# State of New Jersey

**NEW JERSEY DEPARTMENT OF TRANSPORTATION**
**1035 PARKWAY AVENUE**
**P.O. Box 600**
**TRENTON, NEW JERSEY 08625-0600**

**BRIDGE REHABILITATION CONSTRUCTION COST ESTIMATE**
**FOR**
**STRUCTURE NO. 1315-150**
**NJ ROUTE 36 OVER SHREWSBURY RIVER AND BAY AVENUE**
**HIGHLANDS BOROUGH**
**MONMOUTH COUNTY**

Prepared By

**STV Incorporated**
**820 Bear Tavern Road, Suite 200**
**Trenton, NJ 08628**

# TABLE OF CONTENTS

## I. Introduction:

STV Incorporated has been directed by NJDOT to prepare a construction cost estimate for the rehabilitation of the bridge carrying NJ Route 36 over Shrewsbury River and Bay Avenue. The bridge is a four (4) lanes state highway structure that was originally built in 1932, and was reconstructed in 1960. The structure is 1,240 feet long and consists of nine (9) simply supported fixed spans (approach spans), two (2) flanking spans and one (1) double leaf bascule span. The approach spans are comprised of a three (3) girder concrete encased steel girder and floorbeam system, while both the flanking spans and the bascule span consist of a steel two (2) girder system with floorbeams and stringers.

The overall condition of the structure as per the Cycle No. 13 Inspection Report dated June, 2005 and current field inspection performed on March 26, 2007 is "POOR" due to the condition of the superstructure.

The controlling ratings as per the special inspection report (dated February 2007) are as follows:

| | | Truck Type (Tons) | | |
|---|---|---|---|---|
| **Controlling Member** | **HS20** | **3** | **3S2** | **3-3** |
| Floorbeam 2 – Inventory Rating | 21 | 18 | 26 | 35 |
| Bascule Span – Operating Rating | 36 | 30 | 43 | 59 |

## II. Objective:

The Department's goal if a rehabilitation project would be undertaken would be to provide a minimum of 20 years of service life, which will require the replacement of the entire superstructure within the footprint of the existing structure while maintaining the existing profile and touchdown points, and to accomplish the construction with limited or negligible permit delays using pre-fabricated components to accelerate construction to the extent possible. This objective can be accomplished in a number of ways, however at the core of our approach is the mitigation of construction impacts to the traveling public and the community as a whole.

## III. Structure Type:

The approach spans will be replaced with a load path redundant three (3) or four (4) girder system supporting an Inverset deck with floorbeams. The two (2) girder flanking span will be replaced with a pseudo four (4) girder system with the two (2) interior girders framing into a new crossbeam at the same location as the existing live load anchorage which then frames into the main exterior girders. The bascule span will be replaced, in-kind, with a two (2) girder system at the same locations as existing supported by a new trunnion girder via the trunnion shaft that will bear on the flanking span girders. The new machinery will be a modern simplified system that will provide enhanced access for maintenance and inspection.

## IV. Superstructure Alternatives:

Two superstructure alternatives were evaluated and are as follows:

A. Alternative I – Superstructure Replacement with Full Bridge Closure (Detour).

B. Alternative II – Superstructure Replacement with Staged Construction of the Fixed Spans and bridge closures only for the flanking and bascule spans replacement.

### A. Alternative I:

This alternative will implement the superstructure replacement with the bridge completely closed with traffic being detoured onto surrounding roadways. The full lane closure permits the utilization of full-width deck panels without longitudinal joints. This implies that future deck replacements will have to be done with full bridge closures. Under this scheme the bridge will be closed for approximately two, eight (8) month construction seasons with the bridge open during the summer season only. This alternative is the least expensive construction cost but has the highest user costs considering the length of time the detour will be in place and the potential impact the detour may have on the traveling public and the community.

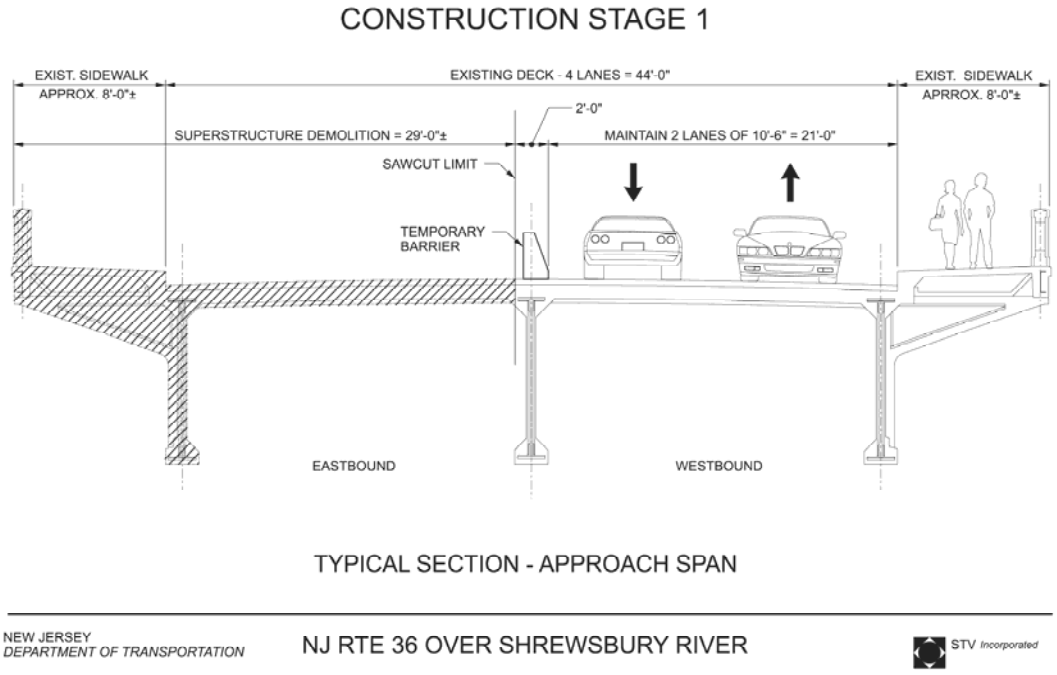
For all schemes a detour is required. The degree of the impact is the length of the duration the detour is in place. Some of the key issues are:

- There will be increased traffic on the local road network.
- There will be longer travel times for deliveries, etc to some destinations.
- Selected bridges on the detour routes may have to be rehabilitated to increase their load carrying capabilities before implementing detour.
- Portions of the detour roadways may have to be rehabilitated before implementing the detour.
- Some traffic signals on the detour routes may have to be reconfigured to handle the detour volumes.

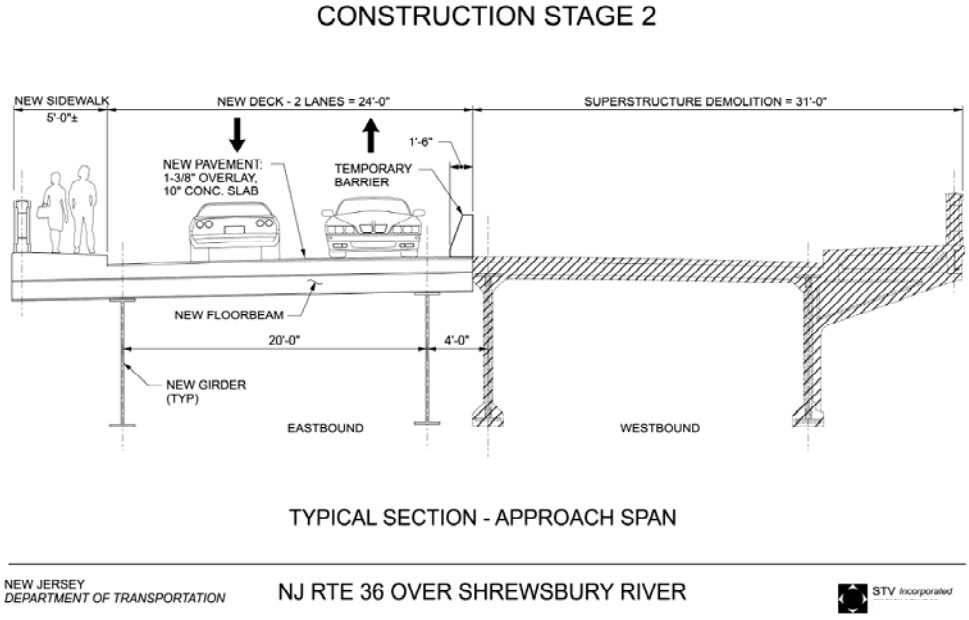
## B. Alternative II:

Alternative II implements the superstructure replacement with staged construction of the approach (fixed) spans only while the bascule and the flanking spans are constructed with a shorter duration full closure of the bridge. It is estimated that the full closure will be in place for three (3) to four (4) months during replacement of the bascule and the flanking spans, after which the bridge structure will be opened to traffic and the remaining approach spans constructed in stages. However, the overall construction duration will be longer than Alternative I and would result in greater congestion during the summer. This scheme will result in a longitudinal deck joint on the approach spans.

