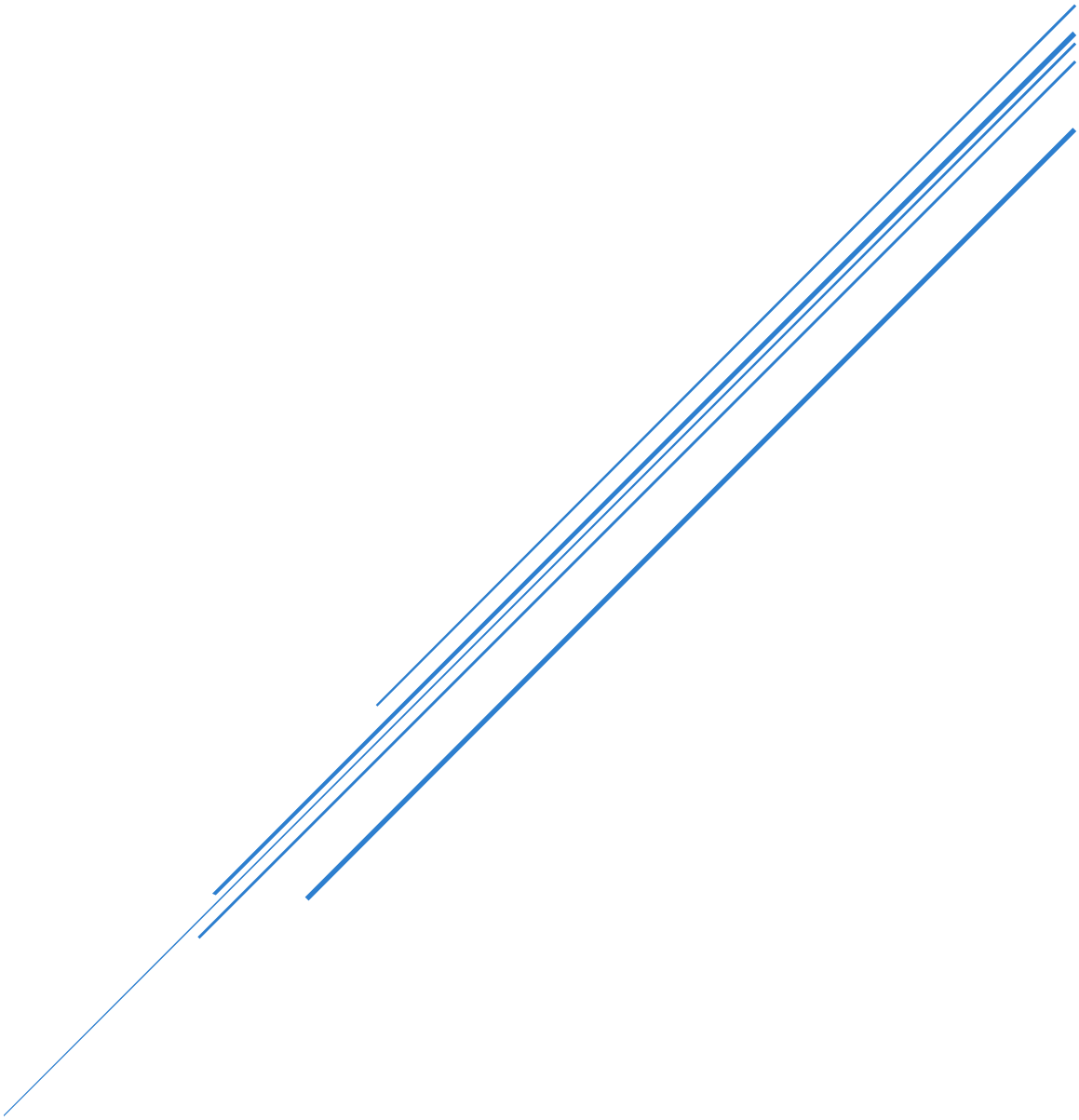
REACHING NEW BROOKLYN HEIGHTS

Reimagining the Brooklyn-Queens Expressway Triple Cantilever



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Problem Statement

The Brooklyn-Queens Expressway was built between 1937 and 1964 playing a significant role in moving people and goods locally and regionally. It was part of the Eisenhower Interstate System and is currently the only Interstate highway that runs through Brooklyn. Approximately 130,000 vehicles use the BQE daily, of which 10% is trucks (13,000/130,000 vehicles). Other parkways in Brooklyn include the Belt Parkway and the Jackie Robinson Parkway (formerly known as the Interborough Parkway), neither of which trucks can use due to height and weight restrictions, making the Brooklyn-Queens Expressway the only option for trucks to travel into and out of Staten Island.

The triple cantilever was an engineering feat in its time. Robert Moses was responsible for the planning, design, and construction of the Brooklyn-Queens Expressway (including the cantilever), with the objective of minimizing intrusion in the surrounding neighborhood. The cantilever consists of three layers, the lowest layer carries traffic to Staten Island, the middle layer carries traffic to Queens, and the top layer is the Brooklyn Heights Promenade, overlooking the East River and lower Manhattan.

However, it was not designed for the traffic it carries today. Truck traffic has increased greatly over the years, and the steel the cantilever sits on has grown weary. With every day that passes, the fear of not only the Brooklyn Heights community, but the entire city grows greatly. As more trucks passed over the crumbling structure, measures had to be considered to reduce the load on the triple cantilever. As a temporary measure, the outermost lane of each direction was striped over to prevent traffic from using it, putting extraneous weight on the cantilever.

A resolution is imminent for the Brooklyn-Queens Expressway. Many proposals include transforming the highway into a tunnel, or restructuring the highway in its entirety, however the political battles with the neighborhood of Brooklyn Heights would create a challenge for any constructive work on the Brooklyn-Queens Expressway. This is mainly due to the Brooklyn Heights Promenade, as most residents do not want any construction interference near the promenade. On the weekend of October 14th in 2023, the entire Brooklyn-Queens Expressway was reduced to one lane due to the incredibly weak concrete on the wall of the cantilever. Even though there is currently a fresh pour of concrete, the expressway needs saving if it is to continue holding the traffic it does.

