BROOKLYN-QUEENS EXPRESSWAY EXPERT PANEL REPORT

JANUARY 30, 2020

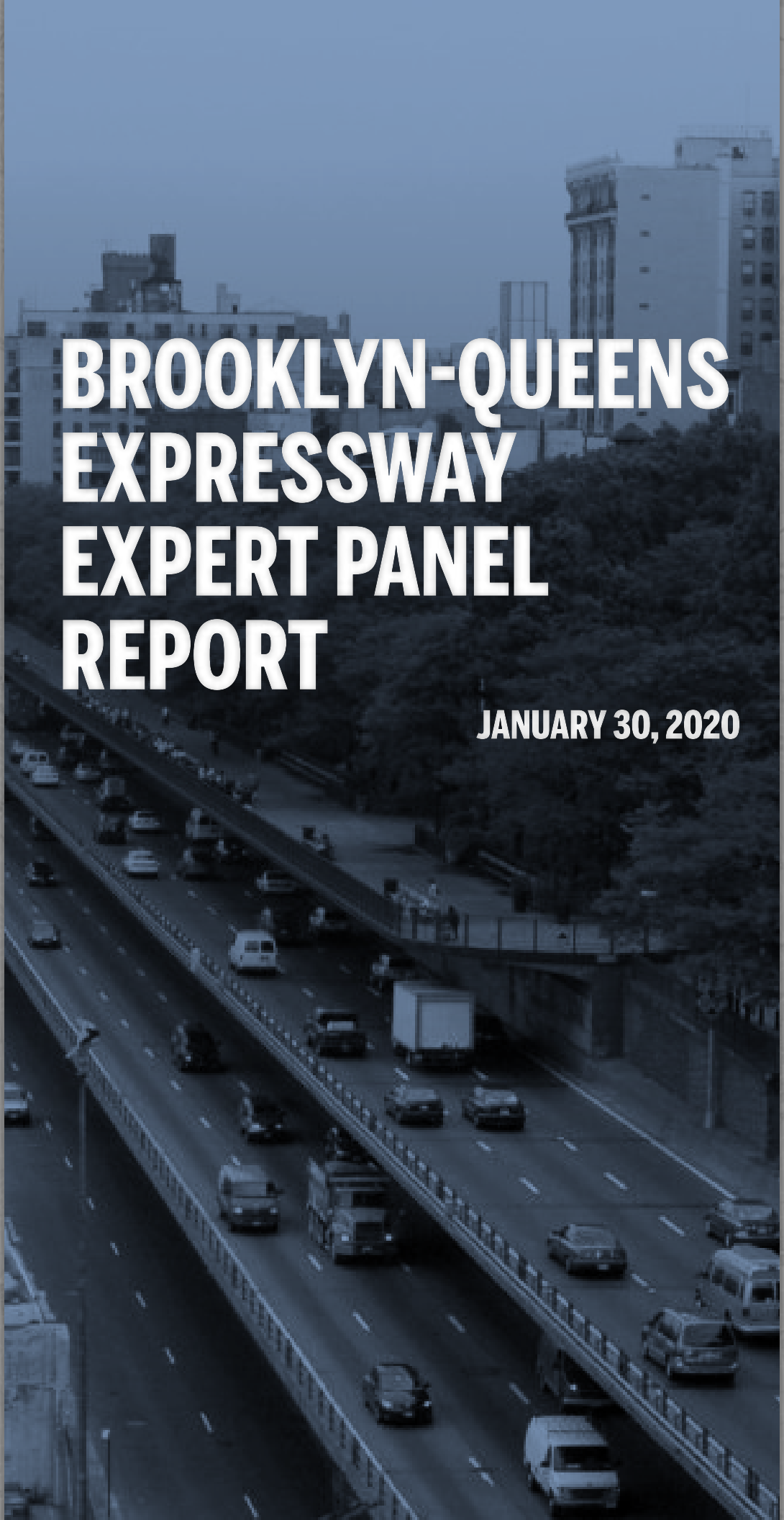

TABLE OF CONTENTS

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LETTER FROM THE CHAIR

January 30, 2020

Dear Mayor de Blasio,

Thank you for the opportunity to serve as Chair of the Brooklyn-Queens Expressway (BQE) Expert Panel ("the Panel") and participate in the tremendous work accomplished since you formed the group in April 2019. On the Panel, we were fortunate to have a wide array of experts representing the building industry, including labor, design, engineering, transportation expertise and construction professionals as well as innovative business and civic associations. This allowed us to directly address the challenges that have historically plagued previous efforts to identify a solution for this antiquated roadway.

Over the past several months, we have engaged in robust discussions with the New York City Department of Transportation (NYC DOT), experts in various fields, elected officials and community representatives. The Panel has examined many of the proposals that have been put forward, while also grappling with the complexities of a project of this scale in this area of Brooklyn.

When we began, the Panel thought we might identify "a physical solution" for the project area or propose a clean plan for rebuilding this roadway – we did not. Instead, the Panel viewed its role as twofold:

- *Identify the steps necessary to keep the current roadway safe and extend its life span.*
- *Lay out a vision that New York City, New York State and the federal government could use to inform the underlying project assumptions and successfully complete not just rehabilitating this 1.5-mile stretch, but a transformative corridor-wide infrastructure project.*

This report – which identifies our findings and recommendations for next steps – marks the end of our time as a Panel, but the beginning of the work that must be done to address this problem for the next century. It will not be easy, and compromises will need to be made. Significant levels of investment will undoubtedly be required. But there is no choice. We must come together and act now. Kicking the can down the road is not an option.

I would like to especially thank NYC DOT Commissioner Polly Trottenberg, her excellent staff and the consultants who helped the Panel over these past months. I'd also like to thank all the elected officials for their leadership and input throughout this process. Finally, I've been encouraged by the commitment and ideas expressed by community members and groups along the corridor and thank them for their participation.

I'm grateful to my fellow Panelists for their time and effort throughout these months. I look forward to working with them, the constituencies and communities they represent and many others in taking the foundation we present here and building on it in ways that allow the speedy delivery of a roadway for the next century.

Very truly yours,

Carlo A. Scissura, Esq.
Chair , BQE Expert Panel
President & CEO, New York Building Congress

EXECUTIVE SUMMARY

1. <u>The BQE roadway is suffering from significant deterioration and work must begin this year to fix it.</u> The Panel has worked with New York City Department of Transportation (NYC DOT) to collect new, more precise data that suggests that the presence of many overweight trucks and faster-than-expected deterioration may cause sections of the road to become unsafe and incapable of carrying current traffic within five years. NYC DOT should immediately conduct all necessary maintenance and repair work based on the current condition of the roadway and should have every appropriate tool at its disposal to do the necessary work to keep the road safe and drivable.

Actions to mitigate the impact of traffic – both to extend the highway's life and to facilitate a transition to a zero-growth traffic future – must also be undertaken right away. Our recommendations include a series of immediate next steps, whose implementation will require the joint efforts of the City, State and federal government.

2. <u>The cantilevered section of the BQE will need to be repaired immediately.</u> NYC DOT should redefine its program to be limited to a four-lane highway that will be capable of handling a traffic load adequate for the region, but with volumes slightly lower than current usage. A four-lane configuration will be possible as a result of traffic changes resulting from the State's congestion pricing program, the return to split-toll collection on the Verrazano Bridge, and other traffic management strategies. A four-lane configuration will make the highway safer, reduce injuries, avoid capacity-reducing accidents and breakdowns, and will make handling traffic during any construction more manageable.

3. <u>We specifically reject any proposal to build a temporary highway at the Brooklyn Heights Promenade (the "Promenade") or Brooklyn Bridge Park (the "Park").</u> Additional proposals to repair and improve the 1.5-mile project area have been made, but they are flawed: their capacity assumptions were incorrect, as they assumed maintaining existing volumes, they compromise adjacent public spaces in ways that are unacceptable or they require levels of investment that are not realistic or equitable.

4. <u>Work needs to be undertaken to immediately devise a broader transformation of the entirety of the BQE corridor from Staten Island to Queens.</u> Any new, corridor-wide vision needs to be grounded in today's transportation and sustainability goals – minimizing growth in road traffic, maximizing public transit usage, providing alternatives for local freight, protecting the environment and promoting quality of life in adjacent communities. Work on this new vision for the BQE needs to start immediately, as the implementation of a new roadway could take two decades.

Developing and implementing a new, corridor-wide vision will require participation well beyond the City and local stakeholders – New York State and federal agencies and elected officials will also need to play a major role in planning and funding. Given the need for multi-jurisdictional cooperation on both a long-term vision and immediate next steps, a joint working group of these three levels of government and community stakeholders along the corridor should be convened immediately to oversee both and move this corridor-wide project forward.

PROJECT & EXPERT PANEL OVERVIEW

The BQE and its respective structures have lasted a half-century but deterioration has been recognized for decades. The BQE project, in its current form, started in 2006 when the New York State Department of Transportation (NYS DOT) convened a Design and Construction Workshop to discuss the complexities of rebuilding the triple-cantilever. NYS DOT then followed with a draft scoping document in preparation for an Environmental Impact Statement (EIS) in 2009, only to suspend the environmental process in 2011, citing a lack of funds. After a long period of discussion between the City and State, in 2014 NYC DOT decided it was necessary to resume the project in light of the structure's continued deterioration.

NYC DOT conducted a charrette with industry experts in 2015 to determine early actions to inform the scope of the project. The recommended actions included conducting an in-depth inspection, an origin-destination traffic study and a tunnel study, as well as identifying staffing needs. The results of the in-depth inspection indicated a level of deterioration that required action. NYC DOT began studying the feasibility of various construction options and publicly presented preliminary concepts in September 2018.

Community members and elected officials expressed concerns about the proposed concepts, particularly in light of potential effects on the Promenade. They strongly supported an independent, thorough review of potential solutions, including additional proposals that had been put forward by stakeholders. City officials recognized that both concepts presented in September 2018 by NYC DOT were unlikely to obtain the community buy-in or legislative approvals needed to move forward with the project.

As a result, in April 2019, Mayor Bill de Blasio signed Executive Order 43, convening an independent panel of experts to review the project assumptions and concepts for the city's BQE project. Thanks in part to advocacy from local civic associations and elected officials, the BQE Expert Panel's purpose was to take a fresh look at the project due to the critical role the BQE plays in New York City's transportation network and the surrounding neighborhoods.

Over the past eight months, we have met weekly, with NYC DOT Commissioner and staff regularly in attendance. In order to further utilize the expertise of our members and allow in-depth analysis, we created committees focused on 1) governance, organizational capacity and legislation/policy 2) engineering, feasibility and constructability and 3) urban design and transportation planning. The Panel received numerous presentations from experts and government agencies, including the New York City Department of Environmental Protection (DEP), Department of City Planning, Department of Parks and Recreation, Economic Development Corporation, the Port Authority of New York and New Jersey and the Metropolitan Transportation Authority. The Panel conducted tours of the project area and surrounding sites. In addition, the Panel also hosted two public meetings with civic associations and elected officials to gather input and to brief stakeholders on the progress of the group's work.

During this process NYC DOT developed a number of additional potential concepts for the project, which the Panel reviewed. These concepts included a range of potential solutions from rehabilitation to longer-lasting partial or full replacement options. For each potential concept NYC DOT provided estimates on cost, construction duration, and service life, as well as potential project benefits and tradeoffs. ***These concepts are presented in Appendix 1.*** The BQE Expert Panel does not endorse either the options or their descriptions.

The Panel undertook direct engagement with the public and other stakeholders where possible, to understand their views on the respective proposals. Individual members worked with NYC DOT and their consultants to initiate analysis where possible. These actions have set the stage for this report, which we expect and hope will move the project forward in a clear direction, setting a framework for further research and stakeholder involvement over the next several years.

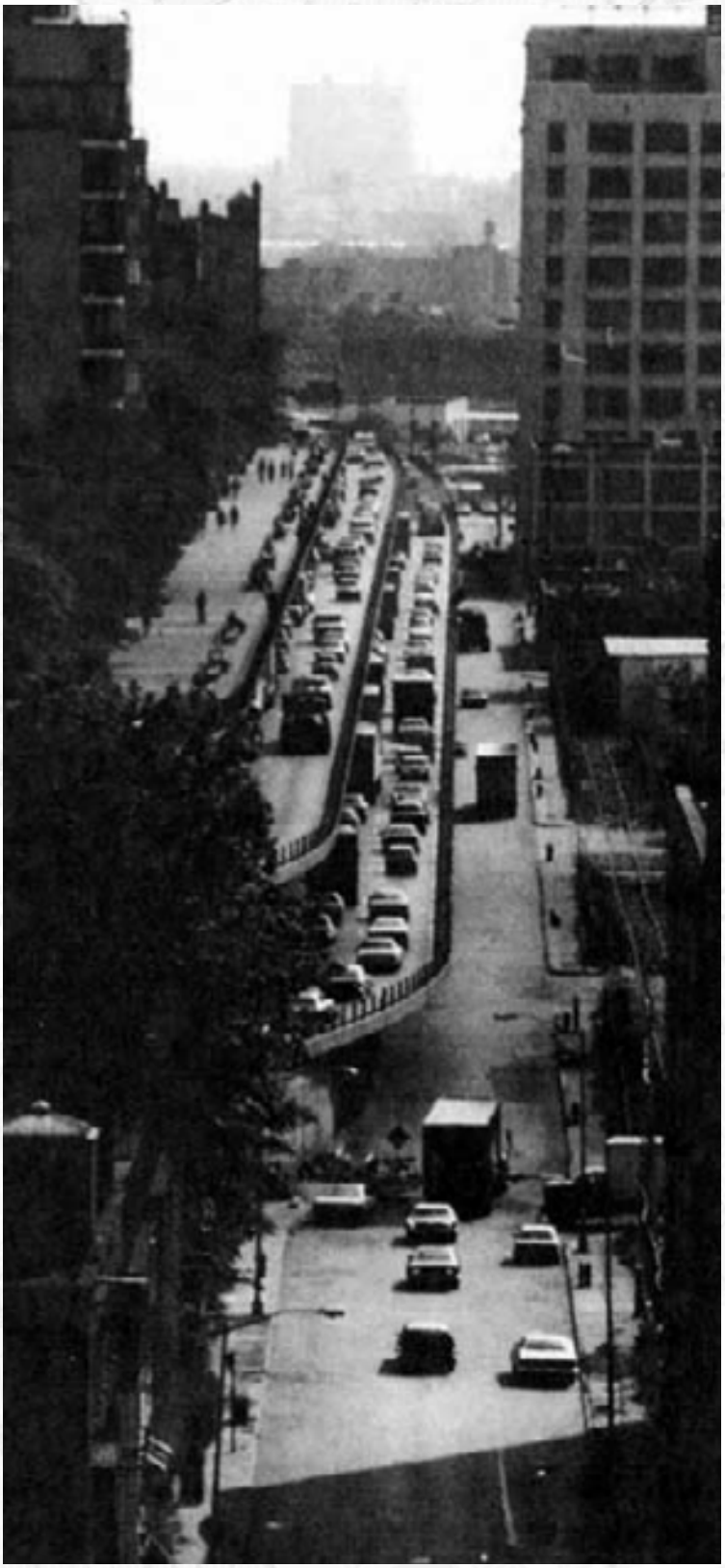
CURRENT STATE OF THE BQE

HISTORY

The BQE first opened to traffic in the 1950s as part of the United States' ambitious highway-building program of the mid-20th century. In Brooklyn Heights, the highway was difficult to build, particularly the section from the Atlantic Avenue interchange to the vicinity of Sands Street. That section is a complicated series of over 15 structures, many of which have outlived their service life. This approximately 1.5-mile portion of the BQE, first opened to traffic in 1954, includes the unique triple-cantilever, a stacked highway with the renowned Brooklyn Heights Promenade as the top level.

The triple-cantilever structure extends roughly 0.4 miles along Furman Street, between Remsen Street to the south and Orange Street to the north. When it was built, it was hailed as "the great compromise," preserving historic residences in Brooklyn Heights and creating the Promenade as park space. Its structural decks carry three levels of traffic: the lowest level carries the Staten Island-bound traffic, the middle level carries the Queens-bound traffic and the upper level carries the pedestrian traffic of the Brooklyn Heights Promenade. All three levels are supported by one wall, which also acts to retain the earth fill of the adjacent Brooklyn Heights community.

Other neighborhoods, more industrial and lower in income, were not fortunate enough to have a highway "hidden." In these cases, a trenched roadway cut neighborhoods in half or an elevated roadway forced New Yorkers to live in the shadow of the structure. Today, those same neighborhoods are more residential and have a different mix of businesses and uses compared to when the roadway was first built. The area adjacent to the cantilever has seen a similar shift: the recently built Brooklyn Bridge Park has replaced much of the industrial area to the west and additional residential buildings have been built or adapted nearby.



CURRENT STATE OF THE BQE

ROADWAY CONDITIONS

In terms of usage, the roadway is part of Interstate-278, a critical interstate and inter-borough connector — where daily traffic now exceeds 150,000 vehicles, including more than 15,000 trucks. The BQE is a vital freight corridor, critical to the city's and region's commerce and businesses. It also is the only interstate in Brooklyn and handles substantial freight traffic through Brooklyn and Queens. Of all morning rush-hour truck trips going north on the triple-cantilever, approximately 50 percent originate from the Southwest Brooklyn Industrial Business Zone alone. This indicates a continuing need for reliable freight movement along the BQE corridor.

The BQE serves as an important link for passenger vehicles through Brooklyn and Queens, handling both local and regional traffic. Compared to other major roadways in the New York City area and beyond, the BQE is heavily utilized – it has higher daily volumes of traffic than the Governor Mario M. Cuomo Bridge, FDR Drive, the Cross-Bronx Expressway and the West Side Highway. The current toll structures have a distorting effect on traffic patterns, leading to greater use of the study area by both freight (avoiding tolls on a regional scale) and passenger vehicles driving into Manhattan from Brooklyn and Queens (avoiding tolls to cross the East River). Split tolling on the Verrazzano-Narrows Bridge and congestion pricing will change these incentives.

The project area addresses the portion of the BQE between the Atlantic Avenue Interchange in the south/west and Sands Street in the north/east. This 1.5 miles of an over-20-mile stretch of state highway suffers from high levels of congestion and crashes due to particular design issues, including:

- **Narrow lanes** – the lanes in this section of the BQE are 10.5 feet wide instead of the typical highway lane width of 12 feet. While a width of 10.5 feet works well for city streets, highways function better with wider lanes that allow for more throughput and operational flexibility.
- **Lack of breakdown lanes/shoulders** – the roadway has no shoulders, so any kind of incident on the structure results in a lane closure and added congestion, which can delay travel, cause backups or additional traffic on local streets and increase emissions from idling vehicles. With disabled vehicles and trucks making up 41 percent of incidents on the roadway, adding shoulders could lead to a reduction in delays on the BQE.
- **Unsafe mergers** – On- and off-ramps have short merge distances, making it difficult for vehicles to safely enter and exit the roadway.
- **Horizontal curvature** – non-standard curves lead to limited sight distances, making it difficult for drivers to see slowdowns in a timely manner.

