

Historic Bridge Alternatives Analysis for Goethals Bridge Replacement

**Connecting Interstates 278 and 95 over the Arthur Kill
City of Elizabeth, New Jersey, and
Borough of Staten Island, New York**



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Executive Summary

The Port Authority of New York and New Jersey (Port Authority) had formerly proposed a twinning of the Goethals Bridge as part of its 1990s Goethals Bridge Modernization Program (GBMP). As part of the studies of that project, the New Jersey Historic Preservation Office (NJHPO) and the New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP) determined that the Goethals Bridge is eligible for listing in the National Register of Historic Places (National Register) in February and January 1995, respectively. The New York City Landmarks Preservation Commission (LPC) also noted in December 1996 that the bridge was potentially eligible for inclusion in the National Register or as a New York City Landmark. However, the LPC has stated in two Environmental Reviews dated May 16, 2008 and August 13, 2008, which were both based on reviews of recent GBR-related materials, that the Goethals Bridge does not appear to be eligible for LPC designation.

Pursuant to Section 106 of the National Historic Preservation Act of 1966 and the National Environmental Policy Act (NEPA) of 1969, and in conjunction with studies being conducted for the Goethals Bridge Replacement Environmental Impact Statement (GBR EIS), consultation with the NJHPO and the NYSOPRHP was officially initiated in June 2005 with the submittal of a Project Initiation Letter to each agency; NJHPO and NYSOPRHP were also invited to participate as part of the project scoping process for the Draft Environmental Impact Statement (DEIS) in the Fall of 2004. Although this Historic Bridge Alternatives Analysis Report has specifically been requested by the NJHPO, the report serves as part of the Section 106 consultation process for the entire bridge replacement project.

The Architectural Area of Potential Effect (APE) encompasses portions of the cities of Elizabeth and Linden in Union County, New Jersey, and a portion of the Borough of Staten Island (Richmond County), New York City, New York. Most of the APE is relatively flat and low lying. The New Jersey side contains a higher density of industrial uses and residential areas, while the New York side has industrial properties interspersed among large tracts of vacant land and wetlands. The *Historic Architectural Resource Study* (December 2007) revealed a total of 11 historic architectural properties in the New Jersey portion of the APE, including the Goethals Bridge, that have opinions of eligibility for inclusion in the National Register. In the New York portion of the APE, a total of two historic properties have been determined eligible for inclusion in the National Register, both of which are also included on the New Jersey list of eligible resources.

An archaeological assessment has concluded, based on archaeological testing conducted to date, that neither the New Jersey nor the New York portion of the Archaeological APE contains any significant or recommended National Register-eligible prehistoric or historic archaeological resources that would be impacted by any of the Goethals Bridge Replacement project alternatives.

The Goethals Bridge was determined eligible for inclusion in the National Register in 1995 by both NJHPO and NYSOPRHP under Criteria A and C. Criterion A includes sites “that are associated with events that have made a significant contribution to the broad patterns of our history,” which applies in this case because of the bridge’s connection by automobile and truck, along with the Outerbridge Crossing, of New Jersey and New York. Criterion C applies because the bridge was constructed using innovative engineering methods.

The Goethals Bridge was constructed from 1925 to 1928, and carries Interstate 278 over the Arthur Kill between Elizabeth, New Jersey, and Staten Island, New York. The structure currently carries two lanes of traffic in each direction and each lane is approximately 10 feet wide. There are no shoulders on the structure. The north and south sidewalks in the truss spans are 5 feet wide, but pedestrian traffic has been prohibited on the bridge in recent years due to safety and security issues. The width of the approach

sidewalks was reduced to 3'-4" in the mid-1960s when a concrete barrier curb was installed on all approach spans.

In the period from 1987 to 2005, a total of almost \$121 million was spent in repair and maintenance. A complete deck replacement with seismic retrofit, security upgrades and other related repairs will be required within the next decade, and is expected to cost approximately \$276 million (2007 dollars). Significant repair and maintenance contracts will continue to be required every 10 to 50 years, depending on the specific nature of the work.

An analysis has also been conducted of the life-cycle cost of bridge rehabilitation. This analysis considered the activities and associated costs for rehabilitation and maintenance of the existing Goethals Bridge for an additional 100 years beyond any near-term rehabilitation (i.e., the costs associated with a 100-year service life, until 2110), consistent with the design life for a replacement bridge. These life cycle costs are estimated at approximately \$804 million in 2007 dollars (net present value), including the near-term rehabilitation and bridge deck replacement required by 2014 or 2015.

A comprehensive traffic data collection program was performed for the GBR EIS in 2004. Existing traffic volumes crossing the bridge total approximately 38,000 eastbound vehicles on an average weekday and over 40,000 daily vehicles on Saturdays and Sundays. During the AM peak period, the bridge carries over 7,100 vehicles eastbound, while eastbound traffic during the PM peak period increases to over 11,000 vehicles (PM eastbound traffic carries the largest volume of vehicles). Preliminary travel forecasts for 2034 (the future No-Build analysis year) indicate that without improvements at the Goethals Bridge crossing, peak-period traffic will operate at level-of-service F, reflecting breakdown conditions, excessive congestion and delays, which is considered to be below acceptable operating conditions. Substandard design features that adversely affect traffic operations and safety include 10-foot lane widths, lack of emergency shoulder lanes, and a pronounced bend in the alignment of the New Jersey approach span.

Accident rates on the Goethals Bridge are the highest among the Port Authority's three Staten Island bridges, and are higher than the normal statewide rates for four-lane highways in both New York and New Jersey. The comparatively high number of accidents on the Goethals Bridge can be attributed to the undesirable combination of narrow lane widths, lack of emergency shoulders, and steep grade constraints.

To address these problems, four bridge replacement alternatives anticipated to be of a cable-stayed design are currently being evaluated in detail in the GBR EIS, in addition to the No-Build alternative. The four project alternatives include: a new 6-lane bridge either south or north of, and largely inclusive of the existing structure's alignment (i.e., Existing Alignment South and Existing Alignment North, respectively); and a new 6-lane bridge either entirely south or north of the existing structure's alignment (i.e., New Alignment South and New Alignment North, respectively). The estimated preliminary costs for these alternatives range from approximately \$754 million to \$802 million (in 2007 dollars), including ancillary construction costs for the demolition of the existing bridge as well as the redesign of the railroad bridge that crosses over I-278 at a point west of the Goethals Bridge toll plaza in Staten Island. These four "build" alternatives were selected for evaluation in the EIS on the basis of an alternatives screening process, including agency and public input and comment on the process and its results.

Other options considered in the alternatives screening process, but which were not advanced for detailed evaluation in the GBR EIS for a variety of reasons, included both structural and non-structural solutions. Among the alternatives presented in this report that have been considered and dismissed due to their inability to fully achieve the current purpose and need and associated goals identified for the project include: 1) Rehabilitation According to the Secretary of Interior's Standards for Rehabilitation; 2) Modified Rehabilitation, or Parallel-Bridge Alternative (i.e., rehabilitation and reconfiguration of the existing bridge span to carry one direction of traffic and construction of a second, new span, either north

or south of the Goethals Bridge, for the opposing direction of traffic); and 3) a variety of others. The criteria used to screen potential alternatives were defined to reflect the purpose and need for the proposed project and included: feasibility considerations; traffic performance, including safety; environmental considerations; and construction cost and complexity. The four alternatives selected for EIS evaluation were those deemed to have the highest potential to address the project's purpose and need.

The project, as proposed, would result in an Adverse Effect to three historic properties. The proposed replacement of the Goethals Bridge would result in an adverse effect on the bridge itself, a National Register-eligible property, by requiring the structure's demolition. Under Section 106, the "physical destruction of or damage to all or part of a historic property" is an adverse effect. In the case of the proposed Goethals Bridge Replacement and its relationship to other historic properties, any of the four replacement alternatives being considered would be generally consistent with the current bridge alignment in terms of spatial relationship between the Staten Island Railroad Historic District (SIRRHD) and the bridge; the same is true between the Staten Island Railway Lift Truss Bridge over the Arthur Kill and the Goethals Bridge. Both resources are located to the north of the bridge and would not be directly impacted by the footprint of any bridge alternative. The SIRRHD has a NJHPO Opinion of Eligibility, while the Lift Bridge has both a NJHPO Opinion of Eligibility and a NYSOPRHP Determination of Eligibility. The SIRRHD's eligibility as a historic resource in New Jersey, as well as the Lift Bridge's eligibility in both states, do not depend upon their respective relationships to the Goethals Bridge, and the proposed bridge alternatives would not directly impact the character-defining features of the resource, which would continue unimpaired. There would be, however, an adverse effect to both resources through the introduction of visual elements associated with the replacement bridge. Mitigation of the adverse effects would be determined in consultation with the NJHPO and the NYSOPRHP and could include Level II Historic American Engineering Record (HAER) recordation.

1.0. The Proposed Project

1.1 Introduction

The Port Authority of New York and New Jersey (the Port Authority) has proposed a Goethals Bridge Modernization Program (GBMP), featuring a new crossing to replace the existing Goethals Bridge, referred to herein as the “Goethals Bridge Replacement” (GBR) or the “Proposed Project.” The Goethals Bridge provides a direct connection between Staten Island, New York, and Elizabeth, New Jersey. It facilitates mobility between the two states as part of the Port Authority’s Interstate Transportation Network, comprised of the George Washington Bridge, the Holland and Lincoln Tunnels, and the three Staten Island Bridges (i.e., Goethals Bridge, Outerbridge Crossing, and Bayonne Bridge). In addition, the bridge is considered a primary path of travel within the Southern Corridor, connecting Interstate 278 (the Staten Island Expressway) near Staten Island’s north shore with the New Jersey Turnpike (Interstate 95) and U.S. Route 1/9 in New Jersey.

The Port Authority notified the U.S. Coast Guard (USCG) by letter of June 3, 2004, of its intent to submit a formal application for a Bridge Permit under the General Bridge Act of 1946, for replacement of the Goethals Bridge. Accordingly, the USCG assumed the role of the lead federal agency for preparation and issuance of the Goethals Bridge Replacement Environmental Impact Statement (GBR EIS), in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969, as amended, and other federal requirements, regulations, and guidance, as applicable.

Based on a historic architectural survey and on documentation of the Goethals Bridge submitted to the New Jersey Historic Preservation Office (NJHPO) for review and concurrence related to an earlier Goethals Bridge project proposal (USCG 1995), the Goethals Bridge was given an opinion of eligibility for listing on the National Register of Historic Places (National Register). The NJHPO provided concurrence on the submitted documentation via letter dated February 14, 1995 and the New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP) provided concurrence via letter dated January 24, 1995. Additionally, the New York City Landmarks Preservation Commission (LPC) noted the structure as potentially eligible in 1996, although it identified the bridge as not being eligible for LPC designation in two Environmental Reviews dated May 16, 2008 and August 13, 2008, following the review of recent GBR-related materials.

Potential impacts to historic resources are analyzed in conformance with Section 106 of the National Historic Preservation Act of 1966 (NHPA). Section 106 of the NHPA requires that federal agencies or applicants for federal funding, permits and authorizations take into account the effects of their undertaking on historic properties. Historic properties include buildings, districts, objects, sites, and structures, as well as prehistoric and historic archaeological sites and objects, listed on or eligible for listing on the National Register. The steps required to be undertaken by federal agencies in order to comply with Section 106 are outlined in the Advisory Council on Historic Preservation’s (ACHP) regulations implementing Section 106, *Protection of Historic Properties* (36 CFR 800). The implementing regulations require federal agencies to consult with the respective state’s State Historic Preservation Offices (SHPO) to: identify historic properties potentially affected by the undertaking; assess the undertaking’s effects on properties listed or eligible for listing on the National Register; and avoid, minimize, or mitigate any adverse effects on historic properties.

Section 106 consultation with the two SHPOs having responsibility in the Goethals Bridge study area, for purposes of the proposed bridge replacement, began in June 2005. (Appendix A of this report includes the June 17, 2005 Project Initiation Letters to both SHPOs.)

In the State of New Jersey, the responsible state agency is the NJHPO, which is an office within the New Jersey Department of Environmental Protection. In the State of New York, the NYSOPRHP serves as the SHPO. Consultation and review of historic architectural issues in New York is conducted under authority of the New York State Historic Preservation Act of 1980 (Chapter 354 of Parks, Recreation and Historic Preservation Law).

1.2 Project Background

The Goethals Bridge, built in the 1920s, was completed in 1928. Opening day was June 29, 1928, on the same day as the opening of the Outerbridge Crossing. This event marked the successful completion of the first two bistate development projects by the recently-created Port Authority. Both bridges were built to accommodate increasing bi-state automobile and truck traffic following World War I. The bridge was named in memory of Major General George W. Goethals, builder of the Panama Canal and the first consulting engineer of the Port Authority.

When the Goethals Bridge and the other Staten Island Bridges were first designed and constructed, traffic conditions were very different from the conditions that exist today. Initially, the bridges were not heavily used, primarily facilitating movements between New Jersey and Staten Island. However, the opening of the Verrazano-Narrows Bridge in 1964 created a highly used travel corridor from New Jersey through Staten Island to Brooklyn, Queens, and the rapidly developing counties of Nassau and Suffolk on Long Island. The opening of the Verrazano-Narrows Bridge also resulted in rapid growth of Staten Island in the ensuing years. These factors led to marked growth in traffic volumes on the Goethals Bridge.

The existing Goethals Bridge, originally designed for narrower vehicles and local traffic movements, has become increasingly deficient in accommodating the expanding markets it serves. As early as the mid-1980s, the Port Authority recognized that the bridge had become functionally and physically obsolete as original design features based on then-current codes and standards no longer met current standards. In addition, deteriorated traffic conditions and relatively higher accident levels on the bridge were attributed to ever-increasing traffic volumes, including truck traffic; these conditions had also been projected to continue to deteriorate in future years. The Port Authority then undertook a screening analysis of potential alternative improvements for the Staten Island Bridges, and an environmental review of the alternatives that appeared to best address identified needs at that time was undertaken in the early 1990s.

As a result of those studies, the Port Authority proposed the construction of a parallel bridge operating in conjunction with the existing bridge to enhance the bridge's capacity to meet the future transportation needs of the region. This proposal became known as the Staten Island Bridges Program – Modernization and Capacity Enhancement Project. A Notice of Intent (NOI) was published in the Federal Register by the USCG for a proposed twinning of the Goethals Bridge. Subsequently, a DEIS was completed in 1995 and a Final Environmental Impact Statement (FEIS) was completed in 1997. However, a Record of Decision (ROD) for the project was not issued due to various unresolved issues.

Although the project was stalled for several years, the need for modernization of the Goethals Bridge only increased. The Port Authority reassessed the condition of the existing Goethals Bridge, its operational constraints and improvement needs. In addition to the various needs that had been identified during the early 1990s, the Port Authority determined that due to the age and condition of the bridge, there is also an ongoing need to enhance structural integrity of the bridge and to reduce life-cycle costs associated with long-term maintenance, repair and rehabilitation of the bridge. Additional factors underlying the current need for a modernized bridge include: 1) the need to provide standard features and address design deficiencies; 2) the need to provide system redundancy, especially in the post-9/11 era; 3) the need to improve traffic service as the traffic operations on the bridge continue to deteriorate; 4) the need to provide safer operating conditions and reduce accidents; 5) the need to provide for safe and reliable truck

access for regional goods movement; and 6) the need to provide for potential future transit in the corridor. These needs are discussed in greater detail in Section 4.0 of this report.

As a result of a reassessment of the project and identification of the current needs of the bridge, the Port Authority determined that a total replacement of the existing Goethals Bridge would be the best solution to meet the project's needs. Following discussions with the USCG as the lead federal agency, it was determined that a new EIS should be prepared for the project, which is now named the "Goethals Bridge Replacement (GBR) Project." A Notice of Intent (NOI) to prepare an EIS for the proposed replacement of the Goethals Bridge was published in the Federal Register on August 10, 2004.

1.3 Report Organization

This report has been prepared for submittal to the NJHPO in response to its specific request for a Historic Bridge Alternatives Analysis, although it is also being prepared for NYSOPRHP's use as well, in order to:

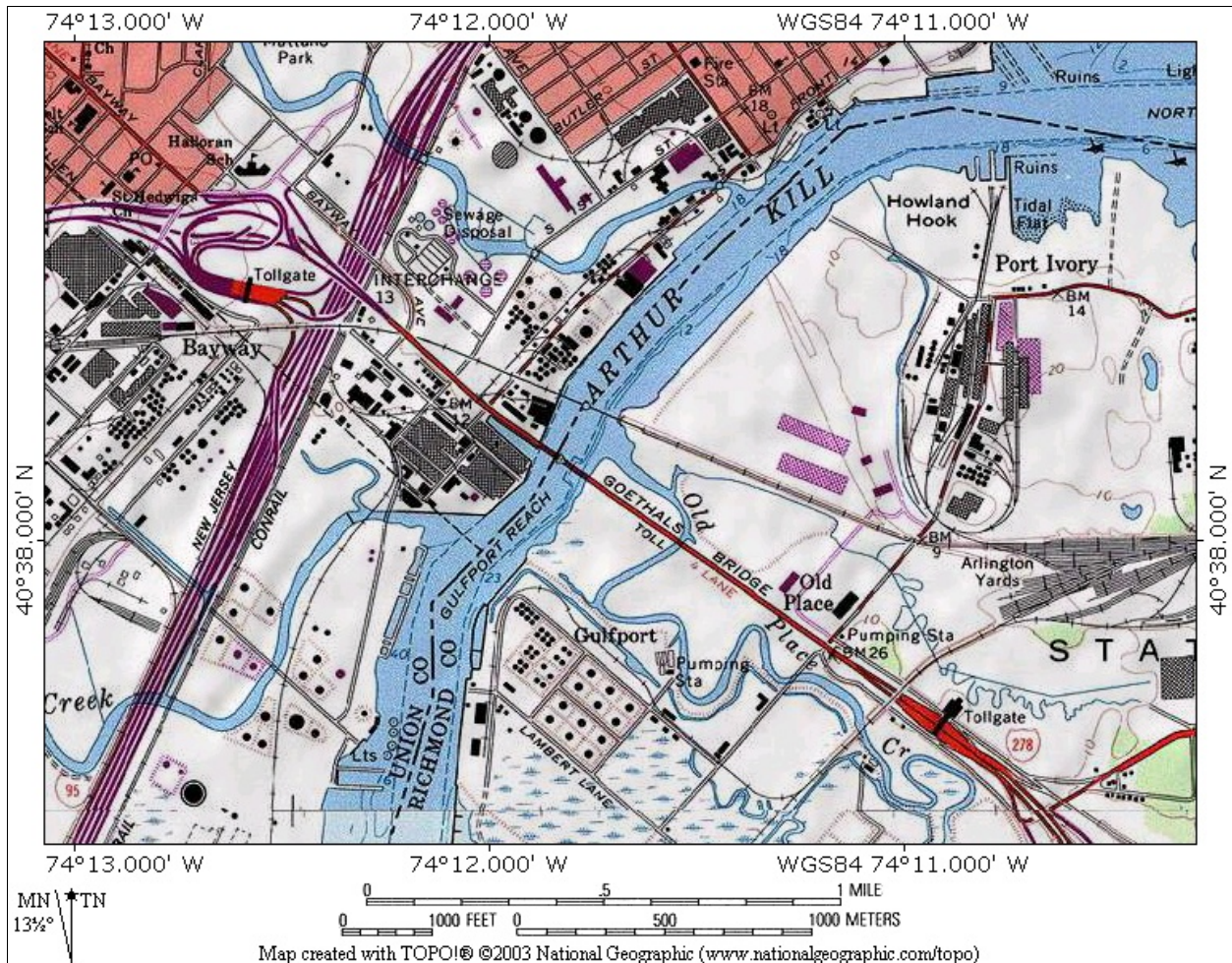
- describe the location of the Goethals Bridge, and its natural and built environs (Section 2.0 of this report);
- describe the existing Goethals Bridge structure and its historic significance (Section 3.0);
- explain the purpose and need for the proposed project (Section 4.0);
- summarize the alternatives screening analysis conducted for the GBR EIS and describe the resultant project alternatives under consideration (Section 5.0);
- present the rationale and justification for the USCG's identification of bridge-replacement alternatives for detailed evaluation in the EIS process (Section 6.0); and
- recommend the finding of effect pertaining to the proposed bridge replacement (Section 7.0).

There are also several appendices that follow the main report, each providing further support regarding the information presented herein.

2.0 Project Location

The Goethals Bridge spans the Arthur Kill linking the New Jersey Turnpike (Interstate 95) via Interchange 13 in Elizabeth, New Jersey, with the Staten Island Expressway (Interstate 278) on Staten Island, New York (see Figure 1). In addition to the New Jersey Turnpike, the Goethals Bridge provides access to and from Routes 1 and 9 and other New Jersey highways, and is a major route for traffic traveling between New Jersey and Brooklyn, New York, with direct connections via the Staten Island Expressway to the Verrazano-Narrows Bridge.

FIGURE 1: PROJECT LOCATION



2.1 Characteristics of Surrounding Natural Environment

The proposed project is located in the Piedmont physiographic province, near its intersection with the Atlantic Coastal Plain and the Manhattan Prong of the New England Uplift. The elevation of the New Jersey approach to the Goethals Bridge ranges from 5 to 12 feet above mean sea level. The topography of the Staten Island approach is low lying, with ground-surface elevations ranging from 3 to 10 feet above mean sea level. The meandering courses of both Morses Creek and Old Place Creek in the New Jersey and Staten Island portions of the project study area, respectively, indicate a low surface relief.

Over the last 200 years, the vegetation of the Goethals Bridge study area has been altered by human activity, including upland clearing, wetland ditching and filling, residential and industrial development, introduction and spread of invasive species, obstructions of surface water movement, and other less physically intrusive disturbances, such as noise from airports and automobile traffic. Industrial development has increased the potential for spills of industrial fuels and chemicals and illegal dumping, which can damage the environment by causing destruction of habitat and loss of species. These actions have directly or indirectly changed and shaped the historical ecological communities to their present state. The Staten Island side of the Arthur Kill, by far, contains the greatest amount of remaining natural environment in the vicinity of the Goethals Bridge, as the New Jersey side is much more heavily developed.

The ecological communities in general proximity to the Goethals Bridge, although influenced by human development and/or invasion by non-native plant species, support a variety of plant species and provide habitat for area wildlife, principally on the Staten Island side of the study area. The environs of the Goethals Bridge in Staten Island reflect a convergence of different types of ecosystems: the channels and shoals of the Arthur Kill and Old Place Creek; adjacent upland areas; and intervening wetland complexes that range from tidal marsh to seasonally-inundated palustrine communities. Superimposed on the continuum of ecosystems is a convergence of aquatic habitats ranging from the saltwater regime of the Arthur Kill to tidal creeks and freshwater wetlands. This complex landscape provides a wide range of chemical, physical, and biological habitat conditions. In turn, this diversity of habitats is reflected in a range of migratory and movement patterns, reproductive strategies, and food preferences among the members of the aquatic and terrestrial communities.

The tidally-influenced communities appear relatively stable with respect to plant succession and wildlife use. One ongoing impact on the marsh communities is the spread of *Phragmites*, which reduces plant diversity and, potentially, wildlife use of a given habitat. Two human-related effects on the tidal community are the effects of boat wakes and prior oil spills.

Despite prior disturbance, the uplands and wetlands provide food, cover, nesting, and resting habitat for the resident mammals and birds as well as birds that utilize the Arthur Kill as a migratory corridor. Many of the bird species common in the area are tolerant of some degree of human presence/disturbance and are "generalists" with regard to habitat requirements, i.e., they are able to utilize several of the habitats present for feeding, cover, and so on. However, several habitat-specific species are also present that utilize only one of the described habitats.

The wildlife value of the existing communities is enhanced by their interconnected nature. North of the Goethals Bridge, the intertidal marsh merges with the high marsh, which then merges with the upland non-native forest. This mosaic of communities increases the amount of "edge" between habitats, increasing utilization opportunities for habitat-specific and generalist wildlife species. In addition to the mosaic of community types in the study area, the proximity of Goethals Bridge Pond adds to the value of existing communities by providing additional foraging grounds and habitat. The pond is located north of the existing Goethals Bridge toll plaza. The pond is a permanent, but seasonally fluctuating freshwater (or slightly brackish) pond that is fed primarily by groundwater seepage and run-off. Goethals Bridge Pond is a New York State Department of State designated Significant Coastal Fish and Wildlife Habitat.

Wetlands dominate the study area east of the Arthur Kill in Staten Island but are limited in New Jersey, west of the Arthur Kill. Wetlands consist of two principal types: open water (Arthur Kill, Newark Bay and Upper New York Bay) and tidal wetlands that are associated with these open waters. Regional tidal wetlands include several creeks and tidal marshes along the Arthur Kill, north and south of the Goethals Bridge. To the north of the Goethals Bridge in New Jersey, the area is developed primarily for industrial use. The Elizabeth River enters the Arthur Kill northwest of the Goethals Bridge and is urbanized at its

outlet. Fringe tidal marsh along the Elizabeth River exists upstream of its outlet. North of the Elizabeth River along the Arthur Kill, bulkheads and fill extend to the Newark Bay.

To the south of the Goethals Bridge in New Jersey is Morses Creek, whose outlet to the Arthur Kill contains bulkheads and piers for docking cargo ships. Upstream of Morses Creek's outlet, the water's edge contains tidal marshes similar to those of Old Place Creek. South of Morses Creek is a small tributary to the Arthur Kill, known as Piles Creek. Similar to Morses Creek, the Piles Creek outlet contains a bulkhead or fill at its water's edge and fringe tidal wetlands upstream of the outlet. South of the Goethals Bridge, the Arthur Kill shoreline along the New Jersey side is dominated by bulkheads, shipping piers and fill.

