DESIGN REPORT

December 2016

Bridge Project
Rehabilitation of 3 Ramps at the Highbridge Interchange
Ramp “C” (BIN 1-06685-B)
Ramp “E” (BIN 1-06685-0)
Ramp “M” (BIN 1-06687-0)
PIN X726.99, Bronx County
PROJECT APPROVAL SHEET
(Pursuant to SAFETEA-LU Matrix)

A. IPP Approval: The project is ready to be added to the Regional Capital Program and project scoping can begin.
   The IPP was approved by:
   Regional Director
   [Signature]
   1/18/17

B. Scope Approval: The project cost and schedule are consistent with the Regional Capital Program.
   This scope was approved by:
   Regional Director
   [Signature]
   1/18/17

C. Public Hearing Certification (23 USC 128): A public hearing was not required.

D. Recommendation for Design Approval: The project cost and schedule are consistent with the Regional Capital Program.
   Regional Program Manager
   [Signature]
   1/12/17

E. Recommendation for Design and Nonstandard Feature Approval: All requirements requisite to these actions and approvals have been met, the required independent quality control reviews separate from the functional group reviews have been accomplished, and the work is consistent with established standards, policies, regulations and procedures, except as otherwise noted and explained.
   Regional Design Engineer
   [Signature]
   1/12/17

F. Nonstandard Feature Approval: The nonstandard features have been adequately justified and it is not prudent to eliminate them as part of this project.
   OR, No nonstandard features have been identified, created, or retained.
   FHWA
   [Signature]
   2/14/17

G. Design Approval: The required environmental determinations have been made and the preferred alternative for this project is ready for final design.
   FHWA
   [Signature]
   2/14/17
LIST OF PREPARERS

Group Director Responsible for Production of the Design Approval Document:

Suhail Albhaisi, PhD. P.E., Project Manager / Structures Group Manager
Jacobs Civil Consultants, Inc.

Description of Work Performed: Directed the preparation of the Design Approval Document in accordance with established standards, policies, regulations and procedures, except as otherwise explained in this document.

Note: 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 an item in any way. If an item bearing the stamp of a licensed professional is altered, the altering engineer, architect, landscape architect, or land surveyor shall stamp the document and include the notation "altered by" followed by their signature, the date of such alteration, and a specific description of the alteration.
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover</td>
<td>i</td>
</tr>
<tr>
<td>Project Approval Sheet</td>
<td>ii</td>
</tr>
<tr>
<td>List of Preparers</td>
<td>iii</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>iv</td>
</tr>
</tbody>
</table>

## Chapter 1 - Executive Summary

1.1. Introduction                                                      | 1-1  |
1.2. Purpose and Need                                                  | 1-2  |
  1.2.1. Where is the Project Located?                                 | 1-2  |
  1.2.2. Why is the Project Needed?                                    | 1-4  |
  1.2.3. What are the Objectives/Purposes of the Project?              | 1-5  |
1.3. What Alternative(s) Are Being Considered?                        | 1-5  |
1.4. How will the Alternative(s) Affect the Environment?              | 1-8  |
1.5. What Are The Costs & Schedule?                                    | 1-9  |
1.6. Which Alternative is Preferred?                                   | 1-9  |
1.7. What are the Opportunities for Public Involvement?                | 1-10 |

## Chapter 2 - Project Context: History, Transportation Plans, Conditions, and Needs

2.1. Project History                                                  | 2-1  |
2.2. Transportation Plans and Land Use                                | 2-5  |
  2.2.1. Local Plans for the Project Area                              | 2-5  |
  2.2.2. Transportation Corridor                                      | 2-6  |
2.3. Transportation Conditions, Deficiencies and Engineering Considerations | 2-7  |
  2.3.1. Operations (Traffic and Safety) & Maintenance                | 2-7  |
  2.3.2. Multimodal                                                   | 2-15 |
  2.3.3. Infrastructure                                               | 2-16 |
  2.3.4. Potential Enhancement Opportunities                          | 2-33 |

## Chapter 3 – Alternatives

3.1. Alternatives Considered and Eliminated from Further Study         | 3-1  |
3.2. Feasible Build Alternatives                                       | 3-1  |
  3.2.1. Description of Feasible Alternatives                          | 3-1  |
  3.2.2. Preferred Alternative                                         | 3-9  |
  3.2.3. Design Criteria for Feasible Alternative(s)                   | 3-9  |
3.3. Engineering Considerations                                       | 3-15 |
  3.3.1. Operations (Traffic and Safety) & Maintenance                 | 3-15 |
  3.3.2. Multimodal                                                    | 3-19 |
  3.3.3. Infrastructure                                                | 3-19 |
  3.3.4. Landscape and Environmental Enhancements                      | 3-22 |
  3.3.5. Miscellaneous                                                | 3-22 |

## Chapter 4 - Social, Economic and Environmental Conditions and Consequences

4.1. Introduction                                                     | 4-1  |
  4.1.1. Environmental Classification and Lead Agencies               | 4-1  |
4.2. Social                                                          | 4-1  |
  4.2.1. Land Use                                                     | 4-1  |
  4.2.2. Neighborhoods and Community Cohesion                         | 4-3  |
  4.2.3. Social Groups Benefitted or Harmed                           | 4-3  |
  4.2.4. Demographics and Affected Population                         | 4-4  |
  4.2.5. School Districts, Recreational Areas, and Places of Worship  | 4-4  |
4.3. Economic                                                         | 4-5  |
  4.3.1. Regional and Local Economies                                 | 4-5  |
  4.3.2. Specific Business Impacts                                   | 4-5  |
4.4 Environmental

4.4.1 Aquifers, Wells and Reservoirs ................................................................. 4-5
4.4.2 Stormwater Management ................................................................. 4-5
4.4.3 Wetlands/Surface Waters ................................................................. 4-5
4.4.4 Floodplains .............................................................................. 4-6
4.4.5 Coastal Zone/Waterfront Revitalization ........................................... 4-6
4.4.6 Wild, Scenic, and Recreational Rivers ............................................. 4-6
4.4.7 Critical Environmental Areas ......................................................... 4-6
4.4.8 General Ecology and Wildlife ......................................................... 4-6
4.4.9 National Wildlife Refuge Lands ....................................................... 4-7
4.4.10 Historic and Cultural Resources .................................................... 4-7
4.4.11 Parks and Recreational Resources ................................................. 4-10
4.4.12 Visual Resources ...................................................................... 4-11
4.4.13 Air Quality ............................................................................... 4-11
4.4.14 Noise ..................................................................................... 4-14
4.4.15 Energy and Greenhouse Gases ..................................................... 4-15
4.4.16 Asbestos .................................................................................. 4-15
4.4.17 Contaminated and Hazardous Materials ......................................... 4-20
4.4.18 Construction Effects ................................................................. 4-22
4.4.19 Anticipated Permits, Approvals, and Coordination .......................... 4-22
<table>
<thead>
<tr>
<th></th>
<th>Appendices</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Preliminary Plans</td>
</tr>
<tr>
<td>B</td>
<td>Environmental Information</td>
</tr>
<tr>
<td>C</td>
<td>Traffic Information</td>
</tr>
<tr>
<td>D</td>
<td>Structures Information</td>
</tr>
<tr>
<td>E</td>
<td>Non-Standard Features Justification Forms</td>
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<td>F</td>
<td>Preliminary Cost Estimate</td>
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<tr>
<td>G</td>
<td>Regional Traffic Engineer – Design Speed Concurrence</td>
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</table>
CHAPTER 1 - EXECUTIVE SUMMARY

1.1. Introduction

This report has been prepared to familiarize the interested parties with existing conditions and the proposed rehabilitation or replacement work for three (3) ramp bridges and their five (5) segments of associated on-grade roadways of Highbridge Interchange in Bronx County. These ramp bridges and their associated on-grade roadways are located adjacent to the Eastern-shore of the Harlem River between the Metro North Commuter Railroads and Undercliff Avenue in the Bronx. The ramp bridges span various combinations of the Cross Bronx Expressway (I-95) connector approaches, the Major Deegan Expressway (I-87), and Sedgwick Avenue.

Presented in this report is a study of feasible alternatives for the rehabilitation or replacement of the existing ramp bridge structures and their associated on-grade roadways. The primary objective of this bridge rehabilitation project is to upgrade the existing three (3) deteriorating bridge structures to a “LIKE NEW” condition and to extend their service life for a minimum of up to forty (40) years. Included in this project is also the rehabilitation of five (5) segments of associated on-grade approach roadways for the ramp bridges. This report also includes a review of social, economic, and environmental issues of the proposed action for the project area.

This project was initiated by NYSDOT Region 11 Structures to address deficient structural (bridge) conditions at the following three bridges in the Bronx:

- Ramp “C” / BIN 1-06685-B – Southbound I-95 (Westbound Cross Bronx Expressway) to Northbound I-87 (Major Deegan Expressway)
  
  Note: The two-lane road segment between the start of the project from the I-95SB exit to the diverge point on Ramps C and E is designated and stationed as Ramp C on the As-Built plans. The proposed plan alignment for this same segment is continuously stationed as Ramp E.

- Ramp “E” / BIN 1-06685-0) – Southbound I-95 (Westbound Cross Bronx Expressway) to Southbound I-87 (Major Deegan Expressway)
  
  Note: The ramp segment between the merge point of Ramps D and E and the merge with Southbound I-87 is designated and stationed as Ramp D on the As-Built plans. The proposed plan alignment for this same segment is continuously stationed as Ramp E.

- Ramp “M” / BIN 1-06687-0) - Southbound I-87 (Major Deegan Expressway) to Northbound I-95 (Eastbound Cross Bronx Expressway)
  
  Note: The ramp segment between the diverge point from southbound I-87 and the diverge point of Ramps A and M is designated as Ramp A on the As-Built plans. The proposed plan alignment for this same segment within this document and plans is continuously stationed as Ramp M.

Table 1 below provides more detailed information regarding the three (3) bridge ramps:
Table 1: Bridge Ramps in the Project

<table>
<thead>
<tr>
<th></th>
<th>Ramp C</th>
<th>Ramp E</th>
<th>Ramp M</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIN</td>
<td>1-06685-B</td>
<td>1-06685-0</td>
<td>1-06687-0</td>
</tr>
<tr>
<td>Year Built</td>
<td>1964</td>
<td>1964</td>
<td>1964</td>
</tr>
<tr>
<td>Total Length</td>
<td>180 feet</td>
<td>864 feet</td>
<td>1194 feet</td>
</tr>
<tr>
<td>Max. Span Length</td>
<td>97.2 feet</td>
<td>113.3 feet</td>
<td>110.7 feet</td>
</tr>
<tr>
<td>Ramp Width</td>
<td>30.7 feet</td>
<td>30.7 feet</td>
<td>31.7 feet</td>
</tr>
<tr>
<td>Roadway Width</td>
<td>24 feet</td>
<td>24 feet</td>
<td>25 feet</td>
</tr>
<tr>
<td>Number of Spans</td>
<td>2</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>Superstructure</td>
<td>Steel girder/floorbeam</td>
<td>Steel girder/floorbeam</td>
<td>Steel girder/floorbeam</td>
</tr>
<tr>
<td>Substructure</td>
<td>Reinforced concrete</td>
<td>Reinforced concrete</td>
<td>Reinforced concrete</td>
</tr>
<tr>
<td>Foundation</td>
<td>Spread/Piles Footing</td>
<td>Spread/Piles Footing</td>
<td>Spread/Piles Footing</td>
</tr>
</tbody>
</table>

Repair or replacement of other deteriorated or non-standard bridge elements, as well as repair or replacement of on-grade approach elements, were incorporated into the project as well.

This report was prepared in accordance with the NYSDOT Project Development Manual, 17 NYCRR (New York Codes, Rules and Regulations) Part 15, and 23 CFR (Code of Federal Regulations) 771. Transportation needs have been identified (Section 1.2.2), objectives established (Section 1.2.3) to address the needs, and cost-effective alternatives developed (Section 1.3). This project is federally funded.

1.2. Purpose and Need

1.2.1. Where is the Project Located?

The project is located between Depot Place to the South, 179th Street to the North, Metro North Railroad to the West and Jesup Avenue to the East, in the Bronx County of the City of New York. Refer to Photos 1 and 2 and Figure 1 for the location of this project.
1.2.2. Why is the Project Needed?

Based on the evaluations of the latest NYSDOT Biennial Inspections and the condition of the existing bridges noted during the recently completed Alexander Hamilton Bridge and Highbridge Interchange Ramps Rehabilitation Project, D260888 PIN X726.81 and recent field inspections, the three (3) ramp bridges and their five (5) associated segments of on-grade approach roadways, the ramp bridges are considered to be in an advanced stage of deterioration and the on-grade approach roadways are considered to be in fair conditions. The need for improvement on these ramp bridges and on-grade roadways is evidenced by their deficiencies caused by age and deterioration. If this project is not implemented, the bridges and roadways will continue to deteriorate at an increasing rate, until load posting is required, and subsequently may lead to chaotic roadway closures. Therefore, in late 2013, the Department made the decision to progress with the Preliminary Engineering Design for the bridges and their associated on-grade approach roadways.

According to the latest (2013) Biennial Inspection Reports, the general bridge ratings are as follows:
Table 2: General Bridge Ratings

<table>
<thead>
<tr>
<th></th>
<th>Ramp C</th>
<th>Ramp E</th>
<th>Ramp M</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Condition Rating</td>
<td>4.028</td>
<td>3.917</td>
<td>3.708</td>
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<tr>
<td>Sufficiency Rating</td>
<td>47</td>
<td>78</td>
<td>59</td>
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<tr>
<td>Load Rating (Inventory / Operating)</td>
<td>HS-39 / HS-83</td>
<td>HS-45 / HS-83</td>
<td>HS-40 / HS-99</td>
</tr>
<tr>
<td>Structurally Deficient</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Functionally Obsolete</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

In addition, non-standard highway features and roadway geometry of these segments of the Highbridge interchange, if any, were identified and evaluated for operational and safety improvement where possible and practical.

1.2.3. What are the Objectives/Purposes of the Project?

The purpose of this project is to rehabilitate or replace the three (3) bridge structures and their five (5) segments of associated approach roadways. For each of the three (3) bridges and associated roadways, design alternatives were investigated, and the recommended design alternatives are included in this report for review and approval. The primary objective of this project is to upgrade the existing deteriorating bridge structures and roadways to a “LIKE NEW” condition and to extend their service life for a minimum of forty (40) years. This report also includes a review of social, economic, and environmental issues of the proposed actions for the project area. The primary objectives of this project are to:

1. Restore the bridge condition rating to 5 or greater, using cost effective techniques to minimize the life cycle cost of maintenance and repair.
2. Rehabilitate and upgrade the deficient bridge elements to obtain an HL-93 live load rating and a forty (40) year of minimum design life.
3. Rehabilitate using construction methods and materials that will prolong the life of the bridge and reduce future bridge maintenance costs, including the use of high performance concrete, epoxy coated reinforcement, span continuity, joint-less decks, and elastomeric bearings where feasible and cost effective.
4. Improve overall traffic conditions using cost effective methods to reduce delay and to provide an acceptable level of service, for a design period of forty (40) years.
5. Address geometric deficiencies to improve traffic flow and facilitate traffic operations.
6. Correct identified pavement deficiencies, if necessary, that will extend the useful life of the highway and maintain it in a sound condition using cost effective pavement treatments which provide low life cycle costs.
7. Restore pavement to good condition and ride-ability using cost effective pavement treatments which provide a service life of ten (10) years.
8. Improve, if feasible, the identified non-standard features within the project limits.

1.3. What Alternative(s) Are Being Considered?

The following rehabilitation or replacement alternatives, established by the Department, are recommended for the evaluation of these bridges.

- Alternative 1 – Null
- Alternative 2 – Deck Replacement, Pier Replacement above Foundations, and Rehabilitation of Superstructure, Abutments and Foundations (as Necessary)
- Alternative 3 – Deck Replacement, Superstructure Replacement, Pier Replacement above Foundations, and Rehabilitation of Abutments and Foundations (as Necessary)
- Alternative 4 – Complete Bridge Structure Replacement on Existing Alignment
- Alternative 5 – Complete Bridge Structure Replacement on Modified Alignment
Table 3 below summarizes the work items included in each alternative:

<table>
<thead>
<tr>
<th>Work Item</th>
<th>Rehabilitation/Replacement Alternative</th>
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<tbody>
<tr>
<td></td>
<td>1</td>
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<tr>
<td>Widening</td>
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</tr>
<tr>
<td>Bridge Deck</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Superstructure</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Bearings</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Substructure</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Foundation</td>
<td>No Work</td>
</tr>
</tbody>
</table>

**Alternative 1: Null Alternative**

This alternative calls for no capital improvement on the project except routine maintenance work. This alternative will result in the continued deterioration of the structure with progressively lower condition ratings and possibly safety hazards. Implementation of this alternative will not address the prevailing problems and will not satisfy the project objectives. Therefore, it will not be considered further.

**Alternative 2: Deck Replacement, Pier Replacement above Foundations, and Rehabilitation of Superstructure, Abutment and Foundations (as Necessary)**

This alternative calls for bridge deck replacement and rehabilitation of the superstructure and the substructure. Under this alternative, all the bearings and deck joints would be replaced with possible elimination of few deck joints. While roadway alignment would remain the same, the bridge will be widened by 1.75 feet on each side to improve the existing geometric non-standard features. The construction cost estimate for this alternative is **($47.3M)**. This alternative fully satisfies all project objectives.

**Advantages:**
- Shortest overall construction duration
- Shortest full closure durations
- Lowest construction cost
- Typical rehabilitation

**Disadvantages:**
- Does not address the high superstructure weight issue
- Does not address the seismic vulnerabilities of the structure
- Keeps most of the current deck joints
- Additional major rehabilitation of the superstructure and/or the substructure may be required in 20 years

**Alternative 3: Deck Replacement, Superstructure Replacement, Pier Replacement above Foundations, and Rehabilitation of Abutment and Foundations (as Necessary)**

This alternative calls for the total replacement of the superstructure including the bridge deck and the bearings. The new proposed superstructure (excluding the deck slab) will be 50% lighter than the existing superstructure. The new proposed superstructure (including deck slab) will be 15% lighter than the existing superstructure. Approximately 40% of the deck joints will be eliminated under this alternative. This alternative also calls for rehabilitation of the substructure including the total replacement of several piers above the top of footing elevation. This alternative has the second lowest construction cost estimate of **($52.0M)** and fully satisfies all project objectives. The feasibility of this alternative shall be investigated in detail for two spans, where one span is common between ramps M and A, and another span that is common between ramps E and D.
Advantages:
- New redundant superstructure
- Eliminates approximately 40% of the deck joints
- Reduces approximately 50% of the superstructure steel weight
- Extends the service life of the bridge by a minimum of 50 years
- Improves the durability and the seismic performance of the bridge and reduces seismic demands

Disadvantages:
- Longer construction duration and longer closures compared to Alternative 2
- Requires full closures of ramps for extended times
- Higher construction cost than Alternative 2
- Requires major changes to top of piers
- Additional major rehabilitation of substructure may be required in 20 years

• **Alternative 4: Complete Bridge Structure Replacement on Existing Alignment**

  This alternative calls for the total replacement of the bridge on the same alignment with a new span arrangement to optimize the new design and to eliminate as many piers as possible. While roadway alignment would stay close to the original alignment, the bridge width would be increased to eliminate or improve the geometric substandard conditions. The construction cost estimate for this alternative is ($65.7). This alternative satisfies all project objectives.

Advantages:
- New 100-year service life bridge
- Eliminates most of the deck joints
- Optimum design with optimum span arrangement
- Allows the use of concrete and steel superstructure elements
- Reduces the life cycle maintenance cost

Disadvantages:
- The highest construction cost
- Longer construction duration and longer closures compared to other alternatives
- Minimum improvement to bridge horizontal and vertical geometry
- Longer and more detailed environmental process

• **Alternative 5: Complete Bridge Structure Replacement on Modified Alignment**

  This alternative calls for the total replacement of the bridge on a new horizontal and vertical alignment to eliminate the geometric substandard conditions and create new span arrangement that optimizes the new design and eliminates as many piers as possible. This alternative would require Right of Way (ROW) acquisitions, extensive environmental assessment, and might significantly delay the project. Therefore it will not be further considered.

 Alternatives 2 through 5 will provide a wider bridge deck than the current width for all three bridges. The extent of bridge widening will vary for each bridge deck with each alternative consummate with the level of rehabilitation/reconstruction of the superstructure and/or substructure.

Alternatives 2 through 5 will require complete structure closure and associated detours. Staged construction is feasible on straight/tangent sections of Ramp M only. Full temporary ramp structures are not anticipated; however, since closing and/or detouring Ramp A and Ramp D traffic are not permitted, localized temporary fill in structures for two areas (Ramp M splits with neighboring Ramp A, and Ramp D merges with Ramp E) are anticipated to carry the Ramp A traffic as it exits the Ramp M merge point and the Ramp D traffic as it merges into Ramp E. The posted speeds for these segments would need to be very low due to non-standard temporary geometry. The temporary fill in structures would only be limited to these merge points. Another alternative to carry the Ramp A traffic while the Ramp A/M merge point bridge deck section is replaced is to construct a temporary at grade road from Ramp M across Ramps B and L and reconnect to Ramp A. This would allow traffic to be maintained on Ramp A and Ramp L while the Ramp M/A nose is constructed. Ramp B would need to be temporary detoured for this to be a viable option.
There are a few non-standard features for each ramp anticipated to remain for each listed Alternative (1-4). Alternative 5 would likely eliminate all the nonstandard features; however, space limitations and significant right-of-way acquisitions make realignment using the desired ramp design speeds and design criteria unfeasible.

For a more in-depth discussion of the design criteria and nonstandard features see Section 3.2.3. Design Criteria for Feasible Alternative.

1.4. How will the Alternative(s) Affect the Environment?

See Exhibit 1.4-A and 1.4-B for Environmental Summary and Comparison of Alternatives.

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### Exhibit 1.4-A
Environmental Summary

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<th>NEPA Classification</th>
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<td>BY NYSDOT</td>
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### Exhibit 1.4-B
Comparison of Alternatives

<table>
<thead>
<tr>
<th>Category</th>
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<td>Null</td>
<td>2</td>
<td>3</td>
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<tr>
<td>Wetland impacts</td>
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<td>None</td>
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<td>100 year floodplain impact</td>
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<td>None</td>
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<td>None</td>
<td>Temporary Construction Noise Impacts</td>
<td>Temporary Construction Noise Impacts</td>
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<td>Impact to foreasted areas</td>
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<td>Property impacts</td>
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<td>None</td>
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<tr>
<td>Operation at ETC + 20 (LOS)</td>
<td>Ramp C: C</td>
<td>Ramp C: C</td>
<td>Ramp C: C</td>
<td>Ramp C: C</td>
<td>Ramp C: C</td>
</tr>
<tr>
<td>Construction Cost</td>
<td>Ramp E: F</td>
<td>Ramp E: F</td>
<td>Ramp E: F</td>
<td>Ramp E: F</td>
<td>Ramp E: F</td>
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<td>Wetland Impacts</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Refer to Chapter 4 Section(s) 4.4 for mitigation measures that are proposed for this project.

Anticipated Permits/Certifications/Coordination:

Permits:

NYSDEC
- State Pollutant Discharge Elimination System (SPDES) General Permit
NYSDOS

- Coastal Zone Consistency Certification Statement
- Coastal Zone Local Waterfront Revitalization Certification

Coordination:
- Coordination with Federal Highway Administration
- Coordination with New York State Historic Preservation Officer (SHPO)
- Coordination with the US Fish and Wildlife Service
- Coordination with the New York Natural Heritage Program

Certifications:
- NYSDOL: Asbestos Variances

Others:
- Historic or Archaeological Impacts on Federal 106

1.5. What Are The Costs & Schedule?

Design Approval is scheduled for December of 2016 with construction scheduled to last 24 months beginning in Summer of 2017 (See Exhibit 1.5A). A comparison of the cost for each alternative is shown in Exhibit 1.5B.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date Occurred/Tentative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scoping Approval</td>
<td>N/A</td>
</tr>
<tr>
<td>Design Approval</td>
<td>December 2016</td>
</tr>
<tr>
<td>ROW Acquisition</td>
<td>N/A</td>
</tr>
<tr>
<td>Construction Start</td>
<td>Summer 2017</td>
</tr>
<tr>
<td>Construction Complete</td>
<td>Summer 2019</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total cost</th>
<th>Null</th>
<th>Alternate 2</th>
<th>Alternate 3</th>
<th>Alternate 4</th>
<th>Alternate 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>$47.3M</td>
<td>$59.9M</td>
<td>$65.7M</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

For more detail on costs for each alternative refer to Section 3.2.1.

1.6. Which Alternative is Preferred?

Alternative 2 - Deck Replacement, Pier Replacement above Foundations, and Rehabilitation of Superstructure, Abutment, and Foundations (as Necessary) is identified as the preferred alternative for the three (3) bridge structures and their five segments of on-grade roadways. Based on the life cycle analyses performed for all five (5) five alternatives considered, Alternatives 3, 4 and 5 received lower life cycle costs than Alternative 2, however, due to the complexity of existing bridge superstructures that preclude the possibility of staged construction, the stringent traffic restrictions for Ramp A and D closures,
and the good conditions of the existing Ramp C, M, and E superstructure steel, Alternatives 3, 4 and 5 had to be eliminated even though they had the lowest life cycle cost.

Under the preferred Alternative 2, the deteriorated deck slabs for the bridges will be removed and replaced with 9 1/2" thick high early strength concrete deck slabs with epoxy coated reinforcement. The deteriorated superstructure steel will be rehabilitated and modified to accommodate the new wider deck slabs. All existing rocker and steel bearings will be replaced with elastomeric bearings. The concrete abutments will be rehabilitated while all piers will be replaced above the top of footing. Foundations will be rehabilitated as deemed necessary by analysis. The safety walks and steel railing on the existing bridge structures will be eliminated in the preferred alternative. The new bridge deck slab will be constructed with new single slope concrete barriers and no safety walks.

1.7. What are the Opportunities for Public Involvement?
A meeting was held with Bronx Community Board #4- Municipal Services Committee on October 5th, 2016. An overview of the project and major scope items was presented. The project was well received to perform this work and there were no comments or questions provided by the board at that time.

No public hearings are anticipated for this project at this stage.

The remainder of this report is a detailed technical evaluation of the existing conditions, the proposed alternatives, the impacts of the alternatives, copies of technical reports and plans and other supporting information.
CHAPTER 2 - PROJECT CONTEXT: HISTORY, TRANSPORTATION PLANS, CONDITIONS, AND NEEDS

This chapter addresses the history and existing context of the project site, including the existing conditions, deficiencies, and needs for this part of the Cross Bronx Expressway (I-95) and Major Deegan Expressway (I-87) Corridors.