CONSTRUCTION CHALLENGES

Fixing the BQE is exceptionally complicated due to its unusual design and the constrained site in which it operates. This corridor is sandwiched between Brooklyn Bridge Park, the Promenade and Brooklyn Heights, the Manhattan and Brooklyn Bridges, bustling DUMBO and Vinegar Hill, new residential buildings along Furman Street and an extraordinary volume of infrastructure below – four subway lines, an 8-foot DEP interceptor sewer, water mains and many other utility lines.

Creating sufficient space to stage the construction is a key challenge. Specifically, any construction concept needs to account for the complexities of working with a cantilever structure, buildings along Furman Street, the surrounding open spaces and the critical infrastructure running above and below the BQE.

This part of the BQE corridor is also comprised of multiple structures that require different methods of rehabilitation or replacement. Although the triple-cantilever is the most well-known portion of this project, the double-cantilever and the structures at Joralemon, Old Fulton and Columbia Heights all require repair. In addition, the BQE passes under the Columbia Heights Brooklyn and Manhattan bridges, creating substantial pinch points in construction and configuration of the roadway.

A traditional bridge structure is usually rehabilitated lane by lane. Construction crews shut down a portion of the structure, repair those areas and then shift traffic to the rehabilitated section. This type of construction staging is not possible on the triple-cantilever due to its unique nature. Unlike a traditional highway bridge structure, which has multiple supports (girders) along the travel lanes below the roadway deck surface, the BQE is a single reinforced-concrete structure with three cantilevers that support the promenade, Queens-bound traffic and Staten Island-bound traffic. It also serves as a retaining wall for Brooklyn Heights and the historic residences located there.

Rebuilding cantilevers is difficult because each level of the cantilever is a deck anchored at only one end, and the system of roadways and retaining wall need to work together to remain stable. In order to maintain the structural integrity of the whole system, repairs must happen perpendicular to the flow of traffic. Only small sections of the roadway can be removed at any time, and the gap in the roadway will cross all lanes of traffic on the deck. For this type of work to occur without any kind of temporary bypass structure means extensive overnight and weekend closures, as well as a patchwork of steel plates covering the deck during the day.

DETERIORATION AND IMMEDIATE NEEDS

The results of NYC DOT's 2016 in-depth inspection of the structures within the corridor determined that if significant repairs and replacements are not made by 2026, vehicle-weight limits and truck diversions would be necessary. However, the Panel has worked with NYC DOT to collect new, more precise data on the current traffic loads and state of the cantilever's deterioration in order to more reliably predict its remaining life. This data is alarming; it suggests that the presence of many overweight trucks – a function of limited monitoring and enforcement - coupled with deterioration of the cantilever could cause sections of the road to become unsafe and unable to carry existing levels of traffic within five years.

It is important to note that this stretch of highway is technically a series of bridges. Bridges are designed to carry their own weight (dead load) plus the live load of vehicles. A bridge structure must be designed so that its strength or "capacity" exceeds the total weight of its dead load plus the live load. For an old bridge, the original design capacity must be adjusted based upon the actual condition of the bridge plus the weight of the live load that the structure is then carrying.

Three major elements are in play when reaching a conclusion on the reliability of a bridge structure: current condition, dead weight plus live load and safety standards by which engineers determine reliability. The Panel accepted NYC DOT's assessment of current conditions. It has applied conservative assumptions about live load (weight of the trucks using the cantilevered section) and a conservative safety standard by which to judge the cantilevered section's reliability, but adjusted that output for the actual weight of trucks to determine the appropriate timeline for the repairs:

1. CURRENT CONDITION:

The Panel accepted NYC DOT's data on the condition of the BQE's cantilevered section. NYC DOT, between 2014 and 2016, performed an extensive, in-depth inspection. This involved hands-on inspections, testing of concrete cores and rebars and various forms of non-destructive testing to indicate corrosion rates, cracks and moisture/chloride penetration. In 2019, NYC DOT, working with its subconsultants, updated the data used in the predictions of the corrosion of the reinforcement bars at various concrete sections of the BQE cantilever structure.

Looking at the BQE today, the signs of its deterioration are obvious – spalling concrete, deteriorated joints, exposed rebar

in the retaining walls and wood shoring are all signs of a structure in distress. These issues are occurring throughout the project corridor, whether it is the triple-cantilever, double-cantilever or other structures that make up the highway. Serious vibration from the roadway impacts nearby residents, as well.

2. LIVE LOAD:

NYC DOT used a standard load factor as specified by the American Association of State Highway and Transportation Officials (AASHTO) in its load ratings calculations. AASHTO's standard load factor (which does include an additional margin for safety) assumes that the 80,000-pound limit ("80kips") for trucks is being enforced, an assumption that is not realistic given the illegal overweight trucks using the BQE. In fact, the load on the cantilevered section of the BQE far exceeds the standard loading of 80 kips. New data collected at the request of the Panel between October 16, 2019 and January 19, 2020 showed that on the Queens-bound roadway, 11.1 percent of the trucks exceeded 80,000 pounds and 27 percent exceeded the Federal Bridge Formula, which relates to the weight carried by trucks compared to the size of the trucks. Some trucks weighed 170,000 pounds or more. Higher live loads cause greater stress on the structure, shorten its life, decrease reliability and reduce the safety factor. The data used in this analysis is preliminary and we urge NYC DOT to continue monitoring and collecting additional data.

3. SAFETY STANDARD:

NYC DOT used AASHTO's safety standard level for judging the reliability of the cantilevered section of the BQE. AASHTO's standard reliability index is based on the average of data collected from typical bridges, which are primarily slab-on-girder bridges. Based on these assumptions, AASHTO sets a target reliability level of 2.5.

However, the BQE is not a typical bridge structure. The cantilevered section of the BQE is unique and poses different and greater risks than slab-on-girder bridges. The Panel does not believe AASHTO's data collected exclusively from such typical, better-supported bridges can be applied without adjustment to a cantilever bridge.

AASHTO also assumed in establishing its standard reliability index that trucks did not exceed legal weights and that enforcement of overweight trucks would be effective. This is not the case on the BQE. The cantilevered section lacks redundancy in its supporting structure and is continuously stressed by illegal overweight trucks.

The predictions of the corrosion rate of the rebars is also a concern. The deck of the cantilevered section of the BQE was built 65 years ago (exceeding its design life of 50 years) using uncoated rebars that lack protection against rust and corrosion. The rebars, which are buried in the deck and run perpendicular to traffic, provide resistance to the stresses produced by the dead load and live load.

Because of these factors, the Panel concluded that AASHTO's recently developed reliability-based Load and Resistance Factor Rating (LRFR) approach is applicable in utilizing the actual site-specific Weigh-In-Motion (WIM) truck weight data for the cantilever section of the BQE. Additionally, given the uncertainty in dealing with this type of cantilevered structure, the target standard reliability index for the cantilevered section of the BQE should be set at least at 2.5. The target reliability index should properly consider the cantilevered section's unique structure, the site-specific WIM-based heavier live loads and the uncertainty in predicting corrosion rates.

DETERIORATION AND IMMEDIATE NEEDS

When the Panel used AASHTO's target safety index of 2.5, based on the calculations made by the NYCDOT and joint-venture team it found that the majority of the spans that make up the cantilevered section of the BQE will, over the next five (i.e., before 2024) to 15 (i.e., before 2034) years, fall below the prudent target reliability index standard of 2.5. Two spans will be below the prudent safety standard of 2.5 by 2024. These two deficient spans must be addressed within the next five years. The application of this safety index is based on the unique qualities of the BQE cantilever and should not be applied uniformly to any other, conventional roadways in New York City or State

The short period of time before the cantilever becomes unreliable underscores the Panel's belief that the City must take immediate steps to protect and repair the cantilevered section of the BQE. Given the Panel's findings, NYC DOT has expanded its monitoring and inspection program of the BQE project area to be continuous and more rigorous and will be beginning maintenance of certain sections of the cantilever as early as spring 2020. This repair work must begin right away, and NYCDOT should have every appropriate tool at its disposal in order to keep the road safe and drivable. Closure of the road for extended periods may be necessary to complete these repairs in the most efficient way possible and to achieve the most durable results.

FINDINGS

1. ASSESSMENT OF THE NYC DOT PLAN

The Mayor and NYC DOT deserve credit for attempting to tackle this problem at this time, particularly given that the deteriorating condition of the BQE has been known and studied for over a decade, without meaningful efforts being made to address the problem.

The temporary elevated roadway plan proposed by NYC DOT, however, is not an appropriate solution to the problem presented by the deteriorating condition of this stretch of the BQE for the following four reasons:

1. The Brooklyn Heights Promenade and Brooklyn Bridge Park should not be part of any transportation solution.
2. The plan sought to accommodate 150,000 vehicles per day, even though evidence clearly demonstrates that increased capacity induces more driving without solving traffic congestion for those trips on the highway that have reasonable transportation alternatives.
3. The plan did not adequately consider approaches to traffic management that can and should be employed both during construction and beyond to reduce the stress placed on the roadway by vehicles that have alternatives.
4. The plan was proposed prior to the collection of the most recent data concerning both the condition of the roadway and the composition of the current traffic flow.

We recognize that there are instances in which building a new bridge (or highway) next to the old is a practical way to proceed. Indeed, the Governor Mario M. Cuomo Bridge and Kosciuszko Bridge were successfully completed in this manner. In neither case, however, was the new bridge "temporary" (to be torn down in six-eight years), as contemplated here. If the only considerations were to avoid diverting or interrupting the current traffic flow and to simplify the replacement of the cantilever structure – and if there were sufficient space for a temporary highway — the plan might have made sense. But those are not the only relevant considerations and there is not sufficient space.

The public announcement of the proposed "Innovative Plan" prompted an outpouring of opposition from neighboring community groups and local elected officials. The arguments presented against the proposal included the loss of the Promenade for a period of years, as well as the damage to the neighboring residential area caused by increased noise, air pollution and vibration resulting from a six-lane highway abutting the homes on Columbia Heights, with new elevated highways flying over the neighborhood at either end.

The public policy and legal issues raised by the NYC DOT proposal were enough for the Panel to conclude that it was not a viable solution. Moreover, as demonstrated by newly acquired data, the need to repair or rehabilitate the highway is too immediate to allow for the regulatory and legal process involved in building a temporary roadway. In short, there is neither the space nor the time for the DOT's "Innovative Plan" or any of the proposed variations thereof.

The Panel strongly urges an assessment of the role to be played by this highway going forward. We do not accept the premise that the highway must be rebuilt in its current form to accommodate more cars and trucks. Analysis of the data collected for the Panel demonstrates the distorting effect existing toll structures have on the current volume and composition of traffic. The analysis also makes clear the problems caused or exacerbated by the lack of effective enforcement to prevent oversized and overweight trucks from using a roadway that was never intended to handle the load or from instead traversing residential streets they are not legally permitted to use.

We recognize that as part of the interstate highway system, and as an important route for locally originated or destined freight (at least until alternatives can be implemented), it is unrealistic to expect that the highway can or should be eliminated anytime soon. However, we believe that a broad assortment of effective traffic management tools can and should be employed both in the near term – to accommodate rehabilitation of

the existing structure while minimizing the impact on surrounding communities along the affected corridor – and on a permanent basis, if possible, to reduce vehicular volumes. New York City has established ambitious goals for reducing carbon emissions and improving freight distribution in the five boroughs and beyond. Rationalizing the role of the BQE in this system is long overdue. Before embarking on a multi-billion-dollar construction project designed simply to replicate the existing structure and accommodate current traffic levels in perpetuity, the Panel believes traffic management alternatives should be implemented to reduce capacity and facilitate a long-term reduction in volume. To the extent any of these actions may require legislative, regulatory or budgetary cooperation from the State or federal governments, we encourage all involved to work together to achieve these goals.

2. ASSESSMENT OF ALTERNATIVE PLANS

In the wake of the strong public opposition to NYC DOT's proposal to rebuild the triple-cantilever by employing a "temporary" highway where the Promenade now stands, both the New York City Comptroller and local community groups (working with design firms) proposed a variety of alternative plans. During meetings with the Panel, NYC DOT also presented various potential concepts related to repairs as well as major rehabilitation and replacement.

Some of these groups argued that the need to repair or replace the triple-cantilever was an opportunity for a "transformative" re-imagining of the transportation infrastructure and accordingly unveiled proposals that included a narrowing of the existing roadway and the addition of parkland, pedestrian walkways and recreational spaces. At least one of these groups heralded their own plan as a step forward in moving beyond today's "car culture."

One of the alternative plans proposed by a local community group would have moved the "temporary" highway from the Promenade to Brooklyn Bridge Park.

The Panel concluded that this approach simply shifted the burden from one group of park users to another. The Brooklyn Heights Promenade and Brooklyn Bridge Park are both essential to New York City, especially to the surrounding neighborhoods and Brooklyn as a whole. These iconic locations provide outdoor space, scenic vistas and recreational opportunities to millions of visitors each year from all parts of the world and to city residents. These two destinations are also critical to the economic survival of local area businesses.

Consequently, in June 2019, this Panel publicly recommended the rejection of any proposal that included a temporary highway on the Promenade or through the Park. The Panel reached this conclusion with an understanding that such a limitation might make the rehabilitation, rebuilding and repair of the triple-cantilever more difficult. Nonetheless, we were persuaded of the importance of both the Promenade and the Park as integral features of the local community and unique and vital destinations within the City.

Since that June announcement, several groups have continued to object to any kind of triple-cantilever rehabilitation, rebuilding or repair that merely restores the structure to good health; these groups have pressed the Panel, government officials and the media to embrace a "transformative" approach. These proposals are ambitious in nature and offer ideas that warrant further study. Nonetheless, such an approach is at odds with the need to act expeditiously to maintain the safety of the roadway and to prevent an unplanned interruption of its use. These complex and expensive proposals also raise questions of fairness and equity – questions that go beyond the mandate of this Panel.

FINDINGS

Given the enthusiasm of some members of the community for a visionary plan and the visceral appeal of these concepts, it is important to identify some of the challenges of adopting such an approach at present:

1. ***The various plans are conceptual.*** Each plan would require extensive engineering studies and further design work. Only then would it be possible to begin the long process of environmental and other governmental reviews. The engineering and design process would consume years – and that is before a shovel ever hits the ground. The actual construction itself would also be a complicated, multiyear process. While we appreciate the ambition of these proposals, we are mindful that they do not accurately take into consideration the engineering and construction complexities and the time it would take to turn these visions into feasible plans. In other words, while we believe these creative alternatives should be explored by the appropriate public agencies (or a task force made up of those agencies), the proposed plans are not responsive to the immediacy of the current situation.
2. ***Any rehabilitation of the triple-cantilever will be a multibillion-dollar project.*** Adding additional parkland, pedestrian walkways, tunnels and other features will make the project more expensive. While the added cost may well be justified (an issue beyond the purview of this Panel), given the fiscal realities of the City, State and federal government, we are certain that inflating the budget of this project will only handicap the ability to begin the kind of monitoring, maintenance and repair that is immediately required.
3. When this Panel announced in June that we would not support proposals that included temporary highways through either the Promenade or the Park, we were mindful of and responding to the serious objections raised by the local community. There is, however, a corresponding obligation to the communities north and south of the immediate area and to New York City. ***We have been tasked with evaluating a mere 1.5-mile section of a highway that is more than 20 miles long and part of a freight corridor running through Brooklyn, Queens, Staten Island and the Bronx.*** The proposals that have garnered the most local support and media attention would add acres of parkland, scenic vistas and other amenities to an area that is already home to the Brooklyn Heights Promenade and Brooklyn Bridge Park. Any systematic evaluation of these proposals must consider the proper allocation of scarce public funds and the implications for the rest of Brooklyn, New York City and the State.

It is our strong view that these proposals cannot be evaluated (or implemented) in a vacuum. Further, we determined at this juncture that it would not be appropriate to endorse plans of this type. To do so would bestow a benefit to only a few neighborhoods, while not considering the needs of other neighborhoods along the entire BQE corridor in Brooklyn and Queens or its effect on Staten Island and the Verrazano Bridge.

RECOMMENDATIONS

The deterioration of the cantilever must be addressed now to avoid severe traffic restrictions before any "new" highway comes online. The Panel recommends a series of immediate steps to protect the roadway from further deterioration, including maintenance and repair work as determined by monitoring and restrictions on weight and use to reduce live load.

INTENSIVE MONITORING AND MAINTENANCE

NYC DOT should immediately conduct all necessary maintenance and repair work based on the current condition of the roadway. Given the uncertainty associated with predicting the roadway's future condition, the Panel and NYC DOT have created a plan for continuous structural health monitoring of the project area to guide the decision-making process related to all future maintenance and repairs.

NYC DOT has agreed to monitor locations where deterioration in the roadway is evident using three different types of sensors:

- **Strain Gauges:** Strain gauges installed at critical sections will continuously track and report on the strains (and consequently the stresses) imposed on the cantilevered structure due to passing trucks and other vehicles, as well as stresses caused by ambient temperature and other environmental conditions.
- **Deflection Gauges:** Deflection gauges installed at various locations including the tip of the cantilever can continuously track and record the maximum (up and down) deflections of the deck as vehicles pass over and cause it to deflect as the weight of the live load changes over time. Excessive deflection beyond code specified or other limits can indicate additional deterioration and loss of stiffness.
- **Accelerometers:** Accelerometers placed at various locations along the cantilever as well as joints and piers can record peak amplification due to dynamic impact from trucks as well as the natural frequency of vibration of the structure. Tracking these vibration measurements over time, coupled with dynamic analysis of mode shapes from a computer model, can provide a means of monitoring degradation in the stiffness due to extremely heavy truck loads and other environmental decay due to corrosion, cracking, etc.

Data collected periodically (or continuously) from all three types of sensors can be used to validate a computer model of the structure, which can be used to more accurately predict the effects of critical scenarios and the effectiveness of repair or rehabilitation approaches to various sections of the cantilever structure.

RESTRICTIONS

The Panel recommends NYC DOT immediately begin to enforce existing restrictions on overweight trucks and impose new restrictions on heavy trucks to extend the life of the current structure. This should include installing automated weight sensors linked to police enforcement. To the extent that the imposition of effective enforcement measures requires the assistance and/or cooperation of the State, including potential legislation, the Panel urges all involved to work together to address this issue.

LANE REDUCTION

The Panel recommends an immediate reduction from three to two lanes of traffic in each direction to discourage all vehicles but especially trucks, and to create safer merging and exiting, thereby prolonging the life of the structure and increasing safety. A two-lane roadway in each direction should be the blueprint for future planning.

A well-designed, two-lane highway with ramps can perform better than a poorly built three-lane highway by providing dedicated acceleration/deceleration lanes, minimizing weaving, providing for shoulders, reducing crash rates (especially crippling incidents) and reducing spill-over onto local streets. The three-lane BQE has a capacity of roughly 4,500 vehicles/hour per direction. A well-designed highway lane handles about 2,000 vehicles/hour. Thus, a well-designed, two-lane-per-direction highway can handle about 4,000 vehicles/hour or just 500 vehicles/hour less than the existing BQE.