Proposed Design

The first phase consists of installing a supporting structure for the Queens-bound level of the cantilever. Depending on the design, this may be either a steel frame or concrete columns. The supporting columns would be placed approximately every 200 feet, requiring between ten and fifteen structures. The supporting structure for the Queens-bound level of the cantilever will occupy the entire middle lane of the Staten-Island-bound level of the cantilever. During this time there will be two lanes open to Queens and one lane open to Staten Island. Since the support structures are approximately 8 feet by 8 feet, the construction of them will only take up one lane worth of width since a lane is approximately 10 feet wide. Furman street will remain open to accommodate any excess traffic. Additionally, since any work done will occur during off-peak hours, Furman Street is expected to have adequate right-of-way for the construction of support structures throughout the rehabilitation. By installing support for the Queens-bound level of the cantilever, the aim is that it will not need to be destroyed but reduced to rehabilitative work.

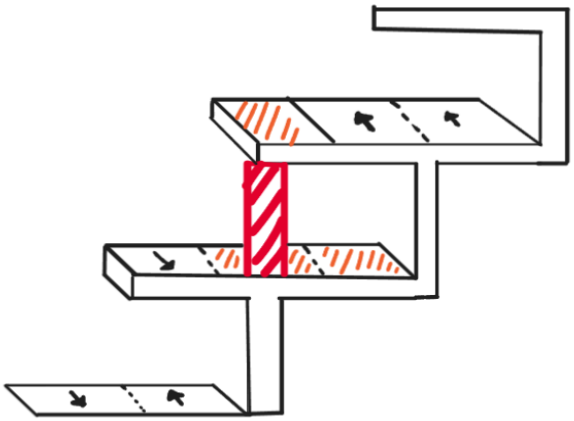

Figure 1: First Phase of Brooklyn-Queens Expressway Reconstruction

The second phase is the installation of a highway deck to support three lanes for the Staten-Island bound Brooklyn-Queens Expressway. This deck will be installed using the existing support of the column from the first phase and use a supporting structure from Furman Street (either a steel frame or concrete columns as discussed earlier). The existing support structure from the first phase will allow two lanes to run in the Staten Island direction without interruption, although there could potentially be an interruption with the installation of the deck. Furman Street must be closed throughout this phase as many supports will have to be installed for the new highway deck. The majority of Furman Street is for recreational space, so a large impact is not anticipated.