On Staten Island, north of the Goethals Bridge and Old Place Creek outlet, is the bulkhead of Howland Hook Marine Terminal. North of the terminal is Howland Hook which contains a small tributary and associated tidal wetlands that discharges to the Arthur Kill. Beyond Howland Hook is the confluence of the Arthur Kill and the Kill Van Kull, which forms the southern terminus of Newark Bay; along the shoreline of Howland Hook are piers and tidal wetlands.

South of the Goethals Bridge are the Pralls and Sawmill Creeks. Pralls Creek separates Staten Island from the small Pralls Island, which contains tidal wetlands. East of Pralls Island is Sawmill Creek, containing a network of tidal ditches flowing from the tidal wetlands along the sides of Pralls Creek.

In summary, while the defined communities and wetlands have been influenced by human development and/or invasion by non-native plant species, they support a variety of plant species and provide habitat for area wildlife, principally on the Staten Island side of the study area.

2.2 Characteristics of Surrounding Built Environment

2.2.1 Urban Character

The Goethals Bridge rises out of a dynamic urban/industrial environment. The existing land use patterns were basically established in the 19th century, predicated in large measure on maritime and railroad transportation and the access both provided to raw materials and markets. Twentieth-century developments in transportation followed 19th century alignments; these included the vehicular bridge across the Arthur Kill to Staten Island (Goethals Bridge) beside the much earlier Baltimore and New York Railroad (Arthur Kill) crossing.

Because of their different development histories, the New Jersey and New York sides of the Goethals Bridge have different development patterns. The New Jersey side contains a higher density of industrial uses and residential areas, while the New York side has industrial properties interspersed among large vacant lands and wetlands (these differences in land uses can be seen in Figure 1). The New York side has recently been the focus of new development plans or proposals, including a NASCAR race track and shopping mall, warehousing and the expansion of port and intermodal facilities in and around New York Container Terminal (operator of the Howland Hook Marine Terminal).

New Jersey

The area immediately around the Goethals Bridge approach (roughly between the Elizabeth River and Morses Creek) is intensively developed. This development began in the mid to late 19th century at what was probably then a peninsula of upland providing access to the Arthur Kill (at a relatively narrow point) and buildable ground for industry. East of the New Jersey Turnpike, the Goethals and Arthur Kill Lift bridges and approaches are the most dominant features. Below and close to either side of the approaches

are closely-spaced, late 19th to mid 20th century industrial buildings, varying from one to several stories, with brick, concrete, concrete block, or metal-clad exteriors. There are also brick and wood frame remnants of the residential neighborhood that grew up in response to the industrial development here. Toward the Elizabeth River, the more open reclaimed marshland features industrial buildings and small tank farms.

Immediately west of New Jersey Turnpike Interchange 13 (north of the long elevated access ramps between Route 1&9 and the New Jersey Turnpike) is a densely built-up urban neighborhood fanning out from Bayway, consisting primarily of low-scale (2.5 stories generally being the maximum height), wood frame and brick-masonry residences and small mixed-use blocks dating to the late 19th to early 20th centuries, terminating at the interchange in service stations from late 20th century. To the north are the Halloran School, Mattano Park (containing a channelized stretch of the Elizabeth River), and a large PSE&G electrical substation, from which emanate lines of tall steel transmission towers. Downstream from Moses Creek, the environment is characterized by an almost abstract landscape of large-scale late 20th century infrastructure and industry that are rather widely scattered across flat, partially reclaimed marshland transected by the former Central Railroad of New Jersey alignment and the New Jersey Turnpike, with a PSE&G generating station on the waterfront on the north side of Piles Creek.

New York

The Staten Island side of the Goethals Bridge is mostly undeveloped or vacant, although transportation and utility, residential, and commercial uses are also present.

Located to the north of the existing bridge approach, between the Arthur Kill and Western Avenue, is an area of wetlands and the 187-acre New York Container Terminal. The SIRR runs between these two areas. A Coca-Cola distributorship is located in the northwest quadrant of the intersection of Western Avenue and Goethals Road North. Located on the north side of Goethals Road North, between Western and Forest Avenues, are a Texas Eastern metering station (in the northeast quadrant of the intersection of Western Avenue and Goethals Road North), a large tract of undeveloped land, the Goethals Bridge administration building and maintenance facility, Goethals Garden Homes Community (a mobile home park), a vacant commercial property and additional undeveloped land. Joseph Manna Park, a small passive city park, is located in the northwest quadrant of Forest Avenue and Goethals Road North. The Travis Branch of the SIRR crosses I-278 in a north-south direction approximately 400 feet east of the existing toll plaza.

2.2.2 Historic Properties

The historic architectural resource studies were conducted to identify historic properties within the Architectural APE. Table 1 contains a list and summary of the eligibility of the resources identified and evaluated as part of the Section 106 process. These resources are mapped on Figure 2. There are a total of 11 historic properties in the Architectural APE that have Opinions of Eligibility from NJHPO and NYSOPRHP as the State Historic Preservation Offices (SHPOs) in New Jersey and New York, respectively (see Figure 3). The historic properties identified in the Architectural APE in New Jersey and New York are outlined below:

1. The Goethals Bridge (NJ and NY SHPO Eligible 1995)
2. The Staten Island Railroad Historic District (NJ SHPO Opinions 6/11/1991 & 2/27/1995)
3. Staten Island Railway Lift Truss Bridge over the Arthur Kill (NJ SHPO Opinion 6/11/1991 & NY SHPO Determination 6/4/2008)
4. Perth Amboy and Elizabethport Branch of the Central Railroad of New Jersey (NJ SHPO Opinion 8/30/2000)

5. Central Railroad of New Jersey Bridge over the Elizabeth River (NJ SHPO Opinion 4/19/1990)
6. South First Street Bridge over the Elizabeth River (NJ SHPO Opinion 3/23/1998)
7. Mattano Park (NJ SHPO Opinion 5/21/2008)
8. Mravlag Manor Housing (NJ SHPO Opinion 5/21/2008)
9. Sound Shore Railroad Historic District (NJ SHPO Opinion 5/21/2008)
10. Sound Shore Railroad Bridge over Morses Creek (contributing resource to the Sound Shore Railroad Historic District)
11. South Front Street Bridge (NJ SHPO Opinion 5/21/2008)

2.2.3 Archaeological Resources

All areas within the New Jersey and New York Archaeological APEs were systematically tested for the presence of archaeological resources if they: 1) were not obscured by impervious surfaces, such as buildings and paved parking areas; 2) did not contain previously documented disturbed/contaminated soils; and 3) were not obscured by standing water. The shovel test pit transects that were excavated for this project are representative of where the ground disturbances would occur within each of the four alternatives discussed in Section 5.3.2, with the exception of the proposed relocation of Goethals Road North (on the New York side) that is associated with both of the Northern alternatives being considered.

Subsurface testing within the New Jersey Archaeological APE did not identify any significant or recommended National Register-eligible archaeological deposits; the NJHPO has concurred that no further archaeological investigations are required within the New Jersey Archaeological APE (NJHPO September 28, 2007). Likewise, the portions of the New York Archaeological APE that were archaeologically investigated do not contain any significant or recommended National Register-eligible prehistoric or historic archaeological resources that will be impacted by any of the four alternatives being considered and that are identified in Section 5.3.2. The NYSOPRHP concurred that no National Register-eligible archaeological resources were identified within the areas of the New York APE that were investigated (NYSOPRHP November 16, 2007 and December 18, 2007). However, as the area of the proposed relocation of Goethals Road North associated with both of the Northern Alternatives being considered were not archaeologically investigated, the NYSOPRHP requires that additional archaeological testing be conducted along the proposed route of the relocation of Goethals Road North if one of the Northern Alternatives is ultimately selected as the environmentally preferred option. Such investigation would be conducted to determine if National Register-eligible archaeological resources are present within that portion of the APE and, if present, such resources would be impacted by the roadway relocation (NYSOPRHP December 18, 2007). Additionally, any proposed staging/work areas beyond the limits of the New Jersey or New York Archaeological APE for which final design plans are not currently available have not been investigated for the presence of archaeological resources. As such, these areas may require an archaeological assessment and/or investigation as well as continued consultation with the SHPOs if any work is performed outside of the respective Archaeological APE that has been investigated to date. No specific plans for such work currently exist, however.

TABLE 1: HISTORIC RESOURCES IDENTIFIED WITHIN THE AREA OF POTENTIAL EFFECT: NEW JERSEY AND NEW YORK

MAP NO.	NAME/ADDRESS	BLOCK/LOT	DATE BUILT	ELIGIBILITY STATUS
New Jersey Resources:				
1*	Goethals Bridge	N/A	1928	Eligible (NJ SHPO Opinion 2/14/1995 & NY SHPO Determination 1/24/1995)
2	167 Bayway, Elizabeth	4/179	ca. 1915	Not Eligible (See also Bayway-Krakow Street District)
3	147 Bayway, Elizabeth	4/177	ca. 1922	Not Eligible (See also Bayway-Krakow Street District)
4	145 Bayway, Elizabeth	4/176	ca. 1922	Not Eligible (See also Bayway-Krakow Street District)
5	137-143 Bayway, Elizabeth	4/175	ca. 1917	Not Eligible (See also Bayway-Krakow Street District)
6	135 Bayway, Elizabeth	4/174	ca. 1922	Not Eligible (See also Bayway-Krakow Street District)
7	133 Bayway, Elizabeth	4/173	ca. 1922	Not Eligible (See also Bayway-Krakow Street District)
8	123 Bayway, Elizabeth	4/172	ca. 1910	Demolished
9	119 Bayway, Elizabeth	4/171	ca. 1950	Not Eligible (See also Bayway-Krakow Street District)
10	117 Bayway, Elizabeth	4/170	ca. 1922	Not Eligible (See also Bayway-Krakow Street District)
11	109 Bayway, Elizabeth	4/167	ca. 1922	Not Eligible (See also Bayway-Krakow Street District)
12	100-103 Bayway, Elizabeth	4/163	ca. 1922	Not Eligible (See also Bayway-Krakow Street District)
13	93-95 Bayway, Elizabeth	4/162	ca. 1903	Not Eligible (See also Bayway-Krakow Street District)
14	89 Bayway, Elizabeth	4/159	ca. 1922	Not Eligible (See also Bayway-Krakow Street District)
15	663 Amboy Avenue	4/51	ca. 1922	Not Eligible (See also Bayway-Krakow Street District)
16	100-106 Krakow Street, Elizabeth	4/51	ca. 1922	Not Eligible (See also Bayway-Krakow Street District)
17	112 Krakow Street, Elizabeth	4/833	ca. 1922	Not Eligible
18	114 Krakow Street, Elizabeth	4/834	ca. 1922	(See also Bayway-Krakow Street District)
19	118 Krakow Street, Elizabeth	4/835	ca. 1922	Not Eligible
20	120 Krakow Street, Elizabeth	4/836	ca. 1922	(See also Bayway-Krakow Street District)
21	Bayway Terminal Storage Warehouse, 666 South Front Street, Elizabeth	4/1471	1927	Not Eligible
22	Phelps Dodge Complex, Elizabeth	4/55 & 4/1457	ca. 1903-1950	Not Eligible
23	Borne Scrymser Company, 632-650 South Front Street, Elizabeth	4/1469	1917-1941	Not Eligible
24*	Staten Island Railroad Historic District, (New Jersey Portion: Elizabeth to Cranford Junction)	N/A	1889-1959	Eligible (NJ SHPO Opinion 2/27/1995)
25*	Staten Island Railway Lift Truss Bridge over Arthur Kill	N/A	1959	Eligible (NJ SHPO Opinion 6/11/1991)

* Note: Resource Nos. 1, 24 and 25 have also been identified within the New York APE.

TABLE 1 (CONTINUED): HISTORIC RESOURCES IDENTIFIED WITHIN THE AREA OF POTENTIAL EFFECT – NEW JERSEY AND NEW YORK

MAP NO.	NAME/ADDRESS	BLOCK/LOT	DATE BUILT	ELIGIBILITY STATUS
26	Perth Amboy and Elizabethport Branch of the Central Railroad of New Jersey (CNJ), Elizabeth	N/A	1871	Eligible (NJ SHPO Opinion 8/30/2000)
27	Elizabeth River Bridge, Central Railroad of New Jersey (CNJ), Elizabeth	N/A	ca. 1912	Eligible (NJ SHPO Opinion 4/9/1990)
28	South Front Street over Elizabeth River, Elizabeth Bridge # 2004001	N/A	1920	Eligible (NJ SHPO Opinion 5/21/2008)
29	South First Street over Elizabeth River, Elizabeth	N/A	1908	Eligible (NJ SHPO Opinion 3/23/1998)
30	Mattano Park, Elizabeth (Union County Park System)	4-59, 5/453.B, 5/1262, 7/968	1921-1964	Eligible (NJ SHPO Opinion 5/21/2008)
31	Mravlag Manor Housing Project 635-681 & 640-664 Clarkson Avenue, Elizabeth	4/361	1939	Eligible (NJ SHPO Opinion 5/21/2008)
32	2710 Allen Street Extension, Linden	586/4	ca. 1920	Not Eligible
33	Carringer Road Bridge over Morses Creek, Linden	586/5	ca. 1950	Not Eligible
34	Sound Shore Bridge over Morses Creek, Linden	586/10	ca. 1920	Contributing Resource to the Sound Shore Railroad
35	Sound Shore Railroad	N/A	ca. 1895	Eligible (NJ SHPO Opinion 5/21/2008)
36	735-757 South Front Street, Elizabeth	4/1458	ca. 1919	Not Eligible
37	760-766 South Front Street, Elizabeth	4/1472	ca. 1950	Not Eligible
38	Bayway-Krakow Street District, Elizabeth	See Map Nos. 2-19	ca. 1901-1923	Not Eligible
39	534-538 and 529-539 South Front Street, Elizabeth	4/1466 & 4/1447	1954 1923	Not Eligible
40	346-532 South Front Street, Elizabeth	4/1464 & 4/1445	ca. 1948 ca. 1923	Not Eligible
41	76-78, 80-312 and 314-344 South Front Street, Elizabeth	4/1461 4/1462 & 4/1463	ca. 1920	Not Eligible
42	2-74 South Front Street, Elizabeth	4/1459	ca. 1930	Not Eligible
43	1-13 South Front Street, Elizabeth	4/1436	ca. 1875	Not Eligible
44	15-21 South First Street, Elizabeth	4/1438.B	ca. 1923	Not Eligible
45	65-85 South Front Street, Elizabeth	4/1438.A	ca. 1950	Not Eligible
46	437 Doyle Street, Elizabeth	5/241.I	ca. 1950	Not Eligible
47	436 Redcliffe Street, Elizabeth	5/1153.I	ca. 1950	Not Eligible
48	437 Redcliffe Street, Elizabeth	5/1144.D	ca. 1950	Not Eligible
49	436 Loomis Street, Elizabeth	5/859.E	ca. 1950	Not Eligible
50	475 Fifth Avenue, aka 439 Loomis Street, Elizabeth	5/895	ca. 1950	Not Eligible
51	505 South Fifth Street, Elizabeth	5/1251	ca. 1945	Not Eligible

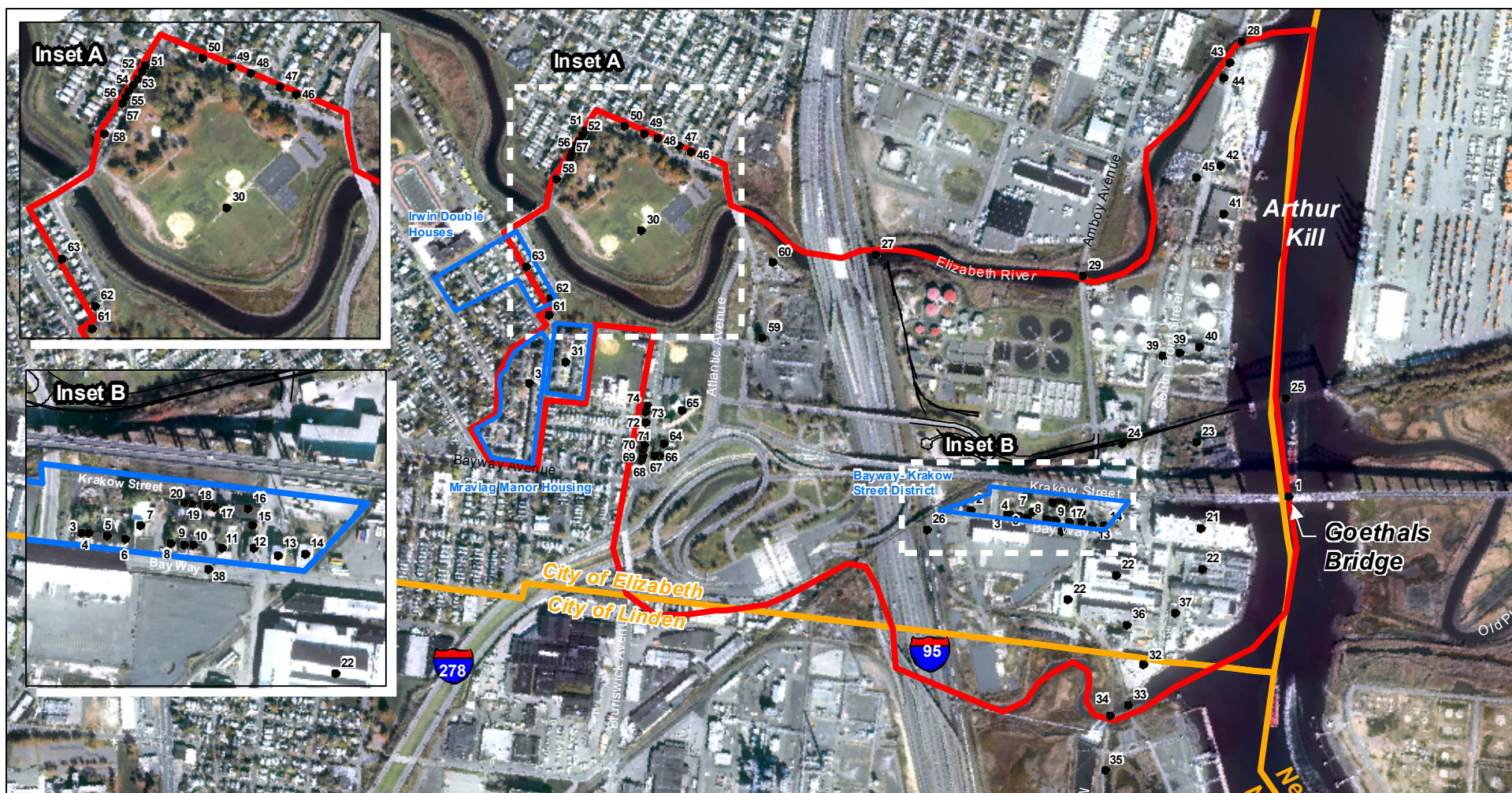
TABLE 1 (CONTINUED): HISTORIC RESOURCES IDENTIFIED WITHIN THE AREA OF POTENTIAL EFFECT – NEW JERSEY AND NEW YORK

MAP NO	NAME/ADDRESS	BLOCK/LOT	DATE BUILT	ELIGIBILITY STATUS
52	507 South Fifth Street, Elizabeth	5/1252	ca. 1930	Not Eligible
53	511-513 South Fifth Street, Elizabeth	5/1253	ca. 1950	Not Eligible
54	515 South Fifth Street, Elizabeth	5/1254	ca. 1950	Not Eligible
55	517 South Fifth Street, Elizabeth	5/1256	ca. 1920	Not Eligible
56	521 South Fifth Street, Elizabeth	5/1257	ca. 1900	Not Eligible
57	525 South Fifth Street, Elizabeth	5/1258	ca. 1900	Not Eligible
58	539 South Fifth Street, Elizabeth	5/1261	ca. 1940	Not Eligible
59	Bayway Switching Station, 530-614 Trenton Avenue, Elizabeth	4/1582	1942	Not Eligible
60	City of Elizabeth Pumping Station, 500-526 Trenton Avenue, Elizabeth	4/1582.A	1950	Not Eligible
61	630 Clarkson Avenue, Elizabeth	4/378.A	ca. 1939	Not Eligible
62	627 Arnett Street, Elizabeth	4/58	ca. 1958	Not Eligible
63	Irwin Double Houses 605-625 Arnett Street and 584-586 Summer Street, Elizabeth	4/57.A – 4/57.H	ca. 1948	Not Eligible
64	442 Richmond Avenue, Elizabeth	4/455	ca. 1923	Not Eligible
65	Halloran School, Elizabeth	4/1278	1950	Not Eligible
66	445 Fern Place, Elizabeth	4/456	ca. 1930	Not Eligible
67	447 Fern Place, Elizabeth	4/457	ca. 1910	Not Eligible
68	663 Pulaski Street, Elizabeth	4/300	1924	Not Eligible
69	659 Pulaski Street, Elizabeth	4/299	1924	Not Eligible
70	655 Pulaski Street, Elizabeth	4/298	1924	Not Eligible
71	653 Pulaski Street, Elizabeth	4/297	1923	Not Eligible
72	501 Richmond, Elizabeth	4/1280.A	1957	Not Eligible
73	641 Pulaski Street, Elizabeth	4/294.K	1957	Not Eligible
74	637 Pulaski Street, Elizabeth	4/294.J	1957	Not Eligible
New York Resources:				
1**	Goethals Bridge	N/A	1928	Eligible (NJ SHPO Opinion 2/14/1995 & NY SHPO Determination 1/24/1995)
24**	Staten Island Railroad Historic District (New York Portion)	N/A	1889-1959	Not Eligible (New York Portion only)
25**	Staten Island Railway Lift Truss Bridge over Arthur Kill	N/A	1959	Eligible (NJ SHPO Opinion 6/11/1991 and NY SHPO Determination 6/4/2008)
75	Texas Eastern Transmission Corporation District Center 2949 Goethals Road North, Staten Island	1394/101	ca. 1940	Not Eligible
76	17 Lilac Court, Staten Island	1707/5	ca. 1915	Not Eligible
77	11 Lilac Court, Staten Island	1707/38	ca. 1940	Not Eligible
78	881 Morrow Street, Staten Island	1384/1	ca. 1915	Not Eligible
79	885 Morrow Street, Staten Island	1384/3	ca. 1915	Not Eligible

** Note: Resource Nos. 1, 24 and 25 have also been identified within the New Jersey APE.

TABLE 1 (CONTINUED): HISTORIC RESOURCES IDENTIFIED WITHIN THE AREA OF POTENTIAL EFFECT – NEW JERSEY AND NEW YORK

MAP NO.	NAME/ADDRESS	BLOCK/ LOT	DATE BUILT	ELIGIBILITY STATUS
80	856 Morrow Street, Staten Island	1717/56	ca. 1940	Not Eligible
81	834 Morrow Street, Staten Island	1717/67	ca. 1920	Not Eligible
82	830 Morrow Street, Staten Island	1717/72	ca. 1920	Not Eligible
83	851 Morrow Street, Staten Island	1380/41	ca. 1915	Not Eligible
84	2437 Forest Avenue, Staten Island	1348/96	ca. 1915	Not Eligible
85	2431 Forest Avenue, Staten Island	1348/102	ca. 1915	Not Eligible
86	2409 Forest Avenue, Staten Island	1290/15	ca. 1931	Not Eligible
87	15 Kinsey Place, Staten Island	1290/66	ca. 1915	Not Eligible
88	17 Kinsey Place, Staten Island	1290/64	ca. 1920	Not Eligible
89	19 Kinsey Place, Staten Island	1290/63	ca. 1920	Not Eligible



Legend

- Area of Potential Effect
- Historical Resource
- Historic Districts

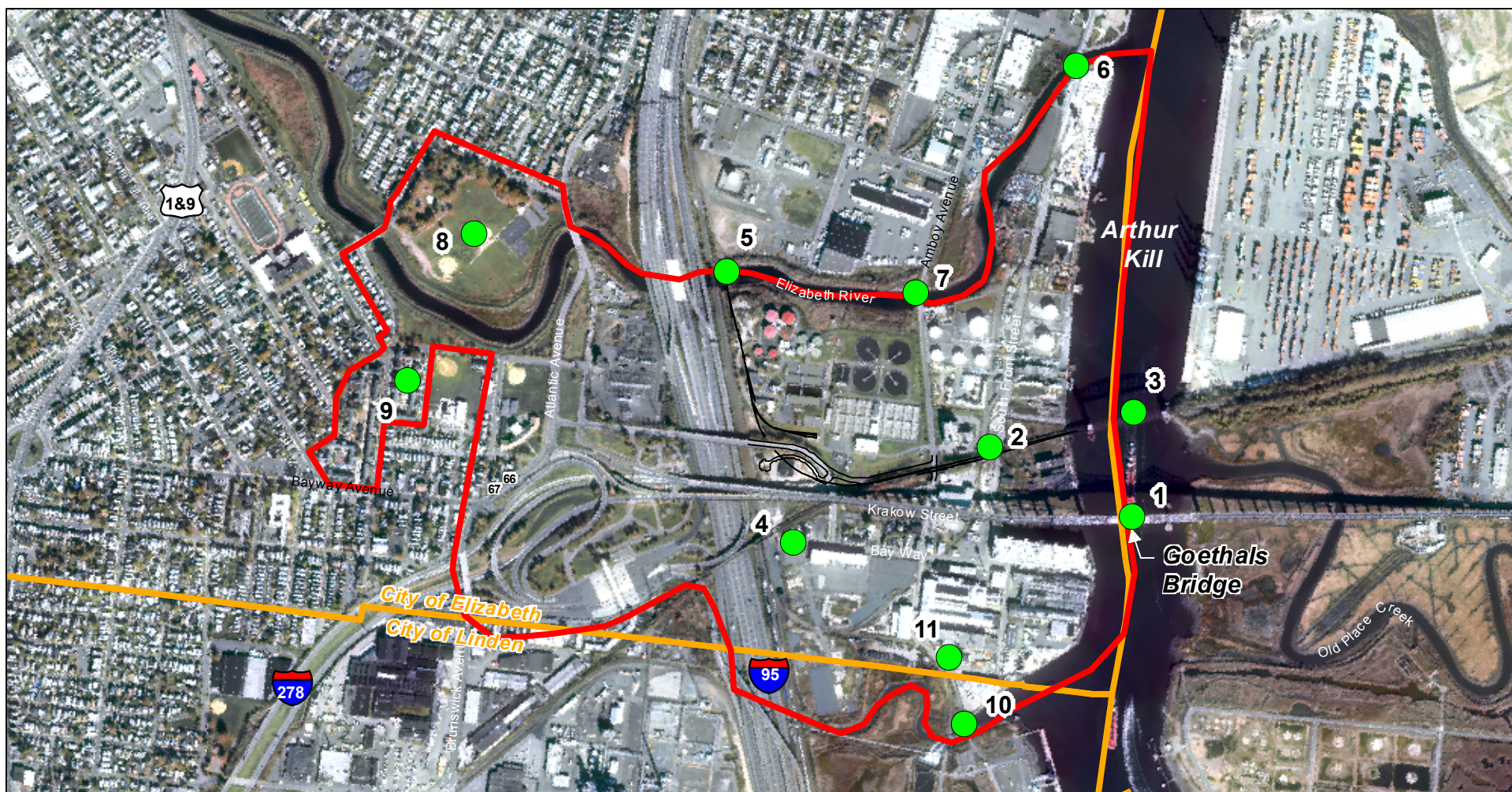
Goethals Bridge Replacement EIS

Figure 2

Documented Historical Resources
in the APE Study Area - New Jersey

United States Coast Guard

Source:
Basemapping: Port Authority of New York and New Jersey, 2002.
Data: The Louis Berger Group, 2004.