As documented by NYC DOT, this segment of the BQE

experiences a crash rate well in excess of the New York State average for comparable roadways. When there is a crash, especially with injuries, multiple lanes are often blocked for extended periods of time. Without shoulders, there is no place to move vehicles off to the side. This triggers huge diversions to local streets. To minimize these "worst cases," which occur with frequency, the BQE can almost immediately be made safer with shoulders by simply restriping the roadway. While this means the roadway may have several more hours/day (than today) when demand exceeds capacity, there would be a sharp reduction in "worst-case" events and fewer casualties. ***See Appendix 2 for more information.***

TRANSPORTATION MANAGEMENT PLAN

Transportation Management Plans (TMP) are often part of major road construction jobs. The TMP functions to address planned and unplanned changes in local and regional travel patterns that happen throughout construction – such as roadway, lane and ramp closures, diversion routes and detour routes during construction. This process should begin now in anticipation of the need to plan for mitigating impacts of future construction stages that could change traffic flow on the regional roadways. Areas to be addressed in the TMP include:

- Diversion strategies during construction stages
- Potential regional impacts
- Proposed signage, traveler information dissemination and other mitigation strategies
- Traffic monitoring and incident management plans
- Communication and outreach plans
- Regional construction project coordination
- Agency roles and responsibilities

As the BQE is one of the most congested roads in the New York metropolitan area, it will be crucial to implement creative measures with a high probability of success and a goal of reducing overall congestion both locally and regionally. The TMP will be scaled and specified to every aspect and critical stage of construction.

The TMP would also include a detailed local Maintenance and Protection of Traffic and Pedestrian Plan that would identify traffic measures to protect pedestrians, adequately maintain traffic flow and minimize impacts on the local community. ***See Appendix 2 for more information.***

DEMAND MANAGEMENT

The Panel proposes that the City consider strategies or develop a plan that would achieve zero to low growth on the roadway and use transportation demand strategies to bring volumes down by 15 percent or more – to about 125,000 vehicles/day or less. The Panel recommends the immediate study and implementation, as appropriate, of a series of demand management strategies to reduce overall volumes, extend the life of the highway, facilitate ongoing maintenance work and encourage the use of other modes and routes of transportation. ***See Appendix 2 for more information.***

The suite of approaches should not be thought of as temporary, but instead set the stage for managing future traffic levels on the roadway during the planning of a corridor-wide plan. This suite of strategies will be critical to demonstrate that the future of the corridor can be planned for a lower capacity without negative effects on surrounding communities. These include:

PRICING STRATEGIES:

- Congestion pricing opportunities – Congestion pricing is expected to end bridge shopping by equalizing costs at all facilities. This means fewer vehicles using the three Brooklyn to Manhattan bridges and more traffic at the two tunnels currently tolled.

- Additional pricing strategies to reduce demand – Pricing is one of the most effective tools in achieving desirable traffic patterns. It does however require approvals and possibly legislation from both the City and State. In addition, approval may be required from the federal government for roads that have received funding in the past.

- Split tolling on the Verrazzano Bridge – Returning the Verrazzano to split toll collections will relieve some demand on the BQE's Queens-bound traffic, where today roughly twice as many trucks use the roadway in that direction. The potential impact on Staten Island-bound traffic requires further study.

DIVERSION STRATEGIES:

- Closure and restrictions of ramps and connections to and from the BQE – Closing or at least restricting ramps to and from the BQE, including the Brooklyn Bridge and Atlantic Avenue entrance, Cadman Plaza exit (from the BQE eastbound) and Hicks Street entrance (to the BQE westbound) can reduce traffic volumes on the BQE and should be studied.

- Diversion to and management of Brooklyn Battery Tunnel – While the Brooklyn Battery Tunnel (BBT) is at or close to capacity during peak hours, there are ways to increase person throughput during those hours, utilize some excess capacity on the HOV lane on the Gowanus and increase operational efficiency. During off-peak hours there is available capacity.

- Permit small trucks on Belt Parkway – Allowing small trucks on the Belt Parkway would reduce some truck traffic on the BQE, particularly trucks traveling between the Verrazzano Bridge and John F. Kennedy International Airport.

- Create and support alternatives for local freight – Providing environmentally friendly alternatives to large trucks for the transportation of locally originated or destined freight, including implementing Freight NYC, could help reduce truck volumes on the BQE corridor.

- Diverting some BQE traffic to the Williamsburg Bridge – The Williamsburg Bridge will see a decline in traffic volumes once congestion pricing goes into effect. This is an opportunity to fill some of that additional capacity with traffic from the Manhattan Bridge, lessening demand on the BQE south of the Williamsburg Bridge.

- Promote a regional dispersion of traffic – An aggressive outreach campaign will accelerate and maximize the regional redistribution of traffic, therefore reducing the demand within the BQE corridor.

TRANSIT STRATEGIES

- Transit Improvements to Reduce Demand on the BQE — The BQE Corridor from Red Hook to Long Island City is poorly served for north-south transit directly between Brooklyn and Queens. The upcoming reconstruction of the BQE and the need to reduce traffic demand, in the long run, could give certain projects the impetus needed to make them happen. These include increasing capacity on the G by adding cars and running trains more frequently, completing the BQX and express service on the D, R and F lines.

- New ferry service — A new ferry from the South Shore of Staten Island to Sunset Park, Downtown Brooklyn and Manhattan, as well as pending ferry service from St. George in Staten Island to Brooklyn and west Midtown Manhattan, and increased parking and service at Pier 4 in Sunset Park could divert traffic from the BQE in a "park and ferry ride" program.

- New express bus service from Staten Island to Brooklyn and expanded use of express bus from Staten Island to Manhattan — new and expanded express bus service for both peak and off-peak conditions may divert some auto users from the BQE.

For these demand management strategies, the cooperation of the following entities will be needed: Federal Highway Administration, New York State Legislature, New York State Department of Transportation, Metropolitan Transportation Authority, Congestion Pricing Commission, Traffic Mobility Review Board, Port Authority of New York and New Jersey, Triborough Bridge & Tunnel Authority, New York City Department of Transportation, New York City Economic Development Corporation, New York City Ferry and New Jersey Department of Transportation.

CORRIDOR-WIDE PLANNING - FROM STATEN ISLAND TO QUEENS

A broader vision for the future of the highway is required, which incorporates modern transportation and sustainability goals while balancing the physical needs of a deteriorating highway segment with those of other communities impacted by the roadway. The Panel recommends that planning for a comprehensive long-term solution begin now, considering these factors. A corridor-wide vision should undertake review of the BQE from Staten Island to Queens, including its feeder highways, such as the Gowanus Expressway, Prospect Expressway and the Belt Parkway, and the key bridges and tunnels that are connected to it, namely the Brooklyn and Manhattan Bridges and the Hugh Carey Tunnel.

We have identified some core objectives that should underpin this long-term, corridor-wide vision. These are by no means an exhaustive list, but rather a distillation of the many thoughts we heard from community stakeholders, elected officials and Panelists themselves. Others will necessarily need to be added as other communities and stakeholders join in the planning. We believe that the core objectives of such a plan must include the following transportation goals:

- right-size the road to the traffic and transportation needs of the future and a well-designed two-lane (in each direction) highway.
- build a smart road that embeds technology that eases traffic, communicates in-formation to end users and penalizes those who violate its rules.
- encourage use of mass transportation, through prioritizing public transport use of the new road and creating thoughtful, last-mile planning to the new corridor.
- create alternative transportation opportunities such as new pedestrian access-ways and bikeways that are safe and desirable as both commuting routes and recreational opportunities.
- promote the reconnection of communities that were severed in the original con-struction of the BQE while reinforcing existing neighborhood character.
- minimize local effects from the highway from air pollution and noise.
- create new urban spaces from remnant property and reconnect neighborhoods to the waterfront.
- further the City's green and renewables agenda by reducing or eliminating carbon emissions and building with the greenest materials and technology possible.

The development of a long-term, corridor-wide plan will involve the visions of and cooperation from multiple jurisdictions. New York State, which controls the remaining 18 miles of the BQE, and the federal government will need to be fully engaged, committed partners in this process, as state legislative and executive action will be required. Given the need for multi-jurisdictional cooperation on both a long-term vision and immediate next steps, a joint working group of the three levels of government should be convened to oversee both.

Developing and implementing this corridor vision will also take time — planning and design work, stakeholder outreach and environmental review could potentially take a decade, and construction will take another decade. That is why it is imperative to bring together the stakeholders to begin work on this now, while immediate repairs are being undertaken. There is no time to wait. We urge that planning begin in 2020.

CONCLUSION

In conclusion, the Panel recommends the following three steps:

- An immediate fix for the roadway, prioritizing the safety of the public, should begin now. This is based on the Panel's new, more precise data that suggests sections of the road may become unsafe and incapable of carrying current traffic within five years.
- Actions to reduce traffic volumes and improve reliability - to extend the highway's life, re-duce crashes and begin transitioning users to other routes or modes of transportation - must be undertaken right away.
- Planning for a corridor-wide vision must begin now, incorporating modern transportation and sustainability ideals while balancing the physical needs of a deteriorating roadway, with the goal of a new, comprehensive road connecting Staten Island, Brooklyn and Queens.

ACKNOWLEDGMENTS

- New York City Department of Transportation
- New York City Department of Environmental Protection
- New York City Economic Development Corporation
- New York City Department of City Planning
- New York City Parks Department
- Metropolitan Transportation Authority
- The Port Authority of New York and New Jersey
- Brooklyn Bridge Park
- Sam Schwartz Engineering
- New York Building Congress

Thank you to all of the offices of elected officials and organizations that worked with the Panel.

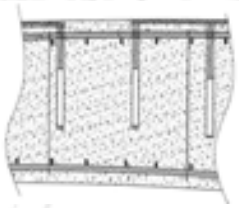

INTERSTATE
278
Bklyn-Qns Expy
Cadman Plaza W
RIGHT LANE EXIT ONLY
DANGER

APPENDIX 1:

POTENTIAL OPTIONS TO MAINTAIN OR REPLACE THE STRUCTURE

NYC DOT and its consultants developed a series of potential rehabilitation and replacement options. The Panel reviewed these options and they are presented in more detail below. The descriptions of the respective options and their attributes are provided by NYC DOT. This chart was a submission to the Panel for its use. The BQE Expert Panel does not endorse either the options or their descriptions.

OPTION M1 - URGENT REPAIRS. Based on current conditions along the BQE, NYC DOT will address the areas of concern through a coordinated repair plan.

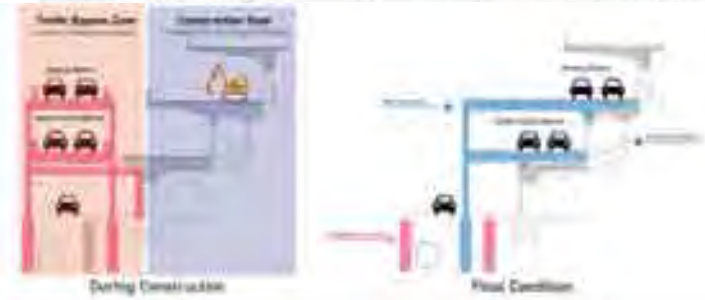


OPTION M2 - CATHODIC PROTECTION. Passive cathodic protection involves installing sacrificial pieces of metal into the structure so that those pieces corrode instead of the supporting rebar.

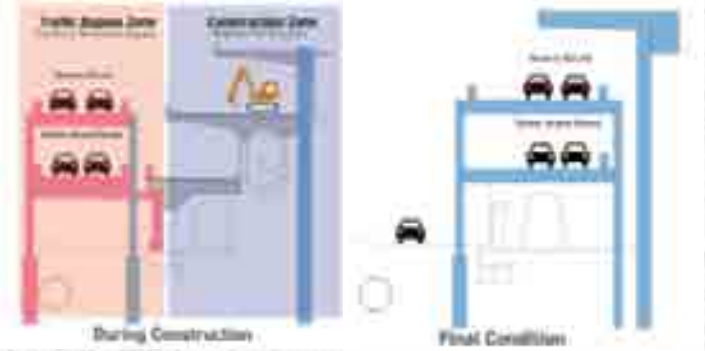
OPTION M3 - PARTIAL DEPTH DECK REPLACEMENT. This method involves replacing deteriorating sections of the deck of the structure.

OPTION M4 - COMPLETE DECK REPLACEMENT. In this method, the deck of the structure is completely replaced, leaving only the original foundations and retaining walls. The work could be accomplished either by building a temporary bypass structure over Furman Street or by creating a series of on-street detours through downtown Brooklyn.

OPTION R1 - PARTIAL STRUCTURE REPLACEMENT. In this method, construction occurs in phases so that lanes can be shifted to a two-level temporary roadway over Furman Street.



OPTION R2 – COMPLETE REPLACEMENT WITH TEMPORARY BYPASS. This method is very similar to the partial structure replacement method. The major difference is that, instead of using the existing retaining wall, this potential option completely separates the BQE structure on a foundation that is distinct from a new retaining wall that holds up the promenade and Brooklyn Heights.



COMPARISON OF POTENTIAL OPTIONS

All numbers are rough order of magnitude estimates subject to modification and further study.

MAINTENANCE OPTIONS TO MAINTAIN CANTILEVER

	Existing Structure	(M1) Urgent Repairs	(M2) Preservation Options (passive cathodic protection)
Construction Duration	n/a	4-8 yrs	5-6 yrs
Construction Cost	n/a	$0.6B - $0.8B	$0.8B - $1.0B
Service Life	< 10 yrs	10 yrs	20 yrs
Lifecycle Cost (50 Year)	n/a	$3.3 - $4.4 B	$3.0 - $4.0 B
Risk of Unanticipated Deterioration	High	High	High
Neighborhood/Driver Impacts during Routine Maintenance	High	High	High
Permanent Conditions			
Cantilever?	Yes	Yes	Yes
Furman Street Condition	2-lane road	2-lane road	2-lane road
Construction Impacts			
Construction Method/Staging	n/a	- Multiple closures of a week or longer could achieve shorter construction duration - Otherwise: 20 to 30 full weekend closures; substantial overnight closures for up to 8 years; and roadway, parking, and open space impacts from daytime equipment storage	- 20 to 30 full weekend closures (late Fri night to early Mon morning) - Approx 200 overnight closures per year for 5-6 yrs - Roadway, parking, and open space impacts from daytime equipment storage
Structural Improvements			
Atlantic Avenue Interchange	None	Limited improvements	Limited improvements
Direct Bridge Connections	None	Manhattan Bridge only	Manhattan Bridge only
Improved Vertical Clearances	✗	✗	✗
Rated to Carry Trucks > 80,000 lbs.	✗	✗	✗
Community Improvements			
Vibration mitigation	✗	✗	✗
Direct Connection to Brooklyn Bridge Park	✗	✗	✗
Open Space Improvements	None	None	Could incorporate small-scale open space improvements

**Construction staging timeframes for options R1 and R2 may be shortened based on construction method north of Columbia Heights bridge.*
Note: All potential options exclude costs for East River Bridge connections and Atlantic Avenue interchange; all potential options require the complete replacement of three bridges: Joralemon, Old Fulton/Cadman Plaza, and Columbia Heights; all potential options require promenade closure in sections while maintaining portions open to the public; and none of the potential options require a temporary roadway in Brooklyn Bridge Park.

MAINTENANCE OPTIONS TO MAINTAIN CANTILEVER

REPLACEMENT OPTIONS THAT FRAME STRUCTURE

	(M3) Partial Depth Deck Replacement	(M4) Complete Deck Replacement	(R1) Partial Structure Replacement w/ Bypass	(R2) Complete Replacement with Incremental
Construction Duration	7-8 yrs	5-6 yrs	8-10 yrs	8-10 yrs
Construction Cost	$1.1B - $1.3B	$1.8B - $2.1B	$2.7B - $3.2B	$3.2B - $3.7B
Service Life	10-15 yrs	40 yrs	40 yrs	100 yrs
Lifecycle Cost (50 Year)	$3.1 - $3.9 B	$3.4 - $4.9 B	$2.0 - $2.3 B	$2.5 - $2.8 B
Risk of Unanticipated Deterioration	High	High	Medium	Low
Neighborhood/Driver Impacts during Routine Maintenance	High	High	Medium	Medium
Permanent Conditions				
Cantilever?	Yes	Yes	No	No
Furman Street Condition	2-lane road	2-lane road	1-lane road	1-lane road
Construction Impacts				
Construction Method/Staging	- 20 to 30 full weekend closures (late Fri night to early Mon morning) - Approx 200 overnight closures per year for 7-8 yrs - Roadway, parking, and open space impacts from daytime equipment storage	- 20 to 30 full weekend closures (late Fri night to early Mon morning) - Approx 200 overnight closures per year until bypass built (2-3 years) - Roadway, parking, and open space impacts from daytime equipment storage until bypass built (2-3 years)	- 20 to 30 full weekend closures (late Fri night to early Mon morning)* - Approx 200 overnight closures per year for 1-2 yrs - Roadway, parking, and open space impacts from daytime equipment storage until bypass built (1-2 years)	- 20 to 30 full weekend closures (late Fri night to early Mon morning)* - Approx 200 overnight closures per year for 2-3 yrs - Roadway, parking, and open space impacts from daytime equipment storage until bypass built (2-3 years)
Structural Improvements				
Atlantic Avenue Interchange	Limited improvements	Limited improvements	Full reconfiguration possible, at added cost, if additional sections are replaced	Full reconfiguration
Direct Bridge Connections	Manhattan Bridge only	Manhattan Bridge only	Manhattan Bridge, Brooklyn Bridge (assuming replacement	Manhattan Bridge, Brooklyn Bridge
Improved Vertical Clearances	✗	✗	✗	✓
Rated to Carry Trucks > 80,000 lbs.	✗	✓	✓	✓
Community Improvements				
Vibration mitigation	✗	✗	Limited, due to framed structure	✓
Direct Connection to Brooklyn Bridge Park	✗	Difficult	✓	✓
Open Space Improvements	Could incorporate small-scale open space improvements	Could incorporate small-scale open space improvements	Could incorporate small-scale open space improvements	Improved Van Voorhees circulation, improvements to Cadman Plaza, Sands Street area

APPENDIX 2:

A REPORT TO THE BQE EXPERT PANEL ON TRAFFIC MEASURES TO REDUCE DEMAND; BY SAM SCHWARTZ

This report was prepared by Sam Schwartz Transportation Consultants (Sam Schwartz) on behalf of the BQE Expert Panel. This document reflects the panel's request for a traffic engineering assessment of the BQE study area from Atlantic Avenue to Sands Street. Specifically, the panel asked Sam Schwartz to develop traffic volume reduction measures on the BQE. Some of the measures included in this report were proposed by Sam Schwartz, others were jointly suggested with the panel, while some were reviewed solely at the Panel's request. Many, but not all, are consistent with NYC DOT's traffic demand strategies. This report was a submission to the panel for its use, and the measures discussed are not endorsed by Sam Schwartz or the Panel.

THE BQE TRIPLE CANTILEVER

A Report to the BQE Expert Panel on Traffic Measures to Reduce Demand

January 16, 2019

Sam Schwartz

Preface

This report was prepared by Sam Schwartz Transportation Consultants (*Sam Schwartz*) on behalf of the BQE Expert Panel. This document reflects the panel's request for a traffic engineering assessment of the BQE study area from Atlantic Avenue to Sands Street. Specifically, the panel asked *Sam Schwartz* to develop traffic volume reduction measures on the BQE. Some of the measures included in this report were proposed by *Sam Schwartz*, others were jointly suggested with the panel, while some were reviewed solely at the Panel's request. Many, but not all, are consistent with NYC DOT's traffic demand strategies. This report is a submission to the panel for its use. Not all the measures discussed are endorsed by *Sam Schwartz*. Nonetheless, this report offers a wide menu of options which can significantly reduce the "pain" during reconstruction of the BQE.