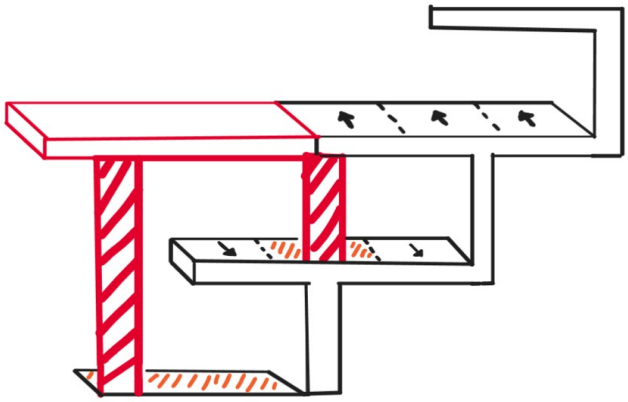

Figure 3: Second Phase of Brooklyn-Queens Expressway Reconstruction

The third and final phase is the destruction of the lowest level of the cantilever. Since the structure is no longer needed and the steel is anticipated to continue to deteriorate and weaken from the load of the structure above, the supporting structure originally placed on the level will need to extend all the way down to Furman Street. The Brooklyn-Queens Expressway will remain open during this phase as it will be supported, however Furman Street must remain fully closed.

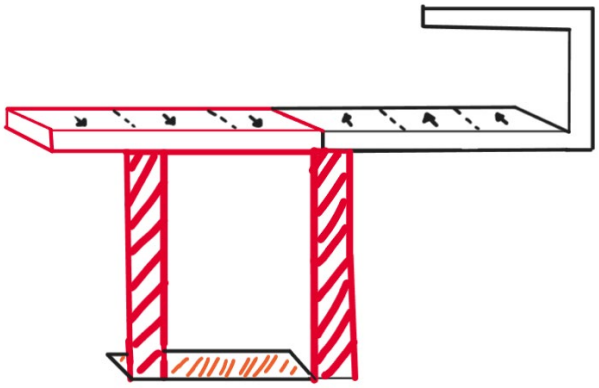

Figure 2: Third Phase of Brooklyn-Queens Expressway Reconstruction

The result is a six-lane highway on the original Queens-Bound level of the cantilever, with Furman Street being enclosed by supporting structures for the highway on both sides of the road. This will allow for minimized levels of disruption to the Brooklyn Heights Promenade at the top of the cantilever, as it will still be above the Brooklyn-Queens Expressway with an unobstructed view of the East River. Furman Street will be able to support two lanes of traffic as Furman Street was measured to be about 32 feet in width, and at least 10 feet of lane width would be required for each direction of travel. Additionally, each lane will be 10 feet wide, with a median of 4 feet, and shoulders of 2 feet.

The reduction of the Brooklyn-Queens Expressway to one lane during the weekend of October 15th offered a lot of insight as to the detours and closures that would be required during each phase of construction. There are many detours that can be utilized through neighborhoods

such as Park Slope and Caroll Gardens. Additionally, closing entrance ramps leading up to the triple cantilever section of the Brooklyn-Queens Expressway is a great method to reduce traffic that would be utilizing the section.