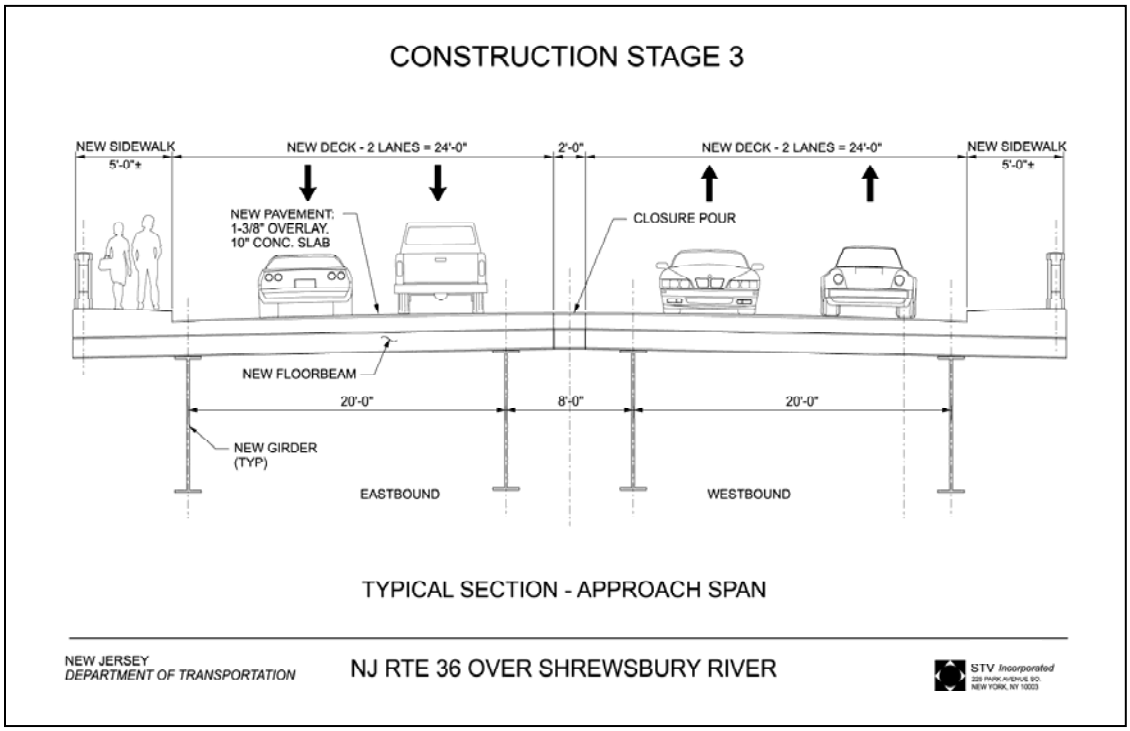
**Stage I** – Install Temporary Barrier, Convert two (2) lane westbound roadway to 10'-6" each single lane east and west bound roadway and saw cut existing roadway at 23'-0" from face of curb. Remove eastbound roadway girder and floorbeams and sidewalk. Erect two (2) new girders and install new inverset deck with floorbeams on the girders. The new girders will have a reduced girder depth to make up for the new 16" deep floorbeams. This is possible because of the provision of the four girders, thus reducing the load per girder, along with the availability of higher strength material than was available when the bridge was built in 1932.




**Stage II** – With the new deck in place traffic will be re-routed onto it and the westbound girders and deck removed. Erect new westbound girders and install the inverset deck with floorbeams.



**Stage III** – Field Splice floorbeams and place cast-in-place concrete to close 2'-0" gap (closure pour).




## V. Criteria:

- *AASHTO Standard Specifications for Highway Bridges 17th Edition*
- *AASHTO LRFD 3rd Edition in addition to the NJDOT Bridge Design Manual.*
- *AASHTO LRFD Movable Highway Bridge Design Specifications 1st Edition*

Design live load for new superstructure will be AASHTO HS 25 for Load Factor Design (LFD) and/or AASHTO HL-93 for Load and Resistance Factor Design (LRFD).

The substructure will be evaluated for the increased live load and retrofit measures incorporated into the rehabilitation.

The substructure and foundation will be evaluated for seismic loadings with a Seismic Performance Category of B. A Rock Acceleration Coefficient, A of 0.15 will be used. This bridge is considered Essential and therefore will be analyzed as single level.

## VI. Substructure Rehabilitation:

The alternatives discussed above all depend on the retention of the existing substructure elements. These components all require rehabilitation to permit the superstructure to be placed, to allow an increase in live load capacity and to reduce future maintenance costs commensurate with the levels expected by the new superstructure. For the most part, the existing substructure elements constructed of cast in place concrete are all in fair condition. Spalls, cracks and other defects exist but are typical for a structure of this age. All need to be repaired as part of the project. Also, all the piers are founded on timber piles driven to dense sands and typical for structures constructed in this era and in these soils. For the most part, these have considerable capacity for vertical loads and considerable resistance to conventional lateral loads. As noted above a seismic assessment is warranted and our recommendations for the level of service are provided. Assuming that the structure can meet the current requirements for seismic compliance, the rehabilitation is straight forward with the exception of the hydraulic analysis which follows this section.

**a) Abutments and Retaining Walls:** The concept studied retains all these elements with minor retrofit. The work would include removal of the existing sidewalks and parapets, the approach slab and replacement with new components that match the new superstructure. The surfaces will be repaired as appropriate for all cracks, spalls,etc

**b) Approach Piers:** All approach span piers, including the flanking span piers are pile supported footings with lower water level or ground level plinths that are the base for columns directly under the primary longitudinal girders. The tops of the columns are tied together with a concrete cap beam. STV has done a preliminary investigation on whether the addition of a $4^{th}$ girder, straddling the center column is possible with minimal effort. The initial results indicate that the column has to be straddled or the capbeam strengthened. The fourth girder line allows staged construction and reduces the unsupported floorbeam length keeping the new deck profile as shallow as possible. This is critical because in the current system the floorbeams frame into the girders while in the new system requires the floorbeams to sit on top of the girders. This loss of depth must be considered against making the girders significantly heavier to carry the increased loadings. As with the abutments and walls, repairs will be performed to correct cracks, spalls, etc.

**c) Bascule Piers:** The bascule span piers are also pile supported structures but the piers are more complex containing service houses, access to the fender system and also support framing for the bascule span trunnion girder and the flanking span girders. STV has done a preliminary investigation on the rehabilitation of these piers and the biggest concern is that it appears a significant amount of demolition of existing concrete slabs and walls may be required to remove the flanking span and bascule steel as it seems that the steel was installed and concrete components cast in place around them for the original construction. All this work is possible within the time frames established but is complicated and will require careful demolition plans and detailing to permit the new components a direct placement path. Our cost estimates assume this effort to be substantial.

