance and cost, the potential largest hurdle to this plan would be the possible need for taking of private property at the tunnel portals and emergency egress shafts.

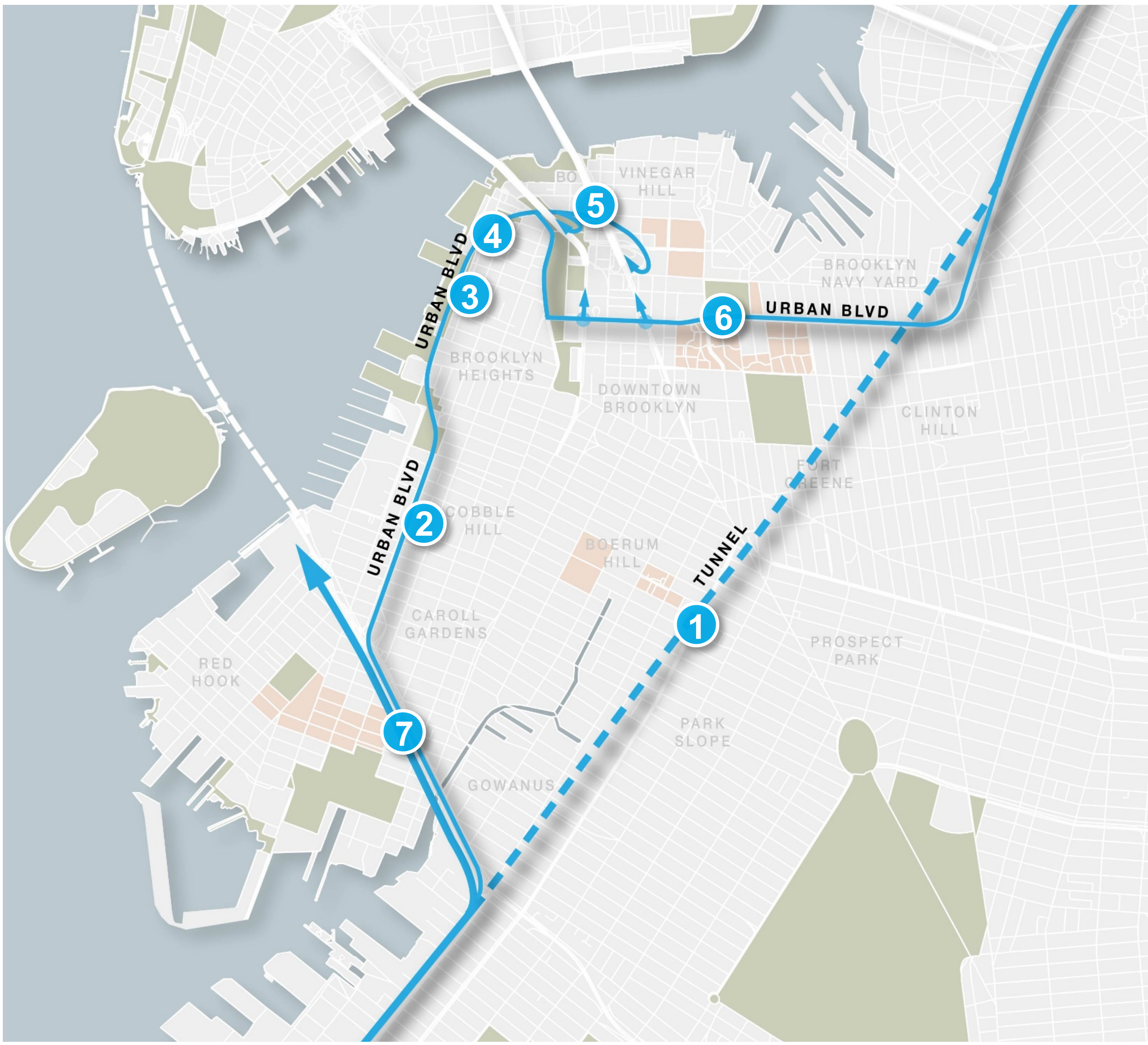


4. Recommendations

The primary elements of the tunnel scenario are:

1. A three-mile, four-lane bypass tunnel from the Prospect Expressway to South Williamsburg.
2. Filled Cobble Hill trench and at-grade Hicks Street.
3. At-grade Atlantic Avenue intersection and four-lane boulevard from Atlantic Avenue to Columbia Heights Bridge.
4. Safety improvements at Columbia Heights Bridge.
5. Maintain eastbound ramps with the new at-grade boulevard (Figure 33).
6. At-grade Park Avenue and Tillary Street would replace the elevated BQE.
7. Opportunity for public realm improvements for Hamilton Avenue.

Figure 31: The primary elements of the tunnel bypass plan.



4. Recommendations

The major benefits of this alternative are spread over a wider area and a greater number of neighborhoods:

1. Remove barrier to the waterfront by replacing Cobble Hill trench with a surface boulevard.
2. Transform the Atlantic Avenue gateway to Brooklyn Bridge Park.
3. Enlarge Brooklyn Bridge Park and improve safety on the BQE.
4. New ramps to East River bridges create direct connections and remove traffic from surface streets.
5. Reconnect Vinegar Hill and Dumbo with Downtown Brooklyn.
6. Reconnect Fort Greene and Clinton Hill with Brooklyn Navy Yard area.
7. Bypass tunnel creates express route between north and south Brooklyn.

Figure 34: Scenario 2 would completely reshape the public realm along the BQE from Hamilton Avenue to South Williamsburg.

4. Recommendations

This plan, as an indicative estimate developed by Arup, could cost between $5 and $11 billion and take 7-10 years to construct. A planning-level schematic design would be needed to begin to narrow the range of the cost estimate.

The tunnel alternative had been dismissed in the pass but should be reconsidered as it is technically feasible, is aided by better ventilation and tunneling technology, and would provide substantial benefits to a larger section of Brooklyn. The higher cost of construction should be balanced against the larger scale of benefits.

Scenario 3: Parallel Bypass Highway (BHA / Marc Wouters)

The BHA / Marc Wouters plan for a temporary parallel bypass over Furman Street is a reasonable construction alternative to NYCDOT's Traditional and Innovative plans. If the triple cantilever is to be rebuilt in its current location, this construction method should be considered. This method makes reconstruction easier by placing the temporary highway next to instead of over the triple cantilever. The bypass structure would infringe on the Brooklyn Bridge Park berms and parking lot, but this would be a temporary condition that could be restored once highway construction is complete. Or the bypass structure could be transformed into a linear park after reconstruction of the highway is complete.

This plan would cost around the same as NYCDOT's Innovative plan. The primary benefit of this alternative is in reducing impacts during the construction phase.

Scenario 4: No Plan

If none of the alternatives described here are pursued, it is possible that NYCDOT will have little time or choice but to use their Traditional option – especially since the Innovative method has been so strongly rejected by residents and elected officials. The Traditional method will result in a lengthy construction process, few benefits beyond rebuilding the triple cantilever, and could result in a framed structure that covers Furman Street.

Figure 35: What the triple cantilever could look like if no other viable path forward is implemented (NYCDOT Traditional).

A better solution is possible. With State and City cooperation and better project conception and delivery, we can build a better BQE for Brooklyn and Queens.

6. Applying the Vision to the I-278 Corridor

It has become clear that any changes to the BQE should be considered through a wider lens. It is a key regional corridor that has profound impacts on the neighborhoods it runs under, over, and through. While there is immediate need to address the triple cantilever for safety reasons, many of the highway interventions discussed in this report could be applied across the I-278 corridor and to other City highways: capping, tunneling, filling, and replacing the highway with more human-scaled infrastructure where feasible as regular lifecycle replacement is required. The specific vision and interventions for each highways segment will vary depending on need, current configuration, and the local communities. Cities as diverse as Madrid, Seattle, and Dallas can offer New York examples of how highways were rebuilt to better fit into their urban context.