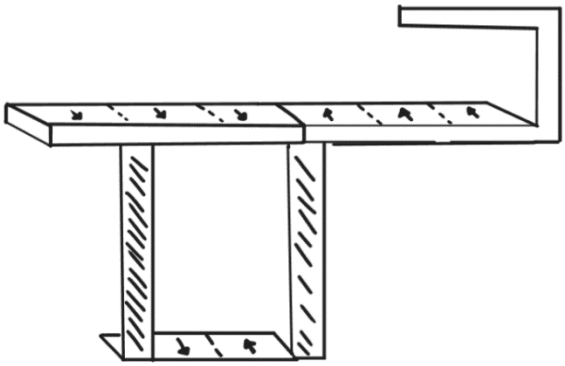

Figure 4: Result of Brooklyn-Queens Expressway Reconstruction

The previous work on the Brooklyn-Queens Expressway showed that over the weekend it is possible to divert traffic and reduce the entirety of the expressway to one lane. To close the expressway to this extent, modifications must be made to Atlantic Avenue. Firstly, various left turns from Atlantic Avenue would be prohibited to help to move traffic near the Brooklyn-Queens Expressway. Additionally, various entrances and exits must be closed such as the entrances to Third Avenue, Sixth Avenue, the Prospect Expressway, Hamilton Avenue, and Atlantic Avenue and the exits to Cadman Plaza, the Brooklyn Bridge, and the Manhattan Bridge. Most detouring vehicles will take Atlantic Avenue and Hamilton Avenue through the local streets of Brooklyn.

Impacts

Traffic Operations

Our proposed plan will substantially impact the traffic operations on the Brooklyn-Queens Expressway, and various strategies can be implemented to minimize this impact. With a new capacity for more trucks and vehicles, the Brooklyn-Queens Expressway will attract more trips. To best preserve the infrastructure of the new construction, imposing an occupancy requirement during peak hours is a potential mitigation of the impact. As a result of the occupancy requirement, a high-occupancy lane that allows access to and from the Brooklyn and Manhattan bridges must be designed. The leftmost lane of the peak direction (going eastbound towards Manhattan in the mornings and westbound away from Manhattan in the evenings) may be reserved for high occupancy vehicles. However, some challenges may arise, since a high-occupancy lane for less than a mile of highway may be considered unproductive in the flow of traffic. Despite this, promoting carpooling could potentially reduce traffic congestion, especially during peak hours. This also helps to promote sustainable transportation practices.

Recently, the Verrazzano-Narrows Bridge began to toll both ways, this promotes only traveling over the bridge for essential reasons and helps to divert traffic away from congested areas such as the Brooklyn-Queens Expressway. Additionally, this new imposition diverted traffic from the roads of Lower Manhattan to the Brooklyn-Queens Expressway since there is no way of avoiding the toll. Tolls can be easily imposed between Brooklyn and Staten Island, another potential measure to reduce traffic on the new Brooklyn Heights sector of the Brooklyn-Queens Expressway. Lastly, promoting public transit in the area will also help to alleviate local traffic in the sector. In the 20-year-needs assessment, the Metropolitan Transportation Authority proposed extending the W line into Red Hook, which can contribute to taking traffic from Red Hook off the road, helping to further alleviate traffic.

Traffic Safety and Environment

All transportation planning in New York City needs to carefully consider the traffic safety and environmental impact of the new construction. For the new Brooklyn-Queens Expressway, reducing traffic congestion can serve to improve both safety in the area and contribute to a cleaner environment. By allowing for three wide lanes in each direction, the aim is for the cantilevered section of the Brooklyn-Queens Expressway to improve traffic flow. Decreased traffic congestion will reduce air pollution and will lessen the number of harmful emissions. This will benefit the Brooklyn Heights community, especially with the Brooklyn Heights promenade directly above the Brooklyn-Queens expressway.

Additionally, it is important to maintain the existing traffic capacity while keeping the road safe. Our design seeks to minimize congestion and safety hazards on the local streets. Additionally, keeping motorists off the city streets will reduce the number of cars and trucks that are in proximity with pedestrians and cyclists. Illustrations of the significance of these measures can be found in many incidents throughout history. One illustration is the collapse of the West Side Highway in 1973 due to the weight of a truck traveling to repair the road. This event serves as a reminder of the importance of maintaining infrastructure of highways nationwide to ensure public safety. By

optimizing traffic flow and ensuring structural integrity and rehabilitation of our structure, our plan will hopefully create a safer environment for both commuters and residents of New York City.