**d) Fender System:** The Department has asked that the existing fender system be replaced in its entirety. This is reasonable especially considering the problems ice and other impacts have caused.

There are two options for the fender replacement. The first is to assume an in-kind replacement where no service load upgrade is required. We are assuming this not to be the case here. The reason is that the rehabilitation is extensive to the point where upgrading the fender system to meet current vessel impact requirements seems reasonable, however, this could be a significant cost. We have not been able to review all the ship impact materials for the replacement structure but assume that these studies would be valid for the rehabilitation that review would include. With this information we could develop a more appropriate response but at this time our assumption is that some fuel and other maintenance barges use the channel even though party boats and pleasure craft make up the majority of the passing craft. Based on this we are assuming that the fender system would consist of large cellular cofferdams supplemented by rub rails and deflectors on the span. Since, unlike the new bridge, we cannot assume the structure can take the impact of these large loads we are assuming that the fender handles 100% of the impact. After evaluation of the piers it may be possible to reduce fender costs.

## VII. Scour Analysis:

The existing bridge is located in Monmouth County, New Jersey where Route 36 crosses the Shrewsbury River. The Shrewsbury River connects the Navesink River to the Atlantic Ocean and is subject to strong tidal flows. It is the only inlet to these two rivers.

We have reviewed the existing available information and we note that the Contract Plans dated 1932 show as-built streambed elevations at each pier. The approach piers are on timber piles with concrete pile caps. The pile caps are 6 ft deep and the bottom elevation of each pile cap is shown. The piles are of unknown length. The embedment of the pile caps at the river approach piers was 7 to 11 ft at the time of construction. They also indicate that riprap protection was placed at both abutments.

A Foundation Inspection was conducted in 1946. The bridge elevation drawing shows undermining of the pile caps and the piles were exposed approximately 4 to 6 ft at all the east approach piers (nos. 6 to 11). Assuming 4 ft of exposed piles, this indicates there was 11 to 15 ft of scour at the east approach piers since the construction of the bridge. Because the timber piles, while exposed due to scour, lacked access to oxygen, decay should not be problematic and they are assumed to be in good condition.

In 1971 a bridge rehabilitation contract “Underwater Foundation Protection” was done for scour protection at the bascule and east approach piers. The protection at the east approach piers (nos. 6 to 11) consisted of sand fill around the timber piles and stone riprap surrounding the piles and concrete footing. The protection at the bascule piers (nos. 4 and 5) included stone underwater foundation protection and steel sheet piling. The plans do not provide information on the size or gradation of the riprap.

Hydraulic and scour information for this bridge can be obtained from an Hydrology & Hydraulics (H&H) study conducted for the proposed high level fixed replacement bridge. The study was done by Jacobs Civil in 2005 and is called: “Route 36 Highlands Bridge over Shrewsbury River, H&H Study, Hydrology, Riverine & Scour Analysis”. The hydraulics at the existing bridge is not compared with those of the proposed bridge, but the existing bridge is modeled in the HEC-RAS hydraulic model. The existing bridge is evaluated for scour for the 10-year storm for the construction period when both bridges are in place. The estimated scour for the 10-year storm at the existing bridge is about 10 feet.

The peak discharges are high, 22,142 and 44,249 cfs for the 100 and 500-year storms respectfully. The estimated velocities at the bridges are about 3.7 and 4.0 fps for the 100 and 500-year storms. An aerial photograph of the existing bridge shows that is has a slight skew to the river and there is bank erosion at the east shoreline on north side of the bridge. The largest pier scour in the 1971 plans was at the piers nearest to this shore. This hydraulic model could be revised and run for the larger storms for scour evaluation and countermeasure design.

The following are our recommendations which are in accordance with the FHWA Hydraulic Engineering Circulars No. 18, *Evaluating Scour at Bridges,* and No. 20, *Stream Stability at Highway Structures,* and No. 23, *Bridge Scour and Stream Instability Countermeasures*. HEC-18 states that riprap should be monitored when used as a scour countermeasure at piers. Due to the strong tidal flows, the proximity of the bridge to the Atlantic Ocean and its history of large scour problems, it is recommended that further evaluation of the scour potential and existing scour countermeasures be conducted. In order to assess any scour and stream stability problems at the existing bridge, and evaluate the existing scour countermeasures, the following historic and current information would be useful:

- Bridge Evaluation Survey Reports (Biennial Inspections)
- Diving Inspections Reports
- Fathometer Surveys Reports
- NJDOT Bridge Scour Evaluations Reports - Stages I and II
- Details on the size and gradation of the riprap protection placed in 1971
- Plans of any additional scour countermeasures (was anything placed after the 1946 inspection?)

Pending results of the review of the available information, the following may be recommended:

(1) Revise the hydraulic model for the existing bridge only for the 10, 50, 100 and 500-year storms;

(2) A scour analysis to estimate the potential scour;

(3) A pier stability analysis;

(4) The development of a Plan of Action; and

(5) The design and installation of scour countermeasures and a scour monitoring program.

At this time costs assume minimal remediation but we do reflect effort is needed at all sites.

## VIII. Detour Plan:

The options for detouring traffic during construction of the Route 36 Bridge between Highlands and Sea Bright were investigated.

The nearest alternate bridge over the Navesink River is the Oceanic Bridge on County Route 8A. The detour route would involve redirecting traffic from Route 36 at milepost 9.37 to County Route 520 and County Route 8A to rejoin Route 36 at milepost 14.46. This would result in an additional 1 mile of travel distance between these two points. STV contacted Monmouth County to obtain off-peak traffic data for intersections and roadways along the detour route. However, the County has not responded to these requests. Off-peak traffic data conjecture available for these roadways. Therefore, STV personnel traveled along Route 36 and the preferred detour route during the evening peak hour on April 26, 2007. Traffic congestion was not observed during the 4:00 pm to 5:15 pm time period. The northbound left turn queues at the Route 36 /CR 520 intersection were observed to be 8 to 10 cars long, however, the queues cleared during the next green phase. Queuing or congestion was not observed at any of the other intersections or roadways. The pavement condition along the preferred detour route was observed to be in good condition except for Oceanic Bridge where the riding surface was of minor concern. There are no load posted restrictions on the two of three bridges along the detour route (Oceanic Bridge on CR 8A over Navesink River, Locust Avenue Bridge over Claypit Creek and Rumson Road (CR 520) Bridge over Shrewsbury River). There is currently posted for 15 tons on the west approach of the Rumson Road Bridge, however, the operating ratings are above the legal trucks. Therefore, the posting can be revised at the discretion of the County and the route used for heavy emergency vehicles (fire trucks).

Based on these field observations the Route 36 to CR 520 to CR 8A to Route 36 detour route is recommended. Two of the intersections along the detour route, Locust Avenue at Locust Point Road and Bingham Avenue/Rumson Road are two-way stop controlled intersections. During the period when the detour is required, it is recommended that these intersections be converted to all-way stop controlled intersections. Currently there is no traffic data and this recommendation is based on field observations only. It is recommended that at the start of the detour the all-way stop controlled intersections be monitored for a week and if necessary, temporary traffic signals be installed at these two locations. Additionally, the signalized intersections of Route36/CR 8A, Route 36/CR 520 and CR 8A/River Road shall be monitored during the first week of the detour and modifications to the existing timing be made if needed. Additionally, the cost of resurfacing the roadways that are part of the detour route after construction should be included in the cost estimate of this detour.

The detour route and the proposed detour signage and traffic control devices are attached.


**Detour Route Map**

## IX. Construction Cost Estimate:

The construction cost estimate for Alternative I is approximately $86,000,000.00, including substructure repair and new fender system. Alternative II costs more than Alternative I at approximately $96,000,000.00 as a result of the construction staging of the Approach Spans.