2.1. Project History

The need for the project was identified by the Initial Project Proposal (IPP) of the Department, dated May 4, 1992 that included fifty (50) bridges on or spanning the Cross Bronx Expressway from Amsterdam Avenue in New York County to Castle Hill Avenue in Bronx County. The total project was divided into four (4) segments and four (4) separate design service contracts. JACOBS was assigned to the contract designated as Segment 1 of the Cross Bronx Expressway series that consists of sixteen (16) mainline and ramp structures. This segment consists of sixteen (16) bridge structures including the Alexander Hamilton Bridge (AHB) which carries CBE mainline, I-95; five (5) Trans Manhattan Expressway Connector Ramps; Ramp TE which carries the Eastbound Trans Manhattan Expressway traffic to Washington Bridge; and nine (9) Highbridge Interchange ramp structures which interconnect the CBE and Major Deegan Expressway (MDE), I-87.

The sixteen (16) bridges structures within the limits of Segment 1 were built between the years 1952 to 1962. Throughout the years, the structures and the at-grade approach roadways have received several minor rehabilitation/repairs and one major Retrofit Project for the Trans Manhattan Expressway Connector Ramps and Highbridge Interchange Connector Ramps in 1990. In this Retrofit Project, two retrofit-girders were added under each ramp bridge superstructure to provide redundancy for the existing two-girder superstructure system. All sixteen (16) bridges included in the original contract were under the Regional Biennial Inspection Program, and their structural conditions were updated every two years.

The original scope for these contracts was to prepare preliminary rehabilitation designs (Phases I-IV) that included In-Depth Inspections, Load Ratings, Survey, Non-standard Features Evaluation, Preparation of Preliminary Design Plans including Maintenance and Protection of Traffic Plans, Bridge Rehabilitation Project Reports (BRPRs) and/or an equivalent Design Approval Document. It was anticipated that the rehabilitation work for each segment would be performed under a single construction contract. However, as the project progressed and based on the rehabilitation/replacement recommendations of each segment consultant, the scope of work which was originally developed based on the objective as outlined in the Scope Summary Memorandum/Design Approval Document (SSM/DAD), was subsequently reviewed and revised when the objective of rehabilitation was modified to upgrade the existing deteriorating bridge structures to standards and to extend their service life for a minimum of up to fifty (50) years (beyond that given in the SSM/DAD).

The modified objective, “rehabilitation” to extend the service life and to upgrade the bridge structures to standards, raised concerns regarding the programmed rehabilitation of certain corridor bridges and the possibility that these structures, if left in their existing configurations, would restrict possible future operational improvement strategies. Therefore, as an extension of the original rehabilitation contracts, a feasibility study was performed in 1996 to assess the extent of civil and structural work, Right-of-Way acquisition required and construction costs necessary to implement operational improvements throughout the CBE Corridor. The various improvement alternatives included in the study were: adding full width shoulders for special use lanes, providing a reversible High Occupancy Vehicles (HOV) lane, and increasing the number of travel lanes without addressing what the environmental, social and economic impacts would be to the surrounding communities and what, if any, operational improvements would be gained. The study concluded that the most feasible option was the symmetrical widening of CBE about its existing centerline. However, given the high construction cost to widen the Corridor (not including the cost required to acquire needed ROW) the option appeared to be cost prohibitive.
Subsequent to the feasibility study described above, the Department also completed a Major Investment Study (MIS) for the CBE project area, PIN X726.86, including the Trans Manhattan Expressway and Major Deegan Expressway. The MIS was provided to the design consultants, and the consultants were directed not to preclude the MIS recommendations and shall progress the bridge rehabilitation/replacement designs with close coordination with the future MIS updates, if any.

Equally as important as the designs of the structural modifications and improvements to the structures within the corridor limits was the planning and scheduling of the work. Construction work would take several years to complete and would affect the daily lives of people living in the vicinity of the project area. In addition, the mainline CBE (I-95) and few connector ramps were operating near or exceeding their capacities during peak hours. Therefore, any construction work for these structures would have to be performed in such a manner as to maintain all through lanes of traffic during construction. For local streets and less congested access ramps, construction work will have to be progressed using either staged construction or short term closures with reasonable detour scenarios. This being the case, possible construction packaging options with workable MPT scenarios were investigated and presented in Contract Packaging and MPT Investigation Report in 1997.

The Cross Bronx Expressway and its associated Highbridge Interchange connector ramps are important arteries in the New York City area and traffic congestion on the corridor and its connector ramps is a daily occurrence. Significantly high volumes of traffic in this corridor complicate the types and methods of rehabilitation/replacement for the deficient bridges. Based on this, the FHWA/NYSDOT requested a study to determine the feasibility of utilizing pre-cast/pre-manufactured/pre-assembled bridge components in order to accelerate the duration of construction and to minimize the duration of lane closures and/or traffic detours during construction work. Completed in 1998, the report concluded that utilizing prefabricated components is physically feasible and provides significant savings in time; however, the cost would be relatively higher than the conventional cast-in-place method.

In order to address the immediate needed repairs for the deficient bridges in the CBE Corridor and its connector ramps, an interim repair project was implemented in 1999. This project repaired the most critical deficient elements of each bridge. Most of the existing broken deck joints and some non-functioning expansion bearings were replaced, and the severely deficient steel members and concrete deck slabs were repaired.

During construction of the Interim Repair Contract in 1999, it was discovered that the conditions of the existing concrete deck slabs of the Alexander Hamilton Bridge (AHB) were in much worse condition than anticipated, and were in need of immediate replacement. Similarly, since construction on the AHB required a coordinated maintenance of traffic plan to minimize disruption and further to limit the disruption to one construction project, it was agreed that it would be advantageous to also include six (6) Highbridge Interchange ramp bridges and seven segments of on grade roadways which were directly impacted by the construction on AHB in the same construction contract.

In 2001, the Department made a decision to scale down the project design scope and to progress the Preliminary Engineering Design and Final Engineering Design for a total of only nine (9) bridges under PIN X726.81: eight (8) of the sixteen (16) bridges including their associated on grade approach roadways in Segment 1 and one (1) of the thirteen (13) bridges in Segment 2. The nine (9) bridges included the Alexander Hamilton Bridge, Ramp “TE”, three (3) bridges on Ramp “D”, two (2) bridges on Ramp “A”, Ramp “B & L” bridge, and the Undercliff Avenue Bridge over I-95. The segments of on-grade roadways along Ramps “D” and “A” between the bridges and the approach roadways of Alexander Hamilton Bridge, Ramps “TE”, “B” and “F” were also rehabilitated in this project. The designs were completed in 2008 and the construction of this rehabilitation project started in 2009 and was completed in 2015.

Furthermore, in 2001, the Department also reassigned the five (5) Trans Manhattan Connector Ramps (of the original assigned 16 bridges in Segment 1) in New York County to the Trans Manhattan Rehabilitation Project, PIN X071.40, and delay the rehabilitation work for the three (3) remaining Highbridge Interchange Ramps C, M, and E in Bronx County which were not directly impacted by the construction of AHB for a later date.
However, during the recent construction project of AHB and based on the latest NYSDOT 2013 Biennial Inspections, all three (3) remaining Highbridge Interchange Ramps C, M, and E bridge deck slabs, on-grade approach roadways, and some substructures were found in advanced stage of deterioration. The need for improvement on these ramp bridges and on-grade roadways was evidenced by their deficiencies caused by age and deterioration. If this project is not implemented, the bridges and roadways will continue to deteriorate at an increasing rate, until load posting is required, and may subsequently lead to chaotic roadway closures. Therefore, in 2014, the Department decided to progress with the Preliminary Engineering Designs for the rehabilitation of Ramps C, M and E ramp bridges and their associated on-grade approach roadways.

Another In-Depth inspection for the three (3) remaining Highbridge Interchange Ramps C, M and E (bridges and on-grade roadways) were conducted between 2015-2016 to assess their current conditions for the development of this Draft Design Report and the Preliminary Plans. This Draft Design Report addresses the evolution of the project, project objectives and project alternatives. Included are discussions of the probable social, economic, and environmental consequences of implementing the preferred alternatives. For certain sections of this report, discussions are addressed on a corridor basis, which are then narrowed to present only the essential information pertaining to each bridge. Copies of this Draft Design Report and the separately bounded Appendices will be distributed for review and comment to the affected Federal and State Agencies. Copies of this design report will also be made available to the local agencies and general public upon request.

This Draft Design Report and Preliminary Plans have been prepared with the intent of obtaining approval and to advance the final rehabilitation/replacement designs for the three (3) Highbridge Interchange Ramps C, M, and E bridges and their associated segments of on grade roadways. The Final Design Approval Documents will incorporate all the comments and concerns received from the Draft Design Report and Preliminary Plans and will be resubmitted as Final Design Approval Documents for FHWA review and approval. When the Final Design Approval Documents are approved, the project will then progress through the Final Design Phases V-VI with the development of construction plans, specifications, and estimates. Letting of bids for the project and actual construction will then follow.

The three (3) ramp bridges included in this PIN X726.99 are as follows:

**Ramp “C” / BIN 1-06685-B – Westbound Cross Bronx Expressway (I-95) to Northbound I-87 (Major Deegan Expressway)**

The current Ramp “C” NYSDOT General Condition Rating* of the bridge structure is 4.028 and the Federal Sufficiency Rating** of the bridge structure is 47.0. Based upon the concrete deck coring results, data obtained during the 1994 and the most recent 2015-2016 In-Depth Inspections (see Appendix D), the rebar within all the concrete cores was rusted and some areas of deterioration such as cracks, scaling, spalls and exposed rebar were noted on the underside of the existing concrete deck slab. The lowest condition ratings of the others major bridge components based on the latest available Biennial Inspection Report-2013 are as follows:

- Structural Deck Slab: Rating = 4
- Superstructure Primary Members Rating = 4
- Superstructure Secondary Members Rating = 5
- Superstructure Paint Rating = 3
- Deck Joints Rating = 3
- Bearings Rating = 4
- Pier Cap Beam Rating = 2
- Pier Columns Rating = 2
- Wearing Surface Rating = 4
- Steel Railings Rating = 3
- Scuppers Rating = 1
Two (2) yellow flags were re-issued during the 2013 Biennial Inspection: for the same conditions and supersede the previously issued yellow flags for corroded girder webs with through-holes at the ends of girders.

One (1) new yellow flag was issued during the 2013 Biennial Inspection: for the hammer head pier cap beam and column with large areas of concrete disintegration, deep spalls with exposed rebar, delamination, and cracks.

Ramp “E” / BIN 1-06685-0) - Westbound Cross Bronx Expressway (I-95) to Southbound I-87 (Major Deegan Expressway)

The current Ramp “E” NYSDOT General Condition Rating* of the bridge structure is 3.917 and the Federal Sufficiency Rating** of the bridge structure is 78.0. Based upon the concrete deck coring results, data obtained during the 1994 and the most recent 2015-2016 In-Depth Inspections (see Appendix D), the rebar within all the concrete cores was rusted and some areas of deterioration such as cracks, scaling, spalls and exposed rebar were noted on the underside of the existing concrete deck slab. The lowest condition ratings of the others major bridge components based on the latest available Biennial Inspection Report-2013 are as follows:

- Structural Deck Slab: Rating = 4
- Superstructure Primary Members Rating = 4
- Superstructure Secondary Members Rating = 5
- Superstructure Paint Rating = 4
- Deck Joints Rating = 3
- Bearings Rating = 4
- Pier Cap Beam Rating = 3
- Pier Columns Rating = 3
- Wearing Surface Rating = 3
- Steel Railings Rating = 2
- Scuppers Rating = 1

Four (4) previously issued safety flags were removed accordingly: Two (2) - light standards with exposed wires; one (1) - deteriorated concrete deck slab; and one (1) – deteriorated concrete pier.

Two (2) previously issued yellow flags were removed accordingly: One (1) – uplifted expansion bearing; and one (1) - corroded girder web with through holes at the ends of girder.

Three (3) new safety flags were issued during the 2013 Biennial Inspection: Two (2) - hammer head pier cap beams and columns exhibit large areas of concrete disintegration, deep spalls with exposed rebar, delamination, and cracks; and one (1) – deck joint concrete header exhibit concrete disintegration, spalls with exposed rebar, and loose concrete.

Ramp “M” / BIN 1-06687-0) - Southbound I-87 (Major Deegan Expressway) to Eastbound Cross Bronx Expressway (I-95)

The current Ramp “M” NYSDOT General Condition Rating* of the bridge structure is 3.708 and the Federal Sufficiency Rating** of the bridge structure is 59.0. Based upon the concrete deck coring results, data obtained during the 1994 and the most recent 2015-2016 In-Depth Inspections (see Appendix D), the rebar within all the concrete cores was rusted and some areas of deterioration such as cracks, scaling, spalls and exposed rebar were noted on the underside of the existing concrete deck slab. The lowest condition ratings of the others major bridge components based on the latest available Biennial Inspection Report-2013 are as follows:
• Structural Deck Slab: Rating = 2
• Superstructure Primary Members Rating = 5
• Superstructure Secondary Members Rating = 5
• Superstructure Paint Rating = 5
• Deck Joints Rating = 1
• Bearings Rating = 4
• Pier Cap Beam Rating = 3
• Pier Columns Rating = 4
• Wearing Surface Rating = 4
• Steel Railings Rating = 3
• Scuppers Rating = 1

Two (2) previously issued safety flags were removed accordingly: One (1) - broken light standard base; and one (1) – area of cracked, crumbled and depressed asphalt overlay.

Three (3) previously issued yellow flags were removed accordingly: Three (3) – corroded girder webs with through holes at the ends of girders.

Seven (7) new safety flags were issued during the 2013 Biennial Inspection: Two (2) – Loose areas of brick veneer at wingwalls; two (2) – deteriorated concrete deck slabs; one (1) - broken light standard base; one (1) - scuppers with broken or missing sections; and one (1) - deck joint concrete header exhibit concrete disintegration, spalls with exposed rebar, and loose concrete.

* The NYSDOT condition rating scale ranges from 1 to 7, with 7 being in new condition and a rating of 5 or greater considered as good condition. NYSDOT further defines a deficient bridge as one with a condition rating less than 5.0. A deficient condition rating indicates deterioration at a level that requires corrective maintenance or rehabilitation to restore the bridge to its fully functional, non-deficient condition. It does not mean that the bridge is unsafe.

** The Federal Sufficiency Rating is considered by the federal government when a state requests federal bridge dollars to improve the condition of the bridge. Bridges with low sufficiency ratings are eligible for more funds.

<table>
<thead>
<tr>
<th>Sufficiency Rating</th>
<th>Federal Funding</th>
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</thead>
<tbody>
<tr>
<td>80 – 100</td>
<td>Not available</td>
</tr>
<tr>
<td>50 – 79</td>
<td>Eligible for costs to rehabilitate or refurbish bridge</td>
</tr>
<tr>
<td>0 – 49</td>
<td>Eligible for costs to replace bridge</td>
</tr>
</tbody>
</table>

2.2. Transportation Plans and Land Use

2.2.1. Local Plans for the Project Area

There are no approved developments planned within the project area that will impact traffic operations.

2.2.1.1. Local Comprehensive Plans (“Master Plan”) -

Local and city-wide planning documents were reviewed in order to compare the proposed project elements with the goals and objectives of local planning efforts. The project improvements are consistent with the local and city-wide planning documents.
2.2.1.2. Local Private Development Plans –

There are no approved developments planned within the project area that will impact traffic operations.

2.2.2. Transportation Corridor

2.2.2.1. Importance of the Project Route Segment -

This project is located in a fully developed urban setting in the Bronx, NY. All three ramp bridges and on grade approach roadways are connector ramps for the Cross Bronx Expressway (CBE), I-95, and the Major Deegan Expressway (MDE), I-87.

All three (3) ramp bridges are classified as eligible for National Register of Historic Places.

2.2.2.2. Alternate Routes –

There are no alternative routes that would be suitable as a permanent detour.

2.2.2.3. Corridor Deficiencies and Needs -

The Cross Bronx Expressway, I-95, and Major Deegan Expressway, I-87, including the connector ramps are classified as an Urban Interstate Highway (Controlled Access), and are in the Federal-Aid System.

This project is limited to the structural rehabilitation/replacement of three (3) existing structurally deficient connector ramp structures for I-95 and I-87. No traffic analyses or improvements were considered in this project. However, considerations were included in eliminating the existing safety walks and widening the existing bridge deck slabs to provide wider roadway at the tight curve segments, as well as replacing the existing steel railings with new single slope concrete barriers.

The Regional Planning Group has confirmed that there are no major plans to reconfigure any part of these Highway segments, or the adjoining highway segments, within the next 20 years. However, currently, there is an ongoing re-construction project to the South of Macombs Dam Bridge for the rehabilitation of existing MDE structurally deficient bridge structures and their associated on grade roadways. In addition, there is also an ongoing design project for the rehabilitation of MDE existing structurally deficient structures and their associated on grade roadways with possibly some geometric modifications to the immediately south of this three (3) ramps project, between the Depot Place Bridge and Macomb Dam Bridge. Based on the current schedules established by the Department for these projects, the construction of this three (3) ramps project will overlap with the construction of the MDE project between Depot Place Bridge and Macombs Dam Bridge. It is anticipated close coordination and planning between the two projects will be exercised during the final design phases to minimize major traffic disruptions and detours in the area.

Based on the review of the latest (2013) Biennial Inspection Report and in-depth inspections, the existing pavements (on deck and on grade) are presently in fair condition with cracked concrete pavement and areas of asphalt rutting, patches, and depressions.

2.2.2.4. Transportation Plans -

This project is on the approved Transportation Improvement Program (TIP) as project No.X726.99.

2.2.2.5. Abutting Highway Segments and Future Plans for Abutting Highway Segments -

The Regional Planning Group has confirmed that there are no plans to reconstruct or widen this highway segment nor the abutting highway segments within the next 20 years. However, there are ongoing
reconstruction and design projects immediately South of this project (see Section 2.2.2.3 above for details).

2.3. Transportation Conditions, Deficiencies and Engineering Considerations

2.3.1. Operations (Traffic and Safety) & Maintenance

2.3.1.1. Functional Classification and National Highway System (NHS) –

<table>
<thead>
<tr>
<th>Exhibit - 2.3.1.1 Classification Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route(s)</td>
</tr>
<tr>
<td>Functional Classification</td>
</tr>
<tr>
<td>National Highway System (NHS)</td>
</tr>
<tr>
<td>Designated Truck Access Route</td>
</tr>
<tr>
<td>Qualifying Highway</td>
</tr>
<tr>
<td>Within 1.6 km of a Qualifying Highway</td>
</tr>
<tr>
<td>Within the 4.9 m Vertical Clearance Network</td>
</tr>
</tbody>
</table>

2.3.1.2. Control of Access -

Ramp access to ramps C, E, and M are fully controlled. Access to Ramps C and E is from a deceleration lane on I-95 SB. Access to Ramp M is from a deceleration lane on I-87 SB.

2.3.1.3. Traffic Control Devices –

A series of regulatory, warning and advisory signs are sequences along each of the ramps as follows:

<table>
<thead>
<tr>
<th>Location (MP)</th>
<th>Description</th>
<th>Location (MP)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overhead Sign Structure ~Sta. E19+50</td>
<td>Exit 3N I-87 NORTH Albany ↓ RAMP 30 MPH</td>
<td>Overhead Sign Structure ~Sta. E19+50</td>
<td>Exit 3S I-87 SOUTH Queens ↓ RAMP 30 MPH</td>
</tr>
<tr>
<td>Overhead Sign Structure ~Sta. E21+70</td>
<td>EXIT 3N I-87 NORTH Albany ↦</td>
<td>Overhead Sign Structure ~Sta. E21+70</td>
<td>EXIT 3S I-87 SOUTH Queens ↖</td>
</tr>
<tr>
<td>~Sta. E22+00</td>
<td>Warning (W1-2 R) Curve Right Arrow</td>
<td>~Sta. E24+00</td>
<td>Warning Sign (W1-8L)</td>
</tr>
</tbody>
</table>
There are no traffic signals, CCTV cameras, variable message signs or ramp metering within the project limits. An impact attenuator is located at the gore area of Ramps C and E and at the gore area of Ramps A and M.

2.3.1.4. Intelligent Transportation Systems (ITS)

No ITS systems are in operation or planned for the project area.
2.3.1.5. Speeds and Delay –

See Exhibit 2.3.1.5 below for speed data.

<table>
<thead>
<tr>
<th>Route Description</th>
<th>Speed Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramp C between I95 SB and I87 NB</td>
<td>30 mph</td>
</tr>
<tr>
<td>Ramp E between I95 SB and I87 SB</td>
<td>30 mph</td>
</tr>
<tr>
<td>Ramp M between I87 SB and I95 NB</td>
<td>20 mph</td>
</tr>
</tbody>
</table>

2.3.1.6. Traffic Volumes - Refer to Appendix C of this report for traffic flow diagrams. The traffic data was obtained in September 2015. To obtain classification and volume traffic counts, 24-hour video recording and ATR counts were collected for 8 consecutive days. Weekday and weekend turning movement counts were collected along potential detour routes including the intersections of Macombs Dam Bridge/Southbound Exit 5 I-87 off-ramp and West Fordham Road/Northbound Exit 9 I-87 off-ramp.

2.3.1.6. (1) Existing traffic volumes – Refer to Exhibits 2.3.1.6-1 and 2.3.1.6-2 for a summary of the traffic data. Exhibits 2.3.1.6-3 Part 1 and 2.3.1.63 Part 2 show AM, PM, and average weekday traffic volumes. A discussion of the traffic count methodology, peak hour, and turning movement volumes for intersections with identified accident problems, all major intersections, and major traffic generator driveways/entrances are included in Appendix C.

<table>
<thead>
<tr>
<th>Route Description</th>
<th>Traffic Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramp C</td>
<td>100% AM, 100% PM</td>
</tr>
<tr>
<td>Ramp E</td>
<td>100% AM, 100% PM</td>
</tr>
<tr>
<td>Ramp M</td>
<td>100% AM, 100% PM</td>
</tr>
<tr>
<td>Directional Distribution</td>
<td>100% AM, 100% PM</td>
</tr>
<tr>
<td>Peak Hour Factor</td>
<td>0.93 0.90 0.95 0.95 0.93 0.90</td>
</tr>
<tr>
<td>% Peak Hour Trucks</td>
<td>7.5%AM, 1.8%PM 5.4%AM, 2.1%PM 16.6%AM, 7.5% PM</td>
</tr>
<tr>
<td>% Daily Trucks</td>
<td>2.2% 1.3% 5.5%</td>
</tr>
</tbody>
</table>
### Exhibit - 2.3.1.6-2
### Existing and Forecast Traffic Volumes

<table>
<thead>
<tr>
<th>Year</th>
<th>Route</th>
<th>ADT</th>
<th>DHV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing (2015)</td>
<td>Ramp C</td>
<td>12,970</td>
<td>835</td>
</tr>
<tr>
<td></td>
<td>Ramp E</td>
<td>7,725</td>
<td>580</td>
</tr>
<tr>
<td></td>
<td>Ramp M</td>
<td>9,620</td>
<td>555</td>
</tr>
<tr>
<td>ETC (2020)</td>
<td>Ramp C</td>
<td>13,800</td>
<td>865</td>
</tr>
<tr>
<td></td>
<td>Ramp E</td>
<td>8,120</td>
<td>605</td>
</tr>
<tr>
<td></td>
<td>Ramp M</td>
<td>10,110</td>
<td>575</td>
</tr>
<tr>
<td>ETC+10 (2030)</td>
<td>Ramp C</td>
<td>14,500</td>
<td>865</td>
</tr>
<tr>
<td></td>
<td>Ramp E</td>
<td>8,520</td>
<td>605</td>
</tr>
<tr>
<td></td>
<td>Ramp M</td>
<td>10,610</td>
<td>575</td>
</tr>
<tr>
<td>ETC+20 (2040)</td>
<td>Ramp C</td>
<td>15,250</td>
<td>865</td>
</tr>
<tr>
<td></td>
<td>Ramp E</td>
<td>8,970</td>
<td>605</td>
</tr>
<tr>
<td></td>
<td>Ramp M</td>
<td>11,270</td>
<td>575</td>
</tr>
<tr>
<td>ETC+30 (2050)</td>
<td>Ramp C</td>
<td>16,850</td>
<td>865</td>
</tr>
<tr>
<td></td>
<td>Ramp E</td>
<td>9,910</td>
<td>605</td>
</tr>
<tr>
<td></td>
<td>Ramp M</td>
<td>12,450</td>
<td>575</td>
</tr>
</tbody>
</table>

Note: ETC is the Estimated Time of Completion year; annual growth for ETC+10, +20, and +30 is 0.5% annually; no change in DHV

2.3.1.6. (2) Future no-build design year traffic volume forecasts – The Estimated Time of Completion (ETC) + design year was selected per PDM Appendix 5. An ETC+30 year projection was completed as the project principally involves a bridge for each ramp. There are no major intersections or major traffic generator driveways/entrances in the project area.
Exhibit 2.3.1.6-3 (Part 1)
Existing AM/MD Weekday Peak Hour Volumes
Exhibit 2.3.1.6-3 (Part 2)
Existing 2015 PM/Saturday Peak Hour Volumes
2.3.1.7. Level of Service and Mobility –

A level of service (LOS) analysis was performed for the existing conditions (year 2015), ETC, ETC +20 and ETC +30. It is important to note, traffic demand on Ramp M is understated by the collected traffic volumes due to Ramp A queues extending from the southbound I-87 off-ramp. Observations indicate that at times, Ramp M traffic is unable to bypass Ramp A traffic prior to the Ramp A/M split. The LOS analyses were performed following the procedures in the Highway Capacity Manual 2000 (HCM2000) and included: examining all study area segments including and leading up to Ramps C, E, and M. Further details regarding the LOS analysis is presented in Appendix C.

2.3.1.7. (1) Existing level of service and capacity analysis –
See Exhibit 2.3.1.7-1.

2.3.1.7. (2) Future no-build design year level of service –
See Exhibit 2.3.1.7-1.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>LOS Ramp C</th>
<th>LOS Ramp E</th>
<th>LOS Ramp M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing (2015)</td>
<td>B</td>
<td>F</td>
<td>D</td>
</tr>
<tr>
<td>ETC</td>
<td>B</td>
<td>F</td>
<td>E</td>
</tr>
<tr>
<td>ETC+20</td>
<td>C</td>
<td>F</td>
<td>E</td>
</tr>
<tr>
<td>ETC+30</td>
<td>D</td>
<td>F</td>
<td>E</td>
</tr>
</tbody>
</table>

2.3.1.8. Safety Considerations, Accident History and Analysis

An accident analysis was performed in accordance with the Highway Design Manual chapter 5 in 2015. The accident rate for each of the ramps within the project area is: Ramp C - 0 accidents per million vehicle miles; Ramp E - 1.17 accidents per million vehicle miles; and Ramp M - 0.16 accidents per million vehicle miles. The rates for ramps C and M are below the statewide accident rate for similar facilities, which is 1.08 accidents per million vehicle miles. The rate for Ramp E is slightly above this statewide average rate.

There are no high accident locations within the study area and none of the accidents involved farm equipment or animals.