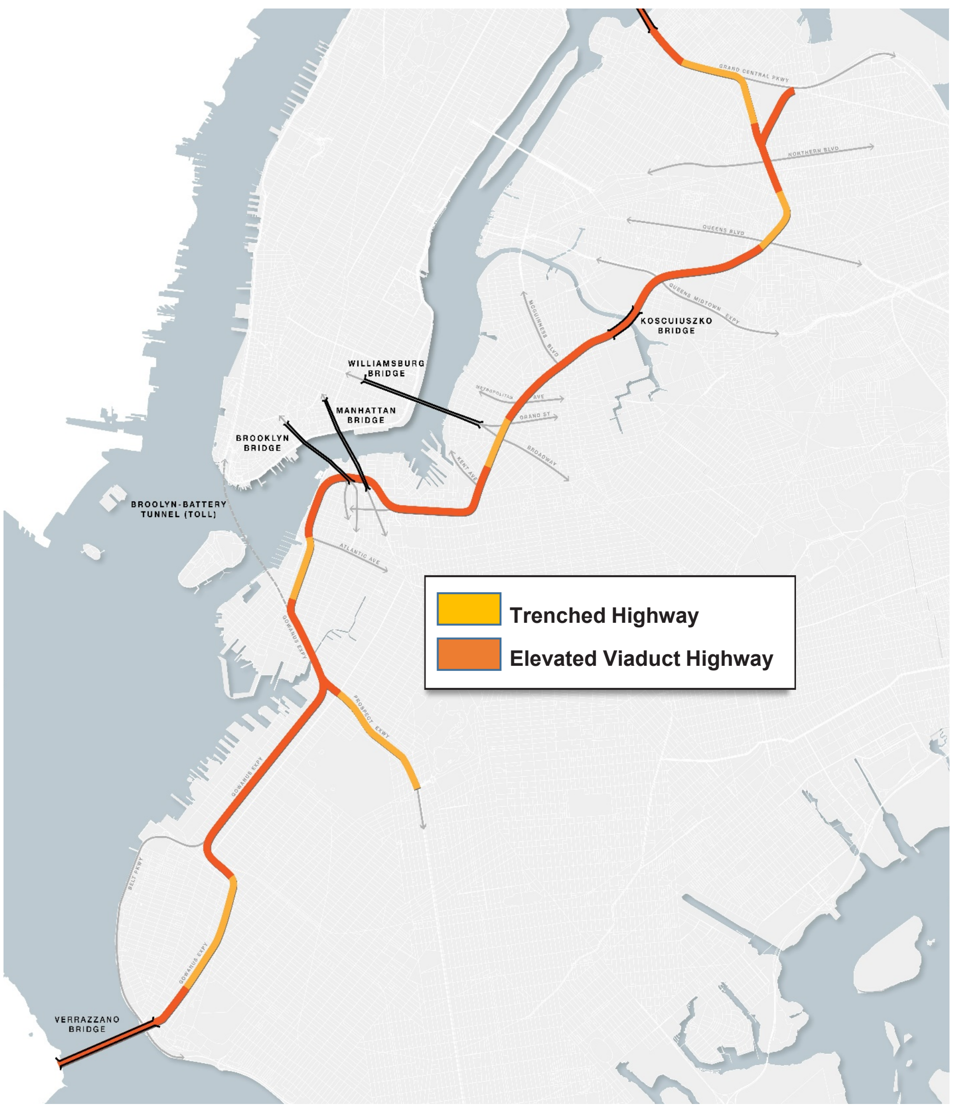


Figure 36: Whether in a trench below-grade or elevated on a viaduct, the I-278 corridor can be a significant barrier for neighborhoods.

4. Recommendations

Once established, the project's governing body will have to work with State and City partners to identify a corridor wide phasing plan to identify subsequent segments of the BQE beyond the triple cantilever that will require replacement as they reach the end of their useful life. The governing body will also work with community and government stakeholders to develop a corridor-wide vision and a set of design guidelines and standards that can be used to shape the local context. The phasing plan should integrate current work with the long-term vision so that a cohesive corridor is created that doesn't shift burdens from one community to another, and so that one segment's plan doesn't preclude another. For example, a BQE bypass tunnel should align with, and not preclude the construction of a potential Gowanus Expressway tunnel.