Sam Schwartz also notes that this report was largely done over a three-week period. It has multiple authors and has not been fully integrated as a single document. For that reason, there may be some redundancy and inconsistent descriptions of conditions, actions, and measures. It should also be noted that many of the topics have not received full study and analysis, as likely to be required for an EIS or a submission to the state and federal departments of transportation.

This report does not review construction techniques or final design with one exception: planning for a four-lane highway vs. the current six-lane highway would not only make the task of rebuilding the BQE triple cantilever (BQE 3X) easier but could also handle most of the traffic and do it more safely. Many of the strategies presented herein would be of value for both construction and the final configuration.

This report offers recommendations that go far beyond the jurisdiction of NYC DOT. It is clear that to "do this right" will require full participation by the MTA including NYC Transit and TBTA, NYS DOT, Brooklyn Bridge Park, NYPD, US DOT and others. A robust community, stakeholder, and political engagement process is warranted.

Lastly, the reconstruction of the BQE 3X is so complicated and costly, and its planning reveals so many weaknesses in Brooklyn's transportation systems – from lack of expressways to poor north-south transit and nonsensical pricing strategies – that such a herculean effort should not be squandered by narrowly focusing on the highway. Carpe Diem - fix the system!

Contents

The Central Issue: The Number of Lanes Needed During and After Reconstruction

A fundamental question with the rebuilding of the BQE triple-cantilever (BQE 3X) is, "does the future BQE need to handle more traffic?" Traditionally highway engineers routinely added capacity as roadways were rebuilt. However, today many planners and even traffic engineers are challenging that approach. They point to examples and studies that show 'if you build it (more capacity) they (the cars) will come.' This principle, *induced demand* by capacity expansion, has been borne out in academic studies as well as in highway capacity projects that failed to relieve congestion.

Law of Induced Demand

In 1962, transportation researcher and economist Anthony Downs posited a fundamental law of highway congestion: On urban commuter expressways, peak-hour traffic congestion rises to meet maximum capacity. This is also referred to as *induced demand*. Researchers have confirmed that building more roads generates more traffic.

Giles Duranton and Matthew Turner published a study around 2010 examining data from roads across the US from 1983 to 2003. They concluded building new roads does not reduce congestion as total miles driven rises proportionately with the miles of traffic lanes added. Furthermore, they found that widening highways does not alleviate congestion on nearby local roads. The 'Poster Child' for induced traffic is the Katy Freeway in Houston; it was widened to 26 lanes in segments, yet traffic congestion worsened.

Nonetheless, many highway engineers across the country justify building more capacity by using a simple formula: whatever the traffic volume is today, add an annual growth factor –usually 1% to 3% over a 30-year period. A 1% growth rate would increase traffic by 35%; with a 3% growth rate traffic would jump by 143%. This has led to US DOT and others making future traffic volume estimates that have been wildly out of whack with reality (see Figure1).

In the case of the BQE, using a daily volume of 150,000 vehicles and a growth rate of 1% would yield a 2050 volume of 202,500, or 52,500 more than today. Even using a 0.5% growth rate would result in a 16% increase in traffic, or 24,000 more vehicles, for a total of 174,000 vehicles/day.

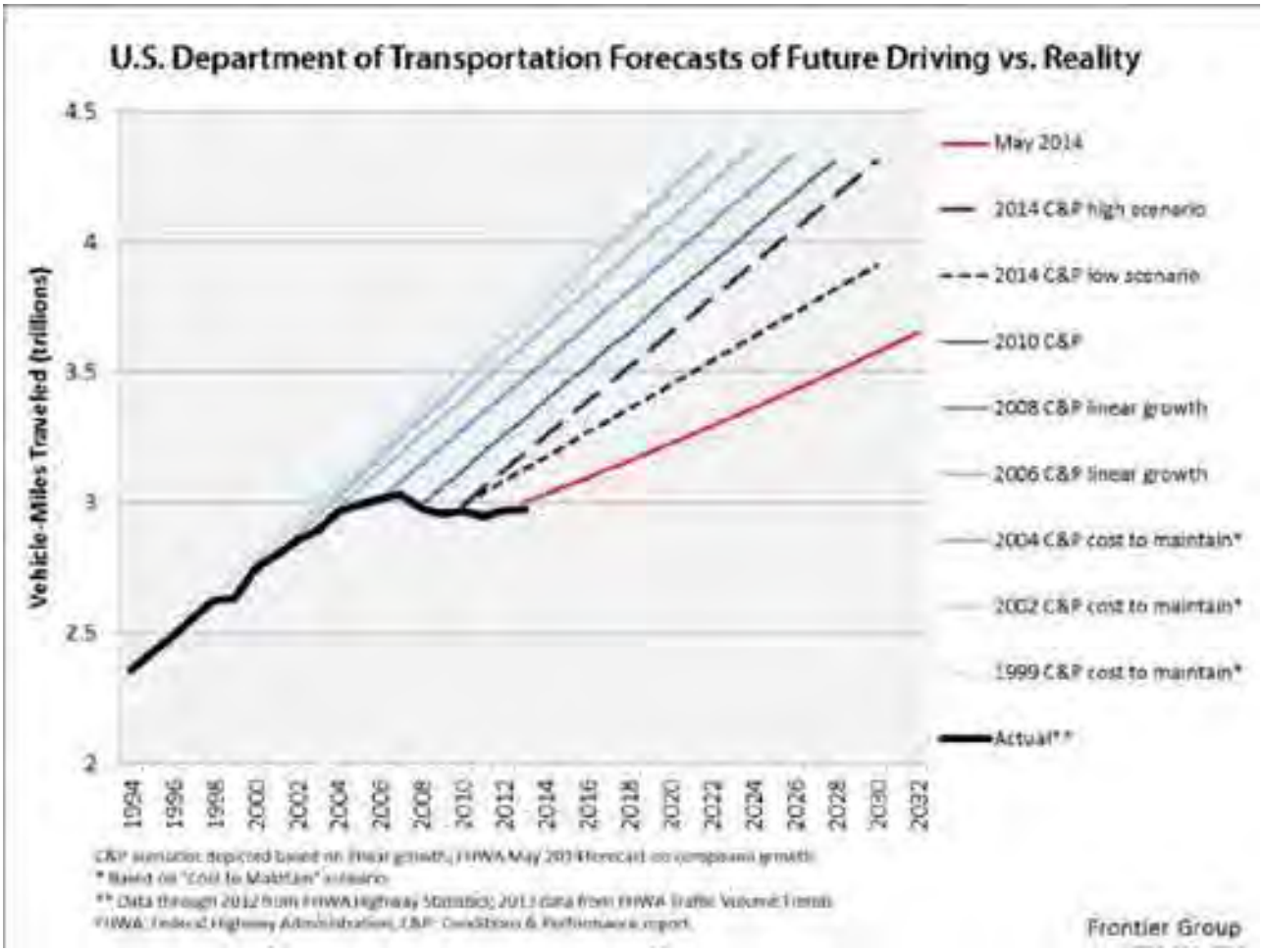


Figure 1 Despite evidence that traffic growth has slowed US DOT routinely overestimates growth rates

It is proposed in this document to start with a zero-growth rate and use transportation demand strategies to bring volumes down by 15% or more – to about 125,000 vehicles/day or less. The NYS DOT and US DOT may push back and insist on a positive growth rate. NYC DOT should remain firm in demanding that NYS and US DOTs review the latest in traffic science and consider the many measures proposed in this report to reduce demand. It wouldn't be alone. In 2014, the State of Washington DOT set a negative growth rate for future estimates (Figure 2).

In the past, NYC & NYS DOTs have shown fortitude, insisting on no growth as it applied for federal funds for the Williamsburg Bridge rehabilitation in 1988. Both state and city DOTs also agreed, after legal battles, to drop plans for Westway – a limited access highway on the West Side of Manhattan from 42nd Street to the Battery Tunnel. Instead, with federal support, a much lower capacity at-grade boulevard was built.

Figure 2 The State of Washington DOT in 2014 started using a negative growth rate

The Corollary – Reducing Capacity Lessens Demand

The corollary to induced demand has been demonstrated as well. As capacity is reduced, traffic volumes overall decline. Perhaps the earliest demonstration of this, the collapse of the West Side Highway in 1973, showed that the loss of a major highway shifted travel patterns so that two years later, while more people entered Manhattan's CBD, they traveled in far fewer vehicles.

Figure 3 West Side Highway 1973 vs. 1975

After West Side Highway collapsed drivers adjusted to changes in the roadway network, some stayed, some detoured, some diverted to transit…some disappeared

This has been demonstrated similarly in San Francisco in 1989, after the 6.9 Loma Prieta earthquake destroyed the Embarcadero Freeway. Officials decided not to rebuild the highway and simply provide an at-grade roadway. A quarter century later, the Embarcadero area, as well as all of San Francisco, is thriving; it is doubtful any official would ever suggest rebuilding it.

An excellent example of this phenomena is the success NYC DOT has been having with reducing traffic demand to and from Manhattan's Central Business District (CBD) over the past 15 years. Numerous car lanes have been removed and converted into bike and bus lanes and wider sidewalks. In addition, Broadway was closed at Times Square and Herald Square and all traffic lanes in Central Park were eliminated. In 2006 the total daily traffic volume to and from the CBD was 1.6 million; by 2016 it had dropped by 200,000 to 1.4 million or by 100,000 vehicles each way. The main reason traffic flow worsened during that period is because of the advent of app-based car services (Uber, Lyft, Via etc.) and growth in micro-deliveries.

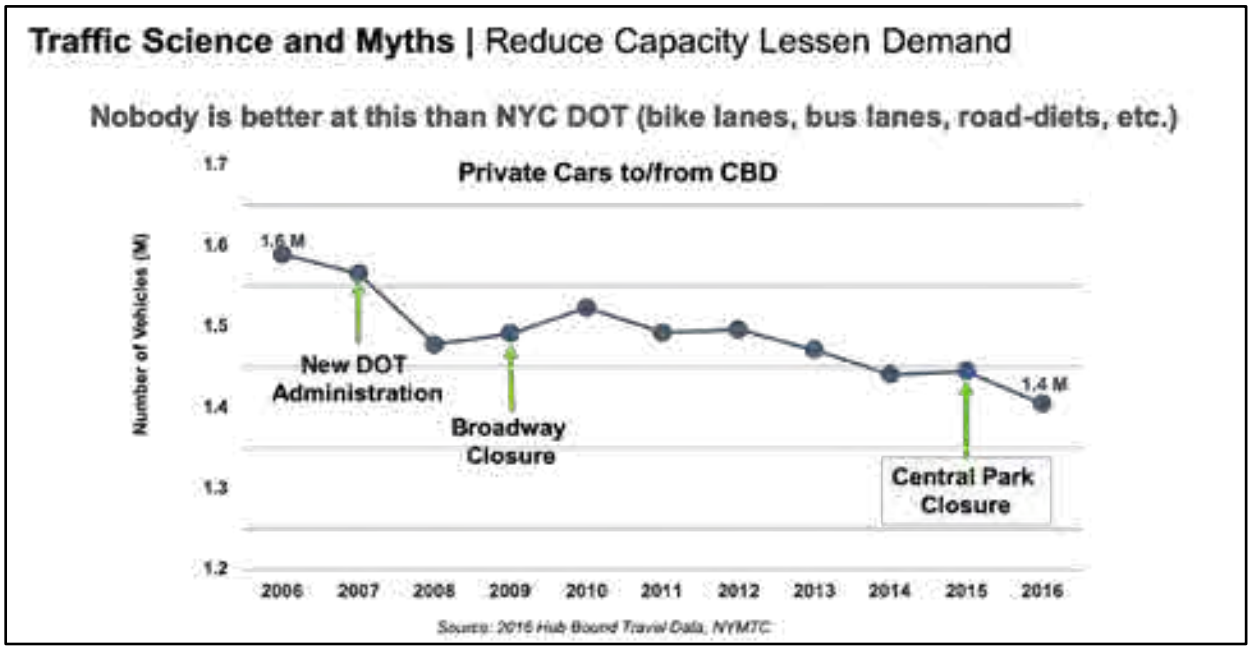


Figure 4 Daily traffic volumes to/from Manhattan's CBD

Daily traffic volumes to/from Manhattan's CBD have dropped by 200,000 since 2006 as NYC DOT reduced car lanes

A Well-Designed Two-Lane BQE Can Work

Why a Two-Lane (each way) Well-Designed BQE Can Operate Better than the Existing Poorly-Designed Three-Lane BQE

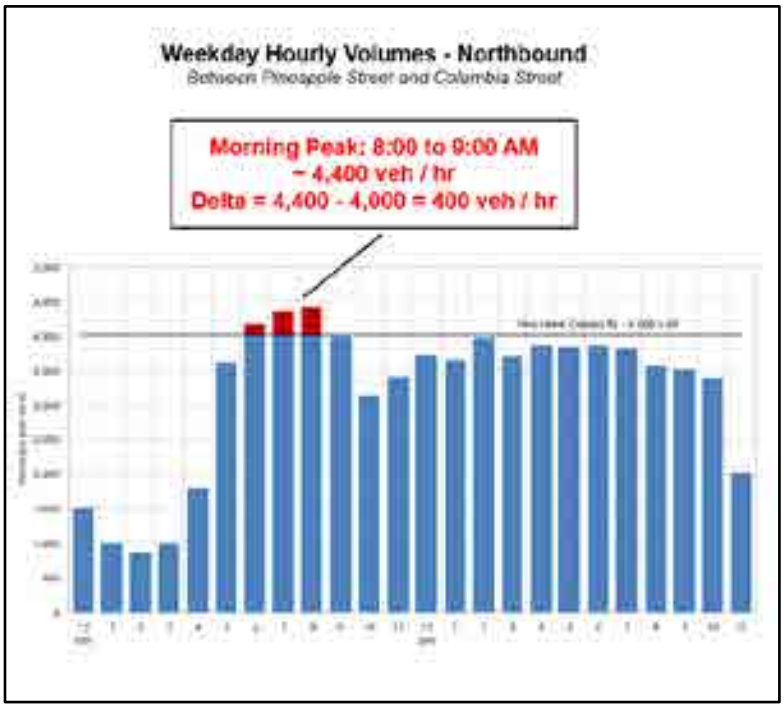
The three-lane in each direction BQE has a capacity of roughly 4,500 vehicles/hour per direction. This is very poor performance for a three-lane limited access highway. The lack of shoulders, poor sight distances, "STOP"-sign control at highway entrance points, and insufficient acceleration and deceleration lanes sharply reduce capacity. A well-designed highway lane

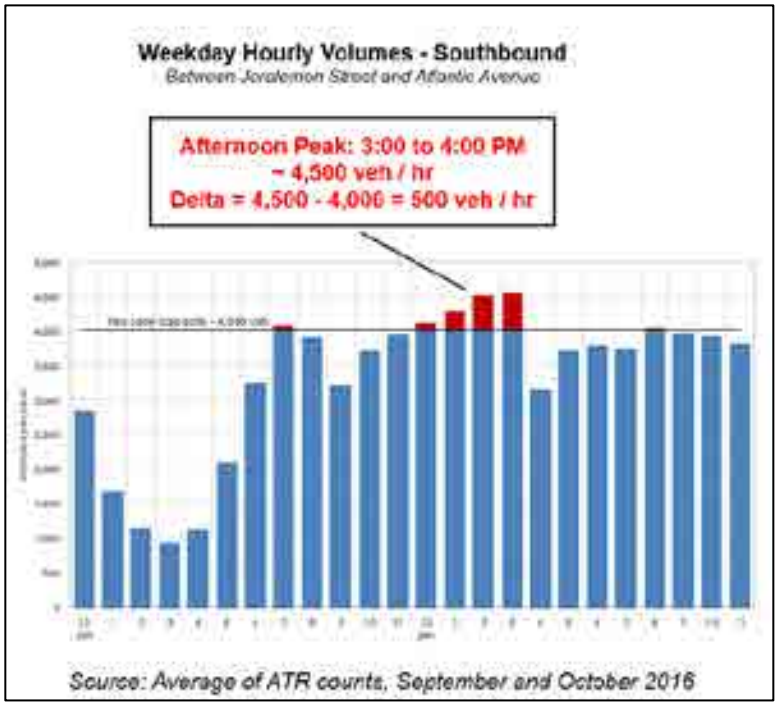
handles about 2,000 vehicles/hour. Had the three-lane BQE been well-designed with shoulders (to handle disabled vehicles) and good acceleration and deceleration lanes, it would have a capacity of roughly 6,000 vehicles/hour per direction. So, a well-designed two-lane per direction highway can handle about 4,000 vehicles/hour or just 500 vehicles/hour less than the existing BQE.

As documented by NYC DOT, this segment of the BQE experiences a crash rate well in excess of the New York State average for comparable roadways. Many times, when there is a crash, especially with injuries, multiple lanes are blocked for extended periods of time. Without shoulders, there is no place to move vehicles off to the side. This triggers huge diversions to local streets. To minimize these “worst cases,” which occur with frequency, the BQE almost overnight can be made safer with shoulders by simply restriping the roadway (see Figure 7). While this means the roadway may have several more hours/day (than today) when demand exceeds capacity there would be a sharp reduction in “worst case” events (and fewer casualties).

Hourly traffic volumes by direction for a typical weekday on the BQE are presented in Figure 5 and Figure 6. As shown on the figures, for a majority of the day traffic volumes on the BQE are less than the capacity for a well-designed two-lane highway (approximately 4,000 per hour).

In the next section we discuss ways to reduce demand sufficiently to at least match today’s demand-capacity ratio.





