This document is provided for informational purposes only. The Design-Build Proposer shall not rely on this information in the preparation of a project Proposal. Please refer to the project’s Request for Proposal (RFP) for the final project requirements.
TABLE OF CONTENTS

1.0 Introduction .........................................................................................................................1
2.0 Superstructure Considerations ..........................................................................................4
3.0 Innovative/Unusual Structure .............................................................................................6
4.0 Geotechnical Considerations .............................................................................................6
5.0 Substructure Considerations .............................................................................................6
6.0 Construction Considerations ...............................................................................................7
  6.1 Construction Cost ..............................................................................................................7
  6.2 Life Cycle/Maintenance Requirements ...........................................................................7
  6.3 Constructability ................................................................................................................7
  6.4 Construction Material Delivery .......................................................................................8
  6.5 Construction Duration ......................................................................................................8
7.0 Architectural Considerations ..............................................................................................8
8.0 Work Zone Traffic Control .................................................................................................8
9.0 Utilities ..............................................................................................................................8
10.0 Asbestos ..........................................................................................................................8
11.0 Contaminated/Hazardous Waste ....................................................................................9
12.0 Conclusion and Recommendation ..................................................................................9
### Westbound Exit Ramp – Vandervoort Avenue to Varick Avenue

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Proposed</th>
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<tr>
<td><strong>YEAR BUILT:</strong></td>
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<td>Anticipated 2020</td>
</tr>
<tr>
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<td><strong>SPAN LENGTH:</strong></td>
<td>Span 59 through 70: 19’-8”</td>
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<td><strong>WIDTH:</strong></td>
<td>23’-0”</td>
<td>39’-0”</td>
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<tr>
<td><strong>SUPERSTRUCTURE:</strong></td>
<td>Concrete Slab</td>
<td>Concrete Slab on Expanded Polystyrene Fill</td>
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<tr>
<td><strong>SUBSTRUCTURE:</strong></td>
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<td>NA</td>
</tr>
<tr>
<td><strong>SKEW:</strong></td>
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### Westbound Exit Ramp – at Varick Avenue

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>YEAR BUILT:</strong></td>
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<td>Anticipated 2020</td>
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<tr>
<td><strong>NO. OF SPANS:</strong></td>
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<tr>
<td><strong>SPAN LENGTH:</strong></td>
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<tr>
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<td><strong>SKEW:</strong></td>
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<tr>
<td>Westbound Exit Ramp – Varick Avenue To Brooklyn Approach</td>
<td>Existing</td>
<td>Proposed</td>
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<tr>
<td>----------------------------------------------------------</td>
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<tr>
<td>YEAR BUILT:</td>
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<td>SUPERSTRUCTURE:</td>
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<td>SUBSTRUCTURE:</td>
<td>Concrete piers on spread footings, Concrete closure walls with brick veneer</td>
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This Structure Justification Report (SJR) describes the structural alternatives that were considered for the replacement of the Westbound Exit Ramp of the Kosciuszko Bridge and identifies the strengths and weaknesses of each option.

The existing structure will be replaced to accommodate the operational and geometric improvements of the Brooklyn-Queens Expressway (BQE) that are scheduled under four contracts of the Kosciuszko Bridge Project. See the November 2011 SJR - BIN 1-07569-9 for further information regarding the Kosciuszko Bridge Project. The ramp is adjacent to the westbound BQE mainline of the Brooklyn Connector and provides access to local street traffic from the westbound BQE. The BQE is identified as an urban principal arterial interstate.

The existing Westbound Exit Ramp is a 20 span Brooklyn bound ramp located between Van Dam Street and the Brooklyn Approach east of Varick Avenue and is part of the Brooklyn Connector. The Brooklyn Connector (spans 1 through 78), which was constructed in 1939 and modified in 1971, is a low level viaduct that extends from west of Morgan Avenue to east of Varick Avenue in Brooklyn. For more information on the Brooklyn Connector please refer the SJR – BIN 1-07569-9. The existing Westbound Exit Ramp, with the exception of the local street crossing over Varick Avenue, consists of reinforced concrete deck slab that is monolithic with reinforced concrete cap beams and supported by individual reinforced concrete columns on spread footings. The area below the ramp is enclosed by reinforced concrete walls with brick veneer. The existing span over Varick Avenue is a concrete rigid frame. The existing ramp is approximately 23 feet wide and carries one lane of westbound traffic.