The predominate accident types and corresponding locations (including reference markers) are shown below in Exhibit 2.3.1.8:
### Exhibit 2.3.1.8
Collision Summary
Ramp C (between I-95SB and I-87NB) Ramp E (bet I-95SB and I-87SB) and Ramp M (bet I-87SB and I-95 NB)

<table>
<thead>
<tr>
<th>Location</th>
<th>Total</th>
<th>Crash Severity</th>
<th>Number of Accidents</th>
<th>Light Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>FTL¹</td>
<td>INJ²</td>
<td>PDO³</td>
</tr>
<tr>
<td>Ramp C (Reference Marker 95I X1MR01C1 to 95I X1MR01G7)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ramp E (Reference Marker 95I X1MR01C1 to 95I X1MR01C4)</td>
<td>6</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Ramp M (Reference Marker 95I X1MR01E1 to 95I X1MR01A5)</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

An accident analysis including an accident summary (TE-213), collision diagrams (TE-56), and recommendations for improvements is in Appendix C. Only one accident incident identified a specific contributing factor which was a rear end collision caused by vehicle following too closely. Safety awareness signage could be installed as a countermeasure to this incident. All other reported accidents identify “unknown” as contributing factors and occur during day-light and/or clear weather conditions. The following countermeasures could be considered to improve safety:

- Add flashing beacons to the advisory arrow signs on each of the ramps
- Fabricate the warning arrow signs (W1-8) with high reflectivity material.
- Post speed restriction signs in advance of the curve section on each ramp

### 2.3.1.9. Existing Police, Fire Protection and Ambulance Access

The interchange ramps connect the Cross Bronx Expressway and the Major Deegan Expressway. These ramps are used by vehicles of the New York Police and Fire Departments and Emergency Medical Services in responding to calls in the Bronx.

### 2.3.1.10. Parking Regulations and Parking Related Conditions

Parking on Interstate highways is restricted by law within the project limits.

### 2.3.1.11. Lighting

The existing street lighting on the parapets of the three ramps will be replaced in-kind as part of the project.
2.3.1.12. Ownership and Maintenance Jurisdiction –

See Exhibit 2.3.1.12 for Existing Maintenance Jurisdiction

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Highway</th>
<th>Limits</th>
<th>Feature(s) being Maintained</th>
<th>Centerline (mile)</th>
<th>Lane (mile)</th>
<th>Agency</th>
<th>Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ramp C</td>
<td>Station C10+00 To C21+60</td>
<td>Structure, Pavement, Shoulders, Curbs, Lighting, Drainage System, and Landscaping</td>
<td>1,160 LF (0.22 mile)</td>
<td>1,160 LF (0.22 mile)</td>
<td>NYSDOT</td>
<td>Section 349-c Highway Law</td>
</tr>
<tr>
<td>2</td>
<td>Ramp E</td>
<td>Station E12+30 To E43+90</td>
<td>Structure, Pavement, Shoulders, Curbs, Lighting, Drainage System, and Landscaping</td>
<td>3,160 LF (0.60 mile)</td>
<td>3,160 LF (0.60 mile)</td>
<td>NYSDOT</td>
<td>Section 349-c Highway Law</td>
</tr>
<tr>
<td>3</td>
<td>Ramp M</td>
<td>Station M11+00 To C42+00</td>
<td>Structure, Pavement, Shoulders, Curbs, Lighting, Drainage System, and Landscaping</td>
<td>3,100 LF (0.59 mile)</td>
<td>3,100 LF (0.59 mile)</td>
<td>NYSDOT</td>
<td>Section 349-c Highway Law</td>
</tr>
</tbody>
</table>

2.3.2. Multimodal

2.3.2.1. Pedestrians

Pedestrians are prohibited on Interstate Highways by state law. A pedestrian generator checklist was not prepared since this project does not extend beyond the Interstate main line.

2.3.2.2. Bicyclists

Bicyclists are prohibited on Interstate Highways by state law.

2.3.2.3. Transit

There are no transit providers operating within the project limits.

2.3.2.4. Airports, Railroad Stations, and Ports

There are no airports, railroad stations or port entrances within or in the vicinity of the project limits.
2.3.2.5. Access to Recreation Areas (Parks, Trails, Waterways, State Lands)

There are no entrances to recreation areas within the project limits.

2.3.3. Infrastructure

2.3.3.1. Existing Highway Section –

See Typical Sections, Plan and Profile sheets in Appendix A.

2.3.3.2. Geometric Design Elements Not Meeting Minimum Standards –

Exhibits 2.3.3.2 (C), (E), and (M) compare the existing geometric elements of the three ramps with the minimum standards as listed in the NYSDOT Highway Design Manual (HDM) as per Chapter 7, Section 7.6.3.2 and Chapter 2, Section 2.7.5.2. The operating speed is based on the functional classification and the posted speed limits for each Ramp C, E, and M. As per the HDM the ramp design speed for the design criteria applies to the sharpest ramp curve and does not apply to the ramp terminals. The posted speed limits for Ramps C and E are 30 mph, whereas the advisory speed for Ramp M is reduced to 20 mph on the existing overhead structure before the ramp curvature.
### RAMP C

<table>
<thead>
<tr>
<th>Critical Design Element</th>
<th>Operating Speed</th>
<th>Standard (from HDM Chapter 2 &amp; Chapter 7, Freeway 3R)</th>
<th>Existing Condition</th>
<th>Adverse Accident History? (Yes/No)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traveled Way Width</td>
<td>30 mph</td>
<td>One-Lane: 16' (12' on tan + 4' combined shldr both sides) Tangent Sections/Inside Radius &gt; 1000' (HDM Section 2.7.5 Exhibit 2-9a)</td>
<td>One-lane: 12' +/- striped, 14' +/- total at end of Ramp C at Ramp C/F nose merge.</td>
<td>No</td>
<td>30 mph posted speed limit. Recommend reconfiguring nose of Ramp C/F in final design to meet standard width.</td>
</tr>
<tr>
<td>Shoulder Width</td>
<td>30 mph</td>
<td>Left: 3'; Right: 6' 0' Shoulder &amp; 2' offset ea. side in presence of curbing (HDM Section 2.7.5 Exhibit 2-10)</td>
<td>1' Offset Left &amp; Right (curb present Left &amp; Right)</td>
<td>No</td>
<td>Non-standard throughout limits at various locations. Shoulder Width improved by removing safety walk.</td>
</tr>
<tr>
<td>Superelevation</td>
<td>30 mph</td>
<td>e=6% Max</td>
<td>e=5.21%</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>Stopping Sight Distance (SSD) at approx. proposed Sta. C13+00</td>
<td>30 mph</td>
<td>200 ft. min. horizontal SSD; (from HDM Section 2.7.5, Exhibit 2-10)</td>
<td>174 ft. horizontal SSD</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>Horizontal Clearance</td>
<td>30 mph</td>
<td>Left: 3' min. Right: 6' min Additional 4' beyond outside shoulders to abutments/piers below structures (HDM Section 2.7.5.2 l)</td>
<td>Left: 2.5' to face of bridge railing Right: 2.5' to face of bridge railing. Right: Light poles from proposed sta. C14+00 to end of work do not meet horizontal clear 6' min requirements</td>
<td>No</td>
<td>Relocate Light Poles as necessary in final design</td>
</tr>
</tbody>
</table>

1. 30 mph (based on semi-direct loop ramp and Regional Traffic Engineer concurred 30 mph design speed) existing 30 mph posted speed limit.

2. The available accident data is inconclusive for determining exact locations or specific causes from non-standard features due to lack of specific mile markers.
### Exhibit 2.3.3.2 (E)  
**Existing Nonstandard Features Ramp E (BIN 1-06685-0)**

<table>
<thead>
<tr>
<th>Critical Design Element</th>
<th>Operating Speed</th>
<th>Standard (from HDM Chapter 2 &amp; Chapter 7, Freeway 3R)</th>
<th>Existing Condition</th>
<th>Adverse Accident History? (Yes/No)²</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder Width</td>
<td>30 mph¹</td>
<td>Left: 3’; Right 6’ (0’ Shoulder &amp; 2’ Offset ea. side in presence of curbing) HDM Section 2.7.5 Exhibit 2-10</td>
<td>1’ Offset Left and Right sides</td>
<td>No</td>
<td>Non-standard throughout limits at various locations. Shoulder Width improved by removing safety walk.</td>
</tr>
<tr>
<td>Horizontal Curvature</td>
<td>30 mph¹</td>
<td>231 ft. min. at e=6% superelevation (from HDM Section 2.7.5, Exhibit 2-10)</td>
<td>200 ft. at e=5.21% superelevation</td>
<td>No</td>
<td>There are existing chevron warning signs indicating the Ramp E curve</td>
</tr>
<tr>
<td>Stoping Sight Distance</td>
<td>30 mph¹</td>
<td>e=6%max</td>
<td>e=5.21%</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>Horizontal Clearance</td>
<td>30 mph¹</td>
<td>200 ft. min. horizontal SSD; (from HDM Section 2.7.5, Exhibit 2-10)</td>
<td>157 ft. horizontal SSD</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>Level of Service (LOS)</td>
<td>30 mph¹</td>
<td>Left: 3’ min. Right: 6’ min Additional 4’ beyond outside shoulders to abutments/piers below structures (HDM Section 2.7.5.2 I)</td>
<td>Left: 2.5’ to face of bridge railing Right: 2.5’ to face of bridge railing. Left: 2 piers for AHB Ramp D overhead Structure (Sta E32+00+/−) are 4.8’ from edge of existing safety walk curb.</td>
<td>No</td>
<td>Relocate Light Poles as necessary in final design. They are within horizontal clearance on Ramp E.</td>
</tr>
</tbody>
</table>

¹ 30 mph (based on semi-direct loop ramp and Regional Traffic Engineer concurred 30 mph design speed) existing 30 mph posted speed limit.

² The available accident data is inconclusive for determining exact locations or specific causes from non-standard features due to lack of specific mile markers.
### RAMP M and at grade segments for Ramp A/M approach and Ramp M/B merge to I-95NB

#### Exhibit 2.3.3.2 (M)

<table>
<thead>
<tr>
<th>Critical Design Element</th>
<th>Operating Speed</th>
<th>Standard (from HDM Chapter 2 &amp; Chapter 7, Freeway 3R)</th>
<th>Existing Condition</th>
<th>Adverse Accident History? (Yes/No)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Speed</td>
<td>30 mph&lt;sup&gt;1&lt;/sup&gt;, 20 mph&lt;sup&gt;3&lt;/sup&gt;</td>
<td>30 mph standard for semi-direct connection ramp.</td>
<td>20 mph advisory speed&lt;sup&gt;2&lt;/sup&gt; on existing overhead sign (entering Ramp M)</td>
<td>No</td>
<td>20 mph advisory speed&lt;sup&gt;2&lt;/sup&gt; (entering Ramp M curve)</td>
</tr>
<tr>
<td>Traveled Way Width</td>
<td>30 mph&lt;sup&gt;1&lt;/sup&gt;</td>
<td>One-Lane: 17' (+2' offset ea. side min desirable = 21' curb to curb) Inside Radius ≥ 500': (for Ramp B/M nose merge) (HDM Section 2.7.5 Exhibit 2-10)</td>
<td>One-lane: 13'-7&quot; +/- w curb both sides R=815' (at Ramp B/M nose merge.)</td>
<td>No</td>
<td>Impacts to widening Ramp M/B merge area to be evaluated in final design.</td>
</tr>
<tr>
<td>Shoulder Width</td>
<td>30 mph&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Left: 3'; Right 6&quot; (0' Shoulder &amp; 2' offset ea. side in presence of curbing) HDM Section 2.7.5 Exhibit 2-10</td>
<td>1' Offset Left and Right sides</td>
<td>No</td>
<td>Non-standard throughout limits at various locations. Shoulder Width improved by removing safety walk.</td>
</tr>
<tr>
<td>Horizontal Curvature</td>
<td>30 mph&lt;sup&gt;1&lt;/sup&gt;</td>
<td>231 ft. min. at e=6% superelevation for design speed 30 mph (from HDM Section 2.7.5, Exhibit 2-10)</td>
<td>180 ft. inside radius at e=5.12% superelevation</td>
<td>No</td>
<td>20 mph advisory speed&lt;sup&gt;3&lt;/sup&gt; (entering Ramp M curve) Should use 30mph design speed.</td>
</tr>
<tr>
<td>Horizontal Clearance</td>
<td>30 mph&lt;sup&gt;1&lt;/sup&gt;</td>
<td>e=6%max</td>
<td>e=5.21%</td>
<td>No</td>
<td>20 mph advisory speed&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Stopping Sight Distance (SSD)</td>
<td>30 mph&lt;sup&gt;1&lt;/sup&gt;</td>
<td>200 ft. min. horizontal SSD for 30mph / 155 ft. for 25mph / 115' for 20 mph; (from HDM Section 2.7.5, Exhibit 2-10)</td>
<td>154 ft. horizontal SSD (non-standard only if use 30 mph design speed)</td>
<td>No</td>
<td>20 mph advisory speed&lt;sup&gt;3&lt;/sup&gt; (entering Ramp M curve).</td>
</tr>
</tbody>
</table>

### Notes

<sup>1</sup> 30 mph (based on semi-direct loop ramp and Regional Traffic Engineer concurred 30 mph design speed) existing 30 mph posted speed limit.

<sup>2</sup> The available accident data is inconclusive for determining exact locations or specific causes from non-standard features due to lack of specific mile markers.

<sup>3</sup> 20 advisory speed on overhead sign structure entering Ramp M curve. Design speed 30 mph based on Regional Traffic Engineer.
2.3.3.2. (1) Other Design Parameters –

The existing conditions were reviewed to determine if other design elements within this project may be considered nonconforming features. In particular, the following were reviewed using the as-built documents, visual assessment of site conditions, and the latest field survey.

- Clear Zone
- Superelevation Runoff/Runout Length
- Minimum Length of Vertical Curves
- Lane Drops
- Broken Back Curves
- Compound Curves
- Auxiliary Lane Lengths
- Curbing
- Guide Rail
- Access Control
- Widening of Lanes

The only nonconforming feature found in the existing conditions is on Ramp C. The compound curve leading from the two-lane Ramp E/C segment to the one-lane Ramp C segment slightly exceeds the desirable 2:1 ratio listed in the HDM Chapter 5.7.3.5.A and AASHTO “A Policy on Geometric Design of Highways and Streets, 2011”, Chapter 3, page 3-84. The existing centerline alignment has an approach radius of 1013 ft. (1000 ft. inside edge) which reduces to a 460 ft. radius along the centerline alignment (448 ft. inside edge). Ideally if the 2:1 ratio were to be used the maximum inside radius would be 500 ft. which would meet this design criteria.

2.3.3.3. Pavement and Shoulder -

The current pavement approach conditions reported in the 2013 biennial inspection report for all three (3) bridges is “fair” on Ramp C and “fair to poor” on Ramps E and M. However, as per visual inspection conducted under this project, each of the approach roadways have some segments that were recently resurfaced. Pavement Evaluation and Treatment Selection Reports (PETSР) are not available.

There are no existing shoulders on the three (3) ramp structures or their approach roadways included within the project limits. There are segments on the ramp approaches that have safety walks of varying width.

2.3.3.4. Drainage Systems -

The existing drainage systems or patterns will be maintained. Existing scuppers and downspouts will be replaced and connected to the existing underground drainage system, as applicable. The points of discharge will remain the same.

2.3.3.5. Geotechnical

There are no special geotechnical concerns with the soils or rock slopes within the project area.

2.3.3.6. Structure

The Highbridge Interchange is composed of the Alexander Hamilton Bridge that carries the Cross Bronx Expressway mainline, I-95, and nine (9) ramp bridge structures including their twelve segments of on grade roadways that distribute the I-95 mainline traffics to and from the Major Deegan Expressway, I-87. The Alexander Hamilton Bridge, six (6) of the nine (9) ramp bridge structures, and seven (7) of the twelve (12) segments of on grade roadways were recently rehabilitated under Contract D260888, in 2014. Those three (3) ramp bridge structures and five (5) segments of on grade roadways that were not included in the
previous rehabilitation project are to be rehabilitated under this Contract D0006939, and are the subject ramp bridges of this Design Report.

2.3.3.6.(1)

**BIN: 106685B - Highbridge Interchange - Ramp C**

This short ramp bridge structure and its two (2) approach roadways carry the I-95 westbound traffic to I-87 northbound. It was built in 1964 and carries one 24'-0" wide lane and a 3'-4" wide raised safety walk with 3-rail steel railings along both sides of the bridge. The total width of the 7 3/8" thick concrete deck slab is 30'-8" and the bridge consists of two (2) simply supported spans, with a total of 181'-6" in length:

- **Span-1: 97'-2"** A curved span between the common Pier-Bent No. 19 (BIN 1066850, Ramp E) and the intermediate hammer head Pier No. 20A.
- **Span-2: 84'-4"** A curved span between Pier No. 20A and End Abutment.

For each span the superstructure consists of two (2) original longitudinal steel girders, intermediate transverse steel floorbeams between girders, and longitudinal middle steel stringers between floorbeams supporting the concrete deck slab. Two (2) longitudinal retrofit steel girders were added onto the underside of the original superstructure in 1989, providing additional supports for the original floorbeams and redundancy to the original two-girder non-redundant superstructure system. This bridge does not carry any utility lines.

The substructure consists of one intermediate concrete hammerhead pier, and the end concrete abutment only. The common double column concrete Pier Bent No. 19 that support both the Ramp C and Ramp E superstructure is considered as a pier for Ramp E.

During the in-depth inspection of the subject ramp bridge in 2015-2016, it was noted that a painting contract was also underway for the bridge steel superstructure. New paint was applied onto all the longitudinal girder ends near their bearing locations.

Photo: General View of Exit 1-D & 1-C, Ramp C Bridge Structure is located at Exit 1-C (Right Exit)
Photo: Left Elevation of Ramp C Bridge Structure

Photo: General View of the Underside of Ramp C Bridge Structure
BIN: 1066850 - Highbridge Interchange - Ramp E

This long ramp bridge structure and its two (2) approach roadways carry the I-95 westbound traffic to I-87 southbound. It was built in 1964 and carries one 24'-0" wide lane and a 3'-4" wide raised safety walk with 3-rail steel railings along both sides of the bridge. The total width of the 7 ½" thick concrete deck slab is 30'-8" and the bridge consists of ten (10) simply supported spans, with a total of 868'-8" in length:

- Span-1: 61'-0" A curved span between the Beginning Abutment and common Pier-Bent No. 19 (BIN 106685B, Ramp C).
- Span-2: 75'-5" A curved span between the common Pier Bent No. 19 (BIN 106685B, Ramp C) and Pier No. 20.
- Span-3: 75'-6" A curved span between Pier Nos. 20 and 21.
- Span-4: 101'-2" A curved span between Pier Nos. 21 and 22.
- Span-5: 85'-9" A curved span between Pier Nos. 22 and 23.
- Span-6: 85'-11" A curved span between Pier Nos. 22 and 23.
- Span-7: 81'-8" A curved span between Pier Nos. 23 and 24.
- Span-8: 80'-7" A straight span between Pier Nos. 24 and 25.
- Span-10: 108'-4" A straight span between Pier No. 26 and End Abutment.

For each span the superstructure consists of two (2) original longitudinal steel girders, intermediate transverse steel floorbeams between girders, and longitudinal middle steel stringers between floorbeams supporting the concrete deck slab. Two (2) longitudinal retrofit steel girders were added onto the underside of the original superstructure in 1989, providing additional supports for the original floorbeams and redundancy to the original two-girder non-redundant superstructure system. This bridge does not carry any utility lines.

The substructure consists of two (2) double column concrete pier bents (the common Pier Bent No. 19 also supports the Ramp C superstructure), seven (7) concrete hammerhead piers,, and the two (2) beginning and end concrete abutments.

During the in-depth inspection of the subject ramp bridge in 2015-2016, it was noted that a painting contract was also underway for the bridge steel superstructure. New paint was applied onto all the longitudinal girder ends near their bearing locations.
Photo: General View of Exit 1-D & 1-C, Ramp E Bridge Structure is located at Exit 1-D (Left Exit)

Photo: Right Elevation of Ramp E Bridge Structure
This long ramp bridge structure and its two (2) approach roadways carry the I-87 southbound traffic to I-95 southbound and northbound. It was built in 1964 and carries two 25’-0” wide lanes and a 3’-4” wide raised safety walk with 3-rail steel railings along both sides of the bridge. The total width of the 7 ½” thick concrete deck slab is 31’-8” and the bridge consists of fourteen (14) simply supported spans, with a total of 1,196’-7” in length:

Span-1: 108’-8”  A straight span between the Beginning Abutment and Pier No. 1.
Span-2: 110’-8”  A straight span between Pier Nos. 1 and 2.
Span-3: 92’-8”  A straight span between Pier Nos. 2 and 3.
Span-4: 92’-9”  A straight span between Pier Nos. 3 and 4.
Span-5: 50’-1”  A straight span between Pier Nos. 4 and 10.
Span-6: 106’-8”  A straight span between Pier Nos. 10 and 11.
Span-7: 106’-9”  A straight span between Pier Nos. 11 and 12.
Span-8: 75’-6”  A curved span between Pier Nos. 12 and 13.
Span-9: 77’-5”  A curved span between Pier Nos. 13 and 14.
Span-10: 68’-10”  A curved span between Pier Nos. 14 and 15.
Span-11: 71’-1”  A curved span between Pier Nos. 15 and 16.
Span-12: 73’-6”  A curved span between Pier Nos. 16 and 17.
Span-13: 68’-4”  A curved span between Pier Nos. 17 and 18.
Span-14 93’-8"  A curved span between Pier No. 18 and End Abutment.

For each span the superstructure consists of two (2) original longitudinal steel girders, intermediate transverse steel floorbeams between girders, and longitudinal middle steel stringers between floorbeams supporting the concrete deck slab. Two (2) longitudinal retrofit steel girders were added onto the underside of the original superstructure in 1989, providing additional supports for the original floorbeams and redundancy to the original two-girder non-redundant superstructure system. This bridge does not carry any utility lines.

The substructure consists of two double column pier bents, eleven (11) concrete hammerhead piers, and the two (2) beginning and end concrete abutments.
During the in-depth inspection of the subject ramp bridge in 2015-2016, it was noted that a painting contract was also underway for the bridge steel superstructure. New paint was applied onto all the longitudinal girder ends near their bearing locations.

Photo: Left Elevation of Ramp M Bridge Structure

Photo: Right Elevation of Ramp M Bridge Structure
2.3.3.6.(2) Clearances (Horizontal/Vertical)

This information is listed in a table in Section 3.2.3.2 under items #9 and #10.

2.3.3.6.(3) History & Deficiencies

The three (3) ramp bridges within the limits of this project were built in 1964. Throughout the years, the structures and the at grade approach roadways have received several minor repairs under the “where and when” Regional Contracts, and two bridge rehabilitation projects in 1989 and 1999. In 1989, longitudinal retrofit steel girders were added to the underside of original steel superstructures providing additional supports for the floorbeams and redundancy to the original two-girder non-redundant superstructure system. Furthermore, an interim repair project was implemented in 1999 for the repair of the most critical deficient elements of each bridge. Most of the existing broken deck joints, the severely deficient steel members, and the areas of deteriorated and spalled concrete deck slabs were repaired. However, these three (3) bridges were excluded from the recently completed Alexander Hamilton Bridge and Highbridge Interchange Ramps Rehabilitation Project, D260888 PIN X726.81, in 2013.

In-depth inspections were conducted for the three subject ramp bridges in 1993 and 2015-2016, and all three (3) bridges are under the Regional Biennial Inspection Program and their structural conditions have been updated every two years.

2.3.3.6.(4) Inspection -

In general, based on the latest 2015-2016 in-depth inspection and 2013 Regional Biennial Inspection, all three subject ramp bridges exhibit areas of severe cracks and spalls with exposed rebar at the underside of the concrete deck slab, leaking deck joints, severe deterioration with holes in steel girder ends, non-functioning bearings, and substructures with large areas of hollow sounding concrete and spalls with exposed rebar. Safety, yellow and red flags have been issued to the existing bridge structures throughout the past fifty-plus years. The general inspection findings for the three subject ramp bridges are as follows:
**BIN: 106685B - Highbridge Interchange - Ramp C**

Based on both the 2015-2016 in-depth inspection and the 2013 Biennial Inspection, the following conditions were identified.

- Severe deterioration on bridge deck asphalt overlay (the asphalt overlay on the bridge and the vast majority of the asphalt overlay on the approach roadways were replaced in 2015).
- Areas of hollow sounding concrete and severe concrete spalls with exposed rebar at the underside of bridge deck.
- Severe water leakage at the deck joints.
- Severe structural steel corrosion at the girder ends, below the deck joints.
- Moderate steel corrosion in bearings.
- Areas of hollow sounding concrete and severe concrete spalls with exposed rebar at the pier and abutment.

**Federal Sufficiency Rating and State Condition Ratings:**

Based on the latest 2013 Biennial Inspection, the Federal Sufficiency Rating for Ramp C bridge structure is 47.0 and the State Condition Rating is 4.028.

**Deck Evaluation:**

Based on the most recent 2015-2016 in-depth inspection and the latest 2013 Regional Biennial Inspection, the existing concrete deck slab of the bridge structure is in advanced stage of deterioration with significant areas of hollow sounding concrete and spalls with exposed rebar at the underside of the deck slab. It is recommended that the entire bridge concrete deck slab be replaced.

**Load Rating**

Based on the latest results of load rating analysis available the existing bridge structure has an inventory rating above HS20 or HL-93.

**Fatigue Analysis**

The results of the fatigue analysis performed indicated that the existing steel superstructure framing has infinite life if one typical fatigue pronged detail is eliminated. The welded top plates for all the existing cantilever brackets along both sides of the bridge structure were determined to be Category E’ welds. It is recommended these welds be removed and replaced with bolted connections when the existing concrete deck slab is removed and the top of existing steel is exposed. Upon the removal of the Category E’ welds, infinite fatigue life will be provided for the existing steel superstructure. See Appendix D for fatigue evaluation.

**Seismic Evaluation**

Detailed seismic evaluation for the existing Ramp C bridge structure has not yet been performed under the Preliminary Design Phases I-IV. However, as per the detailed seismic evaluations performed under the Final Design Phases V-VI for the other five (5) similar Highbridge Interchange ramp structures under the recently completed Alexander Hamilton Bridge and Highbridge Ramps Rehabilitation Construction Project in 2013, all existing bearings of Ramp C bridge structure shall be replaced, and all bearing seats at the top of piers and abutment will have to be retrofitted, if required, to provide adequate edge distances.
Vulnerability Assessments

- Overload Vulnerability Assessment: 5
- Collision Vulnerability Assessment: 3
- Steel Details Assessment: 2
- Concrete Detail Assessment: N.A.