Constructability

Our group anticipates that this project will be challenging to construct. The cost of the project will most likely be upwards of $3 billion. This includes the steel deck for the highway, new asphalt pavement, concrete columns, pavement markings, and the associated labor. Additionally, following the completion of the project, the old infrastructure will be demolished. Ensuring the safe demolition of the existing lower level of the cantilever is anticipated to substantially add to the cost. This reconstruction is anticipated to cause closures for several months over the course of the project.

Additionally, there are a lot of nuances of the project that will add to the complexity of the construction phase. Along with the safety concerns, it is important to ensure that the new segment of the expressway is properly connected at both the Eastern and Western end. A temporary structure will need to be built over the Brooklyn Bridge ramp along with over the promenade. This temporary structure may be a prefabricated roadway to help reduce costs and shorten the construction timeline. Along with the connections to both ends, it is important that the local connections and exits before and after the new segment are maintained as well if there are to be detours along those routes. The most challenging connection would be the Atlantic Avenue entrance, as that is connected to the existing cantilever and would have to cease operations for a substantial timeframe. Access to and from Columbia Street may be limited due to this issue as well. The potential for many closures and detours poses a challenging construction period and it is important to ensure that every aspect and detail is considered.

Community Contextual Compatibility

The Brooklyn Heights community is a staple of not just Brooklyn but New York City. The neighborhood is primarily residential, and its prized possession is the Brooklyn Heights Promenade. During the construction of the new segment of the expressway, the community will be greatly disturbed by the closures, and with the closure of Furman Street, no resident will have access to Brooklyn Bridge Park. Brooklyn Bridge Park contains many walking paths, bike paths, and even parking that may be utilized by some residents of not only Brooklyn Heights but nearby neighborhoods such as Park Slope and Caroll Gardens.

However, once construction is finished, a stabler and stronger infrastructure will be constructed for the Brooklyn Heights community, working to create a cleaner environment, reducing not only air pollution, but noise pollution as well. As has been seen on previous Brooklyn-Queens Expressway work, performing any work on the triple cantilever of the expressway will not be met with kind eyes, but it must be emphasized that the work is pivotal to ensure not only long-term residential improvements to public recreational spaces, but also to ensure public safety near the triple cantilever.

Additionally, to further enhance the community and visitor enjoyment, the closure of Furman Street would allow for improvement of the Promenade. During the same time as the rehabilitation of the cantilever, enhanced lighting systems and increased community event spaces may be implemented in order to please the residents.

Social Equity

Social equity is a crucial component of our proposed plan. It is important to ensure fairness and inclusivity in every transportation initiative throughout the five boroughs. We hope to distribute the cost of this project evenly, without discriminating against any specific demographic group. As traffic eases on the triple cantilever segment of the Brooklyn-Queens Expressway, this presents the opportunity for toll equalization on the East River crossings. The primary access point to the Brooklyn Battery Tunnel is just West of the triple cantilever segment and ensuring that people don't favor one route over another could substantially benefit the traffic patterns on the Brooklyn-Queens expressway and the people of the neighborhood of Brooklyn Heights. We acknowledge concerns about allocating funds solely to roadways. To address this, complementary facilities – such as public transit enhancements and pedestrian friendly infrastructure – will be explored. This provides valid reasoning for the use of public funds for all demographics.

Enforcement

Enforcement is the final impact of our plan. Without proper enforcement, traffic will not move smoothly, and the daily traffic will not see much improvement over its current state. One potential method of enforcement is increased tolling for existing routes, this will discourage unnecessary trips and alleviate potential traffic congestion. Congestion pricing will play a large role in the enforcement of this project, since any traffic entering the local roads of New York City through Brooklyn will get charged. This will serve to ease traffic on the Brooklyn-Queens Expressway further. Another method of enforcement is designating lanes for High-Occupancy Vehicles (HOVs) as discussed earlier. However, this will require either cameras on the expressway, or police cars stationed throughout the expressway.

