ROUTE 36 HIGHLANDS BRIDGE
(OVER THE SHREWSBURY RIVER)

Highlands Borough and Sea Bright Borough
Monmouth County

Feasibility Assessment Report

Submitted to:
The New Jersey Department of Transportation

Submitted by
Sverdrup & Parcel Consultants, Inc.

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1. Regional Context

State Route 36 (Route 36) meanders along a portion of New Jersey's northeast shoreline between Long Branch to the south and Keyport to the north and provides several coastal communities with access to the regional highway network via the Garden State Parkway (GSP) (See Figure I-1). At its northern and southern termini, Route 36 connects with the GSP at the Parkway's Exits 117 and 105, respectively. Route 36 also includes a vital link across the Shrewsbury River for recreational/residential/commercial traffic destined for development on the peninsula as far south as Monmouth Beach. This link is the Route 36 Highlands Bridge. The Gateway National Recreational Area (Sandy Hook) is a major generator of traffic across the bridge.

Opened to traffic in 1933, the Route 36 Bridge is a four-lane structure consisting of 11 simple fixed spans and one double leaf bascule span. Each lane is 11 feet wide, which is less than a standard lane width of 12 feet. No shoulders are provided on the almost quarter-mile long bridge.

There are approximately 2,200 bridge openings annually. Delays approaching the bridge are exacerbated when Route 36 is closed during bridge openings, particularly during the summer months. These conditions impact emergency services in the area. The bridge opens regularly twice an hour (at 15 minutes and 45 minutes after the hour) throughout the day during the heavily traveled summer season. The average time for a bridge opening cycle is 10 minutes.

A related seasonal issue concerns days when Sandy Hook Recreational Area fills its parking lots to capacity. On those days, traffic is closed to the Park and directed to Ocean Avenue southbound (Route 36 eastbound) into Sea Bright, resulting in congestion and associated extensive delays. This condition adds to overall congestion and delay on and in the vicinity of the Bridge.

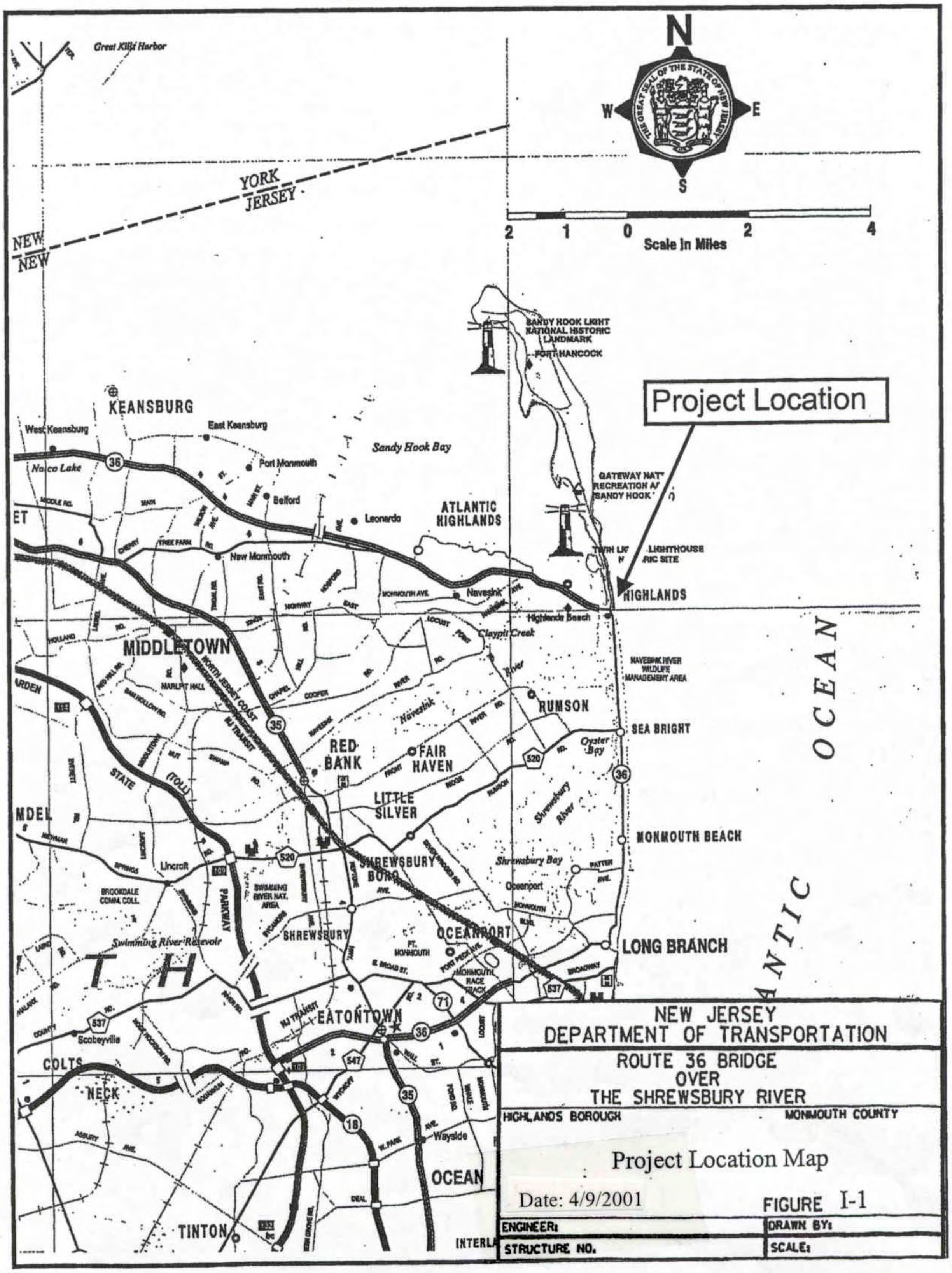
2. Project Need and Description

The Bridge is currently rated in poor condition by the New Jersey Department of Transportation (NJDOT). The bridge is structurally deficient and is functionally obsolete. It has a number of geometric features that either do not meet or meet only minimum current AASHTO and NJDOT design criteria. NJDOT identified needs based on these existing structural conditions and configuration of the Route 36 Highlands Bridge, and the operating problems experienced on the Bridge and its approaches resulting from constrained geometry. These problems are categorized and summarized below.

Bridge Structural Deficiencies

- Poor condition of bridge deck, substructure and superstructure,
- Substandard deck geometry and lateral under-clearance,
- Non-compliance with New Jersey and Federal Specifications for seismic design and vessel collision,

FIGURE I-1


N
W
E
S
Scale In Miles
Project Location
NEW JERSEY
DEPARTMENT OF TRANSPORTATION
ROUTE 36 BRIDGE
OVER
THE SHREWSBURY RIVER
HIGHLANDS BOROUGH
MONMOUTH COUNTY
Project Location Map
Date: 4/9/2001
FIGURE I-1
ENGINEER:
DRAWN BY:
STRUCTURE NO.
SCALE:
KEANSBURG
MIDDLETOWN
HIGHLANDS
RUMSON
SEA BRIGHT
RED BANK
FAIR HAVEN
LITTLE SILVER
MONMOUTH BEACH
SHREWSBURY BORO
LONG BRANCH
EATONTOWN
OCEANPORT
ATLANTIC HIGHLANDS
Sandy Hook Bay
OCEAN

- The structure has a Scour Critical rating of 7, indicating that countermeasures have been installed to correct previous existing problems. However, there is a potential for scour issues to develop in the future if the effectiveness of the countermeasures diminishes over time.

Substandard Design Features

- Substandard lane widths,
- Lack of shoulders,
- Lack of median barrier,
- Small radii on several approach ramps on the eastern side,
- Poor skid resistance on open - grate deck,
- Substandard design of bridge railing,
- Substandard live load capacity.

Vehicle and Marine Traffic Conflicts

- Significant delays experienced on RT 36 during seasonal months,
- Use of the Highlands Bridge as an emergency evacuation route is impaired,
- Response time of emergency vehicles is affected.

Context-Sensitive Issues

Based on community goals and input expressed at Community Partnering Team Meetings conducted in 2001 and 2002, the Department is pursuing context-sensitive design solutions that would reduce congestion and positively affect transportation assets outside the immediate area of the structure. Community issues range as far north as the Sandy Hook Park toll plaza facility, and as far south and west as Sea Bright's and Highlands Borough's (Henry Hudson Trail) multi-use-paths.

Context sensitive issues to be addressed include the following:

- Provide continuity of multi-use pedestrian/bicycle trails across the Highlands Bridge and complete connections to existing trails.
- Evaluate means of mitigating potential difficulty for Portland Road traffic to enter the traffic stream on Route 36 eastbound and Bay Avenue traffic to enter the traffic stream on Route 36 westbound, if a higher bridge is constructed.
- Evaluate alternative interchange configurations at the eastern approach to the bridge.
- Evaluate alternative toll plaza configurations and turn around options.
- Evaluate the use and placement of variable message signs on the bridge and other locations.

The Sea Bright community also stated a municipal need to have access to water from the mainland via a water pipe supported by the new bridge. The fixed bridge would allow the support of a water pipe from the new structure.

In summary, the existing Bridge is in need of major rehabilitation or replacement. In response to this condition, NJDOT proposes to eliminate structural deficiencies and substandard features, and improve safety and traffic operations on the bridge and along its approaches

3. Project History

Sverdrup & Parcel Consultants, Inc. was retained by NJDOT in August 2000 to prepare a Feasibility Study for improvements to the Highlands Bridge. This planning level study is part of a continuing effort by NJDOT to select a final design to remedy the facility's structural, geometric, and community operational problems. The need to upgrade this crossing with a safe and reliable bridge has been recognized for quite some time, and several previous studies have been prepared over the past ten years to determine the most efficient and suitable scheme for providing this crossing. Because many of the tasks included in this report have been performed in these previous efforts, existing information was reused where reasonable to minimize the cost of completing this report. For a list of the studies and reports previously performed, see the Fact Sheet in Appendix A.1.

4. Purpose of the Study

This Feasibility Assessment Report (FAR) was designed to (1) develop design criteria, (2) identify and evaluate a range of actions, including alternatives for replacing alignments and structures, in order to upgrade the current physical, safety, and operational conditions of the Highlands Bridge, and then, (3) recommend a preferred design. An iterative process balancing the mobility needs of marine navigation with safety, accessibility, and capacity issues of neighborhood vehicular and pedestrian traffic formed the basis of the analysis. Important considerations that influenced the study included developing cost efficient solutions that were sensitive to the surrounding area's substantial environmental resources.

The preliminary scoping for this project occurred prior to the introduction of the "NJDOT Procedures Manual" and its formal "Problem Statement Package" in 1996. Therefore, the content of this FAR was based upon the "Transportation Problem Statement" form in NJDOT Procedures Manual, Section 2.1.

5. Evaluation Process

Six alternatives for the rehabilitation or replacement of the bridge were analyzed including:

- Alternative 1: No Build
- Alternative 2: Minor Rehabilitation
- Alternative 3: Major Rehabilitation
- Alternative 4: New Bridge on New Alignment - Maintain Existing Bridge
- Alternative 5a: New High-Level Fixed Bridge with two Alignment Variations
    - Variation 1: Replacement On-Line
    - Variation 2: Replacement Off-Alignment (Alignment would be adjacent to and south of existing Bridge alignment over the Shrewsbury River; however the touch down points at either end of the Bridge would coincide with existing alignment)
    - Variation 3: Optimum Solution – Direct Connector
- Alternative 5b: New High-Level Movable Bridge Replaced On-Line

The alternatives were evaluated and compared based on the following:

(1) ability to meet project needs,
(2) impact on the Historic bridge and other cultural/historic resources in the area, and
(3) operating and capital costs.

The “project needs” categories included:

- access for emergency services
- public safety improvement
- elimination of vehicular and marine traffic conflicts
- repairing structural deficiencies
- operating cost reduction,
- compliance with Coast Guard vertical clearance criteria, and
- inclusion of context sensitive designs

The analysis included a review and assessment of navigation data, traffic data, accident data, recent inspection reports, cost assessments and past studies which led to a suggested bridge alternative that would result in improved access, adequate capacity, increased safety, structural upgrading and a favorable cost structure.

6. Summary of Comparative Analysis

The comparative analysis is summarized in Table III-2. Although Alternative 5a requires demolition of the existing historic structure, it is the only alternative that satisfies all project needs without generating substantial socio-economic impacts on the surrounding communities. This alternative is the only one that addresses identified community issues. The analysis shows that Alternative 5a’s Variation 2 would also be the least costly to construct and minimizes construction duration. Variation 3 (Optimum Solution) would optimize both vehicular and pedestrian access across the interchange at the eastern end of the proposed bridge. However, it would also be the most costly among the alternatives (5a and 5b) that could be constructed within the corridor of the existing Bridge, would require the greatest amount of grading, and disrupt the greatest amount of land in the vicinity of the interchange.

Alternative 5b addresses five of seven project needs. Unlike the fixed bridge scenario, Alternative 5b would still result in vehicle delay associated with bridge openings.

Since a new bridge under Alternative 4 is assumed to have a similar vertical clearance as the existing Bridge, 35 feet clear above Mean High Water (MHW), it is anticipated that this alternative would not improve vehicle delay or reduce inconvenience to marine traffic crossing the channel over current conditions. In addition, this alternative would increase current operating expenditures since the existing bridge would remain and two bridges would have to be manned. Further, Alternative 4 would require extensive ROW acquisition and displacement of existing developed properties.

The remaining rehabilitation alternatives would require expenditure of funds resulting in a structure that would still have deficiencies, both structural and safety, not significantly improve traffic operations, and would continue to expose area residents and visitors to disruptions to critical access.

It is likely that SHPO would maintain that Alternatives 5a and 5b would have an "adverse effect" on an historic resource by altering contributing features and modifying structural elements by replacing the bascule span. The Bridge is currently eligible to be considered a historic resource and placed on the National Register. If an adverse effect were rendered, design/details to avoid or minimize this effect, including context sensitive design, would be utilized to mitigate the impact and assist in gaining approvals.

7. Recommendation

Alternative 5a, Variation 2 - Replacement Off-Alignment with a High-Level Fixed Bridge is recommended as the Initially Preferred Alternative (IPA).

Alternative 5a, Variation 2 would be the least costly scenario among the six options. The cost of this alternative is not only lower than the other alternatives, but also satisfies each of the project needs. The rehabilitation schemes have inherent uncertainty in the feasibility of maintaining the existing Bridge over the next 75 years, given that the structure is already 70 years old. While Alternative 5a's initial investment to construct may be higher than the rehabilitation schemes, it would provide to the Department a higher degree of reliability for the crossing over the next 75 years.

In summary, this report indicates that Alternative 5a, Variation 2 is the most prudent and feasible alternative in meeting the set of project objectives while, at the same time, is the least costly scenario over the 75-year life of the project. Historic mitigation and enhancement measures would be incorporated, as required, into the project.

II. Introduction

A. General Information

1. Project Name

The name of the project is the Route 36 Highlands Bridge (Over Shrewsbury River), Highland Borough and Sea Bright Borough, Monmouth County.

2. Type of Project

This bridge replacement project is in the Feasibility Assessment Phase focused on selecting a final design to remedy the facility's structural, geometric, and operational problems and respond to community and National Park Service (NPS) needs.

3. Project Need

The Route 36 Highlands Bridge is considered a principal "link" within the urban roadway system of the area and must be maintained. During the seasonal months in this shoreline community, the frequent bridge openings cause unacceptable delays to local residents and tourists traveling to and from Sandy Hook. These delays are critical in times of emergency as the bridge is part of a planned evacuation route for the residents of Sea Bright as well as an ambulance route for the residents in the Highlands.

The bridge is structurally deficient and functionally obsolete. The bridge does not provide a safe, efficient crossing for current or forecasted traffic. It has a limited live load capacity and minimal earthquake resistance. The SI&A sheet (2001) for the Route 36 Highlands Bridge gives the structure a Scour Critical rating of 7, indicating that countermeasures have been installed to correct previous existing problems and the Bridge is no longer scour critical. However, there is a potential for scour issues to develop in the future if the effectiveness of the countermeasures diminishes over time.

Geometric features that enhance safe driving conditions, such as shoulders and a center median, are absent. Lane widths on the Bridge only meet minimal NJDOT standards. The roadway surface on the bascule span and the guardrail appurtenances are substandard.

a. Emergency Services/System Linkage

The Highlands Bridge crossing is classified as part of a principal arterial (Route 36) in an urban area and it links the mainland to the coastal peninsula. The linkage is particularly important because Sandy Hook Park visitors and homes and businesses in the town of Sea Bright require access across the bridge to seek refuge on the mainland during times of emergency. The shoreline and peninsula experience periods of flooding and hurricanes for which egress off the peninsula in a minimum amount of time is required. Maintaining this route is important, as it is a planned evacuation route for the town of Sea Bright as stated in the Emergency Management Plan. The nearest other means of egress is the Sea Bright-Rumson Bridge which is approximately 2.5 miles further south along the coast.