Legend

- Area of Potential Effect
- Historical Resource

Source:
 Basemapping: Port Authority of New York and New Jersey, 2002.
 Data: The Louis Berger Group, 2004.

Goethals Bridge Replacement EIS

Figure 3

Historic Architectural Resources
 within the APE - New Jersey

United States Coast Guard

3.0 The Goethals Bridge as a Structure

3.1 Technical Information

The Goethals Bridge is a four-lane cantilever truss bridge that carries Interstate 278 over the Arthur Kill between Elizabeth, New Jersey, and Staten Island, New York. Each travel lane is approximately 10 feet wide, with no shoulders. In the early 1970s, a 2-foot-wide concrete median barrier was installed between the eastbound and westbound roadways for the full length of the bridge. The total elevated length of the Goethals Bridge is 7,109 feet or 1.35 miles. Including approach viaduct spans, the bridge extends approximately 11,825 feet in length.

The main crossing over the Arthur Kill is comprised of a three-span, continuous, through truss superstructure with a total length of 1,152 feet. The navigation channel below the main continuous spans has a width of approximately 350 feet, and the vertical clearance above mean high water measures about 135 feet. The continuous main spans consist of two anchor spans that are each 240 feet in length; two cantilever arms that are each 168 feet in length; and a center suspended span that measures 336 feet. The truss floor system that supports the 9 ½" thick concrete deck slab consists of built-up steel floorbeams spaced 40 feet apart in the anchor spans, and spaced 42 feet apart in the cantilever arms and the suspended span. Each floorbeam spans a distance of 47 feet between the centers of the truss chords. Thirteen simply supported, rolled steel stringers span between the floorbeams, with two stringers supporting each sidewalk and spanning between the cantilevered extensions of the floorbeams. The north and south sidewalks in the truss spans are 5 feet wide, but pedestrian traffic has been prohibited on the bridge for more than five years for safety reasons due to the deteriorated condition of the sidewalk slabs.

The New Jersey, or west, approach spans range in length from 50 feet to 115.5 feet each, and their cumulative length measures 2,831 feet across a total of 35 spans. The New York, or east, approach spans range in length from 57 feet to 112 feet each, and their cumulative length measures 3,126 feet across a total of 37 spans. The superstructure framing in most approach spans consists of two simply supported, built-up deck girders with built-up floorbeams that have a cantilevered segment at each fascia. The floorbeams span a distance of 32 feet between the deck girders, and are spaced between 14'-9" and 20'-0" apart. The width of the approach sidewalks was reduced to 3'-4" in the mid-1960s when a 1'-6" high reinforced concrete barrier curb was installed 9" behind the existing curb on all approach spans.

The New Jersey approach span framing is noticeably different in Span 28W, which carries the westbound roadway over Conrail. Here the superstructure consists of two simply supported, built-up through girders with built-up floorbeams that span 47 feet between the through girders, and which are spaced approximately 5'-4" apart. The original gunite encasement has been removed from all steel members in this span, but still covers the superstructure steel beneath the eastbound and westbound roadways in New Jersey Approach Spans 17W, 18W and 19W where railroad tracks were planned to be built at the time the Goethals Bridge was being constructed.

The superstructure framing is also different in the west approach spans over the New Jersey Turnpike (Span 29W through Span 35W) where modifications were made in the late 1960s to accommodate the widening of the New Jersey Turnpike below, and a separate eastbound approach ramp was constructed to merge into the original west approach structure. This required the construction of new piers, the erection of new longitudinal fascia girders and the installation of new cross girders to connect to the original framing. The new eastbound superstructure in New Jersey Approach Spans 120W through 125W consists of welded I-deck girders with rolled floorbeams, while in Spans 126W through 135W the new framing consists of either four or five simply supported rolled stringers. In addition, pin and hanger assemblies

are found in the original west approach spans that carry the westbound roadway over the New Jersey Turnpike.

Hollow abutments are located at the east and west ends of the Goethals Bridge. The New York hollow abutment consists of six stringer spans with a total length of 126 feet, while the New Jersey hollow abutment has 19 deck spans (no stringers) with a total length of 178 feet. Eastbound On-Ramp No. 6 is located to the west of the New Jersey hollow abutment and has an overall length of 117'-0" and an overall width of 34'-4". The structure was built in 1966 and carries eastbound Route I-278 over westbound Route I-278. The bridge has a two-span, continuously supported, composite steel superstructure with five cover plated, rolled steel stringers in each span and full height abutments at each approach.

Eastbound On-Ramp No. 7 is located adjacent to On-Ramp No. 6, and was also intended to carry eastbound I-278 over westbound I-278, but the structure is not in use and has been abandoned. The bridge was built in 1966 and has an overall length of 154 feet and an overall width of 28 feet. Eastbound On-Ramp No. 7 has a two-span, continuously supported, composite steel superstructure with four cover plated, rolled steel stringers in each span. The substructure consists of a full height south abutment and two piers, but there is no north abutment because construction of the bridge was never completed.

3.2 History and Significance

In letters dated January 25, 1995, and February 14, 1995, the NYSOPRHP and NJHPO, respectively, determined that the Goethals Bridge is eligible for listing in the National Register under Criteria C and A, where:

- Criterion A covers sites "that are associated with events that have made a significant contribution to the broad patterns of our history" and
- Criterion C covers resources "that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant distinguishable entity whose components may lack individual distinction.

The Goethals Bridge, completed in 1928, is eligible for listing in the National Register under Criterion A as the first link for vehicular traffic between Staten Island and the New Jersey mainland. Designed by J.A.L. Waddell with Othmar Ammann, the bridge was intended by the Port of New York Authority (the predecessor agency to the Port Authority of New York and New Jersey) to alleviate the congested ferry system to Staten Island. The bridge is also eligible under Criterion C in the area of engineering and design. The bridge consists of a high 672-foot-long main span formed by a cantilever steel through truss and long elevated steel girder approaches supported by concrete piers, with a total length of over one mile.

The following history of the Goethals Bridge has been excerpted from the Individual Structure Survey Form, completed in 1994:

The early 1900's, after the incorporation of Staten Island as part of New York City, saw an expansion of factories and other industrial enterprises along the Arthur Kill Channel. This economic boom created strain on the ferry system handling the freight, commuters, and automobiles traveling between Staten Island and New Jersey. To alleviate traffic congestion and allow for further economic development in the area, particularly in Staten Island, various recommendations were put forth to connect Staten Island with New

Jersey. These plans included a tunnel or a low-level railway/highway bridge connecting to Elizabeth, New Jersey. With the formation of the Port of New York Authority, a joint state agency, plans for an interstate bridge could be developed. Concerns that a low-level, low-cost bridge would threaten shipping activities in the channel resulted in a plan for two high-level bridges, the current Goethals and Outerbridge Crossing. These bridges, the first facilities constructed by the Port Authority, are representative of an era of rapid expansion of the New York metropolitan area's highway and bridge network.

The designer of the bridge was John Alexander Low Waddell, a consultant to the Port Authority. Waddell was the founder of what is now the New York-based engineering firm Hardesty and Hanover and the author of several well-known bridge engineering texts. Othmar Ammann, an engineer at the Port Authority who later designed the Bayonne, George Washington, and Verrazano-Narrows Bridges, supervised construction. York and Sawyer, designers of the Bowery Savings Bank on East 42nd Street and the New York Historical Society (both in Manhattan) were the consulting architects for both bridges. The bridge was named for General George W. Goethals, chief engineer of the Panama Canal, who, Port Authority's first chief engineer, also aided in construction of the bridge.

Although not renowned for its architectural details, the Goethals Bridge was notable from an engineering standpoint at the time of its construction. Because of varying soil and subsurface conditions, three diverse pier foundation sinking methods were utilized: wood-pile foundations and unsheeted excavation for most of the piers; steel and wood sheeted open cofferdams for the channel piers where rock was near the surface; and pneumatic caissons for sandstone and soft clay conditions with inadequate rock cores for pier foundations.

When built, the Goethals Bridge and Outerbridge Crossing were the only direct automobile links between Staten Island – a relatively undeveloped and sparsely populated part of New York City – and New Jersey. Transportation engineers for the Port Authority sought to alleviate the congestion of New Jersey's bustling industrial cities and create a more efficient route for motorists traveling from northern New York State and New Jersey toward southern New Jersey. While these bridges were not the first to connect Staten Island and New Jersey – a railroad swing bridge had been built across the Arthur Kill in 1889 just north of the location of the Goethals Bridge – the builders of the Goethals Bridge and Outerbridge Crossing recognized that the economic and industrial futures of both New York and New Jersey relied on improved automobile transportation. In the period following the bridges' construction, Staten Island continued to lag behind as the rest of New York City's population climbed, but increased accessibility undoubtedly reinforced the pattern of “urban” development toward a more populous and industrialized Staten Island. However, it was not for another 35 years, after the construction of the Verrazano-Narrows Bridge connecting Staten Island with Brooklyn, that the population of Staten Island began to grow substantially.

Construction of the Goethals Bridge began in 1925, and the bridge opened to traffic in 1928. The total cost at the time of construction was \$7.2 million.

3.3 Character-Defining Features of the Goethals Bridge

The Goethals Bridge is a narrow, four-lane, two-way toll bridge structure with a total elevated length of 7,109 feet and a truss span of 1,152 feet. The steel-truss cantilever design includes a 672-foot-long suspended main span and two 240-foot-long anchor spans. The piers were sunk 50 feet below the bottom

of the channel. Long viaducts comprised of steel girders set atop 75 arched concrete piers carry the roadway to its mid-span height of 135 feet above the mean high water line of Arthur Kill. Its unusual mid-span height, which was a requirement of the New Jersey ports, permits passage of deep-sea vessels through the Arthur Kill.

A character-defining feature is a prominent or distinctive aspect, quality, or characteristic of a historic property that contributes significantly to its physical character. The character-defining features of the Goethals Bridge are:

- The 672-foot-long Suspended Main Span;
- Two 240-foot-long Anchor Spans, which together with the main span form the truss spans;
- Intricate Steel Trusses;
- Arched Concrete Piers;
- Concrete Pads;
- Bearing Pedestals;
- Steel Through Girders;
- Built-up Steel beams and Steel Stringers;
- Hollow Abutments; and
- Elevated Approach Spans.

The deck, concrete median barrier and parapets, fender system, and traffic striping are not character-defining features. The highway signage and lights appear to be recent replacements and not original to the structure; therefore, they are also not character-defining features. The new toll plaza and administration and maintenance buildings, constructed in 1964, are also not character-defining features.

3.4 Integrity of Character-Defining Features

The National Register criteria defines “integrity” as the ability of a property to convey its significance. Integrity consists of seven aspects: location, design, setting, materials, workmanship, feeling, and association. These seven aspects are the qualities that define integrity.

Eighty years after the bridge opened to traffic, the Goethals Bridge has experienced relatively few changes and continues to retain a high degree of integrity. The location and setting of the bridge has remained constant. Changes have been made at the western end of the New Jersey approach, including the addition of roadways and ramps to accommodate the New Jersey Turnpike. The toll plaza and administration and maintenance buildings on the New York side, which were constructed in 1964, have reflected modest changes to the bridge. The overall setting continues to be predominantly industrial, with the adjacent Staten Island Railroad and Lift Truss Bridge sharing a similar arrangement and focal point along the Arthur Kill.

The design, materials, and workmanship of the Goethals Bridge continue to retain a high degree of integrity. The bridge’s truss design and arched piers comprise the most identifiable components of the bridge. Changes to the bridge over the years have included: removal of several of the original arched concrete piers at the New Jersey Turnpike; addition of concrete medians and parapets for purposes of safety; and installation of two protective fender cells in the Arthur Kill on the north and south sides of the

main Staten Island pier to prevent damage from vessels; otherwise, the design, materials, and workmanship of the bridge have been retained.

The bridge's most dynamic and recognizable features, such as the truss spans over the Arthur Kill, the large arched concrete piers, and major portions of the approach viaducts, have had few alterations since the bridge was constructed. These features are the defining elements that shape the bridge's special silhouette. As such, the Goethals Bridge conveys the monumental feeling associated with vehicular bridges of the early twentieth century. Lastly, the bridge is a tangible reminder of the importance of vehicular transportation and interconnection between New Jersey and New York.

3.5 Condition of Goethals Bridge

A visual structural inspection of the Goethals Bridge and its approach structures was conducted in May 2004, as part of the Goethals Bridge Replacement EIS. The purpose of the inspection was to determine the overall structural integrity of the bridge through visual observation of the structure's general conditions, and to verify the existence of previously documented defects.

The existing conditions of the various structural elements that comprise the Goethals Bridge Main Spans, the New York Approach Spans, the New Jersey Approach Spans, the New York and New Jersey Hollow Abutments, Eastbound On-Ramp No. 6, and Eastbound On-Ramp No. 7 are documented in the *Task B – Structural Inspection Report Final, Goethals Bridge Modernization Program EIS*, dated July 28, 2004 (see Appendix C). The report highlights areas of particular concern for each of the bridge elements, as well as any new defect or finding encountered during the verification inspection. Deficiencies mentioned in previous reports that were found to still be present during the 2004 inspection were also noted. Among the conditions documented in the 2004 report are the potentially significant deficiencies listed below. Photos, with captions, illustrating the bridge's existing condition are also included in the report in Appendix C.

3.5.1 Goethals Bridge Main Spans

The main spans of the Goethals Bridge from Pier A to Pier D are considered to be in satisfactory condition; however, deficiencies noted during the May 2004 inspections included the following:

- Rusting of the stringer or diaphragm top flanges with associated section loss continues to occur at random locations, most noticeably at areas where water leakage through the deck has also resulted in spalls on the underside of the concrete slab.
- A common defect that is noted at several cantilevered floorbeam members involves the development of holes in the floorbeam top flanges beneath the edge of the deck slab overhang where water has apparently been dripping onto the steelwork over the course of many years.
- A gap is often found between the top flanges of the sidewalk stringers and the underside of the sidewalk slab beneath the north and south cantilevers.
- The asphalt wearing surface is in fair to poor condition throughout the main spans, and the underside of the deck slab between the truss chords exhibits random areas of spalled and fractured concrete.
- The sidewalk slabs along the north and south sides of the bridge are in poor condition and remain closed to pedestrians due to extensive concrete deterioration.
- Most bridge scuppers and drainage downspouts remain clogged.

- The south parapet exhibits increased deterioration with exposed rebar, severe spalling, and extensive concrete disintegration noted at two locations.

3.5.2 New Jersey Approach Spans

The New Jersey approach spans from Pier A to Pier 35W in the westbound roadway, and from Pier A to Pier 135W in the eastbound roadway are considered to be in overall good condition; however, deficiencies noted during inspections in May 2004 included the following:

- Active corrosion of the steel members is generally limited to the top flanges of median Stringer S5 and adjacent floorbeam top flanges where light to moderate rust is noted in most spans, apparently due to water leakage from an assumed longitudinal construction joint located beneath the median barrier along the centerline of the bridge.
- Minor section loss from previous corrosion exists along the floorbeam top flanges between the two main girders at several deck joint locations in the New Jersey approach spans.
- Spalled and delaminated areas are observed across the top surface of the north and south sidewalk slabs, with large steel plates still covering the worst areas of concrete deterioration and holed-through locations in several spans. At Pier 11W, a large hole in the south sidewalk slab is allowing water leakage to corrode the superstructure steel below.
- The current inspection found a noticeable increase in the number of clogged or partially clogged drainage scuppers throughout the New Jersey approach spans when compared with the number shown in the previous biennial inspection report.
- Notable substructure defects beneath the New Jersey approach spans include a large spalled area with exposed rebar along the east side of the base of Pier 29W, and a large spall with exposed rebar in the bearing pedestal beneath the south through girder at Pier 28W. These areas of deteriorated substructure concrete both occur beneath the westbound roadway in the original portion of the approach spans.

3.5.3 New York Approach Spans

The New York approach spans from Pier D to Pier 37E are considered to be in overall good condition; however, deficiencies noted during inspections in May 2004 included the following:

- Active corrosion of the steel members is generally limited to the top flanges of median Stringer S5, where light to moderate rust is noted in most spans, apparently due to water leakage from an assumed longitudinal construction joint located beneath the median barrier along the centerline of the bridge. At a few areas, such as in Span 8E, minor section loss is beginning to develop along the top flange and web areas of Stringer S5, and also along the top flanges of the adjacent floorbeams due to this continuing problem.
- Presently, the sidewalk slabs along the north and south sides of the bridge are closed to pedestrians, and remain in poor condition with several holed-through areas still covered over with large steel plates.
- A few of the bridge scuppers and drainage downspouts are clogged or partially clogged, and occasional spalls with exposed rebar are noted along the concrete median barrier that separates the eastbound and westbound roadways.
- The base of the steel parapet section was found to be severely corroded on the north side of Span 27E.

3.5.4 New Jersey Hollow Abutment

The New Jersey hollow abutment is considered to be in overall good condition beneath the west approach roadway from Pier 35W to Pier 56W, although more spalls with exposed rebar were noted on the pier columns, cap beams and underside of roof slab. These areas of concrete deterioration were found predominately near the south side wall from Pier 50W to 54W, although exposed rebar was also noted at a few other random locations in the cellular abutment. Medium longitudinal cracks with rust stains were observed on the underside of the cap beam near the north end of Pier 41W, and water leakage with moderate to heavy efflorescence was noted in the longitudinal joint of the roof slab between Piers 45W and 46W.

3.5.5 New York Hollow Abutment

The New York hollow abutment is considered to be in overall good condition from Pier 37E to Pier 43E beneath the east approach roadway. However, a few spalled areas with exposed rebar were observed on the underside of the roof slab near the south side wall between Piers 38E and 40E. Water leakage and rust stains were noted during the inspection, extending down the north side of a concrete beam near the north side wall just west of Pier 41E.

3.5.6 Eastbound On-Ramp No. 6

The on-ramp structure is considered to be in overall good condition; this evaluation remains unchanged from the previous biennial inspection report. The most notable defect observed during the course of this inspection involved two areas of spalled and delaminated concrete near the west end of the south abutment breastwall that totaled about 10 SF.

3.5.7 Eastbound On-Ramp No. 7

This on-ramp structure is considered to be in overall good condition, with no significant changes noted from the previous biennial inspection report. The bridge was never open to traffic and carries no live load because an adjacent structure (On-Ramp No. 8) was not constructed.

3.6 Recent Rehabilitation and Repair of the Goethals Bridge

Although some of the above-described deficiencies have since been repaired under recent Contract AKG-274.094, these repairs are only interim repairs expected to extend the life of the structure another 7 to 10 years. Specifically, Contract AKG-274.094, which was completed in 2006, involved the extensive repair of spalled, delaminated and cracked areas of concrete in the deck slab, median barrier and curbs. A waterproofing membrane and new asphalt overlay was also applied across the entire top of deck after the bituminous wearing surface was removed and the original drainage scuppers were replaced. The existing granite curb and concrete curb wall was removed from along both sides of all spans and replaced with a New Jersey-style bridge parapet with metal bridge railing. The contract also included removal of existing finger joints and replacement with new strip seal deck joints at several piers in the approach spans and main spans. Extensive superstructure repairs were also made, including replacement of the north and south cantilevered floorbeam brackets at all deck joint locations, and replacement of top flange angles and rivets at numerous floorbeam locations between the deck joints. Floorbeam top and bottom flange areas were replaced or strengthened between the two main girders at several piers, and missing cross bracing angles were replaced beneath the sidewalk slabs. Existing channel diaphragms were replaced in-kind beneath the sidewalks in Spans 1E through 37E, and stringer repairs were made at numerous locations. Areas of impact rust were cleaned and repainted, and deteriorated rivets were replaced throughout the

structure. Superstructure repairs were made to the truss members in the main spans, including the replacement of deteriorated lacing bars, and repairs were made at both hollow abutments.

Despite these repairs, a complete deck replacement with seismic retrofit is anticipated to be required by 2014 or 2015 in order to keep the bridge in service. The concrete deck slab is considered to be in fair to poor condition for both the approach spans and the main spans of the structure. Since the bridge was designed to accommodate lighter volumes of traffic and lighter vehicle weights than it is currently receiving, the ongoing increases in volume and weight of the vehicles has had a significant effect on the condition of the riding surface, deck slab and deck joints of the structure, and has required extensive maintenance-related expenditures over the past 20 to 30 years. Long-term deterioration from salts and deicing agents at the joint locations and drainage areas have also caused the Port Authority to award construction contracts over the years in order to replace structural steel members and maintain the structure in a safe operational condition.

Based on the history and age of the existing deck slab, continuing repairs will be needed to maintain traffic and an entirely new deck slab will be required in the near future. In addition, various superstructure and substructure maintenance repairs, such as repainting and replacement of the median stringers, are likely to be required at that time as well. Besides the aging deck slab and continuing maintenance repairs that are required, one of the most significant detrimental features of the existing Goethals Bridge that was not addressed as part of the recent Contract AKG-274.094, nor capable of being addressed as part of a future deck replacement, is the deficient deck geometry of the structure, which is discussed further in Section 4.3.1 of this report.

4.0 Project Purpose and Need

4.1 Overview of Purpose and Need

The purpose of the Goethals Bridge Replacement is to eliminate the functional and physical obsolescence of the current Goethals Bridge and address the aging structure's escalating maintenance, repair, and structural retrofit needs, and associated costs. The proposed Goethals Bridge Replacement would also serve to improve traffic flows; safety conditions and management of traffic incidents on the bridge; and overall performance, reliability, flexibility, and redundancy of the transportation network serving the greater New York/New Jersey metropolitan area.

The principal factors that underlie the need for the Goethals Bridge Replacement are:

- the existing bridge's functional and physical obsolescence due to inadequate design features, including narrow lanes in relation to increasing traffic and wider trucks and buses using the bridge, no emergency shoulders, and substandard alignment, resulting in deteriorating traffic service, safety conditions, and management of traffic incidents on the bridge;
- the existing bridge's age including the bridge deck, which is well past its normal service life and consequently requires high and ongoing maintenance, repair, and rehabilitation costs, as well as structural seismic retrofitting;
- the existing bridge's deficiency as a reliable transportation link for system redundancy within the Staten Island Bridge system and, more broadly, the New York/New Jersey region in the event of emergency;
- increasing traffic volumes, including truck traffic, across the existing Goethals Bridge due to the continued robust economic and population growth of Staten Island and surrounding counties, resulting in deteriorating traffic conditions and relatively higher accident levels on the facility; and
- the layout of the existing bridge and its approaches are inadequate to provide for priority-lane treatment or dedicated capacity for potential future transit service on the facility.

The Goethals Bridge Replacement is intended to address each of these critical factors and thereby provide for an adequate, efficient, and safe crossing in the Goethals Bridge corridor to meet present and anticipated future transportation system needs.

4.2 Background

4.2.1 Introduction

The Goethals Bridge was constructed in the 1920s to span the Arthur Kill and provide a roadway connection between Staten Island, New York, and Elizabeth, New Jersey. The two other roadway connections between Staten Island and New Jersey are: the Bayonne Bridge, connecting northern Staten Island with Bayonne, New Jersey; and the Outerbridge Crossing, connecting southern Staten Island with Perth Amboy, New Jersey. These three bridges, which in combination comprise the Staten Island Bridges system, are owned and operated by the Port Authority.

4.2.2 Traffic Growth Trends

The opening of both the Goethals Bridge and Outerbridge Crossing on the same day in 1928 was hailed as a major improvement for residents and businesses on Staten Island and in the neighboring communities of New Jersey. The importance of the Goethals Bridge within the regional roadway network grew substantially with the opening in 1964 of the Verrazano-Narrows Bridge. The two bridges, connected by the Staten Island Expressway (part of I-278), became elements of an increasingly intensive travel corridor between and including New Jersey, Staten Island, and geographic Long Island (i.e., Brooklyn, Queens, and Nassau and Suffolk counties). In the larger regional transportation context, I-278 serves as a critical spine within New York City's expressway system, linking the City of New York to northern and central New Jersey via the Goethals Bridge, and to Long Island, upstate New York, and New England via the Verrazano-Narrows Bridge and, for northern destinations, via subsequent connection to I-95.

