The New York State Department of Transportation (NYSDOT) is preparing an Environmental Impact Statement (EIS) to evaluate alternatives for the rehabilitation or replacement of the Kosciuszko Bridge. Focusing on a 1.1-mile segment of the Brooklyn-Queens Expressway (BOE) between Morgan Avenue in Brooklyn and the Long Island Expressway (LIE) interchange in Queens, the EIS will examine five “Build” alternatives – two rehabilitation and three new bridge options – as well as a No Build alternative. Since all build alternatives, including the rehabilitation options, involve construction of a new bridge, the EIS will include detailed information regarding possible bridge design, construction methods and operations. The purpose of this booklet is to define and explain many of the engineering terms that will be used in the design and selection of new bridge concepts for this project.
COMPONENTS OF THE KOSCIUSZKO BRIDGE
There are two primary sections of the Kosciuszko Bridge: the superstructure and the substructure.

SUPERSTRUCTURE: the parts of the bridge that support and carry the roadway.

The Kosciuszko Bridge is a TRUSS bridge, which is a type of bridge that uses a series of steel triangles to support the roadway. Two types of trusses are used as part of the bridge:

THROUGH TRUSS: used for the portion of the bridge that crosses Newtown Creek to provide greater clearance for ships; the name refers to the fact that vehicles travel through the truss.

DECK TRUSS: used for the approach spans leading up to the creek, these trusses support the roadway from below.

The trusses support the FLOOR SYSTEM, which is made up of a series of steel beams and the DECK, on which vehicles travel.

ABUTMENT: a structure that supports the end of a bridge; on the Kosciuszko Bridge, the abutments are located at the ends of the deck truss in Brooklyn and Queens.
**SUBSTRUCTURE:** the parts of a bridge that rise from the ground and support the superstructure. Specific parts include:

**FOUNDATION:** the part of the structure that is underground and on which all the other parts rest. Where the ground is soft, piles made of either concrete or steel rods are driven or drilled into the ground to provide a solid base. On firm ground, wide concrete pads called a spread footings support the bridge. The Kosciuszko Bridge has both pile and spread footing foundations.

**PIER:** the vertical columns that rest on top of the foundation. Most of the bridge’s piers are made of concrete, except for the two piers on each side of Newtown Creek, which are steel.

**ADDITIONAL TERMS**

**VIADUCT:** a bridge consisting of a series of similar spans.

**WEARING SURFACE:** Concrete, asphalt or specialized materials laid on top of the deck on which vehicles travel. Replaced periodically as tires wear it away.

**Main Span**
The section of the bridge that carries traffic over Newtown Creek; the longest span in the Kosciuszko Bridge; also called the **CHANNEL SPAN**.

**Approach Span**

**SPAN:** the distance between consecutive piers of a bridge.
SELECTING A BRIDGE TYPE

BASIC CONSIDERATIONS

Before determining the type of bridge that is best for a specific location, engineers take a number of factors into consideration. They include:

SPAN LENGTH — The main span of the Kosciuszko Bridge is 300 feet, with its two steel piers located at the edge of Newtown Creek just barely in the water. A new bridge would have a longer main span, so that the new piers would not need to be placed in the water. This would reduce impacts to aquatic life and prevent a ship or barge from hitting the piers.

CONSTRUCTABILITY — How a bridge is constructed is often constrained by local site conditions. Access to the site for construction equipment, such as large cranes, is a factor that helps to define how a bridge is built.

COST — Bridge engineers strive to design the most economical structure possible for each project’s particular set of needs (bridge width, span length, surrounding development, etc.).

AESTHETICS — A new bridge should be an attractive structure, especially if it is a high level structure that can be seen from a distance. The existing Kosciuszko Bridge is visible from the nearby communities and from other roadways such as the LIE. It is even visible from the Empire State Building.

CONSTRUCTION DURATION — Both NYS DOT and the community want construction to be completed as quickly as reasonably possible. Different bridge types require different construction methods and can have very different durations.