In the event of a medical emergency, Highlands residents are taken by ambulance to the Monmouth Medical Center at 300 Second Avenue in Long Branch. This requires traveling east over the Route 36 Bridge into Sea Bright, then south along Ocean Avenue into Long Branch. In the event the bridge is closed, the revised route would be to travel southwest to the Oceanic Bridge, traveling through the town of Rumson, over the Sea Bright-Rumson Bridge, then south along Ocean Avenue into Long Branch. The revised route would add approximately 3.1 miles to the trip.

The current operation of the bascule span disrupts Route 36's "system linkage", resulting in substantial delays for neighborhood residents, visitors, and workers, especially critical during emergency events.

b. Safety

The Route 36 Highlands Bridge and roadway approaches have geometric characteristics that do not enhance safety conditions across the bridge. These include:

- No median barrier on the bridge to separate the bi-directional traffic.

- The open steel grating on the bascule span provides poor skid resistance and directional control. This condition is exacerbated when the surface is wet.
- The bridge railing is substandard with its concrete balustrade having no guide rail.
- Emergency escape areas or clear zones to avoid mishaps are not available on the bridge due to the lack of shoulders.
- At the merge, Ramp J (carrying southbound traffic from Sandy Hook to westbound Route 36) curves to the right and Route 36 curves to the left. This instantaneous change in direction increases the difficulty for maintaining directional control.

c. Vehicular and Marine Traffic Conflicts

The marinas along the Navesink and Shrewsbury Rivers were contacted to determine the types and heights of vessels moored upstream of the bridge. It was found that navigation on the river primarily consists of sailboats and other pleasure crafts. There are approximately 1,335 slips/moors in local marinas; about 25 sailboats that use the channel have masts above 59 feet. Appendix N presents correspondence concerning bridge vertical clearance concerns of boating, marina, related business services, and the U.S. Coast Guard.

There are approximately 2,200 bridge openings per year. These openings are concentrated during the months when marine activity is highest (May-October) and result in substantial traffic delays (see Appendices E and F). Annually, the total vehicle delay associated with bridge openings is estimated to be over 57,000 vehicle-hours. This delay translates into a "bridge-related" user cost of over $700,000 per year in 2002 dollars.

d. Structural Deficiencies

1) Bridge Structure

The preliminary 1998 Re-Evaluation Bridge Survey Report prepared by CTE Engineers, states that the overall condition of the Route 36 Bridge is poor. In the 1992 inspection report, the overall condition was designated as serious. The upgrade from "serious" to "poor" (from a sufficiency rating of 4.3 to a sufficiency of 34.3) was due to the change in method of rating. The 1998 report states that due to the poor condition of the deck, inadequate deck geometry, and low inventory ratings, the recommendation is to replace the deck and superstructure of all spans since it would not be practical or cost effective to widen the structure due to the bascule configuration.

Structural Deficiencies as noted in the 1996 November Cycle No. 9 Inspection Report by Hardesty & Hanover LLP are summarized as follows:

Several of the approach span members are overstressed by just the dead load weight of steel and concrete encasement. These factors contribute to the low sufficiency rating of the entire structure of 34.3. The superstructure is in poor condition due to moderate to severe rusting and loss of section in Spans 4, 5, 6, *and end floorbeams at all piers. A Priority One repair was issued for Stringer S1 at Floorbeam 1 in Span 4. The web has holes 9"x2" and 3"x2" with the remaining web at 50% to 70% section loss. Span 5 floorbeams in the west leaf and Floorbeams 2 and 3 in the east leaf exhibit up to 50% section loss and deep pitting to the top and bottom flanges. The lateral bracing in Spans 4, 5, and 6 exhibits up to 100% section loss. The paint on the steel superstructure exhibits widespread peeling, flaking, and surface rust. Most of the bearings on all piers exhibit moderate to severe rusting and exfoliation, especially in the pin and rocker areas. This exfoliation has appeared to cause many of the bearings to become frozen and unable to allow movement during temperature changes.*

The substructure is in fair condition. Wide vertical cracks (1/4" to 1/2") were found in the breastwall, bridge seat, and backwall of the east abutment. Many of the concrete pedestals exhibit spalling (depth of 3" to 7") and hollow areas on their east faces (face exposed to expansion joint leakage). The south pedestal deterioration has resulted in a 30% loss of the girder base plate bearing area. A section of the west abutment footing is exposed with a wide vertical crack extending into the breastwall and backwall. The north pier cap at Pier 3 has a 12-square-foot spall with exposed reinforcement on top. The east face of the base of Pier 5 and the north face of Pier 5 have some large areas of spalled concrete with exposed rusted reinforcement.

A Bridge Deck Condition Survey was performed in 1986. Based on the defects found, a report was prepared which stated the overall condition was rated as Category I, defined as “Extensive Active Corrosion.” The restoration work for long-term benefits prescribed in this report was a complete slab replacement. Since 1986, rehabilitation work on the existing Bridge has been ongoing including repairing and resurfacing the deck.

The bascule span and flanking spans are fracture critical, non-redundant two-girder and three-girder systems.

The approach span girders are encased in concrete. Thus, a thorough inspection of the steel members cannot be performed. Portions of the concrete encasement are spalling and falling off. The concrete encasement in Spans 1 to 3 and 7 to 12 exhibit wide cracking, spalling, deterioration, and hollow sounding concrete with exposed steel having up to 1/4" exfoliation. The north fascia girder top flange encasement in Spans 9 and 10 is disintegrating and has heavy rust staining. Although maintenance work in 1991 included removing all loose concrete encasement, this element of the structure will require ongoing maintenance. The falling pieces of concrete are hazardous to smaller boats passing under the approach spans.

2) Live Load Capacity

The current live load capacity, as rated in the Re-evaluation Bridge Survey Report by Hardesty & Hanover, LLP, dated November 18, 1996, shows the bridge to be less than present day design standards. Using Load Factor Design methods, the Route 36 Highlands Bridge has a current Inventory Rating of HS-15 (28 tons), which is 22% below NJDOT's design load for rehabilitation (HS-20), and 38% lower than the present day design criteria of HS-25 for new construction. The load ratings also show that typical three-axle trucks and five-axle semi-trailer trucks have Inventory Ratings less than current legal load limits. The three-axle truck is rated 8% below a 25-ton vehicle weight, while the five-axle semi-trailer is rated 17.5% below its 40-ton vehicle weight. The low live load ratings are a result of severe steel deterioration as noted in the inspection reports.

3) Earthquake Resistance

The existing Route 36 Highlands Bridge needs to be upgraded for earthquake resistance since it does not meet state or federal specifications for seismic design. A full seismic evaluation of the bridge was not performed for this report. However, based on the knowledge of codes in existence at the time of original design, the piers and abutments likely lack ductility and provide minimal seismic resistance. The substructure is founded on timber piles of unknown size and length; thus, the capacity of the existing pile foundations to support seismic loadings cannot be accurately determined. Because of the composition of the foundations, seismic resistance is presumed to be minimal.

In addition, all of the existing bearings for the approach spans are steel rocker type bearings. This type of bearing is vulnerable to earthquake loadings since they lack stability and transverse shear capacity.

4) Scour Resistance

The Shrewsbury River is subject to tidal flow from the Atlantic Ocean. Per the 1998 Inspection Report, the underwater inspection of Piers 3 to 11 indicated that Piers 6 and 7 have moderate potential scour problems due to undermining of the pile supported footings.

Design scour criteria has been significantly advanced by research in the early 1980's as numerous bridges were damaged or destroyed during flood events. The criteria used in 1932 are less than current standards and, therefore, the Route 36 Highlands Bridge should continue to be monitored for scour.

e. Context Sensitive Design

Based on community goals and input expressed at Community Partnering Team Meetings conducted in 2001 and 2002, the Department is pursuing context-sensitive design solutions that would reduce congestion and would positively affect transportation assets beyond the bridge, as far north as the Sandy Hook Park toll plaza facility and as far south and west as Sea Bright's and Highlands (Henry Hudson Trail) Borough's multi-use paths. Context sensitive issues identified by the Communities and addressed in the FAR include the following:

- Provide continuity of multi-use pedestrian/bicycle trails across the Highlands Bridge and complete connections to existing/proposed trails.

- Evaluate means of mitigating a potential difficulty for Portland Road traffic to enter the traffic stream on Route 36 eastbound and Bay Avenue traffic to enter the traffic stream on Route 36 westbound, if a higher bridge is constructed.
- Design an interchange configuration at the eastern end of the bridge that is compatible with Community goals and objectives.
- Evaluate alternative toll plaza configurations and turn around options.
- Evaluate the use and placement of variable message signs on the bridge and other locations.

The Sea Bright community also stated a municipal need to have access to water from the mainland via a water pipe supported from the new bridge.

4. Project Limits

The highway section under investigation is Route 36, situated approximately between milepost (MP) 11.50 and MP 11.75 on the NJDOT Straight Line Diagram (see Appendix C). This section includes the bridge, itself, the ramps connecting Ocean Avenue and Route 36, and the approach roadway adjacent and below the bridge's western terminus, including the intersections of Route 36 at Portland Avenue and the Bay Avenue ramp, and Bay Avenue below the bridge. In addition, the project limits extend along Ocean Avenue and Sandy Hook Park entrance road between the interchange and the NPS toll plaza.

5. Project Location

a. Local and Regional Significance

Route 36 meanders along a portion of New Jersey's northeast shoreline between Long Branch to the south and Keyport to the north and provides several coastal communities with access to the regional highway network via the Garden State Parkway (GSP). At its northern and southern termini, Route 36 connects with the GSP at the Parkway's Exits 117 and 105, respectively. Route 36 also includes a vital link across the Shrewsbury River for recreational/residential/commercial development located on the peninsula extending north from Monmouth Beach to the mainland. This link is the Route 36 Bridge forming part of the Route 36 alignment and crossing the Shrewsbury River at the entrance to the Gateway National Recreational Area (Sandy Hook) (See Figure I-1).

The Route 36 Highlands Bridge is also important because it is part of the planned evacuation route for the town of Sea Bright, as stated in the municipality's Emergency Management Plan (see Appendix A.2). The Sea Bright-Rumson Bridge, located about 2.5 miles south of the Route 36 Bridge, is the only other river crossing connecting the peninsula and the mainland.

In the event of a medical emergency, residents in Highlands are driven by ambulance to the Monmouth Medical Center at 300 Second Avenue in Long Branch via Route 36 east across the river and Ocean Avenue south. The distance between the Route 36 Highlands Bridge over Shrewsbury River and the Monmouth County Medical Center is approximately 19 miles. If the Route 36 Bridge were closed, the alternate route requires traveling southwest using local streets to access the Oceanic Bridge, which leads into the Town of Rumson along County Road 520. The alternate route continues through Rumson, across the Sea-Bright Rumson Bridge and onto Ocean Avenue, and terminates at the Hospital. This alternate route adds approximately 3.1 miles to the trip.

b. Adjacent Street Network

The street network surrounding the Route 36 Highlands Bridge includes portions of three corridors, namely, Navesink Avenue, Ocean Avenue, and Highland Beach Drive in Sandy Hook Park. (Route 36 is called Navesink Avenue on the west side of the bridge and Ocean Avenue on the east side of the bridge.) These corridors form a T-connection at the eastern terminus of the bridge, with Navesink entering the span from the west and Ocean Avenue and Highland Beach Drive entering the span from the southeast and northeast, respectively.

Navesink Avenue is an east-west, four-lane divided highway that serves an important regional function by providing direct access into Sandy Hook Park from the mainland. Local streets that feed traffic onto Navesink Avenue at the western terminus of the bridge include Bay Avenue, Portland Road, and Highland Avenue. These thoroughfares are each two-lane roads. On the east side of the bridge, Ocean Avenue extends south along the peninsula to the town of Long Branch while Highland Beach Drive runs in the opposite direction into Sandy Hook Park.

c. Bascule Bridge

Opened to traffic in 1933, the Route 36 Highlands Bridge is a four-lane structure consisting of 11 simple fixed spans and one double leaf bascule span. Each lane is 11 feet wide, which is less than a standard lane width of 12 feet. No shoulders are provided on the Bridge.

The length of the bridge is 1,240 feet. The first three spans from the west and the last six spans are concrete-encased, girder spans. The flanking and bascule spans are considered fracture-critical structures. The flanking spans are a three-girder system and the bascule span is a two-girder system. The roadway surface is a concrete deck on the approach and flanking spans and an open steel grating on the bascule span. Both approaches to the Bridge have curved alignments that extend onto the structure. The west approach curves across the first three spans ending at the centerline of Pier 3. The east approach curves at the centerline of Pier 10 and extends across Spans 11 and 12. T he remainder of the bridge is on tangent alignment (see Appendix B, Figure B-1).

The Shrewsbury River begins at Sandy Hook Bay to the north of the Bridge and runs south into the Navesink River. Navigation on the river consists primarily of sailboats and other pleasure crafts. The clear navigation channel at the Bridge is 100 feet wide between fenders and is perpendicular to the span. The vertical clearance is 35 feet when the bascule span is closed. With the bascule span open there is unlimited vertical clearance.

6. Project Manager

The Project Manager is Mr. Atul Shah, Division of Project Management, NJDOT (telephone #: 609-530-2475).

B. Concept Development Report and other Previous Reports

Feasibility Study Evaluation of Alternatives, December 1999 and The Optimum Height Analysis, March 1998 are previous studies that described the deficiencies of the Route 36 Highlands Bridge. These deficiencies are noted above in Section II Introduction, A. General Information, 3. Project Need.

A Concept Development Report was not prepared for this project as the project was moved to Feasibility Assessment prior to the introduction of the NJDOT Concept Development Report.

C. Project Description

1. Project Fact Sheet

The Project Fact Sheet (PFS) is presented in Appendix A.1. At the time of its preparation, May 2002, the IPA was a high level fixed bridge constructed on the existing Route 36 Highlands Bridge alignment (Alternative 5a – Variation 1). Subsequent to the completion of the PFS, NJDOT's Value Engineering Unit (VEU) recommended a modification to a portion of the alignment over the channel. The VEU proposal called for a shift in the horizontal alignment to the south at the channel in order to eliminate the need for a temporary bridge for construction staging. The vertical profile as well as the alignment and connection of the new bridge with the approach road on each end of the structure are similar for both variations. It is estimated that project benefits and impacts would be the same under Alternative 5a's Variation 1 and Variation 2 despite the shift in alignment. The text of the PFS has been included as a record of how the project was presented to the Department. However, the drawings have been updated to reflect the recommended alternatives with the shift in alignment over the river and incorporating context sensitive design recommendations made between May 2002 and December 2002.

Traffic staging activities between Variation 1 and Variation 2 would be different. A description of the traffic staging plans for the IPA's – Variation 2 is presented in Section IV.G.

2. Restatement of Project Need

The preliminary scoping for this project occurred prior to the introduction of the "NJDOT Procedures Manual" in 1996. For this reason, a formal "Problem Statement Package" was not prepared during the earlier stages of the scoping process. This document is based upon the "Transportation Problem Statement" form in NJDOT Procedures Manual, Section 2.1.

NJDOT identified a need for this feasibility study based on the existing structural condition of the Route 36 Bridge and the operating and safety problems experienced on the bridge and its approaches resulting from constrained geometry. The existing Bridge is currently rated in poor condition with a sufficiency rating of 34.3 out of 100 points. The Bridge is substandard structurally and has a number of geometric features that either do not meet or meet only minimum current AASHTO and NJDOT design criteria.

There are approximately 2,200 bridge openings annually. Delays approaching the bridge are exacerbated when Route 36 is closed during bridge openings, particularly during the summer months. These conditions impact emergency services in the area. The bridge opens regularly twice an hour (at 15 minutes and 45 minutes after the hour) throughout the day during the heavily traveled summer season. The average time for a bridge opening cycle is 10 minutes.

A related seasonal issue concerns days when Sandy Hook Recreational Area fills its parking lots to capacity. On those days, traffic is closed to the Park and directed to Ocean Avenue southbound (Route 36 eastbound) into Sea Bright, resulting in congestion and associated extensive delays. This condition adds to overall congestion and delay on and in the vicinity of the Bridge. Community Partnering Team meetings raised additional project needs for connectivity of multi-use paths in the area, improvement of the toll plaza and turn arounds in the park and improvements on the west approach.

Existing Bridge-related problems are categorized below:

Bridge Structural Deficiencies

- Poor condition of bridge deck, substructure and superstructure,
- Substandard deck geometry and lateral under-clearance, and
- Non-compliance with the State of New Jersey and Federal specifications for seismic design.

Substandard Roadway Design Elements

- Substandard lane widths,
- Lack of shoulders,
- Lack of median barrier, and
- Sharp radius on westbound ramp from Sandy Hook Park to Route 36 Bridge.