The opening of the Verrazano-Narrows Bridge and the resultant rapid population growth on Staten Island had a substantial impact on traffic patterns and volumes across Staten Island. Traffic across the Goethals Bridge increased an average of 33 percent annually between 1964 and 1973. Traffic during the weekday peak periods (i.e., 6:00 to 10:00 AM and 3:00 to 7:00 PM) grew at an even steeper rate throughout those years. Compared to weekday peak-period traffic volumes totaling approximately 7,100 vehicles in both directions in 1964, the bridge currently (2004) carries approximately 7,200 eastbound and 10,000 westbound vehicles (a total of 17,200 vehicles) in the weekday AM peak period and approximately 11,000 eastbound and 8,400 westbound vehicles (a total of 19,400 vehicles) in the PM peak period. On a daily basis, 2004 traffic volumes totaled approximately 69,000 vehicles in both directions¹.

The ratio of truck traffic to overall traffic also increased as the Goethals Bridge became a critical component in the regional network of expressways. Regional and national trends toward more spatially dispersed manufacturing and distribution facilities and a shift in goods movement toward more shipments by truck rather than rail led to an increasing proportion of trucks as a component of overall traffic. These factors and trends are reflected in the changing makeup of Goethals Bridge traffic over time. For example, in 1953, trucks represented less than two percent of all traffic across the bridge, and tractor-trailers constituted only one-tenth of all truck traffic. In contrast, existing (2004) traffic data show the highest truck volumes reaching 15 percent of total traffic in the AM peak hour (i.e., 7:30 - 8:30 AM) in the eastbound direction.

In addition, recent national trends toward increased motor vehicle heights, widths, and lengths, have limited truck movements through the Lincoln and Holland Tunnels (Port Authority, *Interstate Goods Movement Study*, 1992). Post-9/11 restrictions imposed by the Port Authority for purposes of security bans tractor-trailers and larger trucks in classes 4, 5 and 6 (four, five and six-axle trucks) from the Holland Tunnel in both directions and at all times. Due to these various restrictions in the tunnels, the Port Authority's interstate bridges, including the Goethals Bridge, have taken on increased importance as routes for goods movement in the New York/New Jersey metropolitan region.

As traffic volumes have grown, travel conditions have become increasingly congested and traffic flows on the Goethals Bridge have begun to operate below acceptable service levels during peak travel periods.

4.2.3 Previous Studies

In response to these trends, the Port Authority initiated its Staten Island Bridges Program (SIBP) in 1989 to investigate potential improvement concepts for the Staten Island Bridges system. In 1992, an

¹ These 2004 figures, which reflect the existing condition for the GBR project, are based on the comprehensive traffic data collection program conducted in 2004 for the GBR EIS.

environmental review of alternative improvement concepts that appeared to best address identified needs was completed. In accordance with the National Environmental Policy Act (NEPA), a comprehensive environmental analysis of the SIBP was undertaken by the USCG in conjunction with its bridge permitting responsibilities, resulting in the completion of the Draft Environmental Impact Statement (DEIS) for the SIBP – Modernization and Capacity Enhancement Project in 1995 and the Final Environmental Impact Statement (FEIS) in 1997.

The SIBP DEIS identified two primary alternative Goethals Bridge improvement concepts: 1) a parallel bridge to the north of the existing Goethals Bridge; and 2) a parallel bridge to its south. Both of the parallel-bridge options were proposed to operate in conjunction with the existing bridge. In addition, an enhancement that was considered for both alternatives was provision of a concurrent high occupancy vehicle (HOV) lane on the new parallel span, as well as on the existing bridge. These alternatives sought to address the transportation deficiencies articulated in the 1997 SIBP FEIS purpose and need documentation, including: 1) the existing span's functional obsolescence caused by deficient physical features (specifically, narrow lanes, restrictive horizontal alignment, no emergency shoulder, and approach span bend in the alignment); 2) peak-period traffic congestion and projections of future traffic growth, and anticipated growth in Howland Hook Marine Terminal activities and other goods movements; and 3) consequent safety concerns. The definition and screening evaluation of potential alternatives, and the subsequent detailed comparative evaluation of the "No-Build," Goethals South, Goethals North, and Expanded Goethals with HOV Lane alternatives in the 1997 FEIS focused on each alternative's ability to address these deficiencies while minimizing adverse environmental impacts.

The environmental analyses concluded that the preferred alternative for addressing the SIBP purpose and need was the construction of a new bridge, parallel and to the south of the Goethals Bridge, to operate in conjunction with the existing bridge. This Expanded Goethals with HOV Lane alternative provided for rehabilitation of the existing span and reconfiguration to accommodate three lanes of westbound traffic, with a shoulder lane. The new span incorporated three lanes for eastbound traffic and additional right-of-way width for a potential future transit service. The project also included an enhanced pedestrian/bikeway. A Record of Decision (ROD) for that project was not issued, due to various unresolved issues at that time.

4.3 The Need for Goethals Bridge Replacement

In the years since the 1997 SIBP FEIS, the project purpose and need have evolved, reflecting physical and operational changes to the Goethals Bridge, existing and future transportation needs, and enhanced focus on needs for system redundancy and improved security. The Port Authority commenced the GBR project to address this expanded purpose and need for modernizing the Goethals Bridge since the SIBP studies, as well as to reassess the operational constraints identified in the earlier analyses.

The GBR seeks to provide for a modernized Goethals Bridge crossing that will address the following needs:

- address design deficiencies that make the span functionally obsolete;
- enhance structural integrity and reduce life-cycle cost concerns with the aging bridge;
- provide transportation system redundancy;
- improve traffic service on the bridge and its approaches;
- provide safer operating conditions and reduce accidents on the bridge;
- provide for safe and reliable truck access for regional goods movement; and
- provide for potential future transit in the corridor.

Each of these elements of the GBR is described below.

4.3.1 The Need to Address Design Deficiencies

As the Goethals Bridge was designed and constructed in the 1920s for narrower vehicles and significantly lower traffic volumes than currently exist, several of the existing bridge's physical features are now functionally obsolete, in terms of current highway design standards defined by the American Association of State Highway and Transportation Officials (AASHTO) and supported by the Federal Highway Administration (FHWA). These deficiencies contribute to the reduction of traffic efficiency, traffic service levels, and safety conditions on the bridge, resulting in diminished traffic performance, driver safety, and heightened operational concerns.

The following substandard design features adversely affect traffic operations on the Goethals Bridge:

- *Ten-Foot Lane Widths.* The travel lanes on the Goethals Bridge and its approaches are 10 feet wide. While 10-foot lanes were consistent with standard highway design when the bridge was built and for many years after, average vehicle dimensions and weight have continued to increase. As a result, AASHTO now recommends a standard lane width of 12 feet. Further exacerbating the adverse operational effects of the narrow lane-widths is the fact that increasing numbers of larger-sized trucks and buses now cross the Goethals Bridge. Typical truck-trailer and full-size passenger bus widths are now 102 inches (8.5 feet). When lane widths are less than 12 feet and lateral clearances (i.e., the distance between the edge of the travel lanes and physical obstructions such as roadway barriers) are less than 6 feet, typical driver reaction is to reduce speed due to uncomfortable driving conditions, and to lengthen the distances between vehicles in the same lane. Drivers often hesitate to pass slow-moving trucks or buses because of limited sight distances and constrained lateral clearances due to the bridge's narrow lane widths. Therefore, traffic queues often build up in both lanes behind slow-moving trucks and buses.
- *Lack of Emergency Shoulder Lanes.* Stalled vehicles and minor accidents on the Goethals Bridge frequently result in significant delays. Due to the narrow lane width and lack of emergency shoulders, clearing accidents sometimes requires blocking all traffic in the affected direction or closing one lane to through traffic. The lack of a shoulder breakdown lane on the bridge main span and approaches also degrades safety conditions, as stalled vehicles themselves become safety hazards.
- *Approach Span Alignment.* There is a pronounced bend in the alignment of the New Jersey approach span of the Goethals Bridge at a point approximately 2,300 feet from the western bridge abutment. To maneuver through the bend, drivers of wider trucks and buses traveling in the right lane often encroach on the left travel lane, making it more difficult for vehicles operating in the left lane to pass slower-moving trucks. This phenomenon results in slower travel speeds for all vehicles and reduced bridge capacity, because trucks operating on the approach span tend to travel at comparatively slower speeds due to the span's incline, truck weight and acceleration requirements, the presence of the bend, and the narrow lane widths.

4.3.2 The Need to Enhance Structural Integrity and Reduce Life-Cycle Costs

Based on review of the Port Authority's 2002 *Biennial Inspection Report* prepared for the Goethals Bridge, as well as a more recent (May 2004) visual structural verification and inspection conducted on the bridge and its approach structures as part of the GBR EIS effort (detailed with text and photos in Appendix C), the existing structure is currently in overall good to satisfactory condition. This is due, principally, to significant expenditures for maintenance and repairs to extend the structure's effective life

span. In the 18-year period from 1987 to 2005, a total of almost \$121 million was spent, approximating \$6.7 million in repair and maintenance costs per year.² A substantial portion of the total expenditures was spent since 2001, including repainting of the entire structure and performance of miscellaneous structural and deck repairs.

Based on these data, it is apparent that repair costs associated with the Goethals Bridge can be expected to continue to increase in future years, despite the work that was performed under a major rehabilitation and repair contract (\$63 million) begun in 2004 and completed in 2006. The 80-year old bridge is well past its normal service life; the recent major rehabilitation work provided interim repairs that are expected to extend the life of the bridge for no more than six years from present, after which time additional repair contracts will most likely be needed to maintain the structure at the same level of service. A complete deck replacement with seismic retrofit, security upgrades and other related repairs will most likely be required by 2014 or 2015 to keep the bridge in service; the cost of this near-term rehabilitation is estimated at \$276 million (2007 dollars).³

An analysis has also been conducted of the life-cycle cost of bridge rehabilitation. This analysis considered the activities and associated costs for rehabilitation and maintenance of the existing Goethals Bridge for an additional 100 years beyond any near-term rehabilitation (i.e., the costs associated with a 100-year service life, until 2110), consistent with the design life for a replacement bridge. These life cycle costs are estimated at approximately \$804 million in 2007 dollars (net present value), including the near-term rehabilitation and bridge deck replacement required by 2014 or 2015.⁴ Depending on the specific nature of each of the maintenance repairs, the frequency of this work would vary from 10 to 50 years. The recurring cycles of maintenance and rehabilitation needs contribute to the increasingly high cost of extending the structure's life span, while also inconveniencing travelers with repetitive construction-related delays. In addition, these costs would be encountered without the benefit of addressing the bridge's fundamental functional obsolescence and related traffic service, safety, emergency response, and system redundancy needs. Necessary future repairs and rehabilitation would also not provide any ability to accommodate potential future transit on the Goethals Bridge, should future travel patterns warrant such consideration.

4.3.3 The Need to Provide Transportation System Redundancy

In March of 2004, a fatal accident on the Goethals Bridge involving four trucks and a car necessitated that the Port Authority shut down the bridge in both directions. A second five-vehicle accident on the Outerbridge Crossing, possibly attributed to additional volume diverted from the accident scene, created an extensive traffic backup for several miles and several hours of congestion and delays. As a result of these two separate but chronologically overlapping incidents, the potential for traveling between Staten Island and New Jersey was virtually eliminated for an extensive period, despite the continued operation of the Bayonne Bridge.

While such a dual-accident scenario is rare, it demonstrates the importance of having adequate lane widths to alleviate the pressure from trucks and buses using the facility between Staten Island and New Jersey, and to provide relief in the event of any type of incident involving one or more of the existing

² These costs are based on Port Authority data on past and anticipated repair contracts.

³ Based on updating costs for inflation that are presented in *GBR EIS Assessment of Bridge Rehabilitation Needs and Maintenance Costs to Extend the Life of the Existing Bridge for Life Span Comparable to Design Life for Proposed Replacement Bridge* (April 2006). This document is included as Appendix D of this report.

⁴ Based on updating costs for inflation that are presented in *GBR EIS Assessment of Bridge Rehabilitation Needs and Maintenance Costs to Extend the Life of the Existing Bridge for Life Span Comparable to Design Life for Proposed Replacement Bridge* (April 2006). This document is included as Appendix D of this report.

bridge crossings. Such incidents could be related to an accident, a bridge closing due to emergency or routine maintenance or repairs, or an emergency condition.

Particularly in the post-9/11 era, operational redundancy of the region's transportation network, including the system of bridges serving Staten Island and providing bi-state access, is a critical need. The increasing recognition of the importance of transportation-system redundancy in the New York/New Jersey metropolitan region reinforces the purpose and need for the GBR. It underscores the need for a solution that provides adequate operational flexibility and safe travel conditions in the Goethals Bridge corridor in order to accommodate traffic diverting from other transportation facilities during closure incidents in other corridors.

4.3.4 The Need to Improve Traffic Service

Existing Travel Conditions

To understand current travel conditions on the Goethals Bridge, a comprehensive traffic data collection program was conducted in May and October 2004. Average weekday traffic volumes on the bridge were approximately 69,000 vehicles, with eastbound and westbound vehicular trips constituting 37,000 and 32,000 vehicles, respectively. Of these volumes, 92.3 percent of total trips were by automobile and 7.7 percent were by truck. While the 2004 traffic data collection program did not include a survey about trip purposes, a 2003 traffic survey conducted by the Port Authority showed that about 62 percent of the trips each weekday were work- and company business-related while about 20 percent were for personal business and 12 percent were for recreational purposes.

The peak directions of travel on the bridge are westbound (leaving Staten Island) in the morning, and eastbound (returning to Staten Island) in the afternoon. The westbound Goethals Bridge carries approximately 2,900 and 10,000 vehicles in the AM peak hour (7:30 – 8:30 AM) and AM peak period (6:00 – 10:00 AM), respectively. Eastbound volumes in the AM peak-hour and AM peak-period total approximately 1,800 and 7,200 vehicles, respectively. These volumes compare to the carrying capacity in each direction of 3,200 vehicles, such that westbound AM traffic operates at level-of-service (LOS) E⁵. LOS E defines the theoretical capacity of a roadway, or the maximum stop-and-go flow of vehicles, given existing physical conditions, and is typically considered below the threshold of acceptable operating conditions.

In the PM peak hour (5:00 – 6:00 PM) and PM peak period (3:00 – 7:00 PM), the dominant eastbound traffic volumes are approximately 3,000 and 11,000 vehicles, respectively. Westbound volumes are approximately 2,100 and 8,400 vehicles, respectively, during the PM peak hour and PM peak period. As during the morning commute period, the predominant traffic flow in the PM peak period of travel operates at LOS E.

⁵ The quality of traffic service provided by a roadway facility is typically characterized for peak-period travel conditions and is measured in terms of levels of service (LOS). As defined by the Transportation Research Board, LOS ranges from level "A" to level "F," where LOS "A" indicates free-flowing traffic conditions with high travel speeds and LOS "F" describes breakdown conditions with excessive congestion and delays. LOS "C" indicates stable traffic flows and overall good travel conditions and is generally used as an optimal design objective. LOS "D" represents heavy traffic flow conditions without excessive delays and is considered to be the minimum acceptable operating condition for urban areas. LOS "E" is defined as the theoretical capacity of the roadway, or the maximum stop-and-go flow of vehicles, given existing physical conditions. It is generally considered that LOS E and LOS F are below the threshold of acceptable operating conditions.

According to 2002-2003 Port Authority traffic surveys, the average number of weekday trips destined to Staten Island was about equal to the number of “through-trips” that originated in or were destined for locations east of the Verrazano-Narrows Bridge. Of the through trips, 36 percent were going to Brooklyn or Queens. During the typical weekend day, slightly more trips, (approximately 60%) travel east of Staten Island, primarily for recreational purposes.

Statistics on truck trips, according to the Port Authority's 2000 truck commodity and cordon survey study, were somewhat different, with 33 percent of truck trips across the Goethals Bridge during an average weekday (in November 2000) bound for destinations in Staten Island, while 35 percent were destined for Brooklyn, 14 percent for Queens, and the remainder for Long Island.

This profile of traffic conditions on the Goethals Bridge changes markedly on the weekend, when approximately 87 percent of all trips across the bridge are non-work-related; during the weekend period, approximately 10 percent of the Goethals Bridge automobile trips are journey-to-work and another 3 percent are business-related. The greater number of non-work-related trips during the weekend is accompanied by an increase in overall traffic volumes. Average daily weekend traffic volumes on the Goethals Bridge exceed weekday levels. Whereas average weekday traffic volumes on the bridge are approximately 69,000 vehicles, average weekend Saturday traffic volumes on the bridge are approximately 76,000 vehicles, with eastbound and westbound vehicular trips constituting 40,000 and 36,000 vehicles, respectively. Average weekend Sunday traffic volumes on the bridge are approximately 73,000 vehicles, with eastbound and westbound vehicular trips constituting 41,000 and 32,000 vehicles, respectively. However, the non-work-related weekend trips are more evenly dispersed over the day than on weekdays. With less pronounced peaking patterns during the weekend, LOS conditions remain relatively stable throughout the day, with the exception of Saturday and Sunday evenings, particularly during summer months, when many residents return to Staten Island and other New York communities from points in New Jersey.

At the Goethals Bridge, peak-hour truck percentages in the existing condition range from 5 to 15 percent of total traffic. The highest truck percentages occur in the non-peak eastbound direction in the morning (15 percent) and in the non-peak westbound direction in the evening (11 percent). In the predominant westbound direction in the morning, trucks account for 8 percent of total vehicles while in the peak eastbound direction in the evening, trucks account for 5 percent of total vehicles. On the New Jersey Turnpike, truck percentages in the Interchange 13 area range from 11 percent of total traffic to as high as 37 percent during both AM and PM peak periods. Along Bayway Avenue approaching the Goethals Bridge, truck volumes comprise 10 to 15 percent of total traffic in the morning peak period; in the PM peak period, trucks comprise 5 to 14 percent of total traffic. On the street network near the Howland Hook Marine Terminal, truck percentages exceed 25 percent on the east- and westbound off-ramps from the Staten Island Expressway and along Forest Avenue, Goethals Road North, and Gulf Avenue in the AM peak period; in the PM peak period, truck percentages range between 17 and 23 percent on these local roads.

Future Traffic Growth and Travel Conditions

Population and employment forecasts prepared by the New York Metropolitan Transportation Council (NYMTC), the Port Authority, and other entities indicate that the regional economy and population will continue to grow in the foreseeable future. Projected growth in some of the areas served by the Goethals Bridge is expected to continue to place increasing traffic demands on the existing crossing, which will likely result in further deterioration of traffic conditions in future years. In addition, forecasted growth of the Howland Hook Marine Terminal in the northwestern corner of Staten Island will reinforce the importance of the Goethals Bridge as a critical link for truck-based goods movement in the region, despite recent improvements in rail-based cargo-carrying capacity at the Terminal.

NYMTC has developed a set of transportation models to meet federal requirements for long-range planning. NYMTC's travel-forecasting model, the Best Practices Model (BPM), was developed as the regional model to be used for sub-regional, corridor-level and conformity-related travel demand forecasting. The model's study area includes 28 counties in New York, New Jersey, and Connecticut and includes over 3,600 transportation analysis zones. The model also includes the study area's transit route system, comprised of more than 1,180 routes, including commuter rail, subway, express bus, local bus, and ferry services.

For purposes of travel demand forecasting and related traffic impact analyses for the GBR EIS, a Goethals Transportation Model (GTM) has been developed from the BPM. The GTM focuses specifically on the Goethals Bridge corridor, with a greater degree of detail than is available in the BPM for this project's study area, to better reflect existing traffic and transportation conditions and forecast future conditions (i.e., for the future analysis year of 2034).

Based on GTM modeling conducted for the GBR EIS, traffic conditions on the Goethals Bridge in the future No-Build condition have been forecast. Forecasted westbound traffic on the Goethals Bridge in the AM peak hour (7:30 – 8:30 AM) and AM peak period (6:00 – 10:00 AM) will be approximately 3,500 and 11,700 vehicles, respectively. Eastbound volumes in the AM peak-hour and AM peak-period would total approximately 2,900 and 9,700 vehicles, respectively. During the AM peak-hour travel period, the predominant westbound traffic flow would operate at LOS F, while eastbound traffic would operate at LOS E. Both LOS E and F represent undesirable traffic conditions, below the threshold of what is typically considered acceptable.

In the PM peak hour (5:00 – 6:00 PM) and PM peak period (3:00 – 7:00 PM), eastbound traffic on the Goethals Bridge would approximate 3,600 and 12,600 vehicles, respectively. Westbound PM peak-hour and PM peak-period volumes would total approximately 3,200 and 11,300 vehicles, respectively. During the PM peak-hour travel period, the predominant eastbound traffic flow would operate at LOS F, while westbound traffic would operate at LOS E. As in the AM peak period of travel, both east- and westbound directions of travel would operate with undesirable traffic conditions.

Overall truck volumes in the future (2034) without the proposed GBR would increase in both directions in both the AM and PM peak hours. However, the truck traffic as a percentage of total traffic volume would decrease slightly to 14 percent in the non-peak eastbound direction of traffic in the AM peak hour. In the predominant westbound direction in the AM peak hour, the truck percentage is forecast to increase to 13 percent (from the existing 8 percent). In the PM peak hour, truck traffic in the westbound direction would remain at 11 percent while, in the predominant eastbound direction, truck traffic would increase marginally to 7 percent (from existing 5 percent) of total traffic volumes.

4.3.5 The Need to Provide Safer Operating Conditions and Reduce Accidents

Accident data for the Goethals Bridge has been compiled by the Port Authority for the period from 2000 through 2003. The total number of accident occurrences on the bridge over the four-year period and the number of accidents per millions of vehicle miles traveled is shown in the following table:

<u>Year</u>	<u>No. of Accidents</u>	<u>Annual Traffic (Millions)</u>	<u>No. of Accidents/MVM</u>
2000	214	26.97	4.23
2001	226	28.47	4.36
2002	222	31.36	3.89
2003	186	28.49	3.59

Note: MVM - millions of vehicle miles

The number of accident occurrences during each year is substantially higher than the annual levels reported in the 1997 SIBP FEIS for the three-year period from 1993 to 1995; annual accident occurrences reported during that earlier period totaled 139, 170, and 158 during 1993, 1994, and 1995, respectively. It is likely that these increases in accident occurrences are attributable to increases in total traffic volumes, truck volumes, and the percentage of larger trucks and buses that are now traveling on the bridge in comparison to the mid-1990s.

Accident rates on the Goethals Bridge are the highest among the three Port Authority's Staten Island bridges and are higher than the normal statewide rates for four-lane highways in both New York and New Jersey. The average accident rate for the four-year period from 2000 through 2003 based on accidents per million vehicle miles (MVM) is 4.02 for the Goethals Bridge. Similar to the trend in accident occurrences, this rate is higher than it was in the mid-1990s, when the 1997 SIBP FEIS reported the average accident rate for the three-year period from 1993 to 1995 as 3.53 accidents per MVM.

The statistics show that accidents on the Goethals Bridge have decreased during recent years. However, despite some reduction in 2002 and 2003, the accident rates on the Goethals continue to be the highest of the three Staten Island Bridges and are well above the averages for similar facilities in New York and New Jersey. For example, the overall average rate is markedly higher than the 2002 New York statewide average of 1.09 accidents per MVM for four-lane divided access-controlled urban mainline highways, as compiled by the New York State Department of Transportation. The overall average rate on the Goethals Bridge is also well above the 2002 average accident incident rate of 3.75 accidents per MVM in New Jersey for four-lane, median barrier divided, full-access-control state and interstate highways with no shoulders, as compiled by the New Jersey Department of Transportation. The comparatively high number of accidents on the Goethals Bridge can be attributed to the undesirable combination of narrow lane widths, lack of emergency shoulders, and steep grade constraints.

4.3.6. The Need to Provide for Safe and Reliable Truck Access for Regional Goods Movement

The Goethals Bridge serves as a key freight link with several roles: serving Staten Island and nearby New Jersey consumer and business needs; connecting distribution centers in New Jersey with businesses and consumers in Brooklyn, Queens, and the Long Island suburbs; and connecting the New York Container Terminal (formerly, the Howland Hook Marine Terminal) in Staten Island with the mainland interstate highway system through a direct connection with the New Jersey Turnpike. Significant growth in cargo volume is forecast for the entire Port of New York and New Jersey, including at the New York Container Terminal. At the time that the SIBP Final EIS was completed in 1997, what was then the Howland Hook Marine Terminal had recently been reactivated with relatively small cargo throughput and modest growth forecasts, compared to the current New York Container Terminal's throughput, ongoing operations and infrastructure improvements, and growth forecasts. The forecasted trend of continued, robust cargo

volume growth in the Port, and notably at the New York Container Terminal, heightens the Goethals Bridge's importance for accommodating goods movement in the region.

Based on the findings of the traffic data collection program conducted for this GBR EIS, a total of approximately 8,600 trucks crossed the Goethals Bridge in both directions on a typical weekday in May 2004. The Goethals Bridge is used principally for truck trips originating near Port Newark and Port Elizabeth, the South Kearny freight yards, and Middlesex County, New Jersey. According to the Port Authority's 2005 *Marine Container Terminals Truck Origin-Destination Survey*, 71 percent of trucks bound for the New York Container Terminal accessed it via the Goethals Bridge, and 72 percent of trucks leaving the Terminal similarly used the Goethals Bridge.

However, truck traffic on the Goethals Bridge is constrained by the physically obsolete configuration of the Goethals Bridge – narrow lanes, no emergency shoulder, and substandard approach span horizontal curvature. Slow-moving truck traffic further exacerbates inefficient traffic service on the span by affecting passenger vehicle flows, as autos queue behind trucks navigating the narrow lanes. Forecasted increases in truck-based goods movement to/from the New York Container Terminal and within and through the region will be increasingly constrained in the Goethals Bridge corridor. As the crossing's geographic significance for goods movement in the region continues to grow, the existing span's increasingly inefficient handling of the demand will act counter to the need for safe and reliable truck access through this corridor.