Vulnerability Rating Descriptions:
1 = Safety Program Watch
2 = Safety Program Alert
3 = Capital Program
4 = Inspection Program
5 = No Action
6 = Not applicable

Repair Recommendations:
- Replace the bridge deck and joints
- Replace the steel railings with single slope concrete barrier
- Replace existing bearings with elastomeric bearings at abutment and piers
- Eliminate all fatigue prone welds at the top plates for the existing cantilever brackets
- Localized repairs of steel girders, floorbeams, brackets, diaphragms, and stringers
- Paint the existing visible and exposed steel superstructure surfaces
- Repair the spalled and hollow sounding areas and cracks on concrete abutment
- Replace the capbeam and column (footing to remain) of the only concrete hammer head Pier No. 20A:

BIN: 1066850 - Highbridge Interchange - Ramp E

Based on both the 2016-2016 in-depth inspection and the 2013 Biennial Inspection, the following conditions were identified.

- Severe deterioration on bridge deck asphalt overlay (the asphalt overlay on the bridge and the vast majority of the asphalt overlay on the approach roadways were replaced in 2015).
- Areas of hollow sounding concrete and severe concrete spalls with exposed rebar at the underside of bridge deck.
- Severe water leakage at the deck joints.
- Severe structural steel corrosion at the girder ends, below the deck joints.
- Moderate steel corrosion in bearings.
- Areas of hollow sounding concrete and severe concrete spalls with exposed rebar at the piers and abutments.

Federal Sufficiency Rating and State Condition Ratings:

Based on the latest 2013 Biennial Inspection, the Federal Sufficiency Rating for Ramp E bridge structure is 78.0 and the State Condition Rating is 3.917.

Deck Evaluation:

Based on the most recent 2015-2016 in-depth inspection and the latest 2013 Regional Biennial Inspection, the existing concrete deck slab of the bridge structure is in advanced stage of deterioration with significant areas of hollow sounding concrete and spalls with exposed rebar at the underside of the deck slab. It is recommended that the entire bridge concrete deck slab be replaced.

Load Rating

Based on the latest results of load rating analysis available the existing bridge structure has an inventory rating above HS20 or HL-93.
Fatigue Analysis

The results of the fatigue analysis performed indicated that the existing steel superstructure framing has infinite life if one typical fatigue pronged detail is eliminated. The welded top plates for all the existing cantilever brackets along both sides of the bridge structures were determined to be Category E’ welds. It is recommended these welds be removed and replaced with bolted connections when the existing concrete deck slab is removed and the top of existing steel is exposed. Upon the removal of the Category E’ welds, infinite fatigue life will be provided for the existing steel superstructure. See Appendix D for fatigue evaluation.

Seismic Evaluation

Detailed seismic evaluation for the existing Ramp E bridge structure has not yet been performed under the Preliminary Design Phases I-IV. However, as per the detailed seismic evaluations performed under the Final Design Phases V-VI for the other five (5) similar Highbridge Interchange ramp structures under the recently completed Alexander Hamilton Bridge and Highbridge Ramps Rehabilitation Construction Project in 2013, all existing bearings of Ramp E bridge structure shall be replaced, and all bearing seats at the top of piers and abutment will have to be retrofitted, if required, to provide adequate edge distances.

Vulnerability Assessments

- Overload Vulnerability Assessment: 3
- Collision Vulnerability Assessment: 3
- Steel Details Assessment: 3
- Concrete Detail Assessment: N.A.

Vulnerability Rating Descriptions:
1 = Safety Program Watch
2 = Safety Program Alert
3 = Capital Program
4 = Inspection Program
5 = No Action
6 = Not applicable

Repair Recommendations:
- Replace the bridge deck and joints
- Replace the steel railings with single slope concrete barrier
- Replace existing bearings with elastomeric bearings at abutments and piers
- Eliminate all fatigue prone welds at the top plates for the existing cantilever brackets
- Localized repairs of steel girders, floorbeams, brackets, diaphragms, and stringers
- Paint the existing visible and exposed steel superstructure surfaces
- Repair the spall and hollow sounding areas and cracks on concrete abutments
- Replace the capbeams and columns (footing to remain) of the two (2) double-column pier bents and all seven (7) concrete hammerhead Piers:

BIN: 1066870 - Hightbridge Interchange - Ramp M

Based on both the in-depth inspection and the 2013 Biennial Inspection, the following conditions were identified.

- Severe deterioration on bridge deck asphalt overlay (the asphalt overlay on the bridge and the vast majority of the asphalt overlay on the approach roadways were replaced in 2015).
- Areas of hollow sounding concrete and severe concrete spalls with exposed rebar at the underside of bridge deck.
• Severe water leakage at the deck joints.
• Severe structural steel corrosion at the girder ends, below the deck joints.
• Moderate steel corrosion in bearings.
• Areas of hollow sounding concrete and severe concrete spalls with exposed rebar at the piers and abutments.

Federal Sufficiency Rating and State Condition Ratings:

Based on the latest 2013 Biennial Inspection, the Federal Sufficiency Rating for Ramp M bridge structure is 59.0 and the State Condition Rating is 3.708.

Deck Evaluation:

Based on the most recent 2015-2016 in-depth inspection and the latest 2013 Regional Biennial Inspection, the existing concrete deck slab of the bridge structure is in advanced stage of deterioration with significant areas of hollow sounding concrete and spalls with exposed rebar at the underside of the deck slab. It is recommended that the entire bridge concrete deck slab be replaced.

Load Rating

Based on the latest results of load rating analysis available the existing bridge structure has an inventory rating above HS20 or HL-93.

Fatigue Analysis

The results of the fatigue analysis performed indicated that the existing steel superstructure framing has infinite life if one typical fatigue pronged detail is eliminated. The welded top plates for all the existing cantilever brackets along both sides of the bridge structures were determined to be Category E’ welds. It is recommended these welds be removed and replaced with bolted connections when the existing concrete deck slab is removed and the top of existing steel is exposed. Upon the removal of the Category E’ welds, infinite fatigue life will be provided for the existing steel superstructure. See Appendix D for fatigue evaluation.

Seismic Evaluation

Detailed seismic evaluation for the existing Ramp E bridge structure has not yet been performed under the Preliminary Design Phases I-IV. However, as per the detailed seismic evaluations performed under the Final Design Phases V-VI for the other five (5) similar Highbridge Interchange ramp structures under the recently completed Alexander Hamilton Bridge and Highbridge Ramps Rehabilitation Construction Project in 2013, all existing bearings of Ramp E bridge structure shall be replaced, and all bearing seats at the top of piers and abutment will have to be retrofitted, if required, to provide adequate edge distances.

Vulnerability Assessments

• Overload Vulnerability Assessment: 5
• Collision Vulnerability Assessment: 2
• Steel Details Assessment: 2
• Concrete Detail Assessment: N.A.

Vulnerability Rating Descriptions:
1 = Safety Program Watch
2 = Safety Program Alert
3 = Capital Program
4 = Inspection Program
5 = No Action
6 = Not applicable
Repair Recommendations:
- Replace the bridge deck and joints
- Replace the steel railings with single slope concrete barrier
- Replace existing bearings with elastomeric bearings at abutments and piers
- Eliminate all fatigue prone welds at the top plates for the existing cantilever brackets
- Localized repairs of steel girders, floorbeams, brackets, diaphragms, and stringers
- Paint the existing visible and exposed steel superstructure surfaces
- Repair the spall and hollow sounding areas and cracks on concrete abutments
- Replace the capbeams and columns (footing to remain) of the two (2) double-column pier bents and all eleven (11) concrete hammerhead Piers:

2.3.3.6.(5) Restrictions

There is currently no restriction on the three subject ramp bridges and their approach roadways.

2.3.3.6.(6) Future Conditions

All existing deficient elements on the three (3) ramp bridge structures and their approach roadways will be rehabilitated, replaced or improved where feasible. The three ramp bridges will be restored to a “LIKE NEW” condition and their service life will be extended for a minimum of forty (40) years.

2.3.3.6.(7) Waterway

A Coast Guard Checklist is not required.

2.3.3.7. Hydraulics of Bridges and Culverts

There are no bridges or culverts over waterways within the project limits. There are no dams in the vicinity of the project that would be adversely affected.

2.3.3.8. Guide Railing, Median Barriers and Impact Attenuators –

See Exhibit 2.3.3.8 for a summary of existing steel railings, guide railings, and impact attenuators.
2.3.3.9. Utilities

There are no utilities within the project limits.

2.3.3.10. Railroad Facilities –

There are no railroads within the project limits and no at-grade crossings within 1 mile distance that could impact traffic conditions.

2.3.4. Potential Enhancement Opportunities

2.3.4.1. Landscape –

There are limited landscape features on the project site. Areas of deciduous trees are present between the MDE and Sedgwick Avenue and Undercliff Avenue. These areas are located under and adjacent to Ramps M and C.

2.3.4.1.(1) Terrain –

The terrain adjacent to the Harlem River is relatively flat thru the Metro-North commuter railroad tracks and Major Deegan Expressway; where-upon just east of the MDE the terrain climbs steeply to a plateau, which also contains primarily dense residential development and some commercial development.

2.3.4.1.(2) Unusual Weather Conditions-

There are no unusual weather conditions within the project area. The weather is governed by four distinct seasons: spring, summer, fall and winter. Spring and fall are usually temperate and mild, summers are usually hot and humid, and although periods of extreme cold are possible from cold fronts originating in Canada, winters are generally mild in the area.
2.3.4.1.(3) Visual Resources –

The project lies within an area of primarily transportation related uses bordering the residential neighborhoods of Highbridge and Morris Heights along the western edge of the Bronx. The AHB crosses over the Harlem River into the Bronx, the bridge and its interchange ramps cross over the MDE and Sedgwick Avenue. The AHB crossing of the Harlem River and the Highbridge Interchange are prominent visual features of the project area along with the Harlem River, Metro-North Commuter Railroad, the High Bridge, and the Washington Bridge. Directly east of the project site the natural topography climbs steeply to a plateau with primarily dense residential development and some commercial development. Some residences are located along the higher elevations and have extensive views overlooking the AHB, Highbridge Interchanges, the MDE, Metro North railroad tracks and the Harlem River.

2.3.4.2. Opportunities for Environmental Enhancements –

There are no practical opportunities for environmental enhancements in the project limits.
CHAPTER 3 – ALTERNATIVES

This chapter discusses the alternatives considered and examines the engineering aspects for all feasible alternatives to address project objectives in Chapter 1 of this report.

Five (5) alternatives were considered for each of the three (3) bridge structures, as follows:

- **Alternative 1 – Null**
- **Alternative 2 – Deck Replacement, Pier Replacement above Foundations, and Rehabilitation of Superstructure, Abutment, and Foundations (as Necessary)**
- **Alternative 3 – Deck Replacement, Superstructure Replacement, Pier Replacement above Foundations, and Rehabilitation of Abutment and Foundations (as Necessary)**
- **Alternative 4 – Complete Bridge Structure Replacement on Existing Alignment**
- **Alternative 5 – Complete Bridge Structure Replacement on Modified Alignment**

3.1. Alternatives Considered and Eliminated from Further Study

Alternative 1- Null, the no-build/maintenance alternative, offers no repairs or modifications to the existing bridges at this time. This will result in the continued deterioration of the structure, resulting in increased maintenance and at one point endangering public safety and eventually requiring the structure to be closed to traffic with consequential constant major impacts to I-95 traffic. Furthermore, none of the nonstandard features can be eliminated nor improved under this alternative. This no-build/maintenance alternative does not meet the project objective and is not considered a feasible alternative. It is eliminated from any further discussion in this report, but will be used for comparison with the feasible alternatives for the purpose of evaluating impacts.

The complete bridge replacement alternative on new alignment was studied/evaluated for each of three (3) ramps under Alternative 5 – Complete replacement on modified alignment. The investigation of the replacement alternative was performed in accordance with the Bridge Rehabilitation or Replacement Selection Guidelines. However, due to the end constraints where the three (3) subject ramps are located at an area congested with many others Highbridge Interchange ramps, I-87 mainline, I-95 mainline, local streets, and Metro North Railroad tracks, the available options for improved alignment are very limited. The complete replacement on modified alignment alternative was eliminated from further discussion in this report primarily because the modified alignment would require significant new ROW acquisitions, severe impacts on many of the recently rehabilitated Highbridge Interchange Ramps, long new bridge structures and on-grade approaches with a larger radius to meet standard geometry, high construction costs, and long construction durations. Furthermore, extensive environmental assessments and mitigation studies/designs would be needed during the Design Phases, possibly requiring the preparation and approval of an Environmental Impact Statement (EIS).

3.2. Feasible Build Alternatives

The three (3) feasible alternatives considered for each of the three (3) bridge structures are as follows:

- **Alternative 2 – Deck Replacement, Pier Replacement above Foundations, and Rehabilitation of Superstructure, Abutment, and Foundations (as Necessary)**
- **Alternative 3 – Deck Replacement, Superstructure Replacement, Pier Replacement above Foundations, and Rehabilitation of Abutment and Foundations (as Necessary)**
- **Alternative 4 – Complete Bridge Structure Replacement on Existing Alignment**
3.2.1. Description of Feasible Alternatives

**Alternative 2 – Deck Replacement, Pier Replacement above Foundations, and Rehabilitation of Superstructure, Abutment, and Foundations (as Necessary)**

This alternative proposes the elimination of existing raised concrete safety walks, replacement of the existing deteriorated concrete bridge deck including its concrete approach slabs, 1'-9" widening along both sides of the concrete bridge deck along the curved segments of the ramps, replacement of the existing steel railings with single slope concrete barriers, and resurfacing of the approach roadway. Under this alternative, both the existing steel superstructure and concrete substructure shall be rehabilitated, the fatigue prone steel details shall be eliminated, and the vertical profile and horizontal alignment of the existing ramp shall be limited for significant improvement.

Investigations for the modification of the existing superstructure in combination with the replacement of existing bearings were performed for the possibility of elimination/reduction of existing deck joints. The feasibility of making the simple spans into continuous spans in combination of strengthening the piers and abutments for new loading conditions were also studied. However, due to the complex geometry of the existing superstructure framing with two (2) levels of girders (original and retrofit) and the tight radius at the curved segment of the ramps, it was concluded that only a couple of deck joints within the tangent segment of the Ramps E & M could be eliminated; therefore, not practical and not considered further for the three (3) ramps.

A comprehensive study comparing the use of precast/prefabricated/pre-assembled deck slab system and the cast-in-place concrete was performed for the replacement of existing concrete deck slabs. It was concluded that both systems are feasible for the three (3) ramps except at the three (3) locations where Ramp C and Ramp E split, Ramp E merges with Ramp D (from Alexander Hamilton Bridge, I-95 SB) and Ramp M merges with Ramp A (to Alexander Hamilton Bridge, I-95 NB). For those three (3) merge locations, cast-in-place concrete appeared to be the only feasible system. Furthermore, based on the production rate provided by Region 11 office from the few recently completed deck replacement projects within the Region 11 area, the replacement of one (1) typical span of the existing Ramps C, E, & M concrete deck slab is feasible within one (1) weekend of complete ramp closure by using either precast/prefabricated/pre-assembled deck slab system or cast-in-place concrete. Due to the complex horizontal alignments and vertical profiles of the three (3) existing ramps, this report recommends the use of cast-in-place concrete for the replacement of the entire lengths of existing ramp bridge deck slabs.

The feasibility of utilizing staged construction for the replacement of the existing bridge deck for all three (3) ramps was investigated. The existing framing along the tangent segments of the ramps do lend themselves to accommodate staged construction; however, the existing framing along the curved segments of the ramps do not accommodate staged construction without adding additional stringers and also over-widening the width to allow for the safe turning of vehicles. It was concluded early on that widening the bridge to allow for truck traffic to safely navigate the turn would not be feasible as the extent of the widening would require significant modifications to the existing superstructure framing and substructures below. As an alternative, a study was done to see if a limited amount of widening could be implemented in order to accommodate non-truck traffic only. It was concluded that widening the bridge by 2'-6" on each side (5-ft total) would allow for the safe movement of non-truck traffic along the curved segments of the ramps without requiring extensive modifications to the existing superstructure framing. However, this scenario was predicated on the idea that trucks would be detoured elsewhere and would not ever enter the staged work zone. This requirement was not considered feasible since it is not practical to allow trucks to maintain continuous usage of Ramp A but be expected to detour past Ramp M. Any truck intruding into the Ramp M work zone would effective become stuck and would require an extensive operation to back it out. As such, the feasibility of staged construction within the curved segments of the ramps was considered as non-feasible and is not pursued further in this report.

Therefore, this report considers that staged construction is only feasible for the tangent segments of Ramps E & M. For the construction of Ramp C and the curved segments of the Ramps E & M, weekend complete ramp closure with traffic detours shall be implemented for the replacement of the existing
deteriorated bridge deck. Based on the preliminary designs, in order to maintain the Ramp D and Ramp A traffic (from and to Alexander Hamilton Bridge, I-95), localized temporary fill-in steel framings (temporary structures) shall be provided for the two (2) locations where Ramp E merges with Ramp D (from Alexander Hamilton Bridge, I-95 SB) and Ramp M merges with Ramp A (to Alexander Hamilton Bridge, I-95 NB).

A study was performed for the feasible types of piers for the replacement of all existing twenty (23) reinforced concrete piers of Ramps C, E & M. The study considered the use of reinforced concrete (cast-in-place or precast) and metalized steel. The results indicated that replacing the existing reinforced concrete piers utilizing either concrete or steel are both feasible and the findings are as follows:

- Some form of temporary shoring is required for the support of existing bridge superstructure during the replacement of the existing bearings, as well as the removal and replacement of existing reinforced concrete piers.
- It is anticipated that the temporary shoring will consist of: transverse cross beam (supporting each of the 4 girders), 4-legged towers (supporting the transverse cross-beam).
- This temporary shoring will utilize the existing pier foundation and will be located near the end of each span, on either side of the existing pier.
- Due to the eccentric nature of the shoring towers loading on the existing foundation, the temporary loading conditions shall be limited to only dead load (with or without the concrete deck) and partial live loads (staged construction). The existing foundation is not adequate to support the full eccentric dead and live loads combined, if the temporary shoring towers are placed eccentric from the existing foundation centerline.
- Designing and making dual use of the temporary and permanent support towers (or some other support system) was investigated, but found not feasible. Moving the permanent bearing points further away from their existing locations require significant modifications to the existing steel girder ends. Furthermore, with the new bearings located away from their current locations, the new deck joint between spans will be at the cantilevered ends of the new deck slab where relative vertical movements between the ends of new cantilever concrete deck slab will be high and difficult to control.
- As a result of the above, the final and permanent supports for the existing girders must be located at or near their current locations, close to the centerline of the existing foundation.

1. **New Cast-In-Place or Precast Reinforced Concrete Pier (Shape similar to the existing pier)**

   - **New Cast-In-Place Reinforced Concrete Pier**
     - The existing reinforced concrete pier would be removed to the top of existing concrete pile cap or spread footing, leaving only the dowels to remain.
     - Additional dowels could be drilled and grouted into existing concrete pile cap or spread footing, if required.
     - New reinforced concrete pier column with dowels for new capbeam shall be formed and casted onto the top of existing concrete pile cap or spread footing.
     - New reinforced concrete pier capbeam with appropriate dowels for new concrete pedestals shall be formed and casted onto the top of new reinforced concrete pier column.
     - New concrete pedestals with proper sizes, orientations, and heights would be constructed on top of the new pier capbeam to accommodate the new bearings.

   - **New Precast Reinforced Concrete Pier**
     - The existing reinforced concrete pier would be removed to the top of the concrete pile cap or spread footing, leaving only the dowels to remain.
     - Additional dowels could be drilled and grouted into existing concrete pile cap or spread footing, if necessary.
The construction of new cast-in-place reinforced concrete base on top of the existing concrete pile cap or spread footing is necessary to engage the dowels and to provide anchor bolts for the precast concrete pier column connection.

The new reinforced concrete base shall have its diameter at least equal to the size of the existing circular pier column (to provide sufficient cover for the existing dowels).

Embedded anchor bolts would be provided in the new reinforced concrete base for the connection of new precast concrete column.

The new precast concrete pier column and capbeam would be erected and interconnected in the field.

New cast-in-place concrete pedestals with proper sizes, orientations, and heights would be constructed on top of the precast pier capbeam to accommodate the new bearings.

2. Prefabricated Metallized Steel Pier (See Preliminary Sketch for shape):

- NEW CAST-IN-PLACE REINFORCED CONCRETE BASE
  - The existing reinforced concrete pier would be removed to the top of the concrete pile cap or spread footing, leaving only the dowels to remain.
  - Additional dowels could be drilled and grouted into existing concrete pile cap or spread footing, if necessary.
  - The construction of new cast-in-place reinforced concrete base on top of the existing concrete pile cap or spread footing is necessary to engage the dowels and to provide adequate connection bolts for the prefabricated metalized steel column.
  - The new reinforced concrete base shall have its diameter at least equal to the size of the existing circular pier column (to provide sufficient cover for the existing dowels).
  - Embedded anchor bolts would be provided in the new reinforced concrete base for the connection of new metalized steel column.

- NEW CIRCULAR OR SQUARE HOLLOW STEEL PIER COLUMN
  - The new hollow steel pier column would have internal horizontal diaphragms with access openings.
  - A welded baseplate would be provided at the bottom of the hollow steel column for the base connection.
  - A welded top flange/cap-plate would be provided at the top of the hollow steel column for the connection with new capbeam.

- NEW STEEL BOX-SECTION STEEL PIER CAPBEAM
  - The new box capbeam would have internal vertical diaphragms with access openings.
  - Access doors will be provided at either end of the box capbeam to allow for future inspection.

- NEW STEEL SADDLES ON STEEL BOX CAPBEAM
  - Steel saddles of proper sizes, orientations, and heights would be bolted onto the top flange of the box capbeam.
  - These saddles will serve the same purpose as traditional concrete pedestal supporting the bearings.
  - New elastomeric bearings (with masonry plates) will be bolted to the saddles.

ESTIMATED CONSTRUCTION COST & DURATION

- The use of precast concrete or prefabricated metallized steel piers in lieu of the cast-in-place reinforced concrete piers requiring the installation of formworks, placement of rebars/concrete, and proper cure time, will reduce the construction time for each pier approximately by 5 weeks. The total construction time reduction for the project will then be dependent on the contractor’s overall schedule of his/her operations.
The use of precast reinforced concrete piers offer no significant cost saving (requiring lesser temporary shoring rental cost but addition of field erection cost) as compared to the cast-in-place reinforced concrete option. However, the precast option will reduce the construction duration for each pier by approximately 5 weeks.

The use of prefabricate metallized steel piers will cost approximately $2.6M more (total for all 23 new piers of 3 ramps) than the cast-in-place reinforced concrete option despite the reduced shoring rental time.

Geometry
- This alternative includes minor improvement to the superelevation.
- This alternative includes widening of the existing bridge deck along the curved segment of the ramp 1'-9" on each side to provide wider roadway for turning of truck traffic.
- This alternative would retain most of the existing nonstandard features. Justification for retaining this nonstandard feature is included in Appendix E of this report.

Operational
- This alternative does not affect operations.

Control of Access
- Control of access for this alternative will meet the criteria in HDM Chapter for Other Freeways.

Right of Way
- This alternative will not require ROW acquisition. All work will be performed within existing highway boundaries.

Environmental
- There are no wetland impacts associated with the proposed rehabilitation.
- There are no significant noise or visual impacts associated with the proposed rehabilitation.

Cost
- Total estimated cost of this alternative is $47.3 M and the breakdowns are:
  - Ramp C = $4.1 M.
  - Ramp E = $19.2 M.
  - Ramp M = $24.0 M.

Project Goals
- These rehabilitations meet the overall objective of the project to bring the three (3) Highbridge Interchange Ramps structurally to “LIKE NEW” condition.

Alternative 3 – Deck Replacement, Superstructure Replacement, Pier Replacement above Foundations, and Rehabilitation of Abutment and Foundations (as Necessary)

This alternative proposes the elimination of existing raised concrete safety walks, replacement of the existing deteriorated concrete bridge deck including its concrete approach slabs, 1'-9" widening along both sides of the concrete bridge deck along the curved segments of the ramps, replacement of the existing steel railings with single slope concrete barriers, and resurfacing of the approach roadway. Under this alternative, the existing steel superstructure shall be completely replaced and the existing concrete substructure shall be rehabilitated or replaced above the existing foundation, the fatigue prone steel details shall be eliminated, and the vertical profile and horizontal alignment of the existing ramp shall be limited for significant improvement.

Investigations for new continuous spans in combination with the arrangement of new bearings were performed for the elimination/reduction of deck joints. The options of strengthening the existing piers and abutments for new loading conditions were also studied. However, based on the latest in-depth inspection and the 2013 Biennial Inspections, the existing steel superstructures of the three (3) ramps bridges were
found still in good condition, the reinforced concrete abutments were found in fair condition, and all the reinforced concrete piers were found in poor condition. Therefore, the replacements of existing steel superstructures and reinforced concrete abutments are feasible but not warranted and justifiable. However, major rehabilitation/complete replacement above the existing foundation shall be implemented for all the existing reinforced concrete piers.

A comprehensive study comparing the use of precast/prefabricated/pre-assembled superstructure with integral deck slab and concrete or steel superstructure with either precast/prefabricated/pre-assembled or cast-in-place concrete deck slab was performed for the replacement of existing superstructure and concrete deck slabs. It was concluded that replacement work for the curved segments of the ramps, the precast/prefabricated/pre-assembled superstructure with integral deck slab is the only feasible system for the three (3) ramps with weekend complete ramp closure. Similarly, as per Alternative 2, at the two (2) locations where Ramp C and Ramp E split, Ramp E merges with Ramp D (from Alexander Hamilton Bridge, I-95 SB) and Ramp M merges with Ramp A (to Alexander Hamilton Bridge, I-95 NB), cast-in-place concrete appeared to be the only feasible system.

It is anticipated that staged construction will only be feasible for the tangent segments of Ramps E & M. For the construction of Ramp C and the curved segments of the Ramps E & M, weekend complete ramp closure with traffic detours will be implemented. Localized temporary fill-in framings (structures) will only be needed for the two (2) locations where Ramp E merges with Ramp D (from Alexander Hamilton Bridge, I-95 SB) and Ramp M merges with Ramp A (to Alexander Hamilton Bridge, I-95 NB) in order to maintain the Ramp D and Ramp A traffic from and to Alexander Hamilton Bridge, I-95 during construction.

Geometry
- This alternative includes improvement to the superelevation.
- This alternative includes widening of the existing bridge deck along the curved segment of the ramp 1'-9" on each side to provide wider roadway for turning of truck traffic.
- This alternative would retain some of the existing nonstandard features. Justification for retaining this nonstandard feature is included in Appendix E of this report.

Operational
- This alternative does not affect operations.

Control of Access
- Control of access for this alternative will meet the criteria in HDM Chapter for Other Freeways.

Right of Way
- This alternative will not require ROW acquisition. All work will be performed within existing highway boundaries.

Environmental
- There are no wetland impacts associated with the proposed rehabilitation.
- There are no significant noise or visual impacts associated with the proposed replacements and rehabilitations.