## X. Conclusion:

If the Department proceeded with a rehabilitation of the structure Alternative I is recommended based on its reduced cost and reduced construction duration. The disadvantage of this Alternative is that the entire bridge will be shut down and traffic detoured to nearby streets for a considerably length of time, approximately ten (10) months. The reason is that the cost of replacing the existing structure in kind within its footprint entails replacing the bascule and flanking spans with same, on an accelerated schedule, thereby driving up the cost to about 50% of the entire construction cost. Even with the replacement of the superstructure, the overall structure will still have a limited service life as compared to a new structure.

In addition, the rehabilitated structure would:

1. Lack shoulders for breakdowns
2. Require bridge openings for marine traffic - with the resultant traffic congestion
3. Would be less reliable due to mechanical breakdowns of the bascule span, particularly a concern if this occurs during an emergency evacuation
4. Would require significant regular maintenance of the bascule span and placement of bridge operators resulting in increased bridge long term operating costs!
5. Would incorporate major portions of the substructure built in 1932 and result in lower reliability and higher future repair costs.

**NEW JERSEY DEPARTMENT OF TRANSPORTATION**

**Structure No. 1315-150**
**NJ Route 36 over the Shrewsbury River and Bay Avenue**
**Highlands Borough**
**Monmouth County, New Jersey**

# Estimated Costs for Bridge Rehabilitation

| ITEM | QUANTITY | UNIT | UNIT COST | TOTAL |
|---|---|---|---|---|
| **BASCULE SPAN** | | | | |
| REMOVAL OF STRUCTURAL STEEL | 2,000,000 | LB | $ 4.50 | $ 9,000,000.00 |
| REMOVAL OF COUNTERWEIGHT CONCRETE | 550 | CY | $ 500.00 | $ 275,000.00 |
| STRUCTURAL STEEL REPLACEMENT | 2,000,000 | LB | $ 9.00 | $ 18,000,000.00 |
| COUNTERWEIGHT CONCRETE REPLACEMENT | 550 | CY | $ 1,500.00 | $ 825,000.00 |
| BRIDGE MACHINERY REPLACEMENT | 1 | LS | $ 4,500,000.00 | $ 4,500,000.00 |
| BRIDGE ELECTRICAL PARTIAL REPLACEMENT | 1 | LS | $ 1,000,000.00 | $ 1,000,000.00 |
| CONCRETE FILLED STEEL GRATING | 5,700 | SF | $ 190.00 | $ 1,083,000.00 |
| BRIDGE RAILING (CONCRETE) | 270 | LF | $ 120.00 | $ 32,400.00 |
| SIDEWALK | 11,500 | SF | $ 18.50 | $ 212,750.00 |
| | | | SUBTOTAL | **$ 34,928,150.00** |
| **APPROACH SPANS** | | | | |
| REMOVAL OF CONCRETE | 2,400 | CY | $ 500.00 | $ 1,200,000.00 |
| BRIDGE RAILING (CONCRETE) | 1,700 | LF | $ 150.00 | $ 255,000.00 |
| REMOVAL OF STRUCTURAL STEEL | 3,150,000 | LB | $ 3.75 | $ 11,812,500.00 |
| INVERSET DECK | 52,750 | SF | $ 180.00 | $ 9,495,000.00 |
| STRUCTURAL STEEL REPLACEMENT | 1,575,000 | LB | $ 6.50 | $ 10,237,500.00 |
| BEARINGS 1 | 54 | EACH | $ 8,000.00 | $ 432,000.00 |
| BEARINGS 2 | 18 | EACH | $ 10,000.00 | $ 180,000.00 |
| SIDEWALK | 14,750 | SF | $ 18.50 | $ 272,875.00 |
| | | | SUBTOTAL | **$ 33,884,875.00** |
| **FLANKING SPANS** | | | | |
| REMOVAL OF CONCRETE | 920 | CY | $ 500.00 | $ 460,000.00 |
| CONCRETE PARAPETS | 550 | LF | $ 60.00 | $ 33,000.00 |
| REMOVAL OF STRUCTURAL STEEL | 1,175,000 | LB | $ 3.75 | $ 4,406,250.00 |
| INVERSET DECK | 17,000 | SF | $ 200.00 | $ 3,400,000.00 |
| STRUCTURAL STEEL REPLACEMENT | 815,000 | LB | $ 6.50 | $ 5,297,500.00 |
| BEARINGS 1 | 8 | EACH | $ 6,000.00 | $ 48,000.00 |
| BEARINGS 2 | 8 | EACH | $ 7,000.00 | $ 56,000.00 |
| SIDEWALK | 4,750 | SF | $ 18.50 | $ 87,875.00 |
| | | | SUBTOTAL | **$ 13,788,625.00** |
| **DETOUR ROUTE UPGRADES** | | | | |
| BARRICADES | 40 | EACH | $ 88.00 | $ 3,520.00 |
| CONES | 20 | EACH | $ 40.00 | $ 800.00 |
| DRUMS | 20 | EACH | $ 68.00 | $ 1,360.00 |
| CONSTRUCTION SIGNS | 680 | SF | $ 12.00 | $ 8,160.00 |
| TEMPORARAY TRAFFIC SIGNAL SYSTEM | 2 | LS | $ 20,000.00 | $ 40,000.00 |
| RESET TRAFFIC SIGNAL TIMING | 3 | LS | $ 2,000.00 | $ 6,000.00 |
| ALLOWANCE FOR REPAVMENT OF ROADWAYS AFTER CONSTRUCTION IF REQUIRED | 1 | LS | $ 1,200,000.00 | $ 1,200,000.00 |
| | | | SUBTOTAL | **$ 1,259,840.00** |
| **BASIC MPT** | | | | |
| BASIC MPT | 10 | MO | $ 30,000.00 | $ 300,000.00 |
| | | | SUBTOTAL | **$ 300,000.00** |
| **TOTAL STRUCTURAL COST** | | | | **$ 84,101,650.00** |
| **FENDER SYSTEM REPLACEMENT** | 1 | LS | $ 600,000.00 | $ 600,000.00 |
| **SUBSTRUCTURE REHABILITATION** | 1 | LS | $ 1,500,000.00 | $ 1,500,000.00 |
| **TOTAL REHABILITATION COST** | | | | **$ 86,201,650.00** |

Scope:
1. Replacement superstructure of the bascule span
2. Replacement of superstructure of the approach and flanking spans
3. Rehabilitation substructure, including cap beams

**BOROUGHS OF SEA BRIGHT & HIGHLANDS**

**MONMOUTH COUNTY**

| STATE | FEDERAL PROJECT NO. |
|---|---|
| N.J. | |

## LEGEND

- BREAKAWAY BARRICADES
- BREAKAWAY BARRICADES WITH SIGN
- CONSTRUCTION SIGNS
- DRUMS
- CONE
- PRECAST CONCRETE CURB CONSTRUCTION BARRIER (PCCCB) (TYPE SPECIFIED)
- DIRECTION OF TRAFFIC FLOW
- FLAGGER
- ILLUMINATED FLASHING ARROW MOUNTED ON TOWING VEHICLE SHOWING BAR PATTERN
- ILLUMINATED FLASHING ARROW MOUNTED ON TOWING VEHICLE SHOWING ARROW PATTERN (Left, Right, Both) — LEFT RIGHT BOTH
- TRAFFIC CONTROL TRUCK WITH MOUNTED CRASH CUSHION AND ARROW BOARD SHOWING BAR PATTERN
- TRAFFIC CONTROL TRUCK WITH MOUNTED CRASH CUSHION AND ARROW BOARD SHOWING ARROW PATTERN (Left, Right, Both) — LEFT RIGHT BOTH
- TEMPORARY CRASH CUSHION, INERTIAL BARRIER SYSTEM
- TEMPORARY CRASH CUSHION, Quad GuardCZ OR ADIEM
- PAINT STRIPING TRUCK OR OTHER OPERATING VEHICLE
- BUFFER ZONE
- WORK AREA