4.3.7 The Need to Provide for Potential Future Transit in the Corridor

The existing configuration of the Goethals Bridge precludes consideration of accommodating a transit system or priority lane treatment for transit/ridesharing vehicles on the structure in the future, should travel patterns and ridership forecasts indicate that these would be feasible transportation options in the Goethals Bridge corridor. Although the New York/New Jersey region's transit network has grown during the past decade, evidenced most recently with implementation of the Hudson-Bergen light-rail transit (LRT) system, and further transit system expansion, including consideration of bus rapid transit (BRT), is under study throughout the region, the constrained design of the existing bridge does not offer a viable option to further enhance the region's transit goals. However, the proposed Goethals Bridge Replacement includes a cross-sectional design that could accommodate potential future introduction of transit service on the new bridge, at such time as it may be warranted.

4.4 Project Purpose

Given the various needs presented above, the primary purpose of the GBR project is to eliminate the functional and physical obsolescence of current design features on the bridge, thereby improving: 1) safety conditions; 2) emergency access and the ability to manage traffic incidents on the bridge; 3) system redundancy to better accommodate incident management of Port Authority interstate crossings and the regional highway network; and 4) traffic conditions on the bridge and its approaches. The GBR would address concerns regarding the structural integrity and increasingly costly repairs and maintenance of the aging bridge, as well as the existing span's deficiencies related to current bridge design standards. The GBR would consider modernization options for accommodation of potential future transit system expansion in the corridor. The GBR could also provide a means for improved efficiency and reliability in truck-based goods movement in the Goethals Bridge corridor and, more broadly, within the metropolitan region. And, finally, the GBR would address post-9/11 concerns that require structural security of the bridge, as well as the need for transportation system redundancy in the event that another regional crossing becomes inoperable due to routine maintenance or repairs or an emergency condition.

4.5 Project Goals

The GBR's goals have been defined on the basis of the stated purpose and need for the project, as discussed above. The project goals, in turn, have served during the environmental review process as the basis for: 1) identifying potential project alternatives; and 2) defining criteria and related performance measures that have been used to select reasonable and feasible alternatives that may best satisfy the project goals, address the project purpose and need, and, therefore, warrant detailed evaluation in this EIS.

Based on the purpose and need for the proposed GBR project, the following project goals have been defined:

- **Address the Functional Obsolescence of the Existing Goethals Bridge** – *to improve safety conditions and performance reliability; to meet current geometric design standards; and provide the ability to manage traffic volumes and respond to traffic incidents on the bridge in an efficient manner;*
- **Address Structural Integrity Issues Associated with the Aging Bridge** – *to reduce escalating maintenance/emergency repair costs and provide a bridge crossing that meets current structural and seismic standards;*
- **Reduce Roadway Congestion and Delays and Enhance Mobility on the Goethals Bridge** – *and thereby upgrade the overall function and capacity of the regional transportation network;*
- **Improve the Flow of Goods to and from Staten Island and in the New York – New Jersey Region** – *to serve the economic growth of commerce locally and in the broader metropolitan region;*
- **Accommodate Future Transit Services** – *and other single-occupant auto commuting alternatives that are emerging as regional responses to increasing highway congestion in both states;*
- **Restore and Enhance Pedestrian Access and Provide for Bicycle Access** – *to further promote alternatives to use of single-occupant auto commuting;*
- **Improve Bridge Structural Security** – *to enhance transportation system redundancy by providing adequate access in the Goethals Bridge corridor in the event that another transportation facility becomes inoperable, and to meet applicable Federal security guidelines for bridges; and*
- **Minimize Environmental Consequences** – *to serve projected future traffic needs and access while minimizing adverse environmental impacts to the maximum extent feasible.*

4.6 Differences Between Current Purpose & Need and the Purpose & Need of the Previous Staten Island Bridges Program – Modernization and Capacity Enhancement Project

As discussed in Section 1.2 of this report, the Port Authority had recognized that the Goethals Bridge had become functionally and physically obsolete by the 1980s, and that ever-increasing traffic volumes had led to deteriorated traffic conditions and relatively higher accident levels on the bridge, with projections that this trend would continue in future years. As a result of studies undertaken in the late 1980s and early 1990s, the Port Authority proposed the construction of a parallel bridge operating in conjunction with the existing bridge to enhance the bridge's capacity to meet the future transportation needs of the region. This

then-proposed twinning of the Goethals Bridge became known as the Staten Island Bridges Program – Modernization and Capacity Enhancement Project.

A DEIS was completed for that previously-proposed project in 1995 and a Final Environmental Impact Statement (FEIS) was completed in 1997, although a Record of Decision (ROD) for the project was not issued due to various unresolved issues. At that time, the purpose and need for the project as presented in the DEIS and FEIS documents was less comprehensive than the purpose and need that has been identified for the currently-proposed project. The project goals related to purpose and need as presented in those earlier documents were focused on the following elements:

- to reduce roadway congestion and delays and enhance mobility on the Staten Island bridges system, and thereby upgrade the overall functioning and capacity of the regional transportation network;
- to improve the flow of goods in and through Staten Island and the region;
- to correct the functional obsolescence of the existing Staten Island bridges and, thereby, improve safety conditions, performance reliability, and the ability to manage traffic incidents efficiently on the bridges;
- to minimize environmental consequences of modernization and capacity enhancement measures employed on the bridges system; and
- to provide a means for integrating the Staten Island bridge crossings with high-occupancy-vehicle facilities proposed for adjoining transportation facilities (i.e., New Jersey Turnpike and Staten Island Expressway).

Although the specific language of the above-stated project goals has been somewhat revised, these goals still apply today and are listed among the current goals related to purpose and need as presented above in Section 4.5. However, after proposed improvements at the Goethals Bridge had been stalled for several years, the need for modernization of the Goethals Bridge only increased and the specific goals were broadened to account for other elements of need that were not previously identified or did not previously exist. The Port Authority reassessed the condition of the existing Goethals Bridge, its operational constraints and improvement needs. In addition to the various needs that had been identified during the late 1980s and early 1990s, the Port Authority determined that due to the age and condition of the bridge, there is also an ongoing need to enhance structural integrity of the bridge and to reduce life-cycle costs associated with long-term maintenance, repair and rehabilitation of the bridge. Given the constrained financial resources available for the Port Authority to maintain and, as necessary, upgrade its regional network of transportation facilities, structural integrity of the bridge and the extensive long-term monetary investment required to keep the bridge in a safe working condition has become increasingly important to the Port Authority. As a result, the goal of addressing structural integrity issues associated with the aging bridge has been added for the current project.

Additional factors underlying the current need for a modernized bridge that were not previously identified as project goals include: 1) improving bridge structural security by enhancing transportation system redundancy and by meeting applicable Federal security guidelines for bridges in the post 9/11 era; and 2) restoring and enhancing pedestrian access and providing for bicycle access.

As a result of the new goals and associated needs, in combination with the pre-existing goals and needs from the earlier proposed project, the Port Authority reassessed the project. In this manner, the Modified Rehabilitation of the existing Goethals Bridge (Parallel-Bridge Alternative) was evaluated, along with other preliminary alternatives, to assess its ability for meeting all of the goals and the purpose and need

for the project. As a result of the alternatives screening process, Modified Rehabilitation (referred to during that process as the Parallel-Bridge Alternative) was found to be incapable of achieving all of the project's goals and needs than would a total replacement of the existing Goethals Bridge. Further discussion of the screening process undertaken to evaluate the relative ability of various alternatives to achieve the purpose and need, as well as other criteria is provided in Section 5.0.

5.0 Explanation of Alternatives

5.1 Alternatives Screening Process

5.1.1 Introduction to the Alternatives Screening Process

This section summarizes the alternatives screening process and analyses that were conducted to select project alternatives for detailed evaluation in this EIS. (Appendix E provides detailed information about the alternatives screening process methodology, findings, and results.) This section also describes the project alternatives selected through the screening process, and defines the No-Build Alternative (also referred to as the “No-Action Alternative” in Appendix E). The No-Build Alternative represents conditions in the future analysis year (2034) absent implementation of a Goethals Bridge Replacement alternative.⁶ It provides the future baseline against which anticipated effects of the project alternatives are compared to identify any significant project-related impacts.

The alternatives screening process conducted to select project alternatives for DEIS evaluation comprised two distinct phases of analysis:

- 1) an initial, qualitative screening of preliminary alternatives that were deemed potentially reasonable and feasible to address the project purpose and need; and
- 2) a comparative, quantitative screening of intermediate alternatives advanced from the initial screening, on the basis of which project alternatives were selected for detailed evaluation in this DEIS.

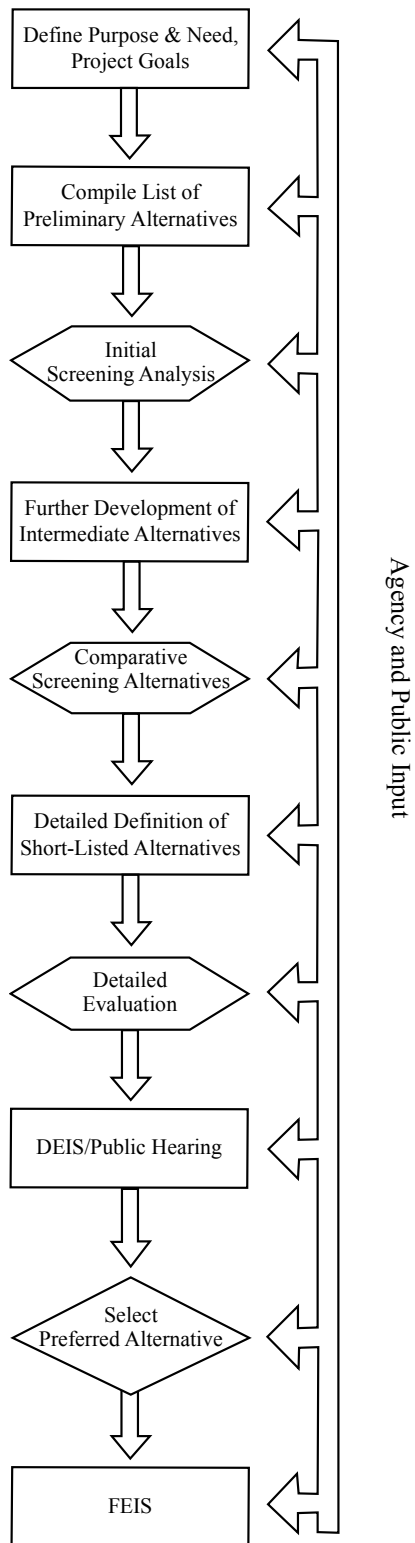
The full alternatives evaluation process, beginning with definition of the project purpose and need and related goals and concluding with the FEIS, is depicted in Figure 4.

As described in Section 4.0, the purpose of and need for the proposed Goethals Bridge Replacement addresses the functional and physical obsolescence of the existing Goethals Bridge and attendant operational deficiencies, among other elements. The preliminary alternatives identified for initial consideration in the screening process were each deemed potentially responsive to some aspect(s) of the project purpose and need, and the related project goals. The preliminary alternatives were identified on the basis of several factors, including: suggestions received during the agency and public scoping process for the DEIS; review of past studies of the Goethals Bridge corridor and the region served by the three Staten Island Bridges; and consideration of projected traffic and transportation conditions in the Goethals Bridge corridor. Potential solutions that would clearly not satisfy at least one aspect of the defined purpose and need for the Proposed Project, and/or were not reasonable and feasible, on the basis of investigation, were not identified as preliminary alternatives for the Proposed Project.

Each preliminary alternative represented a single transportation mode, to enable discrete consideration of its potential to address the project purpose and need, and was defined at a conceptual level, appropriate to the initial, qualitative screening. The initial screening had two purposes: 1) to test each conceptual single-mode alternative against a limited set of qualitative criteria that were designed to determine, early in the alternatives evaluation process, whether a potential alternative had any fundamental flaw(s) that would make it *not* reasonable and feasible; and 2) to consider how comprehensively each single-mode preliminary alternative would likely satisfy the full project purpose and need, and related goals.

⁶ The future analysis year reflects a date that is approximately 20 years after the anticipated date of construction completion. Although 2034 is the analysis year utilized for evaluating the several alternatives that have been advanced for detailed assessment in Section 5.0 following completion of the alternatives screening process described throughout this section of the DEIS, an analysis year of 2030 was utilized within the actual alternatives screening process. This change was made in order to reflect an updated and refined construction completion date (2014) that is currently anticipated for the Proposed Project.

FIGURE 4: ALTERNATIVES EVALUATION PROCESS



Based on the findings of the initial screening, preliminary alternatives that would address at least one element of the project purpose and need and the related project goals and did not have any fundamental flaw(s) were advanced to the comparative screening phase as intermediate alternatives. The intermediate alternatives were then more fully defined in terms of alignments, connections to the existing transportation network, system components, and other characteristics.

The intermediate alternatives were screened against a broader set of criteria and associated qualitative and quantitative performance measures, which collectively reflect the project purpose and need and related goals. The purpose of the comparative screening was to identify principal advantages and shortcomings of each intermediate alternative, highlight key differences among them, and determine the respective merits of each. The further definition and comparative screening of the intermediate alternatives was focused, rather than encyclopedic, to provide sufficient information for selection of a short list of alternatives that warrant further development, albeit still at a concept level, and detailed evaluation in this DEIS.

5.1.2 Preliminary Alternatives

Preliminary “Build” alternatives identified for consideration in the alternatives screening process are transportation options that would directly address one or more aspects of the Proposed Project’s purpose and need. Transportation options that would not directly address at least some aspect of the project purpose and need were not included as preliminary alternatives⁷. Four categories of alternatives were identified as potentially pertinent to the project purpose and need, within which a total of 15 preliminary alternatives were identified; these are listed in Table 2 and described below. (Details of the preliminary alternatives, and of the investigations conducted to identify them, are provided in Section 3.0 of Appendix E.)

Preliminary New-Crossing Alternatives

The identification of preliminary new-crossing alternatives focused on the existing Goethals Bridge corridor, spanning the Arthur Kill to connect major roadway systems in Staten Island, New York, and Elizabeth, New Jersey. This geographic focus appropriately reflects the project’s purpose and need and the crossing’s critical role in the corridor. Each preliminary new-crossing alternative comprised one or more new bridges replacing the existing Goethals Bridge, located immediately north or south of the existing bridge, and connecting to New Jersey Turnpike Interchange 13 on the west and to the Staten Island Expressway on the east, consistent with the existing crossing’s termini (see Section 3.2.1 in Appendix E for details of the preliminary new-crossing alternatives). Both replacement bridge alternatives and parallel bridge alternatives were considered for the preliminary new-crossing alternatives.

Replacement bridge alternatives were originally considered as either a single six-lane bridge or twin replacement bridges of three lanes each. These bridges would be designed and constructed to meet current codes and standards. With either type of replacement bridge (i.e., either single or twin) in the Goethals Bridge corridor, the existing span would be demolished and removed. With the twin bridge replacement alternatives, the new bridge south or north of the existing bridge would be constructed first and would temporarily accommodate both directions of traffic until the existing bridge was demolished and the second bridge was constructed.

⁷ Six possible alternatives that were suggested during the agency and public scoping process for the DEIS were deemed to be not reasonable for consideration as preliminary alternatives. See the first appendix included in Appendix E for details of these options and the rationale for their dismissal from further consideration.

TABLE 2: PRELIMINARY ALTERNATIVES

No-Build Alternative	
Preliminary New-Crossing Alternatives	<ul style="list-style-type: none"> • Goethals Replacement Bridge South • Goethals Replacement Bridge North • Goethals Parallel Bridge South • Goethals Parallel Bridge North • Goethals Twin Replacement Bridges South • Goethals Twin Replacement Bridges North
Preliminary Transit Alternatives	<ul style="list-style-type: none"> • Bus Rapid Transit via New Goethals Bridge • Ferry Service, with or without a New Goethals Bridge
Preliminary Travel Demand Management Alternatives	<ul style="list-style-type: none"> • Temporal Shift, with or without a New Goethals Bridge • Temporal, Payment, and Mode Shift, with or without a New Goethals Bridge • Peak-Period Temporal Shift and Transit Support, with or without a New Goethals Bridge • High-Occupancy Toll Lane, with a New Goethals Bridge
Preliminary Freight-Movement Alternatives	<ul style="list-style-type: none"> • Highway Freight-Movement Enhancement Alternative, with a New Goethals Bridge • Rail Freight-Movement Enhancement Alternative, with or without a New Goethals Bridge • Intermodal Freight-Movement Enhancement Alternative, with or without a New Goethals Bridge

Source: Berger/PB, 2006.

Parallel bridge alternatives, also referred to herein as “modified rehabilitation alternatives,” involved reconfiguration of the existing span to carry one direction of traffic after construction of a new bridge to the north or south of the existing bridge. Traffic lanes would be widened to meet design criteria, but the main span and approaches could accommodate only 4-foot-wide and 2-foot-wide right and left shoulders, respectively. The existing structure would require a full deck replacement and seismic upgrade, as well as a continuous need to repair and rehabilitate elements of the bridge in the future.

Any bridge crossing within the Goethals Bridge corridor must accommodate projected traffic volumes safely and efficiently in order to be responsive to the project purpose and need. The appropriate number of travel lanes is generally determined on the basis of forecasted traffic, considering other transportation improvements in the corridor and region that may affect travel demand volume and, as appropriate, configuration for multimodal access across the bridge. Each preliminary bridge alternative was defined to include a total of six lanes of traffic, three in each direction, in order to normalize the initial analysis of future traffic effect with a proposed Goethals Bridge replacement.

Current safety standards and practices dictate the use of a median barrier and shoulders, as well as wider lanes. A new bridge crossing would also include adequate width to provide for bicyclists, pedestrians, and potential transit use.

Preliminary Transit Alternatives

Preliminary transit alternatives that have potential to address the project purpose and need, and related project goals, were identified based on the following:

- 1) analysis of the potential transit market, as represented by principal current travel patterns and forecasts of future travel patterns of trips using the Goethals Bridge (e.g., predominant origin-destination pairs); and
- 2) potential transit modes (e.g., fixed-guideway systems, roadway-based systems, and waterborne systems) that may be suitable for the Goethals Bridge corridor; as defined in recent transit studies and transportation literature, suitability is based on land use/transit relationships related to cost-effectiveness, productivity, and efficiency.

(See Section 3.2.2 in Appendix E for a discussion of the basis for, and details of the preliminary transit alternatives.)

Two preliminary transit alternatives were defined. The preliminary Bus Rapid Transit (BRT) alternative would provide BRT service from Brooklyn, across the Verrazano Narrows Bridge and Staten Island to Union and Essex counties in New Jersey via a Goethals Bridge replacement(s), and from Interchange 2 of the West Shore Expressway north to and across the Goethals Bridge to the same destinations in Union and Essex counties. Exclusive bus lanes would be provided on a new Goethals Bridge(s), in the North Shore Railroad right-of-way, on the Staten Island Expressway (portions of which already exist or are under construction), and on the West Shore Expressway. BRT buses would operate in both directions on frequent headways via the busway network, would be supported by enhanced local bus services, and would be connected to existing ferry, rail, and bus transit services operated by NJ Transit and the Metropolitan Transportation Authority-New York City Transit (MTA-NYCT).

The preliminary ferry alternative would provide ferry service linking Brooklyn and St. George with a new ferry slip in Elizabethport via the Kill van Kull and New York Harbor. This alternative could be implemented with or without a Goethals Bridge replacement(s). Ferries would operate in both directions on 20-minute headways or more frequently, if warranted by passenger demand, and service would connect with local MTA-NYCT bus services in Brooklyn and St. George, as well as the Staten Island Railway.

Preliminary Travel Demand Management (TDM) Alternatives

Travel demand management (TDM) alternatives embody strategies that change travel behavior (i.e., how, when and where people travel) in order to increase transportation system efficiency and achieve specific objectives such as reduced traffic congestion, road and parking cost savings, increased safety, improved mobility for non-drivers, energy conservation and pollution emission reductions. Implementation of TDM initiatives in the Goethals Bridge corridor was considered to determine their potential to reduce traffic volume and manage congestion on the crossing during peak hours. Four preliminary TDM alternatives were defined, as follows: 1) temporal shift, with or without Goethals Bridge replacement; 2) temporal, payment and mode shift, with or without Goethals Bridge replacement; 3) peak-period temporal shift and transit support, with or without Goethals Bridge replacement; and 4) High-Occupancy Toll (HOT) lane, with Goethals Bridge replacement. (See Section 3.2.3 in Appendix E for a discussion of the basis for, and details of the preliminary TDM alternatives.)

Preliminary Freight-Movement Alternatives

The identification of preliminary freight-movement alternatives was based on several factors, including: review of recent analyses of freight operations in the region and the resulting proposals for freight improvements; truck traffic related to the Port of New York and New Jersey, with major Port facilities located on either side of the Arthur Kill; analysis of freight operations in the study corridor, particularly at the Howland Hook Marine Terminal in Staten Island, located at the base of, and on the north side of the Goethals Bridge; and consideration of freight-movement-related comments received during the GBR EIS scoping process.

Three preliminary freight-movement alternatives were identified: 1) highway freight-movement enhancement on a Goethals Bridge replacement, including improved Howland Hook access, improvement of NJ Turnpike Interchange 13, and exclusive truck or shared HOV lanes on a replacement Goethals Bridge; 2) rail freight-movement enhancement, with or without a Goethals Bridge replacement, including improvements to the Conrail Chemical Coast Secondary (north and south), the Conrail Port Reading Secondary, and the Staten Island Railway (west); and 3) intermodal freight-movement enhancement, with or without a Goethals Bridge replacement, focused on improvements to the Arlington Yard Intermodal Distribution Facility. (See Section 3.2.4 in Appendix E for a discussion of the basis for, and details of these preliminary alternatives.)

5.1.3 Initial Screening Criteria and Results

Initial Screening Criteria

The first step in the initial screening comprised a qualitative assessment of each preliminary alternative's fundamental reasonableness and feasibility, which, for transportation projects, is typically related to primary engineering, design, or operational considerations. Four criteria were defined to screen each preliminary alternative to determine if it could be considered reasonable for further consideration (see Section 2.1 in Appendix E for a detailed definition of the initial screening criteria). The four initial screening criteria are as follows:

- 1) A preliminary alternative must connect logical termini at existing and/or programmed and committed transportation facilities or services.
- 2) A preliminary alternative must be able to be operationally integrated with the existing and/or programmed and committed transportation network.
- 3) A preliminary alternative must have independent utility.
- 4) A preliminary alternative that requires new infrastructure must be able to conform to current, accepted engineering and safety standards, criteria, and practices.

The second step in the initial screening was a qualitative assessment of how well each preliminary alternative would meet the Proposed Project's purpose and need, and its related goals. A rating system was used to assign a value for each alternative's performance against each goal and to derive alternative-specific composite values, on the basis of which the preliminary alternatives could be ranked in terms of each one's likely ability to address the Proposed Project's full purpose and need.

Initial Screening Results and Conclusions

Table 3 summarizes the initial screening of potential project alternatives against the proposed project's needs and associated goals (see Section 4.0 of this report). As shown in Table 3, each of the four bridge-replacement alternatives (identified as B1, B2, B5 and B6, all of which are highlighted in the table)

satisfied all four of the initial screening criteria and had a rating of 36 (out of a total possible rating of 40) against the project goals. All other alternatives, including the two parallel bridge alternatives, exhibit ratings that are substantially below those for the four bridge replacement alternatives.

Following completion of the initial screening, the results were presented and discussed at meetings of the Study's Technical Advisory Committee (TAC), Environmental Task Force (ETF), and Stakeholder Committee (SC). Based on comments received at the Study committees' meetings and on the screening results, the four bridge replacement alternatives were identified for further development and subsequent comparative screening⁸, as identified below.

- *6-Lane Bridge Replacement South* – A new bridge would be designed and constructed south of, and roughly parallel to the existing structure, and the existing Goethals Bridge would be demolished. The new 6-lane bridge would provide: 12-foot-wide lanes, three in each direction; a 12-foot-wide right shoulder and a 5-foot-wide left shoulder in each direction; adequate overall bridge width to accommodate a sidewalk/bikeway and potential transit service.
- *6-Lane Bridge Replacement North* – Improvements with this alternative are similar to the 6-Lane Bridge Replacement South, above, but the new bridge would be designed and constructed north of, and roughly parallel to the existing structure.
- *Twin Replacement Bridges South* – Two 3-lane replacement bridges would be designed and constructed, one south of, and roughly parallel to the existing structure for eastbound traffic, and the second in the right-of-way of the existing Goethals Bridge for westbound traffic, following demolition of the existing structure. Each of the bridges would provide 12-foot-wide lanes and 12- and 5-foot-wide right and left shoulders, respectively. The westbound bridge would also include a 10-foot-wide walkway/bikeway, and the two bridges would together provide sufficient width to accommodate potential transit service.
- *Twin Replacement Bridges North* – This alternative is similar to the Twin Replacement Bridges South, above, but with the first 3-lane bridge north of, and roughly parallel to the existing structure for westbound traffic, and the second in the right-of-way of the existing Goethals Bridge for eastbound traffic, following demolition of the existing structure. The walkway/bikeway would be on the eastbound bridge.

These intermediate alternatives were further defined at a concept level of detail sufficient for estimating their relative performance against each of the comparative screening criteria and associated evaluation measures.

⁸ The nomenclature and design concepts as listed below have been refined since these alternatives were first introduced and evaluated as part of the alternatives screening process. These refinements are discussed in Sections 5.2 and 5.3.