If proper enforcement is placed throughout the Brooklyn-Queens Expressway, it may end up occupying valuable travel space for vehicles. Additionally, stationing police cars throughout the expressway most of the time will trigger a knee-jerk reaction to slow down, and with the traffic conditions of the Brooklyn-Queens Expressway, this can easily snowball into substantial congestion when all the police car is really enforcing are High-Occupancy Vehicles.

Existing Proposals

There are a few existing proposals to divert trucks and car traffic on the roadway while the triple cantilever undergoes reconstruction and repairs. One proposal is a temporary highway alongside the entirety of the section, to allow for all construction and reinforcements to be done. In this scheme, the Queens-Bound traffic will be on the top level, and the Staten-Island-Bound traffic will be on the bottom level, creating a bypass zone. The highway will take approximately one year to complete and will be expected to be used for two to three years to allow for the necessary repairs. However, the construction of this highway will both be expensive and greatly disrupt both the Brooklyn Heights neighborhood and Furman Street. A similar proposal was given as an option back in 2018 by the Brooklyn Heights Association but was met with fierce opposition. The proposal involved partial demolition and obstruction of the Brooklyn Heights Promenade to allow for the construction of a temporary six lane highway. However, many locals opposed the proposal because it threatens the cherished parks and increases air and noise pollution. The new proposal involving the temporary highway will not significantly affect the Promenade.

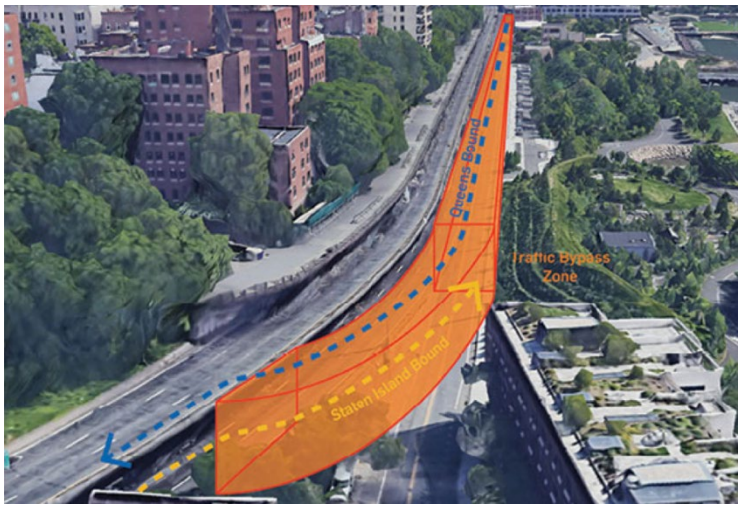

Figure 5: Proposed Temporary Highway

The other option for traffic diversion involves closing parts of the cantilever on certain nights and weekends to allow for repair work. However, this would mean that traffic would be diverted onto the side streets, which would result in large truck traffic through residential neighborhoods which can pose health and safety hazards. This plan can also potentially cause a lot of delays which increases expenses. Both options are being heavily weighed against existing traffic diversions in place by the New York City Department of Transportation.

There are three proposed design concepts for the triple cantilever section that are currently on the New York City Department of Transportation website as a long-term design consideration. The first of the proposed designs is called “The Terrace”. This design is most like the existing Brooklyn-Queens Expressway layout where traffic to the north and south are kept on separate levels. The design will cover the entirety of the triple cantilever in a cascading open space and create a unique recreational space stemming from the Brooklyn Heights Promenade to Brooklyn Bridge Park. There are two design concepts for this proposal, one of which will keep the elevation of the roof, while the other will lower the center portion of the roadway, bringing it down to Furman Street. The design calls for a partial replacement of the cantilever’s retaining walls. The partial replacement will mean that construction will have far lower impact for local communities. Covering this segment of the Brooklyn-Queens Expressway will allow for the installment of the necessary supports without intruding on the external environment. This will provide a challenge if any future rehabilitative work is required underneath the terraces.

Figure 6: Proposed Design - "The Terrace"

The second proposed design is called “The Stoop”. Like “The Terrace”, this design also calls for a partial replacement of the retaining walls. Traffic would be moved to a single level above Furman Street. This design allowed for the promenade to directly connect to the Brooklyn Bridge Park via a staircase, or The Stoop.