## SCHEDULE OF ALLOWABLE LANE CLOSURE HOURS

### ROUTE U.S. 36

NO LANES CLOSURES WILL BE PERMITTED ON THE FOLLOWING HOLIDAYS:

| | |
|---|---|
| MEMORIAL DAY | (SEE NOTE BELOW) |
| JULY 4th. | (SEE NOTE BELOW) |
| LABOR DAY | (SEE NOTE BELOW) |

NOTE:

| IF THE HOLIDAY FALLS ON: | NO LANE CLOSURES PERMITTED |
|---|---|
| SUNDAY OR MONDAY | 6:00 AM FRIDAY UNTIL NOON TUESDAY |
| TUESDAY | 6:00 AM FRIDAY UNTIL NOON WEDNESDAY |
| WEDNESDAY | 6:00 AM TUESDAY UNTIL NOON THURSDAY |
| THURSDAY | 6:00 AM WEDNESDAY UNTIL NOON MONDAY |
| FRIDAY OR SATURDAY | 6:00 AM THURSDAY UNTIL NOON MONDAY |

## GENERAL NOTES

1. ADVANCE WARNING SIGNS, DISTANCES AND TAPER LENGTHS MAY BE EXTENDED, AT THE DIRECTION OF THE ENGINEER,TO ADJUST FOR REDUCED VISIBILITY DUE TO HORIZONTAL AND VERTICAL CURVATURE OF THE ROADWAY.
2. THE APPROXIMATE LOCATIONS OF THE ILLUMINATED FLASHING ARROW BOARDS ARE SHOWN ON THE TRAFFIC CONTROL PLANS. THESE LOCATIONS MAY BE MODIFIED TO ADJUST FOR VISIBILITY DUE TO HORIZONTAL OR VERTICAL CURVATURE OF THE ROADWAY OR TO POSITION AT A SAFER LOCATION. ILLUMINATED FLASHING ARROW BOARDS ARE TO BE USED FOR TEMPORARY LANE CLOSINGS AND AT LOCATIONS SHOWN ON THE TRAFFIC CONTROL PLANS.
3. PRIOR TO ANY ROAD CONSTRUCTION, TRAFFIC CONTROL SIGNS AND DEVICES SHALL BE IN PLACE.
4. RAMPS AND/OR SIDE STREETS ENTERING THE ROADWAY AFTER THE FIRST ADVANCE WARNING SIGN SHALL BE PROVIDED WITH AT LEAST ONE W20-1F SIGN (ROAD WORK AHEAD) AS A MINIMUM.
5. ALL EXISTING ROAD SIGNS, PAVEMENT MARKINGS AND/OR PLOWABLE PAVEMENT REFLECTORS WHICH CONFLICT WITH THE PROPOSED TRAFFIC CONTROL PLAN SHALL BE COVERED, REMOVED OR RELOCATED AS DIRECTED BY THE ENGINEER.
6. CONFLICTING OR NON-OPERATING SIGNAL INDICATIONS ON EITHER THE EXISTING, TEMPORARY, OR PROPOSED TRAFFIC SIGNAL SYSTEMS SHALL BE BAGGED OR COVERED.
7. MAINTENANCE AND PROTECTION OF TRAFFIC SHALL BE IN ACCORDANCE WITH THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES - PART VI "STANDARDS AND GUIDES FOR TRAFFIC CONTROL FOR STREET AND HIGHWAY CONSTRUCTION, MAINTENANCE, UTILITY, AND INCIDENT MANAGEMENT OPERATIONS", UNLESS OTHERWISE NOTED IN THE PLANS AND SPECIFICATIONS, AND SHALL BE APPROVED BY THE ENGINEER.
8. CONSTRUCTION SIGN W99-2 (GIVE US A BRAKE) SHALL BE LOCATED 200 FT IN ADVANCE OF PROJECT LIMITS.
9. A W1-6 (ARROW) SIGN MOUNTED ON A BREAKAWAY BARRICADE AND CENTERED ON THE CLOSED WIDTH SHALL BE LOCATED 100 FT BEYOND EACH INTERSECTION OR MAIN ACCESS POINT WITHIN THE AREA OF A LANE OR SHOULDER CLOSURE.
10. CONSTRUCTION SIGNS R11-4 (ROAD CLOSED TO THROUGH TRAFFIC) SHALL BE PLACED AT THE INTERSECTING STREETS WHICH ARE CLOSED TO TRAFFIC BECAUSE OF CONSTRUCTION.
11. CONSTRUCTION SIGNS W8-9A (SYMBOL FOR UNEVEN PAVEMENT) AND W8-14A (GROOVED PAVEMENT) SHALL BE USED WHEN SUCH PAVEMENT CONDITIONS EXIST.THE PLACEMENT OF THESE SIGNS SHALL BE AS DIRECTED BY THE ENGINEER.
12. MOVING WORK AREAS IN A PERMANENT LANE CLOSURE REQUIRE A TRAILER MOUNTED ILLUMINATED FLASHING ARROW TO REMAIN AT THE END OF THE TAPER.THE TRUCK MOUNTED CRASH CUSHION SHALL MOVE WITH THE WORK AREAS TO KEEP A 75 FT MIN. AND 175 FT MAX. BUFFER IN ADVANCE OF EACH WORK AREA.
13. THE CONTRACTOR SHALL SUBMIT A PLAN FOR THE SAFE ACCESS OF CONSTRUCTION VEHICLES THROUGHOUT THE WORK SITE WHERE SPACE CONSTRAINTS PREVENT THE USE OF LANE CLOSURES. THE PLAN SHALL BE SUBMITTED TO THE ENGINEER IN ACCORDANCE WITH SECTION 617 OF THE STANDARD SPECIFICATIONS.
14. TRAFFIC SAFETY SERVICES SHALL BE USED IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR TRAFFIC CONTROL, SECTION 617.
15. ALL EXCAVATED AREAS WITHIN OR ADJACENT TO THE ROADWAY SHALL BE BACKFILLED AND PLACED ON A MINIMUM 6H:1V SLOPE PRIOR TO THE END OF EACH WORK DAY. OTHER EXCAVATED AREAS WITHIN THE CLEAR ZONE ARE TO BE EITHER BACKFILLED OR A TEMPORARY BARRIER SET IN PLACE TO SHIELD VEHICULAR AND PEDESTRIAN TRAFFIC.
16. WHERE REQUIRED, THE CONTRACTOR SHALL MAKE PROVISIONS FOR MAINTAINING PEDESTRIAN CROSSING LOCATIONS AND TYPE AS DIRECTED BY THE ENGINEER.
17. BITUMINOUS CONCRETE PLACED DURING THE VARIOUS CONSTRUCTION STAGES SHALL BE TRANSITIONED ON A MINIMUM 20H:1V SLOPE TO MEET THE ADJACENT EXISTING GRADE AT THE LONGITUDINAL AND TRANSVERSE LIMITS OF THE STAGE CONSTRUCTION AREAS UNLESS OTHERWISE NOTED ON THE STAGE CONSTRUCTION PLANS.
18. THE PLACEMENT AND OR LOCATION OF PRECAST CONCRETE CURB, CONSTRUCTION BARRIER SHALL BE DONE DURING APPROVED OFF-PEAK HOURS.
19. CONSTRUCTION ZONE SPEED LIMIT WILL BE DETERMINED BY THE TRAFFIC SIGNAL AND SAFETY, REGIONAL TRAFFIC ENGINEER - WORK ZONE AT THE TIME OF OR DURING CONSTRUCTION, AS REQUESTED BY THE RESIDENT ENGINEER.
20. THE SPEED LIMIT, R2-1 (BLACK ON WHITE) SIGN SHALL BE LOCATED THROUGH WORK AREAS AS DIRECTED BY THE TRAFFIC SIGNAL AND SAFETY, REGIONAL TRAFFIC ENGINEER - WORK ZONE.
21. A REDUCED SPEED AHEAD SIGN, R2-5A(S) (BLACK ON WHITE) SHALL BE LOCATED IN ADVANCE OF SPEED LIMIT R2-1 SIGNS WHICH REDUCE THE NORMAL POSTED SPEED LIMIT THROUGH THE CONSTRUCTION ZONE.
22. TRAFFIC FINES DOUBLED IN WORK AREA R(NJ)5-17(S), 4 FT BY 2.5 FT SIGN SHALL BE LOCATED 500 FT AFTER THE FIRST ADVANCE WARNING SIGN, (W20 SERIES) AT EACH WORK AREA LOCATED WITHIN URBAN AREAS. THIS SIGN SHALL ALSO BE USED ON PROJECTS REQUIRING MOVING OPERATIONS IN WHICH CASE THE SIGN SHALL BE MOUNTED ON A SLOW MOVING CONSTRUCTION VEHICLE.
23. THE FINAL BITUMINOUS CONCRETE SURFACE PAVEMENT SHALL NOT BE CONSTRUCTED UNTIL THE FINAL STAGE OF THE PROJECT. MANHOLES AND INLETS SHALL BE SET TO FINISHED GRADE AND TEMPORARY PAVEMENTS RAMPS ARE TO BE CONSTRUCTED AROUND THEM WITH A MINIMUM 20H :1V IN ALL DIRECTIONS USING HOT MIX ASPHALT PAVEMENT. THIS TEMPORARY MATERIAL WILL BE REMOVED IMMEDIATELY PRIOR TO PLACING THE SURFACE COURSE.
24. TRAFFIC CONTROL DEVICES FOR LANE CLOSURES INCLUDING SIGNS, CONES, BARRICADES, ETC. SHALL BE PLACED AS SHOWN ON PLANS. SIGNS SHALL NOT BE PLACED WITHOUT ACTUAL LANE CLOSURES AND SHALL BE IMMEDIATELY REMOVED UPON REMOVAL OF THE CLOSURES.
25. CONES MAY BE SUBSTITUTED FOR DRUMS AND INSTALLED UPON THE APPROVAL OF THE ENGINEER.
26. THE RESIDENT ENGINEER MUST BE NOTIFY TRAFFIC OPERATIONS NORTH IN ACCORDANCE WITH NEW JERSEY DEPARTMENT OF TRANSPORTATION POLICY AND PROCEDURE NUMBER 108 FOR ALL PLANNED LANE AND/OR SHOULDER CLOSURES, AND OTHER TRAFFIC IMPACTS.
27. DRIVEWAY ACCESS MUST BE MAINTAINED TO ALL PROPERTIES ABUTTING THE PROJECT.
28. REMOVABLE PAVEMENT MARKING TAPE OR TEMPORARY PAVEMENT MARKERS SHALL BE UTILIZED WHERE LANE SHIFTS ARE REQUIRED, OR ON EXISTING PAVEMENTS NOT BEING REPAVED. THE PLACEMENT OF TEMPORARY PAVEMENT MARKERS SHALL BE IN ACCORDANCE WITH CONSTRUCTION DETAIL CD-617-2.6.
29. CONSTRUCTION IDENTIFICATION SIGNS NO. 2 SHALL BE INSTALLED IN ADVANCE OF THE PROJECT ON MAJOR EXISTING INTERSECTING HIGHWAYS, ONE SIGN FOR EACH DIRECTION OF TRAFFIC FLOW.
30. ADEQUATE ROADWAY DRAINAGE SHALL BE MAINTAINED DURING CONSTRUCTION.
31. PLACE TEMPORARY CRASH CUSHION AT THE APPROACH ENDS OF PCCCB.
32. THE FOLLOWING TWO-WAY STOP CONTROLLED INTERSECTIONS SHALL BE CHANGED TO OPERATE AS ALL WAY STOP CONTROLLED INTERSECTIONS DURING CONSTRUCTION.
    a) BINGHAM AVENUE AND RUMSON ROAD.
    b) LOCUST AVENUE AND LOCUST POINT ROAD.