TABLE 3: PROJECT GOALS SCREENING MATRIX

Preliminary Alternatives	Address bridge's functional obsolescence	Address bridge's structural integrity	Improve bridge's structural security	Reduce congestion & delays & enhance mobility on bridge	Address bridge's inability to accommodate alternatives to SOVs	Improve goods flow to/from SI & NJ, & in NY/NJ region	Restore/enhance bike & pedestrian access on bridge	Minimize adverse environmental effects	TOTAL
B1 Replacement Bridge South	5	5	5	5	5	3 ¹	5	3	36
B2 Replacement Bridge North	5	5	5	5	5	3 ¹	5	3	36
B3 Parallel Bridge South + Reconfigured Existing Bridge	1 ²	1 ³	1 ⁴	5	5	3 ¹	5	3	26
B4 Parallel Bridge North + Reconfigured Existing Bridge	1 ²	1 ³	1 ⁴	5	5	3 ¹	5	3	26
B5 Twin Replacement Bridges South & in Current ROW	5	5	5	5	5	3 ¹	5	3	36
B6 Twin Replacement Bridges North & in Current ROW	5	5	5	5	5	3 ¹	5	3	36
T1 Bus Rapid Transit (requires new bridge)	1	1	1	3 ⁵	1	3 ^{5,6}	1	3	14
T2 Ferry Service	1	1	1	3	1	3 ⁶	1	3	14
TDM1 Temporal Shift	1	1	1	3	1	3 ⁷	1	5	16
TDM2 Temporal/ Payment/ Mode Shifts	1	1	1	3	1	3 ⁷	1	5	16

TABLE 3: PROJECT GOALS SCREENING MATRIX (CONTINUED)

Preliminary Alternatives	Address bridge's functional obsolescence	Address bridge's structural integrity	Improve bridge's structural security	Reduce congestion & delays & enhance mobility on bridge	Address bridge's inability to accommodate alternatives to SOVs	Improve goods flow to/from SI & NJ, & in NY/NJ region	Restore/enhance bike & pedestrian access on bridge	Minimize adverse environmental effects	TOTAL
TDM3 Peak-Period Temporal Shift + Transit	1	1	1	3	1	3 ⁷	1	3	14
TDM4 HOT Lane (requires new bridge)	1	1	1	3 ⁵	1	3 ^{5,6}	1	3	14
FM1 Highway Freight-Movement Enhancement (requires new bridge)	1	1	1	3 ⁵	1	3 ⁵	1	3	14
FM2 Rail Freight-Movement Enhancement	1	1	1	3 ⁸	1	5	1	3	16
FM3 Intermodal Freight-Movement Enhancement	1	1	1	3 ⁸	1	5	1	3	16

1 = does not meet goal; 3 = uncertain; 5 = satisfies goal

Shading indicates the highest scores when considering all goals.

Notes:

1. Positive effect on truck-based goods movement due to standard-width lanes and increased capacity with six lanes in crossing but uncertainty regarding broader effect on goods movement in NY/NJ region.
2. Emergency shoulders on reconfigured existing bridge would be of substantially substandard width (i.e., 4 and 2 feet widths).
3. Reconfiguration of the existing bridge would not address the structure's age, which is past its normal service life, and consequent need for ongoing maintenance, repair and rehabilitation costs.
4. Design of the new parallel bridge would include structural security measures; the existing bridge could be seismically retrofitted, but only certain measures to limit security threats to the existing bridge could be feasibly implemented.
5. As this single-mode alternative could not be accommodated on the existing bridge but requires a new bridge, it cannot independently address this goal; however, it may have a positive effect related to this goal if implemented with a new bridge.
6. Potential positive effect on truck-based goods movement, depending on degree of alternative's ability to attract sufficient SOV travelers on bridge to use alternate travel option and, thereby, reduce vehicular traffic on bridge, enhancing traffic flows.
7. Potential improvement in traffic flows, but only during peak commutation periods, which are not necessarily coincident with peak periods for truck traffic.
8. Performance related to this goal depends on whether improvements in non-highway-based freight movement sufficiently reduce truck traffic to improve general traffic flows.

5.1.4 Comparative Screening Criteria and Results

Comparative Screening Criteria

The intermediate alternatives were each evaluated independently against the following five criteria, derived from the project purpose and need and project goals:

- 1) An alternative should enhance mobility on the Goethals Bridge and its approaches in the future analysis year.⁹
- 2) An alternative should not result in deterioration of traffic conditions at other crossings or in the region in the future analysis year.
- 3) An alternative should enhance non-single-occupant-vehicle (SOV) commutation opportunities.
- 4) An alternative should seek to minimize potential adverse environmental effects.
- 5) An alternative should be capable of being constructed without extraordinary techniques, with feasible maintenance of existing transportation services during construction, and at reasonable cost comparable to other alternatives with similar benefits.

For each criterion, performance measures were identified. For the measures associated with the first four criteria (i.e., non-construction-related), the alternatives' performance was evaluated relative to the future No-Build condition to determine the likely change, positive or negative, that would occur with implementation of a given alternative, compared to not undertaking the Proposed Project. The results of the screening evaluation of each alternative were then compared to determine each alternative's relative ability, compared to other alternatives, to satisfy the criteria.

Comparative Screening Results and Conclusions

The comparative screening results indicated that the four bridge-replacement alternatives would achieve the desired level of service (LOS)¹⁰ improvement (i.e., LOS D) on the Goethals Bridge and its approaches, and would result in fewer annual accidents, on average, than would occur in the future No-Build condition (i.e., without implementation of the proposed bridge replacement).¹¹ For many of the social, economic, and environmental factors considered in the comparative screening, the potential effects of the four bridge-replacement alternatives would be identical or very similar. For the remaining social, economic, and environmental factors, the potential effects differed somewhat among alternatives for specific measures, but did not collectively represent any given alternative as markedly better or worse than the others. (Section 6.0 in Appendix E provides details of the comparative screening and results.)

The estimated construction period for the bridge-replacement alternatives as assessed in the comparative screening ranged from approximately 4.5 years for the southern 6-lane replacement bridge to

⁹ As indicated in Footnote 6 in Section 5.1.1, a future analysis year of 2030 was utilized for the alternatives screening process; the future analysis year was refined to 2034 for evaluation of the project alternatives in this EIS, based on 2014 as the currently estimated time of completion of project construction.

¹⁰ Level of service (LOS), as defined by the Transportation Research Board, denotes traffic conditions and ranges from level "A" to level "F," where LOS A indicates free-flowing traffic conditions with high travel speeds and LOS "F" describes breakdown conditions with excessive congestion and delays. LOS "D" represents heavy traffic flow conditions without excessive delays and is generally considered to be the minimum acceptable operating condition for urban areas. LOS "E" is defined as the theoretical capacity of a roadway, or the maximum stop-and-go flow of vehicles, given existing physical conditions. It is generally considered that LOS "E" and LOS "F" are below the threshold of acceptable operating conditions.

¹¹ The transportation benefits of the four bridge-replacement alternatives would be identical, due to the alternatives' uniform 6-lane capacity and design in accordance with current design criteria.

approximately 6.5 years for the northern twin replacement bridges. The difference in construction durations among the alternatives was related principally to the estimated complexity of construction, including connection to the existing termini at New Jersey Turnpike Interchange 13 and the Staten Island Expressway, and the longer period required to construct two, rather than a single replacement bridge. The comparative construction costs showed the southern 6-lane bridge replacement at the lower cost range and the northern twin replacement bridges at the upper end of the range.

The results of the comparative screening were presented at meetings of the Study's TAC, ETF, and SC, as well as at two public open-house meetings in June 2006. Based on comments received at these venues and on the full set of findings and results of the comparative screening, it was recommended that all four bridge-replacement alternatives be advanced for detailed impact evaluation in this DEIS. In addition, given public interest in enhanced transit services in the Goethals Bridge corridor and the broader New York/New Jersey region, it was recommended that the design of the bridge-replacement project alternatives should include sufficient width so as to not preclude potential future consideration and accommodation of transit, should future conditions warrant it.

5.2 Post-Screening Refinement of Project Alternatives

Following completion of the alternatives screening process described above, input obtained during the GBR EIS agency coordination and public outreach efforts resulted in the Port Authority making refinements to the four bridge-replacement alternatives that had been identified and selected for further study via the screening process. Details of these refinements are discussed below. It should be noted, however, that since the conceptual alignments of the refined alternatives remain largely the same as those of the intermediate alternatives that were assessed in the screening phase of study, with generally similar impacts to those identified for the intermediate alternatives, the refinements to the project alternatives did not alter the screening process outcome.

The refinements to the project alternatives were precipitated by the Goethals Bridge's proximity to Newark Liberty International Airport, which is located approximately 3 miles north of the bridge. Given this proximity, the Port Authority, as project sponsor, submitted a completed Form 7460 (Notice of Construction or Alteration) to the Federal Aviation Administration (FAA) for review. In response to this form, the FAA, which is a member of this Study's TAC, identified a potential concern with the 350-foot high towers originally proposed for the replacement bridge. The Port Authority then conducted its own aeronautical studies and held further discussions with the FAA and with representatives of the airlines operating at the airport to ascertain a tower height for the replacement bridge that would not pose a hazard to aviation height clearances.

As a result of the Port Authority's aeronautical studies and consultation process with the FAA and airport stakeholders, a maximum tower height of 272 feet above mean sea level (MSL) was established for the proposed Goethals Bridge replacement to avoid conflict with flight departures from the airport. This decrease of 78 feet from the originally proposed maximum tower height of 350 feet above MSL, in turn, required redesign of the proposed bridge-replacement alternatives' main span towers. The decrease in maximum tower height is particularly relevant to a cable-stayed bridge design, which is the primary design concept currently being considered by the Port Authority.

Design studies that were undertaken to address the effects of the tower height decrease on the previously prepared conceptual bridge-replacement designs determined that the 272-foot maximum tower height required refinements to the bridge-replacement alternatives' alignments. The new design studies, while still conceptual, further determined that a single bridge configuration containing two decks separated by a set of bridge towers would be suitable for the alignments of all four bridge-replacement alternatives, instead of the two separate design concepts that had been advanced during the alternatives screening process (i.e., single replacement bridge south or north of the existing bridge's alignment, and twin replacement bridges within and directly south or north of the existing bridge's alignment). Therefore, the

twin replacement-bridge alternatives north and south of the existing Goethals Bridge were eliminated from further consideration.

Following the design studies to refine the four conceptual bridge-replacement alternatives, the refinements were presented to and discussed with the Study's TAC and ETF at a September 2007 meeting scheduled specifically for this purpose. Both the TAC and ETF had been involved in the review of the alternatives screening process, results, conclusions, and recommendations of the original bridge-replacement alternatives. The meeting with the TAC and ETF regarding the refined alternatives included: discussion of the underlying airport-related impediments to the previously assumed maximum tower height and associated design concept modifications; comparison of the refined alternatives' alignments to the alignments of the four original bridge-replacement alternatives, via visual displays of overlay mapping of the original and corresponding refined alignments; and the screening results for the four refined alternatives using the same basic criteria and evaluation measures as were previously used in the alternatives screening process.

With the input received from the TAC and ETF review of the refined alternatives, the USCG, as lead federal agency for preparation of the GBR EIS, concluded that the refined alternatives are consistent with the recommendations of the alternatives screening process and are appropriate for continued detailed evaluation of the Proposed Project's potential social, economic and environmental impacts. Therefore, the four project alternatives being evaluated in detail in the GBR EIS are:

- *New Alignment South Alternative* - a single-span bridge-replacement in an alignment directly south of the existing Goethals Bridge;
- *New Alignment North Alternative* - a single-span bridge-replacement in an alignment directly north of the existing Goethals Bridge;
- *Existing Alignment South Alternative* – a single-span bridge-replacement in an alignment within and extending south of the existing Goethals Bridge alignment; and
- *Existing Alignment North Alternative* - a single-span bridge replacement in an alignment within and extending north of the existing Goethals Bridge alignment.

5.3 Description of Alternatives

The remainder of this section identifies and describes the alternatives that are being evaluated in detail in the GBR EIS in terms of impacts and, as appropriate, mitigation. These include the *No-Build Alternative*, which is also referred to as the *No-Action Alternative* in Appendix E.

The four *Bridge Replacement Alternatives* are also referred to as the *Build Alternatives*. Two of the Build Alternatives entail the construction of a replacement bridge on new alignment located either completely to the south or north of the existing bridge, while two other Build Alternatives entail the construction of a replacement bridge within an alignment that incorporates the existing Goethals Bridge alignment and also extends either to the south or north of the existing alignment. These alternatives are generally referred to as *New Alignment Alternatives* and *Existing Alignment Alternatives*, respectively. The two New Alignment Alternatives are the *New Alignment South Alternative* and the *New Alignment North Alternative*. Similarly, the two Existing Alignment Alternatives are the *Existing Alignment South Alternative* and the *New Alignment North Alternative*.

Two alternatives involving rehabilitation of the existing bridge are also presented in detail, including *Rehabilitation According to Secretary of Interior's Standards for Rehabilitation* and a *Modified Rehabilitation* (also referred to as the *Parallel Bridge Alternative*).

5.3.1 No-Build Alternative

The No-Build Alternative describes future conditions, projected to the analysis year of 2034, assuming the Goethals Bridge is not replaced as proposed. This alternative represents the future baseline against which the Build Alternatives are compared.

The No-Build Alternative assumes that the Goethals Bridge would not be replaced and that operation and maintenance of the bridge and approach roadways would continue in order to maintain this critical crossing in the interstate highway network. As the existing bridge was designed to accommodate the lighter vehicle weights of the early 20th century, an increase in vehicle weights would continue to adversely affect the condition of the riding surface, deck slab and deck joints of the structure. In approximately 7 to 10 years, the existing structure would require, at minimum, a full deck replacement and retrofit procedures for seismic upgrade, as well as security upgrades. Due to the age of the structure and the fact that the bridge is well past its normal service life, future rehabilitation and repair activities, including those related to the superstructure and substructure, would also likely be required.

Following the anticipated deck replacement within the next 7 to 10 years, the Goethals Bridge's geometric and design deficiencies (10-foot lane-widths; lack of shoulders; approach span grade and alignment), and consequent functional obsolescence, would remain and could not be rectified. The functional obsolescence would likely continue to contribute to reduced traffic capacity and unsatisfactory service levels, cumulatively resulting in diminished traffic performance and traveler safety. Following the deck replacement and other rehabilitation work anticipated to be required in the next decade, ongoing maintenance and periodic major rehabilitation projects would continue to be needed to keep the Goethals Bridge in service.

It is expected that by 2034, the structural elements of the then-106-year-old Goethals Bridge would have changed little other than through aging and necessary repairs to maintain its structural integrity. The 7,413-foot-long structure comprises a 1,152-foot-long main span flanked by 3,126 feet of approach spans on Staten Island and 2,831 feet of approach structure in New Jersey. Two sidewalks, which are currently not accessible to pedestrians, would likely remain closed due to security and safety considerations. The height of the Goethals Bridge is 238 feet above mean sea level.

The bridge deck, 62 feet, 1½ inches wide on the main span section and 53 feet, 0 inches wide on the approach spans, would still provide for only four lanes of traffic on a 42-foot-wide roadway, with a curb-to-curb width in each direction of traffic of 20 feet for two lanes. The narrow lanes would impede vehicular traffic at times, due to tractor-trailers and larger trucks that would exceed the lane widths, thereby reducing serviceability to a single lane of traffic in that direction. As today, there would be no shoulders to accommodate traffic incidents, vehicle breakdowns, or other emergencies that disrupt traffic flow, such that existing safety and operational constraints would remain. This existing absence of shoulders has in fact resulted in the closure of the entire bridge on several occasions due to accidents or other breakdowns during recent years. The lack of shoulders would also likely require nighttime closures and associated higher maintenance and construction costs, due to higher labor costs for work performed at night.

5.3.2 “Build” Replacement Alternatives

New Alignment South

The New Alignment South Alternative proposes replacement of the Goethals Bridge with a new six-lane structure directly and entirely south of the existing structure’s alignment (see Figure 5). The new bridge crossing would be constructed first, with traffic maintained across the existing Goethals Bridge, after which the existing crossing would be demolished. Specific elements of this alternative, discussed from west to east, are described below.

New Jersey Alignment. The western terminus of this alternative begins in Elizabeth, approximately 600 feet west of the New Jersey Turnpike mainline near the Interchange 13 ramps. At the crossing of the Turnpike mainline, the new structure would begin to shift to the south with sufficient width to accommodate the additional lanes and shoulders that are proposed. At a point approximately 700 feet east of the Turnpike mainline, where the new approach structure would cross over the Staten Island Railroad (SIRR) trestle, the alignment would be entirely to the south of the existing Goethals Bridge approach structure. From that point eastward to the Arthur Kill, the northern edge of the new approach structure to the bridge would be located close to, and entirely south of the existing structure. This alignment would pass directly over the Krakow Street residential neighborhood and several businesses. Foundation piers would be constructed intermittently along the entire length of the structure to the western pier of the main bridge span, to be located at the edge of the Arthur Kill in an intertidal basin (former boat slip) immediately to the north of the Bayway Industrial Center. The new bridge would also cross the Arthur Kill on a new alignment that closely parallels to the south of the existing bridge alignment.

New York Alignment. At the eastern shoreline of the Arthur Kill, the new main bridge span would similarly be close, but entirely to the south of the existing Goethals Bridge. This alignment would avoid placement of the eastern pier supporting the main bridge span in the Arthur Kill. The alignment would then continue entirely on elevated structure, crossing Old Place Creek and some business properties to a point just west of Gulf Avenue at its western terminus and intersection with Western Avenue, at which point the approach roadway would begin to curve northward to meet the existing alignment. After crossing Gulf Avenue, which would be relocated along a portion of its length due to pier placement, the structure would tie into existing grade and meet the existing roadway and toll plaza. The foundation piers along this entire segment of the approach structure would be placed in both wetland and upland areas.

Right-of-Way. This alternative would require acquisition of (or easements for construction on) several properties in addition to those currently owned and maintained by the Port Authority. A 50-foot-wide right-of-way/security buffer along both sides of the structure and approach roadways is proposed, including an 8-foot high chain-link fence along the length of the project (except in open waters). In New Jersey, the alignment would pass directly over the Krakow Street neighborhood, resulting in the taking of most of the residential and commercial buildings in that neighborhood. The alignment would also cross the Bayway Industrial Center (former Cory Warehouse), requiring a taking of that facility as well. On the New York side, relocation of a portion of Gulf Avenue may be required for this alignment. The relocation of Gulf Avenue and any work in the vicinity of the toll plaza may require relocation of several Con Edison electric lines, both aerial and underground. This alignment would not encroach on the New York Container Terminal at Howland Hook and would avoid pier placements in Old Place Creek, although it would directly cross the R.T. Baker & Sons Machinery Dismantlers property. The northern bend of Old Place Creek located to the east of the R.T. Baker property would lie within the 50-foot right-of-way/security buffer proposed for this alternative.

Bridge Structures. The proposed bridge would be an approximately 7,300-foot-long structure, comprising an approximately 2,700-foot approach on the west (in New Jersey) and an approximately 2,900-foot approach on the east (in New York), with an approximately 1,700-foot main span. The new 6-lane bridge would provide 12-foot-wide lanes, three in each direction on separate bridge decks, with a 12-

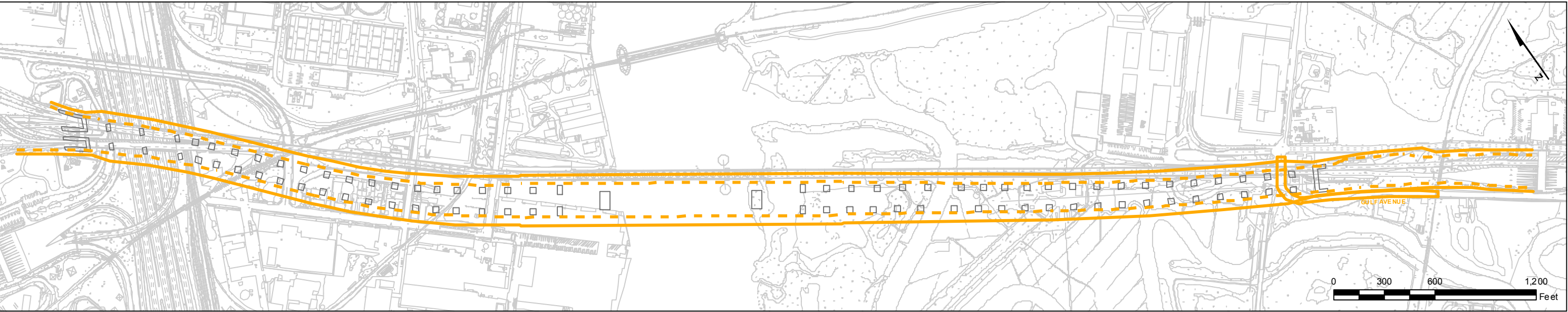
foot-wide right shoulder and a 5-foot-wide left shoulder in each direction. The overall bridge cross-section would provide a 10-foot-wide sidewalk/bikeway (on the north side, with a view toward the Arthur Kill Lift Bridge) and sufficient additional width between the westbound and eastbound roadways, so as to not preclude potential future transit use should future conditions warrant inclusion of transit on the Goethals Bridge crossing. The resultant total out-to-out width would be approximately 210 feet (i.e., about 148 feet wider than the approximately 62-foot-wide existing bridge with the No-Build Alternative). Figure 5 illustrates the New Alignment South Alternative's main-span cross section compared to that of the existing Goethals Bridge.

The bridge towers of a cable-stayed bridge would have a maximum height of approximately 272 feet. Upon completion of the new bridge, the existing bridge, including its main truss span, its New Jersey and New York approach spans, its New Jersey east approach ramp, and its New Jersey and New York hollow abutments, would be demolished and removed.

Navigation. The main span would provide for a 500-foot horizontal clearance measured normal to the channel axis and a minimum 135-foot vertical clearance measured above mean high water. For this alternative (as well as for the other three alignment alternatives, with either bridge design), it is assumed that the existing bridge pier and protective dolphins would be removed from the eastern edge of the navigation channel, and new piers would be constructed well outside the channel limits immediately upland of the eastern shore of the Arthur Kill. As vessels would turn into the Bayway refinery, their sterns would no longer swing close to the existing protective dolphins, and this maneuver would be easier to complete. A protective cell adjacent to the east main pier is proposed; this cell would be a stone-filled, steel sheet pile with a timber or rubber outside-rubbing surface, and would serve to protect the pier from vessels. During construction, effects on navigation would be limited to those that would occur due to the use of barge-mounted equipment to construct the main span piers and the cell at the east main pier.

Construction, Maintenance and Security Access. Access for inspection and maintenance activities would be provided through a combination of: 1) permanent access roads to be constructed on the New York side of the alignment generally below the replacement bridge and its eastern approach, and 2) provisions designed into the main span structure. On the New York side, a permanent road would be constructed primarily on fill between the footings supporting the approach structure, although where the road crosses the open waters of Old Place Creek, it would be constructed on trestle. Also, the purpose of this permanent access road is to serve long-term bridge maintenance and security needs following its initial use for providing construction-phase access. On the New Jersey side of the alignment, and as an additional access mode for inspection and maintenance on the New York side, long-term access to the approach spans would be from truck-mounted snooters; access for the main span would be by climbing and from a truck-mounted cherry picker; and access to the underside of the deck would be by truck-mounted snooter or by a traveler, which could be permanently mounted under the bridge, out of the navigation channel. A trestle system proposed along the Arthur Kill interpier basin (former boat slip) north of the Bayway Industrial Center on the New Jersey side would only be temporary for construction-access, and would be removed in its entirety at the end of construction.

During the short-term construction period, temporary finger roads branching out from the main access road would also be in place in order to enable pier construction to occur, although such finger roads would be removed at the end of the construction period. Similar to the main access road, most of the finger roads would be constructed on fill except where they cross open water, in which case they would be on trestle; all of the finger roads would be in place only during the construction period and would be removed at the end of construction.



Legend

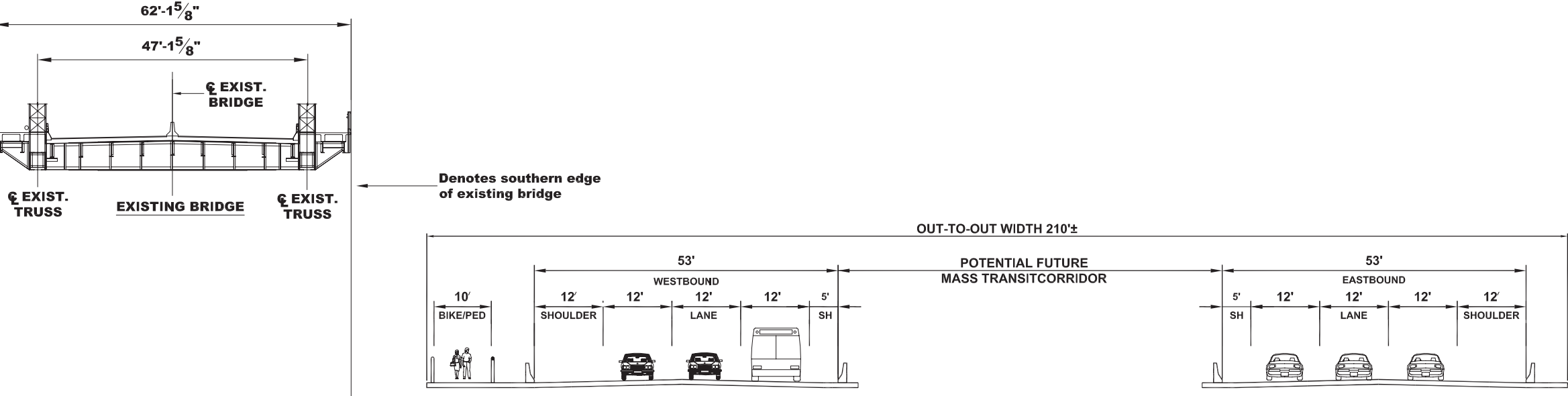
Alignments

- Buffer / Right - of - Way - New Alignment South
- - - Edge of Structure - New Alignment South

Bridge Structures

- Pier/Tower

New Alignment South



Notes:

- Graphic indicates only horizontal relationship of proposed alignment to existing bridge alignment, since both would be at the same elevation.
- Existing bridge to be demolished after half of the new replacement bridge is built.