Vehicle and Marine Traffic Conflicts

- Significant delays are experienced on Route 36 during seasonal months,

- The use of Route 36 Bridge as an emergency evacuation route is impaired, and
- Response time of emergency vehicles is affected.

Safety

The bridge lacks geometric features that would reduce the potential for accidents. These features include:

- a center median barrier,
- shoulders,
- guide rails, and
- a skid resistant surface across the entire bridge.

Pedestrian/Bicycle Access

Current plans for the Henry Hudson trail provide service to the southwest corner of the intersection of Bay Avenue and the Bay Avenue ramp to Route 36 on the northwest corner of the bridge. This trail should be connected to the proposed pedestrian/bicycle trail under design by NPS which is to be located on the east side of Ocean Avenue and starts at the toll plaza facility. The extension of the Sea Bright trail to the toll plaza facility will require the realignment of Ocean Avenue to provide the trail width needed along the seawall. Both of these trails should be connected to the existing Sea Bright trail that runs along the east side of Ocean Avenue on the west side of the seawall and ends at the intersection of the bridge and Ocean Avenue.

3. Project Methodology

A four-step process was used to prepare this analysis. First, the existing conditions were established for the study area. Project needs were then identified from the baseline condition. Next, alternatives were developed based on addressing the project needs. Measures of effectiveness were developed to select a recommended IPA. Finally, an impact assessment was performed to determine the cost/benefits of the IPA. A description of the existing conditions follows below.

a. Highway Classification

The highway section under investigation is Route 36, situated approximately between milepost (MP) 11.50 and MP 11.75 on the NJDOT Straight Line Diagram (see Appendix C). This segment is classified functionally as an Urban Principal Arterial.

b. Lane Configuration

The Bridge has a curb-to-curb width of 44 feet and maintains two 11 feet wide travel lanes in each direction. An 8 foot wide sidewalk flanks the curb lane on each side of the Bridge. There are no shoulders or median on the Bridge.

At the western terminus of the span, Route 36 maintains two 12 feet wide travel lanes in each direction. A curbed median separates eastbound and westbound traffic. A 3 foot wide clear zone is available adjacent to the curb lane in each direction.

At the Bridge's eastern terminus, Route 36 becomes Ocean Avenue and curves from an easterly alignment to a southerly alignment. The roadway width narrows from four lanes to two lanes on the peninsula where the arterial provides land service for both businesses and residences.

c. At-Grade Signalized Intersections

The closest signalized intersection to the project site is located on Route 36 at Miller Road, approximately one-half mile west of the Bridge. Two turning restrictions limit maneuvers at this location; first, no right turn moves are permitted on the red phase on Miller Road's northbound approach and second, left-turn moves are not permitted on Miller Road's southbound approach. The signal's cycle length is 120 seconds.

d. At-Grade Un-signalized Intersections

On the north side of Route 36, the street connecting Bay Avenue with Route 36's westbound lanes and Route 36 form a T-connection at the western terminus of the Bridge. Only right turn maneuvers onto Route 36 northbound can be made from the connecting minor road. A raised triangle-shaped median forms a channelized right turn lane at the intersection. Route 36 traffic traveling in the westbound direction can also enter the connecting road from the highway to access Bay Avenue via a slip ramp.

On the south-west side of Route 36, Portland Road forms a connection with Route 36 eastbound that is opposite of and similar to the Bay Avenue/Route 36 connecting road. Vehicles can only make channelized right-turn maneuvers onto Route 36 eastbound from Portland Road. Portland Road can also be accessed from eastbound Route 36.

e. Grade Separated Interchange

A grade separated interchange is located at the eastern terminus of the Bridge. The interchange is formed by ramp structures, "J" and "K/L", as well as by a portion of Route 36 (See Figure II-1). Ramp J carries southbound traffic from Sandy Hook onto the Bridge on a poor alignment. At Ramp J's merge into the Route 36 mainline, the ramp curves to the right and the mainline curves to the left. Thus, an instantaneous change of direction is required of vehicles leaving the ramp. The Ramp K/L structure provides eastbound Bridge traffic with access to Sandy Hook Park. This structure also connects Sandy Hook Park and Sea Bright via southbound Ocean Avenue. Ramps K/L is also on a tight alignment.

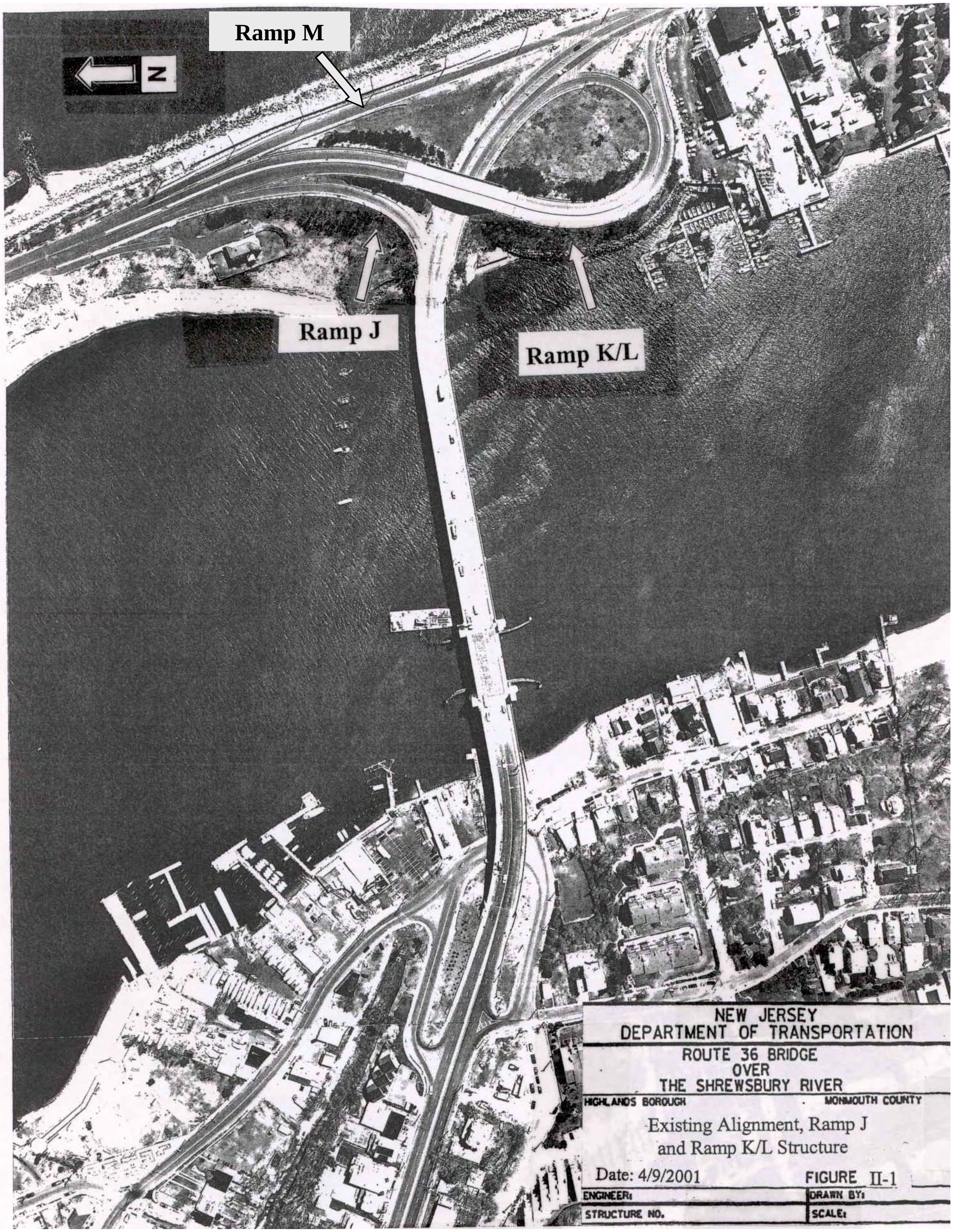
f. Posted Speed Limit

The NJ Straight Line Diagram and Sverdrup field survey conducted in September 2000 show that the posted speed limit through the project area is 45 mph.

g. Right-of-Way Widths (ROW)

ROW and jurisdictional issues between the National Parks Service and the NJDOT exist in the area at the eastern terminus of the Bridge. A map showing Gateway National Recreation Area boundaries on the eastern side of the Bridge is presented in Appendix C. The lines on the map show the boundary of the recreational area using the most recent documents provided by the National Park Service. A list of agencies contacted in order to clarify the boundary issues between the National Parks Service and NJDOT are also listed in Appendix C. Efforts to clarify these issues will continue through the Preliminary Design.

FIGURE II-1


Ramp M
N
Ramp J
Ramp K/L
NEW JERSEY
DEPARTMENT OF TRANSPORTATION
ROUTE 36 BRIDGE
OVER
THE SHREWSBURY RIVER
HIGHLANDS BOROUGH
MONMOUTH COUNTY
Existing Alignment, Ramp J
and Ramp K/L Structure
Date: 4/9/2001
FIGURE II-1
ENGINEER:
DRAWN BY:
STRUCTURE NO.
SCALE:

h. Structures

The following structures are located within the study area:

- Bridge Number 1315-150

The existing Route 36 Bridge is a simple-trunnion, double leaf bascule bridge that is currently rated in poor condition with a sufficiency rating of 34.3 out of 100. Constructed in 1932, the four-lane structure consists of eleven simple fixed spans and one double leaf bascule span. Each lane is 11 feet wide, or less than the standard width of 12 feet. The total length of the bridge is 1,240 feet. The first three spans (from the west) and the last six spans are concrete-encased, girder spans. Spans on either side of the movable span, the flanking spans, are "un-encased". The flanking and bascule span girders are non-redundant and are fracture critical.

The roadway surface consists of a concrete deck on the approach and flanking spans and an open steel grating on the bascule span. A 2 inch thick bituminous wearing surface was placed on the approach spans at an unknown date. The clear navigation channel is 100 feet wide between fenders and is perpendicular to the bridge. The vertical clearance is 35 feet above mean high water when the bascule span is closed. With the bascule span open there is no vertical restriction. The unique design of the bridge's towers and "operators" houses are considered "contributing features" to its historic significance.

In its almost seventy-year lifetime, many systems have been replaced or rehabilitated. Since 1960, at least seven contracts have been let, the last two replacing the entire electrical system and performing major rehabilitation to mechanical systems and the bridge deck. NJDOT's structural inventory and appraisal sheet for the Route 36 Bridge is presented in Appendix D.

- Bridge Number 1315-164

This structure carries local road Ocean Avenue over Route 36 approach ramps. The existing structure is a single span plate girder bridge. The bridge roadway has a concrete deck. In cross section, the deck consists of two roadways of 22 feet each, a 4 foot median, safety walks of 1'-6", and aluminum guardrail/parapet of 1'-1". The bridge is on a skew of 7.5^{o} to the centerline of the roadway. The overall width is 53'-2". The structure's length is 113.7 feet with a minimum vertical under-clearance of 14.42 feet excluding shoulder and 14.17 feet including shoulder. The 2001 SI&A sheet for structure 1315-164 lists the bridge in good condition (see Appendix D).

- Ramps

The study area contains two ramps, Ramp J and Ramps K/L. Ramp J carries southbound traffic leaving Sandy Hook Park onto the Route 36 Bridge westbound. Ramps K/L carries bi-directional traffic, providing access (1) from Sandy Hook Park to Ocean Avenue southbound and (2) from Route 36 eastbound to Sandy Hook Park.

Each ramp is characterized by a sharp horizontal curve as described below:

- Ramp J - Station 0+040 to 0+160
  - R is approximately 160 feet
  - Design speed is 25 mph
  - Minimum radius of curve based on 4 % emax = 205 feet

- Ramps K/L Bridge - Station 18.620 to 18.760
  - R is approximately 120 feet
  - Design speed is 25 mph
  - Minimum radius of curve based on 4 % emax = 205 feet.

i. Utilitie*s*

There are both overhead and underground utilities within the project limits and include electrical wires, sanitary sewers, and storm drainage sewers. In addition, there are also utility easements that are located within the Route 36 Right-of-Way (ROW).

<u>Western Terminus of the Route 36 Bridge</u>

- Electrical Utilities

Overhead electrical wires are supported by poles located within the limits of the sidewalk on either side of Route 36. Electricity is supplied by GPU Energy and telephone service is provided by Verizon.

- Sanitary Sewers

On the west side of the Bridge, sanitary sewer lines extend underneath both the south sidewalk and across Route 36 near Portland Road. Sewer service is provided by the Borough of Highlands.

- Storm Drain Lines

Storm drain lines are found underneath the intersections of Route 36 at Portland Road and the Bay Avenue connector road.

-
-

- Water

The area's water supply is provided by the New Jersey American Water Company.

Eastern Terminus of the Route 36 Bridge

- Storm Drain Lines

Storm drain lines are located underneath Ramp J, Ramps K/L, and Route 36 mainline.

- Electrical Utilities

Power for the bridge is provided across the channel through a submarine cable.

Utilities on the Bridge

Utilities on the Bridge include telephone, electric, water, and sewer.

Easements

Utility easements are located along Route 36's centerline. A utility easement is also located within the eastbound lanes of Route 36.

j. Drainage

Evaluation of the drainage system will be performed during Preliminary Design. It is anticipated that all roadway drainage will be collected and tied into the systems on the approaches. Within the limits of the project, it is not anticipated that significant changes to the drainage would be necessary based on the Initially Preferred Alternative.

k. Hydraulics

Evaluation of the river hydraulics will be performed during the Preliminary Design. The IPA identified in Chapter IV was selected in order to minimize hydraulic impacts. The existing channel is proposed to remain and the number of piers in the river will be reduced to minimize potential impacts.

l. Soils

Information generated by the 1987 test boring programs revealed the following conditions: (1) the project site is underlain generally by medium to fine sand with little silt and (2) the density of the sand varies from very loose to loose immediately below the water table and increases in density with depth, to very dense.

Only two strata below Elevation 7.0 feet could be identified in the six borings drilled. The gradations of all the strata are similar, ranging from coarse to fine sands with traces of gravel and little silt to fine sand with some silt. The various strata can be defined by density of the zone and the color of the material.

m. Pavement

A pavement design report, entitled, "Pavement Design Report, Route 36. Section D", was prepared by Sverdrup Corporation in March 27, 1991. As part of the investigation, a pavement condition survey was conducted in February 1991. The existing pavement conditions described in the report are presented below:

- Pavement Structure

The original pavement on Route 36 is rigid pavement, consisting of a 9-inch thick reinforced concrete pavement slab, typical slab unit 10 feet by 45 feet. The road was widened and resurfaced two times in 1971 and 1984. The 1971 widening and resurfacing provided a bituminous overlay over the concrete pavement and flexible pavement for Ramps J, K, L, and M. (Ramp M is part of Ocean Avenue alignment and is located between the southern termini of Ramps K/L and the northern terminus of Ramp J.) In 1984, the west approach of the Route 36 Highlands Bridge over Shrewsbury River was resurfaced.

The existing eastbound approach pavement structure consists of a 2-inch thick bituminous pavement (MA-BC-1) over a 3-inch thick bituminous pavement overlay on a 9-inch thick reinforced concrete pavement with a 6-inch sub-base.

The original westbound approach pavement structures (Ramps J, K, L, and M) consist of a 9 inch-thick reinforced concrete pavement on a 6 inch-thick sub-base. The 1971 resurfacing work on Route 36 pavement varied from a minimum 3-inch bituminous overlay to a separate pavement structure over the concrete pavement. The flexible pavement for ramps is composed of sub-base, gravel base course, bituminous stabilized base course, and bituminous pavement.

Subsequent pavement contracts have been performed on the bridge, however, the scope of this report did not include updating the pavement condition survey.

n. Wetlands-Type Vegetation

Wetlands, floodplains, sole source aquifers, and stream crossings are present in the surrounding area. The evaluation of potential effects on the surrounding area's ecology, including wetland delineation will be performed during the Preliminary Design.

o. Navigation and River Issues

- Operations

The existing bridge vertical clearance is 35 feet above mean water. A vessel height of 35 feet or greater may request a bridge opening. In the peak season, bridge operators are permitted to open the Bridge as frequently as once every half hour between 10AM and 7PM, provided there is a call. At other times, the Bridge must open on request. Navigation on the river primarily consists of sailboats and other pleasure crafts.

Currently, the duration of a bridge opening varies between 8.5 and 12 minutes with an average "opening time" of approximately ten (10) minutes. The time required to open and close the bascule span is affected by the number of vessels crossing when the Bridge opens.

- Data Collection

An analysis was performed using vessel data including vessel heights in the years 1994 through 1997 and in 2000 collected by NJDOT. A sample data sheet appears in Figure II-2. The data sheets were entered into an electronic database and then analyzed. The analysis resulted in certain conclusions being made about vessels crossing under the Bridge. Although data either were not collected or were not available in the data set for certain months over these five years, sufficient data were collected in each month, particularly in some seasonal months to estimate a profile of the intensity of vessel activity throughout the year.

