New York State
Department of Transportation

Replacement of Kosciuszko Bridge (I-278) Over Newtown Creek
Kings and Queens Counties, NY
40% Design Submittal

Value Engineering Study Report

May 2012

Designer

Value Engineering Consultant
Mr. Robert Adams  
Project Manager  
New York State Department of Transportation  
4740 21st Street, Fifth Floor  
Long Island City, New York 11101

Subject:  
Replacement of Kosciuszko Bridge Over Newtown Creek  
Kings and Queens Counties, New York  
Value Engineering Study Report

Dear Mr. Adams:

ARCADIS is pleased to submit the subject value engineering (VE) study report documenting the events and results of the VE study conducted April 30-May 4, 2012. Included in the alternatives developed by the VE team are quantifiable and non-quantifiable cost reduction ideas and means for enhancing the request for proposal to procure a qualified, cost effective design-build contracting team.

We wish to take this opportunity to thank you and Olga for your support during this effort. Please do not hesitate to call if you or any reviewer has questions about the alternatives presented.

Sincerely,

ARCADIS of New York, Inc.
Howard B. Greenfield, PE, EVS  
Vice President

Copies:
Michael Mariotti, NYSDOT VE Coordinator
# TABLE OF CONTENTS

## SECTION ONE – EXECUTIVE SUMMARY
- INTRODUCTION ........................................ 1
- PROJECT DESCRIPTION .......................... 1
- CONCERNS AND OBJECTIVES ................. 2
- RESULTS OF THE STUDY ....................... 2
- CONSIDERATIONS AND ASSUMPTIONS ...... 4
- SUMMARY OF VE ALTERNATIVES ............ 5

## SECTION TWO – STUDY RESULTS
- GENERAL ............................................. 9
- KEY ISSUES ........................................ 10
- STUDY OBJECTIVES .............................. 10
- RESULTS OF THE STUDY ....................... 11
- EVALUATION OF ALTERNATIVES AND DESIGN SUGGESTIONS .......................... 17
- VE ALTERNATIVES ................................ 19

## SECTION THREE – PROJECT DESCRIPTION ........................................ 103

## SECTION FOUR – VALUE ANALYSIS AND CONCLUSIONS
- PREPARATION EFFORTS ............................ 118
- VE WORKSHOP EFFORT ........................... 118
- POST WORKSHOP EFFORT ......................... 123
- WORKSHOP PARTICIPANTS ....................... 125
- ECONOMIC DATA .................................... 128
- COST MODEL ........................................ 129
- FUNCTION ANALYSIS ............................. 132
- CREATIVE IDEA LISTING AND EVALUATION OF IDEAS .......................... 135
SECTION ONE – EXECUTIVE SUMMARY

INTRODUCTION

This value engineering (VE) study report documents the events and results of the VE study conducted by ARCADIS of New York, Inc. for the New York State Department of Transportation (NYS DOT). The subject of the study was the Replacement of Kosciuszko Bridge (I-278) Over Newtown Creek, Kings and Queens Counties, New York (P.I.N. 729.77). Working with NYS DOT to develop the project is the Parsons Brinckerhoff/Hardesty & Hanover team which has brought the project to the 40% stage of development that served as the basis of the VE team’s work. The study was conducted April 30-May 4, 2012 in the NYS DOT Region 11 office in Long Island City, New York.

The VE team was comprised of a multi-disciplinary group of highway bridge specialists including bridge engineers, bridge architect, construction specialist, environmental specialist and a Certified Value Specialist (CVS) team leader. The following VE Job Plan served to guide the deliberations of the team:

- Information Gathering Phase (including a site visit)
- Function Analysis Phase
- Creative Idea Generation Phase
- Evaluation/Judgment Phase
- Alternative Development Phase
- Presentation Phase

PROJECT DESCRIPTION

This project will replace the existing 70-year old Kosciuszko Bridge Over Newtown Creek which carries 160,000 vehicles per day in six lanes between Kings and Queens Counties. The current plan includes building a new eastbound bridge with two through lanes, and three collector-distributor lanes to the east of the existing bridge using a design-build (DB) contract, demolish the existing bridge using a second contract, and building a new four-lane bridge in the footprint of the existing bridge, using the design-bid-build approach.

Structure Justification Reports have been developed for each of the bridge structures comprising the project. Starting at the Queens’ terminus, the at-grade connections to the Long Island Expressway (LIE) will be modified, leading to the bridge approach viaduct, beginning just west of the 54th Avenue underpass. The preferred construction of the Approach Spans, which are set at about 180 ft., is two precast concrete box girders per direction, erected using the span-by-span approach, each sitting on a vertical pier supported on piles. The Queens approach will connect to a preferred cable-stayed bridge for the main span over Newtown Creek to create a “signature” bridge to mark the entrances to the two boroughs. In the preferred concept, the westbound pylon is situated on the east side of Newtown Creek and the eastbound pylon is situated on the west side of Newtown Creek. The bridge pylons will extend 298 ft. above the ground level and be supported on 6 ft. diameter drilled
shafts. An “H-shaped” pylon has been selected to support the cables. The bridge will provide a 90 ft. clearance over the creek’s high water level.

This will lead to the Brooklyn Approach Spans, which will use the same construction as the Queens side. The Brooklyn approach will end at a fill section, the Brooklyn Connector, which will consist of precast concrete panels encasing a block of polyethylene fill material that will support a thin soil layer and the roadway pavement. Where local streets have to cross under the highway, bridge structures will be constructed. The Brooklyn Connector terminates with a short viaduct section that connects to the Meeker Avenue Viaduct.

The project includes: local streetscaping, environmental remediation, bridge and highway lighting, local street lighting, utility relocations, demolition of buildings within the new right-of-way, stormwater drainage, ITS work, and the construction of three new parks. The estimated construction cost, in 2010 dollars, is approximately $690 million and the project is scheduled to be completed in 2020.

CONCERNS AND OBJECTIVES

This project has been in the development stage for about 10 years, with many meetings and community interactions. Preferred structure types have been identified through this process and the development of the Structure Justification Reports. Recently a decision was made to change the contracting approach for the demolition of the buildings in the right of way and construction of the eastbound roadway from a design-bid-build approach to the design-build (DB) approach. Under a DB scenario, the way the project is presented changes from being prescriptive to more performance based. There is also a desire to provide a “signature” bridge for the entrances to the Queens and Brooklyn communities. The project is also being constructed in an area where the ground water and soils are contaminated, after many years of industrial use of the land, which poses a risk to the eventual contractors.

To assist NYSDOT and the design team achieve these goals in a cost-effective manner, NYSDOT engaged this VE study. The objective of the study was to identify specific ideas that could be implemented in the project documents to enhance the project team's ability to have a cost effective and lower risk project.

RESULTS OF THE STUDY

The VE team brainstormed numerous options for enhancing the value of the project, in terms of fine-tuning the request for proposal (RFP) for the design-build contracting team, saving project costs, and improving the performance of the final project. To provide a RFP that will produce the best responses from potential DB teams, the VE team suggests the following be incorporated into the RFP:

1. Since the properties adjacent to the proposed alignment have already been acquired by the Department, issue a separate contract or multiple contracts to demolish those properties and clear the widened right-of-way for the use of the DB contractor. This will allow the DB team to begin construction immediately on a “cleared site” and thus save some schedule time.
2. Include a milestone for completing the eastbound bridge roadway construction and shifting six lanes (three eastbound and three westbound) of the Brooklyn Queens Expressway (BQE) traffic onto the newly constructed eastbound bridge. Specify the maximum number of days allowed to meet the milestone. Allow the bidders to bid less number of days to meet the milestone. Incorporate this item in the bid evaluation matrix.

3. Include daily liquidated damages for not meeting the milestone in number 2.

4. Identify all potential staging areas beyond the area within the footprint of the new roadway.

5. Investigate if the materials can be brought to the site by rail and by trucking as back-up modes of material delivery. Cast-in-place concrete for the pier foundations and some of the connector structures will most likely be delivered by trucks. Identify convenient trucking routes from Brooklyn and Queens to the project site.

6. Allow the contractor to set a concrete batch plant on site, if desired.

7. To reduce confusion, identify that the entire length of the project has contaminated soils and include all available information regarding ground contamination to the DB contract bidders. Do not specify any clean areas.

8. Identify the areas of archeological sensitivity and, in coordination with State Historic Preservation Office (SHPO), develop a protocol to be followed by the DB contractor and include that in the RFP documents. This may entail a need for a certified archeologist to be on-site during all excavation and drilling operations to monitor the process and to scour the excavated materials for sensitive remains. This action will minimize the project premium by managing the uncertainty.

9. Investigate and develop a suggested list of acceptable and unacceptable actions for the construction of pier foundations in coordination with the environmental compliance agencies. Make this list available to the DB contract bidders marked “For Information Only.” Stipulate that the bidders must develop means and methods to construct the bridge foundations or any other below ground structures by complying with all environmental regulations. This action will minimize the project premium by managing the uncertainty.

10. Identify in the RFP document that the designer of the eastbound Main Crossing shall also design the westbound Main Crossing. For the third and the last major contract of this project, the Prime Consultant (the designer) of the westbound BQE, within the Design-Bid-Build (DBB) project limits, shall retain the services of the designer of the westbound Main Crossing as a subconsultant for any updates required, coordination between the Main Crossing and the approaches and to provide engineering support services during construction of that DBB contract.

11. Plan an overlap between Contract 2: Demolition of the Existing Bridge and Contract 3: Construction of the Westbound Crossing. This will minimize the overall project schedule. Specify the areas that need to be demolished first, so that the Contract 3 Contractor can follow the Contract 2 Contractor and start building the westbound crossing. Construction of the Main Crossing and the approach viaducts up to certain length will be easier to construct first and can be followed by the tie-ins in the connector areas. From the demolition perspective, demolishing the Main Crossing first may have advantage of having access from the approaches to the bridge deck level.

12. Include only one park located south of the Eastbound Crossing in Brooklyn, in the Design-Build contract. Include the other two parks (one in Brooklyn and one in Queens) in the contract for the Westbound Crossing.

Suggestions are also included for ways to describe the project requirements in the RFP for the DB contract for the Eastbound Crossing, the Basic Project Configuration, alternatives for the Main Crossing and alternatives for the Approach Spans.

In addition, several alternatives were developed with identifiable cost savings and several design suggestions with non-quantifiable cost savings, performance improvements, or options for achieving the
desired aesthetic features of the project. Each alternative is identified with an Alternative Number (Alt. No.) (for tracking purposes) that has a letter prefix indicating the project element addressed; and a number indicating the order in which the original idea was conceived during the Creative Idea Generation Phase. All of the alternatives are summarized on the following Summary of Value Engineering Alternatives worksheets. The list below indicates those that could be implemented together to achieve the maximum cost savings for the project.

### TABLE OF ALTERNATIVES PRODUCING THE MAXIMUM POTENTIAL COST SAVINGS

<table>
<thead>
<tr>
<th>Alt. No.</th>
<th>Description</th>
<th>Potential Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS-9</td>
<td>Allow the use of a single precast concrete box girder in lieu of twin precast concrete box girders for the approach spans</td>
<td>$11,922,000</td>
</tr>
<tr>
<td>MS-19</td>
<td>For the Main Span use two tied arches with 450 ft. spans in lieu of cable-stayed bridges</td>
<td>$46,132,000</td>
</tr>
<tr>
<td>G-1</td>
<td>Lower the bridge clearance over Newtown Creek from 88 ft. 6 in. to 70 ft. 0 in.</td>
<td>$3,279,000</td>
</tr>
<tr>
<td>G-6</td>
<td>Combine the demolition of the existing bridge and the westbound bridge contracts together</td>
<td>$5,000,000</td>
</tr>
<tr>
<td>G-8</td>
<td>Reduce the eastbound roadway width from 94 ft. clear to 90 ft. clear</td>
<td>$17,012,000</td>
</tr>
</tbody>
</table>

**TOTAL POTENTIAL COST SAVINGS** $83,345,000

### CONSIDERATIONS AND ASSUMPTIONS

In the preparation of this report, and the alternatives and design suggestions that were developed, the VE team made some assumptions with respect to conditions that may occur in the future. In addition, the VE team reviewed the project documentation, relying solely upon the information provided by NYSDOT and Parsons, and relying on that information as being true, complete and accurate. This summary of considerations and assumptions should be read in connection with the report:

- The alternatives and design suggestions rendered herein are as of the date of this report. We assume no duty to monitor events after the date, or to advise or incorporate into the alternatives and design suggestions, any new, previously unknown technology.

- It is assumed that there are no material documents affecting the design or construction costs that the VE team has not seen. The existence of any such documents will necessarily alter the alternatives and design suggestions contained herein.

- We are not warranting the feasibility of these alternatives and design suggestions or the advisability of their implementation. It is solely the responsibility of NYSDOT and its design consultant team to explore their technical feasibility and make the determination of implementation.
## SUMMARY OF VALUE ENGINEERING ALTERNATIVES

**PROJECT:** REPLACEMENT OF KOSCIUSZKO BRIDGE (I-278) OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES  
*New York State Department of Transportation*

<table>
<thead>
<tr>
<th>ALT. NO.</th>
<th>DESCRIPTION</th>
<th>ORIGINAL COST</th>
<th>ALTERNATIVE COST</th>
<th>INITIAL COST SAVINGS</th>
<th>RECURRING COST SAVINGS</th>
<th>TOTAL PW LCC SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS-1</td>
<td>Allow the use of precast concrete segmental box girders using cantilevered construction for the approach spans</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AS-3</td>
<td>Allow the use of galvanized or weathering steel girders in lieu of concrete box girders for the approach spans</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AS-5</td>
<td>Use a single inverted delta pier in lieu of two vertical piers for the approach spans</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AS-9</td>
<td>Allow the use of a single precast concrete box girder in lieu of the twin precast concrete box girders for the approach spans</td>
<td>$225,556,000</td>
<td>$213,634,000</td>
<td>$11,922,000</td>
<td></td>
<td>$11,922,000</td>
</tr>
</tbody>
</table>
## SUMMARY OF VALUE ENGINEERING ALTERNATIVES

**PROJECT:** REPLACEMENT OF KOSCIUSZKO BRIDGE (I-278) OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES  
*New York State Department of Transportation*

<table>
<thead>
<tr>
<th>ALT. NO.</th>
<th>DESCRIPTION</th>
<th>ORIGINAL COST</th>
<th>ALTERNATIVE COST</th>
<th>INITIAL COST SAVINGS</th>
<th>RECURRING COST SAVINGS</th>
<th>TOTAL PW LCC SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MAIN SPAN</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-1</td>
<td>Use a tied arch structure in lieu of a cable-stayed bridge for the main span</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-3</td>
<td>Use a &quot;V-shaped&quot; tower for both main span cable-stayed bridges in lieu of the &quot;H-shaped&quot; towers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-8</td>
<td>Use multiple tied arches in lieu of the cable-stayed bridge for the main span</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-11</td>
<td>Prescribe the configuration of the main span bridge after additional community outreach</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-12</td>
<td>Use a cable-stayed bridge for the eastbound roadway only and use a box girder for the westbound roadway</td>
<td>$696,739,000</td>
<td>$685,686,000</td>
<td>$11,053,000</td>
<td></td>
<td>$11,053,000</td>
</tr>
<tr>
<td>MS-14</td>
<td>Place the towers for both main span cable-stayed bridges on the west side of Newtown Creek</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-15</td>
<td>Use symmetrical cable-stayed main spans in lieu of staggered cable-stayed main spans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-16</td>
<td>Use staggered tied arches in lieu of staggered cable-stayed bridges for the main span</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-18</td>
<td>Use a partial &quot;W-shaped&quot; tower on the west side of Newtown Creek in lieu of &quot;H-shaped&quot; towers on either side of Newtown Creek</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-19</td>
<td>Use two tied arches with 450 ft. spans in lieu of cable-stayed bridges for the main span</td>
<td>$122,495,000</td>
<td>$76,363,000</td>
<td>$46,132,000</td>
<td></td>
<td>$46,132,000</td>
</tr>
<tr>
<td>MS-20</td>
<td>Use a &quot;V-shaped&quot; tower on the west side of Newtown Creek for the eastbound bridge and an &quot;A-shaped&quot; tower on the east side of Newtown Creek for the westbound bridge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PRESENT WORTH OF COST SAVINGS**
**SUMMARY OF VALUE ENGINEERING ALTERNATIVES**

**PROJECT:** REPLACEMENT OF KOSCIUSZKO BRIDGE (I-278) OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES  
*New York State Department of Transportation*

<table>
<thead>
<tr>
<th>ALT. NO.</th>
<th>DESCRIPTION</th>
<th>ORIGINAL COST</th>
<th>ALTERNATIVE COST</th>
<th>INITIAL COST SAVINGS</th>
<th>RECURRING COST SAVINGS</th>
<th>TOTAL PW LCC SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-1</td>
<td>Lower the bridge clearance over Newtown Creek from 88 ft. 6 in. to 70 ft. 0 in.</td>
<td>$37,201,000</td>
<td>$33,922,000</td>
<td>$3,279,000</td>
<td></td>
<td>$3,279,000</td>
</tr>
<tr>
<td>G-3</td>
<td>Evaluate the timing of the design build request for proposal release date considering other major projects locally and nationally</td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>G-5</td>
<td>Have the design build team design both cable-stayed main spans</td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>G-6</td>
<td>Combine the demolition of the existing bridge and westbound bridge construction contracts together</td>
<td>$5,000,000</td>
<td>$0</td>
<td>$5,000,000</td>
<td></td>
<td>$5,000,000</td>
</tr>
<tr>
<td>G-9</td>
<td>Reduce the eastbound roadway width from 94 ft. clear to 90 ft. clear</td>
<td>$381,079,000</td>
<td>$364,067,000</td>
<td>$17,012,000</td>
<td></td>
<td>$17,012,000</td>
</tr>
<tr>
<td>G-11</td>
<td>Provide public access to the waterfront</td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>G-12</td>
<td>Combine the environmental work for the westbound bridge into the eastbound bridge contract</td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>G-13</td>
<td>Change the vertical profile of the westbound roadway to be about 10 ft. lower than the eastbound roadway over Newtown Creek</td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
</tbody>
</table>
### SUMMARY OF VALUE ENGINEERING ALTERNATIVES

**PROJECT:** REPLACEMENT OF KOŚCIUSZKO BRIDGE (I-278) OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES  
*New York State Department of Transportation*

<table>
<thead>
<tr>
<th>ALT. NO.</th>
<th>DESCRIPTION</th>
<th>ORIGINAL COST</th>
<th>ALTERNATIVE COST</th>
<th>INITIAL COST SAVINGS</th>
<th>RECURRING COST SAVINGS</th>
<th>TOTAL PW LCC SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BROOKLYN CONNECTION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BC-2</td>
<td>Restrict the movement of pedestrians exiting the bridge on the Brooklyn side to reduce congestion at the Meeker Avenue intersection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
<tr>
<td><strong>PEDESTRIAN CONNECTION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC-1</td>
<td>On the Queens side, align the pedestrian connection to go under the ramp from the eastbound Long Island Expressway and eliminate the helical ramp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
<tr>
<td>PC-2</td>
<td>Provide a pedestrian overlook at the tower</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
<tr>
<td><strong>ENVIRONMENTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-1</td>
<td>Design and implement treatment technologies for all ground water encountered during all construction activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
<tr>
<td>E-4</td>
<td>Update sampling data (ground water and soils) on suspected contaminated areas of concern before the design-build request for proposal is issued</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
<tr>
<td>E-5</td>
<td>Define approved or appropriate protective construction methods in identified adversely impacted areas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
</tbody>
</table>
SECTION TWO – STUDY RESULTS

GENERAL

The results of this value engineering study conducted on the Replacement of Kosciuszko Bridge (I-278) Over Newtown Creek, Kings and Queens Counties, New York, portray the benefits that can be realized by the owner, New York State Department of Transportation (NYSDOT), the surrounding community, the traveling public and Parsons Brinckerhoff/Hardesty & Hanover (the design team.) The results will directly affect the project’s design and will require coordination between NYSDOT staff, the design team and the Federal Highway Administration to determine the disposition of each alternative.

During the study, many ideas for potential value enhancement were conceived and evaluated by the team for technical merit, applicability to the project, implementability considering the project’s status, and the ability to meet the NYSDOT’s project value objectives. Research performed on those ideas considered to have potential to enhance the value of the project resulted in the development of individual alternatives, identifying specific changes to the project as a whole, or individual elements that comprise the project. For each alternative developed, the following information is provided:

- A summary of the original design;
- A description of the proposed change to the project;
- Sketches and design calculations, if appropriate;
- A capital cost comparison and life cycle discounted present worth cost comparison of the alternative and original design (where appropriate);
- A descriptive evaluation of the advantages and disadvantages of selecting the alternative; and
- A brief narrative to compare the original design and the proposed change and provide a rationale for implementing the change into the project.

The capital cost comparisons used unit quantities, contained in the project cost estimate prepared by the design team, whenever possible. If unit quantities were not available, published databases, such as the one produced by the RS Means Company, or team member or owner databases were consulted. A composite markup of 71%, as described in Section Four of the report, was used to generate an all-inclusive project cost for the construction items being compared.

Each design suggestion contains the same information as the VE alternatives, except that no cost information is usually included. Design suggestions are presented to bring attention to areas of the design that, in the opinion of the VE team, should be changed for reasons other than cost. Examples of these reasons include improved permanent operations, improved maintenance and protection of traffic, ease of maintenance, ease of construction, safer working conditions, reduced project risk and the development of a design-build request for proposal that delivers the desired end product. In addition, some ideas cannot be quantified in terms of cost with the design information provided; these are also presented as design suggestions and are intended to improve the quality of the project.
Each alternative or design suggestion developed is identified with an alternative number (Alt. No.) to track it through the value analysis process and thus facilitate referencing among the Creative Idea Listing and Evaluation worksheets, the alternatives, and the Summary of Value Engineering Alternatives table. The Alt. No. includes a prefix that refers to a major project element listed below:

<table>
<thead>
<tr>
<th>PROJECT ELEMENT</th>
<th>PREFIX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach Spans</td>
<td>AS</td>
</tr>
<tr>
<td>Main Span</td>
<td>MS</td>
</tr>
<tr>
<td>Brooklyn Connector</td>
<td>BC</td>
</tr>
<tr>
<td>Pedestrian Connector</td>
<td>PC</td>
</tr>
<tr>
<td>Environmental</td>
<td>E</td>
</tr>
<tr>
<td>General</td>
<td>G</td>
</tr>
</tbody>
</table>

Summaries of the alternatives and design suggestions are provided on the Summary of Value Engineering Alternatives tables. The tables are divided into project elements and are used to divide the study results section. The complete documentation of the developed alternatives and design suggestions follows each of the tables.