TRAFFIC DELAYS SHALL BE MONITORED AT THESE INTERSECTIONS AND TEMPORARY TRAFFIC SIGNAL SYSTEMS DEPLOYED AT THE REQUEST OF THE RESIDENT ENGINEER.

## CONSTRUCTION SIGN TABLE

| SIGN DESIGNATION | MESSAGE | SIZE IN x IN | AREA IN S.F. | REQUIRED QUANTITY IN NUMBER | TOTAL AREA IN S.F. |
|---|---|---|---|---|---|
| M3-2 | EAST | 24" x 12" | 2.0 | 6 | 12.00 |
| M3-4 | WEST | 24" x 12" | 2.0 | 5 | 10.00 |
| M4-8a | END DETOUR | 24" x 18" | 3.0 | 2 | 6.00 |
| M4-9RX | DETOUR - RIGHT ARROW | 30" x 24" | 5.0 | 2 | 10.00 |
| M4-9LX | DETOUR - LEFT ARROW | 30" x 24" | 5.0 | 1 | 5.00 |
| M4-9X | DETOUR - STRAIGHT ARROW | 30" x 24" | 5.0 | 16 | 80.00 |
| M4-10R | DETOUR - RIGHT | 48" x 18" | 6.0 | 11 | 66.00 |
| M4-10L | DETOUR - LEFT | 48" x 18" | 6.0 | 15 | 90.00 |
| R1-1 | STOP | 30" x 30" | 6.3 | 7 | 43.75 |
| R11-2 | ROAD CLOSED | 48" x 30" | 10.0 | 3 | 30.00 |
| R11-3a | BRIDGE CLOSED * MILES AHEAD LOCAL TRAFFIC ONLY | 60" x 30" | 12.5 | 2 | 25.00 |
| SS-1 | RTE 36 BRIDGE TO SEABRIGHT CLOSED FOLLOW DETOUR | 48" x 24" | 8.0 | 3 | 24.00 |
| SS-2 | RTE 36 BRIDGE TO HIGHLANDS CLOSED FOLLOW DETOUR | 48" x 24" | 8.0 | 3 | 24.00 |
| SS-3 | ROUTE 36 CLOSED | 30" x 18" | 3.8 | 2 | 7.50 |
| SS-4 | ROUTE 36 | 30" x 12" | 2.5 | 12 | 30.00 |
| W20-2a | DETOUR AHEAD | 48" x 48" | 16.0 | 5 | 80.00 |
| W20-3 | ROAD CLOSED ___ MILE | 48" x 48" | 16.0 | 4 | 64.00 |
| W20-5AR | RIGHT LANE CLOSED 1000 FEET | 48" x 48" | 16.0 | 1 | 16.00 |
| W20-5BR | RIGHT LANE CLOSED 1500 FEET | 48" x 48" | 16.0 | 1 | 16.00 |
| W4-2L | MERGE LEFT | 48" x 48" | 16.0 | 1 | 16.00 |
| W1-6L | LEFT ARROW ONLY | 48" x 24" | 8.0 | 3 | 24.00 |
| | | | | CONSTRUCTION SIGN TOTAL = | 679.25 |

TC-1 / TC-4

NEW JERSEY DEPARTMENT OF TRANSPORTATION

# TRAFFIC CONTROL PLAN

## ROUTE 36 BRIDGE REHABILITATION GROUP SM7A

STV Incorporated

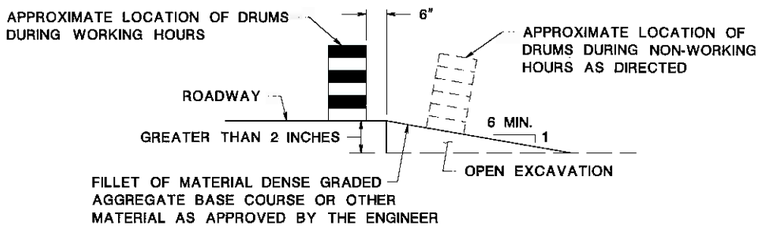
CERTIFICATION OF AUTHORIZATION NO. 24GA28018400

DONALD J. MAUER Jr.