The data indicate that the most active period, or "peak season" for boating activity on the river extends from May through October. During these six months, the number of recorded boats that crossed under the Route 36 Bridge while the bascule span was opened accounted for 94 percent of the five-year recorded total (see Appendix E). This period overlaps the period of peak vehicle travel over the Bridge (see Section II.1.17. Traffic).

The variation in vessel heights during the peak season was also estimated based on collected 1997 and 2000 data, the years when the most extensive information was recorded. Of the almost 2,900 records collected between 1994 and 1997, and 2000, 75 percent of the data (2140 observations) were recorded in 1997 and 2000.

Appendix F includes a table and graph indicating the average number of recorded vessels per hour requiring a bridge opening, with at least a certain minimum height and a corresponding histogram showing the cumulative distribution of recorded vessels by height. This peak season data show that the average number of vessels arriving at the Bridge and requiring the opening of the Bridge was 1.50 vessels per hour, or about 1 vessel every 40 minutes. Approximately 95 percent of

FIGURE II-2

Form EL-50 9/94

"BRIDGE OPENING REPORT"
New Jersey Department of Transportation
Bureau of Maintenance Engineering
Movable Bridge Operations

SHEET NO. 1 OF 1

FILE 13801, PROJ. DATA

Unit No. 07 Crew No. 0067 For Month Ending: JANUARY 31 19 97

Route No. 36 SHREWSbury RIVER HIGHLANDS Job Number: 1315285

(Waterway) City/Town

Certified as to correctness by Chief Bridge Operator or Designee: Robert R. Stoll Chief Bridge Operator

Day of Month	Start Time A.M.	Start Time P.M.	Duration Of Opening	*Vessel Type	Operator	Day of Month	Start Time A.M.	Start Time P.M.	Duration Of Opening	*Vessel Type	Operator	Day of Month	Start Time A.M.	Start Time P.M.	Duration Of Opening	*Vessel Type	Operator
6	8:00		4	R	RRS	14		2:40	5	R	MB						
"	8:54		7	R	RRS	"		2:53	5	R	MB						
"	9:15		8	R	RRS	16	10		5	R	MB						
"	9:32		11	R	RRS	"	11		5	R	MB						
"	10:00		14	R	RRS	"	12		5	R	MB						
"	10:16		8	R	RRS	"	12:30		5	R	MB						
"		2:27	14	R	RRS	23	10:25		15	T+T + DN	RRS						
"		2:47	3	R	RRS	25		2:12	10	PB	LK						
"		2:51	4	R	RRS	29	12:05		10	TB	JH						
"		2:54	4	R	RRS	"	6:57		10	TB	JH						
"		3:—	4	R	MB	"		1:35	10	T+PB	LK						
		3:07	4	R	MB	31	10:20		4	R	RRS						
7		1:42	7	R	JH												
		2:45	3	R	JH												
13	12:41		5	R	MB												
"	12:54		4	R	MB												
"		2:—	5	R	MB												
14	7:50		15	T+D	MB												
"	9:44		10	R	MB												
"		2:35	5	R	MB												
*Boat Openings					0	*Boat Openings											

NEW JERSEY
DEPARTMENT OF TRANSPORTATION
ROUTE 36 BRIDGE
OVER
THE SHREWSBURY RIVER
HIGHLANDS BOROUGH MONMOUTH COUNTY

Sample Vessel Data Sheet

FIGURE II-2

ENGINEER: DRAWN BY:
STRUCTURE NO. SCALE:

all recorded vessels require the bascule span to be opened to continue passage under the existing span. These numbers include a 4 foot adjustment to account for variances in tides. The NJDOT has continued to record vessel data and review of the most recent vessel reports reveals that the height and frequency of vessels using the channel remain consistent with previous records.

p. Aesthetics

The Route 36 Bridge is located in the scenic shoreline area in Highlands Borough and Sea Bright Borough in Monmouth County. The Bridge and retaining walls have aesthetically pleasing architectural elements that give the Bridge an "historic look". Roadside plantings are found adjacent to ramps at the eastern terminus of the Bridge. The Bridge piers and the operator's houses have architectural treatments that resemble towers. The view of the bridge, as one approaches it either by auto or boat, is one of beauty and history. In addition, the bridge can be seen from the various restaurants, marinas, and other recreational locations in the area, and is a factor in the appeal of these locations. See Appendix T for photographs of the Bridge.

q. Traffic Analysis

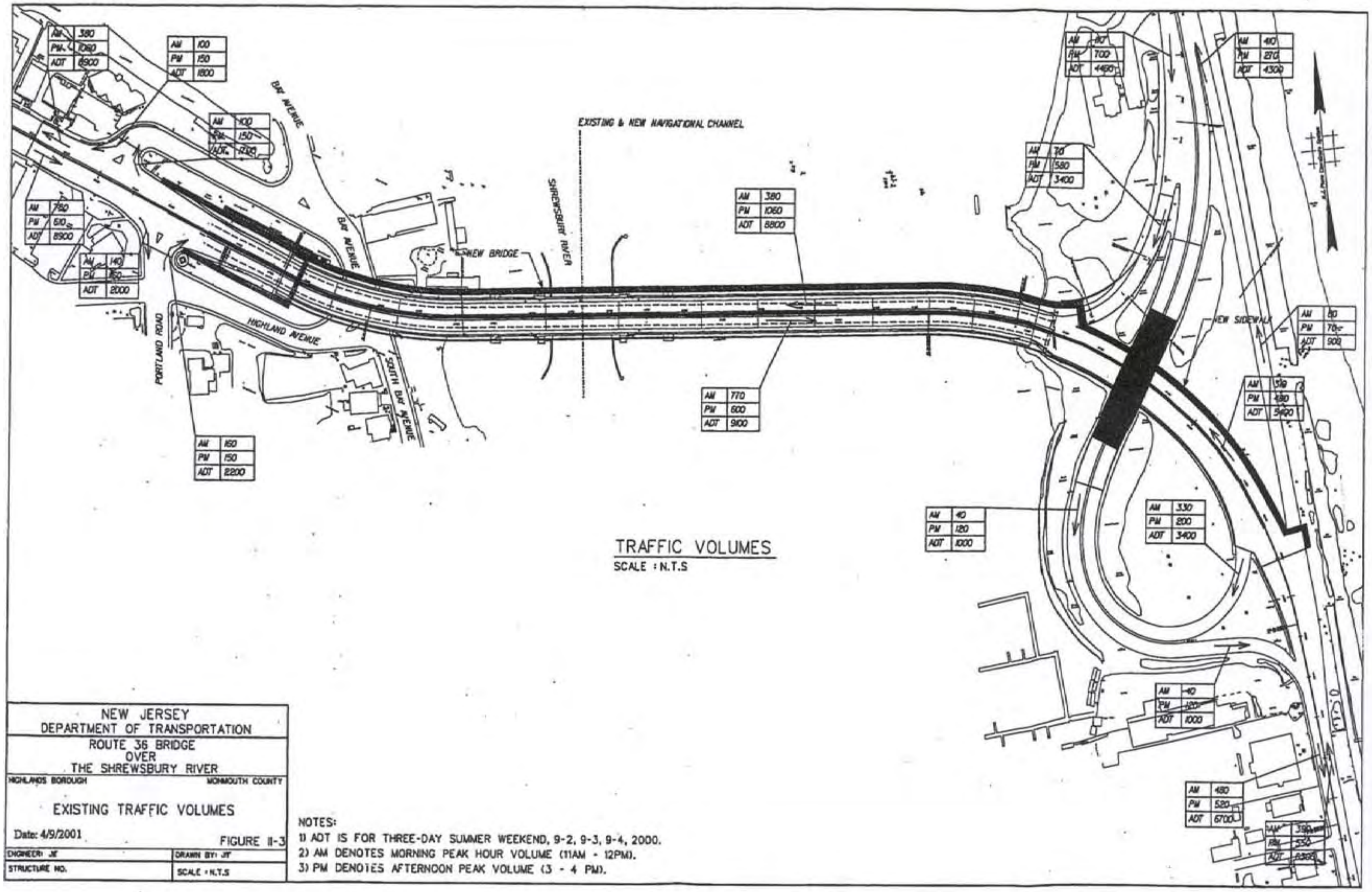
- Volumes

According to 1998 data collected at NJDOT's permanent count station ID 6-1-20 located on Route 36 near Route 520 in Sea Bright Borough, the highest volumes on the highway occurred on weekend days (Saturday and Sunday) during the summer months and portions of the spring and fall. Inspection of 1997 and 2000 weekly temporal distribution data of marine traffic on the Shrewsbury River also revealed that marine activity was highest during these same periods. Therefore, to assess the full effect of bridge operations on both vehicular and marine traffic, this analysis included both weekend and typical weekday conditions during the seasonal months (May-October). Traffic data were collected on the Bridge, roadway approach and ramps sections, and adjacent local streets over the 2000 Labor Day weekend, September 2, 3, and 4 (see Appendix G.)

- Average Daily Traffic

The data show that the daily traffic crossing the Bridge on September 2 (Saturday) and 3 (Sunday) was about 18,000 vehicles (See Figure II-3). Slightly more than half the traffic (9,100 vehicles) traveled in the eastbound direction. Near the Route 36 approach ramps, Ocean Avenue carried 13,000 vehicles daily. The ADT on Portland Road at Route 36 was about 2,200 vehicles.

The average annual daily traffic (AADT) on the Bridge was estimated using data from the September 2000 field survey and a NJDOT ATR permanent count on


TRAFFIC VOLUMES
SCALE : N.T.S
EXISTING & NEW NAVIGATIONAL CHANNEL
SHREWSBURY RIVER
NEW BRIDGE
BAY AVENUE
HIGHLAND AVENUE
SOUTH BAY AVENUE
PORTLAND ROAD
NEW SIDEWALK
NEW JERSEY
DEPARTMENT OF TRANSPORTATION
ROUTE 36 BRIDGE
OVER
THE SHREWSBURY RIVER
HIGHLANDS BOROUGH
MONMOUTH COUNTY
EXISTING TRAFFIC VOLUMES
Date: 4/9/2001
FIGURE II-3
ENGINEER: JE
DRAWN BY: JT
STRUCTURE NO.
SCALE : N.T.S
NOTES:
1) ADT IS FOR THREE-DAY SUMMER WEEKEND, 9-2, 9-3, 9-4, 2000.
2) AM DENOTES MORNING PEAK HOUR VOLUME (11AM - 12PM).
3) PM DENOTES AFTERNOON PEAK VOLUME (3 - 4 PM).

Route 36 in Sea Bright near the span. The data indicated that the AADT crossing the Bridge is approximately 16,000 vehicles.

- Peak Hour Traffic

The data show that the AM and PM peak hours occurred between 11 AM and 12 PM and between 3 PM and 4 PM, respectively. During the AM peak hour, approximately 770 vehicles cross the Bridge in the eastbound direction. Of this total, about 43 percent (330) are destined for Sandy Hook Park while the remaining vehicles continue eastbound into Sea Bright.

In the westbound direction, about 300 of the total 380 vehicles that cross the Bridge come from the south via Ocean Avenue. The remaining westbound vehicles originate from Sandy Hook, accessing the Bridge from the north.

During the PM peak hour, the peak direction of travel across the Bridge is westbound where 1,060 vehicles were counted. Almost 600 westbound vehicles entered the Bridge from Ramp J, which affords Bridge access for Sandy Hook traffic. Six hundred (600) vehicles were counted on the span's eastbound lanes.

Approximately 300 vehicles traveled on Portland Road during both the AM and PM peak hours. About the same number of vehicles entered Portland Road from Route 36 as exited the local street onto Route 36 during each peak hour.

- Operations

- Level-of-Service (LOS)

Traffic crossing the Bridge operated at LOS of B or better during the peak hour (3-4 PM) of Sunday, September 3, 2000 (part of the Labor Day weekend), when approximately 1,600 vehicles traveled on the multi-lane highway (see Appendix H). Vehicular travel speeds reached approximately 40 mph in each direction. A summer weekend is considered a peak travel condition for this recreational area.

- Vehicle Delay Associated with Bridge Operations

Although the capacity of Route 36 in the vicinity of the Shrewsbury River is sufficient to process existing hourly volumes at an acceptable LOS, traffic is periodically disrupted and delayed when the Bridge is opened. Currently, the Bridge opens twice an hour (at 15 and 45 minutes after the hour during the recreational season). A field investigation revealed that the Bridge is closed an average of 10 minutes per "opening/closing" operation.

To estimate vehicle delay, an analysis was performed based on Highway Capacity Manual techniques (Chapter 6, page 6-7), which compares the vehicle arrival rate to the vehicle processing rate for three conditions. These conditions are: (1) immediately after the Bridge is opened and queues begin forming, (2) immediately after the Bridge is re-opened to traffic but the queues continue to lengthen because full capacity has not yet been achieved (full capacity can not be restored until the queues dissipate), and (3) immediately after the queues begin to dissipate (when the service rate exceeds the arrival rate).

- Estimation of Vehicle Arrival Rate

The analysis initially estimated Bridge traffic based on ATR counts collected on the Bridge between August 31 and September 6, 2000 and data obtained from a Route 36 permanent ATR count station located in Sea Bright, New Jersey, approximately three miles south of the Bridge. Delayed volume was estimated for three different time periods, Saturday, Sunday, and a typical weekday, using the following steps:

- From the August/September data collected on the Bridge, the temporal distribution for each period was examined in order to select the peak eight-hour period.

- The average hour within the eight-hour peak period for the month of September was computed for each study period.

- Monthly adjustment factors for Bridge traffic were created based on the Route 36 "permanent count" station in Sea Bright (see Appendix I).

- The average hour within the eight-hour peak period for each month was estimated for a Saturday, Sunday, and typical weekday, based on the monthly adjustment factors developed in the above step. Vessel data show that marine traffic passing under the Bridge is not significant between November and April. Therefore, volumes were developed only for the six-month period, May thru October.

- The annual average hour within the eight-hour peak period for each study period was calculated by dividing the total volume crossing the bridge between May and October by six.

- Estimation of Vehicle Processing Rate

The Highway Capacity Manual (HCM) estimates that the normal capacity of a multi-lane highway with a free flow speed of 45 mph is 1,900 passenger cars per lane per hour (pcplph) under ideal conditions. The HCM also observes that a reduction in the minimum flow rate of vehicles departing from a queue may drop as low as 25 percent of a roadway's capacity, depending on local driving characteristics. For this analysis, the roadway capacity under stable flow conditions was assumed to be 1,900 pcplph and about 1,700 pcplph when queues were dispersing.

- Delay and Queues

The delay assessment is presented in Appendix J and assumes that the span is opened typically twice an hour throughout the study period. The results show that the vehicular delay occurring in both directions on Saturday and Sunday averages between 50 and 55 vehicle-hours on each day. The vehicle delay experienced on a typical weekday reaches approximately 40 vehicle hours. The average delay per vehicle reaches about 4.5 minutes on weekends and about 4.3 minutes on a typical weekday. For the year 2002, the annual vehicle delay associated with Bridge openings was estimated to be approximately 57,900 vehicle-hours (see Appendix K).

Appendix J's "delay calculation" spreadsheets also show the results of modeled traffic queue patterns for an average hour within the peak period for a Saturday, Sunday, and typical weekday, respectively. The results show that maximum queues reach 60 vehicles per lane on weekends and about 45 vehicles per lane on weekdays along the eastern approach to the Bridge. This translates into a queue length ranging between 1,100 feet and 1,500 feet from the Bridge.

- Cost of Delay

The cost of delay generated at the Bridge was computed based on an average vehicle occupancy (AVO) of 1.98 persons and a per-person time value of $6.15. The source of the AVO number is the <u>AASHTO Manual on User Benefit Analysis of Highway and Bus-Transit Improvement for Recreational Areas</u>, 1977. The average worth of a person's time was estimated based on the same source. The average worth of a person's time in 1977 is presented as $2.40 in the above AASHTO manual. This value was escalated to a current worth (2002) of $6.15 per hour by increasing the 1977 value by 4 percent annually. A per-person time value of $6.15 results in a current annual cost associated with bridge-related delay of approximately $704,635 (57,866 x 1.98 x $6.15) (see Appendix K).

r. Accident Analysis

According to the Bureau of Traffic Engineering and Safety Programs (BTESP), a total of four (4) accidents were reported at the Bridge for the most recent three year period, 1998-2000 (see Appendix L). The accidents included two "same direction" (rear end) collisions, one "angle" mishap, and one hit with a parked vehicle. No accident category was over-represented compared to statewide average values within the study area. The BTESP data also show that the overall accident rate at the bridge was 0.30 accidents per million vehicle miles (MVM) traveled during year 2000. This rate is below the statewide average of 7.02 accidents per MVM for highway cross sections that are similar to the cross section on the bridge (e.g. four travel lanes, no median, and no shoulders).

s. Pedestrian and Bicycle Circulation

Both the north and south sidewalks of Route 36 extend across the Bridge. Currently, the sidewalks serve as a shared path for pedestrians, bicyclists, and fishermen. Pedestrian and bicycle traffic was observed on both the north and south sidewalks of Route 36. On September 3, 2000, pedestrians and bicyclists were observed to walk or cycle from or to the Bridge, or across Route 36. Of the total volume counted on September 3, 86 percent consisted of bridge traffic and the remaining 14 percent were destined for points other than the Bridge, such as a marina and restaurants located north of the Bridge on Bay Avenue.