1. Cap the BQE to enlarge McKinley Park.
2. Bury the Gowanus Expressway viaduct.
3. Cap or fill the Prospect Expressway.
4. Bury the elevated highway and cover the portal to the Hugh L. Carey Tunnel in Red Hook.
5. Cap the BQE in South Williamsburg.
6. Cap and connect Woodside, Elmhurst, and Jackson Heights.
7. Cover the trench in Astoria.

Figure 37: Future Vision: when sections of I-278 need investment, we should be thinking more ambitiously about the opportunity for broader benefit - capping trenches, reconnecting neighborhoods, improving road safety, and providing new opportunities for open space.

4. Recommendations

Several communities along I-278 have developed proposals for reducing the impact of the highway and reconnecting neighborhoods. These are great examples of how communities have advocated – in some instances for many decades – for a better future for our urban highways. The energy and vision espoused by these community plans should be integrated in to an overall plan for the highway. These community plans have often been paid for by funds secured by local elected officials. Some of these plans include:

- BQ Green in South Williamsburg (http://bqgreen.org/en/the-park/): a plan designed by architect Susannah Drake that originated in 2010 to cap the BQE from South Third to South Fifth Streets, joining two parks with a new 3.5-acre open space that would include a flower garden, playground, baseball diamond, barbecues, grassy and wooded areas, an indoor pool, and a water play zone. This is very similar to a project that was built in Dallas, where three-blocks of a highway were covered with a new park.
- Fix the Ditch in Cobble Hill: a plan developed in 2011 for the Cobble Hill Trench in a partnership between the NYC Economic Development Corporation, Starr Whitehouse Landscape Architects, Community Board 6, and the Cobble Hill Association that envisions a series of escalating interventions to address noise and pollution and increase connectivity to the waterfront.
- Gowanus Expressway in Sunset Park: Since the 1990's, communities along the elevated Gowanus Expressway have been advocating for it to be torn down and buried beneath Third Avenue, which would help to better connect the residential and industrial portions of Sunset Park and provide new opportunities for open space.

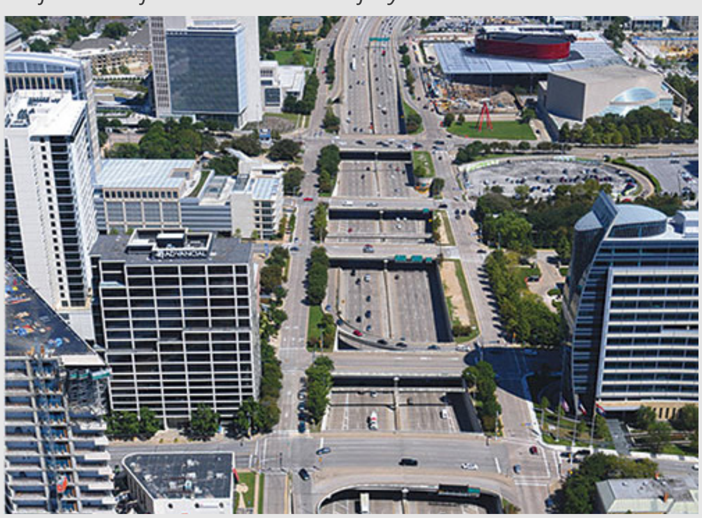
These community visions and the advocacy behind it expresses a deep desire to bury our highway infrastructure beneath new open space, a best practice for urban highways that has been replicated in cities like San Francisco, Seattle, Boston, Dallas, St. Louis, and Madrid.

Highway Case Study: Woodall Rodgers Freeway, Dallas, TX

Klyde Warren Park is a 5.2 acre privately managed open space that spans the Woodall Rodgers Freeway in Dallas's Arts District. The park was built by a public private partnership (P3) consisting of the Texas Department of Transportation, the City of Dallas, and The Woodall Rodgers Park Foundation. The 200 foot wide section of highway now supports a park with over 300 trees, daily programing, a children's play area, dog park, and a large passive lawn, among other features.