COMMUNITY IMPACTS — All of the factors listed above must be balanced against any impacts to the community, including impacts on property, air quality, and noise. The Draft EIS will document the impacts associated with each of the alternatives.

Any time a bridge is built, these considerations are weighed against each other to come up with the best solution for the particular context. The Kosciuszko Bridge is in a congested urban setting with residences and commercial uses in close proximity; several businesses even operate underneath the bridge. Given that context, the following are several bridge types that will be considered for any new bridge built to either replace or complement the Kosciuszko Bridge.

BEAM BRIDGE

The modern version of a felled tree trunk spanning between two rocks, a beam bridge consists of steel or concrete beams (also called girders) between piers which are spaced at regular intervals.

Appropriate Span Length: 200 – 600 feet
Local Example: Williamsburg Bridge Approaches
Applicability to Kosciuszko Bridge Project: Suitable bridge type.

ARCH BRIDGE

The arch bridge uses a curve made of either steel or concrete to shift some of the weight of the bridge and vehicles to the abutments at either end.

Appropriate Span Length: 500 – 1,200 feet
Local Example: Henry Hudson Bridge (Route 9A)
Applicability to Kosciuszko Bridge Project: Arch would encroach on Newtown Creek marine vessel navigation.
**TRUSS BRIDGE**

Truss bridges consist of an assembly of triangles, which are made from a series of straight, steel bars. Long spans can be achieved by increasing the overall depth without drastically increasing the weight of materials.

**Appropriate Span Length:** 500 – 1,200 feet

**Local Examples:** Kosciuszko and Queensboro Bridges

**Applicability to Kosciuszko Bridge Project:** Suitable bridge type.

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**CONCRETE SEGMENTAL BRIDGE**

A concrete segmental, or box girder, bridge is a particular type of beam bridge where the girders and deck are combined in a single trapezoidal hollow section. It is assembled in small segments which are later connected.

**Appropriate Span Length:** 200 – 600 feet

**Local Examples:** JFK Airtrain Viaduct, BQE Connector Ramp to Williamsburg Bridge

**Applicability to Kosciuszko Bridge Project:** Suitable bridge type.

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**CABLE-STAYED BRIDGE**

Cable-stayed refers to a type of bridge where the deck is supported by straight cables attached to the top of towers. The towers are built first and then deck sections and stays are attached progressively.

**Appropriate Span Length:** 600 – 1,800 feet

**Local Example:** None

**Applicability to Kosciuszko Bridge Project:** Long span bridge type not economical for short Kosciuszko Bridge main span.

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**EXTRADOSED BRIDGE**

The extradosed bridge type is a relatively new form which combines a cable-stayed bridge and a segmental bridge. The cable stays and the deck work in combination, allowing the deck to be more slender than a typical segmental bridge and the towers to be shorter than a typical cable-stayed bridge.

**Appropriate Span Length:** 300 – 900 feet

**Local Example:** None

**Applicability to Kosciuszko Bridge Project:** Suitable bridge type.

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**SUSPENSION BRIDGE**

In suspension bridges, the roadway hangs from massive steel cables, which are draped over two towers and secured into solid concrete blocks, called anchorages, at both ends of the bridge.

**Appropriate Span Length:** 1,500 feet and up

**Local Example:** Williamsburg Bridge

**Applicability to Kosciuszko Bridge Project:** Long span bridge type not economical for short Kosciuszko Bridge main span.
In recent years, NYSDOT has worked closely with communities to minimize construction-related impacts on residents, businesses, and community facilities. Some of the measures for avoiding impacts are straightforward; others are the result of technological innovations. They include the following:

MAINTAINING TRAFFIC DURING CONSTRUCTION

As with any project involving a key link in the existing transportation network, maintaining traffic during construction is critical. NYSDOT has committed to maintaining 6 lanes of traffic on the BQE across Newtown Creek (3 in each direction) and all existing ramp connections throughout construction, to minimize the number of vehicles that might use local streets to avoid the construction area. However, to accomplish this, in some places it is necessary to construct temporary structures or ramps.