Goethals Bridge Replacement EIS

FIGURE 5

New Alignment South
Plan View and Cross Section

United States Coast Guard

Cost. The main span and approach span bridge costs were estimated by preparing concept-level designs of typical bridge elements and then using these concept-level designs to establish quantity estimates for major cost items such as concrete, structural steel, and excavation. These quantities were then multiplied by typical New York area unit costs for the items identified. For the highway items, square-foot takeoffs developed during the project's preliminary alternatives analysis were multiplied by square-foot costs to estimate construction costs, and escalated to allow for mobilization and contingencies.

The estimated costs of construction of this alternative total approximately \$755 million in 2007 dollars. These costs do not include right-of-way or maintenance of traffic, allowance for special access requirements in the wetlands, wetlands restoration, utility relocation, engineering, or administration.

New Alignment North

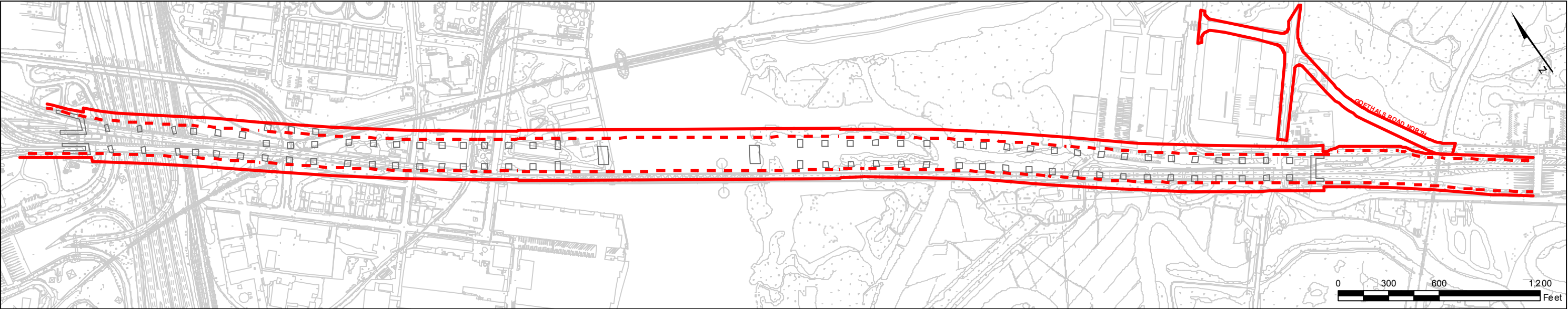
The New Alignment North Alternative proposes replacement of the Goethals Bridge directly and entirely to the north of its current alignment (see Figure 6). As with the New Alignment South Alternative, the new bridge crossing would be constructed first, with traffic maintained across the existing Goethals Bridge, after which the existing crossing would be demolished. Specific elements of this alternative, discussed from west to east, are described below.

One other difference between the access road for this alternative, and that for the New Alignment South Alternative, is the fact that no temporary trestle across the Arthur Kill interpier basin (former boat slip) on the New Jersey side would be required, since the bridge would be on land located to the north of the basin.

New Jersey Alignment. The western terminus of this alternative begins in Elizabeth, approximately 600 feet west of the New Jersey Turnpike mainline near the Interchange 13 ramps. At the crossing of the Turnpike mainline, the new approach structure would begin to shift to the north with sufficient width to accommodate the additional lanes and shoulders that are proposed. At a point approximately 1,700 feet east of the Turnpike mainline, the new approach structure would be located entirely to the north of the existing Goethals Bridge approach structure. From that point eastward to and across the Arthur Kill, the southern edge of the new approach structure would be located close to, and entirely north of the existing structure. This alignment would pass directly over several business properties. Foundation piers would be constructed intermittently along the entire length of the structure to the western pier of the main bridge span, to be located on the site of a proposed dredged material processing facility, near the edge of an intertidal basin (former boat slip) to the north of the Bayway Industrial Center. The new bridge would also cross the Arthur Kill on a new alignment that closely parallels to the north of the existing bridge alignment.

New York Alignment. Near the eastern shoreline of the Arthur Kill, the new main bridge span would be close to, but north of the existing bridge. East of the new main span structure, the approach roadway would continue entirely on elevated structure lengthwise over a tributary to Old Place Creek, crossing a portion of New York Container Terminal at Howland Hook, a portion of the Coca-Cola distributorship property, and Texas Eastern and KeySpan metering stations, and requiring a relocation of Goethals Road North as well. The alignment would then shift southward to tie into the existing approach roadway just to the west of the Goethals Bridge toll plaza.

Right-of-Way. This alternative would require acquisition of (or easements for construction on) properties in addition to those currently maintained by the Port Authority. A 50-foot-wide right-of-way and security buffer along both sides of the structure and approach roadways is proposed, including an 8-foot high chain-link fence along the length of the project (except in open waters). The western approach in New

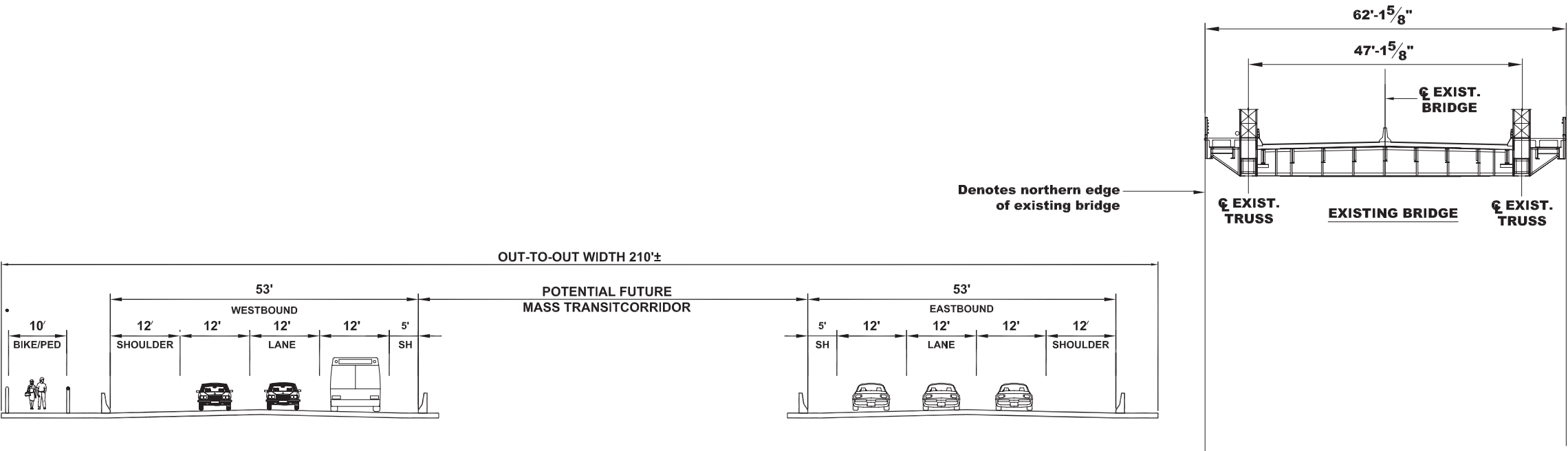


Legend

- Alignments**
- Buffer / Right - of - Way - New Alignment North
 - - - Edge of Structure - New Alignment North

- Bridge Structures**
- Pier/Tower

New Alignment North



- Notes:
1. Graphic indicates only horizontal relationship of proposed alignment to existing bridge alignment, since both would be at the same elevation.
 2. Existing bridge to be demolished after half of the new replacement bridge is built.

Goethals Bridge Replacement EIS

FIGURE 6
New Alignment North
Plan View and Cross Section

United States Coast Guard

Jersey would cross directly over several business properties, including: the Bayway Metals scrap yard at 645 Amboy Avenue; the Waste Management Transfer Station at 625-647 South Front Street; and the former Borne Chemical Co. property at 632 South Front Street, which is the site of a proposed dredged material processing facility. The eastern approach, as stated previously, would require foundations that would encroach on the New York Container Terminal property, the Coca-Cola distributorship property, Texas Eastern and KeySpan metering station properties, and Goethals Road North. In order to compensate for the direct impact on Goethals Road North, relocation of that roadway further to the north would be required between the Travis Branch of the Staten Island Railroad and Western Avenue. In order to replace access to and from New York Container Terminal at Howland Hook, a continued relocation of Goethals Road North from Western Avenue to New York Container Terminal would also be required, possibly at a location to the north of the existing Coca-Cola distributorship.

Bridge Structures and Navigation. These elements of the New Alignment North Alternative would be as described, above, for the New Alignment South Alternative. Figure 6 illustrates the New Alignment North Alternative's main-span cross section compared to that of the existing Goethals Bridge.

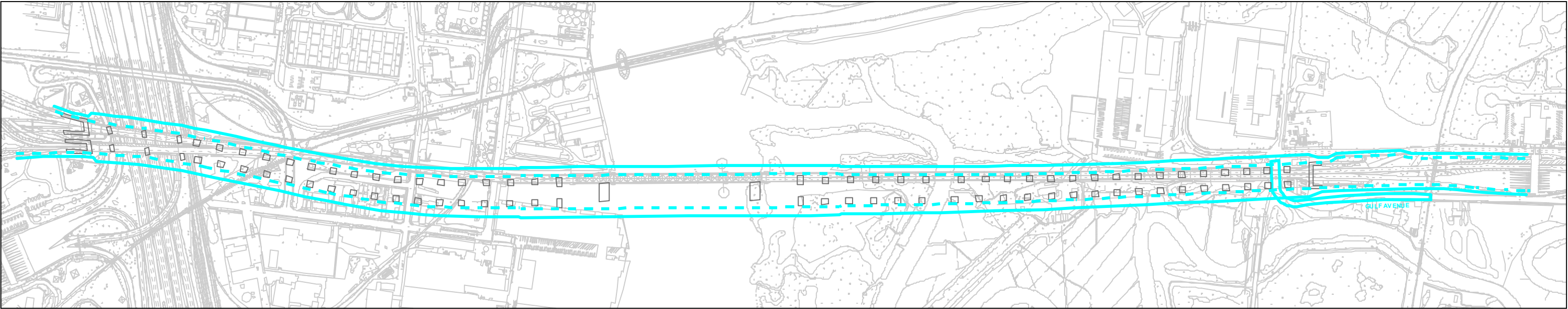
Construction, Maintenance and Security Access. Provision for long-term inspection and maintenance activities for this alternative would generally be the same as described above, for the New Alignment South Alternative, with the exception that the permanent access road on the New York side east of Old Place Creek may have to be located north of the proposed approach span, rather than beneath it. This is due to the fact that a tributary to Old Place Creek would flow directly beneath the proposed replacement bridge. In addition to the permanent access road across Old Place Creek being constructed on trestle, several temporary finger roads across this tributary would exist on trestle during the construction period as well, which would then be removed at the end of the construction period.

Cost. The same methodology used for estimating cost of construction for the New Alignment South Alternative was also used for this alternative. The estimated cost of construction of this alternative totals approximately \$754 million, in 2007 dollars. These costs do not include right-of-way or maintenance of traffic, allowance for special access requirements in the wetlands, wetlands restoration, utility relocation, engineering, or administration.

Existing Alignment South

This alternative would replace the Goethals Bridge with a new six-lane structure, one-half of which (i.e., the northern deck) would essentially be within the existing Goethals Bridge's alignment, with the second, half (i.e., the southern deck) adjacent to the existing alignment (see Figure 7). Employing a method known as half-width construction, the southern half of the new bridge that would be adjacent to the existing Goethals Bridge alignment would be constructed first. It would then temporarily accommodate both directions of traffic during demolition of the existing bridge and construction of the northern half of the new bridge within the existing span's alignment. Following completion of all construction, the northern deck and the southern deck of the replacement bridge would each carry three westbound and three eastbound lanes of traffic, respectively.

New Jersey Alignment. The western terminus of this alternative begins in Elizabeth, approximately 600 feet west of the New Jersey Turnpike mainline near the Interchange 13 ramps. At the crossing of the Turnpike mainline, the new structure would begin to shift slightly to the south with sufficient width to accommodate the additional lanes and shoulders that are proposed. At a point approximately 700 feet east of the Turnpike mainline, where the new approach structure would cross over the Staten Island Railroad (SIRR) trestle that accesses the Arthur Kill Lift Bridge from the southwest, the alignment would be entirely to the south of the existing Goethals Bridge approach structure. At the crossing of South Front



Legend

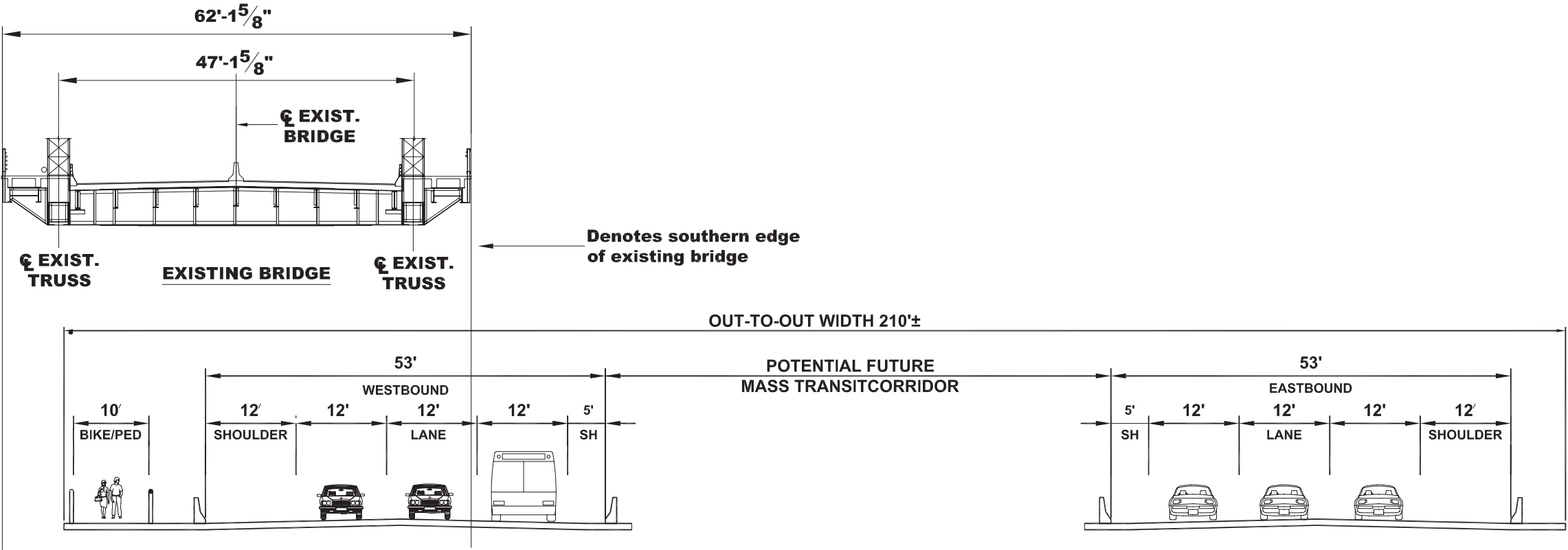
Alignments

- Buffer / Right - of - Way - Existing Alignment South
- - - Edge of Structure - Existing Alignment South

Bridge Structures

- Pier/Tower

Existing Alignment South



- Notes:
1. Graphic indicates only horizontal relationship of proposed alignment to existing bridge alignment, since both would be at the same elevation.
 2. Existing bridge to be demolished after half of the new replacement bridge is built.

Goethals Bridge Replacement EIS

FIGURE 7
Existing Alignment South
Plan View and Cross Section

United States Coast Guard

Street, the northern deck of the replacement bridge would generally coincide with that of the existing bridge alignment and continue in that manner eastward to and over the Arthur Kill, while the southern deck would be entirely to the south of the existing structure. This alignment would pass directly over the Krakow Street residential neighborhood and several businesses. Foundation piers would be constructed intermittently along the entire length of the structure to the western pier of the main bridge span, to be located at the edge of the Arthur Kill in an intertidal basin (former boat slip) immediately to the north of the Bayway Industrial Center.

New York Alignment. The alignment would continue entirely on elevated structure, with the eastern pier of the main bridge span located near the shoreline of the Arthur Kill, but outside of the actual waterway. The northern deck of the replacement bridge would continue along the existing bridge alignment, while the southern deck would continue to parallel it immediately to the south. The western portions of the New York approach spans would be constructed in wetlands associated with Old Place Creek, although no piers would be placed directly in the waterway. After crossing the western terminus of Gulf Avenue, which would be relocated along a portion of its length due to pier placement, the structure would tie into existing grade and meet the existing roadway and toll plaza. The foundation piers along this entire segment of the approach structure would be placed in both wetland and upland areas.

Right-of-Way. As with the New Alignment South Alternative, the Existing Alignment South Alternative would require acquisition of (or easements for construction on) properties in addition to those currently maintained by the Port Authority. A 50-foot-wide right-of-way/security buffer along both sides of the structure and approach roadways is proposed, including an 8-foot high chain-link fence along the length of the project (except in open waters). In New Jersey, the alignment would pass directly over the majority of the Krakow Street neighborhood, resulting in the taking of most of the residential and commercial buildings in that neighborhood. The alignment would also cross the Bayway Industrial Center (former Cory Warehouse), likely requiring a taking of that facility as well. On the New York side, the alignment would directly cross the R.T. Baker & Sons Machinery Dismantlers property, and may require a minor taking at the southern end of the New York Container Terminal property. The alignment may require relocation of Gulf Avenue due to proposed pier locations where these roadways intersect and to improve clearance. Further east, relocation of Gulf Avenue and any work in the vicinity of the toll plaza may require relocation of several Con Edison electric lines, both aerial and underground.

Bridge Structures and Navigation. These elements of the Existing Alignment South Alternative would be as described, above, for the New Alignment South Alternative. Figure 7 illustrates the Existing Alignment South Alternative's main-span cross section compared to that of the existing Goethals Bridge.

Construction, Maintenance and Security Access. Provision for long-term inspection and maintenance activities for this alternative would generally be the same as described above, for the New Alignment South Alternative.

Cost. The same methodology used for estimating cost of construction for the New Alignment South Alternative was also used for this alternative. The estimated costs of construction of this alternative total approximately \$804 million in 2007 dollars. These costs do not include right-of-way or maintenance of traffic, allowance for special access requirements in the wetlands, wetlands restoration, utility relocation, engineering, or administration.

Existing Alignment North

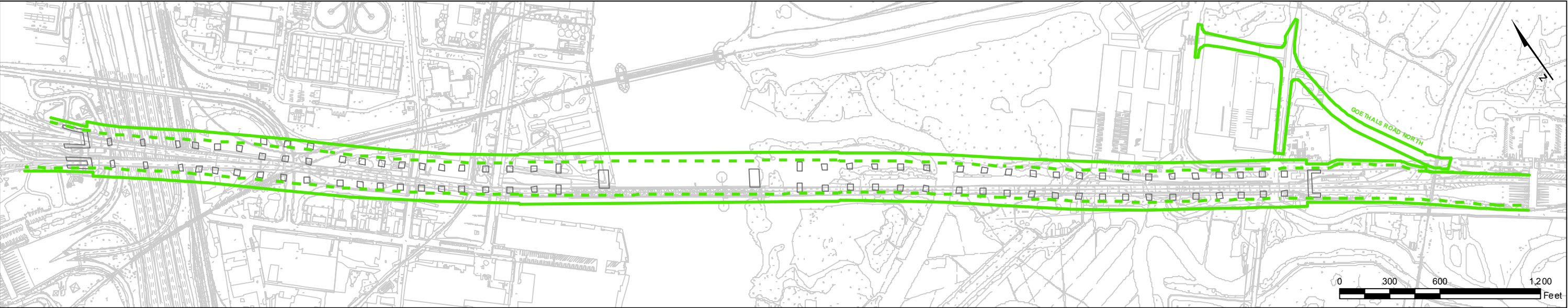
This alternative would replace the Goethals Bridge with a new six-lane structure, one-half of which (i.e., the southern deck) would essentially be within the existing Goethals Bridge's alignment, with the second, half (i.e., the northern deck) adjacent to the existing alignment (see Figure 8). This alternative would be

constructed using the half-width construction method, as described above for the Existing Alignment South Alternative, though in mirror image (i.e., the northern half of the new bridge would first be constructed adjacent to the existing bridge and then used to accommodate both directions of traffic during demolition of the existing bridge and construction of the southern half of the new bridge within the existing span's alignment). Following completion of all construction, the northern deck and the southern deck of the replacement bridge would each carry three westbound and eastbound lanes of traffic, respectively.

New Jersey Alignment. The western terminus of this alternative begins in Elizabeth, approximately 600 feet west of the New Jersey Turnpike mainline near the Interchange 13 ramps. After crossing the Turnpike mainline, the new structure would begin to straddle the existing bridge alignment but widen beyond the limits of the existing bridge footprint so as to accommodate the additional lanes and shoulders that are proposed. At the crossing over South Front Street, the southern deck of the replacement bridge would generally coincide with that of the existing bridge alignment and continue in that manner eastward to and over the Arthur Kill, while the northern deck would be entirely to the north of the existing structure. This alignment would pass directly over several businesses. Foundation piers would be constructed intermittently along the entire length of the structure to the western pier of the main bridge span, to be located on the site of a proposed dredged material processing facility, near the edge of an intertidal basin (former boat slip) to the north of the Bayway Industrial Center.

New York Alignment. The alignment would continue entirely on elevated structure, with the eastern pier of the main bridge span located near the shoreline of the Arthur Kill, but outside of the actual waterway. The southern deck of the replacement bridge would continue along the existing bridge alignment, while the northern deck would continue to parallel it immediately to the north. The western portions of the New York approach spans would be constructed in wetlands associated with Old Place Creek, although no piers would be placed directly in the waterway. After crossing Old Place Creek, the new structure would once again straddle the existing bridge alignment to its eastern terminus where it would tie into the existing approach roadway just to the west of the Goethals Bridge toll plaza. The approach roadway would continue across portions of several private and public properties, and would require a relocation of Goethals Road North as well.

Right-of-Way. As with the New Alignment North Alternative, this alternative would require acquisition of (or easements for construction on) properties in addition to those currently maintained by the Port Authority. A 50-foot-wide right-of-way/security buffer along both sides of the structure and approach roadways is proposed, including an 8-foot high chain-link fence along the length of the project (except in open waters). The western approach in New Jersey would cross directly over portions of several business properties, including: the Bayway Metals scrap yard at 645 Amboy Avenue; the Waste Management Transfer Station at 625-647 South Front Street; and the former Borne Chemical Co. property at 632 South Front Street, which is the site of a proposed dredged material processing facility. The eastern approach in New York would require foundations that would encroach on the R.T. Baker & Sons Machinery Distillers property, New York Container Terminal property, the Coca-Cola distributorship property, Texas Eastern and KeySpan metering station properties, although the extent of these encroachments is not as great as for the New Alignment North Alternative. In order to compensate for a direct impact on Goethals Road North, relocation of that roadway further to the north would be required between the Travis Branch of the Staten Island Railroad and Western Avenue. In order to replace access to and from New York Container Terminal at Howland Hook, a continued relocation of Goethals Road North from Western Avenue to New York Container Terminal would also be required, possibly at a location to the north of the existing Coca-Cola distributorship.



Legend

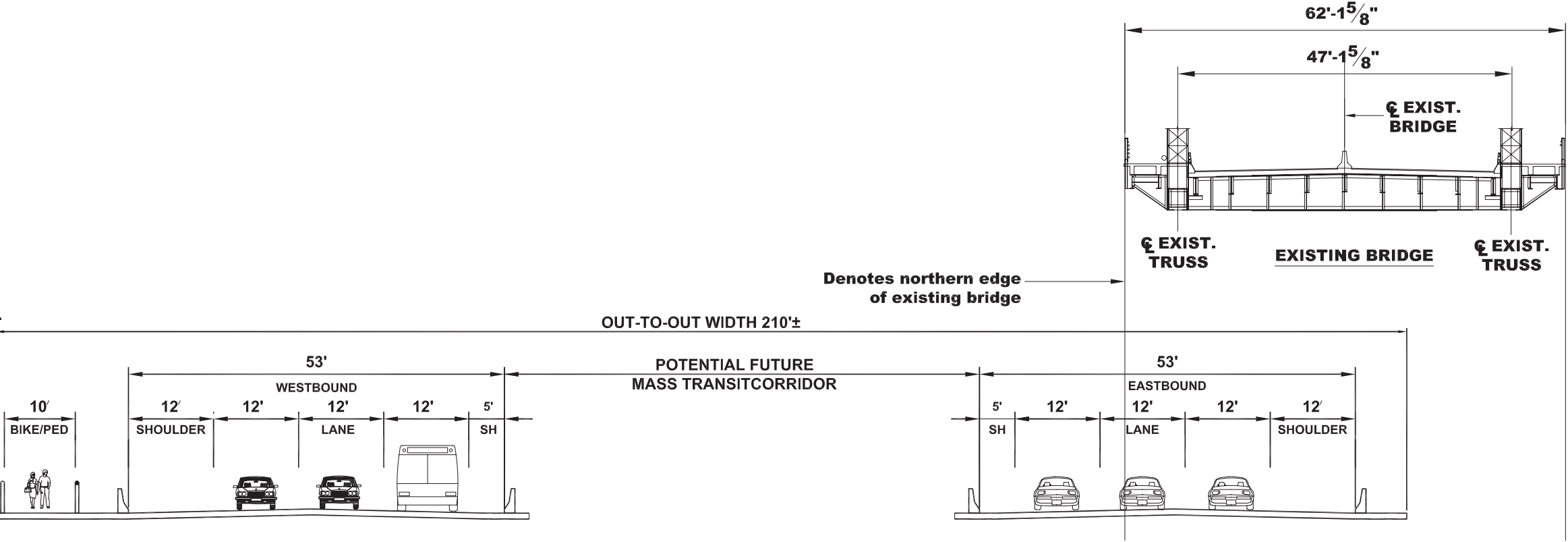
Alignments

- Buffer / Right - of - Way - Existing Alignment North
- - - Edge of Structure - Existing Alignment North

Bridge Structures

- Pier/Tower

Existing Alignment North



Notes:
1. Graphic indicates only horizontal relationship of proposed alignment to existing bridge alignment, since both would be at the same elevation.
2. Existing bridge to be demolished after half of the new replacement bridge is built.