KEY ISSUES

This project has been in the development stage for about 10 years with many meetings and community interactions. Preferred structure types have been identified through this process and the development of the Structure Justification Reports. Recently a decision was made to change the contracting approach for the demolition of the buildings in the right of way, and construction of the eastbound roadway from a design-bid-build approach to the design-build (DB) approach. Under a DB scenario, the way the project is presented changes from being prescriptive to more performance based. There is also a desire to provide a "signature" bridge for the entrances to the Queens and Brooklyn communities. The project is also being constructed in an area where the ground water and soils are contaminated after many years of industrial use of the land, which poses a risk to the eventual contractors.

STUDY OBJECTIVES

To assist NYSDOT and the design team achieve these goals in a cost-effective manner, NYSDOT engaged this VE study. The objective of the study was to identify specific ideas that could be implemented in the project documents to enhance the project team's ability to have a cost effective and lower risk project.
RESULTS OF THE STUDY

Means For Improving the Design Build Contract Request for Proposal

What originally started as a process that intended to develop a series of conventional design-bid-build contracts has recently been modified as follows: the project was split into three major contracts; a design-build (DB) contract for the eastbound structure and two subsequent conventional design-bid-build contracts for the demolition of the existing bridge and construction of the westbound structure. The DB contract is currently under development by the NYSDOT. A strong desire exists to develop a technically comprehensive and legally defensible DB contract to deliver this project in accordance with the purpose and needs, budget, and schedule of the project. To assist with the development of the request for proposal (RFP) to procure a qualified DB team to perform the work, the VE team provides the following ideas, constraints and suggested mechanisms to achieve the intended goals including:

- Constructing a signature structure across the Newtown Creek
- Achieving aesthetic goals for the entire bridge
- Generating more competition
- Providing more flexibility in the RFP for each of the contracts to generate cost-effective solutions for the project.

Suggestions include:

1. Since the properties adjacent to the proposed alignment have already been acquired by the Department, issue a separate contract or multiple contracts to demolish those properties and clear the widened right-of-way for the use of the DB contractor. This will allow the DB team to begin construction immediately on a “cleared site” and thus save some schedule time.

2. Include a milestone for completing the eastbound bridge roadway construction and shifting six lanes (three eastbound and three westbound) of the Brooklyn Queens Expressway (BQE) traffic onto the newly constructed eastbound bridge. Specify the maximum number of days allowed to meet the milestone. Allow the bidders to bid less number of days to meet the milestone. Incorporate this item in the bid evaluation matrix.

3. Include daily liquidated damages for not meeting the milestone in number 2.

4. Identify all potential staging areas beyond the area within the footprint of the new roadway.

5. Investigate if the materials can be brought to the site by rail and by trucking as back-up modes of material delivery. Cast-in-place concrete for the pier foundations and some of the connector structures will most likely be delivered by trucks. Identify convenient trucking routes from Brooklyn and Queens to the project site.

6. Allow the contractor to set a concrete batch plant on site, if desired.

7. To reduce confusion, identify that the entire length of the project has contaminated soils and include all available information regarding ground contamination to the DB contract bidders. Do not specify any clean areas.

8. Identify the areas of archeological sensitivity and, in coordination with State Historic Preservation Office (SHPO), develop a protocol to be followed by the DB contractor and include
that in the RFP documents. This may entail a need for a certified archeologist to be on-site
during all excavation and drilling operations to monitor the process and to scour the excavated
materials for sensitive remains. This action will minimize the project premium by managing the
uncertainty.

9. Investigate and develop suggested list of acceptable and unacceptable actions for the construction
of pier foundations in coordination with the environmental compliance agencies. Make this list
available to the DB contract bidders marked as “For Information Only.” Stipulate that the
bidders must develop means and methods to construct the bridge foundations or any other below
ground structures by complying with all environmental regulations. This action will minimize the
project premium by managing the uncertainty.

10. Identify in the RFP document that the designer of the eastbound Main Crossing shall also design
the Westbound Main Crossing. For the third and the last major contract of this project, the Prime
Consultant (the designer) of the westbound BQE within the Design-Bid-Build (DBB) project
limits shall retain the services of the designer of the Westbound Main Crossing as a
subconsultant for any updates required, coordination between the Main Crossing and the
approaches and to provide engineering support services during construction of that DBB
contract.

11. Plan an overlap between Contract 2: Demolition of the Existing Bridge and Contract 3:
Construction of the Westbound Crossing. This will minimize the overall project schedule.
Specify the areas that need to be demolished first, so that the Contract 3 Contractor can follow
the Contract 2 Contractor and start building the Westbound Crossing. Construction of the Main
Crossing and the approach viaducts up to a certain length will be easier to construct first and can
be followed by the tie-ins in the connector areas. From the demolition perspective, demolishing
the Main Crossing first may have the advantage of having access from the approaches to the
bridge deck level.

12. Include only one park, located south of the Eastbound Crossing in Brooklyn, in the Design-Build
contract. Include the other two parks (one in Brooklyn and one in Queens) in the contract for the
Westbound Crossing.

The following is suggested as a way of describing the project requirements in the RFP for the DB
contract for the Eastbound Crossing.

Project-wide Requirements

The Design-Builder shall provide the following:

1. A new eastbound structure (Crossing) located to the south of the existing Kosciuszko Bridge.
The Design-Builder shall maintain the approximate centerline alignment for the Crossing as
shown on the Directive Plans in Part xxx—RFP Plans. Minor variations in the vertical and
horizontal alignments may be allowed, to suit the proposed design of the Design-Builder as long
as the final structure stays within the southern right-of-way line and the eastbound structure
accounts for the proposed westbound structure alignment, widths and the minimum specified
required gap between the eastbound and westbound structure fasciae as specified in the Directive
Plans in Part xxx.
2. A Crossing that provides the minimum shipping and highway clearance requirements as shown on the Directive Plans in Part xxx;

3. A Crossing that provides local street crossings and railroad crossings under it with minimum vertical clearances as specified in the Directive Plans in Part xxx;

4. A Crossing that complies with the requirements included in Part xxx – Project Requirements;

5. A Crossing with a minimum 100-year service life before major maintenance is required;

6. Crossing, of adequate width, designed to carry the eastbound and westbound traffic lanes, shoulders and shared use path as shown on the Directive Plans in Part xxx – RFP Plans and all traffic barriers, end attenuators, fencing and railings required by the AASHTO Code and the Contract Documents, as well as the temporary lane configuration shown;

7. A Crossing with capacity to withstand extreme events, both natural and intentional, during construction and after completion in accordance with the Part xxx – Project Requirements;

8. A Crossing designed and constructed to allow continued operation, maintenance and security of the existing bridge by the Department including, but not limited to, operation, maintenance and security activities associated with the three traffic lanes in each direction, maintenance facilities, staff support facilities, emergency access, security facilities and access, utilities, lighting, ITS, signage, barriers and fencing, pavement and structures;

9. A Crossing with safe and efficient accommodations for bicycles and pedestrians in accordance with the Part xxx – Project Requirements, including, but not limited to, appropriate rail height, bicycle-safe bridge joints, separation from vehicular traffic, and Americans with Disabilities Act (ADA) compliance;

10. A Crossing designed and constructed for utility conveyance across the bridge and in the landings including, but not limited to, fiber optic communications, electrical service and maintenance lighting, mechanical and natural ventilation, ITS, instrumentation for bridge monitoring, and facilities in accordance with the Part xxx – Project Requirements;

11. A Crossing and landings aesthetic, in accordance with Part xxx – Project Requirements, that give consideration to previous and/or future public preferences and as determined through the public involvement process;

12. The Crossing shall provide a minimum 18-ft.-wide separation between the eastbound and westbound structures from Sta. xxxx to Sta.xxxx;

13. There shall be no piers for the Crossing in Newtown Creek.

14. On both sides of Newtown Creek, potential bridge staging areas have been identified in the Indicative Plans in Part xxx.
Major Project Components

The Project will include, but not be limited to, the following:

1. Brooklyn Queens Expressway (I-278) relocation and reconstruction beginning at approximately Sta. xxxx and ending at approximately Sta. xxxx;

2. A new bridge across Newtown Creek, over the shipping channel;

3. Approach roadways;

4. Adequate relocation of Cherry Street between Vandervoort Avenue and Stewart Avenue to the south of the existing location to accommodate the Crossing;

5. On and off ramp adjustments at Morgan and Vandervoort Avenues and Long Island Expressway (LIE) Interchange connections;

6. A park to the south of the Eastbound Crossing on the Brooklyn side;

7. Related roadway work such as paving, grading, and appurtenances such as barriers guiderails, rumble strips, curbs and gutter, fencing, etc.;

8. Retaining walls;

9. A shared use path;

10. Drainage systems, including stormwater treatment systems;

11. Signage and pavement markings;

12. Lighting;

13. Intelligent transportation systems;

14. Security measures;

15. Maintenance of shipping, including warning signalization;

16. Protection, relocation, replacement, and/or addition of utilities, including coordination with utility owners and operators;

17. Erosion control, including slope stabilization and storm water pollution prevention;

18. Landscaping;

19. Visual quality enhancement and management;

20. Demolition and removal of facilities within the right-of-way that are not part of the permanent work;
21. Demolition and removal of temporary construction facilities;
22. Maintenance and protection of traffic;
23. Temporary facilities necessary to construct the project;
24. Maintenance of the Project Site;
25. Construction over and adjacent to railroad facilities and related coordination;
26. Environmental management, compliance, mitigation, and associated permits; and
27. Public information activities.

**Basic Project Configuration**

The Basic Project Configuration shall consist of the following, as shown in *Part xxx – Project Plans*:

A. The Project Limits;

B. Crossing geometries including alignment, profile, number and width of lanes, shoulders, Shared Use Path, barriers, rails, and tie-ins to existing roadway approaches;

C. The minimum vertical and horizontal clearances for navigation and vehicular traffic;

D. Minimum span length for the Main Crossing;

E. Minimum span length for the approaches; and

F. The right-of-way limits.

The following alternatives may be considered for the Main Crossing:

1. A single span tied arch structure;

2. A three tied arch combination with a larger span tied arch spanning the Creek and a smaller span tied arch on each side; and

3. A cabled-stayed Main Crossing

The following alternatives may be considered for the Approach Spans:

1. Two side-by-side concrete box girders supported on separate piers;

2. Two side-by-side concrete box girders supported on a single inverted delta pier;

3. Single box girder supported by a single pier;
4. Multi-girder galvanized or weathering steel superstructure supported by a multi-column pier bent or an inverted delta pier;

5. Modified AASHTO beams supported by a multi-column pier bent or an inverted delta pier;

6. Two side-by-side concrete box-girders supported on piers with inverted delta in longitudinal direction.

Identify in the RFP which combinations of the Main Crossing and Approach Structure types listed above are unacceptable.

The following alternatives describe various stand-alone VE suggestions for the Project Team’s consideration.

**Main Crossing**

MS-1: Allow use of tied arch structure.

MS-3: Allow use of a “V-shaped” tower instead of an “H-shape.”

MS-8: Allow use of multiple tied arches.

MS-11: Prescribe the acceptable configurations of the main span.

MS-14: Use a single tower on same side of creek for both bridges.

MS-18: Use a partial “W-shaped” pylon.

**Approach Spans**

AS-1: Allow use of cantilever construction methods.

AS-2: Allow use of galvanized or weathering steel box girder as superstructure alternative.

AS-4: Minimize number of spans in Queens approach.

AS-7: Allow use of inverted delta frame piers in the longitudinal direction of the bridge.

**General**

G-3: Time RFP considering other major projects.

G-4: Require an Architect on the Design-Build Team.

G-5: Have the designer of the Design-Build Team design the westbound signature bridge.

E-1: Design the dewatering system to contain all contamination, not just ground water encountered during construction.

E-5: Define approved construction in environmentally sensitive areas.
E-6: Require Environmental specialists on the Design-Build Team.

The advantages of adopting the above into the RFP include:

- Increased contractor flexibility that will drive down project costs, particularly on the Approach Spans.
- Additional suggested alternatives for the signature span and the approaches will promote competition, innovation and cost optimization.
- Identifies the prescriptive requirements (constraints) in the Design-Build RFP but allows flexibility for the rest of the project.
- Reduced construction schedule due to the options available to the Design-Build Contractors in developing the project bid.

Value Engineering Alternatives and Design Suggestions

The VE team developed the following six alternatives that could produce the maximum potential cost savings noted:

**TABLE OF ALTERNATIVES PRODUCING THE MAXIMUM POTENTIAL COST SAVINGS**

<table>
<thead>
<tr>
<th>Alt. No.</th>
<th>Description</th>
<th>Potential Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS-9</td>
<td>Allow the use of a single precast concrete box girder in lieu of twin precast concrete box girders for the approach spans</td>
<td>$11,922,000</td>
</tr>
<tr>
<td>MS-19</td>
<td>For the Main Span use two tied arches with 450 ft. spans in lieu of cable-stayed bridges</td>
<td>$46,132,000</td>
</tr>
<tr>
<td>G-1</td>
<td>Lower the bridge clearance over Newtown Creek from 88 ft. 6 in. to 70 ft. 0 in.</td>
<td>$3,279,000</td>
</tr>
<tr>
<td>G-6</td>
<td>Combine the demolition of the existing bridge and the westbound bridge contracts together</td>
<td>$5,000,000</td>
</tr>
<tr>
<td>G-8</td>
<td>Reduce the eastbound roadway width from 94 ft. clear to 90 ft. clear</td>
<td>$17,012,000</td>
</tr>
<tr>
<td><strong>TOTAL POTENTIAL COST SAVINGS</strong></td>
<td></td>
<td><strong>$83,345,000</strong></td>
</tr>
</tbody>
</table>

In addition, there are several design suggestions in the environmental area that will assist the NYSDOT contractor to deal effectively with the difficult environmental challenges in constructing the project and several that offer opportunities to provide a wider range of aesthetic features for the “signature” bridge that the contractors may want to pursue. Some have the potential to reduce the project’s costs as well. A third group of design suggestions will add features to the current design that will enhance the project’s value to the community and its operational characteristics.

EVALUATION OF ALTERNATIVES AND DESIGN SUGGESTIONS

During review of the study results, the reader should consider each part of an alternative or design suggestion on its own merit. Each area within an alternative or design suggestion that is acceptable should be considered for use in the final design, even if the entire alternative is not implemented.
Variations of these alternatives by NYSDOT or Parsons Brinckerhoff/Hardesty & Hanover are encouraged.

All alternatives and design suggestions were developed independently to provide a broad range of options to consider for implementation. Therefore, some of them are mutually exclusive, so acceptance of one may preclude the acceptance of another. In addition, some of the alternatives may be interrelated, so acceptance of one or more may not yield the total of the cost savings shown for each alternative.

The reader should evaluate all alternatives carefully in order to select the combination of ideas with the greatest beneficial impact on the project. Once this has been accomplished, the total cost savings resulting from the VE study can be calculated based on implementing a revised, all-inclusive design solution. The table above indicates the maximum potential cost savings achievable, but does not represent the all of the combinations of alternatives that could be implemented.
## SUMMARY OF VALUE ENGINEERING ALTERNATIVES

**PROJECT:** REPLACEMENT OF KOSCIUSZKO BRIDGE (I-278) OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES  
**New York State Department of Transportation**

**PRESENT WORTH OF COST SAVINGS**

<table>
<thead>
<tr>
<th>ALT. NO.</th>
<th>DESCRIPTION</th>
<th>ORIGINAL COST</th>
<th>ALTERNATIVE COST</th>
<th>INITIAL COST SAVINGS</th>
<th>RECURRING COST SAVINGS</th>
<th>TOTAL PW LCC SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>APPROACH SPANS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AS-1 Allow the use of precast concrete segmental box</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>girders using cantilevered construction for the</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>approach spans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AS-3 Allow the use of galvanized or weathering steel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>girders in lieu of concrete box girders for the</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>approach spans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AS-5 Use a single inverted delta pier in lieu of</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>two vertical piers for the approach spans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AS-9 Allow the use of a single precast concrete box</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>box girder in lieu of the twin precast concrete</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>box girders for the approach spans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$225,556,000</td>
<td>$213,634,000</td>
<td>$11,922,000</td>
<td></td>
<td>$11,922,000</td>
</tr>
</tbody>
</table>

**DESIGN SUGGESTION**
DESCRIPTION:
ALLOW THE USE OF PRECAST CONCRETE SEGMENTAL BOX GIRDERS USING CANTILEVER CONSTRUCTION FOR THE APPROACH SPANS

ORGINAL DESIGN:
A span-by-span assembly of precast concrete box girder segments is being considered for the Approach Spans.

ALTERNATIVE:
Allow the use of cantilevered assembly of precast concrete box segments, with standard equipment. Use either high capacity cranes to place segments from the ground, travelling derricks to pick up segments from the deck, or both.

ADVANTAGES:
- Uses standard lifting equipment or light special equipment
- Provides flexibility associated with the use of standard/light equipment
- Provides a potential reduction of time for assembly by using several sets of equipment, without a heavy investment

DISADVANTAGES:
- Increases complexity and quantities of post-tensioning

DISCUSSION:
With the span range considered, the span-by-span method of assembly is at its upper limit, and might not be the most cost effective globally, because of the cost and complexity of the assembly equipment. It therefore appears appropriate to offer contractors the possibility of using the cantilever assembly method.

In order to maximize the advantages of this method, it should be associated with a pier redesign, where the box piers would be replaced by twin wall piers in order to better accommodate the unbalanced loading during construction. The flexibility of these piers would allow the contractors to make some of them integral with the deck, with all associated advantages including: structural efficiency and reduction in the number of bearings.

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PROJECT: REPLACEMENT OF KOŚCIELNIE BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

DESCRIPTION: ALLOW THE USE OF GALVANIZED OR WEATHERING STEEL GIRDERS IN LIEU OF CONCRETE BOX GIRDERS FOR THE APPROACH SPANS

ORIGINAL DESIGN: (sketch attached)

For both the approaches, the design uses concrete box girders.

ALTERNATIVE: (sketch attached)

Allow the use of steel plate girders for Brooklyn and Queens approaches. Consider high strength weathering steel or high strength galvanized steel. Use inverted delta piers with a single footing, per pier, per roadway.

ADVANTAGES:

- May be more economical
- Plate girder segments are easier to transport and trucks can be used if there is an issue with the marine transport
- Enhances the aesthetic by varying the depth of plate girders
- Generates more competition since there are many established steel fabricators in the northeast
- Using galvanizing as a corrosion protection minimizes the life cycle costs
- Minimizes the number of piers and foundations through use of longer continuous spans
- Eliminates construction joints and the need to place a separate overlay by using conventional cast-in-place deck with stay-in-place forms
- Supplies cast-in-place concrete in an expedient and economical way, by setting up a concrete batch plant on site

DISADVANTAGES:

- None apparent

COST SUMMARY

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pier lines are staggered in elevation between the eastbound and the westbound approaches as described here. However, by adjusting the span lengths, this stagger can be minimized to an extent that the visual impact is negligible. The main idea is to use longer spans.

Use the following span configurations with varying depth plate girders:

**Queens Approach: Eastbound** - Two – 3 span continuous units. 225’ – 350’ – 225’ = 1,600’
- Corresponding depths at end support and intermediate support would be 9’ and 14’.

**Queens Approach: Westbound** - Two – 3 span continuous units. 200’ – 300’ – 200’ = 1,400’
- Corresponding depths at end support and intermediate support would be 8’ and 12’.

**Brooklyn Approach: Eastbound** - Two – 3 span continuous units. 180’ – 266’ – 180’ = 1,252
- Corresponding depths at end support and intermediate support would be 7’ and 11”.

**Brooklyn Approach: Eastbound** - Two – 3 span continuous units. 188’ – 311’ – 188’ = 1,372’
- Corresponding depths at end support and intermediate support would be 7.5’ and 12.5’.
NOTES:
1. Span lengths shown are along E8 and N37 TIES.
2. Remove existing piers to install new form.
3. Existing main span pilings remain in place.

LEGEND:
F - Fixed Bearing
E - Expansion Bearing

NOTES:
1. Span lengths shown are along E8 and N37 TIES.
2. Remove existing foundations as needed to install new foundations.

Preliminary Structure Plans
D01562
Sheet No.

New York State Department of Transportation

It is a violation of NYS Vehicular Law to use a vehicle under the control of a person who holds a driver's license issued to an individual who is convicted of operating a vehicle while under the influence of alcohol or drugs without having restored his or her ability to use the vehicle to the New York State Department of Transportation. Any person who violates this law is subject to the penalties provided for in the New York State Vehicle and Traffic Law.
GIRDER DEPTHS VARY FROM 14' TO 11' FOR MIDDLE SPANS AND FROM 9' TO 7.5' FOR END SPANS OF A TYPICAL 3-SPAN CONTINUOUS UNIT.

SUGGESTED FLET SHAPES

TYPICAL APPROACH SECTION
LOOKING EAST

NOTES:
1. THE TOP OF PARAPET SHALL RECEIVE A 4" OVERLAY.
2. ACCESS DOORS WITH COVER SHALL BE PROVIDED ALONG THE PARAPET.
3. THE RAIN GUARD SHALL RECEIVE A PROTECTIVE SEALING.

PRELIMINARY STRUCTURE PLANS
PROPOSED TYPICAL SECTIONS

SHEET NO. 19

ALT. NO. 0015624

NEW YORK STATE DEPARTMENT OF TRANSPORTATION DESIGN 77

DOCUMENT NAME: 070772.000.000.S31.png
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK,
KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

DESCRIPTION: USE A SINGLE INVERTED DELTA PIER IN LIEU OF TWO
VERTICAL PIERS FOR THE APPROACH SPANS

ORIGINAL DESIGN:

For both the approaches, the design uses twin precast concrete piers for the eastbound and westbound roadways.

ALTERNATIVE: (for sketches, see Alt. No. A-3)

Use inverted delta piers with a single footing per pier for each roadway.

ADVANTAGES:

• A combined foundation may be more economical than two separate foundations
• Adds aesthetic value
• Lessens disturbance to the contaminated ground due to smaller foundations – saves cleanup costs
• Less intrusion to the usable space at ground level under the bridge
• The pier cap can support any type of superstructure
• Can use post-tensioned precast segments

DISADVANTAGES:

• None apparent

DISCUSSION:

A single inverted delta pier per roadway will be more dramatic in appearance and will add to the signature aspect of the bridge as well as potentially save costs.