The alternatives considered for the replacement of the Westbound Exit Ramp, which are the same as those considered for the replacement of the Brooklyn Connector, are as follows:

- Expanded Polystyrene (EPS) Fill
- Retained Earth

These two options eliminate the need for structure and therefore will have minimal maintenance requirements and have significantly lower construction costs. Also, since this structure would be enclosed by precast concrete closure walls under any option, these non-structure alternatives would have identical aesthetics as structure alternatives. Therefore, structure alternatives, such as steel and concrete girders were eliminated from consideration. For a more detailed discussion of the structure alternatives see the SJR – BIN 1-07569-9.

The proposed ramp structure is shorter than the existing ramp structure and will have a constant width of 39'-0" of which includes the bikeway/walkway. The proposed ramp structure will meet the mainline structure west of Varick Avenue. The proposed span over Varick Avenue will be considered part of the mainline structure.

The proposed ramp alignment will contain one 12'-0" wide travel lane. The left shoulder will be 3'-6" wide and the right shoulder will be 6'-6" wide. There will be one concrete barrier located between the bikeway/walkway and the right shoulder of the roadway, and another outside the left shoulder and adjacent to the westbound mainline structure. The north fascia will contain a vertical concrete parapet.

The exit ramp will be constructed in two stages with the ramp roadway being constructed concurrently with the westbound BQE mainline roadway, and the bikeway/walkway constructed in a subsequent stage. The new exit ramp will be located to the south of the existing exit ramp.
and within the footprint of the existing bridge.

The existing eastbound BQE mainline and entrance ramp will be demolished and the proposed westbound BQE and westbound exit ramp roadway will be built within its footprint. Once all traffic is transferred to the new structure, the existing westbound structure and exit ramp will be demolished. The new bikeway/walkway will then be constructed within its footprint.

The bikeway/walkway must be constructed in a separate stage because it overlaps the existing westbound BQE mainline roadway. The existing westbound BQE mainline and exit ramp must remain in service until the proposed westbound mainline is constructed and fully operational.

An EPS fill structure is the preferred structure type for this exit ramp to be consistent with this segment of the Brooklyn Connector considering there are no local street crossings or overhangs. See Section 2.0 for a discussion of the structural alternatives.

2.0 Superstructure Considerations

In coordination with NYSDOT, the bridge types described below were developed by a team of bridge engineers and bridge architects with the overall goal of providing an attractive, economical structure that is an appropriate solution for each segment described above.

Alternative 1: Expanded Polystyrene (EPS) Fill

Alternative 1 consists of composite pavement slab supported on a layer of earth fill, a reinforced concrete slab, and below, the EPS. The earth fill would be a minimum of 4 feet thick to prevent differential icing in accordance with NYSDOT requirements and as recommended in NCHRP Web Document 65, Geofoam Applications in the Design and Construction of Highway Embankments. The EPS fill would consist of large blocks that would be glued together using an adhesive and that would be founded on a gravel leveling course. All surfaces of the EPS would be protected with a petroleum-compatible polymer geomembrane. The pavement slab would also serve to anchor the precast concrete side walls that would enclose the fill.

This system would be enclosed by precast concrete wall panels. This would match the preferred alternative for the mainline in this segment of the Brooklyn Connector. The EPS is furnished in blocks that will provide a self standing alternative to M.S.E.S. walls or other retained earth alternatives. In addition, since this segment of the connector would be enclosed regardless of the alternative chosen, the EPS-alternative would provide identical aesthetics to the structural alternatives. The proposed ramp would be constructed concurrently with and abutting the eastbound mainline. See Figure 2.1. There would be a cast-in-place solid concrete pier located on the west side of Varick Avenue. The solid pier would be supported on cast-in-place concrete piles.

The use of EPS as the fill material would provide advantages over an earth fill alternative. Benefits of utilizing an EPS-embankment include: (1) significant reduction in truck traffic that would be required to place earth fill, (2) ease and speed of construction, (3) elimination of the possible need for preloading and surcharging and (4) little to no lateral load on the side walls or abutments. This would allow the end pier at Varick Avenue to be designed primarily as a solid concrete pier, and not an abutment, thereby minimizing the numbers of piles required.
When compared to a retained earth alternative, the use of EPS fill would minimize the number of truck loads to the highly congested area, one of the stated objectives of the EIS. Standard EPS blocks are 8’ x 4’ x 3’ and are relatively mass less. The EPS blocks can be brought to the site by tractor trailer (flatbed or closed box) and quickly offloaded and placed. When compared to the use of earth fill, it is estimated that approximately 80% fewer truck trips would be involved.