A similar urban design strategy could be used to span over trenched parts of the BQE to reconnect neighborhoods with new parkland. While the freeway carries more traffic than the BQE, it does so on a modern highway with one additional lane in each direction plus full exit lanes.

Before and after the construction of Klyde Warren Park over the Woodall Rodgers Freeway.



5. Next Steps

Collectively we, New Yorkers, must develop a viable path forward for the BQE and demonstrate that something better is possible beyond just rebuilding legacy infrastructure. Past efforts have faltered due to a lack of coherent vision and rationale for the corridor. Without this, communities have felt targeted or left out – and have always wanted to better understand the opportunity costs of such enormous public works. New York is not alone in trying to solve this problem. Other cities have successfully tackled equally complex problems with innovative delivery and engineering solutions. We can too.

The City Council has laid out in this report concrete and actionable next steps. The Council will continue to push on the governance recommendations with our City and State partners and with the communities that have fought so hard to get us to reconsider this problem in the first place.

The first step is already in motion as NYCDOT works to maintain safe operations of the BQE. There is no doubt that there is a need for immediate fixes, however, the Council does not want the urgency of the near-term to distract from the urgency to create a long-term delivery method and plan for the entire corridor – including a fix for the triple cantilever.

The Council sees those steps as:

1. Pass **legislation** in Albany this session (by June 2020) to create a new I-278 corridor governing body which, as a **first step, should focus on implementing one of the two approaches described in this report**.
    a. The legislation should create equal partners in the City and State, and identify broad goals for the corridor related to transportation, community engagement, the public realm, and sustainability.
2. The **new governing body** must begin its work in haste.
    a. Create a robust regional transportation model to aid in the assessment of alternatives, and to test various road pricing schemes and other demand management strategies to create a viable pathway to a smaller future roadway for the entire corridor.
    b. Work with State and City partners to identify a corridor wide phasing plan to identify subsequent segments of the BQE that will need to be replaced. The plan should integrate current work with the long-term vision.
    c. Create design guidelines and standards for the corridor that align with the vision and can help communities shape local decision making and replacement schemes as their segment of the BQE is reconstructed.
3. Maintain **safe operations** of the triple cantilever for the near-term.
    a. Continue to monitor the structure and do necessary maintenance and repair work.
    b. Work with State elected officials to implement automatic enforcement of overweight vehicles using weigh in motion (WIM) technology and cameras.
    c. Convert the roadway to two-lanes in each direction consistent with what the Mayor's Panel on the BQE recommended.

This document proposes a path forward for the immediate and long-term needs of the BQE, aspiring for a better highway that does more than just move people and goods between places, but also unites communities and creates a model for the large-scale replacement of legacy infrastructure in New York City. The time to act is now.

6. Resources

Highway Case Studies - Summary

Urban highways are being rethought, replaced, and in some cases torn down, in cities across the globe. It is a correction for the massive highway expansion that was a feature of 20th century planning and urban renewal, and a recognition that highways do not make good neighbors. However, not all highways can be torn down. Those that have been are often in economically declining cities whose populations have shrunk since their mid-century highs, have an adequate parallel route and are therefore redundant, or sometimes both. Some of the most prominent local highway removal projects meet these criteria, such as I-81 in Syracuse and Rochester's Inner Loop.

In contrast, the legacy highways that serve as critical economic corridors for the movement of goods and people must be rethought. Best practices from around the world for highways in dense urban environments show that they should be covered or buried when they need to be replaced. This helps to remove barriers, reuniting once divided neighborhoods, better integrating the highways with their context, and provides new opportunities for open space and development.

Table 3 is a summary comparison of the highway case studies that are presented throughout this report.

Table 3: Comparison of highway transformation case studies.