Goethals Bridge Replacement EIS

FIGURE 8
Existing Alignment North
Plan View and Cross Section

United States Coast Guard

Bridge Structures and Navigation would be as described, above, for the New Alignment South Alternative. Figure 8 illustrates the Existing Alignment North Alternative's main-span cross section compared to that of the existing Goethals Bridge.

Construction, Maintenance and Security Access. Provision for long-term inspection and maintenance activities for this alternative would generally be the same as described above, for the New Alignment South Alternative.

Cost. The same methodology used for estimating cost of construction for the New Alignment South Alternative was also used for this alternative. The estimated costs of construction of this alternative total approximately \$802 million in 2007 dollars. These costs do not include right-of-way or maintenance of traffic, allowance for special access requirements in the wetlands, wetlands restoration, utility relocation, engineering, or administration.

5.3.3 Rehabilitation of the Existing Goethals Bridge

Rehabilitation According to Secretary of Interior's Standards for Rehabilitation

Rehabilitation of the existing bridge would include a new deck, structural repairs, as required, and seismic retrofit, as discussed above for the No-Build Alternative. In this scenario, it is likely that the facility could meet the Secretary of the Interior's Standards for Rehabilitation, insofar as the following could be accomplished:

1. the Goethals Bridge would be used for its historic purpose (i.e., access to both New Jersey and New York);
2. the bridge's historic character could be retained;
3. the bridge would remain a physical record of its time, place, and use;
4. historically significant changes (i.e., NJ Turnpike crossing) would be preserved;
5. distinctive features could be preserved;
6. the repair of distinctive but deteriorated features could match the original;
7. damaging treatments would not be employed;
8. archeological resources would be protected;
9. new construction would not destroy character defining historic materials; and
10. new construction would not hinder the preservation of essential form and integrity.

Based on analyses conducted in support of the GBR EIS (e.g., *Task B – Structural Inspection Report Final, Goethals Bridge Modernization Program EIS* [July 28, 2004] included in Appendix C) and previous studies conducted by the Port Authority, a major rehabilitation of the existing Goethals Bridge (i.e., the deck replacement including seismic retrofitting, security upgrades and other related repairs as described above for the No-Build Alternative) would need to be performed in the next decade. The cost of this near-term rehabilitation is estimated at approximately \$276 million (2007 dollars).

As part of the GBR EIS, an analysis was conducted of the life-cycle cost of bridge rehabilitation (see *Assessment of Bridge Rehabilitation Needs and Maintenance Costs to Extend the Life of the Existing Bridge for Life Span Comparable to Design Life for Proposed Replacement Bridge* included in Appendix D). The analysis considered the activities and associated costs for rehabilitation and maintenance of the existing Goethals Bridge for an additional 100 years beyond any near-term rehabilitation (i.e., the costs associated with a 100-year service life, until 2110), consistent with the design life for a replacement bridge. These life cycle costs are estimated at approximately \$804 million in 2007 dollars (net present

value).¹² Depending on the specific nature of each of the maintenance repairs, the frequency of this work would vary from 10 to 50 years.

This alternative would not specifically meet any of the purpose and need elements, and associated goals identified for this project.

Modified Rehabilitation (Parallel Bridge Alternative)

Although the Modified Rehabilitation / Parallel Bridge Alternative was not advanced past the interim screening process because of its inability to meet all of the needs of this project and its associated goals (see Table 3 and the discussion in Section 5.1.2), this alternative is further presented and discussed in this section.

In the environmental review conducted of the Goethals Bridge in the *Staten Island Bridges Program – Modernization and Capacity Enhancement Project* (SIBP EIS) in the 1990s, two parallel-bridge alternatives were evaluated. Both alternatives comprised rehabilitation and reconfiguration of the existing span to carry one direction of traffic and construction of a second, new span, either north or south of the Goethals Bridge, for the opposing direction of traffic. As documented in the SIBP Final EIS, these alternatives would have affected features of the bridge that do not contribute to the bridge’s significance, in that the proposed work would not have altered “those characteristics of design, innovative construction methods or regional transportation history” for which the bridge had been determined eligible for inclusion on the National Register (*SIBP FEIS*, Volume 1 of 3, page 7-13, October 1997). The integrity of the bridge’s design would have remained intact, and the bridge’s truss system would not have been altered. The SIBP FEIS also stated that the new bridge paralleling the reconfigured existing Goethals Bridge would not have introduced an element out of keeping with the setting nor would it have altered the character of the setting of the historic resource. The parallel-bridge design, which was commonly referred to at that time as the “twinning” design, was incorporated into the Port Authority’s Preferred Alternative that was advanced through the SIBP DEIS and FEIS (i.e., the Goethals South Crossing Alternative, comprised of a bridge incorporating a new span built to the south of the rehabilitated existing span).

Regardless of the finding in the previous SIBP FEIS, it should be noted that the construction of a new span adjacent to an existing historic bridge for the purpose of enhancing the capacity of the crossing is generally considered an effect on that historic resource and can be an adverse effect, depending on specific design considerations. Such action could also result in an effect on adjacent historic properties; once again, the effect may or may not be adverse, depending on specific design considerations, as well as alignment considerations. In the case of the “twinning” of the Goethals Bridge, such action may or may not result in adverse visual effects on the nearby Staten Island Railroad Historic District and the Staten Island Railway Lift Truss Bridge over the Arthur Kill.

Parallel-bridge alternatives, herein referred to as modified rehabilitation alternatives, in which the existing bridge would be retained were among the preliminary alternatives considered in the alternatives screening process for the GBR EIS. These alternatives, identified as Preliminary Alternatives B3 and B4 in Table 2, exhibit ratings in that table that are substantially below those for the four bridge-replacement alternatives (i.e., 26 vs. 36). These alternatives have not been advanced for further evaluation in the DEIS for the current project because retention of the existing Goethals Bridge would fail to address issues related to the aging span’s structural integrity. As discussed in Section 4.6, the purpose and need for the current project, as well as the associated goals of the project, have expanded since the SIBP of the 1990s, with the need to enhance structural integrity of the bridge and reduce associated life-cycle costs now comprising an

¹² The referenced report included as Appendix D presents costs in 2005 dollars, although the costs presented herein have been updated to reflect 2007 dollars.

important aspect of the overall purpose and need. This need is discussed in further detail in Section 4.3.2. As discussed in that section, a complete deck replacement with seismic retrofit, security upgrades and other related repairs will most likely be required by 2014 or 2015 to keep the bridge in service; the cost of this near-term rehabilitation is estimated at approximately \$276 million (2007 dollars). This near-term rehabilitation and bridge deck replacement is only one component of the total costs that would be required for rehabilitation and maintenance of the existing Goethals Bridge over a 100-year service life beyond the short-term rehabilitation (i.e., through approximately 2110), a period of time that is consistent with the design life for a replacement bridge. These total life cycle costs are estimated at approximately \$804 million in 2007 dollars (net present value).

The \$804 million life-cycle costs would be in addition to the cost of constructing a second bridge parallel to the rehabilitated existing bridge. The Port Authority assessed the cost of constructing such a bridge, which would be an entirely separate structure of somewhat greater width than the existing bridge in order to accommodate a sidewalk/bikeway. Based on a cable-stayed design for the new parallel bridge, the construction cost is estimated at approximately \$485 million. Therefore, the total cost of the modified rehabilitation or parallel-bridge design would be greater than \$1.289 billion, including the construction cost of the new parallel bridge and the life-cycle rehabilitation and maintenance cost of the existing bridge. This total cost is approximately \$487 million to \$533 million greater than the construction cost of an entirely new bridge (including demolition of the existing bridge), depending on which specific alternative alignment is selected. Although this alternative would enhance structural integrity of the bridge, it would not do so in a manner that would reduce life-cycle costs, as the costs of rehabilitation, repair and maintenance would actually continue to increase over the next 100 years. Therefore, the stated need to enhance structural integrity and reduce life-cycle costs would not be met, though other elements of purpose and need can be achieved.

Modified rehabilitation (parallel bridge alternative) also exhibits low ratings in Table 3 (see pages 43 and 44 in Section 5.1.3) in comparison to all of the bridge replacement alternatives because the existing bridge, even after rehabilitation, would not adequately and completely address the increased security standards imposed after 9/11. Also, emergency shoulders on the existing, but reconfigured bridge would still be substandard in terms of total width, thereby restricting emergency shoulders to only 4 feet and 2 feet on the right and left sides, respectively.

6.0 Selection of Project Alternatives

The Port Authority has not yet selected its preferred alternative from among the four bridge replacement alternatives, which will ultimately be identified in consideration of a variety of factors, including the evaluations being conducted for the GBR EIS, comments and input received during the ongoing public and agency outreach program and potentially, the public hearing process for the Draft EIS (DEIS), as well as others. As discussed in Section 5.3.2, the alternatives screening process has identified the following project alternatives for detailed evaluation in the GBR DEIS:

- *New Alignment South Alternative* - a single bridge replacement in an alignment directly south of the existing Goethals Bridge;
- *New Alignment North Alternative* - a single bridge replacement in an alignment directly north of the existing Goethals Bridge;
- *Existing Alignment South Alternative* – a single bridge replacement in an alignment within and extending south of the existing Goethals Bridge alignment; and
- *Existing Alignment North Alternative* - a single bridge replacement in an alignment within and extending north of the existing Goethals Bridge alignment.

All of the above six-lane bridge replacement bridge alternatives would adequately and most fully satisfy the project goals and the purpose and need for the project. Any of these four options would provide the same high rating in the Project Goals Screening Matrix included as Table 3 in Section 5.1.3. As also shown in Table 3, other potential structural and non-structural alternatives considered for the proposed project would not satisfy the project goals to the same degree as the four bridge-replacement alternatives and, therefore, were not advanced for further consideration. The No-Build alternative would also not satisfy the project purpose and need; however, consistent with NEPA requirements, the No-Build alternative is being examined in detail in the GBR EIS, representing the future baseline against which project “build” alternatives are being evaluated to determine any significant project impacts.

Rehabilitation of the existing Goethals Bridge was investigated to determine the activities and associated costs that would be required to maintain the existing structure for an additional 100-year life span, consistent with the life span for the proposed replacement bridge. On the basis of these analyses, the estimated cost for ongoing bridge rehabilitation would be approximately \$804 million (in 2007 dollars), compared to a range of capital costs from approximately \$754 million to \$802 million (in 2007 dollars) for the bridge-replacement alternatives, depending on which alignment is selected. At the same time, a rehabilitated Goethals Bridge would not address the project goals nor satisfy the purpose and need for the proposed project.

Modified rehabilitation of the existing Goethals Bridge, also known as the parallel-bridge concept, would result in the same estimated cost for ongoing bridge rehabilitation as the basic rehabilitation option (i.e., approximately \$804 million, in 2007 dollars), in addition to the cost of constructing a second parallel bridge (i.e., \$485 million for a cable-stayed design). In combination, the total cost of the modified rehabilitation alternative would be greater than \$1.289 billion, which is dramatically higher than any of the four six-lane bridge replacement alternatives being further evaluated in the GBR EIS. In turn, modified rehabilitation of the bridge would not adequately address the project goals nor satisfy the purpose and need for the proposed project as fully as the bridge replacement alternatives.

The Draft EIS for the Goethals Bridge Replacement is currently underway. Throughout the associated alternatives screening process and during the current analyses for the GBR DEIS, agency and public comment and input have been solicited. The following opportunities for stakeholder participation have been provided to date:

- September 14, 2004 – Agency Scoping Meeting
- October 5, 2004 – Public Scoping Meeting in Staten Island, NY
- October 6, 2004 – Public Scoping Meeting in Elizabeth, NJ
- November 5, 2004 – Close of Scoping Comment Period
- March 3, 2005 – Technical Advisory Committee (TAC) Meeting #1 at USCG Offices, including review of the alternatives screening process and criteria
- March 3, 2005 – Environmental Task Force (ETF) Meeting #1 at USCG Offices, including review of the alternatives screening process and criteria
- March 24, 2005 – Stakeholder Committee (SC) Meeting #1 in Staten Island, NY, including review of the alternatives screening process and criteria
- June 1, 2006 – TAC Meeting #2 at USCG Offices, including review of findings, conclusions, and recommendations of the alternatives screening process
- June 1, 2006 – ETF Meeting #2 at USCG Offices, including review of findings, conclusions, and recommendations of the alternatives screening process
- June 15, 2006 – SC Meeting #2 in Elizabeth, NJ, including review of findings, conclusions, and recommendations of the alternatives screening process
- June 27, 2006 – Public Open House, Elizabeth, NJ, including review of findings, conclusions, and recommendations of the alternatives screening process
- June 28, 2006 – Public Open House, Staten Island, NY, including review of findings, conclusions, and recommendations of the alternatives screening process
- September 6, 2007 – Interim ETF/TAC Meeting at USCG Offices, for presentation and discussion of refined bridge-replacement alternatives

Comments received through some of these venues are included in Appendix F.

An additional round of ETF/TAC/SC meetings and public open houses is anticipated to occur during the fall of 2008. The DEIS is scheduled to be completed and circulated for agency and public review and comment in late 2008, to be followed by public hearings in Elizabeth, New Jersey, and Staten Island, New York. Following close of the Draft EIS comment period, and review and consideration of all substantive comments, the Port Authority's proposed action will be identified, and the GBR Final EIS (FEIS) will be prepared and circulated.

Table 4 provides information pertaining to how each of the four Bridge Replacement Alternatives, the No-Build Alternative, Rehabilitation of the Existing Bridge, and the Modified Rehabilitation / Parallel-Bridge Alternative would meet the specific types of goals as identified in the NJHPO's *Historic Bridge Alternatives Analysis Report Outline* (April 19, 1994), which was provided by NJHPO to the environmental consultant team preparing the GBR EIS for the USCG, the lead federal agency. It should be noted that no attempt has been made to rank these alternatives among all of the criteria included in Table 4, since some of the criteria are somewhat subjective, some do not apply to all alternatives, and any attempt to rank them (including the four six-lane bridge replacement alternatives) would be contrary to the intent to present such alternatives in equal fashion within the DEIS. Also, such a ranking system would require that a weighting scale be developed and applied to the individual criteria, which perhaps could be perceived as arbitrary. However, the intent of Table 4 is to provide sufficient information for a reviewer to at least gain a general understanding of the issues associated with each alternative, thereby enabling a general comparison of them to be made regarding a variety of criteria.

TABLE 4: MATRIX COMPARING HOW EACH ALTERNATIVE MEETS GOALS IDENTIFIED IN NJHPO HISTORIC BRIDGE ALTERNATIVES ANALYSIS REPORT OUTLINE

	No-Build	Build Alternatives				Rehabilitation of Existing Goethals Bridge	Modified Rehabilitation of Existing Goethals Bridge
		Existing Alignment South	Existing Alignment North	New Alignment South	New Alignment North		
Cultural Resource Direct Impacts and Adverse Effects to – 1) NR-eligible historic properties	No Impact / No Adverse Effect	Goethals Bridge: Direct Impact / Adverse Effect; SIRR HD & SI Railway Lift Truss: Adverse Effect	Goethals Bridge: Direct Impact and Adverse Effect; SIRR HD & SI Railway Lift Truss: Adverse Effect	Goethals Bridge: Direct Impact and Adverse Effect; SIRR HD & SI Railway Lift Truss: Adverse Effect	Goethals Bridge: Direct Impact and Adverse Effect; SIRR HD & SI Railway Lift Truss: Adverse Effect	No Impact / No Adverse Effect	No Adverse Effect (SIBP FEIS 1997)
and 2) identified NR-Listed or NR-eligible areas of archeological sensitivity within alignment	No Impact / No Adverse Effect	No NR-eligible areas of archaeological sensitivity	No NR-eligible areas of archaeological sensitivity identified to date	No NR-eligible areas of archaeological sensitivity	No NR-eligible areas of archaeological sensitivity identified to date	No Impact / No Adverse Effect	No NR-eligible areas of archaeological sensitivity identified to date
Cost (in 2007 dollars)	\$804 million	\$802 million	\$801.5 million	\$755 million	\$754 million	\$804 million	\$1.289 billion ¹
Geometrics	Unsatisfactory	Meets goals	Meets goals	Meets goals	Meets goals	Unsatisfactory	Unsatisfactory
Traffic Capacity: LOS in peak hour, peak direction	F	D	D	D	D	F	D
Safety	Unsatisfactory	Meets goals	Meets goals	Meets goals	Meets goals	Unsatisfactory	Partially meets goals
Environmental							
1) wetland acres	N/A	5.59 – 7.02	5.27 – 6.95	5.99 - 6.14	5.89 – 6.30	N/A	≤ 7.02 acres ²
2) known hazardous substance site encroachments	N/A	13	10	13	10	N/A	10 - 13 ²
3) business displacements	N/A	8	4	8	3	N/A	3 - 8 ²
4) residential units displaced	N/A	51	11	51	0	N/A	0 - 51 ²
5) utility displacements	N/A	0	0	0	0	N/A	0 ²
6) transportation infrastructure displacements & relocations	N/A	1	3	1	3	N/A	1 - 3 ²
Construction constraints:							
MPT complexity	N/A	Medium	Medium	Medium	Medium	N/A	Medium
Duration	ongoing, for additional 100-year life span	65 – 78 months	65 – 78 months	52 – 60 months	52 – 60 months	ongoing, for additional 100-year life span	ongoing, for additional 100-year life span ³

¹ Modified rehabilitation cost includes \$804 million for ongoing rehabilitation for 100 years + \$485 million for constructing a new parallel bridge.

² Modified rehabilitation environmental impacts vary depending on location of new parallel bridge. Impacts estimated based on bridge replacement alternatives.

³ Modified rehabilitation construction duration would be ongoing for additional 100-year life span due to continuous rehabilitation / repairs, including construction of new parallel bridge during the short term.

7.0 Conclusion

7.1 Summary of Alternatives

The *No-Build Alternative* assumes that the Goethals Bridge would not be replaced and would therefore have no long term effect on its historic integrity. However, this alternative is not viable without periodic future rehabilitation activities and routine repair and maintenance that would be required in order to respond to structural integrity concerns and continued repair and maintenance needs. Although short term improvements addressing structural integrity concerns can be provided at significant cost, none of the other identified elements of project need or identified goals of the project as presented in Section 4.0 would be met.

The *Rehabilitation Alternative* would include construction of a new deck, structural repairs (as required) and seismic retrofit and would likely allow the bridge to meet the Secretary of Interior's Standards for Rehabilitation. The historic integrity of the bridge would be maintained. However, most of the identified elements of project need and the identified goals of the project as stated in Section 4.0 would not be met, and the cost of rehabilitation during both the short term and the long term would be significant with limited long term benefit.

The *Modified Rehabilitation Alternative*, also referred to the Parallel-Bridge Alternative, would include rehabilitation of the existing bridge in conjunction with construction of a new parallel bridge, either to the south or the north of the existing bridge. The integrity of the existing bridge design would remain intact, and a new parallel bridge would not necessarily alter the character of the setting of the historic resource. However, this alternative would be the most expensive as it involves the significant cost associated with periodic future rehabilitation activities and routine maintenance of the existing bridge, in addition to the cost of constructing a new parallel bridge. This alternative partially meets the identified elements of project need and identified goals of the project as stated in Section 4.0.

Any of the four *Bridge-Replacement Alternatives* (i.e., New Alignment South, New Alignment North, Existing Alignment South, Existing Alignment North), which includes demolition of the existing bridge, would successfully meet all of the identified elements of need and the identified goals of the project as stated in Section 4.0. All four of these alternatives are being carried forward for detailed consideration and analysis in the Draft Environmental Impact Statement. Any of these alternatives would have a direct effect on the existing historic bridge structure. This proposed action constitutes an adverse effect on the historic bridge. The adverse effect would be mitigated through documentation of the structure prior to demolition of the existing bridge, or via other mitigation determined during the ongoing Section 106 Consultation process. The new replacement bridge, which would likely be of cable-stayed design, is anticipated to be a signature bridge that takes into consideration the grand scale of the current structure in conjunction with proposed alignment and design constraints.

7.2 Finding of Adverse Effect

The proposed action, consisting of one of the four Bridge-Replacement Alternatives (i.e. New Alignment South, New Alignment North, Existing Alignment South, or Existing Alignment North), would have an Adverse Effect on three of the 11 historic properties within the Architectural Area of Potential Effect (APE). In a letter dated May 21, 2008, the NJHPO concurred with the assessment of effects to the historic resources and that the proposed project would result in an adverse effect. The three historic properties that would be adversely affected are discussed below:

Goethals Bridge – Under any of the Bridge-Replacement Alternatives, the proposed project would cause the demolition and complete loss of the Goethals Bridge and all character-defining features, including: the truss spans over the Arthur Kill; the concrete arch piers; and the approach spans.

Staten Island Railroad Historic District – Due to the close proximity of this resource to the Goethals Bridge and the bridge's New Jersey approach viaducts, the proposed realignment alternatives and replacement of the bridge would encroach on the setting and visual integrity of this historic resource, thereby creating an Adverse Effect.

Staten Island Railway Lift Truss Bridge over Arthur Kill – The Staten Island Railway Lift Truss Bridge and the Goethals Bridge are parallel structures that cross the Arthur Kill. The bridges form a dynamic and powerful setting at this crossing. The proposed loss of the Goethals Bridge and proposed realignment would create a significant intrusion on this visual landscape and alter the setting and visual integrity of the railway bridge.

7.3 Mitigation

The proposed Goethals Bridge Replacement project will have an Adverse Effect on the National Register eligible Goethals Bridge, the Staten Island Railroad Historic District, and the Staten Island Railway Lift Truss Bridge over Arthur Kill, as a result of the proposed demolition and replacement of the historic structure. A review of the alternatives and subsequent mitigation initiatives will be coordinated with the SHPOs. Suggestions of possible mitigation measures are described below:

Historic American Engineering Record (HAER)

The Goethals Bridge and its companion structure, the Outerbridge Crossing Bridge, represent the earliest projects undertaken by the newly formed Port of New York Authority (now called the Port Authority of New York and New Jersey). The two bridges were both completed in 1928 and provide crossings between New Jersey and Staten Island over the Arthur Kill. Likewise, both bridges were recognized as significant historic structures and were photo-documented in 1991 for the Historic American Engineering Record (HAER NY-304, NY-305 1991).

Historic American Buildings Survey and the Historic American Engineering Record (HABS/HAER, respectively) provide documentation, usually in the form of measured drawings, photographs, and written data, of America's most noteworthy historic buildings, structures, and objects. Documentation can also include other media that help to illustrate aspects of history or process associated with the resource. For mitigation documentation projects, generally, Level I documentation, which includes measured drawings depicting existing or historic conditions; large-format photographs of the resource, existing drawings, and/or historic views; and a detailed written history and description; is required for nationally significant buildings and structures.

Signature Bridge

The Goethals Bridge is a monumental structure of historic and scenic significance. Aesthetics concern the visual quality of a property and the scenic view associated with a property, not only in terms of the character of visual experience, but also with its excellence. Proposed replacement of a monumental structure, such as the Goethals Bridge, has long-term scenic and other visual impacts to surrounding historic resources. A new *signature* bridge, design of which should be not only exemplary, but should also be compatible with other historic properties in overall plan, concept, scale, materials, and feeling, should be considered to replace the existing structure. The Port Authority has currently proposed a cable-

stayed design for its signature bridge.¹³ A review of proposed replacement bridge designs are anticipated to be undertaken by the NYSOPRHP and NJHPO.

Educational Materials

Educational materials, such as a booklet documenting the Goethals & Outerbridge Crossing Bridges—Highway Bridges of the Arthur Kill, can be produced for circulation to libraries, historical societies, and other educational facilities. A special educational video or story about the Goethals Bridge, its technology, people, and era, can be developed and posted on a website about the bridge. As a resource for educators, materials can be structured in such a way as to include lesson plans that support social studies content and learning standards, with grade appropriate content broken into specific grade groupings. Lesson plans might also include related transportation history and the impact of the automobile on our environment.

Displays, such as exhibits or panels that depict the history of the bridge(s), can be developed. Exhibit materials might include elements salvaged from the bridge that are incorporated into three-dimensional display modules with corresponding photographs and exhibit panels. Development of educational displays would be undertaken in cooperation with NYSOPRHP and NJHPO.

¹³ The Port Authority had previously considered a tied-arch design as well as a cable-stayed design, but the tied-arch design was eliminated from further consideration due to several factors, including: 1) a tied-arch design would have a construction cost of at least \$170 million greater and a total project cost of \$400 million greater than a cable-stayed bridge; 2) the superstructure for a tied-arch bridge would have approximately 1 million more square feet of steel surface than a cable-stayed bridge, thereby requiring increased maintenance and painting over time; 3) a tied-arch bridge has greater security issues than a cable-stayed bridge, due to its more vulnerable structure and its greater fire risk related to steel melts; 4) a tied-arch bridge would take six months longer to construct than a cable-stayed bridge; 5) a tied-arch bridge is more complex to construct than a cable-stayed bridge, thereby resulting in more waterway channel closures and more airspace restrictions, as well as the need to provide temporary piers at channel limits within the Arthur Kill, which would not be required for the cable-stayed bridge; 6) a tied-arch bridge requires substantially more foreign steel fabrication and European construction techniques in comparison to a cable-stayed bridge; and 7) the solid arch of the tied-arch bridge requires substantially more lighting than the towers of the cable-stayed bridge, thereby resulting in increased cost.