Figures 5, 6 Hourly Traffic Volumes on the BQE by direction. The bars shown in red indicate those times and volumes when the traffic demand on the BQE exceeds a well-designed two-lane highway capacity. This occurs for three hours in the morning and about four hours in the evening

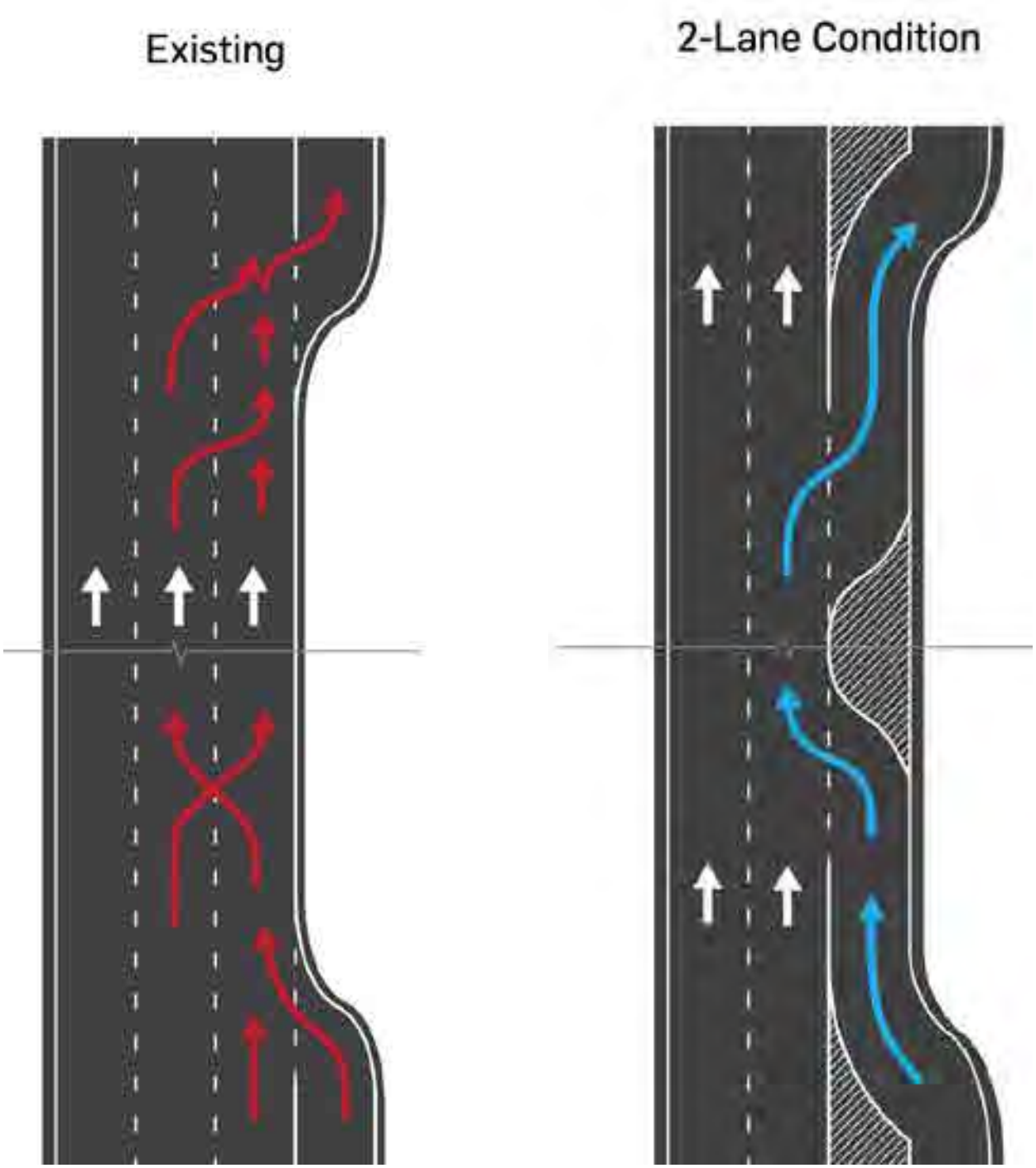


Figure 7 A 3-lane highway vs. 2-lane highway w/ shoulders and improved ramps

A well-designed 2-lane highway w/ ramps can perform better than a poorly built 3-lane highway by providing dedicated acceleration/deceleration lanes, minimizing weaving, providing for shoulders thereby reducing crash rates, especially crippling incidents thus reducing spill-over onto local streets. See Appendix for a conceptual layout for the BQE in the study area.

A Review of Traffic Trends for Bridges in Brooklyn Supports Zero Growth

In further support of the premise to start with a zero-growth rate, a study of traffic volumes over the past decade, from NYC DOT's Bridge Volume Report, reveals little growth. We looked at three major indicators of BQE trends – the East River crossings from Brooklyn to Manhattan; traffic volumes between Brooklyn and Queens; and traffic volumes between Staten Island and Brooklyn.

Daily Traffic volumes across the four crossings from Brooklyn to Manhattan, (the BBT, Brooklyn, Manhattan, and Williamsburg bridges) have declined over the past decade from 370,000 to 352,000, a decrease of 4.6 percent.

Traffic volumes on the Kosciuszko Bridge (the BQE between Brooklyn and Queens) dropped by 23,000, going from 186,000 to 163,000. Given that the "Koz" has been under construction for several years, a review of volumes on the nearby bridges likely to pick up diverting traffic (Pulaski, Greenpoint and Metropolitan) showed an increase of just 7,000 vehicles, for an overall loss 16,000 vehicles. Not only was there no growth – a significant amount of traffic disappeared.

Volumes on the Verrazzano Bridge barely budged in 10 years going from 201,000 to 203,000.

In conclusion, based on this discussion and history of traffic volumes in this corridor a two-lane roadway in each direction should be the blueprint for future planning. A conceptual layout for the BQE within the study area is shown in the Appendix. In the next section we discuss ways to reduce traffic demand in the BQE 3X corridor.

Table 1 Summary of Bridge Volume Data

	Bridge	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Bridges between Brooklyn and Queens	**Pulaski Bridge**										
	Daily volume	37,221	37,019	36,103	36,981	37,422	36,867	39,076	40,405	40,485	40,722
	% change from previous year		-0.5%	-2.5%	2.4%	1.2%	-1.5%	6.0%	3.4%	0.2%	0.6%
	Greenpoint Avenue Bridge										
	Daily volume	27,027	26,926	26,637	26,716	25,709	26,379	25,701	27,836	28,361	31,622
	% change from previous year		-0.4%	-1.1%	0.3%	-3.8%	2.6%	-2.6%	8.3%	1.9%	11.5%
	Kosciuszko Bridge								(1)	(1)	(1)
	Daily volume	186,493	181,783	188,322	190,753	191,624	196,217	191,225	184,025	179,137	162,581
	% change from previous year		-2.5%	3.6%	1.3%	0.5%	2.4%	-2.5%	-3.8%	-2.7%	-9.2%
	Metropolitan Avenue Bridge										
	Daily volume	37,332	38,587	37,557	38,279	38,613	38,262	37,437	39,620	38,191	35,687
	% change from previous year		3.4%	-2.7%	1.9%	0.9%	-0.9%	-2.2%	5.8%	-3.6%	-6.6%
	Total Brooklyn-Queens Bridges										
	Daily volume	288,073	284,315	288,619	292,729	293,368	297,725	293,439	291,886	286,174	270,612
	% change from previous year		-1.3%	1.5%	1.4%	0.2%	1.5%	-1.4%	-0.5%	-2.0%	-5.4%
Crossings between Brooklyn and Manhattan	**Williamsburg Bridge**										
	Daily volume	110,412	106,647	108,077	111,189	103,590	112,696	115,618	111,575	105,154	105,590
	% change from previous year		-3.4%	1.3%	2.9%	-6.8%	8.8%	2.6%	-3.5%	-5.8%	0.4%
	Manhattan Bridge										
	Daily volume	73,139	70,276	71,872	74,777	85,392	89,087	87,375	84,048	87,046	85,084
	% change from previous year		-3.9%	2.3%	4.0%	14.2%	4.3%	-1.9%	-3.8%	3.6%	-2.3%
	Brooklyn Bridge										
	Daily volume	131,551	123,781	125,021	123,640	105,820	100,288	102,542	99,986	102,219	105,679
	% change from previous year		-5.9%	1.0%	-1.1%	-14.4%	-5.2%	2.2%	-2.5%	2.2%	3.4%
	Brooklyn-Battery Tunnel										
	Daily volume	54,989	43,010	50,440	54,097	49,967	53,067	53,389	53,532	55,734	56,545
	% change from previous year		-21.8%	17.3%	7.3%	-7.6%	6.2%	0.6%	0.3%	4.1%	1.5%
	Total Brooklyn-Manhattan Crossings										
	Daily volume	370,091	343,714	355,410	363,703	344,769	355,138	358,924	349,141	350,153	352,898
	% change from previous year		-7.1%	3.4%	2.3%	-5.2%	3.0%	1.1%	-2.7%	0.3%	0.8%
VNB	**Verrazano-Narrows Bridge**										
	Daily volume	201,116	203,507	202,052	204,181	194,758	193,100	192,033	187,438	198,123	202,523
	% change from previous year		1.2%	-0.7%	1.1%	-4.6%	-0.9%	-0.6%	-2.4%	5.7%	2.2%

(1) Note: Construction on the new Kosciuszko Bridge began in 2014 and was fully reopened to traffic in both directions in April 2017.

Traffic volumes at bridges near the BQE have shown little growth and some declines in volume.
Source: Annual New York City Bridge Volume Report

Reducing Demand on the BQE within the Study Area

Congestion Pricing

Congestion Pricing will Provide Relief to the BQE in the Study Area as well as Downtown Brooklyn

New York State passed congestion pricing legislation on April 1, 2019. The plan is scheduled to go into effect in early 2021, certainly before any rehabilitation work begins on the BQE. All vehicles will be subjected to a charge as they travel within the CBD. There are a few exceptions in the law: drivers using the exterior highways – the FDR and West Side Highway – and not exiting into the CBD will not be charged. There are also exemptions for vehicles transporting people with disabilities and low-income drivers. Many groups and elected officials are pressing for additional exemptions. Despite whatever exemptions are ultimately granted, the revenue target remains the same – an annual stream sufficient to generate $15 Billion in bonds which translates into about $1 Billion annually. The rates for drivers have yet to be established; details of the program will be recommended to the MTA by a six-person Traffic Mobility Panel to be appointed by the city and state. Final specifics are expected to be set by the end of 2020.

- FHV charge began Feb. 2019 South of 96th
  - $2.75 Uber/Lyft | $2.50 Taxi | 75¢ Shared Rides
- Traffic Mobility Act – Passed 4/1/19
  - CP all vehicles So. of 60th
  - Revenue goal = $15B bonds
    - 80% Subways & Buses
    - 20% Railroads
- Fee to be recommended by a city/state Traffic Mobility Board
- Traffic Mobility Board recommendations due Nov. 2020 (after elections)
- Exemptions:
  - FDR Drive & Westside Highway thru trips
  - Vehicles transporting disabled
  - CBD residents income < $60K
- Earliest date Jan. 2021

Figure 8 Congestion Pricing Overview

The imposition of congestion pricing will have a dramatic effect on traffic patterns in Downtown Brooklyn and at the East River crossings. Today, tens of thousands of drivers avoid the tolled crossings to use the untolled crossings (often mislabeled as 'free'). Round trip for cars, even with E-ZPass at the Brooklyn Battery Tunnel (BBT) and Queens Midtown Tunnel (QMT), is $12.24 (toll is $19 for cars without E-ZPass). For regular commuters the annual cost approaches $3,000. Consequently, many drivers "shop" for the cheapest crossing. This is manifested on the BQE as drivers avoid the BBT and opt for the Brooklyn Bridge (cars only) and the Manhattan Bridge (all vehicles). Congestion pricing is expected to end bridge shopping by equalizing costs at all facilities. This means fewer vehicles using the three Brooklyn to Manhattan bridges and more traffic at the two tunnels currently tolled. The BQE will not be the only arterial to see some relief. Flatbush Avenue, Adams Street, Tillary Street and other streets used to avoid tolls will also see decreases in traffic volumes.

Sam Schwartz conducted a study to assess the change in traffic volumes within the study area. A congestion pricing rate identical to the current toll rate at the BBT and QMT was assumed. The Balanced Transportation Analyzer (BTA), used by the State in recent congestion pricing panels, was used as the basis for volume changes to/from the Central Business District. In addition, elasticity factors (how drivers respond to change in toll rates) were obtained from an April 2019 study by the MTA's Triborough Bridge and Tunnel Authority[1]. Origin and destination data were provided by NYC DOT. The basic findings indicated an approximately 7% to 14% reduction in traffic volumes during peak hours on the BQE between the BBT and the Manhattan Bridge.

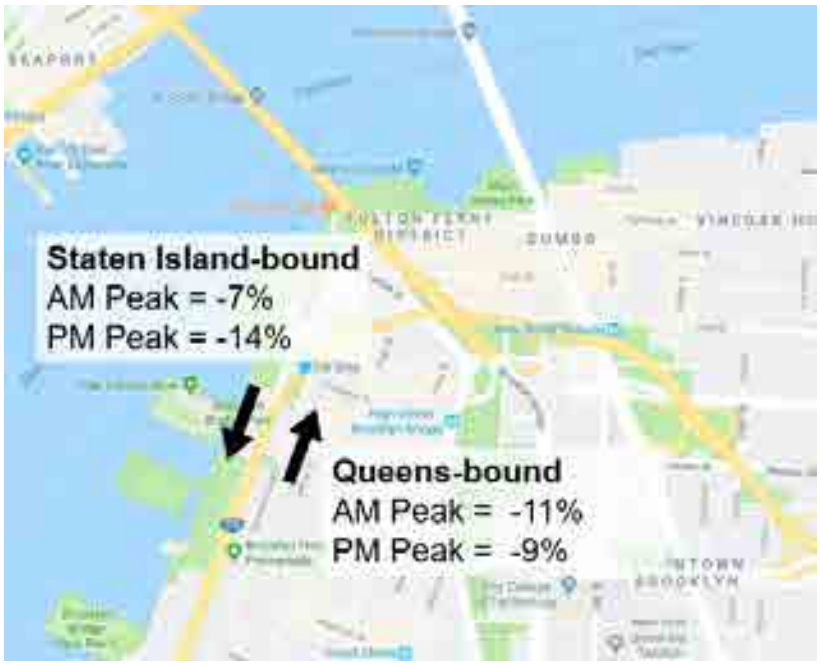


Figure 9 Estimated Vehicle Reduction on the BQE Triple Cantilever due to Congestion Pricing

[1] Stantec, "History and Projection of Traffic, Toll Revenues and Expenses and Review of Physical Conditions of the Facilities of the Triborough Bridge and Tunnel Authority," Triborough Bridge and Tunnel Authority, April 30, 2019.

Other Pricing Strategies to Reduce Demand

Pricing is one of the most effective tools in achieving desirable traffic patterns. It does however require approvals and possibly legislation from both the city and state. In addition, approval may be required from the federal government for roads that have received funding in the past.

Create a pricing differential between the BBT and the Manhattan and Brooklyn bridges. The Manhattan and Brooklyn bridges can be priced at a higher rate than the toll at the BBT. This could be done on a temporal basis reflecting times when such diversion is most needed. Trucks could face an even greater difference encouraging more trucks, within the clearance limit of 12-feet, to take the tunnel. At critical periods during construction the BBT could be made "free." The issue of bond covenants has been raised. There are several precedents at TBTA facilities whereby discounts are given, and the state makes up the difference.

Make the BQE, within the study area, HOT. At a number of freeways around the country, highway lanes are dedicated to high occupancy vehicles (usually two or more) and driver-only cars that pay a toll. These High Occupancy Toll (HOT) lanes often are priced based on real-time traffic conditions. The BQE in the study area could be reserved for only cars with two or more occupants. Driver-only vehicles would be allowed but must pay a toll. The toll could be a variable based on real-time conditions or based on construction phases. A variation would be to just make the ramps to the Brooklyn and Manhattan bridges "HOT."

Return the Verrazzano-Narrows Bridge to two-way toll collections. In the late 1980's, over the objections of NYC DOT, the Verrazzano-Narrows Bridge toll plaza was converted to one-way operation so that only Staten Island-bound drivers were tolled. Going into Brooklyn from Staten Island was made free. This was done as an Act of Congress orchestrated by a Staten Island representative. The Staten Island-bound tolls are double that of any other of the TBTA's major crossings. Consequently, more drivers go into Brooklyn than into Staten Island. About 9,000 vehicles detour daily because of this pricing scheme. About 9,000 vehicles divert daily because of this pricing scheme. Returning the Verrazzano to two-way toll collections would relieve some demand on the Queens-bound BQE. It's unclear what the impact would be Staten Island-bound. More study would be needed to assess the overall impact. In December 2019, the House of Representatives approved a $1.4 trillion spending package for Fiscal Year 2020 that includes a repeal of the one-way tolls on the Verrazzano-Narrows Bridge. The package was submitted to the Senate for review in late December.

Table 2 Verrazzano-Narrows Bridge, Average 24-Hour Traffic Volumes (2014-2016)

	Eastbound (EB) (Towards Brooklyn)	Westbound (WB) (Towards Staten Island)	Difference (EB vs. WB)
Verrazzano Narrows Bridge	102,523	93,505	9,017

About 9,000 fewer vehicles use the bridge to Staten Island vs. Brooklyn most likely because of the high tolls to the island but free to Brooklyn.

Source: New York City Bridge Traffic Volumes, NYCDOT, 2014-2016

Additional Strategies to Reduce Demand on the BQE

In addition to pricing strategies there are a number of other measures that can reduce traffic volumes on the BQE. They include closing or restricting ramps to and from the BQE, making the East River crossings to the north and south of the area, the Williamsburg Bridge and Battery Tunnel, more attractive than taking the BQE, transit measures to attract vehicle riders, and some regional highway modifications.

Closing or Restricting Ramps to and from the BQE

Closing the ramp to the Brooklyn Bridge or making it HOV Only

In the eastbound (Queens bound) direction almost a third of the BQE car traffic exits to the Brooklyn Bridge. Closing that ramp would immediately reduce demand on the BQE significantly as drivers would find alternate ways to get into Manhattan by using the Battery Tunnel, the Manhattan Bridge, local streets or avoid the area altogether (disappear). An alternative is to make the ramp HOV 2 (2 or more occupants) which would reduce the number of cars using the ramp by 30-40%. A concern is that this will favor TNCs (Ubers, Lyfts etc.) with one passenger over driver-only cars adding more traffic in general. Studies have shown that TNCs drive about 1.6 miles to move a passenger one mile. Nonetheless an HOV strategy from the Brooklyn Bridge ramp would reduce traffic on the BQE significantly. [An alternative, discussed in the previous section, is to make the ramp a HOT (High Occupancy Toll) lane].

In the westbound (SI Bound) direction far less is gained by closing the Brooklyn Bridge ramp or making it HOV 2. This is because the ramp is close to the northern terminus of the study area, so current Brooklyn Bridge traffic only travels a short stretch of the BQE to be rehabilitated. In addition, the ramp from the BQE westbound doesn't connect directly to the bridge requiring traffic to use local streets. It may be desirable to keep local access to the bridge open.

Closing the Atlantic Avenue entrance to the BQE

The Atlantic Avenue entrance to the BQE eastbound is one of the worst designed ramps in New York City. Cars and trucks turn from Atlantic Avenue onto a steep rising grade and then encounter a stop sign before merging onto the highway. This poor configuration has made this a high crash location. Despite that, approximately 700 to 800 vehicles used the ramp during the AM peak hour and about 500 during the PM peak hour. Closing the ramp would not only reduce the traffic volume on the BQE significantly but improve the capacity of the roadway by eliminating the poorly designed merge. The diverted vehicles would most likely use local streets as the main diversion followed by the Brooklyn Battery Tunnel. Closing the Atlantic Avenue ramp to the BQE westbound will not reduce traffic flow on the BQE within the study area. However, it too is a high crash location and there may be some very local community benefits in closing this ramp.

Closing the Cadman Plaza exit from the BQE eastbound

This exit is the most lightly used ramp along this stretch of the BQE. About 100 vehicles use it during the peak hours. Closing it would reduce the BQE volumes somewhat as some drivers will exit at Atlantic Avenue. Some may stay on the BQE to take the next two exits somewhat lessening the benefit to the BQE.

Closing the Hicks Street (or Vine Street) entrance ramp to the BQE westbound

This is a very active entrance ramp with volumes currently ranging from 1,200 to 1,300 during the peak hours; however, a majority of the trips using the ramp have originated in Manhattan, crossed the Brooklyn Bridge and connected to the BQE via Cadman Plaza West and Old Fulton Street. With congestion pricing traffic demand on this ramp will drop sharply.

Diverting BQE Traffic to the Brooklyn Battery Tunnel

While the Brooklyn Battery Tunnel (BBT) is at or close to capacity during the peak hours there are ways to increase person-throughput during those hours, utilize some excess capacity on the HOV lane on the Gowanus, and increase operational efficiency. During off-peak hours there is available capacity.