NEW JERSEY PROFESSIONAL ENGINEER LICENSE NO. 28231

#

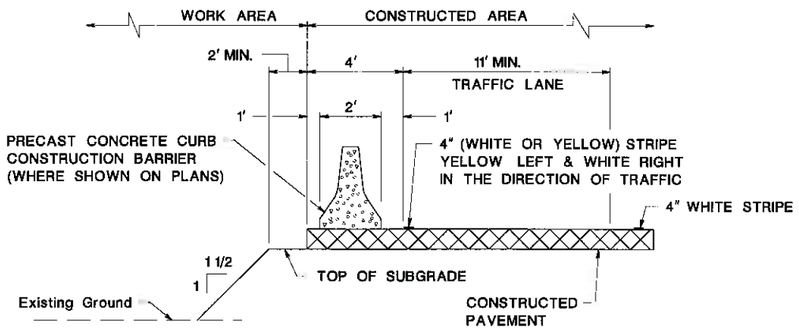
smithrl 5/4/2007 I:\Projects\4013303\4013303_0001\Drawings\TRA\Traffic Control\RT 36 Detour-01.dgn




**NOTE:**

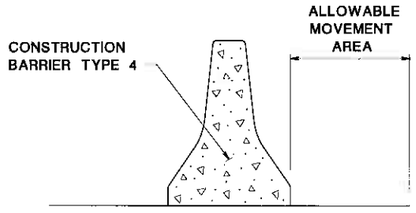
ESCAPE RAMPS MUST BE CONSTRUCTED AND MAINTAINED DURING NON-WORKING HOURS WHERE A VERTICAL DROP GREATER THAN 2 INCHES EXISTS ADJACENT TO TRAVELED LANE.

## ESCAPE RAMP DETAIL




**TYPICAL SECTION**

## PLACEMENT OF PRECAST CONCRETE CONSTRUCTION BARRIER




| JOINT CLASS | ALLOWABLE MOVEMENT |
|---|---|
| A | OVER 16 TO 20 INCHES |
| B | 11 TO 16 INCHES |
| C | LESS THAN 11 INCHES |

**NOTES:**

1. CHANGES TO THE PROPOSED JOINT CLASS AT ANY LOCATION MUST BE APPROVED BY THE ENGINEER.
2. NO WORK OR STORAGE OF MATERIALS WILL BE PERMITTED IN THE ALLOWABLE MOVEMENT AREA.

## CONSTRUCTION BARRIER, TYPE 4 JOINT CLASS AND ALLOWABLE MOVEMENT

| REGULATORY APPROACH SPEED OF TRAFFIC MILES/HOUR | RECOMMENDED SIGHT DISTANCE TO BEGINNING OF CHANNELIZING TAPERS | | |
|---|---|---|---|
| | DESIRABLE | | MINIMUM |
| | RURAL FEET | URBAN FEET | RURAL AND URBAN FEET |
| 25 | 375 | 525 | 150 |
| 30 | 450 | 625 | 200 |
| 35 | 525 | 725 | 250 |
| 40 | 600 | 825 | 325 |
| 45 | 675 | 925 | 400 |
| 50 | 750 | 1025 | 475 |
| 55 | 875 | 1150 | 550 |
| 60 | 1000 | 1275 | 650 |
| 65 | 1050 | | 725 |

**NOTES:**

1. AVOIDANCE MANEUVER IS FOR A SPEED, PATH, AND/OR DIRECTION CHANGE PRIOR TO THE BEGINNING OF CHANNELIZING TAPERS.
2. RECOMMENDED DISTANCES BETWEEN TWO SEPARATE LANE CLOSURES SHALL BE DOUBLE THE VALUES SHOWN ABOVE.
3. RURAL AND URBAN ROAD DESIGNATIONS SHALL BE AS DEFINED IN THE NJDOT STATE HIGHWAY STRAIGHT LINE DIAGRAMS.
4. DESIRABLE VALUES SHALL BE PROVIDED WHEREVER POSSIBLE. IF IT IS NOT FEASIBLE OR PRACTICAL TO PROVIDE DESIRABLE VALUES BECAUSE OF HORIZONTAL OR VERTICAL CURVATURE OR IF RELOCATION OF THE TAPER IS NOT POSSIBLE, THEN MINIMUM VALUES CAN BE APPLIED. WHEN MINIMUM VALUES ARE USED, SPECIAL ATTENTION SHOULD BE GIVEN TO THE USE OF SUITABLE TRAFFIC CONTROL DEVICES FOR PROVIDING ADVANCED WARNING OF THE CONDITIONS THAT ARE LIKELY TO BE ENCOUNTERED.
5. TAPERS SHALL BE LOCATED TO MAXIMIZE THE VISIBILITY OF THEIR TOTAL LENGTH.

| RECOMMENDED TAPER LENGTH AND SPACING FOR CHANNELIZING TAPERS | | | | | | RECOMMENDED SPACING ALONG TANGENTS |
|---|---|---|---|---|---|---|
| REGULATORY APPROACH SPEED OF TRAFFIC MILES/HOUR | MINIMUM TAPER RATIO IN LENGTH PER FOOT OF WIDTH | MINIMUM TAPER LENGTH L – FOR LANE WIDTHS 10′ | 11′ | 12′ | MAXIMUM DEVICE (B) SPACING ALONG TAPERS IN FEET | MAXIMUM DEVICE (D) SPACING ALONG TANGENTS IN FEET |
| 25 | 10.5:1 | 105 | 115 | 125 | 25 | 50 |
| 30 | 15:1 | 150 | 165 | 180 | 30 | 60 |
| 35 | 20.5:1 | 205 | 225 | 245 | 35 | 70 |
| 40 | 27:1 | 270 | 300 | 325 | 40 | 80 |
| 45 | 45:1 | 450 | 495 | 540 | 45 | 90 |
| 50 | 50:1 | 500 | 550 | 600 | 50 | 100 |
| 55 | 55:1 | 550 | 605 | 660 | 55 | 110 |
| 60 | 60:1 | 600 | 660 | 720 | 60 | 120 |
| 65 | 65:1 | 650 | 715 | 780 | 65 | 130 |

**NOTE:**

THE MAXIMUM DEVICE SPACING ALONG CURVES SHALL BE AS DEFINED FOR TAPERS (B) IN THE ABOVE TABLE.

N.T.S.

TCD-2 | TC-2 / TC-4

NEW JERSEY DEPARTMENT OF TRANSPORTATION

# TRAFFIC CONTROL PLAN

ROUTE 36 BRIDGE REHABILITATION
GROUP SM7A

STV Incorporated
CERTIFICATION OF AUTHORIZATION NO. 24GA28018400

DONALD J. MAUER Jr.
NEW JERSEY PROFESSIONAL ENGINEER LICENSE NO. 28231

#

BOROUGHS OF SEA BRIGHT & HIGHLANDS

MONMOUTH COUNTY

| STATE | FEDERAL PROJECT NO. |
|---|---|
| N.J. | |

1500' 0 1500' 3000'

SANDY HOOK BAY

ATLANTIC HIGHLANDS

SPERMACETTI COVE

SKELETON HILL ISLAND

SOUTH ISLAND

N.J. Plane Coordinate System

HIGHLANDS

PLUM ISLAND

U.S. NAVAL WEAPONS STATION EARLE

36

516

BEACON HILL RD

PORTLAND RD

MONMOUTH AVE

VALLEY DR

NAVASINK AVE

HARTSHORNE RD

(1 MILE) (17)

HARTSHORNE WOODS PARK

(1/2 MILE) (17)

LOCUST POINT RD

CLAYPIT CREEK

SEE INSET 1 SHEET TC-4

SEE INSET 2 SHEET TC-4

TWIN LIGHTS OF NAVESINK LIGHTHOUSE (HISTORIC SITE)

HIGHLANDS ARMY AIR DEFENSE

SEA BRIGHT

(1/2 MILE) (17)

(1 MILE) (17)