A proposed roadway (Shore Drive) and multi-use path has recently been approved by Highlands just north of the Bay Avenue slip ramp. Construction on this multi-use path is estimated to start this spring. This trail is proposed to tie into the Henry Hudson Trail at a future date. The Henry Hudson Trail is a 9-mile-long, 10 foot wide bike trail that runs through Northeast Monmouth County. The trail runs just north of and parallel to Route 36, from the Aberdeen/Keyport border at the intersection of Lloyd Road and Clark Street to the Middletown/Atlantic Highlands border at North Leonard Avenue. Also a bike path exists in Sea Bright along the west side of the seawall ending at the Bridge overpass. Built by the U.S. Army Corps of Engineers as a "splash pad" along the seawall, the path is used by cyclists, walkers, joggers, etc. It is approximately 1 ½-mile long and approximately 15 feet to 20 feet wide.

In addition to existing trails, the National Parks Service has studied alternatives for a bike path in Gateway National Park. A value engineering study was done and an Environmental Assessment was produced for this proposal. The preferred alternative for the bike path is a 12 foot wide asphalt paved path running from the park entrance station to the Fort Hancock Ferry Dock. The bike path, located in the park, will be a 5^{th} lane, but grade separated from the road. The project has been funded and construction is scheduled for 2003.

t. Transit Services

- Current Service

Academy Bus Lines provides limited transit service via Route 36 into the project area. Academy provides this service from three locations including:

- Port Authority Bus Terminal in New York City
- Wall Street, New York City, and
- Newark, NJ.

Buses leaving from the Port Authority and Wall Street stop in Long Branch, North Long Branch, Sea Bright, Highlands, Atlantic Highlands, Leonardo, Port Monmouth, and other points north. In addition, the Wall Street buses stop in Monmouth Beach.

The Newark buses stop in Monmouth Beach (Ocean and Atlantic Avenue), Sea Bright (Ocean Avenue and East Church Street), Highlands (Route 36 and Bay Avenue), Atlantic Highlands (Route 36 and 1^{st} Avenue), Leonardo (Route 36 and Hosford Avenue), Port Monmouth (Route 36 and Main Street), and points north. This line is the former NJ Transit bus line # 61 operating between Newark and Monmouth Beach. NJ Transit transferred the operation and management of this line to Academy Bus Company effective January 1, 2001 (see Appendix M).

The three bus lines operate on a limited schedule. The Port Authority line operates the most buses and offers service on both weekdays and weekends. The buses to Wall Street and Newark only operate on weekdays. Academy runs 18 buses to and from Port Authority on weekdays, and nine buses on Saturdays, Sundays, and holidays. Academy runs two buses in the morning from Long Branch to Wall Street and five buses in the afternoon from Wall Street to Long Branch. Only two buses run each morning and afternoon between Newark and Monmouth Beach. These buses are all geared towards commuters and, as shown, run rather infrequently during weekends and holidays when the Route 36 Bridge is most congested.

In addition, NJ Transit runs the M24 bus from the Red Bank Rail Station to the Corner of Bay and Water Witch Avenues in Highlands. This bus also runs infrequently, and only on weekdays and Saturdays. One bus per hour runs in each direction from 7:00 a.m. to 8:00 p.m.

- Proposed Service

As part of its Sandy Hook – Route 36 Corridor Summer Traffic Management and Agency Coordination Plan, February 2001, the Monmouth County Planning Board proposes to implement a shuttle bus service to Sandy Hook called the Bayshore Shuttle. The Bayshore Shuttle would operate between 10:45 AM and 8 PM using four vehicles. This service would be coordinated with four midday and evening trains in each direction at the Middletown rail station. The proposed schedule would provide a loop service operating between Sandy Hook, Highlands, and Atlantic Highlands on a 30-minute headway (see Appendix M).

u. Land Uses/Adjoining Properties

- Surrounding Land Use

The area surrounding the Bridge on the mainland side is a mixed-use area that includes residences and local businesses. Popular area destinations, including marinas and Bahrs Seafood Restaurant, are located along Bay Avenue where it crosses underneath Route 36 at the Bridge's western terminus. The Gateway National Recreation Area, often referred to as Sandy Hook Park, is located on the east side, or peninsula side, of the Bridge and encompasses the northern half of the peninsula.

- Adjacent Properties

On the mainland, Route 36 provides land service for both businesses and residences. At the western terminus of the Bridge, a restaurant with adjacent off-street parking is located at the corner of Portland Road and Route 36. The remaining land uses on the south side of Route 36 between Portland Road and Miller Street are generally one- and two-family residences. One- and two-family residences also front the north side of Route 36 between Bay Avenue and Miller Street.

On the peninsular side, the westbound on-ramp connecting the Bridge and the National Park lies within a parcel of land whose jurisdiction was transferred from the State of New Jersey to the U.S. Department of the Interior in 1977. However, NJDOT retains an easement to maintain the approach roadways.

- Planned New Development

NJDOT's Bureau of Mobility Strategies (BMS) forecasted traffic growth on Route 36 through Highlands Borough to be approximately one percent annually up to 2028. According to the BMS, this projection is based, in part, on information obtained from local municipal and county planners who described the availability of developable land surrounding the project site as limited. Therefore, BMS's forecast of traffic growth is largely attributable to projected increases in background or through traffic rather than in vehicle trips generated by planned new development in proximity to the study area.

v. Access

There are 10 driveways located within the project limits. Five are at the western terminus of the Bridge and the other five are at the eastern terminus of the Bridge (see Appendix U).

The New Jersey State Highway Access Management Code states that the width of a curb line opening can vary between 12 feet and 30 feet for residential properties and between 20 feet and 46 feet (two-way access) for non-residential properties. The widths of all the driveways within the project limits are in compliance with the State Access Management. However, a number of driveways are not in compliance with required distances between driveways and intersections.

w. Significant Historic and Cultural Resources

The Route 36 Bridge was designed by Dr. J.A.L. Waddell, a prominent bridge engineer during the early 1900s who primarily designed movable bridges such as swing spans, vertical lifts, and bascule type bridges. This Bridge consists of a double-leaf trunnion bascule main span and eleven approach spans with multi-girders. In 1991, the bridge was surveyed by A.G. Lichtenstein for NJDOT and found to be eligible for the National Register of Historic Places under Criterion C, due to the notable design of the movable span as the "work of a master" and as "an exceptionally well-preserved and beautifully situated example of early 20th century movable bridge technology" (A.G. Lichtenstein Associates, Inc. 1991); the bridge received a State Historic Preservation Office (SHPO) Opinion of Eligibility in 1991.

Due to the high visibility of the bridge to and from the residential community of Highlands Borough, the Area of Potential Effects (APE) for this project may encompass as many as 75 buildings over fifty years of age. Some of these properties, notably along Shrewsbury Avenue, possess a high degree of architectural integrity and may be potentially eligible for the National Register of Historic Places. The only property within the potential APE-Architecture, besides the Route 36 bridge, listed in the National Register of Historic Places is Twin Lights (Navesink Lighthouse), an 1862 sandstone building with two corner light towers sited on a promontory overlooking the Route 36 bridge. Twin Lights was listed in the National Register of Historic Places in 1970 and the New Jersey Register in 1980. In Highlands Borough, the *Monmouth County Historic Sites Inventory* (1984) surveyed three properties within the APE-Architecture for this project and made recommendations regarding their National Register eligibility: 66 Navesink Avenue (possibly eligible); 79 Portland Road (not eligible); and 24-26 Shrewsbury Road (not eligible). No properties were surveyed in the APE-Architecture in Sea Bright Borough. The former corridor of the Central Railroad of New Jersey Coastal Spur, whose tracks passed south of Second Street in Highlands Borough, spanned the Shrewsbury River via a non-extant bridge, and continued north and south along the east side of Ocean Avenue in Sea Bright Borough, was recommended not eligible for the National Register by SHPO in 1993.

4. Project Design Standards

Key project design criteria used for the studies are summarized below. These criteria are based on the NJDOT "Roadway Design Manual", 1995, the Bridges and Structural Design Manual", 1998, and AASHTO's "A Policy on Geometric Design of Highways and Streets", 2001.

Item	**Design Criteria**	
Design Speed:		
Mainline	45 mph	
Ramp	25 mph	
Lane Width:	10 feet – minimum; 12 feet – desired	
Shoulder Width:		
Right	10 feet – desirable	
Left	3 feet	
Maximum Grade:		
Mainline	6.5 %	
Ramps	7 %	
Minimum Horizontal Radius:		
Mainline	730 feet – minimum; 955 feet – desired	
Ramps	185 feet – minimum and desired	
Maximum Rate of Super-elevation:		
Mainline	0.04 feet/ft	
Ramp	0.06 feet/ft	
Stopping Sight Distance:		
Mainline	360 feet – minimum; 955 feet – desired	
Ramp	155 feet – minimum and desired	
Cross Slope:	0.015 feet/ft	
Rate of Vertical Curvature:		
Mainline	Kc = 61 – minimum	Ks = 79
Ramp	Kc = 12 – minimum	Ks = 26
Vertical Clearance:		
Ramps	15.5 feet (See Appendix O)	
Navigable Channel	65 feet	
Level of Service:	“D” – minimum; “C” – desired	

III. Alternatives Analysis

The need to upgrade the Highlands Bridge with a safe and reliable bridge has been recognized for quite some time, and several previous studies have been prepared to determine the most efficient and suitable scheme for providing this crossing. Five alternatives for the rehabilitation or replacement of the bridge were analyzed. The alternatives were evaluated and compared based on their (1) ability to meet the project needs identified in Chapter II, (2) impact to the Historic Bridge, and (3) life cycle costs. This analysis resulted in the selection of the Initially Preferred Alternative (IPA), which is assessed more fully in Chapter IV.

Description of the Bridge Alternatives Considered

The following six alternatives for improving the Route 36 Bridge are evaluated below:

- Alternative 1: No Build
- Alternative 2: Minor Rehabilitation
- Alternative 3: Major Rehabilitation
- Alternative 4: New Bridge on New Alignment - Maintain Existing Bridge
- Alternative 5a: New High-Level Fixed Bridge
  - Variation 1: Replaced On-Line
  - Variation 2: Replaced Off-Alignment
  - Variation 3: Optimum Alternative – Direct Connector
- Alternative 5b: New High-Level Movable Bridge Replaced On-Line

A. Alternative 1: No Build

This alternative assumes routine maintenance would continue, but that no portion of the bridge would be upgraded.

The analysis of this alternative follows.

1. Ability to Fulfill Project Needs

a. *Emergency Services (System Linkage)* – Although the Bridge would benefit from a continuing maintenance program that would occur under this alternative, the Bridge's function as a principal link within the area's urban roadway system would continue to be disrupted with numerous bridge openings occurring during the seasonal months. Unacceptable delays and detours would continue to be experienced by area residents and visitors in times of emergencies.

b. *Safety on Bridge* - The safety inadequacies of the bridge would not be addressed.

c. *Vehicular and Marine Traffic Conflicts* – The No-Build option would not change the existing vehicle capacity on the Bridge. In addition, the existing conflicts between marine and vehicle traffic would also remain under the No-Build option, resulting in a high frequency of bridge openings. If no structural or geometric improvements are made, vehicle delay at the Bridge during bridge openings would likely increase as NJDOT forecasts show higher traffic volumes crossing the span over the next 30 years. Further, periodic lane closures related to the routine maintenance of an aging structure would occur and result in additional delays and queue build-ups across the Bridge.

d. *Structural Deficiencies* - This alternative would not address any structural deficiencies. The problems of low structural capacity, minimal seismic resistance, potential scour problems, and substandard geometric features would remain.

e. *Reduction in Operating Cost* - The operating cost would be the same as the existing condition.

f. *Coast Guard Vertical Clearance Requirements* – The US Coast Guard requires a minimum vertical clearance of 65 feet for under clearance for structures over the Inter-Coastal Waterway. While the Shrewsbury River is not an Inter-Costal Waterway, this vertical clearance provides assurance that this level of service would be available. Current "unrestricted passage" conditions for vessels would be maintained.

2. Impact on Cultural/Historic Resources

This alternative would possess no impact to cultural, historic, prehistoric, or archaeological resources. Since the existing Bridge would continue to be used under this alternative, no adverse effects to the structure would be anticipated. However, vigilant and regular maintenance efforts would be required to inhibit further deterioration of the Bridge. There would be no effect on the view of the Navesink Twin Lights from the Bridge.

3. Context Sensitive Design

Selection of the No-Build Alternative would preclude implementing context sensitive design solutions to address issues raised by the communities at project-sponsored Community Partnering Team Meetings.

4. Cost

The present worth of the No-Build option is estimated as approximately $56,409,000 over a 75-year life of the structure (See Table III-1). The cost estimate included initial, maintenance, operating, and vehicle delay costs. See Appendix K for vehicle delay costs.

5. Summary

While this Alternative has a low Life Cycle cost, it also provides the least benefit and response to the project needs. Alternative 1 only address one project need, that is, it meets Coast Guard requirements for clearance (see Table III-2). Although current

Route 36 Bridge over the Shrewsbury River

Table III-1
Data for Life Cycle Costs

Assumptions

1. Costs incurred in 'x' years from now are calculated by inflating 2001 dollars to year 'x' and then they are brought back to present worth using interest rate.
2. Discount rate = 4% (diff b/t interest and inflation rate)
3. Removal of lead paint is included in the initial cost of Alt. 2
4. Life Cycle costs will be calculated as present worth values
5. Alternatives 1,2, &3 -Paint the bridge and refurb machinery (if a bascule) every 25 years for ($520,000+870,000= $1,390,000)
6. Alternative 5B -Paint the bridge (bascule) every 25 years for $520,000
7. Replace the deck every 35 years for $5,200,000 for movable span; replace deck every 25 years for $4,737,000 for fixed span.