The BBT has a similar configuration to the Queens-Midtown Tunnel (QMT). Both have two lanes in each direction except during peak hours when one lane is reversed. At the BBT the lane reversal occurs during the a.m. and p.m. peaks. At the QMT there is only an a.m. reversal. Both tunnels are fed by limited access highways within the boroughs (Brooklyn and Queens) and both disperse traffic onto the street system in Manhattan. Even with these similarities the QMT, in both directions, handles almost 20,000 more vehicles/day.

As Figure 10 and Figure 11 show the QMT has much higher traffic volumes off-peak and even moderately higher volumes during some peak hours. This indicates that the Brooklyn Battery Tunnel would be able to handle more traffic and, if fact historically it has, reaching a peak volume in 1971 when it carried 64,000 vehicles, or 10,000 more vehicles than today (the 2016 volume was 54,000).

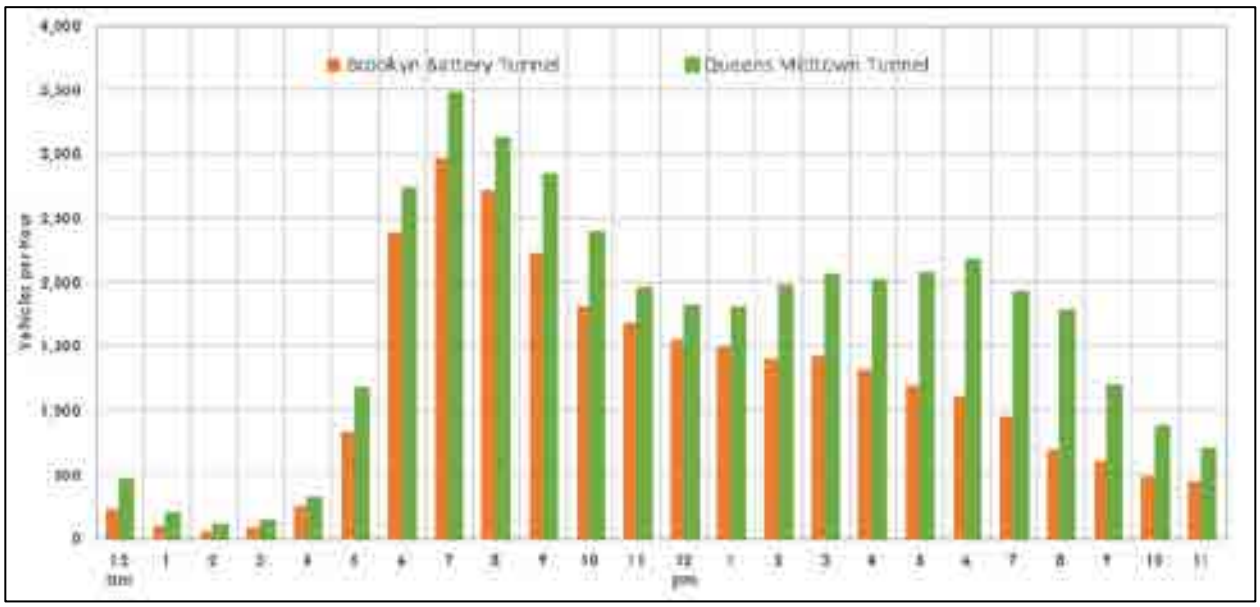


Figure 10 Hourly Traffic Volumes entering Manhattan – Brooklyn Battery Tunnel and Queens Midtown Tunnel

The Brooklyn Battery Tunnel carries almost 28,000 vehicles into Manhattan per day as compared to the Queens Midtown Tunnel, which carries 40,000 vehicles per day, a difference of 12,000 vehicles. Note: The BBT has both and a.m. and p.m. peak period lane reversal; the QMT has only an a.m. reversal.

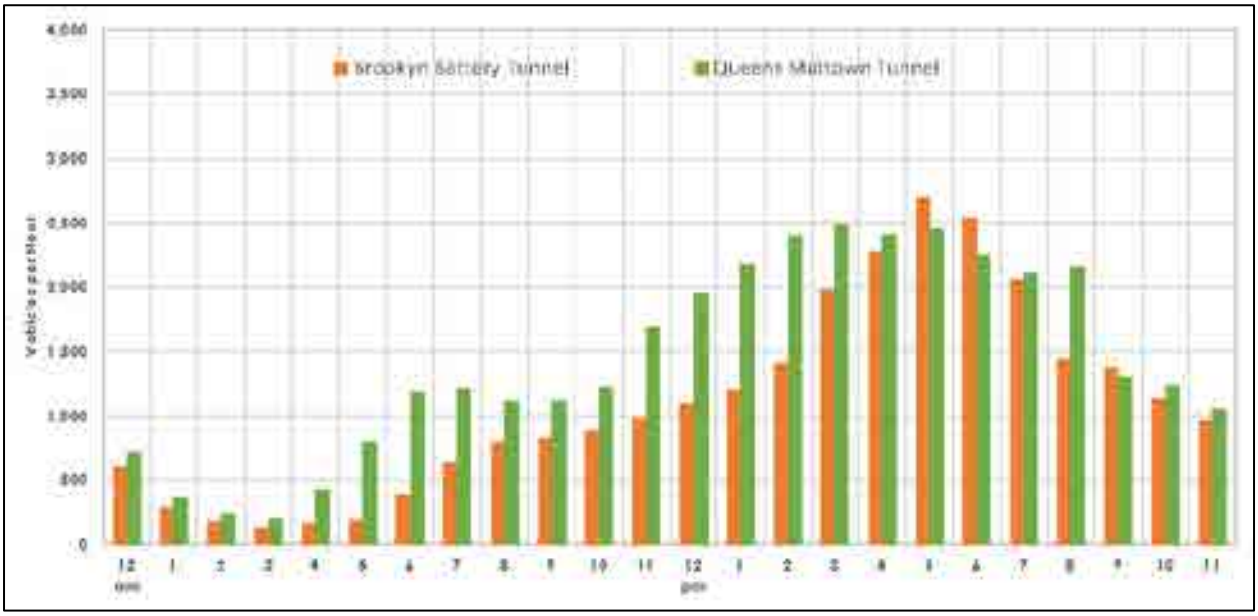


Figure 11 Hourly Traffic Volumes leaving Manhattan – Brooklyn Battery Tunnel and Queens Midtown Tunnel

Exiting Manhattan, the Brooklyn Battery Tunnel carries approximately 26,000 vehicles per day as compared to the Queens Midtown Tunnel, which carries 34,000 vehicles per day, a difference of 8,000 vehicles. Note: The BBT has both and a.m. and p.m. peak period lane reversal; the QMT has only an a.m. reversal.

Measures to Make the Brooklyn Battery Tunnel More Attractive than taking BQE

Create a pricing differential between the BBT and the Manhattan Bridge and Brooklyn Bridge. Make the BBT less expensive to use than the Brooklyn and Manhattan bridges. This is described in the section above "Other Pricing Strategies to Reduce Demand."

Convert the Gowanus HOV 3+ Lane to a HOT Lane. As described in "Other Pricing Strategies to Reduce Demand" High Occupancy Toll (HOT) Lanes allow multi-passenger vehicles to travel free but driver-only cars must pay a toll. On the Brooklyn side of the BBT, a High-Occupancy Vehicle (HOV) lane provides a direct connection between Staten Island/Bay Ridge and the BBT (inbound during the AM peak period and outbound during the PM peak period). Vehicles carrying at least three passengers (including the driver) can use the HOV lane during peak periods for substantive travel time savings. The lane is effective in moving traffic at high speeds particularly in the p.m. while the Gowanus is jammed but the adjacent HOV lane has available capacity. If the HOV 3 lane were converted to a HOT lane, this lane would serve additional demand generated by drivers willing to pay for reduced travel time to/from the BBT further decreasing BQE traffic using the bridges.

Dynamic Variable Message signs could be used to alert drivers of travel time savings by taking the BBT to Staten Island, especially with a HOT lane, compared to the Brooklyn or Manhattan Bridge crossings.

Improving person throughput at the Battery Tunnel may be possible, counterintuitively, by discontinuing the evening lane reversal. That is because two significant negative effects of the current operations:

- To implement the contra flow operations, tunnel traffic is stopped for up to 20 minutes so that operators can revise signage, move cones, and clear the tunnel of traffic prior to changing lane directions. Stopping traffic flow for 20 minutes, particularly prior to the PM peak period, reduces capacity.
- During contraflow operations, the capacity of the non-peak direction of travel is substantively reduced. This primarily affects express buses that are deadheading back to the start of their routes. For example, during the PM peak period today, an express bus reaps the benefit of the contraflow lane as it travels from Manhattan to Brooklyn, but encounters delay as it returns to Manhattan to start another trip. The increased delay for express buses returning to Manhattan during the PM peak period negatively impacts on time performance and degrades transit service operations.

Consequently, it may be possible to make more buses available during the p.m. peak thereby increasing the person throughput but not necessarily the vehicular volumes.

Maximize Street Capacity in Lower Manhattan to Facilitate Flow to the BBT

A key toward shifting traffic away from the Manhattan Bridge and Brooklyn Bridge and towards the Brooklyn Battery Tunnel is to maximize flow in the lower Manhattan area especially south of Chambers Street. Much of the capacity loss on the lower Manhattan network is due to “placard” vehicles parking legally and illegally. A typical scene near City Hall and elsewhere Downtown is to see a row of cars parked with placards in truck loading zones and trucks double-parked since they have no access to the curb. Consequently, street capacity is severely limited. While this seems like an intransigent problem NYC DOT, when it controlled parking enforcement, successfully lessened this behavior. They key was control of placard issuance, reduction in dedicated parking spaces, a recognition that these spaces were not meant for commutation but rather access needed to carry out work, and the creation of No Permit Zones. The following steps are recommended to improve traffic flow accessing the BBT (and city-wide):

Ten Steps toward Solving the Placard Conundrum

1- All permits to expire on June 30, 2020. New and reapplications accepted starting May 1, 2020.
2- Create a Triumvirate consisting of reps from NYPD, DOT and City Hall that must unanimously agree on all permit applications.
3- Only two permit types to be issued: *Law Enforcement* and *Agency*. The permits should be hard to counterfeit and machine readable.
4- Publish names/titles/reason for every placard recipient (undercover officers exempted).
5- Share recipient info with IRS, state and city tax authorities as a benefit. Value should be set at average parking rates for monthly parkers in area estimated at $6-10,000/annually.
6- Assign 100 selected enforcement officers and ten tow truck drivers to either DOT or DOI. Appoint a Czar of Placard Parking who has the backbone to ticket fellow government workers. The Czar would have access to the NYPD Commissioner and Chief of Patrol as well as City hall to ensure the full support of the NYPD and City.
7- Adopt summons first, adjudicate later policy. Set up a formal adjudication process for those placard holders who contest summonses.
8- Set three-hour limits to ensure spaces not used for commutation.

9- Create NO PERMIT ZONES in critical areas.
10- Make displaying a false placard a $1,000 fine + a towable offense.

In addition, DOT should establish parameters to measure the success or failure of the program including numbers of both legal and illegal parking placard parkers by block face on a monthly basis. License plate numbers and placard numbers of violators will be shared with NYPD and DOI.

Reducing Truck Demand

As the only interstate route (I-278) in Brooklyn, the Brooklyn-Queens Expressway serves a vital role in providing goods and services to millions of New Yorkers every day; however, there are a number of strategies available to redistribute or reduce the truck demand in the corridor by taking a more holistic perspective. A few truck-oriented demand reduction strategies follow.

Permit Small Trucks on Belt Parkway

The Belt Parkway is a direct highway connection between the Verrazzano Bridge and JFK Airport as well as the south shore of Long Island. Cars are permitted on the Belt but not trucks. Consequently, most trucks to and from the Verrazzano take the Gowanus to the BQE to the LIE and then the Van Wyck if they are heading to JFK (and vice versa). Not only is it circuitous it is torturous for drivers with severe congestion on all segments. There is no compelling reason to not allow cars with commercial plates and small trucks (under 10’6”) from using the Belt other than state law established by Robert Moses. There is recent precedence for allowing trucks on parkways. NYC DOT, in the mid-1990s, amended rules to allow trucks under 12’6” to use the Grand Central Parkway from the RFK Bridge to the BQE. In 2017 the DOT announced it is raising bridges and lowering the roadway to eliminate even the height restriction. A similar change for the Belt would reduce some truck traffic from the BQE 3X.

Truck Ferries

Freight Ferries are used by many cities to reduce impacts on roadways. In Detroit-Windsor, freight ferries are scheduled every 20 minutes reducing traffic demand on the Ambassador Bridge and Detroit-Windsor Tunnel. Two routes have been identified that would reduce the number of trucks on the BQE 3X:

- Brooklyn Army Terminal to the Brooklyn Navy Yard.
- South Brooklyn Marine Terminal to Hunts Point Food Center

In addition, JFK Redevelopment will overlap with BQE 3X reconstruction and generate substantial freight traffic to deliver and remove materials. This may be an opportunity to promote material shipment by ferry. Furthermore, JFK Airport is the #1 destination for long-haul trucks in NYC so a focused JFK Strategy to reduce truck traffic will benefit the BQE.

Figure 12 The Detroit-Windsor Truck Ferry moves cargo between the two cities. Such a system can be used to move freight within the NYC region to bypass the BQE corridor.

Cross-Harbor Freight Tunnel

The long proposed Cross Harbor Freight Tunnel would link freight trains in Jersey City, New Jersey and Bay Ridge Brooklyn. It would connect with existing rail lines that extend through Brooklyn to Queens, Long Island and to the Bronx. The project would reduce truck traffic on the BQE. Costs have been estimated in the $7-10B range and an estimated design and construction period in excess of 10 years.

Increase Service on the Floating Barge Freight Train

A floating barge freight train currently goes between Brooklyn's 65th Street Rail Yard and Jersey City. It essentially follows the path of the planned Cross-Harbor Tunnel. It is currently under review by The Port Authority of New York and New Jersey. Attracting additional trains to the Barge would reduce truck traffic on the BQE 3X.

Pricing Strategies to Reduce Truck Traffic on BQE 3X

As mentioned earlier pricing the Manhattan Bridge more expensively than the Brooklyn Battery Tunnel would divert some traffic from the BQE to the Battery Tunnel. Similarly, making the Williamsburg Bridge less expensive than the Manhattan Bridge would reduce some traffic at the northern terminus of the project study area.

Enforcement of Over-Sized Trucks

Observations, confirmed by electronic monitoring, found over-sized trucks regularly using the BQE 3X. This is worrisome considering the condition of the structure. These vehicles, while not large in number, have a disproportionate impact on traffic due to their size and performance. Stepped up enforcement by state and city police is essential now to prevent additional damage by these large vehicles.

Other Truck Strategies

Strategies such as regional dispersion and exit/entrance closures would reduce general traffic including trucks. These are discussed elsewhere in the report. In addition, measures to protect the local communities from illegal truck intrusion are described.

Diverting Some BQE Traffic to the Williamsburg Bridge

The Williamsburg Bridge, the northernmost East River bridge in Brooklyn, will see a decline in traffic volumes once congestion pricing goes into effect. That drop will largely come from drivers who today avoid the tolls at the Queens-Midtown Tunnel and use the Williamsburg. With congestion pricing some of them will take a more direct path by using the Queens-Midtown Tunnel. This is an opportunity to fill some of that additional capacity with traffic from the Manhattan Bridge, lessening demand on the BQE south of the Williamsburg.

Westbound (SIB) traffic on the BQE, south of the LIE, can enter the CBD via the Williamsburg, Manhattan or Brooklyn bridges. If some traffic can shift from the Manhattan and Brooklyn bridges to the Williamsburg some pressure will be removed from the study area. Currently traffic on the BQE heading west has an option just north of the Williamsburg Bridge to choose crossing the bridge or continuing west on the BQE. At this decision point, the left lane is “Bridge Only,” the right lane is “BQE Only” and the center lane has the option of the bridge or the BQE. Converting the option lane to “Bridge Only” would make the bridge more attractive to drivers destined for the CBD.

Traffic on the Williamsburg Bridge can be further improved by managing the number of lanes to and from Manhattan. Currently there are eight traffic lanes on four separate roadways. In the past, peak hour traffic would be favored by having six lanes in the peak direction and two lanes in the opposite direction. That is, during the morning peak, the south inner roadway would be reversed to Manhattan (meaning six lanes toward Manhattan and two lanes toward Brooklyn). During the PM peak period, six lanes would flow toward Brooklyn and two lanes to Manhattan. By making the Williamsburg Bridge more attractive, some Manhattan Bridge traffic (and to a lesser extent Brooklyn Bridge traffic) will switch to the Williamsburg Bridge.

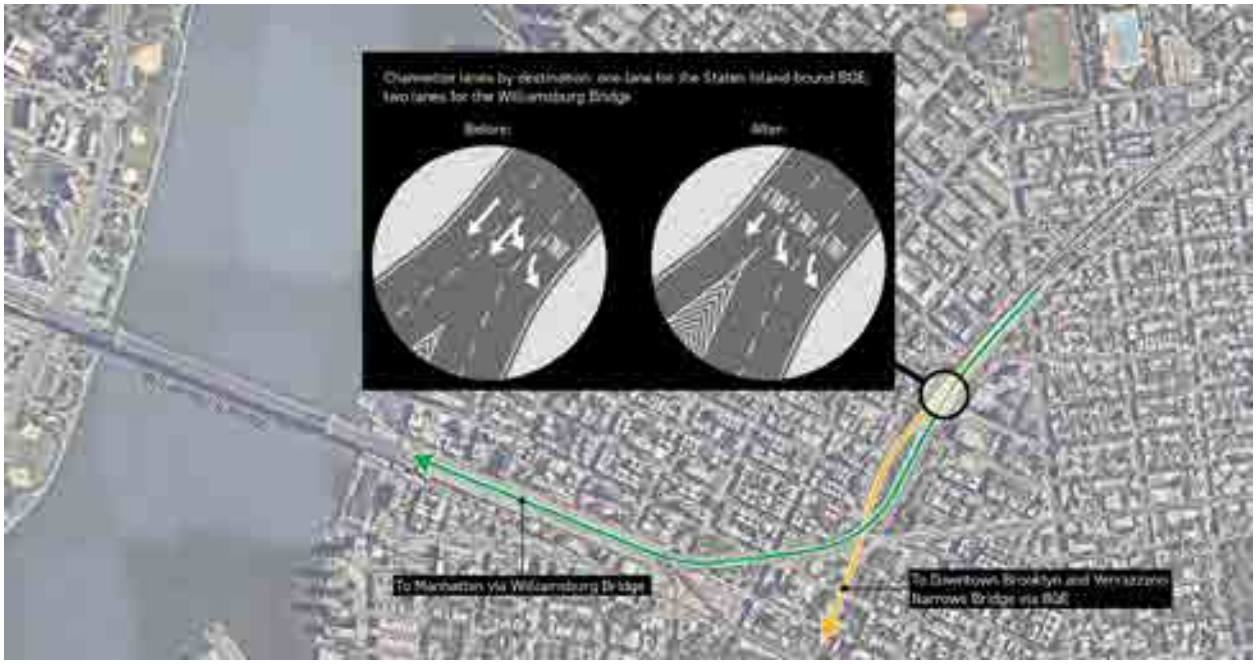


Figure 13 The Williamsburg Bridge can become more attractive by changing lane assignments on the BQE and manage traffic on the bridge to match peak demand

Regional Dispersion of Traffic

Traffic rebalances itself every time there is a major change to the overall network. For the BQE, this "rebalancing" will affect all major north-south highways from the Garden State Parkway to the Cross-Island Expressway (see Figure 13, the thick arrows reflect trucks options such as the NJ Turnpike and Van Wyck Expressway, thinner arrows reflect auto-only routes).