Project	Location	Roadway Type	Length	Width	Traffic Volume	Cost	Construction Duration	User Fees
Alaskan Way Viaduct	Seattle WA	Tunnel	2 mi	4 lanes 57.5 ft diameter tunnel	80,000 ADT	$2.1 bn for tunnel ($3.3 bn entire project)	5.5 yrs	Electronic tolling with variable rates based on time of day, number of axles, and payment method
Presidio Parkway	San Francisco CA	Capped tunnel	1,750 ft (0.3mi)	6 lanes	110,000 ADT	$1 bn	5.5 yrs	Golden Gate Bridge is tolled electronically and in the southbound direction only, variable rates based on number of axles and payment method
Central Artery / Tunnel Project	Boston MA	Capped trench	1.5 mi	8-10 lanes	198,000 ADT	$22 bn with interest	15 yrs	None
Inner Loop Conversion	Rochester NY	Boulevard conversion from filled trench	0.9 mi	2 lanes, 1 turn lane, 2 parking lanes	7,000 ADT	$21 million	3 yrs	None
Madrid Rio (Calle 30)	Madrid Spain	Tunnel and capped trench	62 mi (35 mi of tunnels)	6 lanes	150,000 AADT	€3.9 bn (2007)	3 yrs	None
I-44	St. Louis MO	Capped trench	285 ft	6 lanes	75,000 AADT	$33.6 million	4 yrs*	None
Woodall Rodgers Freeway	Dallas TX	Capped trench	1,200 ft (0.2mi)	8-10 lanes	201,888 AADT	$51 million	4 yrs	None

* The St. Louis project was part of a larger, four-year renovation of a national park.

6. Resources

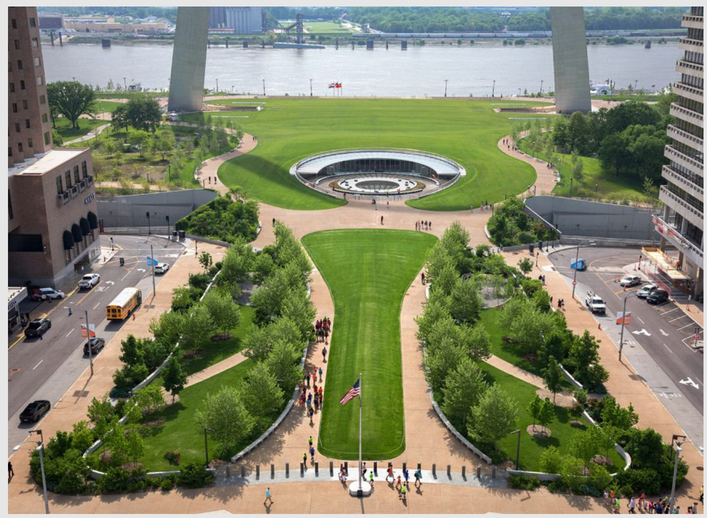
Highway Case Study: Park-Over-Highway, St. Louis, MO

Gateway Arch National Park in St. Louis, home to the iconic silver arch designed by architect Eero Saarinen, was cut off from downtown by I-70 (later re-designated as I-44). As part of a $380 million, 4-year renovation of the park, a one-block long cap was built over the highway to connect the famed park with the rest of St. Louis. The overall renovation added 11 acres of parkland, including the highway cap, which was completed in 2018.

St. Louis and St. Louis County residents passed a 3/16-cent sales tax, in part to fund the Arch grounds renovations. The tax was projected to raise about $9.4 million a year and fund as much as $90 million in bond issues. The structural work for the park over the highway was largely funded with state and federal transportation dollars.

A similar urban design strategy could be used to span over trenched parts of the BQE to reconnect neighborhoods with new parkland. This project was made possible by funding that was connected to a larger National Park renovation. It is technically less challenging than the BQE because it was for a single block length and spanned a highway that carries about half of the traffic volume of the BQE.

Before and after the decking over of I-70 through Gateway Arch National Park.



Governance Case Studies

Alaskan Way Viaduct, Seattle, WA

The Alaskan Way Viaduct was an elevated section of State Highway SR 99. A 2001 earthquake made the structure unstable and made removal necessary. State and local agencies studied more than 90 alternatives, but it was difficult to reach consensus. By 2009, tunnel boring costs had come down enough to make a tunneled replacement with a waterfront boulevard feasible.