* Life Cycle cost includes initial cost

Alternative 1

Initial Cost (yr 0)		*Life of initial work*	*Maintenance*		*Operation (for 75 yrs.)*		*Work Cost*		*Total # of Traffic Lanes*	*Vehicular Delay Cost*	*Life Cycle Cost**
							Minimum repairs @ yr 5 = $8.3M	**$6,821,770**			
			$58,000: 0-5 yrs	**$258,204**			*Reconstr @ yr 22.5 = $21.2M*	**$8,439,750**			
0	**$0**	*5 yr*	*$26,500: 5-30 yrs*	**$340,255**	*$770,000*	**$18,233,908**	*Paint & refurb mach @ yr 50*	**$195,573**	*4*	**$21,550,544**	
			$11,700: 30-75 yrs	**$74,739**			*Replace deck @ yr 60*	**$494,520**			
	$0			**$673,199**		**$18,233,908**		**$15,951,613**		**$21,550,544**	**$56,409,264**

Alternative 2

Initial Cost (yr 0)		*Life of initial work*	*Maintenance*		*Operation (for 75 yrs.)*		*Work Cost*		*Total # of Traffic Lanes*	*Vehicular Delay Cost*	*Life Cycle Cost*
							Reconstr @ yr 25 = $22.5M	**$8,439,750**			
7.2+1.1=	**$8,300,000**	*25 yr*	*$26,500: 0-25 yrs*	**$413,986**	*$770,000*	**$18,233,908**	*Paint & refurb mach @ yr 50*	**$195,573**	*4*	**$21,550,544**	
$8.3M			*$11,700: 25-75 yrs*	**$94,278**			*Replace deck @ yr 60*	**$494,520**			
	$8,300,000			**$508,264**		**$18,233,908**		**$9,129,843**		**$21,550,544**	**$57,722,559**

Alternative 3

Initial Cost (yr 0)		*Life of initial work*	*Maintenance*		*Operation (for 75 yrs.)*		*Work Cost*		*Total # of Traffic Lanes*	*Vehicular Delay Cost*	*Life Cycle Cost*
							Paint & refurb mach @ yr 25	**$521,389**			
$22.5M	**$22,500,000**	*50 yr*	*$11,700: 0-75 yrs*	**$277,061**	*$770,000*	**$18,233,908**	*Replace deck @ yr 35*	**$1,317,680**	*4*	**$21,550,544**	
							Paint & refurb mach @ yr 50	**$195,573**			
							Minor Rehab Full Structure @ yr 50=$8.3M	**$1,167,810**			
	$22,500,000			**$277,061**		**$18,233,908**		**$3,202,452**		**$21,550,544**	**$65,763,965**

Alternative 5a Variation 1 On Line (High-Level Fixed)

Initial Cost (yr 0)		*Life of initial work*	*Maintenance*		*Operation (for 75 yrs.)*		*Work Cost*		*Total # of Traffic Lanes*	*Vehicular Delay Cost*	*Life Cycle Cost*
$52.3M	**$52,306,000**	75 yr	$10,000: 0-75 yrs	**$236,804**	0	**$0**	Deck replacement @25 yrs	**$1,776,849**	4	**0**	
							Deck replacement @50 yrs	**$666,496**			
	$52,306,000			**$236,804**		**$0**		**$2,443,345**		**$0**	**$54,986,149**

Alternative 5a Variation 2 Off Line (High-Level Fixed)

Initial Cost (yr 0)		*Life of initial work*	*Maintenance*		*Operation (for 75 yrs.)*		*Work Cost*		*Total # of Traffic Lanes*	*Vehicular Delay Cost*	*Life Cycle Cost*
$50.3M	**$50,306,000**	75 yr	$10,000: 0-75 yrs	**$236,804**	0	**$0**	Deck replacement @25 yrs	**$1,776,849**	4	**0**	
							Deck replacement @50 yrs	**$666,496**			
	$50,306,000			**$236,804**		**$0**		**$2,443,345**		**$0**	**$52,986,149**

Alternative 5b (High-Level Movable)

Initial Cost (yr 0)		*Life of initial work*	*Maintenance*		*Operation (for 75 yrs.)*		*Work Cost*		*Total # of Traffic Lanes*	*Vehicular Delay Cost*	*Life Cycle Cost*
$84.9M	**$84,900,000**	*75 yr*	*$11,700: 0-75 yrs*	**$277,061**	*$375,000*	**$8,880,150**	*Paint @ yr 25*	**$195,052**	*4*	**$5,386,432**	
							Replace deck @ yr 35	**$1,317,680**			
							Paint @ yr 50	**$73,164**			
	$84,900,000			**$277,061**		$8,880,150		$1,585,896		**$5,386,432**	**$101,029,539**

Table III-2

Alternatives Evaluation Summary

	Project Needs							*Effects*				
Alternative	Improve Access for Emergency Services	Improve Public Safety	Eliminate Vehicular and Marine Traffic Conflicts	Repair Structural Deficiencies	Address Context-Sensitive Issues?	Reduce Operating Cost	Meets NJDOT Vertical Clearance Criteria	Number of "Project Need" Categories which are Satisfied	Cultural/Historic Resource Impacts	Community Impacts	Initial Cost	Life Cycle Cost* (75 Years, i=4%)
1 - No Build	No	No	No	No	No	No	Yes	1	None	None	$0.00	$56.4 Million
2 - Minor Rehab	No	No	No	Improvement	No	No	Yes	2	Minor	None	$8.3 Million	$57.7 Million
3 - Major Rehab	No	No	No	Improvement	No	No	Yes	2	Adverse	None	$22.5 Million	$65.8 Million
4 - New Bridge on New Alignment	No	Improvement	No	Improvement	No	No	Yes	3	None	Adverse	$92.5 Million	$165.0 Million
5 - Replacement On-Line												
A. High-Level Fixed Variation 1-on line	Significant Improvement	Significant Improvement	Yes	Yes	Yes	Significant Improvement	Yes	6	Adverse	Minimal	$52.3 Million	$55.0 Million
Variation 2-off line	Significant Improvement	Significant Improvement	Yes	Yes	Yes	Significant Improvement	Yes	6	Adverse	Minimal	$50.3 Million	$53 Million
B. High-Level Movable	Improvement	Significant Improvement	No	Yes	No	Improvement	Yes	5	Adverse	Minimal	$84.9 Million	$101.0 Million

"unrestricted passage" conditions for vessels would be maintained, traffic congestion would continue to be a problem due to the frequent bridge openings. In addition, structural deterioration and related safety problems would continue to escalate. It does not address context sensitive issues.

B. Alternative 2: Minor Rehabilitation

This alternative assumes that minor rehabilitation work would be performed. The rehabilitation would include replacing the deck on the approach spans, repairing select steel members, and painting the bridge. Steel members such as floor beams and horizontal bracing would be repaired or replaced. The rehabilitation work would be performed in kind and routine maintenance of the bridge would continue, but no portion of the bridge would be upgraded in a way that would change the bridge configuration and capacity.

The analysis of this alternative follows.

1. Ability to Fulfill Project Needs

a. *Disruption to Emergency Services (System Linkage)* **–** Alternative 2's effect on system linkage would be similar to Alternative 1, that is, the span's function as a principal link within the area's urban roadway system would continue to be disrupted with numerous bridge openings occurring during the seasonal months

b. *Safety on Bridge* –Roadway improvements that would increase safety on the Bridge, such as median barrier, guide rails, and shoulders would not be implemented under this Alternative. As a result, safety on the bridge would not be improved.

c. *Vehicular and Marine Traffic Conflicts* - Minor rehabilitative work to the bridge would generally maintain the current conditions, which are poor. Roadway closures for long and repetitive periods of time due to bridge openings would not change. Delays experienced today by motorists waiting for the bridge to lower and resume normal traffic flow would not be alleviated. In the future, as vehicular and navigational traffic volumes continue to increase, the conflict between automobiles and water navigation will be exacerbated. Compared to the "No Build" option, the only beneficial effect on traffic operations gained under Alternative 2 is that routine maintenance and subsequent lane closures would be reduced.

d. *Structural Deficiencies* - This alternative would result in improvements to structural deficiencies over the No-Build Alternative. However, there is a limit to the capacity to which the existing structure can be raised. Alternative 2 would eliminate the low capacity of the floor beams, and rehabilitate horizontal bracing and the poor condition of the deck. Problems associated with the Bridge's fracture critical superstructure, substructure, scour, and seismic capacity would remain.

e. *Operating Cost* - The cost of operation would remain the same as under the No-Build Alternative.

f. *Coast Guard Vertical Clearance Requirements* – Same as Alternative 1.

2. Impact on Cultural/Historic Resources

Similar to Alternative 1, this alternative would possess no impact to cultural, historic, prehistoric, or archaeological resources. Alternative 2 would not have an adverse effect on the views to/from the Navesink Twin Lights.

3. Context Sensitive Design

Same as the No-Build Alternative.

4. Cost

The present worth of Alternative 2 is estimated as approximately $57,723,000 over the 75-year life of the structure. This cost is lower than some build options (See Table III-1).

5. Summary

Although less costly than some build options, this alternative would not address four of the project needs. Although some structural deficiencies would be eliminated, traffic congestion, structure deterioration, and related safety problems would continue to escalate. The structure would continue to deteriorate and maintenance costs would be high.

C. Alternative 3: Major Rehabilitation

This alternative consists of an in-depth rehabilitation of the existing bridge. Work would include the following:

- Replacement of the superstructure of the approach spans, providing two 12 feet lanes in each direction and two 6 feet sidewalks. As the overall width of the structure would not be changed, the existing 8 feet sidewalks would be narrowed to 6 feet to provide for wider traffic lanes. Proper super elevation would be provided on the curved approach ramps.
- Modification to the piers to provide a cap beam to support a new multi-girder superstructure.
- Replacement of the flanking and bascule span deck with a solid deck span, either an orthotropic steel deck, partial filled steel grating or FRP deck.
- Repairs to select flanking and bascule span steel members.
- Painting of the flanking and bascule spans.
- Replacement of bearings.
- Crack and spall repairs to substructure units.
- Rehabilitation of the operator’s houses.

- Repairs to timber fender system.

An analysis of this alternative follows.

1. Ability to Fulfill Project Needs

a. *Disruption to Emergency Services (System Linkage)* – Similar to Alternatives 1 and 2, Alternative 3 would not address the issue associated with disruptions to access between Highland Park and the peninsula.

b. *Safety on Bridge* - Safety would improve on the Bridge. NJDOT would widen each travel lane on the span to a standard width of 12 feet. Wider traffic lanes would reduce slightly the potential for “head-on” collisions, sideswipes, and “fixed object” hits. Also, replacement of the flanking and bascule span deck with a solid deck would improve traction and directional control on the Bridge, thus reducing the potential for rear end mishaps and vehicles from straying into oncoming traffic, particularly on wet surfaces. However, other safety improvements, such as shoulders and a raised center median would not be provided.

c. *Vehicular and Marine Traffic Conflicts* - Major rehabilitation work to the bridge would not significantly reduce existing delay impacts associated with vehicle/marine traffic (See Alternative 2). Similar to Alternative 2, the only beneficial effect on traffic operations would be reduced delay resulting from lane closures required for routine maintenance.

d. *Structural Deficiencies* - Many structural deficiencies would be eliminated under this alternative. However, the existing substructure would not be replaced. Therefore, the low seismic capacity would be only moderately increased due to the bearing replacement. The potential scour problems would also remain.

e. *Operating Cost* - The cost of operation would remain the same as under the No-Build Alternative.

f. *Coast Guard Vertical Clearance Requirements* – Same as Alternatives 1 and 2.

2. Impact on Cultural/Historic Resources

This alternative would possess a low to moderate potential to impact cultural, historic, prehistoric, and archaeological resources. Models of prehistoric settlement identify areas within 300 feet of water as the zone of highest probability for the presence of prehistoric sites. The APE-Archaeology for this alternative is situated within 300 feet of the Shrewsbury River, however, prehistoric resources may have been impacted by previous construction of the Route 36 Bridge and associated road construction. On the Highlands Borough side, the bridge approach is situated in an area with a descending topography (10-25 percent slopes), which decreases the potential for prehistoric occupation. In Sea Bright Borough, the off-ramp has been constructed on a considerable amount of fill material, which may have buried intact prehistoric resources. This area was subject to residential development in the late nineteenth century and the construction of a railroad corridor, both of which may have impacted prehistoric resources.

Alternative 3 possesses a low to moderate potential to impact historic archaeological resources. In Highlands Borough, historic maps indicate that the proposed project would be in the immediate vicinity of a residential structure and a gas light factory. These structures are not extant and were likely removed prior to the construction of the Route 36 Bridge. The proposed project is also located in the vicinity of a former building on the north side of Navesink Avenue which is no longer extant. Intact historic period archaeological resources may not have survived the construction of the Route 36 Bridge. Historic maps indicate that the construction of the eastern approach of Route 36 in Sea Bright Borough passes through four cottages/residential structures that were extant in 1889 (Wolverton 1889). The 1907 Sanborn map also depicts two additional structures in the vicinity of Route 36 (Sanborn Map Company 1907). These structures are no longer extant. Depending on the location and extent of the proposed improvements in this area, intact foundations, and features associated with these structures could be present beneath fill material brought in for the construction of the off-ramp.

Under this alternative, the existing bridge would be substantially altered, diminishing its historic integrity and, therefore, causing an adverse impact. Mitigation measures could include HAER-level documentation, and consultation with SHPO would be necessary in order to develop final mitigation measures. Alternative 3 may also have an adverse visual impact to/from Twin Lights and any potentially eligible properties within the APE-Architecture.

3. Context Sensitive Design

Same as the No-Build and Minor Rehabilitation Alternatives.

4. Cost

The present worth of Alternative 3 is approximately $65,764,000 for the 75-year life of the structure (See Table III-1). This cost is the highest among the rehabilitation options.

5. Summary

This alternative provides greater safety and structural capacity than either Alternative 1 or 2. However, it is limited in its response to project needs as it addresses only two project needs categories and would result in an adverse impact on historic character of the Route 36 Bridge. It does not address context sensitive issues.

D. Alternative 4: New Bridge on New Alignment

This alternative assumes the construction of a new movable bridge on a new alignment in addition to preserving the existing Route 36 Bridge. The Gateway National Recreation Area is located just north of the Bridge. Realignment of a new bridge connection to Ocean Avenue to the north would alienate parkland; this is not a viable option.

Realignment to the south of the site would require routing eastbound Route 36 traffic further south along the shoreline to a selected new location for the bridge. This would require widening existing local streets, which are primarily residential, and would involve extensive property acquisition. The communities would undoubtedly oppose this option. In addition, the left-in-place Route 36 Bridge would still need to be maintained. The artery's relocation would likely generate severe environmental and socioeconomic impacts on the area and the surrounding communities. Therefore, the following analysis is for discussion/comparison purposes only.

1. Ability to Fulfill Project Needs

a. *Disruptions to Emergency Services (System Linkage)* – The new bridge would be designed with a vertical clearance similar to the existing Bridge, disruption of service across the channel would not significantly improve over current conditions.

b. *Safety on Bridge* – The new bridge would be designed to meet NJDOT design criteria, thus improving safety on the new bridge. However, safety on the existing Bridge would not improve since rehabilitation activities would not substantially upgrade the poor geometry of that structure.

c. *Vehicular and Marine Traffic Conflicts*- This alternative would not eliminate the vehicle delay and inconvenience to marine traffic that currently occurs at the existing Bridge. With a vertical clearance similar to the existing structure for the new bridge, vehicle and marine traffic conflicts would not diminish significantly over current conditions.

d. *Structural Deficiencies*- The new bridge would eliminate all existing structural deficiencies. However, structural and geometric problems on the existing Bridge would remain under this scenario.

e. *Operating Cost* – Under this scenario, operating costs would likely be significantly higher compared to the No-Build and rehab-options since both the new bridge and the existing bridge would requiring an operating crew to ensure unrestricted passage across the channel.

f. *Coast Guard Vertical Clearance Requirements*- Same as Alternatives 1, 2, and 3.

2. Impact on Cultural/Historic Resources

This alternative would possess no impact to cultural, historic, prehistoric, or archaeological. However, views to/from the lighthouse would be adversely affected since a second structure would intrude across the channel.

3. Cost

It is estimated that the present worth of the 75 year life cycle cost for this option would be approximately $165,000,000.

4. Context Sensitive Design

Similar to the No-Build and Rehabilitation scenarios, this alternative would not address the context sensitive design issues raised by the Communities

5. Summary

Alternative 4 would provide a channel crossing that would provide standard width travel lanes, and safety features such as shoulders, median barrier, and standard guide rails. However, this alternative would not significantly improve vehicle delay or reduce inconvenience to marine traffic crossing the channel. In addition, this alternative would increase current operating expenditures since the existing bridge as well as the new bridge would have to be manned. Alternative 4 would require extensive ROW acquisition and displacement of existing developed properties, which would further increase the cost of the project as well as the environmental impacts. This option would also adversely affect the aesthetic views to/from the Lighthouse and would not address context sensitive design issues raised by the Communities.

E. Alternative 5a: New High-Level Fixed Bridge

- Variation 1: Replaced On-Line

Under this alternative, a new high-level fixed bridge would be constructed on the existing alignment. Alternative 5a would provide a fixed bridge with a vertical clearance of 65 feet above M.H.W.

The analysis of this alternative is as follows:

1. Ability to Fulfill Project Needs

a. *Disruptions to Emergency Services (System Linkage)* – The fixed bridge would provide uninterrupted traffic flow across the structure and eliminate completely vehicle/marine traffic conflicts. However, the fixed structure would now limit vessel traffic to those with masks of 65 feet or less.

b. *Safety on Bridge*- The new bridge would significantly improve safety by upgrading the existing Bridge's poor geometry. For example, geometric transitions would be improved as a result of softer curves on the on/off ramps at the eastern terminus of the bridge. A median barrier separating opposing traffic flows would eliminate the potential for head-on collisions. Traffic would no longer be required to stop for bridge openings. Therefore, the stoppage of traffic resulting from bridge openings would be eliminated as a contributing factor to rear-end collisions. The addition of shoulders would also reduce the potential for collisions by providing an emergency escape area. A new deck would improve traction and directional control on the span.

   Provisions for disabled access would be provided in accordance with the Americans with Disabilities Act. Sidewalks on both sides of the bridge with a width of 8 feet would be provided.

c. *Vehicular and Marine Traffic Conflicts* - The fixed bridge would eliminate the vehicle delay and reduce the inconvenience to all but a small portion of the marine traffic that cross under the existing Bridge.

d. *Structural Deficiencies* - The new fixed bridge would eliminate all existing structural deficiencies.

e. *Operating Cost* – The fixed bridge would eliminate all operating costs associated with the operations of the bascule span.

f. *Coast Guard Vertical Clearance Requirements* - While the proposed clearance of 65 feet meets Coast Guard requirements for bridges over the Inter-Coastal Waterway, the fixed bridge modifies the current unrestricted passage provided at the crossing and the U.S. Coast Guard has jurisdiction over the final structure clearance. The Coast Guard posted a preliminary notice to marinas which received favorable reactions. The Coast Guard must complete the formal permit process before granting approval of the restricted clearance.

2. Impacts on Cultural/Historic Resources

This alternative would possess a low to moderate potential to impact cultural, historic, prehistoric, and archaeological resources. Due to the demolition of the Route 36 Bridge, there would be an adverse effect to this historic resource. Additionally, construction of a new bridge would have an adverse effect on the National Register-listed Twin Lights and possibly on other potentially eligible properties.