MIDDLETOWN

OCEANIC BRIDGE

RIVER

NAVASINK RIVER RD

W RIVER RD

BINGHAM AVE

RUMSON

520

RUMSON RD

RIDGE RD

BELLEVIEW AVE

OYSTER BAY

NAVESINK

FAIR HAVEN

RIVERVIEW MEDICAL CENTER

RED

## SIGN LEGEND

| | | | | | |
|---|---|---|---|---|---|
| ① | EAST | M3-2 24" X 12" | ⑭ | ROUTE 36 CLOSED | SS-3 |
| ② | WEST | M3-4 24" X 12" | ⑮ | ROUTE 36 | SS-4 |
| ③ | END DETOUR | M4-8a 24" X 18" | ⑯ | DETOUR AHEAD | W20-2a 48" X 48" |
| ④ | DETOUR | M4-9RX (30" X 24") | ⑰ | ROAD CLOSED | W20-3 48" X 48" |
| ⑤ | DETOUR | M4-9LX (30" X 24") | | | |
| ⑥ | DETOUR | M4-9X (30" X 24") | | | |
| ⑦ | DETOUR | M4-10R (48" X 18") | | | |
| ⑧ | DETOUR | M4-10L (48" X 18") | | | |
| ⑨ | STOP | R1-1 30" X 30" | | | |
| ⑩ | ROAD CLOSED | R11-2 (48" x 30") | | | |
| ⑪ | BRIDGE CLOSED * MILES AHEAD LOCAL TRAFFIC ONLY (BLK/ORG) | 4" C 4" C 4" C | R11-3a (48" X 24") | | |
| ⑫ | RTE 36 BRIDGE TO SEABRIGHT CLOSED FOLLOW DETOUR (BLK/ORG) | 4" C 4" C 4" C | SS-1 (48" X 24") | | |
| ⑬ | RTE 36 BRIDGE TO HIGHLANDS CLOSED FOLLOW DETOUR (BLK/ORG) | 4" C 4" C 4" C | SS-2 (48" X 24") | | |

DETOUR PLAN

TC-3 / TC-4

NEW JERSEY DEPARTMENT OF TRANSPORTATION

**DETOUR PLAN**

ROUTE 36 BRIDGE REHABILITATION
GROUP SM7A

STV Incorporated

CERTIFICATION OF AUTHORIZATION NO. 24GA28018400

DONALD J. MAUER Jr.

NEW JERSEY PROFESSIONAL ENGINEER LICENSE NO. 28231

#

smithrl 5/4/2007 I:\Projects\4013303\4013303_0001\Drawings\RA\Traffic Control\Rt 36 Detour-03.dgn

## BOROUGHS OF SEA BRIGHT & HIGHLANDS

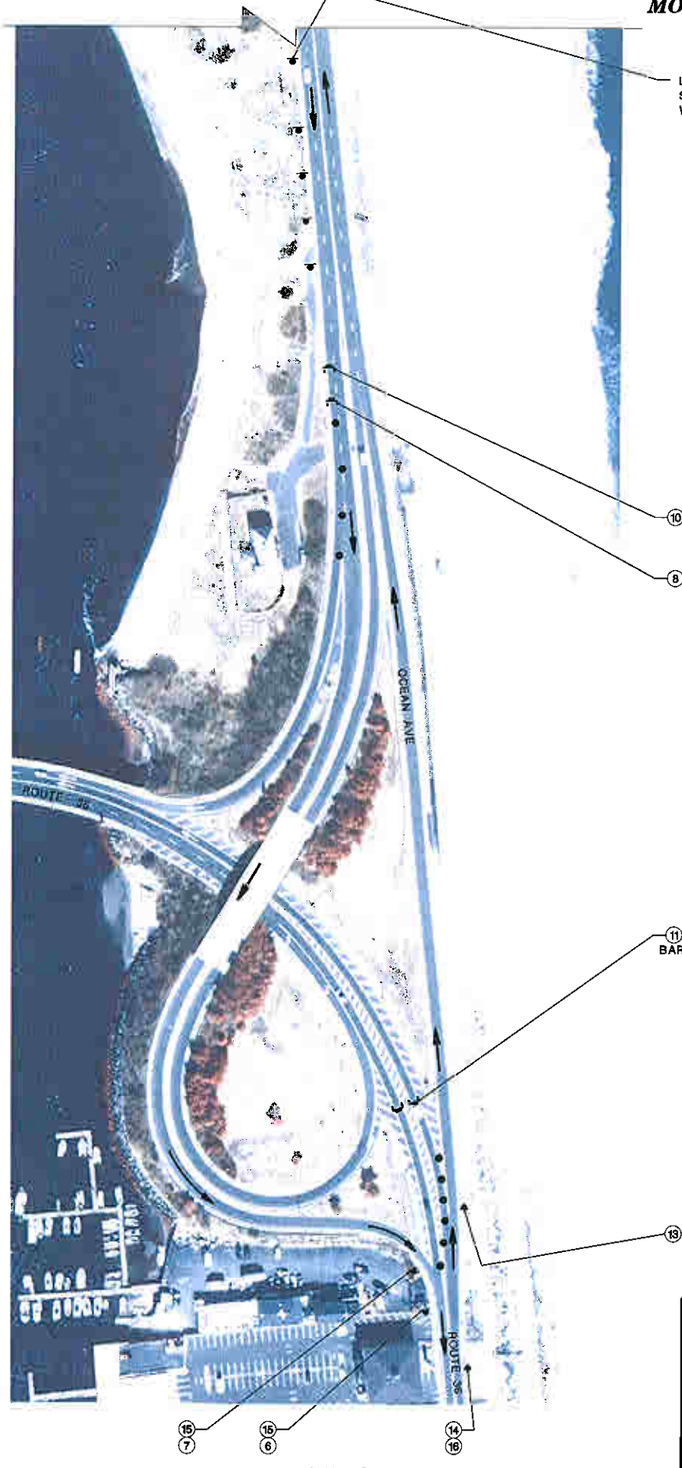
## MONMOUTH COUNTY

| STATE | FEDERAL PROJECT NO. |
|---|---|
| N.J. | |

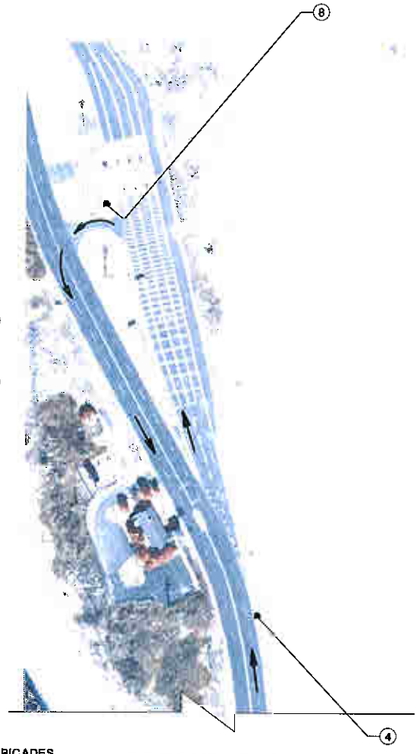
100' 50' 0 100' 200'

N.J. Plane Coordinate System


DETOUR PLAN
INSET 1




DETOUR PLAN
INSET 2




DETOUR PLAN
INSET 2
(CONTINUED)

NOTES
1. FOR SIGN LEGEND SEE SHEET TC-3.

TC-4
TC-4

NEW JERSEY DEPARTMENT OF TRANSPORTATION

**DETOUR PLAN INSETS**

ROUTE 36 BRIDGE REHABILITATION
GROUP SM7A

STV Incorporated
CERTIFICATION OF AUTHORIZATION NO. 24GA28018400

DONALD J. MAUER Jr.
NEW JERSEY PROFESSIONAL ENGINEER LICENSE NO. 28231

#

smithrl 5/4/2007 I:\Projects\4013303\4013303_0001\Drawings\TRA\Traffic Control\Rt 36 Detour-04.dgn