Any improvements to these somewhat parallel highways, especially when combined with major construction on the BQE, will divert some drivers to the upgraded arterial. Fortunately, the Van Wyck Expressway is undergoing major reconstruction to be completed by the start of BQE construction that will add a lane in both directions. This will divert some car traffic that uses the BQE from northern Queens and the northeast suburbs to the Verrazzano Bridge and some south Brooklyn destinations.

An aggressive outreach campaign will accelerate and maximize the regional redistribution of traffic; therefore, reducing the demand within the BQE corridor. Elements that have proven successful in other major projects include:

- Aggressive Information Campaign
  - Partnerships with GPS apps (Google, Waze, Garmin, etc.)
  - Traffic Media
  - Social media
  - Paid Ads
  - Regional VMS
  - Targeted Communications (TLC, Truckers, AAA, etc.)
- Improving Alternate Routes (such as the Van Wyck Expressway improvements)

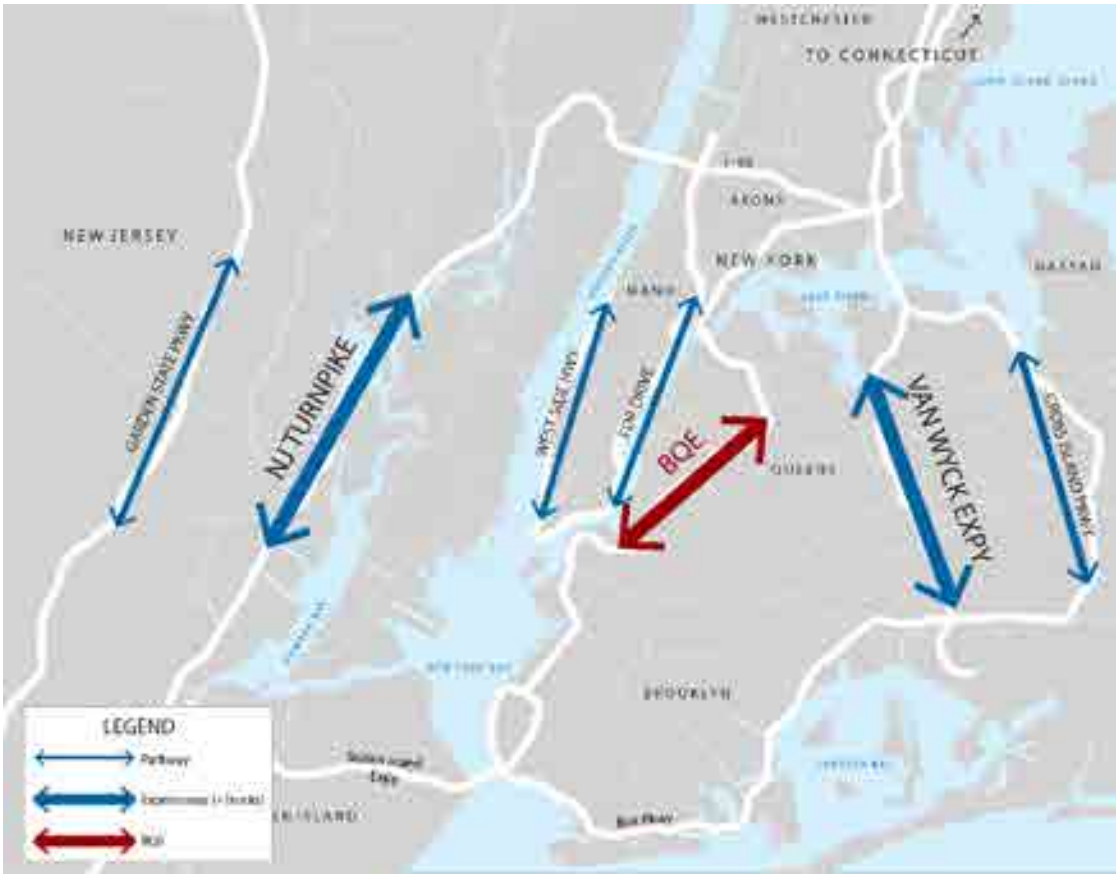


Figure 14 Regional Dispersion of Traffic

An aggressive outreach campaign will accelerate and maximize a regional distribution of traffic (Note: Van Wyck Expressway is also undergoing a capacity improvement project to be completed by 2025).

Transit Improvements to Reduce Demand on the BQE

The BQE Corridor from Red Hook to Long Island City is poorly served for north-south transit directly between Brooklyn and Queens. There have been proposals over the years that would address this transit deficiency. The upcoming reconstruction of the BQE and the need to reduce traffic demand in the long run could give these valuable projects the impetus needed to make them happen. It is noted that transit is subsidized (not that car traffic is not) and increases in service come with a cost. But, for a project of this magnitude, in such a dense area, it is not unusual to dedicate over 30% to manage traffic flow. So, a $2B construction project might include $600M for traffic management. A $3B construction cost might require nearly $1B. Taken in that light it may be wise to include in the project costs funding of a *transit support budget* to help facilitate construction. Here are several transit recommendations that would lessen BQE demand:

Increase the G Train Capacity by Greater Frequency, and Longer Trains

Almost overnight, the G Train capacity can be increased by restoring 8-car trains to the line. Currently trains are 4-cars long and were to be lengthened during the L-Train tunnel rehab. Historically, the G was eight cars long and ran to Queens Plaza in Long Island City (at one time even further to Forest Hills-71st Street) and Church Avenue in Flatbush. Currently there are many times the G is so crowded that riders need to wait for multiple trains to squeeze on. This results in a loss of riders to Uber, Lyft and green taxis with some using the BQE. Increasing frequency of service would also reduce the need for vehicular traffic over transit.

Build the BQX

The BQX, as proposed, runs along the Brooklyn-Queens waterfront often within blocks of the BQE. With a southern terminus in Red Hook (note: an early version extended to Sunset Park) and a northern terminus in Astoria, the BQX would link 13 housing projects and major job generator areas such as Industry City, The Navy Yard, Downtown Brooklyn and Long Island City. It also would provide a transit link to the ferries to Manhattan from Brooklyn and Queens. It would provide an inexpensive and reliable alternative to car services and taxis along the BQE corridor.

Advance the Triboro RX

The Regional Plan Association (RPA) has long called for the use of existing rail tracks, mostly reserved for freight or currently out-of-service, into a passenger line shared with freight linking Brooklyn, Queens and the Bronx. By offering an interborough transit link that does not go through Manhattan, the public would have a transit alternative to vehicular travel from Sunset Park in Brooklyn to Jackson Heights in Queens to Co-Op City in the Bronx.

According to the RPA, the Triboro would extend for 24 miles from Co-op City in the Bronx to Bay Ridge in Brooklyn and act as the wheel connecting the various spokes of the subway system branching from Manhattan. It would open an urgently needed north-south transit corridor, allowing New Yorkers for the first time to move seamlessly between communities in these three boroughs. As proposed, the Triboro would intersect with 17 subway lines and four commuter rail lines along its route. However, competing for the same rail lines is the Cross-Harbor Freight Tunnel which would provide a direct connection for rail freight between New Jersey to Long Island, via Brooklyn.

Additional studies are warranted to define if and how these initiatives could share the same rail lines (or if additional rail would need to be added within the same right-of-way).

Diverting Auto-Users to Express Buses

There are two distinct markets here, peak and off-peak periods.

Peak Conditions A key issue here is less the ability to divert customers than the availability of buses to carry them. Assuming buses are available, one attraction could be lowering the express bus fare from Staten Island. (Doing so from Brooklyn would be less productive, as it might be more likely to divert subway riders than auto users.) A reduction from $6.75 (approximately $6.20 per trip for weekly passholders) to around $5.00 could be appealing. Current peak trips on four routes that bypass lower Manhattan and go express to midtown are quite popular. Adding service to those and extending their hours could be another strategy.

Off-Peak Conditions Bus availability is not a problem (because of the highly-peaked nature of express services), and labor costs would be marginal by converting inefficient swing runs to more efficient straight runs. Fare discounts could be offered similar to the commuter railroads, i.e. on trips arriving in Manhattan after 10 AM, and departing Manhattan up to 3:00 (not 4:00) PM and then again after 8 PM. A $5.00 fare would reflect approximately the same discount as the railroads. Revenue loss would be significantly less, because of much lighter ridership during these periods and the fact that some current riders are already traveling at half-fare.

New Ferry Services

Ferry from South Shore to midtown and/or downtown. The south shore has the least convenient access to the SI Expressway and probably the longest drive times to the Verrazzano Bridge and to the St George ferry, making it a source of some autos using the BQE. Coupled with demographics that probably have the highest rate of auto ownership, this is a combination that might divert some drivers from the BQE. The ferry terminus could be in Great Kills Park-GNRA, a sheltered harbor with an existing boat presence. Existing parking lots within the park and near potential ferry pier sites have a capacity of about 400 cars. (Ownership by the federal government, and accommodation of park users, particularly in warmer months, are issues that would have to be addressed.)

A ferry fare at the express bus fare level could be attractive and less costly than the combined Verrazzano and congestion pricing fees.

Another ferry possibility for further research is Pier 4 in Sunset Park. This is already served by a NYC ferry, and has room for about 500 cars on the pier. This appears to be near parking capacity today, in part because EDC offers this parking for free. A pending proposal to charge for parking has generated controversy, and if implemented, could make capacity available. Its half-hourly peak and hourly off-peak service may not be sufficiently attractive. Begun as a mitigation for the R Train Sandy-related shutdown, its current ridership is drawn from former subway users from Bay Ridge. If parking does become available, this could be an intercept for vehicles approaching the Gowanus that otherwise would take the BQE.

Pending ferry service from St. George to West Midtown has potential to divert traffic from the BQE because its direct route to midtown will be faster than by car, offers a supply of nearby private and municipal parking (although not inexpensive), and may tap a market with current easy

access to the SI Expressway. These city-run services tend to begin with low, potentially unattractive levels of service, something that could be reviewed as the cantilever reconstruction nears. Side-by-side competition with the free SI Ferry may be a factor.

Protecting the Local Communities from Major Negative Impacts During Construction

No matter how well traffic reduction and dispersion strategies work this corridor will still have more than 100,000 vehicles daily traveling through the area. A focus on minimizing disruption to the community is integral to the reconstruction of the BQE. As seen with large projects such as the JFK Airtrain, a plan for protecting the community was essential for gaining community consent and subsequently successfully executed. Furthermore, as witnessed with other large infrastructure projects in dense New York City neighborhoods (such as the Second Avenue Subway), there is an opportunity for the project team to go further and be a "good neighbor" providing community benefits during construction. This section will address these considerations.

Reducing the Impact of Trucks

As the BQE is Brooklyn's only thru-expressway for trucks, steps need be taken to minimize intrusion by trucks onto local streets during construction. Potential interventions are:

Prevention of unauthorized truck intrusion by increasing enforcement by at key locations as was done on other major projects, such as the Barclays Center, and JFK Airtrain. The best guarantee to get this done is to **include the cost of NYPD officers as the contractor's obligation.** Using the NYPD's Paid Detail off-duty program could lower overall costs as opposed to hiring on-duty police. In addition**,** License Plate Reader (LPR) and E-ZPass technology can be used to issue fines (legislation likely needed).

High-Tech communication with truckers. Ensuring that any changes that impact truck routes are communicated to both commercial GPS mapping companies, as well as GPS systems designed specifically for truckers.

Limited Truck Zones for areas impacted by construction. As part of such zones, operators are prohibited from stopping, standing or parking their vehicle on streets so designated, except when making

Figure 15-During the construction of the JFK Airtrain, off-duty NYPD Officers under the Paid Detail Program prevented trucks from using local residential streets. Note: the sign prohibiting trucks from entering local street on Lakewood Avenue in Queens.

a delivery, loading or servicing. There is precedent for such zones in Manhattan.

Slow Zones to Make Streets Safer and Discourage Thru-traffic

Figure 16 Current slow zones in the project area. While DOT is not currently accepting applications for new zones, the opportunity exists to revisit this program for communities impacted by BQE construction.

Neighborhood slow zone initiatives are also gaining in popularity and can be explored, not only as a way to discourage unwanted through-traffic, but as a lasting community benefit that improves safety on neighborhood streets.

As part of a neighborhood slow zone, neighborhood streets are changed to 20 mph, while boundary streets remain unchanged at 25 mph. Gateway signage is placed at neighborhood entrances to inform drivers that they are entering a slow zone, and streets are marked throughout to remind motorists of the speed limit. Speed bumps are placed strategically throughout the zone.

Zones are selected through an application and review process. The Boerum Hill and Brooklyn Heights neighborhoods had slow zones implemented in recent years.

Leveraging Technology to Relieve Traffic Issues

Cities around the world are grappling with the impacts of technology as it both worsens and solves traffic issues. As it pertains to protecting the community, partnerships with regulators and technology providers themselves can be part of the strategy:

Update road changes and closures. Because today's drivers are so reliant on GPS services, at LaGuardia Airport, traffic engineers have developed partnerships with Waze and Google Maps to update roadway closures and preferred routing as the airport undergoes an $8B redevelopment. Redevelopment staff push updates with upcoming changes to contacts at the companies, who update the platform. A similar program for the BQE would be effective during construction.

Implement a cruising cap for TNCs. An increase in traffic by Transportation Network Companies (TNCs) such as Uber and Lyft has led to a dramatic increase in congestion. To address this the city's Taxi and Limousine Commission is instituting a cap designed to reduce the time FHVs are without a passenger below 96th Street in Manhattan from the current 41% to 36% in February 2020 and further to 31% by August 2020. This is currently on hold as a result of court ruling in late December 2019. TNC companies will pay fines for vehicles exceeding 31% of the time empty. Applying this same strategy to the communities straddling the BQE would reduce congestion.

A bid to limit how long ride-hail drivers for companies like Uber and Lyft are able to cruise in Manhattan without passengers could have a second life in the New York City Council after being shot down by a judge last month, Crain's New York Business reported on Friday. In June 2019, New York City Mayor Bill de Blasio proposed a cruising cap south of 96th Street in Manhattan, which would limit ride-hail cars to driving without passengers no more than 36% of the time starting February 2020– the idea being that such vehicle usage worsens congestion. By August, the cruising cap was set to be further lowered to 31%. But in December 2019, a state judge struck down the new rule, calling the cap "arbitrary and capricious."

It is important to develop local traffic control plans and street modifications to mitigate the impacts of major construction projects. Some strategies include:

- Assignment of personnel to actively manage pedestrians and vehicles, including traffic agents, NYPD officers, and pedestrian traffic managers.
- Street modifications, including updating parking regulations and turn restrictions; reviewing the direction of streets; installing speed humps; optimizing traffic signals; channelized turn islands; and installing camera enforcement.

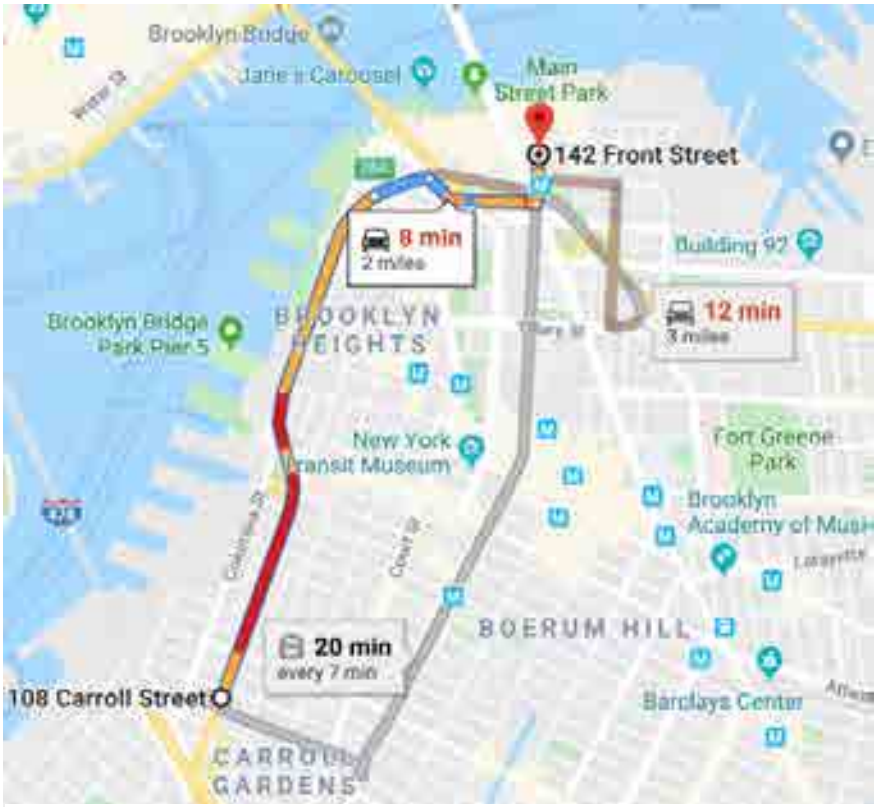


Figure 17 Proactive notifications and partnerships with mapping companies can be effective in discouraging GPS technology from directing drivers toward impacted or closed routes.

Creating a Realtime On-Site Traffic Operations Center for the BQE Construction

A project with the scale and impact as the BQE requires a multi-agency response. For projects of similar size and complexity, such as the reconstruction of LaGuardia Airport, agencies have built on-site traffic monitoring centers to solve and mitigate traffic turbulence in real-time.

The monitoring center is the "home base" for active traffic management; it is a place for agencies, engineers, police, contractors to muster each morning, make plans together, and actively collaborate during times of traffic disruptions.

Figure 18 At the LaGuardia Airport Operations Center (AOC), Traffic Engineers collaborate with Construction Management, Airport Operators, Port Authority Police, and other partners involved in keeping traffic moving during disruptive construction activity

Such a center, often operating 24/7, allows for a level of collaboration that is not possible when those key partners sit remotely. In advance, the team would develop a protocol document that includes operating procedures and a set of mitigations that can be implemented to actively manage traffic.

These centers allow for rapid incident detection and response and the close coordination allows for swift deployment of emergency personnel and vehicles. Heavy duty tow trucks for disabled and crashed vehicles can be strategically placed to speed their clearing.

As a hub of communication, the center can be the link to the joint NYC/NYS/NYPD Traffic Management Center to propose traffic signal pattern modifications, request NYPD assistance to control traffic, activate Variable Message Signs (VMS) to redirect traffic; notify media using agency protocols and communicate with Uber/Lyft/TLC with travel alerts; and provide updates to trucking associations and major local operators (USPS,UPS, FedEx, etc.).

Provide Community Benefits During Construction

For the multi-year Second Avenue Subway project, MTA recognized the need for a robust community engagement program that focused on positioning the agency as a "good neighbor." Their efforts can serve as a model for a community engagement program for the BQE reconstruction

Figure 19 The Second Avenue Subway Community Information Center served as a community liaison office, educational center, and community meeting space during the construction of the subway line on the Upper East Side.