The EPS fill alternative has an initial construction cost that would be somewhat higher but comparable to a retained earth alternative. The advantage of minimizing truck traffic and the shorter construction duration when compared to a retained earth alternative outweigh the slightly higher initial construction cost. In addition, since this segment of the connector would be enclosed regardless of alternative chosen, the EPS fill alternative will provide identical aesthetics to the more expensive structural alternatives.

Alternative 2: Retained Earth

Alternative 2 is similar to Alternative 1 except an earth fill, utilizing Mechanically Stabilized Earth System (M.S.E.S.) walls, would be provided instead of EPS fill. The proposed ramp roadway would be constructed concurrently with and abutting the westbound mainline in the first stage. The bikeway/walkway would be than constructed right up to the face of a temporary G.R.E.S. wall that will be constructed at the limit of the previous stage.

A modular (T-Wall) system was also investigated but the necessity of installing the proposed bikeway/walkway on the north side of the mainline in a separate stage would prohibit the use of the system. The vertical height would require a larger stem length for the modular system than what could be installed within the limited horizontal width of the bikeway/walkway construction stage. The visual appearance of a T wall system would also not be consistent with the remaining portions of the enclosure walls.

Although the initial construction cost of an M.S.E.S. wall alternative is slightly lower than that of an EPS fill alternative, there is one primary disadvantage when compared to the EPS fill. The primary disadvantage of this option is the logistics of transporting the earth fill to the job site, as the number of trucks would be significantly higher than that for the EPS fill alternative.
Secondary issues could include anticipated longer construction duration, due to the need to place and compact the fill, the possibility for settlement that could impact any local utilities, and the possible difficulty in obtaining sufficient suitable fill.

3.0 Innovative/Unusual Structure

As per Section 20.2.2 of the NYSDOT Bridge Manual the Westbound Exit Ramp is not considered an unusual structure. However, the Kosciuszko Bridge Project as a whole is considered a complex project due to the geometric constraints of the replacement structure being located within the tight transportation corridor and the intricate construction staging and contract breakdown required to maintain traffic on this critical interstate highway.

4.0 Geotechnical Considerations

A geotechnical subsurface investigation was performed between September and November 2009. The full results of this investigation can be found in the Preliminary Geotechnical Report included in Appendix B. The investigation included sixteen (16) 4-inch diameter boreholes.

Based on the results of the subsurface investigation the soil/rock stratigraphy above bedrock at the project site can be generally described in the following 5 sections:

- Stratum 1: Fill;
- Stratum 2: Organic Deposits
- Stratum 3: Silty Sand
- Stratum 4: Silty Clay
- Stratum 5: Decomposed Rock.

Strata 1 and 2 are not considered as suitable foundation bearing strata. Strata 3, 4 and 5 are considered adequate foundation bearing strata.

Stratum 3 exists at a depth of approximately 10 to 15 feet from the ground surface.

5.0 Substructure Considerations

Since the preferred alternative is to eliminate structure by providing an enclosed EPS filled ramp, no substructures, other than piles at the abutments will be required. It is recommended, subject to approval by the NYSDOT GEB that cast-in-place concrete piles be used at the abutments.

6.0 Construction Considerations

6.1 Construction Cost

The proposed Westbound Exit Ramp is part of the new Brooklyn Connector and will be constructed with the Connector, therefore, the construction cost estimates for this ramp are included with the estimates for the complete Brooklyn Connector. These costs are presented in
SJR – BIN 1-07569-9. These cost comparisons also show that the Retained Earth and EPS fill are significantly less expensive to construct than other structure alternatives.

6.2 Life Cycle/Maintenance Requirements

The NYSDOT will continue to be responsible for the maintenance of the Kosciuszko Bridge. All bridge types will require periodic inspection and maintenance, including cleaning and washing, and pavement re-stripping.

The EPS and Retained Earth alternatives will require minimal inspection and maintenance of the precast enclosure walls. All other bridge types would require bearing replacement at 20 to 30 year intervals. Painting of the structural steel elements can be minimized through the use of weathering steel, ASTM A 709 Gr. 50W, which could be unpainted except at roadway expansion joints and at fascia beams if they are exposed. It is expected that any painted steel elements would require recoating every 12 to 15 years.

6.3 Constructability

Since the proposed Westbound Exit Ramp would not cross any local streets, temporary night closures or local detours would not be expected for the specific construction of the ramp.

For the EPS fill alternative it is important that the site is prepared properly before installation of the blocks. The soil should not be frozen and there should be no debris or large pieces of vegetation protruding through the subgrade. Ideally there will be no standing water present although experience has shown that some standing water can be accommodated.