Figure 7: Proposed Design – “The Stoop”

Another proposed design is called “The Lookout”. This design calls for a full replacement of the cantilever’s existing retaining walls. Although construction would have a much greater impact on nearby neighborhoods than the previous two proposals, the completed design will minimize the footprint of the Brooklyn-Queens Expressway by reducing vibration and noise while increasing its lifespan. Traffic on the north and south lanes would be stacked on top of each other underneath the promenade. A larger promenade will cover the roadway, making it more visually appealing while also adding lots of open spaces both below and above the roadway at the promenade.

Figure 8: Proposed Design – “The Lookout”

All three proposals will likely be implemented with two lanes with a pullover shoulder lane instead of three to reduce pollution and increase safety.

Other Improvements

An improvement outside of an immediate rehabilitation project of the triple cantilever is "Vision Zero" by New York City. A common concern with the small lanes and the unsafe mergers of the Brooklyn-Queens Expressway is crashes. Whether the crash leads to stopped traffic, or a much larger concern of fatalities, vision zero proposes a method prevent crashes all together.

Mayor Adams announced that New York City's annual "Dusk and Darkness" campaign and traffic enforcement has returned. The campaign will focus on promoting vehicle and pedestrian safety during dark hours of the day. The department emphasizes vehicles to drive at a slower pace of 25 miles per hour, and slow 5-mile-per-hour turns are crosswalks. The program also expanded the city's speed cameras and increased the surveillance to 24/7. The policy implemented over 2000 speed cameras in 750 school zones. A 72% reduction in average speed has decreased the number of accidents and dangerous behavior. A 4-million-dollar campaign targeted speeding and dangerous driving, which was funded by the $900 million traffic safety plan by Mayor Adams. The $900 million will be distributed over five years, with the goal of improving New York City Street plans and transportation infrastructure. Approximately 300 blocks will be covered by the 2022 Open Street program. Finally, public service announcements across a multitude of platforms – YouTube, Instagram, and Facebook – have been raising awareness for the safety of bikers. More specifically, opening car doors while a biker to nearby.

The policies issued by the city of New York have been implemented to not only improve transportation infrastructure, such as the Brooklyn-Queens Expressway, but also street networks overall. With historic low crashes in New York City, new data and regulations will continue to improve the safety of all residents.

In addition to improving pedestrian accessibility through installation of ramps and plazas, the proposal of restricted hours for trucks would potentially address congestion concerns. For instance, peak traffic hours or high commuter activity may be particularly suitable for these limitations. Furthermore, the definition of trucks could also be categorized as purely transportation vehicles, for companies such as Amazon and FedEx.

Additionally, sustainability is a large goal and by creating pedestrian plazas and green spaces, we hope that our proposal will create a smaller carbon footprint. Lastly, we want to continue to ensure that public transit is promoted as a sustainable transportation option. By reducing the number of car lanes and reallocating curb space along the corridor, hopefully the use of personal vehicles will be discouraged. Furthermore, restricting truck hours can lead to a reduction in idling times and fuel consumption, directly contributing to a more environmentally friendly system.

Historical Perspective

The Brooklyn-Queens Expressway planning and construction were based on the idea of not infiltrating the surrounding neighborhoods and conserving space. The need for the roadway was due to the accommodation for the growing number of automobiles in the New York Area. Construction began to slow down as funding was reduced due to World War II. Post-war, the project began to accelerate, pushing the importance of having a connection between Brooklyn and Queens.

Constructed in the 1950s, the Brooklyn-Queens Expressway served a vital role in moving people and goods both locally and regionally in New York. The expressway is owned by both New York City and the State. Most of the ownership falls to the state – 88% - which spans 10.6 miles in the north and south areas of Brooklyn. The City owns 1.5 miles (12%).