Mitigation of the adverse effect to the bridge may include HAER-level documentation. Consultation with the SHPO would be necessary in order to develop final mitigation measures. It may be feasible to relocate the structure off site. NJDOT has placed an advertisement in the local papers offering the bridge for sale. To date, NJDOT has not received any offers to purchase the bridge.

3. Context Sensitive Design

This alternative would address all context sensitive design issues except for the direct connection into Sandy Hook Park.

4. Costs

The Present Worth of Alternative 5a is approximately $55,000,000 for the 75-year life of the structure.

- Variation 2: Replaced Off-Alignment

A shift in the horizontal alignment of Variation 1 is proposed for Variation 2. Under this scheme, a portion of the proposed bridge alignment over the channel would be shifted adjacent to and south of the existing Bridge. This would result in reduced construction costs compared with Variation 1. Constructing a new bridge off-line would eliminate the need to erect and demolish a temporary structure, required under Variation 1, to maintain traffic while the new bridge is being built. Traffic would be maintained on the existing bridge while the eastbound lanes on the new bridge are being constructed and then the traffic could be shifted to the new eastbound lanes while the remainder of the bridge is constructed. In total, the construction cost savings under Variation 2 would be approximately $2 million dollars compared with Variation 1 and it is estimated that Variation 2 would reduce construction duration by three to six months (see Appendix Q). Besides the financial consideration and more efficient MPT staging, the benefits, impacts and response to context sensitive design issues would be similar for both Variations 1 and 2.

- Variation 3: Optimum Alternative – Direct Connector

The Optimum Alternative would be similar to Alternative 5a, Variation 1 with the exception that the interchange configuration at the eastern terminus of the proposed bridge would differ. This optimum alternative would provide the most favorable connections to both Sea Bright and to Sandy Hook Park. Only under this option would uninterrupted and full movement be accommodated via direct connection ramps for all traffic movements between the new Bridge, Sandy Hook and Sea Bright. The Direct Connector Solution would require substantially more structure and grading compared with either of the other variations under Alternative 5a. The Optimum Solution would also provide two above grade pedestrian bridges, including one south of the interchange and one north of the interchange. However, the Direct Connector Solution would require substantially more structure and grading and result in more disruption of land in the vicinity of the interchange compared with the other Alternative 5a variations or Alternative 5b. Further, the 75-year life cycle cost for the Optimum Alternative would be the highest among the three variations, $58.5 million, or $3.5 million and $5.5 million higher than the cost of Alternative 5a's Variation 1 and Variation 2, respectively.

5. Summary

Alternative 5a would meet all six "project needs" categories. Unlike the remaining alternatives, this scenario would eliminate completely vehicle delay associated with bridge openings. This scenario would also significantly improve safety compared to conditions on the existing bridge and the rehabilitation alternatives. Further, alternative 5a would not generate significant adverse social, business, and environmental impacts on the surrounding communities. Alternative 5a, Variation 2 would be the least costly scenario to implement, including the No-Build scenario, and would cost approximately half the amount of the movable bridge scheme under Alternative 5b. Similar to Variation 1, it would also address all context sensitive design issues except for the direct connection into Sandy Hook Park. This alternative would result in the demolition of the existing bridge which is one of the area's historic resources currently eligible for the National Register. A number of mitigation techniques could be employed to reduce the historic impact generated by this loss.

F. Alternative 5b: New High-Level Movable Bridge Replaced On-Line

Under this alternative, a new high-level movable bridge would be constructed on the existing alignment. Four possible vertical clearances 50 feet, 55 feet, 60 feet, and 65 feet were analyzed as possible candidates for the optimum height of the structure in the closed position. The Optimum Height Report, 1999, prepared by Jacobs Engineering, recommended a movable bridge with the vertical clearance of 55 feet in the closed position. Therefore, this analysis assumed the same 55 feet vertical clearance. The Optimum Height Report Executive Summary is presented in Appendix P as a reference. The analysis of this alternative is as follows.

1. Ability to Fulfill Project Needs

a. *Disruptions to Emergency Services (System Linkage)* - Linkage would be significantly improved with minimum disruptions to Bridge access by reducing the number and frequency of bridge openings. However, openings would still be required and, during these periods, services would be disrupted.

b. *Safety on Bridge* - The new bridge would upgrade the existing poor geometry. For example, geometric transitions would be improved as a result of softer curves on the on/off ramps at the eastern terminus of the bridge. A median barrier separating opposing traffic flows would significantly reduce the potential for head-on collisions. Traffic would no longer be required to stop for bridge openings as often as every 1/2 hour and, thus, reducing the potential for the rear-end collisions. The addition of shoulders would also reduce the potential for collisions by providing an emergency escape area. A new deck would improve traction and directional control on the span.

   Provisions for disabled access would be provided in accordance with the Americans with Disabilities Act. Sidewalks on both sides of the bridge with a width of 8 feet would be provided.

c. *Vehicular and Marine Traffic Conflicts* - The conflict would be greatly reduced. By increasing the vertical clearance of the existing bridge to 55 feet, the total number of bridge openings would be significantly reduced. For example, there is a high probability that a bridge with a vertical clearance of 55 feet would not open more than once an hour and would have a lower average number of total openings during peak days in the summer months compared to the existing bridge operations. There would be a low probability that bridge openings would occur more than once every hour. Approximately 5 percent of recorded marine vessels are currently able to pass under the closed bridge. This percentage would increase to about 68 percent if a bridge with a 55 feet high vertical clearance replaced the existing bridge.

   Replacement of the existing bridge with a high-level movable bridge would provide traffic flow with limited interruptions by bridge openings. This would allow vehicular traffic to flow uninterrupted by most navigational traffic which in the past has forced the bridge to be raised frequently, stopping all vehicular traffic for long periods of time. The average delay per vehicle would be reduced from a current 4.5 minutes to about 2 minutes. The vehicular delay cost would be reduced from about $21.5 million (keeping the existing structure) to about $5.4 million by constructing a new and higher movable bridge.

d. *Structural Deficiencies* - The new bridge design would be in accordance with all current standards, including seismic and scour criteria.

e. *Operating Cost* – With Coast Guard approval, Alternative 5b may not need to be manned 24 hours a day during the off peak seasons. However, for cost comparison purposes, similar staffing for all movable schemes has been used.

f. *Coast Guard Vertical Clearance Requirements* – Same as Alternative 1, 2, and 3.

2. Impact on Cultural/Historic Resources

This alternative would possess a low to moderate potential to impact cultural, historic, prehistoric, and archaeological resources. Mitigation measures to ameliorate project effects would be the same as under Alternative 5a.

3. Context Sensitive Design

This alternative would not address all the context sensitive design issues raised by the Communities.

4. Cost

The present worth of Alternative 5b is approximately $101,030,000 for the 75-year life of the structure.

5. Summary

Alternative 5b would meet five of the six "project needs" categories. Alternative 5b would significantly improve safety compared to conditions on the existing bridge and would be in compliance with current NJDOT design criteria. Further, alternative 5b would not generate significant adverse social, business, and environmental impacts on the surrounding communities. However, even though traffic disruptions under this scheme would be reduced, person-delay generated across the movable bridge would still reach 37,000 hours annually, unlike Alternative 5a that would eliminate bridge opening delays completely. Unlike Alternative 5a, Alternative 5b would not address all context sensitive issues raised by the Communities.

Alternative 5b would result in the demolition of the existing historic bridge.

G. Alternative Summary – Selection of the Initially Preferred Alternative (IPA)

The six alternatives were evaluated based on their ability to meet the project needs, their effect on the historic nature of the bridge, the degree to which they address context sensitive design issues, and their operating and capital costs. The analysis included a review and assessment of navigation data, traffic data, accident data, recent inspection reports, cost assessments and past studies which led to a suggested bridge alternative that would result in improved access, adequate capacity, increased safety, structural upgrading and a favorable cost structure. This “alternatives” analysis resulted in the selection of Alternative 5a. Replacement with a High-Level Fixed Bridge as the Initially Preferred Alternative (IPA). This report further evaluates this option and has identified improvements resulting in the recommendation of Alternative 5a, Variation 2 as the IPA.

Although Alternative 5a requires demolition of the existing historic structure, it is the only alternative that satisfies all project needs without generating substantial socio-economic impacts on the surrounding communities. Alternative 5b addresses five of six project needs. However, unlike the fixed bridge scenario, Alternative 5b would still result in vehicle delay associated with bridge openings.

Since a new bridge under Alternative 4 is assumed to have a similar vertical clearance as the existing Bridge, or 35 feet, it is anticipated that this alternative would not improve vehicle delay or reduce inconvenience to marine traffic crossing the channel over current conditions. In addition, this alternative would increase current operating expenditures since the existing bridge would remain and two bridges would have to be manned. Further, Alternative 4 would require extensive ROW acquisition and displacement of existing developed properties.

The remaining rehabilitation alternatives would require expenditure of funds resulting in a structure that would still have deficiencies, both structural and safety, not significantly improve traffic operations, and would continue to expose area residents and visitors to disruptions to critical access.

It is likely that SHPO would maintain that Alternatives 5a and 5b would have an “adverse effect” on an historic resource by altering contributing features and modifying structural elements by replacing the bascule span and widening the lanes. However, the Bridge is currently eligible to be considered a historic resource and placed on the National Register. If an adverse effect were rendered, design/details to avoid or minimize this effect as well as context sensitive design, currently being included in the Department’s procedures, would be utilized to assist in gaining approvals.

Alternative 5a, Variation 2 would be the least costly scenario among the six options. The cost of this alternative is not only lower than the other alternatives, but also provides a maximum response to each of the project needs. The rehabilitation schemes have inherent uncertainty in the feasibility of maintaining the existing Bridge over the next 75 years, given that the structure is already 70 years old. While Alternative 5a’s initial investment to construct may be higher than the rehabilitation schemes, it would provide to the Department a higher degree of reliability for the crossing over the next 75 years. Finally, it addresses all Community issues with the exception of a direct ramp connection into Sandy Hook Park.

IV. The Initially Preferred Alternative

A. Discussion of Proposed Alternative

The existing Route 36 Highlands Bridge has received preliminary approval for replacement from FHWA and the US Coast Guard. The replacement bridge is proposed to have a 65 foot vertical clearance maintaining the 100 feet channel on the existing navigation alignment. The bridge over the channel would be a 3-span continuous structure with a 200 foot main span. The proposed structure would be built with a slight shift in the alignment to the south at the channel but returns to the existing alignment at the east and west ends of the project. The proposed structure would be symmetrical about the centerline of bridge providing two 12 feet travel lanes, an 8 foot shoulder/bicycle lane, and an 8 foot sidewalk on each side of the bridge. Traveling in an easterly direction over the Shrewsbury River, the grades entering and exiting the bridge are 5.5 % and –6.5 %, respectively.

On the west end of the project, the Portland and Bay Avenues intersections are proposed to be modified by providing dedicated acceleration and deceleration lanes.

On the east end of the project, the existing footprint would be modified by reversing the elevations of Ramps K/L and the Route 36 mainline. The existing loop ramp that passes over the highway is proposed to be lowered to cross below the bridge mainline structure. All other movements off and onto the bridge would remain the same with minor shifts in alignment to meet the new bridge profile.

The project also includes modifications to the existing Fee Plaza area for Gateway National Park. The recommended Toll Plaza is still being coordinated with the National Park Service (NPS) but would include the installation of five new toll lanes and turn around capabilities both before and after the fee area. The existing toll plaza, located approximately 460 feet north of the gatehouse, is proposed to be removed and replaced with the new toll facilities.

The area has a number of pedestrian/bicycle trails that currently do not connect. The new bridge crossing is proposed to complete the trail linkages. On the east end of the project, signage will be used to direct trail users to the north or south side of the bridge depending on their destination. Overpass structures are proposed that connect from the bridge/ramps to a new multi use path along the east edge of Ocean Avenue that extends north into Gateway National Park and south to the existing Sea Bright Trail..

B. Geometrics

1. Proposed Bridge Section

The proposed cross section for the replacement bridge would provide for two 12 feet lanes in each direction, 3 feet median shoulders, 8 feet outside shoulder/bicycle lane and an 8 feet raised sidewalk on each side of the bridge. Overall, the total width of the new section would be 91.5 feet, an increase of 30 feet over the Bridge's existing section width of 61 feet. Upon leaving the structure, the lanes would be transitioned to smoothly connect into adjacent roadway lanes.

2. Proposed Mainline Alignment

The proposed mainline alignment would be shifted slightly to the south of the existing bridge at the channel but would return to the existing alignment at the east and west ends of the facility.

3. NJDOT Design Criteria

The proposed IPA would meet all the design criteria presented Chapter II. Section C.1, Project Design Standards. These criteria are based on the NJDOT "Roadway Design Manual", 1995, the Bridges and Structural Design Manual", 1998, and AASHTO's "A Policy on Geometric Design of Highways and Streets", 2001.

4. Design and Posted Speeds

Under Alternative 5a, the new bridge would have the same design speed as the existing bridge, or 45 mph. The posted speed on the proposed bridge would also remain unchanged at 40 mph.

C. Right-of Way Impacts

Construction easements may be necessary to provide access to the edge of ROW from properties at the western terminus of the Bridge. Existing easements at the span's eastern terminus may be extended to accommodate additional run-outs for toe of slope. ROW below the existing structure, between the river and Bay Avenue, will also be acquired. The two properties to be acquired (one to the north of the bridge and the other to the south of the bridge) are both presently owned by the Borough of Highlands. The property south of the bridge has been identified as a "Green Acres Property."

D. Structural Design

The new bridge would be designed in accordance with the Departments current directives for LRFD design procedures. The approach spans would be evaluated for both steel and concrete alternatives. The use of high performance concrete and high strength steel would also be included in the evaluation to determine the most economical design while keeping with the aesthetics of the structure. Further refinements in the type of deck and materials will be studied during Preliminary Design.

E. Access Impacts

Access management initiatives are instituted when road improvements are implemented. Road improvements include intersection upgrades, roadway expansion, installation of new restrictive medians, and construction of new roads. For this project, access management would be instituted as a result of the upgrading and re-profiling of the Route 36/Portland Avenue and Route 36/north ramp to Bay Avenue intersections.

The goals of access management include; (1) limiting the number of conflict points, (2) separating the conflict points, and (3) removing turning volumes from the through traffic stream. There are 10 driveways within the project limits. Five driveways are located near the western terminus of the Bridge and the other five situated near the eastern terminus of the Bridge. The driveway locations are presented in Appendix C. The discussion below describes driveway compliance issues with the State's access management code.

- <u>Driveways #1 and #2</u>

These driveways are located on the south side of Route 36 and are more than 75 feet from the Route 36/Portland Avenue intersection. These driveways are depressed curbs with no aprons. They are non-functioning driveways. The Bureau of Major Access Permits, Office of Access Design recommends that these driveways should be formally eliminated as part of the project (see Appendix C).

- <u>Driveway #3</u>

This driveway provides access to a restaurant parking lot located on the south side of Route 36 within 50 feet of the Route 36/Portland Avenue intersection. This distance is not in conformance with corner clearance standards which stipulate that a driveway should be no closer than 50 feet from an unsignalized intersection.

It is proposed to modify the access by eliminating the curb cut on Route 36. An alternate opportunity for entering and exiting the parking lot is available on Highland Avenue. According to the New Jersey State Highway Access Management Code, Highland Avenue would be considered a reasonable alternative access because this artery is parallel to Route 36, is sufficiently designed to support commercial traffic, is conveniently accessed from the state highway, and signage could be placed upstream of the alternate path leading to the remaining driveway.

- <u>Driveway #4</u>

This driveway is a two-way driveway to an apartment complex and is located on the north side of Route 36 within 20 feet of the Route 36/north ramp to Bay Avenue intersection. The driveway is sufficiently wide 30 feet to comply with the driveway width standard range for two-way flow for a residential property 20 feet – 46 feet. However, the distance between the driveway and the intersection is not in conformance with corner clearance standards for an unsignalized intersection.

The driveway cannot be relocated since no alternative access location is available for this property. However, the west end treatment reduces the number of travel lanes from two lanes to one lane at the western end of the bridge and on the departure roadway. This would enable driveway users to enter Route 36 westbound on a dedicated lane and avoid conflicts with through traffic (see Appendix U).

- <u>Driveway #5</u>

This driveway is a two-way residential driveway and is located on the north side of Route 36. It is located more than 50 feet from the unsignalized intersection on the north side of

Route 36/north ramp to Bay Avenue unsignalized intersection and is therefore in compliance with corner clearance standards. It also complies with driveway width standards for a two-way operation.