It is imperative that the blocks not be exposed to petroleum products or damaged before, during or after installation. If the blocks are to be stockpiled until placement, a secure area should be designated for this purpose. Shotcrete is typically used to protect the blocks during construction staging.

In general, the paving system can be constructed in the normal manner with only a few cautions related to the presence of EPS blocks. Vehicles and construction equipment such as earthmoving equipment must not directly traffic on the EPS. One construction procedure that can be used to minimize damage to the EPS blocks is to use relatively lightweight equipment to push approximately 12 inches minimum of soil or aggregate onto the EPS blocks before compacting the material. Typically placement of the first lift of unbound material is accomplished by pushing the material ahead using a relatively small bulldozer or front-end loader. Placement of additional unbound and bound layers of the pavement system can then be placed in the normal manner although trafficking of the surface by trucks or heavy equipment of all types should be minimized or avoided altogether until the pavement is completed. If necessary, temporary mats could be provided to distribute vehicle loads.

6.4 Construction Material Delivery

The delivery of construction materials for the exit ramp may be delivered to the site utilizing Newtown Creek for waterway delivery, or the Interstate Highway system and primary arterials in the vicinity for delivery by truck. There are numerous low clearance bridges in the area but the preliminary evaluation indicates that truck delivery is feasible for the Westbound Exit Ramp.
6.5  Construction Duration

Based on additional studies conducted as part of the initial stage of Final Design, the overall construction duration is expected to be performed under 4 construction contracts anticipated for the Kosciuszko Bridge Project. The Kosciuszko Bridge Project has a minimum estimated overall construction duration of approximately 6 years. The overall construction duration would be similar for any of the structure types considered.

7.0  Architectural Considerations

The Brooklyn Connectors and ramps, although not as bold as the signature main span and approaches, should still be noteworthy additions to the Kosciusko Bridge Project, as well as efficient and functional modes of connection to the bridge.

The Westbound Exit Ramp will be enclosed on the north side by precast concrete enclosure walls, on the south side by the adjacent mainline structure. The precast panels will have a vertical architectural pattern. Enclosing the structure will provide a simple facade and keep the area beneath the pavement free from debris.

Architectural features will be included in the design of the structure to address the aesthetic concerns of the community.

8.0  Work Zone traffic Control

The roadway of the Westbound Exit Ramp will be constructed concurrently with the adjacent westbound Brooklyn Connector. Traffic will be maintained on the existing exit ramp until the proposed ramp roadway is completed. Traffic will then be shifted to the new roadway and the existing westbound structure will be demolished and the bikeway/walkway constructed within its footprint.

See Appendix D for the construction staging of the overall project.

9.0  Utilities

The Brooklyn Connector and Westbound Exit Ramp will be designed to allow construction in an elaborate network of subterranean and overhead utilities. Please see Section 4.8 of the Connector SJR for more information regarding utilities affected in this area of the Kosciuszko Bridge project.

10.0  Asbestos

The inspection of the existing bridge structure identified several locations of suspect asbestos containing materials along the length of the Brooklyn Connector and in the materials found inside the structure’s storage areas. The suspect materials include bond breaker, ebony boards, arc shields, floor tiles, window caulk, debris, waterproofing membrane, and pipe wrap and insulation on utilities to be relocated.

See the Asbestos Assessment and Design Report for further information. The report provides the results from the field investigation including asbestos materials identified, location, type and
quantity found. Appropriate handling and disposal procedures will be specified in the construction documents.

11.0 Contaminated/Hazardous Waste

Several environmental investigations completed for the project identified soil and groundwater across much of the project site with volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and polychlorinated biphenyls (PCBs), likely as a result of the historic industrial nature of the area. Construction of the Brooklyn Connector foundations will require excavation and dewatering in areas of known contamination. The Meeker Avenue Chlorinated Solvent Plume and the Greenpoint Underground Oil Spill are sources of contamination along the Brooklyn Connector. Please see Section 4.10 of the Connector SJR for more information regarding contaminated/hazardous waste in the vicinity of the Brooklyn Connector.

12.0 Conclusion and Recommendation

Based on the parameters discussed relating to the technical criteria, construction methodology, initial construction costs, and future maintenance costs of each option, the preferred alternative for the Westbound Exit Ramp is apparent.

The EPS fill alternative provides the identical aesthetic appearance of any structural alternative, a comparable initial construction cost to retained earth with considerably fewer delivery trucks needed during construction, and the lowest long term maintenance costs. For these reasons the EPS system is the preferred alternative.

Signature/Title: _______________________________________

Date: _______________________________________

9