Cost
- Total estimated cost of this alternative is $52.0 M and the breakdowns are:
  o Ramp C = $4.8 M.
  o Ramp E = $20.6 M.
  o Ramp M = $26.6 M.

Project Goals
- These replacements and rehabilitations meet the overall objective of the project to bring the three (3) Highbridge Interchange Ramps structurally “LIKE NEW” condition.
Alternative 4 – Complete Bridge Structure Replacement on Existing Alignment

This alternative proposes the elimination of existing raised concrete safety walks, replacement of the existing deteriorated concrete bridge deck including its concrete approach slabs, 1'-9" widening along both sides of the concrete bridge deck along the curved segments of the ramps, replacement of the existing steel railings with single slope concrete barriers, and resurfacing of the approach roadway. Under this alternative, the existing steel superstructure and concrete substructure shall be completely replaced, the fatigue prone steel details shall be eliminated, and the vertical profile and horizontal alignment of the existing ramp shall be limited for significant improvement.

Investigations for new continuous spans in combination with the arrangement of new bearings were performed for the elimination/reduction of deck joints. The piers and abutments shall be designed for new loading conditions. Based on the latest in-depth inspection and the 2013 Biennial Inspections, the existing steel superstructures of the three (3) ramps bridges were found still in good conditions. Therefore, the replacement of the existing steel superstructures is feasible but not warranted and not justifiable. However, the existing substructures where found to be in fair to poor conditions; therefore, replacement of the existing concrete substructures is justifiable.

A comprehensive study comparing the use of precast/prefabricated/pre-assembled superstructure with integral deck slab and concrete or steel superstructure with either precast/prefabricated/pre-assembled or cast-in-place concrete deck slab was perform for the replacement of existing superstructure and concrete deck slabs. It was concluded that replacement work for the curved segments of the ramps, the precast/prefabricated/pre-assembled superstructure with integral deck slab is the only feasible system for the three (3) ramps with weekend complete ramp closure. Similarly, as per Alternative 2, at the two (2) locations where Ramp C and Ramp E split, Ramp E merges with Ramp D (from Alexander Hamilton Bridge, I-95 SB) and Ramp M mergers with Ramp A (to Alexander Hamilton Bridge, I-95 NB) cast-in-place concrete appeared to be the only feasible system.

It is anticipated that temporary support is needed during staged construction and will only be feasible for the tangent segments of Ramps E & M. For the construction of Ramp C and the curved segments of the Ramps E & M, weekend complete ramp closure with traffic detours will be implemented. Localized temporary fill-in framings (structures) will only be needed for the two (2) locations where Ramp E merges with Ramp D (from Alexander Hamilton Bridge, I-95 SB) and Ramp M mergers with Ramp A (to Alexander Hamilton Bridge, I-95 NB) in order to maintain the Ramp D and Ramp A traffic from and to Alexander Hamilton Bridge, I-95 during construction.

Geometry
- This alternative includes improvement to the superelevation.
- This alternative includes widening of the existing bridge deck along the curved segment of the ramp 1'-9" on each side to provide wider roadway for turning of truck traffic.
- This alternative would retain some of the existing nonstandard features. Justification for retaining this nonstandard feature is included in Appendix E of this report.

Operational
- This alternative does not affect operations.

Control of Access
- Control of access for this alternative will meet the criteria in HDM Chapter for Other Freeways.

Right of Way
- This alternative will not require ROW acquisition. All work will be performed within existing highway boundaries.

Environmental
- There are no wetland impacts associated with the proposed rehabilitation.
There are no significant noise or visual impacts associated with the proposed replacements and rehabilitations.

Cost

Total estimated cost of this alternative is $65.7 M and the breakdowns are:

- Ramp C = $8.3 M.
- Ramp E = $25.6 M.
- Ramp M = $31.8 M.

Project Goals

These replacements and rehabilitations meet the overall objective of the project to bring the three (3) Highbridge Interchange Ramps structurally to "NEW" condition.

Exhibit 3.2.1 shows a summary of costs for each alternative.

| Exhibit 3.2.1 Summary of Alternative Costs - Million Dollars (Calculated Year) |
|--------------------------------------------------|--------|--------|--------|
| Activities                                      | Alt 2         | Alt 3         | Alt 4         |
| Construction                                    | $24.21M | $27.14M | $34.78M |
| Bridge                                          | $5.73M      | $5.73M      | $5.73M      |
| Highway                                         | $0          | $0          | $0          |
| Wetland Mitigation                              | $0          | $0          | $0          |
| Storm Pollution Discharge Elimination System (SPDES) | $0          | $0          | $0          |
| Subtotal (2016)                                 | $29.94M   | $32.87M   | $40.51M   |
| Incidentals/Contingencies°F (15% @ Design Approval) | $4.49M    | $4.93M    | $7.29M    |
| Subtotal (2016)                                 | $34.43M   | $37.80M   | $47.801M  |
| Potential Field Change Payment (10%)            | $3.44M    | $3.78M    | $4.78M    |
| Subtotal (2016)                                 | $37.87M   | $41.58M   | $52.58M   |
| Mobilization and WZTC (8%)                      | $3.03M    | $3.33M    | $4.21M    |
| Subtotal (2016)                                 | $40.908M  | $44.91M  | $56.79M  |
| Expected Award Amount – Inflated°F @ x%/yr. to midpoint of Construction (2018) | $43.81M | $48.11M | $60.83M |
| Construction Inspection (8%)                   | $3.51M    | $3.85M    | $4.87M    |
| ROW Costs (2016)                                | $0        | $0        | $0        |
| **Total Cost**                                  | **$47.3M** | **$52.0M** | **$65.7M** |

Notes:
1. The potential cost increase due to unknown or un-tabulated items.
2. NYSDOT recommends standard contingencies: 28% Scoping stage, 15% Design Approval stage, 5% Advanced Detail Plans stage.
3. Use inflation rate (%) from Program Update/PSS inflation values. Questions regarding these inflation rates should be directed to the Regional Planning and Program Manager (RPPM). (See HDM 21.6.3.2 B)
3.2.2. Preferred Alternative

While Alternative 2 - Deck Replacement, Pier Replacement above Foundations, and Rehabilitation of Superstructure, Abutment, and Foundations (as Necessary) is identified as the preferred alternative, all feasible alternatives are under consideration. The selection of the preferred alternative will not be finalized until the alternatives' impacts, comments on the draft design approval document, and comments from the public hearing (if held) have been fully evaluated.

3.2.3. Design Criteria for Feasible Alternative(s)

3.2.3.1. Design Standards

All work performed is in accordance with the Standard and Special Specifications of the New York State Department of Transportation. The bridge rehabilitation design is made in accordance with the New York State Department of Transportation Standard Specifications for Highway Bridges. The design standards used are NYSDOT Highway Design Manual (HDM) Chapter 2, 5, 7, the AASHTO “A Policy on Geometric Design of Highways and Streets, 2011” (AASHTO GDHS), and NYSDOT Bridge Manual U.S. Customary Edition.

3.2.3.2. Critical Design Elements -

Exhibits 3.2.3.2 (C), (E), and (M) present the design criteria for the critical design elements of each ramp and associated at-grade approach roadways within the project area. The existing ramp conditions and proposed conditions of the preferred alternative for the rehabilitation of the three (3) ramps were compared to the current design criteria for the seventeen (17) critical design elements to identify existing and proposed non-standard conditions. For this project, the geometric design standards listed in the NYSDOT Highway Design Manual (HDM) Chapter 2 were applied, wherever possible as stated in HDM Chapter 7, Section 7.2.6.
### Critical Design Elements for Highbridge Interchange – Ramp C (BIN 1-06685B)

<table>
<thead>
<tr>
<th>Element</th>
<th>Standard</th>
<th>Reference to Standard</th>
<th>Existing Condition</th>
<th>Proposed Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Design Speed</td>
<td>30 mph</td>
<td>HDM Section 2.7.5.2 A</td>
<td>30 mph (posted)</td>
<td>30 mph</td>
</tr>
<tr>
<td>2 Traveled Way Width</td>
<td>One-Lane: 21' Inside Radius ≥ 200'</td>
<td>HDM Section 2.7.5.2 B Exhibit 2-9a</td>
<td>One-Lane: 22' min (on Ramp R=248')</td>
<td>One-Lane: 21' min (Curve C-2 R=244.5')</td>
</tr>
<tr>
<td></td>
<td>One-Lane: 12' (+4 combined left and right shoulder) = 16'</td>
<td></td>
<td>One-Lane: 12' (+1' each side w/ curb) = 14' (at Ramp C/F nose)</td>
<td>One-Lane: 12' (+2' ea. side w/ curb) = 16' (at Ramp C/F nose)</td>
</tr>
<tr>
<td></td>
<td>Tangent Sections/Inside Radius ≥ 1000'</td>
<td></td>
<td>Tangent Sections/Inside Radius ≥ 1000'</td>
<td>Tangent Sections/Inside Radius ≥ 1000'</td>
</tr>
<tr>
<td>3 Shoulder Width</td>
<td>Left: 3'; Right: 6' 0' Shoulder &amp; 2' offset ea. side in presence of curbing</td>
<td>HDM Section 2.7.5.2 C Exhibit 2-10</td>
<td>1' Offset Left &amp; Right * (curb present Left &amp; Right)</td>
<td>Left 3'min; Right 6'min, 0' Shldr &amp; 2' offset ea. side with curb</td>
</tr>
<tr>
<td>Approach Shoulder Width</td>
<td>Full Approach Shoulder Width</td>
<td></td>
<td>Full Approach Shoulder Width</td>
<td>Full Approach Shoulder Width</td>
</tr>
<tr>
<td>4 Bridge Roadway Width</td>
<td>Full Approach Ramp Width</td>
<td>BM Sections 2.3.1 Table 2-1</td>
<td>Full Approach Ramp Width</td>
<td>Full Approach Ramp Width</td>
</tr>
<tr>
<td>Approach Roadway Width</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Maximum Grade</td>
<td>7% Max.</td>
<td>HDM Section 2.7.5.2 E Exhibit 2-10</td>
<td>4.75% Max.</td>
<td>5.00% Max.</td>
</tr>
<tr>
<td>6 Horizontal Curvature</td>
<td>231' min. inside radius (@ ε_max = 6%)</td>
<td>HDM Section 2.7.5.2 F Exhibit 2-10</td>
<td>248' Min. inside radius (@ 5.21%)</td>
<td>244.5' Min inside radius</td>
</tr>
<tr>
<td>7 Superelevation</td>
<td>6% Max. (231' Min. Inside Radius)</td>
<td>HDM Section 2.7.5.2 G</td>
<td>5.21% Max.*</td>
<td>5.21% Max*</td>
</tr>
<tr>
<td>8 Stopping Sight Distance</td>
<td>200 Min.</td>
<td>HDM Section 2.7.5.2 H Exhibit 2-10</td>
<td>H: 174' Min.* V: 222 Min.</td>
<td>H: 185.5'* V:274'</td>
</tr>
<tr>
<td>9 Horizontal Clearance</td>
<td>Left: 3' min. Right: 6' min. Additional 4' beyond outside shoulders to abutments/piers below structures</td>
<td>HDM Section 2.7.5.2 I</td>
<td>Left &amp; Right: 2'6&quot; to face of bridge railing*</td>
<td>Left: 3' min. Right: 6' min. (to face of barrier on at grade tangents)</td>
</tr>
<tr>
<td>10 Vertical Clearance (above traveled way)</td>
<td>14'-0&quot; Min. 14'-6&quot; Desirable</td>
<td>BM Section 2.4.1 Table 2-2</td>
<td>16.4'</td>
<td>16.4'</td>
</tr>
<tr>
<td>11 Travel Lane Cross Slope</td>
<td>1.5% Min. to 2% Max.</td>
<td>HDM Section 2.7.5.2 K</td>
<td>½/ft. = 2% Max.</td>
<td>2% Max.</td>
</tr>
<tr>
<td>12 Rollover</td>
<td>4% max between travel lanes (BTL)</td>
<td>HDM Section</td>
<td>0% to ½/ft. = 4%</td>
<td>0% to 4% BTL</td>
</tr>
</tbody>
</table>
Exhibit 3.2.3.2 (C)
Critical Design Elements for Highbridge Interchange – Ramp C (BIN 1-06685B)

<table>
<thead>
<tr>
<th></th>
<th>Critical Design Element</th>
<th>8% max at edge of traveled way (ETW)</th>
<th>2.7.5.2 L</th>
<th>BTL: 0% ETW</th>
<th>0% ETW</th>
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<tbody>
<tr>
<td>13</td>
<td>Structural Capacity</td>
<td>AASHTO HS 20 Live Load</td>
<td>NYS DOT Bridge Manual Section 2.6.2 and HDM Section 2.7.2.2</td>
<td>HS-20</td>
<td>HS-20</td>
</tr>
<tr>
<td>14</td>
<td>Level of Service</td>
<td>C Min.</td>
<td>HDM Section 2.7.5.2 N</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>15</td>
<td>Control of Access</td>
<td>Fully controlled</td>
<td>HDM Section 2.7.5.2 O</td>
<td>Fully Controlled</td>
<td>Fully Controlled</td>
</tr>
<tr>
<td>16</td>
<td>Pedestrian Accommodation</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>17</td>
<td>Median Width</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* Denotes Non-Standard Feature

† Proposed Conditions use proposed alignment curve number nomenclature and stationing

‡ The Regional Traffic Engineer has concurred with the selected design speed. Refer to Appendix G for further information.
### RAMP E:

#### Exhibit 3.2.3.2 (E)

**Critical Design Elements for Highbridge Interchange – Ramp ED (BIN 1-06685-0)**

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<th>PIN:</th>
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<th>NHS (Y/N):</th>
<th>Yes</th>
</tr>
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<tbody>
<tr>
<td>Route No. &amp; Name:</td>
<td>I-95 (Cross Bronx Expressway) SB to I-87 (Major Deegan Expressway) SB Highbridge Interchange - Ramp ED</td>
<td>Functional Classification:</td>
<td>Other Roadway (Semi-Direct Connection Ramp)</td>
</tr>
<tr>
<td>Project Type:</td>
<td>Major Bridge Rehabilitation</td>
<td>Design Classification:</td>
<td>Urban Interstate</td>
</tr>
<tr>
<td>% Trucks:</td>
<td>1.3%</td>
<td>Terrain:</td>
<td>Rolling</td>
</tr>
<tr>
<td>ADT:</td>
<td>8120</td>
<td>Truck Access/Qualifying Hwy.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Element</th>
<th>Standard</th>
<th>Reference to Standard</th>
<th>Existing Condition</th>
<th>Proposed Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Design Speed</td>
<td>30mph</td>
<td>HDM Section 2.7.5.2 A</td>
<td>30 mph (posted)</td>
<td>30 mph</td>
</tr>
<tr>
<td>2 Traveled Way Width</td>
<td>Two-Lane: 24' (where combined shoulder is 4' or greater) One-Lane: 21' Inside Radius ≥ 200':</td>
<td>HDM Section 2.7.5.2.B Exhibit 2-9a</td>
<td>Two-Lane: 26' Tangent One-Lane: 24': (on Ramp R= 200')</td>
<td>Two-Lane: 24' (combined shoulder ≥ 4') Tangent One-Lane: 21' (Curve E-3 R=200.5')</td>
</tr>
<tr>
<td>Approach Lane Width</td>
<td></td>
<td></td>
<td>1'-12' min lane</td>
<td>1'-12' min lane</td>
</tr>
<tr>
<td>3 Shoulder Width</td>
<td>Left: 3'; Right: 6' 0' Shoulder &amp; 2' offset in presence of curbing</td>
<td>HDM Section 2.7.5.2 C Exhibit 2-10</td>
<td>1' Offset Left &amp; Right (curb present)*</td>
<td>Left 3' min; Right 3' min*; 0' Shldr &amp; 2' offset with curb</td>
</tr>
<tr>
<td>Approach Shoulder Width</td>
<td></td>
<td></td>
<td>1' Offset Left &amp; Right</td>
<td>Same as above</td>
</tr>
<tr>
<td>4 Bridge Roadway Width</td>
<td>Full Approach Ramp Width</td>
<td>BM Sections 2.3.1 Table 2-1</td>
<td>Full Approach Ramp Width</td>
<td>Full Approach Ramp Width</td>
</tr>
<tr>
<td>Approach Roadway Width</td>
<td></td>
<td></td>
<td>26'</td>
<td>28' min</td>
</tr>
<tr>
<td>5 Maximum Grade</td>
<td>7%</td>
<td>HDM Section 2.7.5.2 E Exhibit 2-10</td>
<td>6.05%</td>
<td>6.59%</td>
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<tr>
<td>6 Horizontal Curvature</td>
<td>231' min. inside radius (@ e&lt;sub&gt;max&lt;/sub&gt; = 6%)</td>
<td>HDM Section 2.7.5.2 F Exhibit 2-10</td>
<td>200' *</td>
<td>200.5*</td>
</tr>
<tr>
<td>7 Superelevation</td>
<td>6% Max. (@ 231' min. inside radius)</td>
<td>HDM Section 2.7.5.2 G</td>
<td>5.21% Max.*</td>
<td>5.21% Max.*</td>
</tr>
<tr>
<td>8 Stopping Sight Distance</td>
<td>200' Min.</td>
<td>HDM Section 2.7.5.2 H Exhibit 2-10</td>
<td>H: 157' Min* V: 245' Min.</td>
<td>H: 177' Min* V: 245' Min.</td>
</tr>
<tr>
<td>9 Horizontal Clearance</td>
<td>Left: 3' min. Right: 6' min. Additional 4' beyond outside shoulders to abutments/piers below structures</td>
<td>HDM Section 2.7.5.2 I</td>
<td>Left &amp; Right: 26' to face of bridge railing* Left: 4.8' (to AHB left Ramp D piers) Right: 3' (to face barrier &amp; below University Ave structure)</td>
<td>Left: 3' min Left: 5.8' (to AHB left Ramp D piers)</td>
</tr>
<tr>
<td>10 Vertical Clearance (above traveled way)</td>
<td>14'-0'' Min. 14'-6'' Desirable</td>
<td>BM Section 2.4.1 Table 2-2</td>
<td>15.1'</td>
<td>15.1'</td>
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<tr>
<td>11 Travel Lane Cross Slope</td>
<td>1.5% Min. to 2% Max.</td>
<td>HDM Section 2.7.5.2 K</td>
<td>½'/ft. = 2% Max.</td>
<td>2% Max.</td>
</tr>
<tr>
<td>12 Rollover</td>
<td>4% max between travel lanes (BTL) 8% max at edge of traveled way (ETW)</td>
<td>HDM Section 2.7.5.2 L</td>
<td>0% to ½''/ft. = 4% BTL; 0% ETW</td>
<td>0% to 4% BTL 0% ETW</td>
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<tr>
<td></td>
<td></td>
<td>AASHTO HS 20 Live Load</td>
<td>NYSDOT Bridge Manual Section 2.6.2 and HDM Section 2.7.2.2</td>
<td>HS-20</td>
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<tr>
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<td>-----------------------</td>
<td>--------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>13</td>
<td>Structural Capacity</td>
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</tr>
<tr>
<td>14</td>
<td>Level of Service</td>
<td></td>
<td>C Min.</td>
<td>HDM Section 2.7.5.2 N</td>
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<tr>
<td>15</td>
<td>Control of Access</td>
<td></td>
<td>Fully controlled</td>
<td>HDM Section 2.7.5.2 O</td>
</tr>
<tr>
<td>16</td>
<td>Pedestrian Accommodation</td>
<td></td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>17</td>
<td>Median Width</td>
<td></td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* Denotes Non-Standard Feature

1. Proposed Conditions use proposed alignment curve number nomenclature and stationing
2. The Regional Traffic Engineer has concurred with the selected design speed. Refer to Appendix G for further information.
### Critical Design Elements for Highbridge Interchange – Ramp AMB (BIN 1-06687-0)

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<tbody>
<tr>
<td>Route No. &amp; Name:</td>
<td>I-87 (Major Deegan Expressway) SB to I-95 (Cross Bronx Expressway) NB Highbridge Interchange - Ramp AMB</td>
<td>Functional Classification:</td>
<td>Other Roadway (Semi-Direct Connection Ramp)</td>
</tr>
<tr>
<td>Project Type:</td>
<td>Major Bridge Rehabilitation</td>
<td>Design Classification:</td>
<td>Urban Interstate</td>
</tr>
<tr>
<td>% Trucks:</td>
<td>5.5%</td>
<td>Terrain:</td>
<td>Rolling</td>
</tr>
<tr>
<td>ADT:</td>
<td>10,110</td>
<td>Truck Access/Qualifying Hwy.:</td>
<td>Yes</td>
</tr>
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#### Exhibit 3.2.3.2 (M)

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<th>Element</th>
<th>Standard</th>
<th>Reference to Standard</th>
<th>Existing Condition</th>
<th>Proposed Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Design Speed</td>
<td>30mph standard for semidirect connection ramp.</td>
<td>HDM Section 2.7.5.2 A 7.6.3.2 Exhibit 7-10</td>
<td>30 mph (20 mph advisory around curve)</td>
<td>30 mph (20 mph advisory around curve)</td>
</tr>
<tr>
<td>2 Traveled Way Width</td>
<td>Two-Lane: 24' (where combined shoulder is 4' or greater) Tangent Sections/Inside Radius ≥ 1000' One-Lane: 17' Inside Radius ≥ 500':</td>
<td>HDM Section 2.7.5.2 B Exhibit 2-9a</td>
<td>Two-Lane: 24' (combined shoulder ≥ 4') Ramp A/M Tangent One-Lane: 14' (R=800') Two-Lane: 26':</td>
<td>Two-Lane 24' (combined shoulder &gt; 4') Tangent One-Lane: 14' min* (Ramp M/B nose merge point, R=800)</td>
</tr>
<tr>
<td>Approach Lane Width</td>
<td>Left: 3'; Right: 6' 0' Shoulder &amp; 2' offset in presence of curbing</td>
<td>HDM Section 2.7.5.2 C Exhibit 2-10</td>
<td>1' Offset Left &amp; Right * (curb present)</td>
<td>Left 2'-10&quot; min*; Right 2'-10&quot;*: 0' Shldr &amp; 2' offset with curb</td>
</tr>
<tr>
<td>3 Shoulder Width</td>
<td>Left: 3'; Right: 6' 0' Shoulder &amp; 2' offset in presence of curbing</td>
<td>HDM Section 2.7.5.2 C Exhibit 2-10</td>
<td>1' Offset Left &amp; Right</td>
<td>Same as above</td>
</tr>
<tr>
<td>Approach Shoulder Width</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Bridge Roadway Width</td>
<td>Full Approach Ramp Width</td>
<td>BM Sections 2.3.1 Table 2-1</td>
<td>Full Approach Ramp Width</td>
<td>Full Approach Ramp Width</td>
</tr>
<tr>
<td>Approach Roadway Width</td>
<td>2-12' Lanes</td>
<td>BM Sections 2.3.1 Table 2-1</td>
<td>2-12' Lanes</td>
<td>2-12' Lanes</td>
</tr>
<tr>
<td>5 Maximum Grade</td>
<td>7%</td>
<td>HDM Section 2.7.5.2 E Exhibit 2-10</td>
<td>4.47%</td>
<td>4.47%</td>
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<tr>
<td>6 Horizontal Curvature</td>
<td>231' min. inside radius (@ e max = 6%) for 30mph desirable / 144' min inside radius for 25 mph</td>
<td>HDM Section 2.7.5.2 F Exhibit 2-10</td>
<td>180' min.*</td>
<td>184' min inside radius*</td>
</tr>
<tr>
<td>7 Superelevation</td>
<td>6% Max. (@ 231' Min. inside radius)</td>
<td>HDM Section 2.7.5.2 G</td>
<td>5.21% Max.*</td>
<td>5.21% Max.*</td>
</tr>
<tr>
<td>8 Stopping Sight Distance</td>
<td>200' Min. for 30mph desirable / 155' for 25mph</td>
<td>HDM Section 2.7.5.2 H Exhibit 2-10</td>
<td>H: 154' min.* V:187' min. *</td>
<td>H:158* V:186*</td>
</tr>
<tr>
<td>9 Horizontal Clearance</td>
<td>Right: 6' Left: 3' min. Additional 4' beyond outside shoulders to abutments/piers below structures</td>
<td>HDM Section 2.7.5.2 I</td>
<td>Left &amp; Right: 2'6&quot; to face of bridge railing*</td>
<td>Left &amp; Right: 2'6&quot; to face of barrier on tangents)*</td>
</tr>
<tr>
<td>10 Vertical Clearance (above traveled way)</td>
<td>14'-0&quot; Min. 14'-6&quot; Desirable</td>
<td>BM Section 2.4.1 Table 2-2</td>
<td>15.1'</td>
<td>15.1'</td>
</tr>
<tr>
<td>11 Travel Lane Cross Slope</td>
<td>1.5% Min. to 2% Max.</td>
<td>HDM Section 2.7.5.2 K</td>
<td>1/&quot;ft. = 2% Max.</td>
<td>2% Max.</td>
</tr>
<tr>
<td>12 Rollover</td>
<td>4% max between travel lanes (BTL)</td>
<td>HDM Section</td>
<td>0% to ½ &quot;/ft. = 4%</td>
<td>0% to 4% BTL</td>
</tr>
</tbody>
</table>
### Exhibit 3.2.3.2 (M)

**Critical Design Elements for Highbridge Interchange – Ramp AMB (BIN 1-06687-0)**

<table>
<thead>
<tr>
<th></th>
<th>8% max at edge of traveled way (ETW)</th>
<th>2.7.5.2 L</th>
<th>BTL: 0% ETW</th>
<th>0% ETW</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 Structural Capacity</td>
<td>AASHTO HS 20 Live Load</td>
<td>NYSDOT Bridge Manual Section 2.6.2 and HDM Section 2.7.2.2</td>
<td>HS-20</td>
<td>HS-20</td>
</tr>
<tr>
<td>14 Level of Service</td>
<td>C Min.</td>
<td>HDM Section 2.7.5.2 N</td>
<td>D</td>
<td>E*</td>
</tr>
<tr>
<td>15 Control of Access</td>
<td>Fully controlled</td>
<td>HDM Section 2.7.5.2 O</td>
<td>Fully Controlled</td>
<td>Fully Controlled</td>
</tr>
<tr>
<td>16 Pedestrian Accommodation</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>17 Median Width</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* Denotes Non-Standard Feature

1. Proposed Conditions use proposed alignment curve number nomenclature and stationing

3.3. Engineering Considerations

#### 3.3.1. Operations (Traffic and Safety) & Maintenance

##### 3.3.1.1. Functional Classification and National Highway System

This project will not change the functional classification of the highway.

##### 3.3.1.2. Control of Access

Access to the highway will be fully controlled; no changes are proposed from the existing condition.

##### 3.3.1.3. Traffic Control Devices -

3.3.1.3. (1) Traffic Signals – No traffic signals are proposed.