At the height of construction, the program employed three full-time community liaisons to handle construction-related concerns, and a Director of Community Outreach to work with businesses, community groups, and political leaders on the corridor. As part of this strategy, the agency employed a "good neighbor initiative" in which the liaisons worked closely with the construction management team to identify, track, and address construction-related quality of life concerns in the field.

Figure 20 The Second Avenue Subway Community Information Center provided not only informational, but educational material that turned the construction project into a learning opportunity for community residents.

The agency opened a "Community Information Center" that functioned as an educational space, an office space for community liaisons, as well as a community space for project-related meetings. Engagement went beyond construction updates; the outreach team was able to turn the construction project taking place outside people's doors into a learning opportunity by bringing in speakers for evening events; developing educational content and hosting school groups; and creating informational exhibits for community members and visitors to enjoy.

Transportation Management Plan

Preparing for Construction: A Comprehensive and Detailed Transportation Management Plan

Transportation Management Plans (TMP) are often part of major road construction jobs. The TMP functions to address planned and unplanned changes in local and regional travel patterns that happen throughout construction – from roadway, lane, and ramp closures; diversion routes; and detour routes during construction. This includes looking-ahead to evaluate and plan for mitigating impacts of future construction stages that could change traffic flow on the regional roadways. Areas to be addressed in the TMP include:

- Diversion strategies during construction stages
- Potential regional impacts
- Proposed signing, traveler information dissemination, and other mitigation strategies
- Traffic monitoring and incident management plans
- Communication and outreach plans
- Regional construction project coordination
- Agency roles and responsibilities

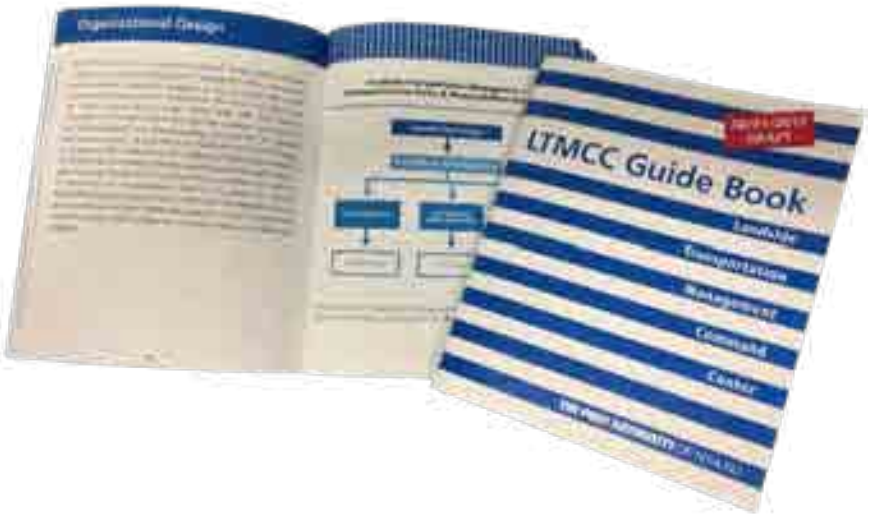


Figure 21 LaGuardia Airport Reconstruction Traffic Management Guidebook

As the BQE is one of the most congested in the New York metropolitan area, it will be crucial to implement creative measures with a high probability of success and a goal of reducing overall congestion both locally and regionally. The TMP will be scaled and specified to every aspect and critical stage of construction.

Local Maintenance and Protection of Traffic and Pedestrian Plan

The Transportation Management Plan would also include a detailed local Maintenance and Protection of Traffic and Pedestrian Plan that would identify traffic measures to protect

pedestrians, adequately maintain traffic flow and minimize impacts on the local community. Such traffic measures could include:

- Traffic Enforcement Agent and Police posts
- Pedestrian Traffic Managers assignments
- Street Modifications
- Parking regulations
- Street directions
- Speed humps
- Camera enforcement
- Traffic signal optimization
- Turn restrictions
- Signal modifications
- Detour routes for various construction phases with appropriate measures along those corridors

A good example of a micro-map that was part of the Traffic Management Plan for both construction and post-opening of the Barclay Center is presented below in **Figure 22**

Figure 22 The Barclays Traffic Management plan is a model for major traffic disrupters

A Final Word of Caution and Urgency: The BQE is on "Borrowed Time"

The triple-cantilever, built in 1950, is well past its planned "life" of 40-50 years. It is a geriatric structure showing significant signs of deterioration including spalling concrete (pieces fall sporadically), exposed reinforcing bars, steel corrosion, salt penetration, joint failures and deck holes. These all indicate a structure that has been weakened. We make no comment as to the remaining "life" of the structure, but we raise this in a report on traffic management because there is a fair probability that an inspection or a structural emergency will trigger immediate actions that can massively worsen traffic, not just in the immediate area but region-wide.

Here are typical responses, often very sudden, engineers use to lighten the traffic load as a road structure deteriorates:

- Ban heavy trucks
- Reduce the number of lanes
- Ban all trucks
- Close the structure

This is not some theoretical mathematical exercise. New York City has experienced fatal collapses of cables on the Brooklyn Bridge and a deck failure on the FDR Drive at 20th St. A structure that underwent the precise sequence listed above is the Williamsburg Bridge in 1988 – first with lane closures, then restrictions of subways and trucks followed soon by a full closure. All this took place in months.


NEW YORK POST

SPORTS FINAL

CLOSED!

Crumbling W'burg bridge shuts – maybe forever

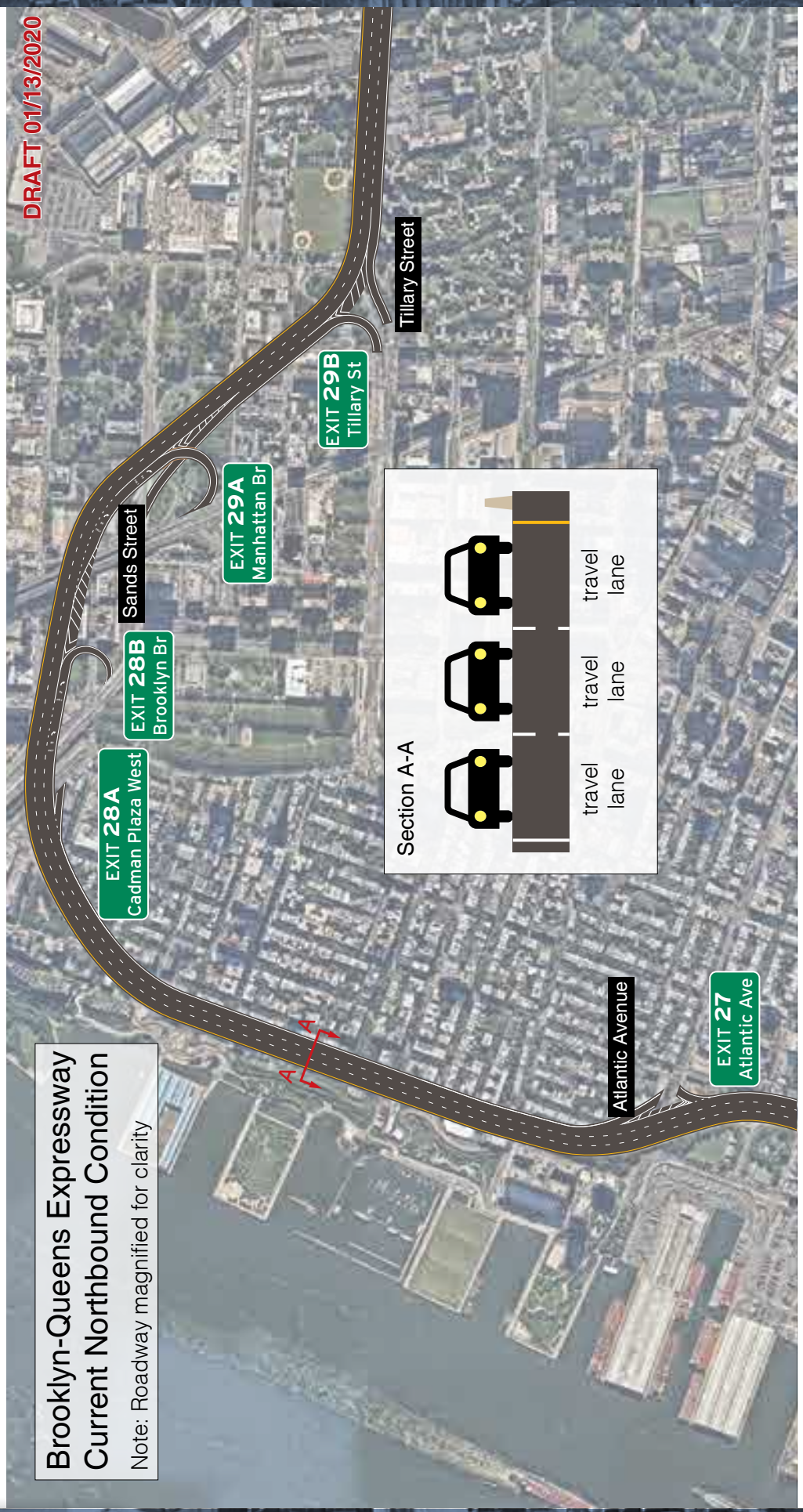
Figure 23 A Headline from the Williamsburg Bridge Closure

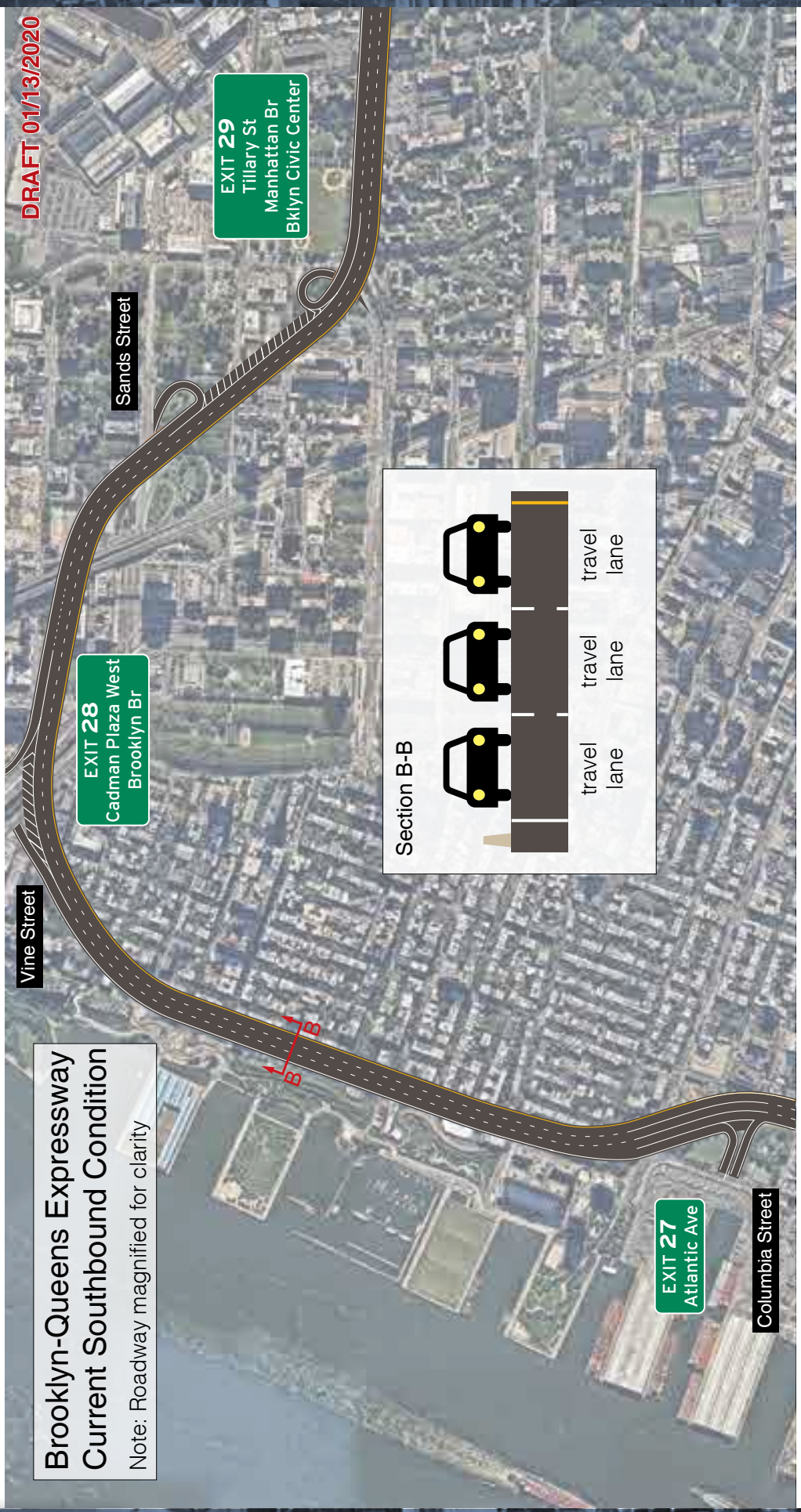
Bridge and viaduct failures are not just something from last century. Around the country trucks are being diverted from weakened structures and some roadways are being closed. In 2019, there were plenty of examples of other distressed roadway viaducts and bridges that have failed. Figure 24 provides a few examples of recent unplanned bridge closures.

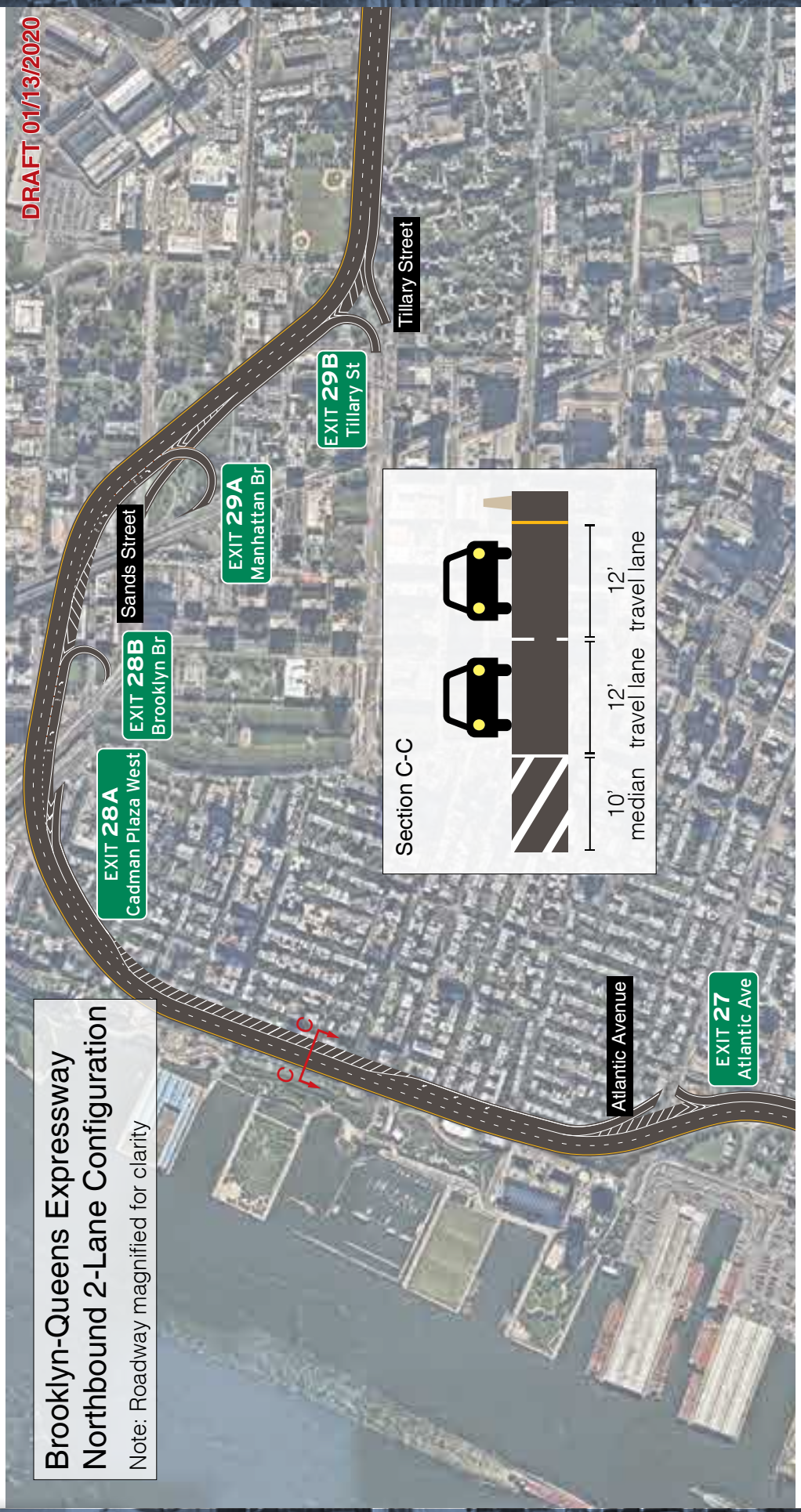
Figure 24 Examples of recent emergency bridge closures

A decision on a long-term fix for the BQE cannot be put off any longer. In the interim, the city must prepare emergency plans for each of the scenarios listed above including a full closure. Too much is at stake.

APPENDIX: Conceptual plans for two lane configuration


DRAFT 01/13/2020
Brooklyn-Queens Expressway
Current Northbound Condition
Note: Roadway magnified for clarity
EXIT 28A
Cadman Plaza West
EXIT 28B
Brooklyn Br
Sands Street
EXIT 29A
Manhattan Br
EXIT 29B
Tillary St
Tillary Street
Atlantic Avenue
EXIT 27
Atlantic Ave
A
A
Section A-A
travel lane
travel lane
travel lane


DRAFT 01/13/2020
Brooklyn-Queens Expressway
Current Southbound Condition
Note: Roadway magnified for clarity
Vine Street
Sands Street
Columbia Street
EXIT 28
Cadman Plaza West
Brooklyn Br
EXIT 29
Tillary St
Manhattan Br
Bklyn Civic Center
EXIT 27
Atlantic Ave
B
B
Section B-B
travel lane
travel lane
travel lane


DRAFT 01/13/2020
Brooklyn-Queens Expressway
Northbound 2-Lane Configuration
Note: Roadway magnified for clarity
EXIT 28A
Cadman Plaza West
EXIT 28B
Brooklyn Br
Sands Street
EXIT 29A
Manhattan Br
EXIT 29B
Tillary St
Tillary Street
Atlantic Avenue
EXIT 27
Atlantic Ave
C
C
Section C-C
10'
median
12'
travel lane
12'
travel lane


DRAFT 01/13/2020
Brooklyn-Queens Expressway
Southbound 2-Lane Configuration
Note: Roadway magnified for clarity
Vine Street
Sands Street
Columbia Street
EXIT 28
Cadman Plaza West
Brooklyn Br
EXIT 29
Tillary St
Manhattan Br
Bklyn Civic Center
EXIT 27
Atlantic Ave
D
D
Section D-D
10'
median
12'
travel lane
12'
travel lane