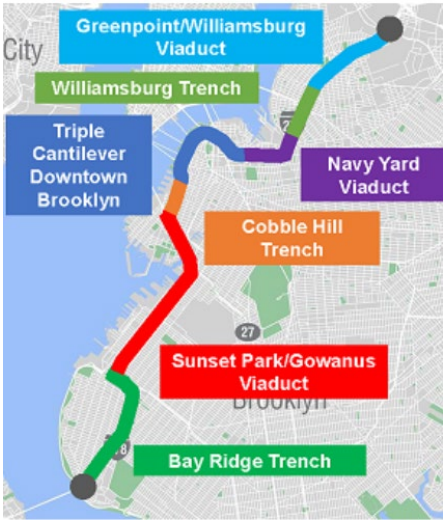

Figure 9: Segments of the Brooklyn-Queens Expressway

An issue seen by the Brooklyn-Queens Expressway throughout recent years is the narrow lanes. Unlike the typical 12-foot lane width of typical highways, the Brooklyn-Queens Expressway lanes are only 10.5 feet. The smaller lanes initially worked well for city streets, but now can no longer serve for the increase in automobile volume. Furthermore, the roadway does not have shoulders or breakdown lanes. Thus, a breakdown on the roadway would be detrimental to congestion as there are no lanes to account for an incident. Many drivers have also voiced their opinion on mergers, deeming the entrance to be unsafe and too short.

Shown in the New York City Department of Transportation's 2016 inspection of the expressway determined that significant repairs and replacement are needed. If immediate repairs are not conducted, then weight limits and truck diversions would be necessary. Further studies by the DOT showed that the current traffic loads and state of the cantilever predicted the remaining life to be up until 2021. Due to COVID, the data collected is slightly skewed, but sections of the Brooklyn-Queens Expressway have still been determined to be unsafe.

Transportation Policies

New York City has constructed policies to fix the immediate concerns of the Brooklyn-Queens Expressway. From the Bipartisan Infrastructure Law, new federal funds are available to restore the BQE throughout the 21st century. The following two initiatives have been discussed with the New York City Department of Transportation to incorporate the communities of "BQE Central" (Atlantic Avenue to Sands Street) and "BQE North and South" (throughout the remainder of Brooklyn).

During the restoration process, the New York City Department of Transportation will continue to tackle repairs and increase their inspections in order ensure the safety of commuters on the central section of the highway, which will incorporate both public complaints and street sensors.

The Regional Plan Association is a non-profit organization that assists government agencies to improve city and public policies. Regarding the Brooklyn-Queens Expressway, the Regional Plan Association has advocated for a diverse range of solutions to improve congestion and the deteriorating structure. Policies such as lane reduction, congestion pricing, elimination of ramps, and the improvement of local street networks were discussed.

The proposed policies by the Regional Plan Association are to discourage commuters from using the expressway, which would overall decrease the total loading on the cantilever and the volume of automobiles. Eliminating ramps and lanes would lead to a lesser inflow of vehicles. Finally, improving local street networks can allow commuters to not need the Brooklyn-Queens Expressway altogether.

Considering the impact of the CBD Congestion Pricing program is essential. The proposed policies aim to influence travel patterns and reduce the reliance of expressways. By discouraging commuters from traveling on high volume roadways, the pricing initiative not only addresses immediate congestion concerns but also environmental effects from pollution. As a result of the pricing, there will be an increase of vehicles in local networks as travelers begin to avoid expressways. Regarding the cantilever, there will be an increased use of High L. Carey Tunnel/ Brooklyn Battery Tunell as an alternative transportation method for the Brooklyn Bridge.

Additionally, the benefits associated with the $15 billion MTA Capital Improvements are substantial. The generated fundings would provide the opportunity to modernize New York City's transportation infrastructure. The funds could potentially be allocated towards maintenance of subway systems, increased public transit option, and the implementation of new technology to improve the safety of commuters. The MTA Capital Improvements can be infused with our proposal on constructing more security cameras and our rehabilitation designs for the BQE.

Due to the mayoral leadership change in New York City, with Eric Adams replacing Bill de Blasio as mayor, this change brought new priorities and approaches for the infrastructure of the Brooklyn-Queens Expressway. With the new Adams administration strategies, it is hoped that the rehabilitation of the cantilever will be successful.

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