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

DESCRIPTION: ALLOW THE USE OF A SINGLE PRECAST CONCRETE BOX GIRDER IN LIEU OF THE TWIN PRECAST CONCRETE BOX GIRDERS FOR THE APPROACH SPANS

ORIGINAL DESIGN: (sketch attached)

The approach span decks for each direction consist of twin, precast concrete box girders, as described on sheet 19 of the Preliminary structure plans.

ALTERNATIVE: (sketch attached)

For the approach bridge decks, use a single precast concrete box girder for each direction with large overhangs supported by inclined struts. Inclined struts may also be placed inside the box to reduce transverse bending into the top slab. The top slab is post-tensioned transversely. Construction may be done in two stages: the first would be the assembly of the box itself, with precast segments, and the second the casting of in situ overhangs.

Lateral struts enhance the architectural quality of the project by providing rhythm and lightness.

ADVANTAGES: DISADVANTAGES:

- Minimizes ground impacts
- Saves cost and schedule
- Meets/improves aesthetic goals
- None apparent

DISCUSSION:

Similar approaches for other projects have proven the efficiency and architectural quality of this concept. We refer to the Lizeria Bridge over Tagus River in Portugal, and the “Three Bassin” Bridge in La Réunion Island (see attached sketches). The Sunshine Skyway Bridge in Tampa also has a deck width of approximately 100 feet, and a single box girder with internal struts.

The cost comparison was based upon global estimates. A global cost saving of 20% was considered for the supports (foundations + piers), resulting from structural optimization and reduction of operations, with no additional complexity. No cost savings were considered for the deck, based upon a balance between structural and operational optimization, on one hand, and additional complexity on the other hand. However, potential cost savings do exist and may be confirmed by the contractors’ evaluation.

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td>$ 225,556,000</td>
<td>-</td>
<td>$ 225,556,000</td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td>$ 213,634,000</td>
<td>-</td>
<td>$ 213,634,000</td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td>$ 11,922,000</td>
<td>-</td>
<td>$ 11,922,000</td>
</tr>
</tbody>
</table>
NOTES:
1. THE GAP OF MEADWAY SHALL RECEIVE A 2" OVERLAY.
2. ACCESS OPENING WITH COVER SHALL BE PROVIDED ADJACENT TO PIER AS REQUIRED.
3. THE MID-DECKING SHALL RECEIVE A PROTECTIVE SEALANT.

TYPICAL APPROACH SECTION

1:1000 SCALE

ASBUILT
DESCRIPTION OF ALTERATIONS

ITEM: 553.0104

ALBERT W.

12'-0" 10'-0"

NOTE

10'-0"

20'-0"

30'-0"

40'-0"

50'-0"

60'-0"

70'-0"

80'-0"

90'-0"

100'-0"

110'-0"

120'-0"

130'-0"

140'-0"

150'-0"

160'-0"

170'-0"

180'-0"

190'-0"

200'-0"

210'-0"

220'-0"

230'-0"

240'-0"

250'-0"

260'-0"

270'-0"

280'-0"

290'-0"

300'-0"

310'-0"

320'-0"

330'-0"

340'-0"

350'-0"

360'-0"

370'-0"

380'-0"

390'-0"

400'-0"

410'-0"

420'-0"

430'-0"

440'-0"

450'-0"

460'-0"

470'-0"

480'-0"

490'-0"

500'-0"

510'-0"

520'-0"

530'-0"

540'-0"

550'-0"

560'-0"

570'-0"

580'-0"

590'-0"

600'-0"

610'-0"

620'-0"

630'-0"

640'-0"

650'-0"

660'-0"

670'-0"

680'-0"

690'-0"

700'-0"

710'-0"

720'-0"

730'-0"

740'-0"

750'-0"

760'-0"

770'-0"

780'-0"

790'-0"

800'-0"

810'-0"

820'-0"

830'-0"

840'-0"

850'-0"

860'-0"

870'-0"

880'-0"

890'-0"

900'-0"

910'-0"

920'-0"

930'-0"

940'-0"

950'-0"

960'-0"

970'-0"

980'-0"

990'-0"

1000'-0"
**Example of structures using box girders with lateral inclined struts:**

«Puente de la Lizeria» in Portugal; Total deck width: 100 feet
Example of structures using box girders with lateral inclined struts:

"Trois Bassins" Bridge on La Réunion Island
<table>
<thead>
<tr>
<th>CONSTRUCTION ITEM</th>
<th>ORIGINAL ESTIMATE</th>
<th>PROPOSED ESTIMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO. OF UNITS</td>
<td>COST/UNIT</td>
</tr>
<tr>
<td>AS Piers and foundations (segmental deck)</td>
<td>LS</td>
<td>1</td>
</tr>
<tr>
<td>AS deck (segmental deck)</td>
<td>LS</td>
<td>1</td>
</tr>
</tbody>
</table>

Subtotal: 225,555,570  213,634,453

Markup (%) at 30

TOTAL: 225,555,570  213,634,453

TOTAL ROUNDED: 225,556,000  213,634,000
## SUMMARY OF VALUE ENGINEERING ALTERNATIVES

**PROJECT:** REPLACEMENT OF KOSCIUSZKO BRIDGE (I-278) OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES  
New York State Department of Transportation  
PRESENT WORTH OF COST SAVINGS

<table>
<thead>
<tr>
<th>ALT. NO.</th>
<th>DESCRIPTION</th>
<th>ORIGINAL COST</th>
<th>ALTERNATIVE COST</th>
<th>INITIAL COST SAVINGS</th>
<th>RECURRING COST SAVINGS</th>
<th>TOTAL PW LCC SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS-1</td>
<td>Use a tied arch structure in lieu of a cable-stayed bridge for the main span</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-3</td>
<td>Use a &quot;V-shaped&quot; tower for both main span cable-stayed bridges in lieu of the &quot;H-shaped&quot; towers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-8</td>
<td>Use multiple tied arches in lieu of the cable-stayed bridge for the main span</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-11</td>
<td>Prescribe the configuration of the main span bridge after additional community outreach</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-12</td>
<td>Use a cable-stayed bridge for the eastbound roadway only and use a box girder for the westbound roadway</td>
<td>$696,739,000</td>
<td>$685,686,000</td>
<td>$11,053,000</td>
<td></td>
<td>$11,053,000</td>
</tr>
<tr>
<td>MS-14</td>
<td>Place the towers for both main span cable-stayed bridges on the west side of Newtown Creek</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-15</td>
<td>Use symmetrical cable-stayed main spans in lieu of staggered cable-stayed main spans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-16</td>
<td>Use staggered tied arches in lieu of staggered cable-stayed bridges for the main span</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-18</td>
<td>Use a partial &quot;W-shaped&quot; tower on the west side of Newtown Creek in lieu of &quot;H-shaped&quot; towers on either side of Newtown Creek</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-19</td>
<td>Use two tied arches with 450 ft. spans in lieu of cable-stayed bridges for the main span</td>
<td>$122,495,000</td>
<td>$76,363,000</td>
<td>$46,132,000</td>
<td></td>
<td>$46,132,000</td>
</tr>
<tr>
<td>MS-20</td>
<td>Use a &quot;V-shaped&quot; tower on the west side of Newtown Creek for the eastbound bridge and an &quot;A-shaped&quot; tower on the east side of Newtown Creek for the westbound bridge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

ALTERNATIVE NO.: MS-1

DESCRIPTION: USE A TIED ARCH STRUCTURE IN LIEU OF A CABLE-STAYED BRIDGE FOR THE MAIN SPAN

The Structure Justification Report investigated a cable-stayed bridge, a through arch bridge and a deck arch bridge for the main span and the cable-stayed bridge was selected as the preferred option.

ALTERNATIVE: (sketch attached)

Use a tied arch bridge for the main span.

ADVANTAGES:

- Provides better structural efficiency: horizontal thrust is carried to the deck
- Meets aesthetics goals: main carrying structure is higher above deck level
- Improves the neighborhood (better gateway symbol)
- Reminds one of the existing structure

DISADVANTAGES:

- May require temporary bents in the creek

DISCUSSION:

By combining the advantages of arches and that of girders, tied arches are among the most efficient types of structures, and should be preferred to standard arches when soil conditions do not provide easy handling of horizontal thrust (rock type ground). With the success of cable-stayed bridges, tied arches tend to be considered outdated. However, there is now a renewal of their use, under the influence of bridge architects like Santiago Calatrava. In this case, the tied arch option also has the advantage of leading to a structure higher above the deck, which is necessary to create a gateway landmark. To be more specific, the height above the deck of the main span carrying structure, in order to be at a right scale, should be at least equal to, or larger than the width of the deck, i.e., approximately 90 feet. This criterion is met by a 450 ft. tied arch with a one to five depth to span ratio.

In order to meet the redundancy requirement with regard to the potential of fracture of the tie girder, post tensioning or other appropriate features are required.

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Documents which illustrate the new approaches to tied arch bridges

Milsaucy Bridge – Liège – Belgium
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOŚCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

ALTERNATIVE NO.: MS-3

DESCRIPTION: USE A “V-SHAPED” TOWER FOR BOTH THE MAIN SPAN CABLE-STAYED BRIDGES IN LIEU OF THE “H-SHAPED” TOWERS

SHEET NO.: 1 of 4

ORIGINAL DESIGN: (sketch attached)

The main span consists of two cable-stayed bridges, one for each direction of travel. The tower for the eastbound (EB) bridge is west of Newtown Creek; the tower for the westbound (WB) bridge is east of Newtown Creek. The towers are an “H-shape” with slanted lower legs. They support two planes of cables that in turn support welded steel I-shaped edge girders.

ALTERNATIVE: (sketch attached)

Use “V-shaped” towers for the two main span cable-stayed bridges. The tower for the EB bridge would still be west of Newtown Creek; the tower for the WB bridge would still be east of Newtown Creek. The two arms of the “V” would support two planes of cables that in turn support welded steel I-shaped edge girders.

ADVANTAGES:

- Simplifies and potentially improves the appearance of the landmark feature
- Fewer “V” shaped towers than “H” shaped towers have been built, making the bridge more unique
- Simplifies the appearance to make the towers more effective as a distinctive landmark

DISADVANTAGES:

- Clearance problems between the tower arm and the adjacent median lane of the opposite roadway may limit the angle of the “V”, limiting the visual effectiveness of the form
- Construction of the upper part of the median arm of the “V” would be above the opposite roadway requiring a temporary work platform to protect opposing traffic
- The upper median arm of the WB tower may impinge on the EB traffic clearance envelope

DISCUSSION:

Meeting the aesthetic goals is mostly a matter of having a shape distinctive enough to be recognized and remembered and high enough to be seen from many viewpoints. Since “V-shaped” towers are relatively rare, especially for bridges of this size, its uniqueness will symbolize Brooklyn, Queens and the Kosciuszko Bridge at the national and even international level.

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## DISCUSSION: (continued)

Cable-stayed bridges derive much of their appeal from the triangular “sail” shape of the cable array. The triangular shape is the clearest when it can be seen as a single silhouette without visual overlap or competition, and when the angles of the stays are close to each other and the stays do not appear to cross each other. In the opinion of the VE team, the cable arrays of the “V” meet these criteria much better than the “H” towers of the original design.

With the slanted arms of this tower, the cable planes define a three dimensional shape, a trapezoidal “valley.” Drivers will experience the bridge as traversing an immense open space widening to the sky.

Clearance problems at the point where the WB median arm intersects the EB clearance envelope, can be reduced by slanting the web of the edge girder at the same angle as the cable plane. If this is not sufficient, a small amount of additional median width may be required. Construction of any tower adjacent to active traffic lanes will likely raise the need for traffic protection of some sort. Traffic protection will be needed in any case, though the “V” arm may make these a bit more difficult.
ILL

\[ \text{ALT NO. } \]

\[ \text{MS-3, Sht. 3 of 4} \]

\[ \text{CONCRETE CROSS BEAM} \]
\[ \text{ITEM 555.09} \]

\[ \text{STAY CABLE (TYP.)} \]
\[ \text{ITEM 564.00} \]

\[ \text{CONCRETE TOWER (TYP.)} \]
\[ \text{ITEM 555.09} \]

\[ \text{APPROPRIATE GROUND (TYP.)} \]

\[ \text{PROPOSED EASTBOUND TOWER LOOKING UPSTATION} \]

\[ \text{PROPOSED 6'-0" DIA. DRILLED SHAFT AND} \]
\[ \text{5'-0" DIA. ROCK SOCKET} \]
\[ \text{ITEM 551.0949617} \]

\[ \text{AS DESIGNED} \]

\[ \text{ON OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR IN ANY WAY, IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED. THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR OF THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.} \]
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

ALTERNATIVE NO.: MS-8

DESCRIPTION: USE MULTIPLE TIED ARCHES IN LIEU OF THE CABLE-STAYED BRIDGES FOR THE MAIN SPAN

ORIGINAL DESIGN: (sketch attached)

The Structure Justification Report investigated a cable-stayed bridge, a through arch bridge and a deck arch bridge for the main span and the cable-stayed bridge was selected as the preferred option.

ALTERNATIVE: (sketch attached)

For the main span, use a succession of three tied arches with respectively 300, 500 and 300 feet spans.

ADVANTAGES:

- Meets aesthetic goals
- Minimizes ground impact
- Reminds one of the existing bridge
- Minimizes project risks
- The landmark span is clearly centered to the creek

DISADVANTAGES:

- Changes aesthetics

DISCUSSION:

While providing a nice progression from the simple deck approaches to the main span, this alternative minimizes the number of piers to four over the central 1,100 feet of the entire bridge, which from this point of view, is similar to the cable-stayed alternative.

By centering those three spans to the creek, a clear indication of their location is given.

In terms of cost, it should not be more than that of the cable-stayed main span.

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

DESCRIPTION: PRESCRIBE THE CONFIGURATION OF THE MAIN SPAN BRIDGE AFTER ADDITIONAL COMMUNITY OUTREACH

ORIGINAL DESIGN:

The main span of the bridge consists of two cable-stayed bridges, one for each direction of travel. The tower for the eastbound (EB) bridge is west of Newtown Creek; the tower for the westbound (WB) bridge is east of Newtown Creek. The towers are an “H” shape with slanted lower legs. They support two planes of cables that in turn support welded steel I-shaped edge girders.

ALTERNATIVE: (sketch attached)

Develop and evaluate, with stakeholder participation, additional variations of the main span that meet aesthetic goals and either reduce cost and/or add value. After evaluation and selection of 1 to 3 preferred options, prescribe the form and major dimensions of those options in the design-build request for proposal (DB RFP).

ADVANTAGES:

- Provides full consideration of promising additional main span options
- Provides assurance to the owner that the bridge resulting from the DB contract will be acceptable to stakeholders
- Removes vital, but subjective, aesthetic judgments from the DB selection process

DISADVANTAGES:

- Less flexibility for the DB designer/contractor to innovate/reduce cost
- Some additional time and cost in the pre-RFP development process

DISCUSSION:

As this project has developed, the symbolic and visual presence of the crossing of Newtown Creek has become a critical element. This conclusion has been the result of strong opinions from adjacent communities and their elected officials. They have developed their opinions based on presentations of specific alternatives with specific visual characteristics. Unless the contractor is required to produce a bridge with these visual characteristics or better, the community and their elected officials are likely to be disappointed. Specifying visual characteristics does not require specifying a design. The goal is to establish a qualitative floor. The DB design must have visual characteristics equal to, or better than, the prescribed concept. The DB designer still has plenty of latitude to work out his own design.

COST SUMMARY

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DISCUSSION: (continued)

Some DB owners have attempted to address project elements of this magnitude by giving aesthetics a high score in the value - selection process. However, this strategy has two significant drawbacks:

1. There is no guarantee that any of the proposals submitted by the DB contractors will meet the stakeholders’ expectations, leaving the owner with no worthwhile alternative to choose from, and leaving the stakeholders disappointed;

2. A DB proposal may be submitted, which does not meet the aesthetic requirements, but which is significantly less expensive than a proposal that does. In that event it is, as a practical matter, difficult for the owner to select the higher-priced proposal. Comparing subjective aesthetic scores with hard dollar numbers is always controversial. The tendency is for the dollars to win, again leaving the stakeholders disappointed.

With the specific visual characteristics of the crossing of Newtown Creek prescribed, then the DB contractors and their designers can compete to produce the desired result in the most cost-effective and innovative way. The owner and the stakeholders will get what they want, and at the least cost.

See attached examples of how to prescribe the desired bridge characteristics.
The contractor shall be responsible for the number and arrangement of cables.

160' min., 225' max. from top of deck at centerline of tower to the top of tower.

Overhead power lines.

Overhead power lines.
NOTE: THE CONTRACTOR SHALL PROVIDE THE VISUAL QUALITY CHARACTERISTICS AND FEATURES SHOWN. THIS DRAWING ILLUSTRATES REQUIRED SHAPES AND PROPORTIONS AND SOME REQUIRED DIMENSIONS. ALL OTHER QUANTITIES, ELEMENT LOCATIONS AND DIMENSIONS ARE LEFT TO THE CONTRACTOR AND SHALL NOT BE INFERRED FROM THIS DRAWING.
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOŚCIUSZKO BRIDGE OVER NEWTOWN CREEK,
KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

ALTERNATIVE NO.: MS-12

DESCRIPTION: USE A CABLE STAY BRIDGE FOR THE EASTBOUND ROADWAY
ONLY AND USE A BOX GIRDER FOR THE WESTBOUND ROADWAY

ORIgINAL DESIGN:

The main span consists of two cable-stayed bridges, one for each direction of travel. The tower for the eastbound (EB) bridge is west of Newtown Creek; the tower for the westbound (WB) bridge is east of Newtown Creek. The towers are an "H" shape with slanted lower legs. They support two planes of cables that in turn support welded steel I-shaped edge girders.

ALTERNATIVE:

Use a cable-stayed bridge of the same height and configuration for the EB bridge and a concrete box girder bridge for the westbound roadway.

ADVANTAGES:

• Saves approximately $11 million
• The visual impact of the signature span would be comparable
• Simplifies the appearance of the signature span
• Eliminates the need to coordinate the design of the WB bridge with the design of the EB bridge
• There would be one less cable-stayed bridge to maintain

DISADVANTAGES:

• Additional piers would be required in the contaminated areas
• The signature span would have somewhat less visual mass, though it would still be a visible and memorable element from all of the same viewpoints
• WB travelers would not have the same "gateway" experience as the eastbound travelers

DISCUSSION:

Meeting the aesthetic goals is mostly a matter of having a shape distinctive enough to be recognized and remembered and high enough to be seen from many viewpoints. The first cable-stay bridge accomplishes this task all by itself. In the opinion of the VE team, because the tower of the second bridge is in a different position, adding the second cable-stayed bridge compromises the effect more than it enhances it.

However, the second cable-stayed bridge does provide a "gateway" experience for westbound drivers. With only the eastbound bridge in place, westbound travelers would certainly recognize that they are passing a landmark, but their experience of it would be different than if they had their own tower.

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td>$ 696,739,000</td>
<td>—</td>
<td>$ 696,739,000</td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td>$ 685,686,000</td>
<td>—</td>
<td>$ 685,686,080</td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td>$ 11,053,000</td>
<td>—</td>
<td>$ 11,053,000</td>
</tr>
</tbody>
</table>
Also, since the second cable-stayed bridge would be built at a later time under another contract, its design would have to be closely coordinated with the first in order to assure a compatible appearance. This would likely require coordinating the work of two different designers that may not see eye-to-eye on every detail. Though the box girder span would require more work in contaminated areas, the remediation resources would already be available and their work could easily be extended.
Comparative Cost Calculation

1. Cost of Total Project with Cable Stay Main Span = $696,739,000
2. Cost of Total Project with Concrete Box Girder Main Span = $672,177,000
3. Difference in Cost = $24,562,000
4. Width of EB Roadway = 97'
5. Width of WB Roadway = 79'
6. Total Width = 176'
7. WB Percentage of Width = 79/176 = 45%
8. Difference in Cost for WB Roadway only = 45% x $24,562,000 = $11,053,000
9. Cost of Alternative = $696,739,000 - $11,053,000 = $685,686,000
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

DESCRIPTION: PLACE THE TOWERS FOR BOTH MAIN SPAN CABLE-STAYED BRIDGES ON THE WEST SIDE OF NEWTOWN CREEK

ORIGINAL DESIGN: (sketch attached)

The main span consists of two cable-stayed bridges, one for each direction of travel. The tower for the eastbound (EB) bridge is west of Newtown Creek; the tower for the westbound (WB) bridge is east of Newtown Creek. The towers are an “H” shape with slanted lower legs. They support two planes of cables that in turn support welded steel I-shaped edge girders.

ALTERNATIVE: (sketch attached)

Place the towers for both cable-stayed bridges on the west side of Newtown Creek. (Placing both towers on the east side of the creek would be similar but the contamination issues appear more extreme.)

ADVANTAGES:
- Simplifies and potentially improves the appearance of the landmark feature
- Provides for possibly sharing the central legs or other tower structural features thus saving costs
- Consolidates contamination cleanup and other site work for tower foundations in one general location

DISADVANTAGES:
- Visual mass of landmark feature is reduced

DISCUSSION:
Meeting the aesthetic goals is mostly a matter of having a shape distinctive enough to be recognized and remembered and high enough to be seen from many viewpoints. Having both towers at the same location meets this requirement as well as having the tower at different locations. In fact, many will feel that with both towers at one location, the landmark shape is simpler and easier to recognize, which would make it even more effective. While the visual mass of the landmark feature will be reduced, having it a more recognizable shape will more than compensate.

COST SUMMARY

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DISCUSSION: (continued)

Cable-stayed bridges derive much of their appeal from the triangular “sail” shape of the cable array. The triangular shape is the clearest when it can be seen as a single silhouette without visual overlap or competition, and when the angles of the stays are close to each other and the stays do not appear to cross each. With both towers adjacent to each other the cable arrays are much closer to each other and the angles of the stays more closely parallel. Thus placing the towers on the same side of the creek makes it possible to meet the above criteria much better than with the separated “H” towers of the original design.