3.3.1.3. (2) Signs - Existing signs will be evaluated and replaced as necessary. New signs will be added where required. Curve warning and speed advisory signs will be added for the non-standard curvature. Signs as needed will be added for Work Zone Traffic Control.

##### 3.3.1.4. Intelligent Transportation Systems (ITS)

No ITS measures are proposed as part of this project.
3.3.1.5. Speeds and Delay -

3.3.1.5. (1) Proposed Speed Limit –
The existing posted speed limits of 30 mph on Ramps C and E and 20 mph on Ramp M will be retained upon completion of the project (see Exhibit 3.3.1.5).

3.3.1.5. (2) Travel Time Estimates –
Travel time estimates are not included as the feasible alternatives will not change the capacity.

<table>
<thead>
<tr>
<th>Route</th>
<th>Route</th>
<th>Route</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramp C between I95 SB and I87 NB</td>
<td>Ramp C between I95 SB and I87 NB</td>
<td>Ramp C between I95 SB and I87 NB</td>
</tr>
<tr>
<td>Ramp E between I95 SB and I87 SB</td>
<td>Ramp E between I95 SB and I87 SB</td>
<td>Ramp E between I95 SB and I87 SB</td>
</tr>
<tr>
<td>Ramp M between I87 SB and I95 NB</td>
<td>Ramp M between I87 SB and I95 NB</td>
<td>Ramp M between I87 SB and I95 NB</td>
</tr>
</tbody>
</table>

Exhibit - 3.3.1.5 Speed Data

<table>
<thead>
<tr>
<th>Route</th>
<th>Advisory Speed Limit</th>
<th>Operating Speed and Method Used to Measure</th>
<th>Operating Speeds (Existing Conditions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramp C</td>
<td>30 mph</td>
<td>Floating car technique</td>
<td>Ramp C 36 mph</td>
</tr>
<tr>
<td>Ramp E</td>
<td>30 mph</td>
<td></td>
<td>Ramp E 34 mph</td>
</tr>
<tr>
<td>Ramp M</td>
<td>20 mph</td>
<td></td>
<td>Ramp M 33 mph</td>
</tr>
</tbody>
</table>

3.3.1.6. Traffic Volumes –

Since there are no anticipated changes in the design hourly traffic volumes, see Section 2.3.1.6 for existing traffic volumes. However, Average Daily Traffic (ADT) is projected to increase at 1% annually between 2015 and the ETC; and 0.5% annually between the ETC and ETC+30. Refer to Exhibit 2.3.1.6-3 and Appendix C for traffic flow diagrams. Refer to Exhibits 2.3.1.6-1 and 2.3.1.6-2 for a summary of the traffic data. Peak hour turning movement volumes for intersections with identified accident history, all major intersections, & major traffic generator driveways/entrances are included in Appendix C.

<table>
<thead>
<tr>
<th>Route</th>
<th>Ramp C</th>
<th>Ramp E</th>
<th>Ramp M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directional Distribution</td>
<td>100% AM, 100% PM</td>
<td>100% AM, 100% PM</td>
<td>100% AM, 100% PM</td>
</tr>
<tr>
<td>Peak Hour Factor</td>
<td>0.93</td>
<td>0.90</td>
<td>0.95</td>
</tr>
<tr>
<td>Peak Hour Percent Trucks</td>
<td>7.5% AM, 1.8% PM</td>
<td>5.4% AM, 2.1% PM</td>
<td>16.6% AM, 7.5% PM</td>
</tr>
<tr>
<td>Daily Trucks</td>
<td>6.6%</td>
<td>4.8%</td>
<td>5.8%</td>
</tr>
</tbody>
</table>

Exhibit 3.3.1.6 Traffic Data

3.3.1.7. Level of Service and Mobility

A level of service (LOS) analysis was performed for year 2020 ETC base year, 2040 ETC +20, and 2050 ETC +30. Due to the low growth rate, volumes are not considerably different between scenarios; therefore the resulting LOS is not significantly different.

Since capacity improvements are not part of any of the rehabilitation or replacement alternatives, the LOS for the No-Build and Build alternatives are the same.
3.3.1.7 (1) At Project Completion & Design Year –
Exhibit 3.3.1.7-1 identifies AM/PM LOS conditions for future design years ETC, ETC+20, and ETC+30.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Ramp C</th>
<th>Ramp E</th>
<th>Ramp M</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETC 2020</td>
<td>B/B</td>
<td>F/F</td>
<td>D/E</td>
</tr>
<tr>
<td>ETC+20 2040</td>
<td>C/C</td>
<td>F/F</td>
<td>D/E</td>
</tr>
<tr>
<td>ETC+30 2050</td>
<td>C/D</td>
<td>F/F</td>
<td>E/E</td>
</tr>
</tbody>
</table>

3.3.1.7 (2) – Work Zone Safety & Mobility –

A. Work Zone Traffic Control Plan –

Work shall be performed on each ramp separately. There are no viable detour routes that will allow a total closure of the ramps without causing major bottlenecks at the interchanges where traffic would be diverted. Recommended ramp closure hours are identified in Exhibit 3.3.1.7-2.

<table>
<thead>
<tr>
<th>Ramp Closure Hours During Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weeknights: 11 PM to 6 AM</td>
</tr>
<tr>
<td>Weekends: 12 AM to 2 PM</td>
</tr>
</tbody>
</table>

Weeknight closures will provide 7 hour time intervals on Ramps C and E and 24 hour time intervals on weekends. Weeknight closures will provide 6 hour time intervals on Ramp M and 13 hour time intervals on Saturdays and Sundays.

During the closure hours traffic will be detoured as follows:

Ramp C – Vehicles will be detoured to I-87 SB via Ramp E to Exit 5 (a full access interchange at Macombs Dam Bridge and redirected to I-87 northbound).

Ramp E – Vehicles will be detoured to I-87 NB via Ramp C to I-87 NB (approximately 1.2 miles) to Exit 8 (a full access interchange at West Fordham Road) and redirected to I-87 southbound.

Ramp M – Vehicles will be instructed to continue south on I-87 SB to Exit 5 (Macombs Dam Bridge and redirected to I-87 NB then to Exit 7N approximately 0.6 miles to the north.

Construction activities that would require closing a ramp to traffic for an entire weekend would require implementing a primary and secondary detour route during the closure period. Exhibit 3.3.1.7-2 indicates the time periods in which the primary detour route would be implemented. The traffic analysis identifying these time intervals is included in Appendix C. A potential secondary detour route is presented in Appendix C for each ramp closure. Further analysis of these secondary detours is required to evaluate the feasibility of these secondary detour routes.
Other Investigated Construction Period Alternatives

A staged construction alternative for “Cars Only, Detour Trucks” was thoroughly investigated during preliminary design for Ramps C and M. While this type of staging could be constructed, it was ultimately dismissed due to complexities involving the enforcement of the “No Truck” access restriction to the ramps. Ramp E would require a full detour, as staging is not a recommended option due to width restrictions on the structure. The “Cars Only, Detour Trucks” alternative required a permanent Ramp M build out of at least 2.5 feet on either side of the existing curved structure to maintain a 14 foot minimum travel way. An at-grade temporary roadway segment with potential retaining walls would be required for staging between Ramp M and Ramps B and L. This temporary connection would allow cars using ramp A to share Ramp M and cross over Ramps B and L in order to reconnect with Ramp A while the Ramp A/M nose was constructed. The at-grade temporary roadway would require a detour of Ramp B. For Ramp C, a “Cars Only, Detour Trucks” staged construction would require a temporary ramp build out on a GRES wall. While this is geometrically feasible, the enforcement of “No Trucks” again makes this option undesirable.

Since closing and/or detouring Ramp A traffic is not feasible at any time, a temporary structure was investigated to handle the Ramp A traffic as it exits the Ramp M merge point. The temporary structure would be limited to this merge point and would then direct traffic back onto Ramp A shortly after. The use of full length temporary structures was not advanced as they are undesirable due to the geometric restraints and the connection impacts to the newly constructed Ramps A and L.

B. Special Provisions

There should be no construction work that requires ramp closures and the implementation of detours when events are scheduled at Yankee Stadium.

C. Significant Projects (per 23 CFR 630.1010)

The Region has determined that the subject project is significant per 23 CFR 630.1010. The construction of Ramps C, E, and M will complete the rehabilitation work of the High Bridge Interchange.

A Transportation Management Plan (TMP) will be prepared for the project consistent with 23 CFR 630.1012. The TMP will consist of a Temporary Traffic Control (TTC) plan. Transportation Operations (TO) and Public Information (PI) components of a TMP will be considered during final design.

3.3.1.8. Safety Considerations, Accident History and Analysis –

Flashing beacons or fabrication of the warning arrow signs (W1-8 R and W1-8L) with a higher reflectivity material is proposed along the curved sections of the ramps. Refer to Appendix C for the Accident Analysis. No locations were identified within the project limits as a NYSDOT Priority Investigation/Safety Deficiency Location.

3.3.1.9. Impacts on Police, Fire Protection and Ambulance Access -

The completion of this project will have no impact on Police, Fire Protection and Ambulance access.

3.3.1.10. Parking Regulations and Parking Related Issues –

No changes are proposed.

3.3.1.11. Lighting –

No changes are proposed.
3.3.1.12. Ownership and Maintenance Jurisdiction –

No changes are proposed; please refer to Chapter 2 Section 2.3.1.12. NYSDOT will continue ownership and maintenance responsibilities for the highway.

3.3.1.13. Constructability Review -

The Regional Construction Group will review the project and any concerns will be addressed.

3.3.2. Multimodal

3.3.2.1. Pedestrians –

Pedestrians are prohibited on Interstate Highways by state law. There are no pedestrian crossings or other provisions proposed at the ramp terminals.

3.3.2.2. Bicyclists –

Bicyclists are prohibited on Interstate Highways by state law.

3.3.2.3. Transit –

No changes are proposed.

3.3.2.4. Airports, Railroad Stations, and Ports –

No changes are proposed; no conflicts are expected.

3.3.2.5. Access to Recreation Areas (Parks, Trails, Waterways, and State Lands) –

No changes are proposed.

3.3.3. Infrastructure

3.3.3.1. Proposed Highway Section –

Refer to Appendix A for typical sections.

3.3.3.1. (1) Right of Way -

There are no proposed ROW acquisitions.

3.3.3.1. (2) Curb –

After the Ramp C Bridge abutment and beyond the Ramp C/F merge, the half section barrier will transition into approximately 270’ of new 6” vertical faced curb on the right side of the roadway towards the I-87 NB Major Deegan Expressway. Ramp M will have 6” vertical spaced curb along the edge of the at-grade roadway between the half section barrier after the abutment and the merge with Ramp B. Ramp E will not have curb and instead shall have half section barriers on both sides of the roadway approach within the project limits. Refer to the General Plans in Appendix A.

3.3.3.1. (3) Grades – The proposed maximum grades will be 5.00% for Ramp C, 4.47% for Ramp M, and 6.05% for Ramp E.

3.3.3.1. (4) Intersection Geometry and Conditions –

There are no existing intersections within the project limits.
3.3.3.2. Special Geometric Design Elements -

3.3.3.2. (1) Nonstandard Features –
See Appendix E for the Nonstandard Feature Justification Exhibits for Ramps C, E and M.

3.3.3.2. (2) Nonconforming Features –
The only nonconforming feature, as noted in the existing conditions, that will remain in the preferred alternative is the compound curve on Ramp C. This curve slightly exceeds the desirable 2:1 ratio listed in the HDM Chapter 5.7.3.5.A and AASHTO Chapter 3, page 3-84 (1000’R to 448’R inside radius). Changing the alignment to meet this criteria is not feasible under alternative 2.

3.3.3.3. Pavement and Shoulder –
All three ramp structures will have new concrete decks under the preferred alternative. The at-grade approach roadways will have new full depth pavement within the shoulder areas to replace the existing safety walkways. The existing pavement of the approach roadways are proposed to be milled and resurfaced to improve rideability and increase pavement life. Refer to plans and typical sections in Appendix A for further details.

3.3.3.4. Drainage Systems –
The existing drainage systems or patterns will be maintained. Existing scuppers and downspouts will be replaced and connected to the existing underground drainage system, as applicable. The points of discharge will remain the same. The at grade drainage structures at the Ramp C/F merge will be relocated and replaced as necessary with the ramp widening and extension.

3.3.3.5. Geotechnical –
There are no special geotechnical concerns with the soils or rock slopes within the project area.

3.3.3.6. Structures –
3.3.3.6. (1) Description of Work –
(a) The major items of work for each ramp will be deck replacement, substructure rehabilitation or replacement, and cleaning/painting the fascia stringers. See Appendix A for the location of substructures to be rehabilitated versus replaced.
(b) The overall length, number of spans, and structural framing system will be maintained from the existing condition. See Section 2.3.3.6 for a detailed description of the existing structures. See Appendix A for the proposed width of travel lanes and shoulders.
(c) Utilities carried – No new utilities will be carried by the ramps.

3.3.3.6. (2) Clearances (Horizontal/Vertical) –
Existing clearances will be maintained with the rehabilitation work. This information is listed in a table in Section 2.3.3.2

3.3.3.6. (3) Live Load –
The live load for the three (3) ramps will be HL-93

3.3.3.6. (4) Waterway –
A Coast Guard Checklist is not required
3.3.3.7. Hydraulics of Bridges and Culverts –

There are no bridges or culverts over waterways within the project limits.

There are no dams in the vicinity of the project that would be adversely affected.

3.3.3.8. Guide Railing, Median Barriers and Impact Attenuators –

All single-slope half section barriers and guidewalls within the project limits, including bridge railing will be evaluated during final design for conformance to design standards and replaced or repaired, as necessary. The existing blue painted steel railings mounted on the existing safety walls within the project are to be removed and replaced with new single slope half section concrete barriers (listed below in Exhibit 3.3.3.8). There are only two locations where existing guide rail sections are found on the at-grade approaches listed in Exhibit 2.3.3.8. They are to be replaced as necessary to meet current design standards. In addition, new single-slope half section concrete barrier will continue at-grade to provide clear zone protection for the new retaining wall along the embankment between Sedgwick Avenue and Ramp C. The locations for impact attenuators will be evaluated during final design and replaced or repaired, as necessary.

<table>
<thead>
<tr>
<th>Exhibit 3.3.3.8 Proposed Location of New Single Slope Half Section Barriers, New Guide Rail and Impact Attenuators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td>New Single Slope Half Section Barrier</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>New Single Slope Half Section Barrier</td>
</tr>
<tr>
<td></td>
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<tr>
<td>New Single Slope Half Section Barrier</td>
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<tr>
<td></td>
</tr>
<tr>
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<tr>
<td>Guide Rail</td>
</tr>
<tr>
<td>Impact Attenuator</td>
</tr>
<tr>
<td>Impact Attenuator</td>
</tr>
<tr>
<td>Impact Attenuator</td>
</tr>
</tbody>
</table>

3.3.3.9. Utilities –

There are no utilities within the project limits.
3.3.3.10. Railroad Facilities –

There are no railroads within the project limits and no at-grade crossings within 1 mile distance that could impact traffic conditions.

3.3.4. Landscape and Environmental Enhancements –

Refer to Chapter 4 for complete discussion.

3.3.4.1. Landscape Development and Other Aesthetics Improvements –

The Department will provide/replace landscaping as a part of the overall enhancement and aesthetic improvement efforts for this project. Refer to Chapter 4 for a more detailed discussion.

3.3.4.2. Environmental Enhancements –

There are no practical opportunities for environmental enhancements in the project limits.

3.3.5. Miscellaneous

Ramp C/F Merge Roadway Extension

The Ramp C Merge with Ramp F has been a reason of concern for drivers entering the northbound Major Deegan Expressway (MDE) due to the short merge length. Under the subject project, NYSDOT investigated potential improvements that can be made to increase the merge length.

**Existing Ramp C/F Merge Conditions:**

The existing Ramp C on-grade roadway merges with Ramp F to form a single acceleration lane that becomes the third travel lane on the northbound MDE. This third travel lane on the northbound MDE continues past the next exit at W 179th Street. The existing advisory speed limits for Ramps C and F are 30mph and the existing posted speed limit on the Major Deegan Expressway is 50 mph.

**Proposed Ramp C/F Merge Conditions:**

The preliminary plans for the preferred alternative in Appendix A includes the proposed improvements required to extend the Ramp C/F merge length to alleviate this condition. Exhibit 3.5.5 compares the standard/recommended values per AASHTO GDHS to the existing and proposed elements under this proposed improvement. The proposed alternative provides a longer merge length requiring relocation of the terminus of the proposed acceleration lane approximately 165 ft under the Robert Clemente State Park Bridge.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Standard/Recommended</th>
<th>Existing¹</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gap Acceptance Length</td>
<td>300'²</td>
<td>185'+/-</td>
<td>300'²</td>
</tr>
<tr>
<td>Taper Length</td>
<td>300'²</td>
<td>160'+/-</td>
<td>300'²</td>
</tr>
<tr>
<td>Acceleration Length</td>
<td>910'³</td>
<td>1000'+/-</td>
<td>910'³</td>
</tr>
<tr>
<td>Weave Distance</td>
<td>2000'⁴</td>
<td>1320'+/-</td>
<td>1155'+/-</td>
</tr>
</tbody>
</table>

¹ existing lengths are approximate based off available survey limits and google maps
² based off AASHTO GDHS 2011, 6th Edition, Figure 10-69
³ based off AASHTO GDHS 2011, 6th Edition, Table 10-3 (using design speeds of 60mph on MDE and 30mph on Ramp C/F)
⁴ recommended distance based off AASHTO GDHS 2011, 6th Edition, Figure 10-68
The preferred alternative provides the minimum required 300 ft gap acceptance length and 300 ft taper length. The modifications of Ramp C will include the installation of new full depth pavement in the areas of widening and an extension of the existing retaining wall.

The required acceleration length of Ramp F is governed by the speed differential between the operating speed of Ramp F (30 mph) and the operating speed of the Major Deegan Expressway (60 mph). Taking into consideration that the posted speed limit on the Major Deegan Expressway is 50 mph, it was determined that an acceleration length of 910 ft would suffice.

Extending the Ramp C/F merge reduces the weave length to the W 179th St Exit from approximately 1320 ft to 1155 ft. As per AASHTO GDHS, Figure 10-68, the recommended minimum length between successive ramp terminals of an entrance-exit configuration for a “System to Service Interchange” on full freeway is 2000 ft. As the project is located in the highly urbanized section of Bronx, the existing condition on the MDE does not meet this recommended minimum due to physical constraints. While the W 179th Street Exit is not anticipated to have a heavy traffic volume, during detailed design additional traffic data collection and weave analysis is recommended to determine the minimum weave length required based on site specific conditions.

The widened roadway for the Ramp C/F merge places the roadway in a cut section which will require extending the existing retaining wall between Sedgwick Ave and Ramp C to avoid impacts to the existing Sedgwick Avenue roadway. Since a portion of the wall will be located within the Ramp C clear zone, construction of a single-slope concrete half section barrier at the face of the retaining wall will be required to shield the wall and prevent direct impact. The existing fence along Sedgwick Avenue will be replaced and mounted on the new retaining wall. Refer to Appendix A Plans for the Ramp C/F merge and retaining wall extension.

**NYS Smart Growth Public Infrastructure Policy Act (SGPIPA)**

Pursuant to ECL Article 6, this project is compliant with the New York State Smart Growth Public Infrastructure Policy Act (SGPIPA).

To the extent practicable this project has met the relevant criteria as described in ECL § 6-0107. The Smart Growth Screening Tool was used to assess the project’s consistency and alignment with relevant Smart Growth criteria; the tool was completed by the Region’s Planning and Program Management group and reflects the current project scope.
CHAPTER 4 - SOCIAL, ECONOMIC and ENVIRONMENTAL CONDITIONS and CONSEQUENCES

4.1 Introduction

4.1.1 Environmental Classification and Lead Agencies

This project is being processed as a Class II Action (Categorical Exclusion) because it does not individually or cumulatively have a significant environmental impact and is excluded from the requirement to prepare an Environmental Impact Statement (EIS) or an Environmental Assessment as documented in the Federal Environmental Approvals Worksheet (FEAW) (Refer to Appendix B for the FEAWS). In accordance with the Federal Highway Administration’s regulations the project qualifies as a Categorical Exclusion per 23 CFR 771.117 (d)(13): “actions described in paragraphs (c)(26), (c)(27), and (c)(28) of this section that do not meet the constraints in paragraph (e) of this section”. The project does not meet the constraints of 23 CFR 771.117 (e)(5) as it will result in construction of temporary access, or the closure of existing road, bridge, or ramps, that would result in major traffic disruptions and therefore reverts to the D-list as (d)(13).

In accordance with 17 NYCRR, Part 15, “Procedures for Implementation of State Environmental Quality Review Act”, the NYSDOT has determined that this project is a SEQR Type II Action. No further SEQR processing is required. The project has been identified as a Type II Action, per 17 NYCRR, Part 15, Section 15.14, Subdivision (e), Item 37, Paragraph IV. This permits the project to be classified as Type II since the project does not violate any of the criteria contained in subdivision (d) of Section 15.14, and is of a scale and scope illustrated by the following:

(iv) replacement, reconstruction or rehabilitation, at present site or immediately adjacent thereto, of existing bridges, culvers or other transportation structures, including railroad crossing structures, not involving substantial expansion of the structure;

The study area extends approximately 150 feet from the project limits, unless otherwise specified. It is believed that any impacts would reasonably occur within this distance, since the work is characterized in general by in-kind rehabilitation work.

4.2 Social

The purpose of this section is to discuss the social environment in the vicinity of the project. This project proposes improvements to three Highbridge Interchange ramp bridges (C, E, and M) and their associated on-grade approach roadways. The proposed improvements entail replacement of the deck and rehabilitation of the superstructure and substructure of the three (3) ramp bridges (C, E, & M) and rehabilitation of their five (5) associated segments of on-grade approach roadways. Improvements will generally follow the existing horizontal and vertical alignment. The proposed improvements, as well as the new entrance ramp, would not result in impacts to the local community, as all improvements will be located within existing NYSDOT right-of-way. Replacement of the deck and rehabilitation of the superstructure and substructure of the three (3) ramp bridges (C, E, & M), along with repairs of other deteriorated elements is needed to assure continued safe operations and extend the service life of the ramp bridges.

4.2.1 Land Use

The project is located within an urban environment in the western edge of Bronx County, New York. Land uses are predominantly transportation related with residential and commercial uses located to the east.
The project site consists of transportation infrastructure associated with the Alexander Hamilton Bridge and the Highbridge Interchange ramps, the Metro North Commuter Railroad, the Major Deegan Expressway (I-87), the Cross Bronx Expressway (I-95), the Washington Bridge, as well Sedgwick Avenue and Undercliff Avenue. Metro-North commuter rail tracks, NYC parkland and the Harlem River are located to the west of the three ramp bridges and associated on-grade approach roadways. Land uses east of the project site consist of multi-family apartment buildings and a number of commercial establishments found primarily along Sedgwick Avenue.

The proposed rehabilitation of the three ramp bridges and their associated on-grade approach roadways would occur within the existing right-of-way and no right-of-way acquisition would be required. During construction, ramp bridge closures and detours would be required and would result in a temporary disruption of the normal traffic pattern in the vicinity of the project site. This temporary disruption in the traffic pattern is not anticipated to generate a land use change within the project area. Furthermore, the project would not affect any proposed land use development plans.

4.2.1.1 Comprehensive Plans and Zoning

The following local and city-wide planning documents were reviewed in order to compare the proposed project elements with the goals and objectives of local planning efforts. The project improvements are consistent with the local and city-wide planning documents.

Bronx Federal Empowerment Zone

The project corridor runs through the Bronx 4 Federal Empowerment Zone. This program provides financial benefits and tax benefits to qualified businesses operating within the zone. Benefits include employer wage credits for increased depreciation tax deductions and tax-exempt bond financing. The federal zone is administered by the Bronx Overall Economic Development Corporation.

Bronx Community District 4 Statement of Community District Needs Fiscal Year 2016

Each fiscal year, Community Boards throughout the City of New York issue a Statement of Community District Needs. These statements, which describe each Community Boards’ respective needs, provide a context for development and an assessment of budget priorities. The project site south of the Washington Bridge falls within Community District 4. The 2016 Statement of Community District Needs requests additional funding for transportation investments, and identifies the need for more affordable housing, additional youth services, additional school safety and police officers in the 44th precinct, business services and economic development, services for the homeless and mentally ill, development of and improvements to existing open space facilities, and services to improve public health. The community district needs statement did not specifically addressed the Highbridge Interchange improvements.

The Community District 4 Statement of District Needs identifies a desire for the Harlem River Waterfront to be improved. As part of the Harlem River Initiative, the area located west of the Major Deegan Expressway would be restored with the use of green infrastructure for storm water retention and treatment, the addition of lighting and public art at street levels, and restoration of the natural waterfront, including waterfront public open space/parkland. Where feasible, Community District 4 would like a greenway along the river and improved access to the river. The proposed project will not impact any initiatives identified in the Community District Needs Statement.

Statement of Community District Needs, Bronx Community District 5

The project site north of the Washington Bridge falls within Community District 5. The Community District 5 Statement of District Needs identifies several community issues that need to be addressed. The district

is currently saturated with supportive and transitional housing. It is the goal of the district to have similar facilities equally distributed to other districts within NYC. Transportation infrastructure improvements are also requested, including the need for support from the NYSDOT to reduce traffic speeds on local roads to improve safety and reduce traffic generated noise levels and continued maintenance of Washington Bridge. Community District 5 also identified the need for additional parkland, community development and youth services, housing preservation and affordable housing development. Safety is also a priority and additional support from the NYC Police Department is requested. In addition, funding is requested for 911 dispatchers to increase response time (ambulatory and fire department). Needs that are specifically related to the project area include the need for increased street and sidewalk cleanliness along Major Deegan/Sedgwick Avenue with the assistance of the Department of Sanitation. The proposed project will not impact any initiatives identified in the Community District Needs statement.

Harlem River Greenway Vision

The Harlem River Greenway Vision is an initiative of the Harlem River Working Group with the focus of improving water quality, providing access to the waterfront and building a greenway alongside the length of the river. The plan identified 23 recommendations for the Harlem River Waterfront including providing a link between Depot Place and Roberto Clemente State Park via the Regatta Greenway. The project will not impact any proposed initiatives or recommendations identified for the Harlem River Waterfront.

Jerome Avenue Planning Study

The Department of City Planning is currently conducting a study that is looking at revitalizing a two-mile stretch of Jerome Avenue and surrounding neighborhoods. The study area is located adjacent to the project site. The study is focused on preserving and creating affordable housing, economic development, investing in community services and infrastructure, and promoting growth of livable neighborhoods.

Zoning

According to the New York City Zoning Map, the project site falls within the R7-1 Medium Density Apartment House District and M1-1 Manufacturing District. Zoning districts adjacent to the project site also include C1-4 Commercial Overlay District, C8-1 Commercial District and M1-5 Manufacturing District. The project improvements remain within the right-of-way of existing transportation infrastructure, and as such, the project will not result in impacts to local zoning.