The project is governed by a traditional partnership, led by the Washington State Department of Transportation (WSDOT). Partners are King County, which implemented transit changes and improvements, the Port of Seattle, which committed $300 million in funding, and the City of Seattle, responsible for traffic operations and maintenance. In addition, the City owns and maintains Alaskan Way, the area that was under the viaduct, and many of the utilities located in the project area.

Transbay Transit Center, San Francisco, CA

The Transbay Transit Center was financed, designed, developed, constructed, and operated by the Transbay Joint Powers Authority (TJPA). The TJPA is a joint exercise of powers authority created by the City and County of San Francisco, the Alameda-Contra Costa Transit District, the Peninsula Corridor Joint Powers Board, the California High Speed Rail Authority, and Caltrans (ex officio). The TJPA is managed by TJPA staff and is overseen by an eight-member Board of Directors.

California has enabling legislation (the Joint Exercise of Powers Act) to allow government entities in the state (including state departments, counties, cities, redevelopment agencies, etc.) to jointly exercise their powers without getting approval from the legislature. This is helpful when an issue spans jurisdictional boundaries and could benefit from the joint effort and funding of more than one distinct agency. A joint powers agreement (JPA) is a legal agreement between two or more public agencies that share a common power and want to jointly implement programs, build infrastructure, or deliver services. The legislation also allows for the formation of a joint powers authority, a new, separate government body created by the member agencies. This is a standard process in the state, involving the agreement of the agency officials which is then sent to the Secretary of State to sign (but not approve). JPAs have been used for powers as wide-ranging as creating a new transit agency, consolidating waste collection, or generating funding for capital projects. A lead agency is designated, and all JPA members can exercise the powers of this lead agency for the project.

Gateway Project, New York and New Jersey

The Gateway Project, intended to improve and rehabilitate rail connections between New York and New Jersey, had enabling legislation passed in June 2019 to establish a bi-state commission. The Gateway Development Commission Act, passed by both houses of legislature in each state and signed off by the Governors, gave more powers to the Gateway Program Development Corporation (GDC), a non-profit formed in 2015.

The legislation makes GDC an eligible recipient for federal, state, and local grants, and establishes the GDC as an entity solely dedicated to overseeing the planning, finance, and construction of the Gateway Program. The seven commissioners guiding the GDC will be nominated by the governor (in New Jersey) and the State DOT commissioner (in New York), and the Amtrak representative will be directly appointed by Amtrak. The legislation allows the commission to collect tolls and fees to fund the program.

Partners include U.S. Department of Transportation, Amtrak, NJ Transit, and the Port Authority of New York and New Jersey. The project sponsors for the first phase of the program are the Port Authority (for the Hudson Tunnel Project) and NJ Transit (for the Portal North Bridge Project).

The Central Artery/Tunnel Project (the ‘Big Dig’), Boston, MA

The I-93 elevated roadway divided central Boston neighborhoods, was regularly clogged with traffic, and had many non-standard design features. City leaders and residents were eager to see it removed and a tunnel solution was proposed in the 1972 Boston Transportation Planning Review (BTPR), a state-led regional large-scale analysis of highways and transit. The project gained traction in the second term of Governor Michael Dukakis, whose Secretary of Transportation worked with him to group the project with a tunnel to Logan Airport, another regional improvement which had strong support from the city and from business leaders.

After federal funding was appropriated and environmental approval achieved, the Massachusetts state legislature created the Metropolitan Highway System, a designation that encompassed the Central Artery and airport tunnel, as well as the state highways approaching them. The Massachusetts Turnpike Authority (MTA) was given responsibility to handle finances and delivery of these roads. To help with management, design, and delivery, the MTA hired a joint venture for the Central Artery and airport tunnel, and eventually combined its employees with joint venture employees in an integrated project organization. Because of its scale, the Central Artery and airport tunnel project was divided into portions to be delivered by various contractors.

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