With the towers in close proximity, it would be possible for certain of their structural elements to be combined, creating potential improvements in structural capacity and reductions in cost. Also, contamination cleanup and other site work could be consolidated, potentially saving time and money.
PROPOSED WESTBOUND AND EASTBOUND CABLE-STAYED MAIN SPAN ELEVATIONS (VIEWED FROM SOUTH FASCIA OF EASTBOUND ROADWAY)

AS DESIGNED

PROPOSED EASTBOUND CABLE-STAYED MAIN SPAN ELEVATION - SOUTH FASCIA

ALTERNATIVE

LEGEND:

F - FIXED BEARING
E - EXPANSION BEARING

NOTES:
1. Span locations shown are taken along south face of CB and PB structures.
2. Remove existing foundations as required to install new foundations.
3. Existing main span foundations to be removed from roadway.
4. See Doc. No. 57-20 for detailed plans.

SCALE:
1" = 100'
PROJECT: REPLACEMENT OF KOŚCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

DESCRIPTION: USE SYMMETRICAL CABLE-STAYED MAIN SPANS IN LIEU OF STAGGERED CABLE-STAYED MAIN SPANS

ORIGINAL DESIGN: (sketch attached)

Staggered cable-stayed main spans are designed.

ALTERNATIVE: (sketch attached)

Use a symmetrical, 600-ft. cable-stayed main span with 300 ft. lateral spans and with a harp arrangement of cables.

ADVANTAGES:

- Meets aesthetic goals
- Reduces visual conflicts between eastbound and westbound cable-stay systems
- Saves costs

DISADVANTAGES:

- None apparent

DISCUSSION:

To clarify the visual impact of the crossing, both eastbound and westbound cable-stayed spans have two symmetrical towers. To be at the right scale with regard to the width of the roadway and to the site, the main span is 600 feet long and the pylon 140 feet high above deck level. To simplify the stay arrangement and visual perception, the harp type is adopted, which is well adapted to these relatively modest dimensions. Pylons and decks are resting on the piers through neoprene bearings, which allow optimizing piers and foundations – it provides, in particular, seismic isolation. Altogether a minimalist approach is proposed (“less is more”).

The towers are further apart from the creek than in the original design, and the ground impact of the main spans is similar.

When building the westbound bridge, a connection will have to be made between the two decks, but at the level of the towers only.

COST SUMMARY

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NOTES:
1. Span elevations taken along South Face of EB and WB structures.
2. Bearing earth anchors as required to stabilize new foundations.
3. Existing span foundations to be removed from drawings.
4. See plans No. 51-10 for bearing details.
Connection between 1st stage of 2nd stage - At pier only

CROSS SECTION AT PYLON LOCATION
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK,
KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

DESCRIPTION: USE STAGGERED TIED ARCHES IN LIEU OF STAGGERED CABLE-
STAYED BRIDGES FOR THE MAIN SPAN

ORIGINAL DESIGN: (sketch attached)

The structure justification report investigated a cable-stayed bridge, a through arch bridge and a deck arch bridge for the main span and the cable-stayed bridge was selected as the preferred option. Staggered cable stayed bridges with 630/639 feet spans are shown.

ALTERNATIVE: (sketch attached)

For the main span, use staggered tied arches with 630 and 639 feet spans.

ADVANTAGES:

- Meets aesthetic goals
- Saves costs and schedule
- Minimizes project risk
- Reminds one of the existing bridge

DISADVANTAGES:

- Lower height above deck than a cable-stayed bridge

DISCUSSION:

This option retains all the advantages of the cable-stayed option with regard to the support locations, while proposing a more conventional, probably more economical structure. The height above the deck could be taken as one fifth of the span, i.e., 126 feet, which has a good proportion to the height of the deck above ground – approximately 3 to 2, or more if the deck is lowered, as proposed in Alt. No. G-1, which moves it in the right direction.

COST SUMMARY

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

DESCRIPTION: USE A PARTIAL "W-SHAPED" TOWER ON THE WEST SIDE OF NEWTOWN CREEK IN LIEU OF "H-SHAPED" TOWERS ON EITHER SIDE OF NEWTOWN CREEK

ORIGINAL DESIGN: (sketch attached)

The main span consists of two cable stayed bridges, one for each direction of travel. The tower for the eastbound (EB) bridge is west of Newtown Creek; the tower for the westbound (WB) bridge is east of Newtown Creek. The towers are an “H” shape with slanted lower legs. They support two planes of cables that in turn support welded steel I-shaped edge girders.

ALTERNATIVE: (sketch attached)

Consolidate the towers for both cable-stayed bridges into a single element shaped like a partial “W” and placed on the west side of Newtown Creek. The central tower leg supports the median cable stays for both the EB and WB roadways.

ADVANTAGES:

- The landmark feature would have a distinctive shape not previously used on any other bridge, making this bridge particularly memorable
- The shape of the cable arrays and the drivers’ experience of them would be dramatically different in the EB and WB directions, making the experience of using the bridge even more memorable
- Notwithstanding the above, the direction and angles of the stays would be clearer and easier to understand than that for the original design
- Consolidates contamination cleanup and other site work for tower foundations in one general location
- Clearance problems between the WB median tower arm and the EB clearance envelope are unlikely
- The two sides of the tower form would accommodate the difference in roadway width and a potential difference in roadway height without compromising the proportioning of the tower element

DISADVANTAGES:

- Visual mass of landmark feature is reduced
- Construction of the upper part of the median arm of the “W” would be above the opposite roadway requiring a temporary work platform to protect opposing traffic

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

DESCRIPTION: USE A PARTIAL “W-SHAPED” TOWER ON THE WEST SIDE OF NEWTOWN CREEK IN LIEU OF “H-SHAPED” TOWERS ON EITHER SIDE OF NEWTOWN CREEK

DISCUSSION:

Meeting the aesthetic goals is mostly a matter of having a shape distinctive enough to be recognized and remembered and high enough to be seen from many viewpoints. Having a unique, easily recognized and memorable form at one location meets this requirement better than having the tower at different locations. Since this particular shape has never been built before, its uniqueness will symbolize Brooklyn, Queens and the Kosciuszko Bridge at the national and even international level.

Cable-stayed bridges derive much of their appeal from the triangular “sail” shape of the cable array. The triangular shape is the clearest when it can be seen as a single silhouette without visual overlap or competition, and when the angles of the stays are close to each other and the stays do not appear to cross each. In the opinion of the VE team, the cable arrays of the partial “W” meet these criteria much better than the “H” towers of the original design.

With the slanted arms of this tower, the cable planes define three dimensional shapes, a trapezoidal “valley” for the EB bridge and an elongated pyramidal shape for the WB bridge. Drivers in the EB direction will experience the bridge as traversing an immense open space widening to the sky. Drivers in the WB direction will experience the bridge as traversing an elongated virtual pyramid. This dramatic difference will make using the bridge even more memorable.

While the visual mass of the landmark feature will be reduced, having it a more recognizable shape will more than compensate.

Since the two towers are combined into a single unified shape, certain of their structural elements are combined, creating potential improvements in structural capacity and reductions in cost.

Clearance problems between the WB median tower arm and the EB clearance envelope is more likely because that arm slopes away from traffic. Construction of any tower adjacent to active traffic lanes will likely raise the need for traffic protection of some sort. Traffic protection will be needed, in any case, though the “V” arm may make these a bit more difficult.

Also, contamination cleanup and other site work can be consolidated, potentially saving time and money.
ALTERNATIVE

PROPOSED WESTBOUND
62'-0"

79'-0"

PROPOSED EASTBOUND

4'-0" SHOULDER

10'-0"

FOUR 12'-0"

TRAFFIC LANES

SHOULDER

SHOULDER

SHOULDER

THREE 12'-0"

TRAFFIC LANES

20'-0"

20'-0"

40'-0"

40'-0"

30'-0"

13'-1" BIKEWAY/WALKWAY

42'-0"

EASTBOUND

50'-0"

EASTBOUND

4'-0" SHOULDER

9'-0"

TWO 12'-0"

TRAFFIC LANES

SHOULDER

SHOULDER

SHOULDER

SHELD

SHELD

SHELD

SHELD
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

DESCRIPTION: USE TWO TIED ARCHES WITH 450 FEET SPANS IN LIEU OF CABLE-STAYED BRIDGES FOR THE MAIN SPAN

ORIGINAL DESIGN: (sketch attached)

The Structure Justification Report investigated a cable-stayed bridge, a through arch bridge and a deck arch bridge for the main span and the cable-stayed bridge was selected as the preferred option.

ALTERNATIVE: (sketch attached)

For the main span, use tied arches.

ADVANTAGES:

• Meets aesthetic goals
• Tied arch is centered to the creek
• Reminds one of existing bridge main span
• Saves cost and schedule
• Minimizes project risks

DISADVANTAGES:

• Reduces height above deck level, as compared to cable-stayed option or longer tied arches (Alt. No. MS-16)
• 45° span may result in locating the Queens side pier in the Class-2 Contaminated site

DISCUSSION:

This is probably the most basic solution for the crossing of the creek. The ratio between the height above deck (90 feet) and the height below deck (approximately 85 feet), approximately one, is not satisfactory. This could be improved by lowering the deck level as suggested in Alt. No. G-1.

This alternative could be significantly improved by increasing the span to 550/600 feet, which would lead to a scale better adapted to the site, and reduce ground impact in the vicinity of the creek. This would not affect the budget significantly (see cost estimate below).

The cost analysis was based upon the following assumptions: approaches are estimated on the basis of the cost per linear meter of segmental bridges, and the main span is estimated on the basis of the cost per linear foot of the cable-stayed option.

Approaches cost per linear meter : $225,555,570/7130 = $31,634/foot
Main span cost per linear meter (2010 $) : 122,494,599/1987 = $61,648/foot
Cost of the tied arch 450 feet main span : 450 x $61,648 = $27,741,600
Cost of the approaches extensions: (1987 – 450) x $31,634 = $48,621,458

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td>$ 122,495,000</td>
<td>—</td>
<td>$ 122,495,000</td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td>$ 76,363,000</td>
<td>—</td>
<td>$ 76,363,000</td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td>$ 46,132,000</td>
<td>—</td>
<td>$ 46,132,000</td>
</tr>
</tbody>
</table>
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

ALTERNATIVE NO.: MS-20

SHEET NO.: 1 of 6

DESCRIPTION: USE A "V-SHAPED" TOWER ON THE WEST SIDE OF NEWTOWN CREEK FOR THE EASTBOUND BRIDGE; USE AN "A-SHAPED" TOWER ON THE EAST SIDE OF NEWTOWN CREEK FOR THE WESTBOUND BRIDGE

ORIGINAL DESIGN: (sketch attached)

The main span consists of two cable-stayed bridges, one for each direction of travel. The tower for the eastbound (EB) bridge is west of Newtown Creek; the tower for the westbound (WB) bridge is east of Newtown Creek. The towers are an “H” shape with slanted lower legs. They support two planes of cables that in turn support welded steel I-shaped edge girders.

ALTERNATIVE: (sketch attached)

Use a “V-shaped” tower for the EB cable-stayed bridge and place it west of Newtown Creek. Use an “A-shaped” tower for the WB cable-stayed bridge and place it east of Newtown Creek. Align all of the tower legs parallel with each other.

ADVANTAGES: DISADVANTAGES:

• The “V-shaped” and “A-shaped” towers would be reciprocal shapes that would complement each other when seen together
• The landmark features taken together would form a distinctive composite landmark element not previously used on any other bridge, making this bridge particularly memorable
• The shape of the cable arrays and the drivers’ experience of them would be dramatically different in the EB and WB directions, making the experience of using the bridge even more memorable
• Notwithstanding the above, the direction and angles of the stays would be more nearly parallel, making these cable arrays visually clearer and easier to understand than those for the original design

• Visual mass of the landmark feature is reduced
• Construction of the upper part of the median arm of the “V” would be above the opposite roadway requiring a temporary work platform to protect opposing traffic

COST SUMMARY

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

62
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

DESCRIPTION: USE A "V-SHAPED" TOWER ON THE WEST SIDE OF NEWTOWN CREEK FOR THE EASTBOUND BRIDGE; USE AN "A-SHAPED" TOWER ON THE EAST SIDE OF NEWTOWN CREEK FOR THE WESTBOUND BRIDGE

ADVANTAGES: (continued)

- The two tower types would accommodate the difference in roadway width and potentially differences in roadway height without compromising the proportions of either tower
- Clearance problems between the WB tower arm and the EB traffic clearance envelope are unlikely with an "A-shaped" tower for the WB bridge

DISCUSSION:

Meeting the aesthetic goals is mostly a matter of having a shape distinctive enough to be recognized and remembered and high enough to be seen from many viewpoints. Combining two different but visually compatible tower forms would create a unique, easily recognized and therefore memorable landmark element. Since this particular combination has never been built before, its uniqueness will symbolize Brooklyn, Queens and the Kosciuszko bridge at the national and even international level.

Cable stayed bridges derive much of their appeal from the triangular "sail" shape of the cable array. The triangular shape is the clearest when its can be seen as a single silhouette without visual overlap or competition, and when the angles of the stays are close to each other and the stays do not appear to cross each other. With this concept the triangular "sail" areas would overlap but the angles of the stays would be more nearly parallel so that the cable arrays of the "V" and "A" taken together would, in the opinion of the VE team, meet these criteria somewhat better than the "H" towers of the original design.

With the slanted arms of these towers the cable planes define three dimensional shapes, a trapezoidal "valley" for the EB bridge and an elongated pyramidal shape for the WB bridge. Drivers in the EB direction will experience the bridge as traversing an immense open space widening to the sky. Drivers in the WB direction will experience the bridge as traversing the interior of an elongated virtual pyramid. This dramatic difference will make using the bridge even more memorable.

While the visual mass of the landmark feature will be reduced, having it a more recognizable shape will more than compensate.
DISCUSSION: (continued)

Clearance problems between the WB median tower arm and the EB traffic clearance is unlikely because the arm slopes away from the traffic. Construction of any tower adjacent to active traffic lanes will likely raise the need for traffic protection of some sort. Traffic protection will be needed in any case, though the "V" arm may make these a bit more difficult.

Also, contamination cleanup and other site work can be consolidated, potentially saving time and money.
PROPOSED WESTBOUND
62'-0"

WESTBOUND
11'-0"

4'-0" SHOULDER

FOUR 12'-0"

TRAFFIC LANES

4'-0" SHOULDER

EASTBOUND
50'-0"

EASTBOUND
42'-0"

EASTBOUND

TWO 12'-0"

TRAFFIC LANES

THREE 12'-0"

TRAFFIC LANES

ALTERNATIVE

Preliminary structure plans
Main span
Construction staging cross sections - 2

Preliminary structure plans
Main span
Construction staging cross sections - 2

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 11

DOCUMENT NAME: K72977.cob.sec.trn_const-stage-xsec
<table>
<thead>
<tr>
<th>ALT. NO.</th>
<th>DESCRIPTION</th>
<th>ORIGINAL COST</th>
<th>ALTERNATIVE COST</th>
<th>INITIAL COST SAVINGS</th>
<th>RECURRING COST SAVINGS</th>
<th>TOTAL PW LCC SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-1</td>
<td>Lower the bridge clearance over Newtown Creek from 88 ft. 6 in. to 70 ft. 0 in.</td>
<td>$37,201,000</td>
<td>$33,922,000</td>
<td>$3,279,000</td>
<td></td>
<td>$3,279,000</td>
</tr>
<tr>
<td>G-3</td>
<td>Evaluate the timing of the design build request for proposal release date considering other major projects locally and nationally</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
<tr>
<td>G-5</td>
<td>Have the design build team design both cable-stayed main spans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
<tr>
<td>G-6</td>
<td>Combine the demolition of the existing bridge and westbound bridge construction contracts together</td>
<td>$5,000,000</td>
<td>$0</td>
<td>$5,000,000</td>
<td></td>
<td>$5,000,000</td>
</tr>
<tr>
<td>G-9</td>
<td>Reduce the eastbound roadway width from 94 ft. clear to 90 ft. clear</td>
<td>$381,079,000</td>
<td>$364,067,000</td>
<td>$17,012,000</td>
<td></td>
<td>$17,012,000</td>
</tr>
<tr>
<td>G-11</td>
<td>Provide public access to the waterfront</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
<tr>
<td>G-12</td>
<td>Combine the environmental work for the westbound bridge into the eastbound bridge contract</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
<tr>
<td>G-13</td>
<td>Change the vertical profile of the westbound roadway to be about 10 ft. lower than the eastbound roadway over Newtown Creek</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DESIGN SUGGESTION</td>
</tr>
</tbody>
</table>
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

DESCRIPTION: LOWER THE BRIDGE CLEARANCE OVER NEWTOWN CREEK FROM 88 FT. 6 IN. TO 70 FT. 0 IN.

ORIGINAL DESIGN: (sketch attached)
The clearance for the bridge over Newtown Creek is set as 88 ft. 6 in.

ALTERNATIVE: (sketch attached)
Lower the bridge clearance to 70 ft. 0 in. and return the height of the bridge pylon.

ADVANTAGES:
- Reduces the height of the piers for the approach slabs and resulting effect on the pier foundations
- Allows the main span cable-stays to move higher up on the pylon increasing their effectiveness and improving the height to span ratio of the pylon to the deck
- Reduces the cost of the bridges
- Reduces the approach grades making it easier for trucks to climb and keep traffic flowing smoothly – sustainability benefit, reduces carbon footprint

DISADVANTAGES:
- Requires approval by federal agencies

DISCUSSION:
This alternative has the potential to enhance the aesthetic value of the cable-stayed bridge option for the main span by increasing the height of the pylon above the deck and getting more efficient use of the cables as well as reducing the cost of all of the piers and pier foundations for the approaches.

In order to be implemented, the idea has to be approved by the Coast Guard and other federal government agencies.

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td>$37,201,000</td>
<td>—</td>
<td>$37,201,000</td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td>$33,922,000</td>
<td>—</td>
<td>$33,922,000</td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td>$3,279,000</td>
<td>—</td>
<td>$3,279,000</td>
</tr>
</tbody>
</table>
## COST WORKSHEET

**REPLACEMENT OF THE KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK**
**KINGS AND QUEENS COUNTIES, NEW YORK**

*New York State Department of Transportation*

**ALTERNATIVE NO.: G-1**

**SHEET NO.: 6 of 6**

<table>
<thead>
<tr>
<th>CONSTRUCTION ITEM</th>
<th>ORIGINAL ESTIMATE</th>
<th>PROPOSED ESTIMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ITEM</td>
<td>UNITS</td>
</tr>
<tr>
<td>Piles</td>
<td>LF</td>
<td>66,080</td>
</tr>
<tr>
<td>Concrete for Structures</td>
<td>CY</td>
<td>7,316</td>
</tr>
</tbody>
</table>

**Subtotal**

37,200,633

33,921,663

**Markup (%) at**

**TOTAL**

37,200,633

33,921,663

**TOTAL ROUNDED**

37,201,000

33,922,000
PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

ALTERNATIVE NO.: G-3

DESCRIPTION: EVALUATE THE TIMING OF THE DESIGN-BUILD REQUEST FOR PROPOSAL RELEASE DATE CONSIDERING OTHER MAJOR PROJECTS LOCALLY AND NATIONALLY

ORIGINAL DESIGN:
Currently, little regard is being placed on the timing of this major design build project.

ALTERNATIVE:
Coordinate the timing of the bidding of this project, considering other major projects proceeding locally and nationally, and schedule the advertisement of the large projects within a 1 month after the last one bid.

ADVANTAGES:
- Increases competition on the large projects, creating cost savings to the Department
- Allows smaller local contractors to get involved on the projects

DISADVANTAGES:
- Potential slight delay with a project bid date

DISCUSSION:
The total project cost (in 2010 dollars) of the preferred alternative is $682,300,000. Eliminating the cost of the existing bridge demolition, $44,753,000 results in a net base cost of $637,547,000 for both the eastbound and westbound structures. The approximate value of contract #2 is $319,000,000. The large construction value will attract a national and regional pool of construction companies and partnerships.

Considering the large commitment of resources necessary by the contracting and engineering community, strong consideration should be given to staggering the bid dates for the following projects. It is likely that the large national contractors will be interested in pursuing several of the projects. An overload of very large projects may cause some qualified contracting teams to not submit, thereby reducing competition and increasing bidding costs.

- Tappan Zee Bridge - $6B
- Goethals Bridge - $3B
- Bayonne Bridge - $1B
- Major Deegan Expressway - $250M

COST SUMMARY

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>+ DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOŚCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

DESCRIPTION: HAVE THE DESIGN-BUILD TEAM DESIGN BOTH CABLE-STAYED MAIN SPANS

ORIGINAL DESIGN:

The bridge is to be constructed using multiple contracts, with the first being a design-build contract to construct the eastbound roadway and a cable-stayed main span; and another being to construct the westbound roadway including the second cable-stayed main span using a design-bid-build approach.

ALTERNATIVE:

The cable-stayed main spans are designed to create a “signature bridge” with entrances to Kings and Queens Counties. Have the design team of the design-build contract design the main span for the westbound roadway.

ADVANTAGES:

- Takes advantage of the designer’s experience in designing the eastbound main span
- Ensures that the aesthetics of the two bridges are carried to fruition
- Ensures that the second bridge can be constructed as desired

DISADVANTAGES:

- Requires two independent designers to put their documents together for bidding the westbound roadway project

DISCUSSION:

A cable-stayed bridge requires a complex design. By having the same design team design both bridges, the lessons learned on the first bridge design are carried forward to the second bridge. It also assures that the aesthetic component of the design-build team’s submission is carried out as intended and the bridge can be constructed.

Using two independent designers to formulate a single bid document will require that one of the designers be a subconsultant to the prime consultant, of the design-bid-build approach, which would need to be contractually worked out.

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK,
KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

ALTERNATIVE NO.: G-6

DESCRIPTION: COMBINE THE DEMOLITION OF THE EXISTING BRIDGE AND
WESTBOUND BRIDGE CONSTRUCTION CONTRACTS INTO ONE
CONTRACT

ORIGINAL DESIGN:

The current approach uses one design-build construction contract, a demolition contract for the existing bridge and a contract for the construction of the new westbound bridge.

ALTERNATIVE:

Combine the demolition contract and westbound (WB) bridge construction contract into one contract.

ADVANTAGES:

• Expedites construction of the WB structure by allowing new WB bridge construction to occur as soon as a reasonable portion of existing bridge is demolished
• Avoids the new bridge contract needing to wait 14 months until the demolition contract is completed
• Moving the WB bridge construction project forward to July, 2016 can reduce the cost of 14 months of escalation on the $319,000,000 structure. A conservative estimate of 6 month schedule shift forward can save approximately $5 M if a 3% inflation factor is considered.