Rehabilitation of the three ramp bridges and associated approach roadways on the same horizontal and vertical alignment is consistent with the community’s comprehensive plans and will not affect local zoning.

4.2.2 Neighborhoods and Community Cohesion

The existing ramp bridges and associated approach roadways generally provide links between the Cross Bronx (I-95) and the Major Deegan Expressway (I-87) and do not provide direct access to the adjoining neighborhoods. Rehabilitation of the existing ramp bridges and associated approach roadways would occur within the existing right-of-way and on the same horizontal and vertical alignment. The project would not divide or isolate neighborhoods or separate residents from community facilities or public safety services. The project would not impact the cohesiveness of the adjacent communities and neighborhoods.

4.2.3 Social Groups Benefitted or Harmed

Commercial establishments in the vicinity of the project site are limited. They are primarily located on Sedgwick Avenue and Ogden Avenue east of the ramp bridges and associated approach roadways. Residences are located east of Sedgwick Avenue. Residences consisting of high-rise apartment buildings and apartment complexes are found north of Washington Bridge (181 Street Bridge) along Sedgwick Avenue and Undercliff Avenue. High-rise residential apartments and two-story single and multi-family homes are located at the northeast corner of the Edward L. Grant Highway and the Cross Bronx Expressway. In the southern portion of the project area residences consisting of high-rise apartments are located east of Undercliff Avenue, fronting University Avenue.

The proposed project would not result in any displacement of residents or businesses within or adjacent to the project area as the project would be limited to the existing right-of-way and would not require any right-of-way acquisitions. The proposed project would not result in changes to socioeconomics conditions of the area that could lead to indirect displacement. The proposed project would have no significant long term permanent effects on residential communities or existing businesses within the vicinity of the project limits.

During construction, ramp bridge closures and detours would be required and would result in a temporary disruption of the normal traffic pattern in the vicinity of the project site. A reasonable rerouting plan will be established for each ramp bridge. Access to residents and businesses would be maintained during construction and would not result in any permanent adverse impacts.

### 4.2.4 Demographics and Affected Population

The project site is located within a “potential environmental justice area”, as delineated by the New York State Department of Environmental Conservation Office (NYSDEC) of Environmental Justice; however the scope of the project activities is limited to improvements within the existing right-of-way. The proposed rehabilitation of the three ramp bridges and their associated approach roadways would not significantly change either the horizontal or vertical alignment. All ramp bridge and approach roadway improvements would be constructed within the existing right-of-way and right-of-way acquisitions would not be required. No new land uses would be introduced as a result of the project. The project is necessary to ensure the continued safety of the existing three ramp bridges and associated roadways. As such, the project would not result in disproportionately high and adverse human health and environmental effects on minority or low-income populations.

### 4.2.5 School Districts, Recreational Areas, and Places of Worship

The project area is located within NYC Board of Education School District 9. There are no schools located within or immediately adjacent to the project site. There are no known places of worship within or immediately adjacent to the project area. The Sedgwick Avenue Community Center located at 1553 University Avenue, north of Ramp C, is sponsored by the Catholic Charities Community Services Archdiocese of NY.

Refer to Section 4.4.11 for recreational areas. During construction, ramp bridge closures and detours would be required and would result in a temporary disruption of the normal traffic pattern in the vicinity of the project site. A reasonable rerouting plan will be established for each ramp bridge. Access to community facilities would be maintained during construction and would not result in any permanent adverse impacts.

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4.3 Economic

4.3.1 Regional and Local Economies

The project would not result in significant impacts on the regional and local economy.

4.3.2 Specific Business Impacts

Commercial establishments in the vicinity of the project site are limited. Commercial establishments are primarily located on Sedgwick Avenue and Ogden Avenue east of the ramp bridges and associated approach roadways. These businesses include a deli, grocery store, preschool and day care, a parking garage and restaurant. Additional businesses or establishments south of Ramp M include a gas station, the Howard Johnson, the Bronx Task Force Police, and U-Haul facility located on Sedgewick Avenue. The project would not result in adverse impacts to businesses within or adjacent to the project area. The proposed project would not result in any displacement of businesses as the project would be limited to the existing right-of-way and would not require any right-of-way acquisition. The existing ramps and associated roadway segments generally provide links between the Cross Bronx (I-95) and the Major Deegan Expressway (I-87) and do not provide direct access to businesses within the study area. Construction would temporarily disrupt normal traffic patterns within the project area; however access to businesses would be maintained. A reasonable rerouting plan will be established for each ramp bridge under construction. The project would not result in any permanent adverse impacts.

4.4 Environmental

4.4.1 Aquifers, Wells and Reservoirs

The project site is not located near a water supply source, therefore, the project would not have a direct impact on any water supply sources, such as an aquifer, well or reservoir. The New Croton Aqueduct, Shaft House 24 and blow-off vault are located within the project limits. The New Croton Aqueduct system is one of three systems that provide water to NYC. The project would not result in any impacts to the Croton Aqueduct System. As such, water source quality would not be affected by the proposed project.

4.4.2 Stormwater Management

The project will not result in an increase in impervious surfaces and additional runoff is not anticipated. As with current conditions, the proposed improvements will continue to tie into the existing storm sewer system that delivers roadway runoff to the Harlem River. Since site disturbance is expected to exceed one-acre, a SPDES General Permit for Storm Water Discharges from Construction Activity (GP-0-15-002, effective as of January 2015) will be required. Prior to construction, a soil erosion and sedimentation control plan would be developed to minimize sediment disturbance during construction. All required mitigation measures for soil erosion will be incorporated into the soil erosion and sediment control plans as part of the project’s construction plans.

4.4.3 Wetlands/Surface Waters

The project site and/or construction staging areas do not contain wetlands or waterbodies that are regulated by the United States Army Corps of Engineers or the United States Coast Guard. The proposed limits of ground disturbance are not proposed within NYSDEC regulated freshwater or tidal wetlands jurisdiction.
4.4.4 Floodplains

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) dated September 5, 2007, the project limits do not fall within areas with a 1% annual chance of flooding (100-year floodplain). The southern segments of Ramps E and M fall within a moderate flood hazard area or .0.2% annual chance of flooding (500-year floodplain).

According to the Preliminary FIRM Maps issued by the FEMA on January 1, 2015 the southern portion of Ramp M extends within the 1% annual chance flood hazard area (100-year floodplain), with a base flood elevation of 10 feet.

The project would not result in any new development or structures within the flood zone. Ramp M would be reconstructed within the existing alignment and would not result in a significant encroachment or impact of floodplain areas.

4.4.5 Coastal Zone/Waterfront Revitalization

The project site is located within the NYS Department of State (NYSDOS) designated Coastal Zone. As such, all discretionary land use actions and projects involving the use of federal or state funds, or requiring federal or state permits, within the mapped Coastal Zone Boundary must be found consistent with the policies and intent of the NYSDOS Coastal Management Program (CMP). The program provides for local implementation through the adoption of a Local Waterfront Revitalization Program (WRP). NYC has adopted a WRP administered by the NYC Department of City Planning. The project is subject to the NYC’s WRP consistency determination, along with a State Consistency Review and submission to NYSDOS. This review includes completion of the NYC WRP Consistency Assessment Form, the State Coastal Assessment Form (CAF) and Federal Consistency Assessment Form (FCAF) provided in Appendix B. As noted in Appendix B, the project is consistent with the policies of the NYSDOS Coastal Management Program and the NYC Waterfront Revitalization Program. Refer to Appendix B for general concurrence issued by NYSDOS on October 20, 2016.

4.4.6 Wild, Scenic, and Recreational Rivers

The Harlem River, adjacent to the project site, is not classified as a protected river under the federal Wild and Scenic Rivers Act (WSRA) or state Wild, Scenic and Recreational Rivers System Act.

4.4.7 Critical Environmental Areas

According to information obtained from NSYDEC, there are no significant natural communities and no rare plants or rare animals within the project study area. There are presently no Critical Environmental Areas in Bronx County.

4.4.8 General Ecology and Wildlife

According to an IPaC Trust Resource Report, generated on May 5, 2015, the Piping Plover has been known to be present within the vicinity of the project site. No other species that are managed by the Endangered Species Program have been identified in the project vicinity, to date. The IPaC Trust Resource Report also listed several migratory birds that may occur within the vicinity of the project site.

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8 http://apps.femadata.com/preliminaryviewer/?appid=687703427dd347018b8fa2bb0adee979
The Migratory Bird Treaty Act requires a project to comply with the appropriate regulations for the protection of birds, which involves analyzing potential impacts and implementing appropriate conservation measures for all project activities.

The migratory birds that may occur within the vicinity of the Project Site were listed as follows:

- American Oystercatcher
- American Bittern
- Bald Eagle
- Black Skimmer
- Black Billed Cuckoo
- Blue-winged Warbler
- Cerulean Warbler
- Fox Sparrow
- Golden-winged Warbler
- Gull-billed Tern
- Hudsonian Godwit
- Least Bittern
- Least Tern
- Pied-billed Grebe
- Prairie Warbler
- Purple Sandpiper
- Red Knot
- Rusty Blackbird
- Saltmarsh Sparrow
- Seaside Sparrow
- Short-eared Owl
- Snowy Egret
- Upland Sandpiper
- Wood Thrush
- Worm Eating Warbler

The Piping Plover, which is designated as a threatened species under the Endangered Species Program, is a shorebird that nests and feeds along coastal sand and gravel beaches. Since the project site does not contain a suitable shoreline habitat for the Piping Plover, the project would not threaten the Piping Plover or their habitat. This was confirmed through further consultation with the USFWS.\(^\text{11}\) FHWA concurred with the “No Effect” determination on the Piping Plover (Refer to FHWA letter dated November 2, 2016 in Appendix B). The USFWS also confirmed that the proposed project would not result in impacts to the aforementioned listed migratory bird species, as long as trees are not cut down as a result of the project. If tree removal/clearing is deemed necessary in later phases of design development, further consultation with USFWS would be required prior to construction.

In a letter dated July 1, 2015 from the NYS Department of Environmental Conservation Natural Heritage Program, there are no records of rare or state-listed animals or plants, or significant natural communities on or within the immediate vicinity of the project site. Refer to Appendix B for a copy of this letter.

### 4.4.9 National Wildlife Refuge Lands

The project site is not located in the vicinity of any National Wildlife Refuge Lands; therefore, the proposed project is not required to undergo a “Compatibility Determination”.

### 4.4.10 Historic and Cultural Resources

The proposed project involves improvements to three (3) High Bridge Interchange ramps structures (Ramps C, E, and M) and associated on-grade approach roadways associated with the Alexander Hamilton Bridge. Historical Perspectives, Inc. (HPI), for NYSDOT, completed an evaluation of historic properties within and adjacent to the area of potential effect (APE) based on data available from the NYSDOT, the New York State Office of Parks, Recreation and Historic Preservation (SHPO), and the New York City Landmarks Preservation Commission (LPC). HPI also undertook consultation with the SHPO in order to identify any additional cultural resources that could be affected by the present project.

\(^{11}\) Phone correspondence with Steve Papa of USFWS on May 14, 2015.
The result of the evaluation resulted in the preparation of a Documentation of Prior Disturbance and a Finding Documentation (Refer to Appendix B).  

According to the Documentation of Prior Disturbance the only cultural resources that have a direct bearing on archaeological sensitivity in the APE are the components of the New Croton Aqueduct, which have been determined eligible for the State and National Register of Historic Places (S/NRHP). The Aqueduct crosses under Ramps C, E, and M. The Aqueduct itself is buried approximately 300 feet below grade and well below any impacts for the current project. However, the associated Shaft House No. 24 and Blow-Off Chamber/Vault (USN 00501.001347) are located within the project area. Shaft House No. 24 is buried below grade in an area between Undercliff Avenue and Sedgwick Avenue. It will not be affected by the current project. The Blow-Off Vault is located below grade under the overhead Ramps A and E. It is capped by a 1960s rectangular brick superstructure that was constructed at the time that the Alexander Hamilton Bridge and ramps were built.

The Documentation of Prior Disturbance concluded that based on the prior cultural resource study for the project area, as well as a site visit to document existing conditions, the present Archaeological APE has been completely disturbed by prior construction. There is no expectation that any additional archaeological resources beyond those of the previously documented New Croton Aqueduct Blow-Off Chamber/Vault could survive in areas proposed for ramp rehabilitation. The Documentation of Prior Disturbance was reviewed by SHPO and a determination of No Archeological Concerns was issued (Refer to Appendix B, SHPO letter dated 10/23/2015).

According to the Draft Finding Documentation, Alexander Hamilton Bridge (USN 00501.000714), along with all of the ramps that lead to and from the Alexander Hamilton Bridge, including Ramps C, E, and M of the present project, are eligible for listing in the State and National Registers of Historic Properties (S/NRHP). In addition to the Alexander Hamilton Bridge the following historic resources have been identified within or in proximity to the Area of Potential Effect:

- Cross Bronx Expressway Corridor (Part of I-95) – eligible for listing in the State and National Registers of Historic Properties. USN 00501.001590.
- Major Deegan Expressway (Interstate 87) between the Bruckner Expressway and the Westchester County border – eligible for listing in the State and National Registers of Historic Places. USN 00501.001485.
- E.L. Grant Highway Bridge BIN 1-0662-0 (over Cross Bronx Expressway) – eligible for listing in the State and National Registers of Historic Properties. USN 00501.001633.
- Sedgwick Houses (NYCHA housing project) at 140 West 174th Street – eligible for listing in the State and National Registers of Historic Properties. USN 00501.001559.
- General Sedgwick House at 1520 Sedgwick Avenue – eligible for listing in the State and National Registers of Historic Properties. USN 00501.001905.
- Depot Place Bridge BIN 1-06684-0 (over Major Deegan Expressway) – not eligible for listing in the State and National Registers of Historic Properties. USN 00501.001635.
- Old Croton Aqueduct – listed in the State and National Registers of Historic Properties. NR # 90NR02435.
- High Bridge Aqueduct – listed in the State and National Registers of Historic Properties. USN 00501.000753. NR # 72001560.

12 NYSDOT. Draft Finding Documentation Rehabilitation of Three (3) High Bridge Interchange Ramps C, E, and M Borough of the Bronx, Bronx County, New York (PIN X726.99.121 SHPO Project Review Number 15PR05527)
13 Determination of Eligibility written by Daria Merwin of the SHPO in 2015.
14 NYSDOT. Draft Finding Documentation Rehabilitation of Three (3) High Bridge Interchange Ramps C, E, and M Borough of the Bronx, Bronx County, New York (PIN X726.99.121 SHPO Project Review Number 15PR05527)
• Washington Bridge (Undercliff Ave) – listed in the State and National Registers of Historic Properties. USN 00501.000738. NR # 83001645.
• New Croton Aqueduct Shaft House no. 24 & Shaft no. 24 Blow-off Chamber/Vault – eligible for listing in the State and National Registers of Historic Properties. USN 00501.001347.
• Trans-Manhattan Expressway Connector Ramp – eligible for listing in the State and National Registers of Historic Properties. USN 06101.013184.

According to the Draft Finding Documentation, NYSDOT has made a determination of No Effect on the following resources: Sedgwick Houses, General Sedgwick House, and the Trans-Manhattan Expressway Connector Ramp. In no cases will the present project alter any characteristics that qualify these resources for the S/NRHP, or diminish the integrity of the resources’ location, design, setting, materials, workmanship, feel, or association.

The remaining resources, including the Alexander Hamilton Bridge ramps themselves, could potentially experience direct and indirect impacts as a result of this project. In order to prevent any Adverse Effects, a Construction Protection Plan will be developed prior to any construction activity in order to ensure that no portions of the remaining resources would be affected. A discussion of the Criteria of Adverse Effect for these resources follows:

• Alexander Hamilton Bridge and ramps/Cross Bronx Expressway: This resource will be affected by the current project, as ramps will be rehabilitated by replacing deteriorated and outdated components with new elements. However, the rehabilitation of the ramps will not alter the characteristics of the resource that qualify it for inclusion in the Register. The bridge and its associated ramps are significant for their association with the National Register eligible Cross Bronx Expressway, which meets Criterion A in the area of social history as well as Criterion C for engineering design. None of the changes that will occur as a result of the current project will alter this significance. The only potential Adverse Effects to the Alexander Hamilton Bridge and its ramps would be from inadvertent damage to those portions of the resource that are adjacent to the ramps but are not part of this project, from construction-related activities. In order to prevent any Adverse Effects, a Construction Protection Plan should be implemented prior to rehabilitation activities to ensure that no adjoining portions of the bridge or ramps will be affected by the current project. Once project plans for the ramps rehabilitation are finalized, specific recommendations for the Construction Protection Plan should be formulated.

• Major Deegan Expressway: The present project will not alter the characteristics of the Major Deegan Expressway that qualify it for inclusion in the Register. However, because several of the ramps to be rehabilitated cross over the Major Deegan Expressway, there is the possibility of Adverse Effects from construction activities that might damage the resource. In order to prevent any Adverse Effects, a Construction Protection Plan should be implemented prior to rehabilitation activities to ensure that no portions of the resource will be affected by the current project. Once project plans for the ramps rehabilitation are finalized, specific recommendations for the Construction Protection Plan should be formulated.

• E.L. Grant Highway Bridge: The present project will not alter the characteristics of the E.L. Grant Highway Bridge that qualify it for inclusion in the Register. However, because the eastern end of the on-grade portion of Ramp C passes under this bridge, there is the possibility of Adverse Effects from construction activities that might damage the resource. In order to prevent any Adverse Effects, a Construction Protection Plan should be implemented prior to rehabilitation activities to ensure that no portions of the resource will be affected by the current project. Once project plans for the ramps rehabilitation are finalized, specific recommendations for the Construction Protection Plan should be formulated.

• Old Croton Aqueduct (OCA): The present project will not alter the characteristics of the OCA that qualify it for inclusion in the Register. However, because the easternmost, on-grade portions of Ramps C and M may overlap the OCA, there is the possibility of Adverse Effects from
construction activities that might damage the resource. In order to prevent any Adverse Effects, a Construction Protection Plan should be implemented prior to rehabilitation activities to ensure that no portions of the resource will be affected by the current project. Once project plans for the ramps rehabilitation are finalized, specific recommendations for the Construction Protection Plan should be formulated.

- **High Bridge**: The present project will not alter the characteristics of High Bridge that qualify it for inclusion in the Register. However, because the on-grade approach to Ramp E to be rehabilitated passes under High Bridge, there is the possibility of Adverse Effects from construction activities that might damage the resource. In order to prevent any Adverse Effects, a Construction Protection Plan should be implemented prior to rehabilitation activities to ensure that no portions of the resource will be affected by the current project. Once project plans for the ramps rehabilitation are finalized, specific recommendations for the Construction Protection Plan should be formulated.

- **Washington Bridge**: The present project will not alter the characteristics of Washington Bridge that qualify it for inclusion in the Register. However, because it crosses over Ramp E and next to Ramps C and M, there is the possibility of Adverse Effects from construction activities that might damage the resource. In order to prevent any Adverse Effects, a Construction Protection Plan should be implemented prior to rehabilitation activities to ensure that no portions of the resource will be affected by the current project. Once project plans for the ramps rehabilitation are finalized, specific recommendations for the Construction Protection Plan should be formulated.

- **New Croton Aqueduct Shaft House no. 24 and Shaft no. 24 Blow-off Chamber/Vault**: The present project will not alter the characteristics of the New Croton Aqueduct Shaft No. 24 and Blow-Off Chamber that qualify it for inclusion in the Register. However, because Ramp E crosses over the Blow-Off Vault, there is the possibility of Adverse Effects from construction activities that might damage the resource. In order to prevent any Adverse Effects, a Construction Protection Plan should be implemented prior to rehabilitation activities to ensure that no portions of the resource will be affected by the current project. Once project plans for the ramps rehabilitation are finalized, specific recommendations for the Construction Protection Plan should be formulated.

The New York State SHPO has found that the project will have no adverse effect on historic resources provided a Construction Protection Plan is put in place for all construction proposed within 90 feet of a historic resource, as identified above. (Refer to SHPO letter dated October 27, 2016 in Appendix B.) The Construction Protection Plan will be developed in accordance with requirements stipulated in New York City Department of Buildings’ “Technical Policy Procedure Notice #10/88 and guidelines in New York City Landmarks Preservation Commission’s “Protection Programs for Landmarked Buildings.”

### 4.4.11 Parks and Recreational Resources

The Recreational areas within the project study area are as follows:

- **Sedgewick Playground**, a 1.05 acre NYC park, fronts on both Undercliff Avenue and Dr. Martin Luther King Boulevard, north of Ramp C. Facilities include basketball courts, fitness equipment, handball courts, and playgrounds.

- **Bridge Playground**, a 0.61 acre NYC park, is located on Boscobel Place between Dr. Martin Luther King Jr. Boulevard and Undercliff Avenue. Facilities include playground equipment and basketball courts.

- **Bridge Park**, a newly established NYC park, is located along the Harlem River from the Alexander Hamilton Bridge north to West 175 Street.
• A 0.17 unnamed NYC park is located north of the Cross Bronx Expressway, between Dr. Martin Luther King Jr. Boulevard and Plimpton Avenue. A small unnamed park is located north of Ramp C between Sedgwick Avenue and Undercliff Avenue.\textsuperscript{15}

• High Bridge Park (Bronx) and High Bridge is a NYC park located on West 170th Street and University Avenue. High Bridge is NYC’s oldest standing bridge which crosses over the MDE just north of Depot Place and terminates in High Bridge Park. The pedestrian bridge connects the neighborhoods of Washington Heights in Manhattan and Highbridge in the Bronx and was recently reopened to the public on June 9, 2015.\textsuperscript{16}

The proposed rehabilitation of the three ramp bridges and on-grade approach roadways will follow the existing horizontal and vertical alignment. The proposed project would not result in any temporary or permanent acquisition of parkland and would not result in significant impacts to parks and recreational resources within the vicinity of the project limits.

4.4.12 Visual Resources

The project lies within an area of primarily transportation-related uses bordering the residential neighborhoods of Highbridge and Morris Heights along the western edge of the Bronx. The AHB crossing of the Harlem River and the Highbridge Interchange are prominent visual features of the project area along with the Harlem River, Metro-North Commuter Railroad, the High Bridge, and the Washington Bridge. Directly east of the project site the natural topography climbs steeply to a plateau with primarily dense residential development and some commercial development. Some residences are located along the higher elevations and have extensive views overlooking the AHB, Highbridge Interchanges, the MDE, Metro North railroad tracks and the Harlem River.

The proposed rehabilitation of the three ramp bridges and on-grade approach roadways will follow the existing horizontal and vertical alignment and would result in minimal visual changes. The only changes that would occur would be a small increase in the width of the decks and a change to the edge treatment of the ramp bridges. The rehabilitation proposed for these three ramp bridges is similar to that undertaken for the Alexander Hamilton Bridge and the other adjacent ramps, and will match the design elements and current safety code upgrades already completed for those resources.

The existing steel railings along the edges of the ramp bridges, which are both deteriorating and no longer meet the DOT safety code, will be replaced with concrete safety barriers, similar to what is currently in place for existing Alexander Hamilton Bridge Ramps D and A. The concrete barriers are required to comply with current design safety standards. The minor widening of the ramps bridges and modification of the railings would not be significantly perceptible for motorist or residences elevated above the interchange. As such, while there will be a minor visual change, the overall setting would not be altered, and in fact the new barriers will be in keeping with the existing visual elements of the other Alexander Hamilton Bridge ramps. The project would not result in adverse visual impacts.

4.4.13 Air Quality

Regulatory Framework

The Clean Air Act (CAA) and its amendments are the primary basis for regulating national air pollutant emissions. To prevent adverse health effects and protect the public welfare, the U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for certain pollutants, called criteria pollutants. These standards accompany a mandate for each state to continually maintain attainment of, or demonstrate progress toward attainment of the NAAQS.

\textsuperscript{15} NYCityMap. \url{http://maps.nyc.gov/doitt/nycitymap/} (accessed on August 12, 2015).

\textsuperscript{16} New York City Department of Parks & Recreation. High Bridge Park. \url{http://www.nycgovparks.org/parks/highbridge-park_bronx/} (accessed on August 12, 2015).
For transportation projects, the criteria pollutants of concern from vehicular emissions are carbon monoxide (CO), coarse particulate matter (PM$_{10}$), fine particulate matter (PM$_{2.5}$), and precursors to ozone (volatile organic compounds (VOCs) and nitrogen oxides (NOx)). The project area is located in a region of New York State that had been in nonattainment of the CO and particulate matter (PM) NAAQS, but is now in attainment of these standards and, as a result, classified as a maintenance area. The project area is currently designated as in nonattainment of the ozone NAAQS.

### Transportation Conformity

Under the transportation conformity provisions of the Clean Air Act Amendments, federally funded projects located in designated non-attainment or maintenance areas must demonstrate conformity to a State Implementation Plan (SIP). The proposed project is in part federally funded and, as noted above, is located in a region designated as in maintenance or nonattainment of the CO, PM, and ozone NAAQS. As such, the proposed project is required to demonstrate transportation conformity on both a regional (mesoscale) and a project-level (microscale) basis.

The following air quality analysis is consistent with the most recent planning assumptions developed by New York Metropolitan Transportation Council (NYMTC), the Metropolitan Planning Organization for the New York City area. Traffic volume growth rates and other associated parameters used by NYMTC were derived from current and future estimates of population, employment, travel, and congestion used in the current Transportation Improvement Program (TIP) and determination of conformity to the State Implementation Plan (SIP).

Transit service, increases in transit fares and road and bridge tolls, effectiveness of previously implemented transportation control measures and other similar regional planning assumptions did not materially affect the development and selection of the Build alternative for this project, nor is it expected that the completion of this project will materially affect these planning assumptions. Therefore, all assumptions concerning this project are consistent with the latest planning assumptions used by NYMTC for the TIP and plan conformity determinations.

The proposed project (PIN X726.99) is listed in the 2014-2018 NYMTC Transportation Improvement Program (TIP) as an exempt project with air quality code A19 (widening narrow pavements or reconstructing bridges with no additional travel lanes) for the purposes of determining regional air quality conformity with the SIP. The most recent updates to the 2014-2040 Regional Transportation Plan and the 2014-2018 TIP were approved by the NYMTC Council on December 4, 2014, and by the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) on April 9, 2015. The project’s design scope and concept have not changed significantly from that assumed in the conforming plan. As such, the project does not include alternatives which could affect area wide emissions, and no analyses are required to satisfy regional emissions analysis requirements under transportation conformity.

### Mesoscale Analysis

Per the NYSDOT Environmental Procedures Manual (EPM) criteria for projects requiring a mesoscale analysis, the proposed rehabilitation of the three ramp bridges and on-grade approach roadways would not affect area wide emissions. No new or significant modifications will be made to either the horizontal or vertical configuration of the existing ramp bridges and approach roadways; future vehicle miles traveled through the area and region would not be affected. Furthermore, the proposed project is included in the regional emissions budget for the conformity determination of the current NYMTC TIP to the NYSDEC SIP. Therefore, an air quality analysis is not necessary since the project will not affect existing or future conditions to such a degree as to jeopardize attainment of the NAAQS, and none of the EPM criteria are met that would require a mesoscale analysis.