- Driveway #6

This is a two-way driveway providing access to a commercial property. The driveway is situated at the ramp junction formed at the south end of the interchange. The driveway is also situated 10 feet of a residential driveway. From the ramp, the sight distance to the commercial driveway is limited. However, a stop sign at the ramp junction effectively reduces the travel speed of ramp vehicles approaching the driveway. Alternative access for this property is not available.

- Driveway #7 and #8

These driveways operate as a one-way pair with the north driveway (#7) providing ingress only and the south driveway (#8) providing egress only for a restaurant property. They are located adjacent to Driveway # 6 and have the same access issues as Driveway #6.

- Driveway #9

Driveway #9 is located on the east (ocean) side of Route 36 and accesses a small gravel parking lot across from Driveways #7 and #8. It appears that this driveway is in compliance with the access code.

- Driveway #10

The NPS has a building just north of Ramp J at the interchange which is served by two driveways. The southern driveway would be displaced by the horizontal shift of Ramp J that would be required to accommodate the 65 feet vertical clearance bridge. The NPS stated that they would be willing to accept the loss of the southern driveway in order to accommodate the proposed bridge project.

F. Traffic Engineering

1. Volumes

NJDOT has forecasted a growth rate for the area surrounding the Route 36 Bridge of one percent annually between 2000 and 2028. Using this forecasted growth rate, volumes were projected on the Bridge for 2008, the approximate completion date of the project, and for 2028, the out year of NJDOT's 20-year project.

The forecast indicates that eastbound volumes on the Bridge would increase from 770 vehicles to about 1000 vehicles in the AM peak hour and from 600 vehicles to about 800 vehicles in the PM peak hour between 2000 and 2028. In the westbound direction, volume would increase from 380 vehicles to about 500 vehicles in the AM peak hour and from 1060 vehicles to about 1400 vehicles in the PM peak hour over the next 28 years.

The proposed project would maintain the existing two travel lanes in each direction and current access opportunities to the Bridge would be available similar to existing conditions. Alternative 5a would change the capacity on the Bridge minimally by increasing the lane width of each travel lane. The effect of this change would largely be manifested in improved driving comfort across the bridge rather than in increased flow rates. In addition, the number of crossings over the Shrewsbury River would be the same after project implementation. Therefore, although bridge openings and related delays would be eliminated as a result of Alternative 5a, the proposed project is not expected to significantly effect either future volumes across the Bridge or area-wide travel patterns.

2. Operations

- Level Of Service (LOS)

It is expected that 2028 traffic volumes would still operate at LOS "B" or better conditions on the Bridge (see Appendix H). This time period would cover a reasonable design horizon (i.e. estimated time of completion + 20 years). It is anticipated that the comfort level of drivers would improve over current conditions since the proposed project would result in (1) wider travel lanes, reduced horizontal friction from the addition of shoulders, and (3) elimination of bridge openings.

- Vehicle Delay/Cost of Delay

The fixed span Alternative 5a would have zero dollar vehicle-delay costs.

- Accident Analysis

Alternative 5a would upgrade the Bridge's existing geometry including providing "standard width" travel lanes 12 feet, a 3 foot median shoulder and an 8 foot outside shoulder in each direction. Additional safety features would be installed including a concrete center median separating the bi-directional traffic streams and guide rails. The open "steel grating" surface on the existing bascule span would also be eliminated.

The above improvements would provide a clear zone for maneuvering space between the outside travel lane and the bridge structure, and a higher degree of directional control. These conditions would reduce the potential for fixed object hits and accidents occurring on wet surfaces, mishaps that are currently over-represented on the Bridge compared to statewide averages for similar highway sections. Further the center median barrier would eliminate the potential for head-on collisions.

G. Proposed Traffic Staging Plans

By bringing a new alignment slightly to the south, part of the new bridge could be built in an early stage and be used to maintain traffic during subsequent stages. This would reduce the need to construct temporary structures and minimize both construction cost and time.

Construction would be undertaken in three major stages, as follows:

1. **Stage I – Construction of the southerly portion of the new structure. Begin eastern end ramp reconstruction.**

   Stage IA **-** Using a slightly modified alignment, half of the new bridge would be built to the south of the existing bridge (see Appendix A.1). Parts of the new structure could be built totally off-line, thus allowing some work to begin before the off-season.

   Stage IB **-** After Labor day, only one lane in each direction would be permitted on the bascule bridge, both on the northern side of the bridge. This would allow completion of the southern half of the bridge. The goal is to construct enough of the new bridge to permit one lane in each direction on the southern portion of the bridge in the next stage of construction (see Appendix A.1).

   To accommodate connections at the eastern end of the bridge, a temporary signalized T intersection would be constructed to connect the bridge with Ocean Avenue. With the temporary intersection in place, reconstruction could proceed on all ramps at the eastern end. Work would proceed to “flip” the mainline of route 36 with ramps K and L. That is, where ramps K and L passed over Route 36, they would now pass under Route 36.

   The pedestrian overpass would be constructed in this stage, prior to a shift of traffic onto the new structure in Stage II.

2. **Stage II – Construction of the northerly portion of the new structure. Complete eastern end ramp reconstruction.**

   With the new south half of the bridge constructed, traffic would be shifted to the south side, one lane in each direction. Traffic would now be operating on the 65’ fixed bridge, unaffected by navigation. The Bascule Bridge would be demolished and construction of the remainder of the new bridge would begin.

   With Route 36 over ramps K and L completed, along with various at-grade connections on the eastern end, a portion of the reconstructed interchange could be re-opened. Specifically, the connections of Route 36 mainline, Ramp K southbound (Sandy Hook to Sea Bright), and Ramp L eastbound to northbound (Highlands to Sandy Hook) could be completed. The temporary intersection could be closed.

   Ramp J (the direct connection from Sandy Hook to Highlands, southbound to westbound) would be completed during Stage II. Before its completion, this traffic could be handled by a second temporary intersection, created at the southern end of the project (see Appendix A.1). This traffic would use the newly constructed ramp K and turn left at the temporary intersection onto Route 36 westbound.

As soon as Ramp J is completed, the second temporary intersection would be closed.

3. Stage III - Final Stage.

In Stage III, final construction and reconfiguration of the eastbound lanes/sidewalk and ramp elements would take place while traffic is again temporarily shifted to the westbound side of the structure. Upon completion, the Bridge would then be opened to traffic in its final pattern.

H. Utilities

It is expected that Alternative 5a would have some impact on the existing utilities located at the western terminus of the Bridge. Impacted utilities will include electrical lines by GPU Energy, fiberoptic and telephone lines by Verizon, sewer lines by the Borough of Highlands, and water lines by the New Jersey American Water Company. A detailed analysis of potential project impacts on the area's utility systems will be conducted during Preliminary Design.

I. Drainage

The scope of work for the feasibility assessment of the Route 36 Bridge did not include evaluation of the capacity of the existing drainage system. Drainage has been raised as an issue by local officials but the areas of concern are located off the Bridge and, hence, are outside the limits of the current project. Even though it is expected that the IPA would not significantly exacerbate current drainage conditions, a drainage evaluation will be performed during Preliminary Design.

J. Geotechnical Engineering

Preliminary review of existing Geotechnical reports reveals that the sand is a good foundation material; where new foundations are required, spread footings or pile foundations could be used to support the structure. Since the sand is pervious, any settlement would occur instantly during the construction. Displacement piles such as precast prestressed concrete, steel pipe or step-taper piles can be used to support the structures. While being driven, the piles displace and increase the density of the surrounding soil so that driving subsequent piles might be difficult through the dense material. Therefore, jetting the piles to within 5 feet of the final pile tip elevation is recommended.

The embankment at the east abutment can be constructed on a 1 to 1-1/2 vertical to horizontal slope similar to the existing embankment using sand as fill material.

The fine sand would erode readily. Thus, the slope must be protected against erosion either by planting grass or by placing filter material on the slope. The filter material could be natural gravel or engineering fabric.

Where new river piers are required, they could be supported either on pile foundations or spread footing founded in the dense dark gray and black sand below Elevations –24 feet and –30 feet. The allowable bearing pressure at these elevations are 4 tons per square foot.

K. Value Engineering

As a follow-up to the discussion regarding a fixed bridge that was conducted at the Scoping Team Meeting on June 12, 2002, Value Engineering suggested an alignment modification that would save construction costs and time. By shifting the alignment slightly southward, part of the new structure could be built at an early stage and be used to maintain traffic during subsequent stages. This suggestion was incorporated into the IPA.

L. Survey/Base Plans

At the time the initial survey was undertaken and base plans developed, information was presented in metric units. Metric units have been converted to English units and final survey and base plans in English units will be used for all future submittals.

M. Pedestrian and Bicycle Compatibility

The area has a number of pedestrian/bicycle paths that currently do not connect. The proposed IPA would complete the trail linkages. On the east end of the project, signage would be used to direct trail users to the north or south side of the bridge depending on final destination. Overpass structures are proposed to connect with the new multi-use path extending along the east edge of Ocean Avenue to the north into Gateway National Park and on the south to the existing Sea Bright Trail. Signage would also be used to guide pedestrians and cyclists from the Highlands side across the proposed bridge.

N. Context Sensitive Design

Based on community goals and input expressed at Community Partnering Team Meetings conducted in 2001 and 2002, the Department pursued context-sensitive design solutions that would reduce congestion and would positively affect transportation assets beyond the bridge, as far north as the Sandy Hook Park toll plaza facility and as far south and west as Sea Bright's and Highlands Borough's multi-use paths. The IPA evaluated alternative interchange configurations at the eastern end of the bridge and geometric options at the western end of the Bridge based on context sensitive design issues and incorporated treatments that addressed the following issues:

- Provide seamless connections among proposed and existing multi-use pedestrian/bicycle trails on either end of the bridge and across the Route 36 Highlands Bridge.

- Mitigate a potential difficulty for Portland Road traffic to enter the traffic stream on Route 36 eastbound and Bay Avenue traffic to enter the traffic stream on Route 36 westbound via the north ramp, if a higher bridge is constructed.

- Provide u-turn capability to efficiently dissipate Sandy Hook Park-generated traffic when the Park is closed because of parking limitations.

- Evaluate alternative toll plaza configurations at the Sandy Hook Park entrance.

- Design a structure that would support water service across the Bridge.

O. Environmental

The bridge pier construction in the Shrewsbury River will result in an unavoidable impact of displacing natural-river bottom. Shading Impacts on marine vegetation resulting from construction of a wider bridge would likely be insignificant due to the minimal amounts of aquatic vegetation and absence of wetland marshlands at the site and higher profile of the structure.

Normal erosion control measures would mitigate construction runoff and siltation from entering the river. It is anticipated that some wetland areas would be disturbed by roadway construction within the National Parks Service property. The alternative would not result in increased roadway capacity.

The proposed IPA would not increase roadway capacity or significantly alter area travel patterns. Rather, it would only widen narrow pavement. Therefore, the proposed project is listed as an "Exempt" project in the Northern New Jersey Air Quality Conformity Determination of the 1998 Regional Transportation Plan Update/SIP and FY 2003 Transportation Improvement Program

The following is a listing of necessary permits and agency coordination that will be needed for the construction of this project:

Federal Permits

- Section 7 of the Threatened & Endangered Species Act – USF&WS/NMFS Permit
- Section 9 of the Harbors and Rivers Act – US Coast Guard Permit
- Section 10 of the Harbors and Rivers Act – USACOE (Navigational Waters) Permit
- Section 404 of the Clean Waters Act – USACOE (Waters of the US/Wetlands) Permit
- Section 106 of the National Historic Preservation Act of 1966
- Section 4(f) of the National Transportation Act of 1966

Federal Agency Coordination

- National Marine Fisheries Service
- US Environmental Protection Agency
- US Fish and Wildlife Service
- US Department of the Interior
- National Park Service
- National Advisory Council Historic Preservation
- Gateway National Recreation Area
- Sandy Hook Light National Historic Landmark

- Fort Hancock

<u>New Jersey State Permits</u>

- NJDEP Coastal Wetlands Permit
- NJDEP Coastal Area Facility Review Act (CAFRA) Permit
- NJDEP Waterfront Development Act Permit
- NJDEP Water Quality Certificate

<u>State Agency Coordination</u>

- NJDEP Division of Fish and Wildlife
- NJDEP Division of Shellfisheries
- NJ State Historic Preservation Office (SHPO) – Twin Lights Lighthouse Historic Site
- NJDEP Division of Parks and Forestry – Natural Heritage Program

P. Coordination with Stakeholders

A continuation of Public involvement will be necessary throughout the advancement of the process for the IPA (see Appendix R). Public participation efforts will require major partnering strategies, facilitation, dispute resolution, and council briefings. Continuing communications with the various NJDOT Bureaus will also be important to ensure that Agency comments are fully incorporated into the overall project.

A Community partnering Team (CPT) has been assembled including various community groups such as The North Monmouth Chamber of Commerce, the Sandy Hook Foundation, the Highlands Business Partnership, and the Navesink River Municipalities Commission. CPT will be utilized to solicit input from the community and in making decisions that are vital to the community. Information Centers and Public Meetings and Council Briefings will be held to gain public and local municipality acceptance of the project as project progresses. Appendix R includes the meeting minutes/briefing papers/handouts of various community meetings, local briefings and CPT meetings that have taken place to date and Appendix S presents responses to NJDOT Bureau Scoping Checklist comments.

Q. Draft Design Exception Report

It is expected that the proposed IPA would require design exceptions for sight distances and speed on the ramp.

R. Project Commitments

Highlands and Sea Bright are represented on the CPT and have informally agreed with the recommended IPA. Formal legislative briefings and Public Information Centers have been held and formal memorandum of agreements have been requested (see Appendix R1).

S. Major Obstacles

No major obstacles that would prohibit project implementation have been identified in the FAR.

T. Recommendations

The analysis indicates that a fixed span - with a vertical clearance of 65 feet and with a horizontal alignment that would shift slightly south at the channel and return to the existing alignment at the structure's termini - is the most prudent and feasible alternative that would meet the set of project needs while, at the same time, would be the least costly scenario over the 75-year life of the project. Historic mitigation and enhancement measures would be incorporated, as required, into the project. It is recommended that this alternative should be advanced to Preliminary Design.

U. Operation and Maintenance Coordination

1. Project Maintenance Needs

Currently, the Department is responsible for maintaining the existing structure and operations of the Bascule Bridge. The recent span lock failure that occurred in July 2002 resulted in the bridge closing for four hours during a peak seasonal weekend period. This is an example of the Department's ongoing maintenance obligation, the condition and age of the structure, and the need for replacement.

2. Features in IPA to be Maintained by NJDOT Project Maintenance

Jurisdictional limits maps will be developed later in the process to identify NJDOT obligations with respect to standard roadway maintenance (i.e. lighting, snow removal, cleaning, pavement repair, etc.) and inspection.

V. Summary of Key Issues and Critical Problems

The replacement of the Highlands Bridge has been under consideration for a number of years and as a result the community, surrounding businesses and National Parks Service have been through several different proposals for improvements on the structure that have not been realized. The key issues and problems that must be addressed in order to assure that this scheme becomes a reality are as follows:

1. Community Outreach: The key stakeholders must continue to be involved in the design and construction process in order for the project to gain acceptance and move forward.

2. Environmental Impacts: Early determination and concurrence on the classification of the project will expedite the design and review process. Minimizing environmental impacts will be key to obtaining Categorical Exclusion.

3. Historic Impacts: The adverse impact of removing the existing bridge must be able to be mitigated through proper design considerations for SHPO to approve the replacement structure.

4. Constructability: The type of structure and staging of construction will influence the methods of construction, construction schedule and staging needs. The acceptance by the community of the proposed construction staging will also be critical if the project is to continue.

5. Permits: The required permits listed in Section IV- O. Environmental; need to be addressed early in the design phase.

6. Schedule Acceleration: The existing structure will need to be maintained until the replacement bridge is able to handle the traffic. Due to the poor condition of the existing bridge, there will be a cost savings to the Department and greater benefit to the public if the schedule for replacement can be accelerated.

7. Sandy Hook Toll Plaza: National Parks Service is a key stakeholder in the project and the resolution of the traffic congestion generated by the current toll plazas is a necessary component to the success of the project.

8. Bicycle/Pedestrian Access: The identification and importance of the multi-use paths within the project area requires that the final design be responsive to these needs.

9. Local Access: The exiting traffic movements and access locations are critical to the local area residents and businesses. Their agreement with the final design will be critical for the project to move forward.

10. Aesthetics: The project will move forward with context sensitive design to ensure that aesthetics are addressed with the community.

VI. Preliminary Design Scope of Work

A. Final Scope Budget Estimate Package

The estimated construction cost for the proposed IPA is 50.3 million dollars. The Department is currently completing the FA phase of the project to obtain approvals to set a Preliminary Design budget.

B. Anticipated Environmental Package Classification

The Department is currently preparing environmental documents and coordinating with the various environmental agencies, US Coast Guard and National Parks Service, to determine the classification of the project. At the present time, the Department believes the project will qualify as a Categorical Exclusion and will prepare a CED.