DISADVANTAGES:

• The westbound bridge design must be completed sooner than currently planned. Moving forward the bid date by 14 months to September 2017.
• Construction funding for the westbound bridge needs to be available July 2016

DISCUSSION:

Combining the two contracts will enable the general contractor to assume control of the demolition work. In this scenario, he can direct the sequence of demolition to his advantage and ultimately reduce the overall duration of the combined demolition and bridge construction project.

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td>$ 5,000,000</td>
<td>—</td>
<td>$ 5,000,000</td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td>0</td>
<td>—</td>
<td>0</td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td>$ 5,000,000</td>
<td>—</td>
<td>$ 5,000,000</td>
</tr>
</tbody>
</table>
PROJECT: REPLACEMENT OF KOŚCIOUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

DESCRIPTION: REDUCE EASTBOUND ROADWAY WIDTH FROM 94 FT. CLEAR TO 90 FT. CLEAR

ORIGINAL DESIGN: (sketch attached)

The original eastbound (EB) roadway width is 94 ft. 0 in. Starting from the inside lane, the lane dimensions consist of:

- 8 ft. shoulder – two, 12 ft. mainline through lanes – 10 ft. shoulder – 2 ft. median barrier – 4 ft. shoulder – three, 12 ft. collector-distributor lanes and – 10 ft. shoulder

The design provides for an 8-ft.-wide shoulder on the left side of the two 12-ft.-wide through lanes.

ALTERNATIVE: (sketch attached)

Reduce the roadway width for the entire length of the project by reducing the left shoulder width from 8 ft. to 4 ft. on the two through lane portions of the roadway. Eliminating the additional shoulder width for full length of the project will reduce bridge deck widths on the Main Span, Brooklyn Approach Spans, and the Queens Approach Spans.

ADVANTAGES:
- Reduces the overall main span bridge deck width by 4 ft. over the length of the main span, saving bridge deck and superstructure costs
- Reduces out to out width of EB main span bridge from 107 ft. 10 in. to 103 ft. 10 in. This will improve slightly the vertical clearances and compatibility with the alternate tower configurations such as the “Partial W” shape.
- Matches 4 ft. shoulder provided on the collector-distributor side of the median barrier

DISADVANTAGES:
- During maintenance and protection of traffic (MPT) the westbound traffic will have only 11 ft. 4 in. lanes with 2 ft. offsets to the concrete barriers on each side

COST SUMMARY

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td>$ 381,079,000</td>
<td></td>
<td>$ 381,079,000</td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td>$ 364,067,000</td>
<td></td>
<td>$ 364,067,000</td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td>$ 17,012,000</td>
<td></td>
<td>$ 17,012,000</td>
</tr>
</tbody>
</table>
**VALUE ENGINEERING ALTERNATIVE**

**PROJECT:** REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK

New York State Department of Transportation

**ALTERNATIVE NO.:** G-9

**DESCRIPTION:** REDUCE EASTBOUND BRIDGE WIDTH FROM 94 FT. CLEAR TO 90 FT. CLEAR

**DISCUSSION:**

The reduction of the left shoulder on the eastbound mainline lanes from 8 ft to 4 ft can be implemented, and satisfy shoulder requirements. Maintenance and protection of traffic for the westbound traffic can be performed with the reduced deck width, utilizing 3 lanes with a width of 11.33 ft. In addition, 2 ft wide offsets can be included as shy distance away from the parapet and median barrier. This is very common for bridge construction and will save considerable costs on this project.
TYPICAL EASTBOUND SECTION AT MAIN SPAN
STA. EB 41+42.00 TO EB 47+40.00
LOOKING UPSTATION

Illustration of a bridge section at the main span with dimensions and annotations.

Note: This is a Preliminary Structure Plan for the eastbound section of the bridge.

Scale: 1" = 10'
% DECK WIDTH REDUCTION
4'-0" REDUCTION
\[ \frac{107.83}{3.71} \approx 28.91\% \]

\[ \frac{100.00}{94.29} \approx 107.11\% \]

TYPICAL EASTBOUND SECTION AT MAIN SPAN
STA. EB 41+61.00 TO EB 47+40.00
LOOKING UP STATION

**Final Configuration**

**Preliminary Structure Plans**
"EB" Main Span Transverse Section

**County:**

**Sheet No.:** 20

**Contact Number:** 3015624

**Drawing No.:** ST-19

**Document No.:** 13177.00-00001-00002-S-00001

**New York State Department of Transportation Design:**

It is a violation of law for any person, unless authorized under the direction of a licensed professional engineer, architect, landscape architect, or land surveyor, to adopt, use, and publish any part of any item of the exhibit as a foundation for any construction. The exhibit is intended for use as a reference only and is subject to the following conditions: (1) It is not intended for public distribution. (2) It is subject to revision at any time. (3) It is not to be used for any purpose other than those for which it was prepared. (4) It is subject to the condition that the user shall not license or permit the use of any part of it to any other person without the written consent of the State Department of Transportation.
## REPLACEMENT OF THE Kosciuszko BRIDGE
### OVER NEWTOWN CREEK
#### KINGS AND QUEENS COUNTIES, NEW YORK

**New York State Department of Transportation**

**ALTERNATIVE NO.:**  G-9

**SHEET NO.:**  5 of 6

## CONSTRUCTION ITEM

<table>
<thead>
<tr>
<th>ITEM</th>
<th>UNITS</th>
<th>ORIGINAL ESTIMATE</th>
<th>PROPOSED ESTIMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>NO. OF UNITS</td>
<td>COST/UNIT</td>
</tr>
<tr>
<td>Brooklyn Connector</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeker Ave to Vandervoort: (EPS less items which remain regardless of option)</td>
<td>LS</td>
<td>1</td>
<td>15,590,000</td>
</tr>
<tr>
<td>Vandervoort Ave. to Varick Ave.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wearing Surface bottom forms</td>
<td>SY</td>
<td>11,590</td>
<td>291.82</td>
</tr>
<tr>
<td>Armorless joints</td>
<td>LF</td>
<td>730</td>
<td>2,437.00</td>
</tr>
<tr>
<td>Tee Units</td>
<td>LF</td>
<td>14,640</td>
<td>959.36</td>
</tr>
<tr>
<td>Vandervoort Ave. Crossing &quot;D1&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lightweight HP Concrete</td>
<td>SY</td>
<td>1,440</td>
<td>334.45</td>
</tr>
<tr>
<td>Prestress Concrete I-Beams</td>
<td>LF</td>
<td>1,548</td>
<td>855.00</td>
</tr>
<tr>
<td>Armorless joints</td>
<td>LF</td>
<td>210</td>
<td>2,437.00</td>
</tr>
<tr>
<td>Varick Ave. Crossing &quot;E1&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lightweight HP Concrete</td>
<td>SY</td>
<td>1,500</td>
<td>334.45</td>
</tr>
<tr>
<td>Prestress Concrete I-Beams</td>
<td>LF</td>
<td>1,475</td>
<td>959.36</td>
</tr>
<tr>
<td>Armorless joints</td>
<td>LF</td>
<td>210</td>
<td>2,437.00</td>
</tr>
<tr>
<td>Varick Ave. to Brooklyn Approach (EPS less items which remain regardless of option)</td>
<td>LS</td>
<td>1</td>
<td>5,368,027</td>
</tr>
</tbody>
</table>

**Subtotal**

<table>
<thead>
<tr>
<th></th>
<th>ORIGINAL ESTIMATE</th>
<th>PROPOSED ESTIMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>44,909,680</td>
<td>43,095,310</td>
</tr>
</tbody>
</table>

**Markup (%) at**

<table>
<thead>
<tr>
<th>TOTAL</th>
<th>ORIGINAL ESTIMATE</th>
<th>PROPOSED ESTIMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>44,909,680</td>
<td>43,095,310</td>
</tr>
</tbody>
</table>

**TOTAL ROUNDED**

<table>
<thead>
<tr>
<th></th>
<th>ORIGINAL ESTIMATE</th>
<th>PROPOSED ESTIMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>44,910,000</td>
<td>43,095,000</td>
</tr>
</tbody>
</table>
## COST WORKSHEET

**REPLACEMENT OF THE KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK**  
**KINGS AND QUEENS COUNTIES, NEW YORK**

*New York State Department of Transportation*

**ALTERNATIVE NO.: G-9**

**SHEET NO.: 6 of 6**

### Construction Item

<table>
<thead>
<tr>
<th>Item</th>
<th>Original Estimate</th>
<th>Proposed Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>ITEM</strong></td>
<td><strong>UNITS</strong></td>
</tr>
<tr>
<td><strong>Subtotal from Previous Page</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Queens Connector Precast Concrete Bridge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epoxy coated reinforcing</td>
<td>LB</td>
<td>27,000</td>
</tr>
<tr>
<td>Lightweight PH Superstructure slab</td>
<td>SY</td>
<td>2,191</td>
</tr>
<tr>
<td>Protective Sealing</td>
<td>SY</td>
<td>2,987</td>
</tr>
<tr>
<td>Northeast Extreme Tee Beam</td>
<td>LF</td>
<td>2,700</td>
</tr>
<tr>
<td>Amorless Bridge joint System</td>
<td>LF</td>
<td>219</td>
</tr>
<tr>
<td><strong>Main Span Cable Stayed Bridge</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superstructure Slab (Box Girder)</td>
<td>SY</td>
<td>17,912</td>
</tr>
<tr>
<td>Strands (1/2&quot; Diameter)</td>
<td>LB</td>
<td>940,820</td>
</tr>
<tr>
<td>Permanent Concrete Barrier</td>
<td>LF</td>
<td>3,960</td>
</tr>
<tr>
<td>Concrete Overlay</td>
<td>SY</td>
<td>17,912</td>
</tr>
<tr>
<td><strong>Approaches: Segmental Box</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superstructure Box Girder</td>
<td>CY</td>
<td>33,816</td>
</tr>
<tr>
<td>Reinforcing Steel</td>
<td>LB</td>
<td>3,719,760</td>
</tr>
<tr>
<td>Superstructure Box Bonded Tendons</td>
<td>LB</td>
<td>1,710,256</td>
</tr>
<tr>
<td>Superstructure Box Unbonded Tendons</td>
<td>LB</td>
<td>1,160,900</td>
</tr>
<tr>
<td>Protective Sealing</td>
<td>SY</td>
<td>4,020</td>
</tr>
<tr>
<td>Modular Expansion Joints</td>
<td>LF</td>
<td>804</td>
</tr>
<tr>
<td>Overlay</td>
<td>SY</td>
<td>50,878</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Markup (%) at 71%**

<table>
<thead>
<tr>
<th></th>
<th><strong>Original Estimate</strong></th>
<th><strong>Proposed Estimate</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>381,078,965</strong></td>
<td><strong>364,067,266</strong></td>
</tr>
<tr>
<td><strong>TOTAL ROUNDED</strong></td>
<td><strong>381,079,000</strong></td>
<td><strong>364,067,000</strong></td>
</tr>
</tbody>
</table>
**PROJECT:** REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK  
New York State Department of Transportation  

**DESCRIPTION:** PROVIDE PUBLIC ACCESS TO THE WATERFRONT  

**ORIGINAL DESIGN:** (sketch attached)  
The current plans do not appear to allow for any public access to the waterfront at the conclusion of this project.  

**ALTERNATIVE:** (sketch attached)  
At the conclusion of the construction phase of the project, dedicate space along the waterfront of Newtown Creek for public access/enjoyment. The public access to the waterway should be as pedestrian protective as possible.  

**ADVANTAGES:**  
- Builds positive community relations  
- May allow for a certain level of aesthetic requirement compliance  
- May be a required permit condition  

**DISADVANTAGES:**  
- May not be feasible due to possible safety concerns  
- May not be feasible due to safety/access concerns with adjacent properties  

**DISCUSSION:**  
Public access to the waters of the State are typically required by state (NYSDEC) or other regulatory agency issued permits for projects located along waterways. This is consistent with the applicable portions of the Public Trust Doctrines which state the waters of the State are owned by the citizens who should enjoy access to these waters. Additionally, by providing some type of public access to the waterfront, the overall project may realize some aesthetic values as well as some positive community outreach goals.  

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

ALTERNATIVE NO.: G-12

DESCRIPTION: COMBINE THE ENVIRONMENTAL WORK FOR THE WESTBOUND BRIDGE INTO THE EASTBOUND BRIDGE CONTRACT

ORIGINAL DESIGN:

The current environmental management plans call for mitigation work to be completed in each environmentally impacted area identified in the Preliminary Assessment/Site Investigations (PA/SIs) for each respective contract. Contract #2 is construction of the new eastbound bridge. Contract #4 is construction on the new westbound bridge. Currently the estimated timeframe between the letting of these respective contracts is approximately 4.5 years.

ALTERNATIVE:

To the extent practical, incorporate most of the environmental mitigation work into Contract #2.

ADVANTAGES:

- Achieves cost savings by combining into a single environmental mitigation effort, (i.e. at proposed pier locations)
- Reduces impact to local traffic patterns by performing a single remediation effort
- Will contribute to an acceleration of the construction of the second bridge due to not having to perform additional environmental remediation
- Can contribute to a significant reduction of Contractor bid risk on contract #4, resulting in project cost savings

DISADVANTAGES:

- Recontamination due to ongoing sources of contamination that were not successfully addressed in the initial remedial actions
- Big pits under the footprint of the existing bridge will be an impediment to the bridge demolition contractor. His access will be hindered, now allowing crane placements to remove large superstructure segments.
- Westbound crossing contractor will have to go through the clean up process again due to seepage of contaminated ground water
- Westbound crossing contractor will not accept the pits to be clean

DISCUSSION:

This idea takes advantage of the assumption that the westbound bridge substructure units will essentially match the eastbound bridge unit locations along the centerline. The largest advantages include economy of scale of the required remediation areas as currently defined by the PA/SIs by performing remedial actions and/or controls for all areas at one time which then would eliminate the need for a 2nd environmental cleanup for the westbound bridge contractor.

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VALUE ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

ALTERNATIVE NO.: G-13

DESCRIPTION: CHANGE THE VERTICAL PROFILE OF THE WESTBOUND ROADWAY TO BE ABOUT 10 FEET LOWER THAN THE EASTBOUND ROADWAY OVER NEWTOWN CREEK

ORIGINAL DESIGN: (sketch attached)

The vertical profiles of each roadway are essentially at the same elevation throughout the project.

ALTERNATIVE: (sketch attached)

Lower the westbound (WB) roadway 10 feet below the eastbound (EB) roadway as they cross Newtown Creek.

ADVANTAGES:

- The view from the EB roadway to the Manhattan skyline would not be blocked by WB truck traffic
- EB trips across the bridge would be much more memorable
- Since the WB roadway would still be substantially above adjacent development, the view from the WB roadway to the Manhattan skyline would not be affected

DISADVANTAGES:

- Any WB travelers looking to the south would be exposed to the edge of the EB bridge superstructure.
- For cable stayed main spans the proportions of each tower will be different
- Approval for lowering the clearance over Newtown Creek would have to be obtained from the Coast Guard and other federal agencies

DISCUSSION:

One of the most notable aspects of the experience of crossing the Kosciuszko Bridge is the panoramic view of the Manhattan skyline. However, truck traffic on the WB roadway effectively blocks this view for EB travelers. Lowering the WB profile relative to the EB profile by about 10 feet would place the eye height of EB drivers above all but the tallest trucks and allow EB travelers to enjoy the view. That would also place the fascia of the EB superstructure squarely at the eye height of WB travelers. However, it is reasonable to assume that the vast majority of WB travelers will also be looking toward the Manhattan skyline. Most will not notice the EB superstructure. Studies of the tower proportions should alleviate any aesthetic problems caused by differing tower proportions.

COST SUMMARY

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### SUMMARY OF VALUE ENGINEERING ALTERNATIVES

**PROJECT:** REPLACEMENT OF KOSCIUSZKO BRIDGE (1-278) OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES  
New York State Department of Transportation

<table>
<thead>
<tr>
<th>ALT. NO.</th>
<th>DESCRIPTION</th>
<th>ORIGINAL COST</th>
<th>ALTERNATIVE COST</th>
<th>INITIAL COST SAVINGS</th>
<th>RECURRING COST SAVINGS</th>
<th>TOTAL PW LCC SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BROOKLYN CONNECTION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| BC-2 | **RESTRICT THE MOVEMENT OF PEDESTRIANS EXITING THE BRIDGE ON THE BROOKLYN SIDE TO REDUCE CONGESTION AT THE MEEKER AVENUE INTERSECTION** | | | | | |"
PROJECT: REPLACEMENT OF KOSCIuszKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

DESCRIPTION: RESTRICT THE MOVEMENT OF PEDESTRIANS EXITING THE BRIDGE ON THE BROOKLY SIDE TO REDUCE CONGESTION AT THE MEEKER AVENUE INTERSECTION

ORIGINAL DESIGN: (sketch attached)

At the Brooklyn side of the bridge the pedestrian/bicycle pathway ends at the ramp to Meeker Avenue, specifically where it curves off to meet Van Dam Street. If pedestrians and bicyclists are allowed to continue across this ramp exit, traffic on the ramp could be backed up.

ALTERNATIVE: (sketch attached)

Place a fence at the curb line of the curved ramp to direct pedestrians and bicyclists to Meeker Avenue to avoid affecting traffic flow.

ADVANTAGES:
- Moves the pedestrian/bicycle street crossing away from the street so that ramp traffic is not impeded

DISADVANTAGES:
- None apparent

DISCUSSION:
"Funneling" pedestrian and bicycle traffic away from the ramp will eliminate ramp congestion due to these individuals wanting to cross the street after exiting the bridge.

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PROPOSED ELEVATION - SOUTH FASCIA

LEGEND:
F - FIRST READING
E - ELEVATION ELEMS

NOTES:
1. EXISTING FOUNDATIONS ARE SHOWN FOR CLARITY. THEY WILL BE REMOVED WHERE NOT REQUIRED TO SUPPORT NEW FOUNDATIONS.
2. FOUNDATION SIZES AND DEPTHS ARE TAKEN ALONG THE EXISTING FOUNDATION.

AS-BUILT ELEVATION DESCRIPTION OF ALTERATIONS

PRELIMINARY STRUCTURE PLANS PROPOSED PLAN AND ELEVATION SHEET 2

DRAWING NO. 5T-8

CONTRACT NUMBER
0015624

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

IT IS A VIOLATION OF LAW FOR ANY PERSON, EXCEPT THE DIRECTOR OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR, TO MAKE OR ALTER ANY PLAN, OR ANY PART THEREOF, WHICH IS NOT MADE IN COMPLIANCE WITH THE REQUIREMENTS OF THE PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR, OR TO ALTER THE SAME UNLESS ADJUDGED UNALTERED, IN WHICH CASE THE ALTERING PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED AT" FOLLOWED BY THEIR STAMP, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

CONTRACT NUMBER
0015624

DRAWING NO. 5T-8

SHEET NO. 10

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

IT IS A VIOLATION OF LAW FOR ANY PERSON, EXCEPT THE DIRECTOR OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR, TO MAKE OR ALTER ANY PLAN, OR ANY PART THEREOF, WHICH IS NOT MADE IN COMPLIANCE WITH THE REQUIREMENTS OF THE PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR, OR TO ALTER THE SAME UNLESS ADJUDGED UNALTERED, IN WHICH CASE THE ALTERING PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED AT" FOLLOWED BY THEIR STAMP, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.
**SUMMARY OF VALUE ENGINEERING ALTERNATIVES**

**PROJECT:** REPLACEMENT OF KOSCIUSZKO BRIDGE (I-278) OVER NEWTOWN CREEK, KING AND QUEENS COUNTIES  
*New York State Department of Transportation*

<table>
<thead>
<tr>
<th>ALT. NO.</th>
<th>DESCRIPTION</th>
<th>ORIGINAL COST</th>
<th>ALTERNATIVE COST</th>
<th>INITIAL COST SAVINGS</th>
<th>RECURRING COST SAVINGS</th>
<th>TOTAL PW TCC SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEDESTRIAN CONNECTION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC-1</td>
<td>On the Queens side, align the pedestrian connection to go under the ramp from the eastbound Long Island Expressway and eliminate the helical ramp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC-2</td>
<td>Provide a pedestrian overlook at the tower</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*DESIGN SUGGESTION*
**PROJECT:** REPLACEMENT OF KOŚCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK  
New York State Department of Transportation  

**DESCRIPTION:** ON THE QUEENS SIDE, ALIGN THE PEDESTRIAN CONNECTION TO GO UNDER THE RAMP FROM THE EASTBOUND LONG ISLAND EXPRESSWAY AND ELIMINATE THE HELICAL RAMP  

**ORIGINAL DESIGN:** (sketch attached)

The pedestrian connection passes over the ramp from the Long Island Expressway (LIE) eastbound (EB) to Laurel Hill Blvd. and then over ramp from the LIE EB to the Brooklyn Queens Expressway (BQE) westbound (WB): From that point the connection uses a helical ramp to descend about two levels to connect with an existing sidewalk below the LIE that connects to the residential street network in Queens at 43rd street.

**ALTERNATIVE:** (sketch attached)

Align the pedestrian connection between the ramp from the LIE EB to Laurel Hill Blvd. and the ramp from the LIE EB to the BQE WB. The pedestrian connection would descend at a steeper grade than the ramp from the LIE EB to the BQE WB (but be Americans with Disability Act compliant), allowing it to pass below that ramp near the point where it diverges from the ramp to Laurel Hill Blvd. This would place the pedestrian connection at about the same level as the existing sidewalk below the LIE and eliminate the need for the helical ramp. Sufficient clearance would also exist under the ramp to Laurel Hill Blvd to allow a connection to its sidewalk. Finally, the existing sidewalk under the LIE would be enhanced with a new ceiling, lighting and abutment wall surface.

**ADVANTAGES:**

- Users of the pedestrian connection would have a much shorter climb, a benefit to the physically handicapped
- The cost and maintenance of the helical ramp would be eliminated
- Use of the pedestrian connection would be encouraged

**DISADVANTAGES:**

- Requires an underpass of the LIE eastbound off-ramp
- Requires retaining walls for the ramp to descend between the two ramps

**DISCUSSION:**

The new pedestrian connection from Queens to Brooklyn represents a sizable investment. The more frequently the connection is used the more the benefits of this investment will be realized. Flattening the profile of the connection will make it easier for pedestrians, families with strollers and cyclists to use it. Furthermore, on the Queens side almost all of the potential users are east of the LIE, in the existing residential neighborhood. Making their use of the connection as easy and attractive as possible will ensure that the connection is heavily used. Extending the limits of the work under the LIE and making cosmetic improvements to the appearance and security of the existing sidewalk underpass will be well worth the effort.