### Microscale Analysis

Per the NYSDOT Environmental Procedures Manual (EPM) criteria for projects requiring a mesoscale analysis, the proposed rehabilitation of the three ramp bridges and on-grade approach roadways would not affect area wide emissions. No new or significant modifications will be made to either the horizontal or vertical configuration of the existing ramp bridges and approach roadways; future vehicle miles traveled through the area and region would not be affected. Furthermore, the proposed project is included in the regional emissions budget for the conformity determination of the current NYMTC TIP to the NYSDEC SIP. Therefore, an air quality analysis is not necessary since the project will not affect existing or future conditions to such a degree as to jeopardize attainment of the NAAQS, and none of the EPM criteria are met that would require a mesoscale analysis.
The following analyses demonstrate project-level (microscale) conformity of the proposed project for potential emissions of carbon monoxide and particulate matter. Although the project is in an ozone nonattainment area, it is not assessed at the project level as precursors to ozone (VOC and NOx) leading to the formation of ozone are not meaningfully affected by the project itself, and would not affect ozone concentrations at or in the vicinity of the project site. Ozone precursor emissions are transported many miles before the action of sunlight and atmospheric chemistry causes ozone to be formed, and as such are regional (mesoscale) problems that are addressed on a scale much larger than the typical transportation project.

**Particulate Matter (PM) Microscale Analysis**

Per Section 8 of the NYSDOT EPM, revised in 2012, project-level transportation conformity requirements are determined by the 2013 EPA guidance on PM hot-spot analyses. Per 40 CFR 93.123(b)(1), the proposed rehabilitation of the three ramp bridges and on-grade approach roadways would not be of local air quality concern. Although the project is located in a PM attainment/maintenance area, the proposed actions would not result in an increase of diesel vehicles, nor affect the future LOS of intersections. As such, the proposed project would meet the requirements of the CAA and 40 CFR 93.116 without a microscale hot-spot analysis, and will have no significant adverse impact on local ambient PM levels.

**Carbon Monoxide (CO) Microscale Analysis**

The NYSDOT EPM specifies the use of a three-tier screening analysis to determine whether the proposed project requires a detailed air quality analysis. The screening criteria determine whether the action would increase traffic volumes or implement any other changes to the extent that significant increases in air pollutant concentrations may be expected. This procedure seeks to identify projects of potential CO concern by establishing critical thresholds which, when exceeded at any tier, provide cause for detailed analyses. As listed below, these thresholds evaluate all project components associated with the release of CO:

- **Level of Service (LOS) Screening**
  - D, E, or F.
- **Capture Criteria**
  - 10 percent or more increase in average daily traffic volume
  - 10 percent or more increase in pollutant emission rate
  - 10 percent or more decrease in distance between project and CO-sensitive locations
  - 20 percent or more decrease in speed when conditions are under 30 miles per hour
  - New queue lanes.
- **Volume Threshold Screening**

The traffic study did not calculate LOS for the project as signalized intersections would not be affected by the proposed rehabilitation of the ramp bridges. As such, the project in its entirety is advanced to the next screening tier for evaluation against the capture criteria.

The proposed work would be limited to rehabilitation of the three ramp bridges and associated approach roadways, and would not materially alter nor add capacity to the existing facility. Although the curved sections of the bridge ramps would be permanently widened approximately 1'-9" on each side, the existing travel lane count, centerlines, and widths would not be altered, thereby maintaining the existing distances between the ramps and CO-sensitive locations. Likewise, the vertical alignment of the rehabilitated ramps would be unchanged from the existing configuration. The future design speed of the ramps would also remain unchanged from the existing speed limits of 30 MPH on Ramp C and E, and 20 MPH on Ramp M. There would be no alignment or changes in speed to the approach roadways.

As such, based on the results of the capture criteria screening, a violation of the CO NAAQS would be extremely unlikely. Therefore, a detailed microscale analysis would not be required, and the proposed project would not have a significant microscale air quality impact.
Mobile Source Air Toxics (MSATs) Analysis

The proposed project would not have meaningful effects on future traffic volumes, vehicle mix, or physical configuration of the existing facility. As such, a mobile source air toxics (MSAT) analysis is not required for this project.

Construction Impacts

The proposed project will require ramp closure and associated detours. Temporary structures are not anticipated; however, since closing and/or detouring Ramp A and Ramp D traffic is not permitted, localized temporary structures for two areas may be required to carry the Ramp A traffic as it exits the Ramp M merge point and the Ramp D traffic as it merge into Ramp E. The temporary structure would only be limited to these merge points.

Traffic diversions during construction may involve Macombs Dam Bridge (MDE) Exit 5 and Exit 8 at Fordham Road, both of which are diamond interchanges affecting two signalized intersections at each exit. Additional streets may also be involved in the detour plan once the Sedgwick Avenue on-ramp to MDE northbound is closed.

Although local inhalable PM, CO, and dust concentrations are concerns stemming from the proposed construction activities and traffic diversions, the temporary increase in emissions is anticipated to last less than two consecutive CO seasons (winters) and would be self-correcting once the project is completed. Per the NYS DOT EPM, localized microscale air quality analyses are not required for short-term construction activities that last less than two consecutive CO seasons (winters) and do not result in permanent alteration to the operation of facilities in the area. Likewise, transportation conformity requirements do not apply to effects from construction activity lasting less than five years. During the construction phase of the project, effective control measures to limit airborne PM and dust during construction would be taken, including the wetting of exposed soil, covering of trucks and other dust sources, and other best practice means as necessary. Therefore, microscale and mesoscale analyses of the increase in short-term emissions are not required, and the temporary effects of project construction on local and regional air quality would not be significant.

4.4.14 Noise

A noise study was performed to evaluate potential noise impacts of the project. To comply with the Federal-Aid Highway Act of 1970, the Federal Highway Administration (FHWA) has promulgated 23 CFR 772 regulations for the analysis and mitigation of highway traffic noise in Federal-aid highway projects. This federal noise regulation also requires highway agencies to maintain written statewide noise policies. In compliance with this requirement, the noise study adheres to Section 4.4.18 of the 2011 NYSDOT Environmental Procedure Manual (EPM), “Noise Analysis Policy and Procedures.”

Per the NYSDOT EPM, the proposed project does not constitute a Type I noise project and does not require a traffic noise analysis as per 23 CFR 772. The project neither involves construction of new roadways or travel lanes, nor results in substantial horizontal or vertical alteration that would affect the distance or topography between traffic noise sources and sensitive noise receptors. Furthermore, the project would have no effect on future traffic volumes or travel speeds, and would maintain vehicle lane centerlines and widths as currently configured. As such, the proposed project would not affect future traffic noise levels, and no impacts are anticipated.

The construction phase of the proposed project would involve the replacement of ramp decks, rehabilitation of the superstructure and substructure, and rehabilitation of the approach roadways. Construction noise produced by these activities would vary depending on such factors as the phase of construction and the type, quantity, and location of equipment employed during that phase. The average noise levels for typical construction equipment, measured at 50 feet from the construction site, range from 63 to 91 dBA. Federal and New York State guidelines place the significant construction noise impact threshold at 80 dBA for sensitive receptors.
The nearest sensitive receptor to a construction site is a high-rise residence within approximately 70 feet of Ramp C opposite Sedgwick Avenue. Although not generally required, every reasonable effort would be made to comply with local noise control provisions during construction, including federal noise emission standards for construction equipment and vehicles.

New York City Construction Noise Mitigation Plan forms, administered by the Department of Environmental Protection (NYCDEP) for compliance with Title 15 of the Rules of the City of New York (RCNY), would be used to detail precise construction phases, devices and abatement measures. Otherwise an Alternative Noise Mitigation Plan would be filed with NYCDEP before construction activities take place.

To reduce the impact of construction noise, the final contract plans would include notes requiring the contractor to follow construction provisions of the RCNY. A wide variety of measures may be considered in controlling the emission of construction noise at the source. Selecting less noisy construction machinery, installing muffler systems on combustion-powered machinery, attaching enclosures, sound aprons, and shielding to equipment, use of silencers on equipment air intakes, dampening metal surfaces to reduce equipment vibration, and enforcing best practice operation workflows are all potential mitigation methods whose feasibility may be considered in reducing the impact of construction noise. Abatement measures located along the path between noise sources and sensitive receptors, such as temporary or movable shielding (e.g., noise curtains, storage trailers), may also be considered in the construction plan.

4.4.15 Energy and Greenhouse Gases

The proposed project is a ramp repair and rehabilitation project with the aim of correcting deficient structural elements. As such, the project is classified as a categorical exclusion and will not require an energy analysis since, by definition; it will not significantly impact energy utilization.

The project will not increase or decrease vehicle miles traveled (VMT), generate additional vehicle trips, will not affect land use development patterns, will not result in a shift in travel patterns, nor significantly increase or decrease vehicle operating speeds. Therefore, the project will not significantly affect energy consumption and greenhouse gas emissions. No energy and greenhouse gas analysis is required, because the project does not meet any of the criteria in the 2003 NYSDOT ESB Draft Energy and Greenhouse Gas Guidance that would require analysis.

4.4.16 Asbestos

An asbestos assessment was performed by Environmental Planning & Management, Inc. (EPM) to determine the presence of asbestos-containing materials (ACMs) within the three bridge/ramp structures affected by the project. This assessment was in general conformance with Chapter 4.4.19 Asbestos Management, of the NYSDOT’s The Environmental Manual (TEM), and is detailed in 4.4.16.1 Screening. An initial asbestos screening was performed to determine the presence of ACMs and suspect ACMs that may be disturbed by the renovations of the three bridge/ramp structures. Following approval of the asbestos sampling and analysis plan, an inspection for the presence of ACMs was performed which included review of as-built plans, on-site inspections, bulk sampling and laboratory analysis of suspected ACM. The purpose of the inspections was to identify the location, quantity and general removal options for the removal of asbestos containing materials in accordance with the New York State Industrial Code Rule 56, that may be impacted by the rehabilitation of the ramp structures. The results of the inspection are detailed in Appendix B: Asbestos Assessment Survey and Design Report.

4.4.16.1 Screening -

The asbestos screening performed for this project determined that the following identified ACMs and suspect ACMs may be disturbed by the renovations of the three bridge/ramp structures:
1) BIN 1-06685-B: Ramp “C” – I-95 to I-87:

EPM performed a limited inspection of this structure under a different contract. The following was noted and may be disturbed by the current contract scope of work:

A) Suspect orange cloth bearing pad at abutments and piers (determined to be not asbestos containing after laboratory analysis).

B) Suspect black bearing pad at abutments and piers (determined to be not asbestos containing after laboratory analysis).

C) Suspect gray caulk at curb/sidewalk joints and guiderail base posts (determined to be not asbestos containing after laboratory analysis).

D) Suspect light gray caulk at railing base posts (determined to be not asbestos containing after laboratory analysis).

E) Suspect light gray soft caulk at safewalk joints (determined to be not asbestos containing after laboratory analysis).

For this project, EPM performed a limited inspection of this structure as a supplement to the previous inspection. The following additional identified ACMs and suspect ACMs may be disturbed by the current contract scope of work:

A) **Compressed asbestos sheet packing** between abutment backwalls and slabs (as shown on record plans).

B) Suspect electrical components (cable arc wrap, braided wire insulation, ebony board, arc shields, duct seal) located in the 6-relay control cabinet in the north abutment wall.

2) BIN 1-06685-0: Ramp “E” – I-95 to I-87:

EPM performed a limited inspection of this structure under a different contract. The following was noted and may be disturbed by the current contract scope of work:

A) Suspect orange cloth bearing pad at abutments and piers (determined to be not asbestos containing after laboratory analysis).

B) Suspect black bearing pad at abutments and piers (determined to be not asbestos containing after laboratory analysis).

C) Suspect gray caulk at top of deck, at armored deck joints (determined to be not asbestos containing after laboratory analysis).

D) Suspect light gray caulk at top of deck, at armored deck joints through safewalks (determined to be not asbestos containing after laboratory analysis).
For this project, EPM performed a limited inspection of this structure as a supplement to the previous inspection. The following additional identified ACMs and suspect ACMs may be disturbed by the current contract scope of work:

A) Compressed asbestos sheet packing between abutment backwalls and slabs (as shown on record plans).

B) Suspect caulking at top of deck railing bases.

C) Suspect caulking at top of deck curbs and concrete joints.

D) Suspect joint filler between wingwall and approach slab.

3) BIN 1066870: Ramp “M” – I-87 to I-95 N/B:

EPM performed a limited inspection of this structure under a different contract. The following was noted and may be disturbed by the current contract scope of work:

A) Suspect orange cloth bearing pad at abutments and piers (determined to be not asbestos containing after laboratory analysis).

B) Suspect black bearing pad at abutments and piers (determined to be not asbestos containing after laboratory analysis).

C) Suspect light gray caulk at steel curb protection/safewalk joints (determined to be not asbestos containing after laboratory analysis).

D) Suspect light gray caulk at top of deck at expansion joints (determined to be not asbestos containing after laboratory analysis).

For this project, EPM performed a limited inspection of this structure as a supplement to the previous inspection. The following additional identified ACMs and suspect ACMs may be disturbed by the current contract scope of work:

A) Compressed asbestos sheet packing between abutment backwalls and slabs (as shown on record plans).

B) Suspect caulk within concrete barrier at bullnose location (intersection of Ramp “M” and Ramp “A”).

C) Suspect joint filler within concrete barrier at bullnose location (intersection of Ramp “M” and Ramp “A”).

D) Suspect joint filler at east abutment joints.

E) Suspect caulk at east abutment joints.

F) Suspect caulking at top of deck railing bases and guard rails.

G) Suspect electrical components (cable arc wrap, braided wire insulation, ebony board, arc shields, duct seal) located in the 6-relay control cabinet in the east abutment wall.
EPM submitted an asbestos sampling and analysis plan report for analysis of all suspect asbestos containing materials.

4.4.16.2 Assessment and Quantification

Following approval of the asbestos sampling and analysis plan, an asbestos assessment was performed, and the following materials were determined to contain asbestos via bulk sampling and confirmatory laboratory analysis, visual observation of typically suspect asbestos containing materials, and visual confirmation of materials depicted on as-built drawings and project plans:

<table>
<thead>
<tr>
<th>Structure</th>
<th>Description of ACM</th>
<th>Friability</th>
<th>Approx. Quantity</th>
<th>Unit</th>
<th>NYSDOT ITEM # / NYSDOL BV</th>
</tr>
</thead>
</table>
| BIN 106685B: Ramp “C” – I-95 to I-87                                             | At north and east abutments, between back wall and deck slab.  
Note: East abutment joins both Ramp “C” and Ramp “E”. Quantity indicated is for the entire abutment. No quantity is included at this abutment under Ramp “E”. See below. | Non-friable | 68              | SF   | 210.3312 (BV 14)          |
|           | Removal and Disposal of Bond Breaker/Filler ACM (BV14) - Compressed Asbestos Sheet Packing Material |            |                  |      |                           |
|           | Removal and Disposal of Miscellaneous Asbestos-Containing Materials - Cable Arc Wrap ALLOWANCE (assumed ACM) | Friable    | 30              | LF   | 210.480101                |
|           | Removal and Disposal of Miscellaneous Asbestos-Containing Materials (BV 14) – Braided Wire Insulation ALLOWANCE (assumed ACM) | Non-friable | 20              | LF   | 210.481101 (BV 14)        |
|           | Removal and Disposal of Miscellaneous Asbestos-Containing Materials (BV 14) - Ebony Board ALLOWANCE (assumed ACM) | Non-friable | 2               | SF   | 210.481201 (BV 14)        |
### Exhibit 4.4.16.2 Summary of Asbestos Containing Materials

<table>
<thead>
<tr>
<th>Structure</th>
<th>Description of ACM</th>
<th>Friability</th>
<th>Approx. Quantity</th>
<th>Unit</th>
<th>NYSDOT ITEM # / NYS Dol BV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Removal and Disposal of Miscellaneous Asbestos-Containing Materials (BV 14) – Arc Shields ALLOWANCE (assumed ACM)</strong></td>
<td>Non-friable</td>
<td>0.5</td>
<td>SF</td>
<td>210.481202 (BV 14)</td>
<td></td>
</tr>
<tr>
<td><strong>Removal and Disposal of Miscellaneous Asbestos-Containing Materials (BV 14) – Duct Seal ALLOWANCE (assumed ACM)</strong></td>
<td>Non-friable</td>
<td>1</td>
<td>SF</td>
<td>210.481203 (BV 14)</td>
<td></td>
</tr>
<tr>
<td><strong>Removal and Disposal of Bond Breaker/Filler ACM (BV14) - Compressed Asbestos Sheet Packing Material</strong></td>
<td>Non-friable</td>
<td>30</td>
<td>SF</td>
<td>210.3312 (BV 14)</td>
<td></td>
</tr>
<tr>
<td><strong>Removal and Disposal of Miscellaneous Asbestos-Containing Materials - Cable Arc Wrap ALLOWANCE (assumed ACM)</strong></td>
<td>Friable</td>
<td>30</td>
<td>LF</td>
<td>210.480101</td>
<td></td>
</tr>
<tr>
<td><strong>Removal and Disposal of Miscellaneous Asbestos-Containing Materials (BV 14) – Braided Wire Insulation ALLOWANCE (assumed ACM)</strong></td>
<td>Non-friable</td>
<td>20</td>
<td>LF</td>
<td>210.481101 (BV 14)</td>
<td></td>
</tr>
<tr>
<td><strong>Removal and Disposal of Miscellaneous Asbestos-Containing Materials (BV 14) - Ebony Board ALLOWANCE (assumed ACM)</strong></td>
<td>Non-friable</td>
<td>2</td>
<td>SF</td>
<td>210.481201 (BV 14)</td>
<td></td>
</tr>
<tr>
<td><strong>Removal and Disposal of Miscellaneous Asbestos-Containing Materials (BV 14) – Arc Shields ALLOWANCE (assumed ACM)</strong></td>
<td>Non-friable</td>
<td>0.5</td>
<td>SF</td>
<td>210.481202 (BV 14)</td>
<td></td>
</tr>
</tbody>
</table>

**BIN 1066850: Ramp “E” – I-95 to I-87**

South abutment, between back wall and deck slab.

Note: East abutment is part of the Ramp "C" east abutment (quantity included above)

**BIN 1066870: Ramp “M” – I-87 to I-95**

At north and east abutments, between back wall and deck slab

East Abutment - 6-Relay Control Cabinet in Abutment Wall
### Exhibit 4.4.16.2 Summary of Asbestos Containing Materials

<table>
<thead>
<tr>
<th>Structure</th>
<th>Description of ACM</th>
<th>Friability</th>
<th>Approx. Quantity</th>
<th>Unit</th>
<th>NYSDOT ITEM # / NYSDOL BV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Removal and Disposal of Miscellaneous Asbestos-Containing Materials (BV 14) – Duct Seal ALLOWANCE (assumed ACM)</td>
<td>Non-friable</td>
<td>1</td>
<td>SF</td>
<td>210.481203 (BV 14)</td>
</tr>
</tbody>
</table>

#### 4.4.16.3 Mitigation Summary -

Asbestos Special Notes and Specifications were prepared in reference to the ACMs and PACMs identified in the asbestos assessment and are included in Appendix B: Asbestos Assessment Survey and Design Report. No site-specific variances are anticipated for this project; existing Departmental blanket variances or existing variances will be sufficient.

#### 4.4.17 Contaminated and Hazardous Materials

##### 4.4.17.1 Screening

A Hazardous Waste/Contaminated Materials Site Screening was conducted in accordance with NYSDOT’s *The Environmental Manual (TEM)* Section 4.4.20, in order to document the likely presence or absence of hazardous/contaminated environmental conditions.

##### 4.4.17.2 Assessment and Quantification

A hazardous/contaminated environmental condition is the presence or likely presence of any hazardous substances or petroleum products (including products currently in compliance with applicable regulations) on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on a property or into the ground, groundwater, or surface water of a property.

##### 4.4.17.3 Screening and Site Assessment

The Hazardous Waste/Contaminated Materials Site Screening of the project area included a site walkthrough and a review of NYSDEC regulatory data files, historical maps, historical aerial photographs, previous environmental investigations, and a review of past and current land use.

The results of the Hazardous Waste/Contaminated Materials Site Screening indicated the presence of 5 sites with the potential to impact the project area with hazardous waste and/or contaminated materials. The Site Screening determined the potential for petroleum products, solvents, urban fill, polychlorinated biphenyls (PCBs), and heavy metals to be encountered in the subsurface during construction.

It was recommended that environmental soil investigations (limited to within the proposed soil disturbance areas) be performed in relation to the following areas of concern (AOCs):
<table>
<thead>
<tr>
<th>AOC #</th>
<th>Area Identification</th>
<th>Summary of Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ramp C / BIN 106685B</td>
<td>All three project area ramps were listed as generating lead waste between November, 2007 and May, 2008, likely in association with lead paint abatement activities. Significant areas of exposed soil are located within and alongside the project area. There is a potential for the prior deleading activities to have impacted surface soils.</td>
</tr>
<tr>
<td>2</td>
<td>Ramp E / BIN 1066850</td>
<td>In addition, NYSDEC Spills database records relating to the construction yard located between Ramps E and M stated that “As the site is located next to the Major Deegan Expressway and a couple of ramps next to the expressway, the area received almost a continuous supply of motor vehicle exhaust. This exhaust contains [volatile organic compounds] VOCs and [semi-volatile organic compounds] SVOCs. So the area is more akin in background contamination to an industrial site. Therefore, some analyte hits are to be expected.”</td>
</tr>
<tr>
<td>3</td>
<td>Ramp M / BIN 1066870</td>
<td>At the time of EPM’s May 7, 2015 site visit, the area between Ramps E and M was in use as a construction staging yard and the Major Deegan Expressway. EPM observed several construction vehicles, office trailers, timber and metal supplies, and debris within the unpaved area. A closed NYSDEC Spills database incident was registered to the yard, and the area was previously developed with woodworking facilities, a fur processing facility, a boiler repair facility, and a vinyl record manufacturing facility. The southern portion of the yard underneath the elevated section of Ramp M was previously developed with an enameling and stamping facility, sheet metal works, and a small automotive repair facility. Previous subsurface testing in the area topographically upgradient from the central portion of Ramps E and M indicated the presence of lead and polychlorinated biphenyl-contaminated soil.</td>
</tr>
<tr>
<td>4</td>
<td>Construction Yard / 1475 Sedgewick Avenue</td>
<td>Environmental sampling was conducted through the advancement of seven Geoprobe borings (B1 through B7). Soil samples were submitted for laboratory analyses of VOCs, SVOCs, PCBs, pesticides, and metals. Laboratory analytical results were compared to the NYSDEC Part 375 Remedial Program Soil Cleanup Objectives (SCOs) for Unrestricted Use, Restricted Residential Use, and Commercial Use as detailed in Subparts 375-6(a) and (b). Where no Unrestricted Use SCO has been developed for an analyte, the lowest possible guidance value from NYSDEC Commissioner’s Policy 51 (CP-51) “Soil Cleanup Guidance” was used, if available. Soil impacted above Unrestricted SCOs should be considered potentially contaminated when estimating handling and disposal options for excess soil not reusable onsite due to engineering requirements.</td>
</tr>
<tr>
<td>5</td>
<td>West Adjacent Railroad Tracks</td>
<td>Fire insurance maps dating from 1891 through 2007 depicted a series of railroad tracks located approximately parallel to and between 40 and 60 feet west of the westernmost elevated portions of Ramps E and M. At the time of EPM’s site visit, the tracks closest to the project area were in use to store unused freight and track maintenance vehicles. Several railroad personnel and construction vehicles were observed operating in the area between the tracks and the project area.</td>
</tr>
</tbody>
</table>
impacted above Commercial Use SCOs would be considered environmentally unsuitable for onsite reuse as final cover in unpaved areas.

No VOCs were detected in any of the soil samples at concentrations exceeding Unrestricted Use SCOs.

The majority of soil samples collected across the site contained one or more metals above Unrestricted Use SCOs. No metals were detected among onsite soil samples at concentrations above their Commercial Use SCOs. Only two samples exhibited concentrations of metals in excess of their Restricted Residential: lead in B3 (0-2’) and cadmium in B7 (5-7’).

SVOCs, primarily polycyclic aromatic hydrocarbons (PAHs), were detected in samples B1 (5-7’), B4 (5-7’), and all surface samples except from boring B6.

PCBs and pesticides were detected in the majority of soil samples above their respective Unrestricted Use SCOs. No pesticides were detected above Restricted Residential Use SCOs. Aroclor 1260 was detected in surface samples from borings B5, B6, and B7 in excess of its Commercial Use SCO.

4.4.17.4 Mitigation Summary

SVOCs were found at concentrations exceeding Commercial Use SCOs in three onsite surface soil samples as well as sample B1 (5-7’). PCBs were detected at concentrations exceeding Commercial Use SCOs in surface soil samples collected from borings B5, B6, and B7. Metals and pesticides were detected in the majority of soil samples above Unrestricted Use SCOs. Lead and cadmium were detected at concentrations exceeding their Restricted Residential Use SCOs in samples B3 (0-2) and B7 (5-7’), respectively.

SVOCs and/or PCBs were detected above Commercial Use SCOs in the majority of surface samples collected from the project site. Based on these results, site soils would not be considered suitable for onsite reuse as final grading material, but would likely be suitable for onsite reuse if isolated from public contact by being placed beneath pavement or a layer of clean imported soil.

Based on the findings of this investigation, soil that requires offsite disposal would likely be classified as contaminated for disposal purposes. Any excess soil generated during construction that cannot be reused onsite would likely require additional analysis by the receiving facility to determine appropriate disposal options. The final disposal classification of the material would depend on such results.

4.4.18 Construction Effects

The project will be planned and staged to minimize the impact of construction disruptions to the local community and the environment; however, temporary effects during construction are unavoidable. The anticipated construction impacts consist of temporary traffic detours to accommodate ramp closures, staged construction, construction generated noise, nighttime lane closures, dust, and scenic impacts resulting from construction equipment. To minimize soil erosion during construction, soil erosion control devices will be placed on-site for the duration of construction.

4.4.19 Anticipated Permits, Approvals, and Coordination

It is anticipated that the following coordination, approval and or permits would be required:

New York State Department of Environmental Conservation (NYSDEC):

- State Pollutant Discharge Elimination System (SPDES) General Permit
New York State Department of State (NYSDOS) and New York City Department of City Planning

- Coastal Zone Consistency Certification Statement
- Coastal Zone Local Waterfront Revitalization Certification

Additional Coordination:

- Coordination with Federal Highway Administration
- Coordination with New York State Historic Preservation Officer (SHPO) (Section 106 consultation)
- Coordination with the US Fish and Wildlife Service (if tree cutting is required)