For example, at the Vandervoort Avenue and Van Dam Street ramps in Brooklyn, each of the alternatives will reconstruct the existing ramp structures. Each alternative includes the provision of temporary ramps adjacent to the existing ones to allow vehicles to enter and exit the highway during ramp reconstruction.

As shown in the diagram at right, each of the alternatives also includes the reconstruction of the existing viaduct to just west of Morgan Avenue, where the previous Meeker Avenue viaduct project terminated. This section cannot be reconstructed with traffic operating on it. Therefore, a temporary structure must be constructed so that this section can be reconstructed one half at a time (the eastbound lanes and then the westbound lanes). As shown in the diagram at right, it is necessary to transition traffic off the structure some distance before the work area, in order to maintain smooth traffic operations. To minimize the impact on the residences located on the north side of Meeker Avenue, all temporary structures in this section will be constructed on the south side of the viaduct.

HOURS OF CONSTRUCTION

Traditionally, construction work is performed during daytime hours, Monday through Friday. More recently, agencies are considering accelerated construction schedules that use multiple shifts during the day or 24-hour, 7 day-a-week schedules. While round-the-clock construction activity may reduce the length of time that a community is inconvenienced, it is not appropriate in all situations. For example, performing nighttime work adjacent to residential properties is typically inappropriate. On the other hand, nighttime construction may be the best option in industrial areas, particularly those that require daytime access to loading docks or other facilities. The Draft EIS will look closely at the needs of residential neighborhoods, business operations and other factors in order to minimize impacts.
CONSTRUCTION TECHNIQUES

During bridge construction, one of the noisiest activities can be the driving of piles. Pile drivers use a large hydraulic "hammer" to drive concrete or steel rods into the ground. Alternatively, drilled shafts can be used to reduce noise and vibration. Drilled shafts are constructed by drilling a hole in the ground, inserting a steel shaft, and then filling it with concrete. Construction duration can be reduced by fabricating large portions of steel or concrete structures off-site. These pieces can then be transported, by truck or barge, to the site where they are lifted into place. This can cut years off a large construction project.

Bridge construction typically starts from the bottom up, with the foundation constructed first, then the pier, and finally the superstructure, using large cranes to lift sections into place. An innovative construction method called "top-down construction" has been developed for use in environmentally sensitive areas. With this method, a special crane attached to the already completed section of roadway is used to put each section in place, eliminating the need to find space on the ground for a large crane.

TRANSPORTATION OF MATERIALS

While Newtown Creek's role as a shipping channel imposes certain requirements for any new bridge in terms of clearance height and placement of piers, it also presents an opportunity to reduce construction impacts on the community. Typically for a highway or bridge project, equipment (cranes, bulldozers, pavers) and materials (pre-cast sections, concrete, steel beams) must be brought in by truck. In an area such as this, that would mean more large trucks using the highway and local streets to access the site. However, because Newtown Creek is a navigable channel, materials and equipment could be brought in by barge, thereby minimizing the number of trucks traveling to the site.

COMMUNICATION WITH STAKEHOLDERS

In addition to the techniques mentioned above, one of the most important tools for reducing construction impacts on communities is open, ongoing communication. By working closely with surrounding communities and businesses during final design and construction, NYS DOT can better understand local concerns and adjust plans and contractor requirements to reduce project impacts. For example, as mentioned above, it may be appropriate to use different hours of construction in different areas. If a specific business receives all its shipments during a certain time period, it may be possible to schedule activity in that area during other times. This open line of communication can also help the agency more quickly respond to specific complaints concerning construction. Finally, informing the community of when and where disruptions will occur can help them plan accordingly and minimize inconvenience.
How to Contact Us

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