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DESCRIPTION: PROVIDE A PEDESTRIAN OVERLOOK AT THE TOWER

ORIGINAL DESIGN:

The pedestrian connection extends across the whole bridge at a constant width with no place for pedestrians or cyclists to pause or rest.

ALTERNATIVE:

Widen the pedestrian connection in the vicinity of the main span to provide an overlook with benches. The overlook would be coordinated with the main span superstructure. For example, with a cable stayed main span the overlook would occur at the tower.

ADVANTAGES:

- Pedestrians/cyclists would have place to pause and enjoy the panoramic view of the Manhattan skyline without interfering with other users of the connection
- Pedestrians/cyclists would have a place to rest after the ½ mile long climb from Brooklyn or Queens

DISADVANTAGES:

- None apparent

DISCUSSION:

The new pedestrian connection from Queens to Brooklyn represents a sizable investment. The more frequently the connection is used the more the benefits of this investment will be realized. Making the connection more pleasant and attractive to use will increase its use. Providing a place to rest will encourage more users. Having a place to stop and enjoy the view will encourage more users as well.

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### SUMMARY OF VALUE ENGINEERING ALTERNATIVES

**PROJECT:** REPLACEMENT OF KOSCIUSZKO BRIDGE (I-278) OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES

*New York State Department of Transportation*

**PRESENT WORTH OF COST SAVINGS**

<table>
<thead>
<tr>
<th>ALT. NO.</th>
<th>DESCRIPTION</th>
<th>ORIGINAL COST</th>
<th>ALTERNATIVE COST</th>
<th>INITIAL COST SAVINGS</th>
<th>RECURRING COST SAVINGS</th>
<th>TOTAL PW SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-1</td>
<td>Design and implement treatment technologies for all ground water encounter during all construction activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-4</td>
<td>Update sampling data (ground water and soils) on suspected contaminated areas of concern before the design-build request for proposal is issued</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-5</td>
<td>Define approved or appropriate protective construction methods in identified adversely impacted areas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ENVIRONMENTAL**

**PRESENT WORTH OF COST SAVINGS**

<table>
<thead>
<tr>
<th>ALT. NO.</th>
<th>DESCRIPTION</th>
<th>ORIGINAL COST</th>
<th>ALTERNATIVE COST</th>
<th>INITIAL COST SAVINGS</th>
<th>RECURRING COST SAVINGS</th>
<th>TOTAL PW SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VALUES ENGINEERING ALTERNATIVE

PROJECT: REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK
New York State Department of Transportation

ALTERNATIVE NO.: E-1

DESCRIPTION: DESIGN AND IMPLEMENT TREATMENT TECHNOLOGIES FOR ALL GROUNDWATER ENCOUNTERED DURING ALL CONSTRUCTION ACTIVITIES

SHEET NO.: 1 of 2

ORIGINAL DESIGN:

Construction dewatering is necessary throughout most, if not all, locations along the footprint of the project on both sides (Brooklyn and Queens) of Newtown Creek. Due to the high probability of encountering contaminated media in these locations, there will be project requirements that call for the proper treatment of these contaminated materials prior to, or as part of, its disposal and/or discharge to the surface waters of the State. These requirements appear to be addressed as separate project requirements.

ALTERNATIVE:

Combine the design and implementation of these two construction activities as one overall task to be addressed anywhere and everywhere ground water will be encountered. Wherever dewatering is going to be needed, treatment of this encountered ground water will be required prior to its disposal and/or discharge. Account for this need during the design and implementation in order to ensure that special treatment technologies will not be required after initiating specific construction techniques (i.e., drilling, foundation excavation, etc.) have already been started and therefore minimizing project disruptions due to the need for environmental controls.

ADVANTAGES:

• Maintains or expedites construction schedules
• Demonstrates permit and/or regulatory compliance
• Provides budgetary optimization and consistency
• Provides for worker protection
• Provides water quality protection

DISADVANTAGES:

• Treatment requirements may be additional project costs
• Treatment of media (i.e., groundwater) prior to discharge may add time to overall project schedule
• In isolated locations, it may not be necessary but the efforts to determine which areas may not be necessary to treat prior to discharge will be time and cost prohibitive

DISCUSSION:

The Preliminary Assessments and Site Investigations (PA/SIs) for the proposed properties along the project limits reveal a very high probability that contaminated media will be encountered in almost all locations throughout the entire length and breadth of the project. Since soils and ground water are encountered as a normal aspect of any construction project, but contaminated media generally tends to be site or location specific, these two concepts are typically addressed as stand-alone items.

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### VALUE ENGINEERING ALTERNATIVE

<table>
<thead>
<tr>
<th>PROJECT:</th>
<th>REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>New York State Department of Transportation</td>
</tr>
<tr>
<td>DESCRIPTION:</td>
<td>DESIGN AND IMPLEMENT TREATMENT TECHNOLOGIES FOR ALL GROUNDWATER ENCOUNTERED DURING ALL CONSTRUCTION ACTIVITIES</td>
</tr>
<tr>
<td>ALTERNATIVE NO.:</td>
<td>E-1</td>
</tr>
<tr>
<td>SHEET NO.:</td>
<td>2 of 2</td>
</tr>
</tbody>
</table>

**DISCUSSION:** (continued)

For this project, special handling and/or treatment requirements will be required. They should be addressed in concert with each other throughout the project length. Wherever excavation and/or drilling will be required, there should be a plan to capture and treat all ground water prior to discharge either into the surface waters of the State or into a sanitary sewer collection system. By planning and designing for treatment requirements up front, it could lead to maintaining positive and consistent construction schedules and budgets.
**ORIGINAL DESIGN:**

Preliminary Assessments and Site Investigations (PA/SIs) were performed for a number of properties on both sides of Newtown Creek (Brooklyn and Queens) to attempt to define the extent of any contamination found during these activities. The PA/SIs revealed extensive contamination in both surficial and deeper soils as well as ground water(s) and sediments along and within Newtown Creek. However, the PA/SIs are not definitive in terms of complete and/or timely information nor do they provide for full characterization and delineation of all contamination found during this limited effort(s). The PA/SIs properly call for Soils and Ground Water Management Plans as well as site specific Health and Safety Plans (HASPs) prior to commencing any construction activities.

**ALTERNATIVE:**

In order to attempt to reduce assumed project risk (and therefore higher bids) by any potential bidder due to the potential of encountering previously unknown contaminated and/or hazardous media, additional Site Investigations should be conducted on those sites that demonstrated undelineated soils and/or ground water contamination in the PA/SIs previously conducted. By definition, PA/SIs are not meant to be definitive in terms of full delineation of contaminated or potentially contaminated media, but rather they help guide the Remedial Investigation to those sites and/or locations that warranted further evaluation based upon the limited information that was provided.

**ADVANTAGES:**

- Provides more complete knowledge of specific site conditions
- Provides an ability to categorize site(s) requirements based upon timely and verified site specific conditions
- May be able to demonstrate acceptable (as is) conditions that do not require application of treatment technologies
- Reduces builder risk by providing site specific information

**DISADVANTAGES:**

- Based upon existing PA/SIs, it is highly unlikely that uncontaminated properties will be identified that will not require some type of treatment
- Will require additional time to perform this work thus potentially causing a short delay to the issuance of the project request for proposal
- May not add any additional, useful information that is not already known or can be assumed
- The value gained by this activity may not be enough to justify the additional time and monetary costs to perform

**COST SUMMARY**

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Due to the long-time, historical industrial operations in these areas, extensive contamination of soils, ground water and sediments was found at many sites during the performed PA/SIs. A great deal of this contamination is/was not fully characterized and/or delineated. There also may be issues with some of the data quality as well as the representative age(s) of the data. These issues may be problematic to some of the potential bidders due to the relative scale of unknown information that would in turn necessitate any potential bidder to assume a corresponding level of risk when preparing a bid submittal. With the implementation of additional focused remedial investigation, sampling plans at identified priority sites (from the PA/SIs) limits and extent of contamination can be more robustly determined, which can lead to bids that do not have to take into account (larger) assumed risk based upon unknown or incomplete site characterization and delineation.
### VALUE ENGINEERING ALTERNATIVE

**PROJECT:** REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK  
**New York State Department of Transportation**

**DESCRIPTION:** DEFINE APPROVED OR APPROPRIATE PROTECTIVE CONSTRUCTION METHODS IN IDENTIFIED ADVERSELY IMPACTED AREAS

---

**ORIGINAL DESIGN:**

The current plans do not clearly call out for specified means and methods of construction—specifically any drilling or excavation activities—to ensure that any contamination is adequately, fully and/or properly addressed during the implementation of these construction and construction related activities. While soil and groundwater contamination is acknowledged, the plans do not go further and identify and/or recommend/require specific construction techniques, means and/or methods that should be implemented during the performance of these activities across the length and breadth of the project limits.

**ALTERNATIVE:**

Specifically call out for protective construction techniques for all drilling and excavation activities throughout the project limits. Since the Preliminary Assessments and Site Investigations (PA/SIs) that were performed identified extensive soils, groundwater and sediment contamination, appropriate and protective construction techniques will be necessary throughout the project’s implementation phase. Examples of some of these requirements are drilled caissons and the application of proper treatment technologies to treat any water generated prior to its permitted discharge to the waters of the State or sanitary sewer collection system. These construction methods are likely to be required by federal and state permits issued for this project.

**ADVANTAGES:**

- Reduces volume of unknown information—i.e., informs everybody up front that these are going to be requirements
- Maximizes protectiveness of workers
- Reduces volume of generated contaminated material that would require special handling and/or disposal
- Ensures the minimization of the potential to cross-contaminate media that may not be currently contaminated
- Allows for more site specific, robust bids
- Demonstrates permit compliance

**DISADVANTAGES:**

- May restrict the creative abilities of the potential bidders to propose efficient construction techniques
- Could add additional time and budgetary constraints to the overall project

---

**COST SUMMARY**

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
<th>INITIAL COST</th>
<th>PRESENT WORTH RECURRING COSTS</th>
<th>PRESENT WORTH LIFE-CYCLE COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORIGINAL DESIGN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATIVE</td>
<td></td>
<td>DESIGN SUGGESTION</td>
<td></td>
</tr>
<tr>
<td>SAVINGS (Original minus Alternative)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROJECT:</td>
<td>REPLACEMENT OF KOŚCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES, NEW YORK</td>
<td>ALTERNATIVE NO.: E-5</td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
<td>----------------------</td>
<td></td>
</tr>
<tr>
<td>DESCRIPTION:</td>
<td>DEFINE APPROVED OR APPROPRIATE PROTECTIVE CONSTRUCTION METHODS IN IDENTIFIED ADVERSELY IMPACTED AREAS</td>
<td>SHEET NO.: 2 of 2</td>
<td></td>
</tr>
</tbody>
</table>

**DISCUSSION:**

Due to the long-time, historical industrial operations in these areas, extensive contamination of soils, groundwater and sediments was found at many sites during the performed PA/SIs. A great deal of this contamination is/was not fully characterized and/or delineated. There also may be issues with some of the data quality as well as the representative age(s) of the data. However, the PA/SIs overwhelmingly demonstrates that contamination is prevalent throughout all potential locations in this project. This contamination will need to be properly addressed by any and all permits that will be issued for this project. By presenting these requirements as part of any Solicitation, it should lead to more robust and site-specific responses by the potential bidders. It assists these potential bidders by eliminating some of the assumed risk that will need to be taken, based upon available information.
SECTION THREE – PROJECT DESCRIPTION

The Replacement of Kosciuszko Bridge (I-278) over Newtown Creek project replaces a 70 plus year-old bridge connecting Kings (Brooklyn) and Queens Counties in New York, that is in a state of severe disrepair and in need of constant ongoing maintenance. The bridge carries approximately 160,000 vehicles per day with 12% truck traffic and exhibits congestion throughout the day. In the westbound direction, traffic coming from the Long Island Expressway (LIE) tries to merge into the three through lanes that cross the creek. Eastbound congestion occurs where weaving movements are required for vehicles entering at Vandervoort Avenue, and wanting to go eastbound over the LIE, conflict with weaving movements of vehicles coming from Brooklyn, trying to exit to the LIE eastbound.

The proposed project will solve these congestion problems, as well as provide gateways to both counties, in the form of cable-stayed bridges for the Main Spans over Newtown Creek. The new eastbound roadway and bridge will be constructed starting just east of Kingsland Avenue and will be expanded to accept two lanes of traffic entering from Vandervoort Avenue. Where the entrance lane traffic meets the mainline, the typical section will include an edge barrier, an 8 ft. shoulder, two 12 ft. inside through lanes, and 10 ft. inside shoulder, a median barrier, a 4 ft. shoulder, one 12 ft. through lane and two 12 ft. ramp lanes (forming a collector-distributor section) and a 10 ft. outside shoulder with an edge barrier. At the eastern end of the project, two of the collector-distributor lanes will veer off to connect to the eastbound LIE and local streets.

The westbound roadway will be constructed in the footprint of the existing bridge, once it is demolished. This roadway section will consist of: an edge barrier, a 13 ft.-1 in. pedestrian/bike lane, a median barrier, a 10 ft. shoulder; and a 12 ft. auxiliary lane from where the LIE ramps converge with the westbound lanes, which consist of 3, 12 ft. lanes, a 4 ft. shoulder, and an edge barrier. The auxiliary lane will terminate at the exit to Meeker Avenue.

Structure Justification Reports were prepared for each of the project components. The following describes the preferred approach for each. Starting at the LIE expressway in Queens, several of the at-grade ramps will be slightly realigned and the new main roadways will be connected to the existing roadways that bridge over the LIE. The Queens connector structure starts with an abutment to the west of 54th Avenue and includes 6 ft. deep precast prestressed AASHTO girders over 54th Avenue. Starting at the pier bent to the east of 54th Avenue, the Queens approach to the Main Span over Newtown Creek begins. It consists of two, 11 ft.-6 in deep precast, prestressed concrete box girders supported on individual column piers for each direction. The foundations for each column are supported on 24 in. diameter piles. 54 Road and 56 Road pass under the Queens approach bridge.

The Main Span for the westbound direction has a 360 ft. back span and 630 ft. front span and its pylon is on the east side of Newtown Creek. The Main Span for the eastbound roadway has a 369 ft. back span and 630 ft. front span and has its pylon on the west side of Newtown Creek. The pylons, or towers, will be canted “H-shapes” with the bottom legs slightly tilted in and extend which is 298 ft. above the ground surface providing a 90 ft. clearance above the high water level of the creek. The towers would be hollow reinforced concrete structures, with walls approximately 3 feet thick; and
supported on 6 ft. diameter drilled shafts that are socketted into rock with 5 ft. 6 in. diameter sections.

The superstructure will be steel edge girders with transverse steel floor beams spaced between 15 and 16 feet on centers. The edge girders will be approximately 6'-6" deep. There will be two planes of cables at each tower. Each plane will have a total of 22 stay cables, 11 to the Main Span and 11 to the Back Span. The Back Span deck anchorages would be spaced at approximately 30 feet on centers. The Main Span deck anchorages will be spaced at approximately 48 feet on centers. The anchorages in the towers will be spaced at 6 feet on centers, resulting in a fan design of the cables. Both Main Spans cross the Long Island Railroad tracks on the east side of the creek.

Diagram of Cable-Stayed Bridge (from Structure Justification Report)

Diagram of Towers (from Structure Justification Report)
The Brooklyn approach span is the same construction as the Queens approach span and ends at a Pier 15. From Pier 15 east, the roadway pavement is supported on polystyrene blocks and a thin layer of soil. Encasing the polystyrene blocks are precast concrete panels with an architectural finish. At Morgan Avenue, precast concrete NEXT beams will be used to span over the roadway between two abutments. On the west side of Morgan Avenue, the fill section, with precast concrete architectural panels, will continue to the start of the Meeker Avenue viaduct structure.

Almost the entire footprint of the combined bridges has contaminated soil, groundwater or both, necessitating environmental remediation wherever ground construction takes place. Also included in the project are the following:

- Construction of two parks in Brooklyn and one in Queens;
- Stormwater management and drainage;
- At-grade street reconstruction and streetscaping for some of the local streets on the Brooklyn side;
- Bridge lighting;
- Local street lighting;
- Installation of intelligent transportation system equipment;
- Acquisition of properties under the proposed eastbound structure and their demolition;
- Relocation of Cherry Street;
- Utility relocations;
- Dredging and rip rap; and
- Maintenance and protection of traffic including a new bridge for the temporary connection of the new eastbound roadway to the existing roadway while the westbound roadway is completed.

The estimated cost of the construction is $690 million in 2010 dollars. The construction will be procured using a design-build contract for the demolition of existing building structures and construction of the eastbound roadway and bridge; a bridge demolition contract; and a design-bid-build approach for the westbound roadway and bridge. Construction is expected to begin in 2013 and be completed in 2020.

**DRAWINGS**

Selected drawings from the designers Preliminary Structure Plans follow.
It is a violation of law for any person, unless they are acting under the direction of a licensed professional engineer, architect, landscape architect, or land surveyor, to alter any item of any kind of an existing structure that is labeled as "As-Is" or "Existing." The owner or user of the structure shall stamp the document and include the notation: "ALTERED BY: [Name], [Date], [Specific Description of Alteration]."

NOTES:
1. Existing foundations not shown for clarity. See S-1 for existing foundation locations.
2. Remove existing foundations as required to install new foundations.
3. Span lengths shown are taken along the EBI only.

REPLACEMENT OF THE KINGSBRIDGE BRIDGE OVER NEWTOWN CREEK

PRELIMINARY STRUCTURE PLANS

CONTRACT NUMBER: DO3562X
DRAWING NO. 59-7 SHEET NO. 10

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 11
DOCUMENT NAME: NOTEC3
proposed section over morgan ave. - span 3

proposed section over vandervorst ave. - span 12
AS-BUILT REVIEWS
DESCRIPTION OF ALTERATIONS:

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS AUTHORIZED TO DO SO, TO ALTER AN ITEM IN ANY WAY. IF AN ALTERATION IS MADE TO ANY ITEM, THE ALTERATION WILL BE STAMPED AND INCLUDE THE NOTATION "ALTERED" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

PROPOSED WESTBOUND TOWER LOOKING UPSTAGE

PROPOSED TOWER ELEVATION

ITEM 564.500101

PROPOSED 6'-0" DEELED SHAFT AND 6'-0" DEELED SOCKET

ELEV. 306.66

ITEM 564.550617

PROPOSED 6'-0" DEELED SHOE SOCKET

ITEM 551.550617

SECTION D

SECTION E

CONCRETE TOWER STRUCTURE ITEM 551.550101

PROPOSED 6'-0" DEELED SHOE SOCKET

ITEM 551.550101

PROPOSED 6'-0" DEELED SHAFT AND 6'-0" DEELED SOCKET

ELEV. 306.66

CONCRETE TOWER STRUCTURE ITEM 551.550101

PROPOSED 6'-0" DEELED SHAFT AND 6'-0" DEELED SOCKET

ELEV. 306.66

PRELIMINARY STRUCTURE PLANS PROPOSED NO TOWER

SECTION AND ELEVATION SHEET NO. 24

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION II

PRELIMINARY STRUCTURE PLANS PROPOSED NO TOWER

ELEVATION SHEET NO. 24

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION II

Preliminary structure plans presented for review.

Sections D and E of the tower.

Dimensions are given in feet and inches, unless otherwise noted.

Approved drawing date: 09/15/2001.

New York State Department of Transportation Region II.

Contract No. D15624

Drawing No. ST-23

Sheet No. 24

NYSDOT

All dimensions in ft unless otherwise noted. **
SECTION FOUR – VALUE ANALYSIS AND CONCLUSIONS

GENERAL

This section describes the value analysis (VA) procedure used during the VE study conducted for the New York State Department of Transportation by ARCADIS of New York, Inc. on the Replacement of Kosciuszko Bridge (I-278) Over Newtown Creek, Counties of Kings and Queens, New York, project. The workshop was performed April 30-May 4, 2012, at the 40% Design completion stage. The team of Parsons Brinckerhoff/Hardesty & Hanover has been selected by NYSDOT to assist with the development of the project and has provided information for the VE team to use as the basis of the study.

A systematic approach was used in the VE study, which was divided into three parts: (1) Preparation Effort, (2) Workshop Effort, and (3) Post-Workshop Effort. A task flow diagram outlining each of the procedures included in the VE study is attached for reference.

Following this description of the VA procedure, separate narratives and supporting documentation identify the following:

- VE workshop participants
- Economic data
- Cost model
- Function analysis
- Creative ideas and evaluations

PREPARATION EFFORT

Preparation for the workshop consisted of scheduling workshop participants and tasks and gathering necessary project documents for team members to review before attending the workshop. The following document was used as the basis for generating VE alternatives and for determining the cost implications of the selected VE alternatives:

- Replacement of Kosciuszko Bridge (I-278) Over Newtown Creek, Kings and Queens Counties, Preliminary Structure Plans, dated 2/24/2012, prepared by Parsons Brinckerhoff
- Replacement of Kosciuszko Bridge (I-278) Over Newtown Creek, Kings and Queens Counties, Preliminary Structure Plans, Attachment A, Description of Construction Staging for Kosciuszko Bridge Project, dated 2/24/2012, prepared by Parsons Brinckerhoff
- Replacement of Kosciuszko Bridge (I-278) Over Newtown Creek, Kings and Queens Counties, Preliminary Plan Sheet Notes, dated February 2012, prepared by Parsons Brinckerhoff
- Final Environmental Impact Statement, Executive Summary, dated September 2008, prepared by the U.S. Federal Highway Administration (FHWA)
- Structure Justification Report, Westbound Exit Ramp from the Kosciuszko Bridge, dated November 2011, prepared by NYSDOT and USDOT FHA
- Structure Justification Report, Vandervoort Avenue Entrance Ramp to the Kosciuszko Bridge, dated November 2011, prepared by NYSDOT and USDOT FHA
- Structure Justification Report, Meeker Avenue Viaduct, dated November 2011, prepared by NYSDOT and USDOT FHA
- Structure Justification Report, Kosciuszko Bridge over Newtown Creek, dated November 2011, prepared by NYSDOT and USDOT FHA
- Structure Justification Report, Westbound Exit Ramp from the Kosciuszko Bridge, dated November 2011, prepared by NYSDOT and USDOT FHA

Information relating to the project’s purpose and need, owner concerns, project stakeholder concerns, design criteria, project constraints, funding sources and availability, regulatory agency approval requirements, and the project’s schedule and costs is very important as it provides the VE team with insight about how the project has progressed to its current state.

Project cost information, provided by the designers, is used by the VE team as the basis for a comparative analysis with similar projects. To prepare for this exercise, the VE team leader used the cost estimate, prepared by Parsons Brinckerhoff, to develop a cost model for the project. The model was used to distribute the total project cost among the various elements or functions of the project. The VE team used this model to identify the high-cost elements or functions that drive the project, and the elements or functions providing little or no value, so that the team could focus on reducing or eliminating their impact.

VALUE ENGINEERING WORKSHOP EFFORT

The VE workshop was a three-day effort beginning with an orientation/kickoff meeting on Monday, April 30, 2012, and concluding with the final VE Presentation on Friday, May 4, 2012. During the workshop, the VE Job Plan was followed in compliance with SAVE International and U.S. Federal Highway Administration (FHWA) guidelines for conducting a VE study. The Job Plan guided the search for alternatives to mitigate or eliminate high-cost drivers, secondary functions providing little or no value, and potential project risks. Alternatives to specifically address the owner’s project concerns and enhance value by improving operations, reducing maintenance requirements, enhancing constructability, and providing missing functions were also considered. The Job Plan includes six phases:

- Information Phase (with a site visit)
- Function Identification and Analysis Phase
- Creative/Speculation Phase
- Evaluation/Judgment Phase
- Alternative Development Phase
- Presentation of Study Results Phase
Information Phase

At the beginning of the study, the decisions that have influenced the project’s design and proposed construction methods have to be reviewed and understood. For this reason, the workshop began with a presentation of the project by the NYSDOT Project Manager, Robert Adams, to the VE team. The presentation highlighted the information provided in the documentation reviewed by the VE team before the workshop and expanded on it to include a history of the project’s development and any underlying influences that caused the design to develop to its current state. During this presentation, VE team members were given the opportunity to ask questions and obtain clarification about the information provided. Following the presentation, the VE team visited the project site to obtain first-hand information on existing site conditions in order for team members to enhance their understanding of the new project.

Function Identification and Analysis Phase

Having gained some information on the project, the VE team proceeded to define the functions provided by the project, identifying the costs to provide these functions, and determining whether the value provided by the functions has been optimized. Function analysis is a means of evaluating a project to see if the expenditures actually perform the requirements of the project or if there are disproportionate amounts of money spent on support functions. Elements performing support functions add cost to the project but have a relatively low worth to the basic function.

Function is defined as the intended use of a physical or process element. The team attempted to identify functions, in the simplest manner, using measurable noun/verb word combinations. To accomplish this, the team first looked at the project in its entirety and randomly listed its functions, which were recorded on Random Function Analysis Worksheets (provided in the Function Identification and Analysis section). Then the individual function(s) of the major components of the project depicted on the cost model were identified.

After identifying the functions, the team classified the functions according to the following:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Type of Function</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>HO</td>
<td>Higher Order</td>
<td>The primary reason the project is being considered or project goal.</td>
</tr>
<tr>
<td>B</td>
<td>Basic</td>
<td>A function that must occur for the project to meet its higher order functions.</td>
</tr>
<tr>
<td>S</td>
<td>Secondary</td>
<td>A function that occurs because of the concept or process selected and may or may not be necessary.</td>
</tr>
<tr>
<td>R/S</td>
<td>Required</td>
<td>A secondary function that may not be necessary to perform the basic function but must be included to satisfy other requirements or the project cannot proceed.</td>
</tr>
<tr>
<td>G</td>
<td>Goal</td>
<td>Secondary goal of the project.</td>
</tr>
<tr>
<td>O</td>
<td>Objective</td>
<td>Criteria to be met</td>
</tr>
<tr>
<td>LO</td>
<td>Lower Order</td>
<td>A function that serves as a project input.</td>
</tr>
</tbody>
</table>
Higher order and basic functions provide value, while secondary functions tend to reduce value. The goal of the next job phase is to reduce the impact of secondary functions and thereby enhance project value.

To further clarify the impact of the various functions, the team assigned costs to provide the functions, or group of functions, indicated by a specific project element using the cost estimate and cost model(s). Where possible, they seek to find the lowest cost, or worth, to perform the function. This is accomplished using published data from other sources or team knowledge obtained from working on other similar projects to establish cost goals and then comparing them to the current costs. By identifying the cost and worth of a function or group of functions, cost/worth ratios were calculated. Cost/worth ratios greater than one, indicated that less than optimum value was being provided. Those project functions or elements with high cost/worth ratios became prime targets for value improvement.

As well as looking at areas with high cost/worth ratios, the team used the cost model previously prepared to seek out the areas where most of the project funds are being applied. Because of the absolute magnitude of these high-cost elements or functions, they also became initial targets for value enhancement.

The team then identified some of the risks in the project. Overall, these exercises stimulated the VE team members to focus on apparently low value areas and initially channel their creative idea development in these places.

Creative/Speculation Phase

This VE study phase involved the creation and listing of ideas. Starting with the functions or project elements with high cost/worth ratios, a high absolute cost compared to other elements in the project, and secondary functions providing little or no value; and using the classic brainstorming technique, the VE team began to generate as many ideas as possible to provide the necessary functions at a lower total life cycle cost, or to improve the quality of the project. Ideas for improving operation and maintenance, reducing project risk, and simplifying constructability were also encouraged. At this stage of the process, the VE team was looking for a large quantity of ideas and free association of ideas. A Creative Idea Listing worksheet was generated and organized by the function or project element being addressed.

NYSDOT and design team staff may wish to review these creative lists since they may contain ideas that were not pursued by the VE team but can be further evaluated for potential use in the design.

Evaluation Phase

Since the goal of the Creative/Speculation Phase was to conceive as many ideas as possible without regard for technical merit or applicability to the project goals, the Evaluation Phase focused on identifying those ideas that do respond to the project value objectives and are worthy of additional research and development before being presented to the owner. The selection process consisted of the VE team evaluating the ideas originated during the Creative/Speculation Phase based on NYSDOT’s value objectives identified through conversations. Based on the team’s understanding of NYSDOT’s value objectives, each idea was compared with the present design concept, and the advantages and disadvantages of each idea were discussed.
How well an idea met the design criteria was also reviewed. Based on the results of these reviews, the VE team rated the idea by consensus using a scale of 1 to 5, with 5 or 4 indicating an idea with the greatest potential to be technically sound and provide cost savings or improvements in other areas of the project, 3 indicating an idea that provides marginal value but could be used if the project was having budget problems, 2 indicating an idea with a major technical flaw, and 1 indicating an idea that does not respond to project requirements. Generally, ideas rated 4 and 5 are pursued in the next phase and presented to the owner during the Presentation Phase.

The team also used the designation “DS” to indicate a design suggestion, which is an idea that may not have specific quantifiable cost savings but may reduce project risk, improve constructability, help to minimize claims, enhance operability, ease maintenance, reduce schedule time, or enhance project value in other ways. Design suggestions could also increase a project's cost but provide value in areas not currently addressed. These are also developed in the next phase of the VE process.

**Development Phase**

In this phase, each highly rated idea was expanded into a workable solution designated as a VE alternative. The development consisted of describing the current design and the alternative solution, preparing a life cycle cost comparison (where applicable), describing the advantages and disadvantages of the proposed alternative solution, and writing a brief narrative to compare the original design to the proposed change and provide a rationale for implementing the idea into the design. Sketches and design calculations, where appropriate, were also prepared in this part of the study. The VE alternatives and design suggestions are included in the Section Two – Study Results section of this report.

**Presentation Phase**

The goals of the last phase of the workshop were to summarize the results of the study, to prepare draft Summary of Value Engineering Alternatives worksheets to hand out at the presentation, and to present the key VE alternatives and design suggestions to NYSDOT, the Parsons Brinckerhoff design team and a representative from the FHWA. The presentation was held on Friday, May, 2012, at the NYSDOT Region 11 office in Long Island City, New York. The purpose of the meeting was to provide the attendees with an overview of the suggestions for value enhancement, resulting from the VE study, and afford them the opportunity to ask questions to clarify specific aspects of the alternatives presented. Procedures for implementing the results of the study were discussed, and arrangements were made for the reviewers of the VE report to contact the VE team in order to obtain further clarifications, if necessary. On the following Tuesday, draft electronic copies of the Summary of Value Engineering Alternatives worksheets and alternative write-ups were provided to NYSDOT and the design team to facilitate a timely evaluation of the information developed.

**POST-WORKSHOP EFFORT**

The post-workshop portion of the VE study consisted of the preparation of this VE Study Report. Personnel from NYSDOT, the Parsons Brinckerhoff design team, and the FHWA will analyze each alternative and prepare a short response, recommending incorporation of the alternative into the project, offering modifications before implementation, or presenting reasons for rejection. ARCADIS is
available at your convenience as you review the alternatives. Please do not hesitate to call on us for clarification or further information as you consider an implementation approach.

Upon completing their reviews, NYSDOT and the designer will meet and, by consensus, select VE alternatives and design suggestions to incorporate into the project.
VALUE ENGINEERING WORKSHOP PARTICIPANTS

The VE team was organized to provide specific expertise in the unique project elements involved with the Replacement of Kosciuszko Bridge (I-278) Over Newtown Creek, Counties of Kings and Queens project. The multidisciplinary team comprised professionals with bridge and construction experience, and a working knowledge of VE procedures. The following lists the VE team members:

<table>
<thead>
<tr>
<th>Participant</th>
<th>Specialization</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michel Moussard, PE</td>
<td>Bridge Engineering</td>
<td>ARCADIS France</td>
</tr>
<tr>
<td>Edward Adamczyk, PE</td>
<td>Cost/Constructability</td>
<td>ARCADIS U.S., Inc.</td>
</tr>
<tr>
<td>Richard DeWan</td>
<td>Environmental Engineering</td>
<td>ARCADIS U.S., Inc.</td>
</tr>
<tr>
<td>Vikas Wagh, PE</td>
<td>Bridge Engineering</td>
<td>LiRo Engineering, Inc.</td>
</tr>
<tr>
<td>Fred Gottemoeller, AIA</td>
<td>Bridge Architect</td>
<td>Bridgescape, LLC</td>
</tr>
<tr>
<td>Howard B. Greenfield, PE, CVS</td>
<td>VE Team Leader</td>
<td>ARCADIS of New York, Inc.</td>
</tr>
</tbody>
</table>

DESIGNER’S PRESENTATION

An overview of the project was presented on Monday, April 30, 2012, by the NYSDOT project manager, Robert Adams. The purpose of this meeting, in addition to being an integral part of the Information Phase of the VE study, was to bring the VE team up-to-speed regarding the overall project specifics. Additionally, the meeting afforded the owner and design team the opportunity to highlight in greater detail those areas of the project requiring additional or special attention. An attendance list for the meeting is attached.

SITE VISIT

Following the presentation, Robert Adams from NYSDOT and Carol Wyperle and Michael Abrahams from Parsons Brinckerhoff guided the VE team on a tour of the existing bridge and sites for the new bridge.

VALUE ENGINEERING TEAM’S PRESENTATION

A PowerPoint presentation of the alternatives developed was conducted by the VE team on Friday, May 4, 2012, at the NYSDOT Region 11 office in Long Island City, NY to review VE alternatives with NYSDOT staff and representatives from the design team and FHWA. A copy of the PowerPoint presentation was provided to NYSDOT on the following Monday and an electronic copy of the Draft Summary of Value Engineering Alternatives worksheets and draft, unedited, VE alternatives and design suggestions, was provided to NYSDOT to facilitate a timely review on the following Tuesday. An attendance list for the meeting is attached.
### VE STUDY SIGN-IN SHEET

**PROJECT:** REPLACEMENT OF KOSCIUZCKO BRIDGE OVER NEWTOWN CREEK  
KINGS AND QUEENS COUNTIES, NEW YORK  
New York State Department of Transportation  
*In-Brief: April 30, 2012*  
*Out-Brief: May 4, 2012*

<table>
<thead>
<tr>
<th>IN-BRIEF</th>
<th>OUT-BRIEF</th>
<th>NAME</th>
<th>ORGANIZATION/TITLE</th>
<th>PHONE NUMBER</th>
<th>EMAIL ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>Howard Greenfield</td>
<td>ARCADIS/Team Leader</td>
<td>410-381-1990</td>
<td><a href="mailto:Howard.greenfield@arcadis-us.com">Howard.greenfield@arcadis-us.com</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Fred Gottemoeller</td>
<td>Bridgescape, LLC</td>
<td>410-740-0256</td>
<td><a href="mailto:Fred.gottemoeller@bridgescape.net">Fred.gottemoeller@bridgescape.net</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Michel Moussard</td>
<td>ARCADIS</td>
<td>0033146012465</td>
<td><a href="mailto:mmoussard@arcadis-fr.com">mmoussard@arcadis-fr.com</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Richard DeWan</td>
<td>ARCADIS</td>
<td>609-860-0390</td>
<td><a href="mailto:Richard.dewan@arcadis-us.com">Richard.dewan@arcadis-us.com</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Vikas Wagh</td>
<td>LiRo Engineers, Inc.</td>
<td>212-563-0280</td>
<td><a href="mailto:waghv@lro.com">waghv@lro.com</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Ed Adamczyk</td>
<td>ARCADIS</td>
<td>216-298-5226</td>
<td><a href="mailto:Edward.adamczyk@arcadis-us.com">Edward.adamczyk@arcadis-us.com</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Robert Adams</td>
<td>NYSDOT Structures</td>
<td>718-482-4699</td>
<td><a href="mailto:radams@dot.state.ny.us">radams@dot.state.ny.us</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Tadeusz Alberski</td>
<td>NYSDOT Structures</td>
<td>518-457-5862</td>
<td><a href="mailto:taiberski@dot.state.ny.us">taiberski@dot.state.ny.us</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Olga Kleyman</td>
<td>NYSDOT Structures</td>
<td>718-482-6426</td>
<td><a href="mailto:okleyman@dot.state.ny.us">okleyman@dot.state.ny.us</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Saul Haberfield</td>
<td>NYSDOT Structures</td>
<td>718-482-4695</td>
<td><a href="mailto:shaberfield@dot.state.ny.us">shaberfield@dot.state.ny.us</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Meena Kuriakose</td>
<td>NYSDOT Structures</td>
<td>718-482-4685</td>
<td><a href="mailto:mkuriakose@dot.state.ny.us">mkuriakose@dot.state.ny.us</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Mini Varghese</td>
<td>NYSDOT Structures</td>
<td>718-482-4726</td>
<td><a href="mailto:mvarghese@dot.state.ny.us">mvarghese@dot.state.ny.us</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>John Wong</td>
<td>NYSDOT Structures</td>
<td>718-482-4727</td>
<td><a href="mailto:jwong@dot.state.ny.us">jwong@dot.state.ny.us</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Mike Mariotti</td>
<td>NYSDOT VE Coord.</td>
<td>518-485-8960</td>
<td><a href="mailto:mmariotti@dot.ny.gov">mmariotti@dot.ny.gov</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Girish Vaghela</td>
<td>NYSDOT Structures</td>
<td>718-482-4704</td>
<td><a href="mailto:gvaghela@dot.state.ny.us">gvaghela@dot.state.ny.us</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Anshu Trivedi</td>
<td>NYSDOT Structures</td>
<td>718-482-7319</td>
<td><a href="mailto:atrivedi@dot.state.ny.us">atrivedi@dot.state.ny.us</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Kamrul Ahsan</td>
<td>NYSDOT Structures</td>
<td>718-482-7316</td>
<td><a href="mailto:Khsan@dot.state.ny.us">Khsan@dot.state.ny.us</a></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Shoba Jacob</td>
<td>NYSDOT Structures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Sudhir Goswani</td>
<td>NYSDOT Structures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>Wah Hing Chan</td>
<td>NYSDOT Structures</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# PROJECT:
**REPLACEMENT OF KOSCIUZCKO BRIDGE OVER NEWTOWN CREEK**  
**KINGS AND QUEENS COUNTIES, NEW YORK**  
*New York State Department of Transportation*  
*In-Brief: April 30, 2012*  
*Out-Brief: May 4, 2012*

<table>
<thead>
<tr>
<th>IN-BRIEF</th>
<th>OUT-BRIEF</th>
<th>NAME</th>
<th>ORGANIZATION/TITLE</th>
<th>PHONE NUMBER</th>
<th>EMAIL ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td></td>
<td>Hung-Kwong Liu</td>
<td>NYSDOT Structures</td>
<td>718-482-4706</td>
<td><a href="mailto:jkwok@dot.state.ny.us">jkwok@dot.state.ny.us</a></td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td>Mike Henriquez</td>
<td>NYSDOT Structures</td>
<td>718-482-4045</td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td>Andres Mendoza</td>
<td>NYSDOT Structures</td>
<td>718-482-4696</td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td>John Kwok</td>
<td>NYSDOT Structures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td>Bruce Ogurek</td>
<td>NYSDOT Structures</td>
<td></td>
<td><a href="mailto:bogurek@dot.state.ny.us">bogurek@dot.state.ny.us</a></td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td>Craig Ruyle</td>
<td>NYSDOT Structures</td>
<td></td>
<td><a href="mailto:cruyle@dot.state.ny.us">cruyle@dot.state.ny.us</a></td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td>Harold Fink</td>
<td>NYSDOT Structures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td>Chris Alvarez</td>
<td>NYSDOT Construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓ ✓</td>
<td>✓ ✓</td>
<td>Mike Abrahams</td>
<td>Parsons Brinckerhoff</td>
<td>212-465-5185</td>
<td><a href="mailto:Abrahams@pbworld.com">Abrahams@pbworld.com</a></td>
</tr>
<tr>
<td>✓ ✓</td>
<td>✓ ✓</td>
<td>Carol Wynperle</td>
<td>Parsons Brinckerhoff</td>
<td>212-465-5195</td>
<td><a href="mailto:wynperle@pbworld.com">wynperle@pbworld.com</a></td>
</tr>
</tbody>
</table>
ECONOMIC DATA

The comparisons of life cycle costs between the VE alternatives and the current design solutions were performed on the basis of discounted present worth. To accomplish this, the VE team developed economic criteria to use in its calculations based on information gathered from NYSDOT and the design team. The following parameters were used when calculating discounted present worth:

Year of Analysis: 2010

Construction Start Date: 2013

Construction Completion Date: 2020

A composite markup of 71% was used when comparing the construction costs of the current design with the alternative design to account for the following:

- Profit 12%
- Overhead + Indirects 19%
- Plant + Equipment 15%
- Contingency 25%
COST MODEL

The VE team prepared a Pareto Chart, or Cost Histogram, for the project that follows this page. This Cost Histogram displays the major construction elements identified in the cost estimate, prepared by the designer, in descending order of magnitude and thus identifies the high cost areas in the project. The high cost elements provide the VE team with one focus for its work during the study.

As shown on the Cost Histogram, 80% of the project’s costs are in the following project elements:

- AS Prestressed Concrete
- Demolition of Existing Bridge
- CS Edge Girders/Floor Beams
- AS Superstructure Slab
- AS Piles
- AS Structure Concrete
- Vandervoort Avenue to Varick – Fill Concept
- Meeker Avenue Viaduct to Vandervoort Avenue
- CS Structure Concrete
- Queens Temporary Bridge
- Queens Ramps I,IE Interchange
- Meeker Avenue Temporary Bridge
- Varick to BK Approach – EPS Concept
- Building Demolition
- Property Acquisitions
- At-grade Street Restoration
- Utility Relocations
- Environmental Remediation
- CS Superstructure Slab
- AS Rebar
- Queens Connector – Precast Concrete
- AS Interim Steel Sheeting
- Contaminated Soil Handling
- CS Strands
<table>
<thead>
<tr>
<th>PROJECT ELEMENT</th>
<th>COST</th>
<th>PERCENT</th>
<th>CUM. PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS Prestressed Concrete</td>
<td>61,245,444</td>
<td>8.96%</td>
<td>8.96%</td>
</tr>
<tr>
<td>Demolition of Existing Bridge</td>
<td>44,752,593</td>
<td>6.55%</td>
<td>15.52%</td>
</tr>
<tr>
<td>CS Edge Girders/Floor Beams</td>
<td>39,589,513</td>
<td>5.79%</td>
<td>21.31%</td>
</tr>
<tr>
<td>AS Superstructure Slab</td>
<td>37,661,261</td>
<td>5.49%</td>
<td>26.80%</td>
</tr>
<tr>
<td>AS Piles</td>
<td>37,418,656</td>
<td>5.49%</td>
<td>32.29%</td>
</tr>
<tr>
<td>AS Structure Concrete</td>
<td>28,465,393</td>
<td>4.17%</td>
<td>36.46%</td>
</tr>
<tr>
<td>Vanderwood Ave. to Varick - Fill Concept</td>
<td>28,307,037</td>
<td>4.10%</td>
<td>40.56%</td>
</tr>
<tr>
<td>Meerke Ave. Viaduct to Vanderwood Ave.</td>
<td>25,981,073</td>
<td>3.81%</td>
<td>44.37%</td>
</tr>
<tr>
<td>CS Structure Concrete</td>
<td>23,636,006</td>
<td>3.46%</td>
<td>47.83%</td>
</tr>
<tr>
<td>Queens Temporary Bridge</td>
<td>22,013,926</td>
<td>3.23%</td>
<td>51.06%</td>
</tr>
<tr>
<td>Queens Ramps LF Interchange</td>
<td>20,172,438</td>
<td>2.98%</td>
<td>54.04%</td>
</tr>
<tr>
<td>Meerke Ave. Temporary Bridge</td>
<td>17,971,839</td>
<td>2.63%</td>
<td>56.67%</td>
</tr>
<tr>
<td>Varick to BK Approach - EPS Concept</td>
<td>12,915,008</td>
<td>2.33%</td>
<td>58.99%</td>
</tr>
<tr>
<td>Building Demolition</td>
<td>15,814,800</td>
<td>2.32%</td>
<td>61.35%</td>
</tr>
<tr>
<td>Property Acquisitions</td>
<td>15,703,210</td>
<td>2.30%</td>
<td>63.65%</td>
</tr>
<tr>
<td>A grade Street Restoration</td>
<td>15,419,550</td>
<td>2.26%</td>
<td>65.91%</td>
</tr>
<tr>
<td>Utility Relocations</td>
<td>14,417,600</td>
<td>2.12%</td>
<td>68.03%</td>
</tr>
<tr>
<td>Environmental Reclamation</td>
<td>14,193,100</td>
<td>2.08%</td>
<td>70.11%</td>
</tr>
<tr>
<td>CS Superstructure Slab</td>
<td>13,339,156</td>
<td>1.95%</td>
<td>72.06%</td>
</tr>
<tr>
<td>AS Rebar</td>
<td>13,268,541</td>
<td>1.94%</td>
<td>73.99%</td>
</tr>
<tr>
<td>Queens Connector - Precast Concrete</td>
<td>12,646,159</td>
<td>1.85%</td>
<td>75.84%</td>
</tr>
<tr>
<td>AS Interim Steel Shoring</td>
<td>12,532,518</td>
<td>1.84%</td>
<td>77.68%</td>
</tr>
<tr>
<td>Contaminated Soil Handling</td>
<td>11,323,750</td>
<td>1.66%</td>
<td>79.34%</td>
</tr>
<tr>
<td>CS Strands</td>
<td>11,261,615</td>
<td>1.65%</td>
<td>80.99%</td>
</tr>
<tr>
<td>AS Footing Concrete</td>
<td>10,566,082</td>
<td>1.55%</td>
<td>82.54%</td>
</tr>
<tr>
<td>Brooklyn Connector</td>
<td>10,347,419</td>
<td>1.52%</td>
<td>84.06%</td>
</tr>
<tr>
<td>Streetscape</td>
<td>8,173,000</td>
<td>1.28%</td>
<td>85.34%</td>
</tr>
<tr>
<td>Meerke Ave. Viaduct</td>
<td>6,613,543</td>
<td>1.00%</td>
<td>86.34%</td>
</tr>
<tr>
<td>CS Footing Concrete</td>
<td>6,774,613</td>
<td>0.99%</td>
<td>87.33%</td>
</tr>
<tr>
<td>Queens Park</td>
<td>6,562,257</td>
<td>0.98%</td>
<td>88.31%</td>
</tr>
<tr>
<td>Driveway/Rib Rug</td>
<td>6,670,000</td>
<td>0.98%</td>
<td>89.29%</td>
</tr>
<tr>
<td>CS Rebar</td>
<td>6,504,584</td>
<td>0.95%</td>
<td>89.24%</td>
</tr>
<tr>
<td>Lighting on A-Grade Streets</td>
<td>6,072,000</td>
<td>0.89%</td>
<td>89.15%</td>
</tr>
<tr>
<td>ITS Relocations</td>
<td>5,750,000</td>
<td>0.84%</td>
<td>89.99%</td>
</tr>
<tr>
<td>AS Concrete Barriers</td>
<td>4,990,000</td>
<td>0.75%</td>
<td>90.74%</td>
</tr>
<tr>
<td>CS Piles</td>
<td>4,836,144</td>
<td>0.71%</td>
<td>91.45%</td>
</tr>
<tr>
<td>New Sewer to Newtown Creek</td>
<td>4,056,500</td>
<td>0.59%</td>
<td>92.04%</td>
</tr>
<tr>
<td>Sgr. Dougherty Park</td>
<td>3,939,444</td>
<td>0.58%</td>
<td>92.62%</td>
</tr>
<tr>
<td>CS Bearings</td>
<td>3,331,125</td>
<td>0.49%</td>
<td>93.11%</td>
</tr>
<tr>
<td>Brooklyn Active Park</td>
<td>3,231,781</td>
<td>0.48%</td>
<td>93.59%</td>
</tr>
<tr>
<td>CS Overlay Concrete</td>
<td>3,124,625</td>
<td>0.46%</td>
<td>93.75%</td>
</tr>
<tr>
<td>AS Structure Excavation</td>
<td>2,292,013</td>
<td>0.34%</td>
<td>94.09%</td>
</tr>
<tr>
<td>Varick Span NEXT Beam Concept</td>
<td>2,066,044</td>
<td>0.32%</td>
<td>94.41%</td>
</tr>
<tr>
<td>CS Drilled Shafts</td>
<td>2,011,948</td>
<td>0.30%</td>
<td>94.71%</td>
</tr>
<tr>
<td>AS Armored Joint</td>
<td>1,915,482</td>
<td>0.28%</td>
<td>94.99%</td>
</tr>
<tr>
<td>CS Service Elevator</td>
<td>1,915,200</td>
<td>0.28%</td>
<td>95.27%</td>
</tr>
<tr>
<td>AS Protective Sealing</td>
<td>1,830,307</td>
<td>0.27%</td>
<td>95.54%</td>
</tr>
<tr>
<td>CS Permanent Traffic Barrier</td>
<td>1,786,010</td>
<td>0.26%</td>
<td>95.80%</td>
</tr>
<tr>
<td>Lighting on Approach &amp; MS</td>
<td>1,587,020</td>
<td>0.23%</td>
<td>96.03%</td>
</tr>
<tr>
<td>CS Interim Steel Shoring</td>
<td>1,541,833</td>
<td>0.23%</td>
<td>96.26%</td>
</tr>
<tr>
<td>CS Balance Counterweight</td>
<td>1,259,506</td>
<td>0.18%</td>
<td>96.44%</td>
</tr>
<tr>
<td>CS Undar Deck Travelers, ER</td>
<td>1,020,870</td>
<td>0.15%</td>
<td>96.59%</td>
</tr>
<tr>
<td>AS Select Structural Fill</td>
<td>973,110</td>
<td>0.14%</td>
<td>96.73%</td>
</tr>
<tr>
<td>Phelps Dodge Property</td>
<td>937,500</td>
<td>0.14%</td>
<td>96.87%</td>
</tr>
<tr>
<td>Relocations</td>
<td>895,850</td>
<td>0.13%</td>
<td>96.99%</td>
</tr>
<tr>
<td>CS Undar Deck Travelers, WB</td>
<td>812,639</td>
<td>0.12%</td>
<td>97.11%</td>
</tr>
<tr>
<td>CS Excavation</td>
<td>723,468</td>
<td>0.11%</td>
<td>97.22%</td>
</tr>
<tr>
<td>CS M.B. Expansion Boarings</td>
<td>702,947</td>
<td>0.10%</td>
<td>97.32%</td>
</tr>
<tr>
<td>AS Parapet</td>
<td>655,477</td>
<td>0.10%</td>
<td>97.42%</td>
</tr>
<tr>
<td>Brooklyn Park Passies</td>
<td>609,768</td>
<td>0.09%</td>
<td>97.51%</td>
</tr>
<tr>
<td>Boat Launch</td>
<td>575,000</td>
<td>0.08%</td>
<td>97.59%</td>
</tr>
<tr>
<td>CS Shear Studs</td>
<td>521,080</td>
<td>0.08%</td>
<td>97.67%</td>
</tr>
<tr>
<td>AS Sawcutting</td>
<td>516,133</td>
<td>0.08%</td>
<td>97.75%</td>
</tr>
<tr>
<td>CS New Bridge Deck Concrete</td>
<td>402,634</td>
<td>0.07%</td>
<td>97.82%</td>
</tr>
<tr>
<td>Lighting on Brooklyn Connector</td>
<td>473,000</td>
<td>0.07%</td>
<td>97.89%</td>
</tr>
<tr>
<td>CS Modular Expansion Joint Syt.</td>
<td>433,742</td>
<td>0.06%</td>
<td>97.95%</td>
</tr>
<tr>
<td>CS Concrete Parapet</td>
<td>227,000</td>
<td>0.03%</td>
<td>98.03%</td>
</tr>
<tr>
<td>CS Sawcutting</td>
<td>169,924</td>
<td>0.02%</td>
<td>98.05%</td>
</tr>
<tr>
<td>CS Sidewalks &amp; Safety Walks</td>
<td>98,638</td>
<td>0.01%</td>
<td>98.06%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$ 682,343,777</td>
<td>100.02%</td>
<td></td>
</tr>
</tbody>
</table>
COST HISTOGRAM

PROJECT: REPLACEMENT OF KOŚCIEŃSKI BRIDGE OVER NEWTOWN CREEK - CABLE-STAYED MAIN SPAN

AS Prestressed Concrete
Demolition of Existing Bridge
CS Edge Girder/Floor Beams
AS Superstructure Slab
AS Piles
AS Structure Concrete
Vandervoort Ave. to Varick - Fill Concept
Meeker Ave. Viaduct to Vandervoort Ave.
CS Structure Concrete
Queens Temporary Bridge
Queens Ramp I-195 Interchange
Meeker Ave. Temporary Bridge
Varick to BK Approach - EPS Concept
Building Demolition
Property Acquisitions
All-grade Street Restoration
Utility Relocations
Environmental Remediation
CS Superstructure Slab
AS Rafter
Queens Connector - Precast Concrete
AS Interim Steel Sheeting
Contaminated Soil Handling
CS Strands
AS Footing Concrete
Brooklyn Connector
Streetscapes
Meeker Ave. Viaduct
CS Footing Concrete
Queens Park
Dredging/Rip Rap
CS Riser
Lighting on All-Grade Streets
ITS Relocations
AS Concrete Barriers
CS Piles
New Sewer to Newtown Creek
Sgt. Dougherty Park
AS Bearings
Brooklyn Active Park
CS Overway Concrete
AS Structure Excavation
Varick Span NEXT Beam Concept
CS Dilled Shafts
AS Armoured Joint
CS Service Elevator
AS Protective Sealing
CS Permanent Traffic Barrier
Lighting on Approachways & MS
CS Interim Steel Sheeting
CS Balance Counterweight
CS Under Deck Travelers, EB
AS Select Structural Fill
Phelps Dodge Property
Realignments
CS Under Deck Travelers, WB
CS Excavation
CS M.R. Expansion Bearings
AS Parapet
Brooklyn Passive Park
Brant Launch
CS Shear Studs
AS Sawcutting
CS New Bridge Deck Concrete
Lighting on Brooklyn Connector
CS Modular Expansion Joint Seal
CS Concrete Parapet
CS Sawcutting
CS Sidewalks & Safety Walks

Costs in graph are not marked-up.
FUNCTION ANALYSIS

A function analysis was performed to (1) understand the project purpose and needs, (2) define the requirements for each project element, (3) ensure a complete and thorough understanding by the VE team of the basic function(s) needed to attain the given project purpose and needs, (4) identify other public goals, and (5) identify secondary functions that should be addressed by the VE team. The Random Function Analysis worksheet completed by the team for the project in its entirety and the various elements follow.

The key functions identified were:

- Extend Useful Life
- Relieve Congestion
- Create Gateway
## PROJECT FUNCTIONS

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>FUNCTION</th>
<th>KIND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relieve Congestion</td>
<td>HO</td>
<td></td>
</tr>
<tr>
<td>Enhance Structural Capability</td>
<td>HO</td>
<td></td>
</tr>
<tr>
<td>Improve Safety</td>
<td>HO</td>
<td></td>
</tr>
<tr>
<td>Reduce Maintenance</td>
<td>HO</td>
<td></td>
</tr>
<tr>
<td>Create Gateway</td>
<td>HO</td>
<td></td>
</tr>
<tr>
<td>Improve Aesthetics</td>
<td>HO</td>
<td></td>
</tr>
<tr>
<td>Provide Pedestrian/Bike Access</td>
<td>HO</td>
<td></td>
</tr>
<tr>
<td>Improve Neighborhood</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Improve Creek</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Flatten Profile</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Increase Lane Widths</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Increase Shoulder Widths</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Add Ramp Capacity Eastbound</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Add Acceleration/Deceleration Lane</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Maintain Existing Six Lanes</td>
<td>R/S</td>
<td></td>
</tr>
<tr>
<td>Add Pedestrian/Bike Path</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Minimize Ground Impact</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Maintain Land Use</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Minimize Environmental Impacts</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Minimize Construction Duration</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Minimize Existing Bridge Maintenance</td>
<td>G</td>
<td></td>
</tr>
</tbody>
</table>

Function defined as:  
Action Verb  
Kind:  
B = Basic  
HO = Higher Order  
S = Secondary  
LO = Lower Order  
RS = Required Secondary  
G = Goal
## RANDOM FUNCTION ANALYSIS

**PROJECT:** REPLACEMENT OF KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK, KINGS AND QUEENS COUNTIES  
**New York State Department of Transportation**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>VERB</strong></td>
</tr>
<tr>
<td>DEMOLITION</td>
<td>Create</td>
</tr>
<tr>
<td></td>
<td>Create</td>
</tr>
<tr>
<td></td>
<td>Construct</td>
</tr>
<tr>
<td></td>
<td>Reduce</td>
</tr>
</tbody>
</table>

**Function defined as:**  
Action Verb  
Kind:  
B = Basic  
S = Secondary  
RS = Required Secondary  
HO = Higher Order  
LO = Lower Order  
G = Goal
CREATIVE IDEA LISTING AND EVALUATION OF IDEAS

During the Creative/Speculation Phase, numerous ideas were generated for the Four Mile Run Pump Station Upgrade using conventional brainstorming techniques. These ideas were recorded and are shown with their corresponding ranking on the attached Creative Idea Listing Worksheets. For the convenience of tracking an idea through the VA process, the ideas were grouped into the following project functions and numbered according to the order in which they were conceived. The following letter prefixes were used to identify the project elements.

<table>
<thead>
<tr>
<th>PROJECT FUNCTION</th>
<th>PREFIX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach Spans</td>
<td>AS</td>
</tr>
<tr>
<td>Main Span</td>
<td>MS</td>
</tr>
<tr>
<td>Pedestrian Connector</td>
<td>PC</td>
</tr>
<tr>
<td>Brooklyn Connector</td>
<td>BC</td>
</tr>
<tr>
<td>Environmental</td>
<td>E</td>
</tr>
<tr>
<td>General</td>
<td>G</td>
</tr>
</tbody>
</table>

The ideas were ranked on a qualitative scale of 1 to 5 based on how well the VE team believed the idea met the project purpose and need criteria. To assist the team in evaluating the creative ideas, the advantages and disadvantages of each new idea, compared to the existing design solution, were discussed based on the owner's value objectives. The following are the value objectives for this project:

- Minimizes maintenance and protection of traffic
- Implementability
- Meets aesthetic goals
- Saves cost
- Reduces schedule to complete
- Minimizes ground impacts
- Minimizes long-term costs
- Minimizes existing bridge maintenance
- Minimizes project risks
- Improves the neighborhood
- Improves safety

After discussing each idea, the team evaluated the ideas by consensus. This produced 6 ideas rated 4 or 5 to research and develop into formal VE alternatives and 23 ideas to develop as design suggestions to be included in the Study Results section of the report. Highly rated ideas that were not developed further may have been combined with another related idea or discarded as a result of
additional research indicating the concept as not being cost effective or technically feasible. The reader is encouraged to review the Creative Idea Listing and Evaluation worksheet since it may suggest additional ideas that can be applied to the design.
<table>
<thead>
<tr>
<th>NO.</th>
<th>IDEA DESCRIPTION</th>
<th>RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>GENERAL (G)</strong></td>
<td></td>
</tr>
<tr>
<td>G-1</td>
<td>Lower bridge clearance over Newtown Creek from 90 ft. to 70 ft.</td>
<td>4</td>
</tr>
<tr>
<td>G-2</td>
<td>Lower bridge clearance over Newtown Creek from 90 ft. to 70 ft. and use a diamond tower for cable-stayed bridge</td>
<td>4</td>
</tr>
<tr>
<td>G-3</td>
<td>Time RFP considering other major projects</td>
<td>DB</td>
</tr>
<tr>
<td>G-4</td>
<td>Require an architect on DB team</td>
<td>DB</td>
</tr>
<tr>
<td>G-5</td>
<td>Have designer of DB team design second cable-stayed bridge</td>
<td>DB</td>
</tr>
<tr>
<td>G-6</td>
<td>Combine contracts 3 and 4 into one contract</td>
<td>4</td>
</tr>
<tr>
<td>G-7</td>
<td>Bid as one contract with funding milestones</td>
<td>2</td>
</tr>
<tr>
<td>G-8</td>
<td>Reduce eastbound bridge width to 86 ft. from 97 ft.</td>
<td>4</td>
</tr>
<tr>
<td>G-9</td>
<td>Reduce left shoulder width on two-lane eastbound direction from 8 ft. to 4 ft.</td>
<td>4</td>
</tr>
<tr>
<td>G-10</td>
<td>Define areas where approach span piers cannot be located and let contractors determine optimum span lengths – set minimum span length</td>
<td>Combine w/AS-10</td>
</tr>
<tr>
<td>G-11</td>
<td>Provide more public access to water’s edge</td>
<td>DS</td>
</tr>
<tr>
<td>G-12</td>
<td>Combine environmental work for contracts 2 and 4 in contract 2</td>
<td>DS</td>
</tr>
<tr>
<td>G-13</td>
<td>Change vertical profile of westbound roadway to be 10 ft. below the eastbound</td>
<td>DB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>ENVIRONMENTAL (E)</strong></td>
<td></td>
</tr>
<tr>
<td>E-1</td>
<td>Design dewatering to contain all contamination, not just ground water encountered during construction</td>
<td>DB</td>
</tr>
<tr>
<td>E-2</td>
<td>Freeze ground during excavation</td>
<td>2</td>
</tr>
<tr>
<td>E-3</td>
<td>Require ground water management plan and soil management plan</td>
<td>ABD</td>
</tr>
<tr>
<td>E-4</td>
<td>Update data on environmentally sensitive areas before RFP is issued (validate data)</td>
<td>3</td>
</tr>
<tr>
<td>E-5</td>
<td>Define approved construction in environmentally sensitive areas</td>
<td>DB</td>
</tr>
<tr>
<td>E-6</td>
<td>Require environmental specialists on DB team</td>
<td>DB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rating:**
- 1→2 = Not to be developed
- 3→4 = Varying degrees of development potential
- 5 = Most likely to be developed
- DS = Design suggestion
- ABD = Already being done
- DB = Design build
<table>
<thead>
<tr>
<th>NO.</th>
<th>IDEA DESCRIPTION</th>
<th>RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>APPROACH SPANS (AS)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AS-1</td>
<td>Allow use of cantilevered construction</td>
<td>DB</td>
</tr>
<tr>
<td>AS-2</td>
<td>Allow use of galvanized steel box girder</td>
<td>DB</td>
</tr>
<tr>
<td>AS-3</td>
<td>Allow use of galvanized steel girders</td>
<td>4</td>
</tr>
<tr>
<td>AS-4</td>
<td>Minimize number of spans on Queens approach</td>
<td>Combine w/AS-10</td>
</tr>
<tr>
<td>AS-5</td>
<td>Use an inverted delta for piers in lieu of two piers</td>
<td>5</td>
</tr>
<tr>
<td>AS-6</td>
<td>Allow use of precast concrete deck arches for approach</td>
<td>DB</td>
</tr>
<tr>
<td>AS-7</td>
<td>Use a delta frame bridge for approaches</td>
<td>DB</td>
</tr>
<tr>
<td>AS-8</td>
<td>Increase span lengths and use continuous steel plate girders</td>
<td>See AS-3</td>
</tr>
<tr>
<td>AS-9</td>
<td>Allow use of single concrete box girders with struts in lieu of two box girders</td>
<td>4</td>
</tr>
<tr>
<td>AS-10</td>
<td>Do not be prescriptive in approach deck, pier and spacing requirements</td>
<td>Combine w/G-10</td>
</tr>
<tr>
<td><strong>PEDESTRIAN CONNECTION (PC)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC-1</td>
<td>Use undercrossing of ramps on Queen’s side and eliminate helical ramp</td>
<td>DS</td>
</tr>
<tr>
<td>PC-2</td>
<td>Provide pedestrian overlook at tower</td>
<td>DS</td>
</tr>
<tr>
<td><strong>BROOKLYN CONNECTOR (BC)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BC-1</td>
<td>Extend Meeker viaduct to Morgan Street in lieu of using a confided section</td>
<td>DS</td>
</tr>
<tr>
<td>BC-2</td>
<td>Move pedestrians around base at Brooklyn side</td>
<td>DS</td>
</tr>
<tr>
<td><strong>MAIN SPAN (MS)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-1</td>
<td>Allow use of tied arch structure</td>
<td>DB</td>
</tr>
<tr>
<td>MS-2</td>
<td>Use extra dosed structure</td>
<td>2</td>
</tr>
<tr>
<td>MS-3</td>
<td>Allow use of a “V-shaped” tower</td>
<td>DB</td>
</tr>
<tr>
<td>MS-4</td>
<td>Allow use of a single box structure</td>
<td>2</td>
</tr>
<tr>
<td>MS-5</td>
<td>Use a single hammerhead pier in lieu of two piers per side</td>
<td>2</td>
</tr>
<tr>
<td>MS-6</td>
<td>Use a truss bridge</td>
<td>2</td>
</tr>
</tbody>
</table>

**Rating:** 1→2 = Not to be developed  3→4 = Varying degrees of development potential  5 = Most likely to be developed  
DS = Design suggestion  ABD = Already being done  DB = Design build
<table>
<thead>
<tr>
<th>NO.</th>
<th>IDEA DESCRIPTION</th>
<th>RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS-7</td>
<td>Use more transparent edge barriers</td>
<td>DS</td>
</tr>
<tr>
<td>MS-8</td>
<td>Allow use of multiple tied arches</td>
<td>DB</td>
</tr>
<tr>
<td>MS-9</td>
<td>Use a composite floor system</td>
<td>ABD</td>
</tr>
<tr>
<td>MS-10</td>
<td>Use a lift bridge and lower roadway profile</td>
<td>2</td>
</tr>
<tr>
<td>MS-11</td>
<td>Prescribe the acceptable configurations of the main span in DB contract</td>
<td>DB</td>
</tr>
<tr>
<td>MS-12</td>
<td>Use a cable-stayed bridge for the eastbound bridge and a box girder bridge for the westbound bridge</td>
<td>4</td>
</tr>
<tr>
<td>MS-13</td>
<td>Perform more community outreach to determine bridge type</td>
<td>Combine w/MS-11</td>
</tr>
<tr>
<td>MS-14</td>
<td>Use a single tower on same side of creek for both bridges</td>
<td>DB</td>
</tr>
<tr>
<td>MS-15</td>
<td>Use single elliptical tower on each side of creek</td>
<td>4</td>
</tr>
<tr>
<td>MS-16</td>
<td>Use two pairs of staggered arches for two roadways</td>
<td>4</td>
</tr>
<tr>
<td>MS-17</td>
<td>Use three staggered arches</td>
<td>2</td>
</tr>
<tr>
<td>MS-18</td>
<td>Use a partial “W” for pylon</td>
<td>DB</td>
</tr>
<tr>
<td>MS-19</td>
<td>Use two tied arches with a 450 ft. span</td>
<td>4</td>
</tr>
</tbody>
</table>

Rating: 1→2 = Not to be developed 3→4 = Varying degrees of development potential 5 = Most likely to be developed
DS = Design suggestion ABD = Already being done DB = Design build