

**The Route 36 Highlands Bridge:  
Redesign of Bridge Foundations Through Geotechnical and Hydrologic Analysis**  
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**Abstract**

New Jersey State Route 36 serves as a corridor connecting much of the state's northeast shoreline communities between Keyport and Long Branch. The Route 36 Highlands Bridge over the Shrewsbury River was recently inspected and found to be in critical condition. This bridge is a vital connection between the New Jersey mainland and the Sandy Hook peninsula serving recreational, residential, and commercial traffic.

A larger bridge with a higher baseline is to replace failing bridge to better accommodate both vehicular and water traffic. Several ramps, embankments, retaining walls, a toll plaza, pedestrian bridges, and fishing piers will also be included in the project to facilitate the physical bridge requirements as well as recreational benefits.

This report was conducted with the primary purpose being a geotechnical and hydrological analysis of the proposed bridge and associated project structures. The geotechnical analysis included a detailed description of the site conditions, surface conditions, subsurface conditions including soil strata and properties. The following main five soil strata were identified within the project limits: Upper Granular, Alluvial Deposits, Green Alluvial Deposits, Lower Cohesive and Deep Granular. Soil properties calculated for each stratum were used in the foundation design of 7 ramps, 10 bridge piers and 5 mechanically stabilized earth retaining walls. Software packages Driven and Group were utilized in the design of the bridge piers and WinStabl and Embank were used in the design of the MSE walls. Considering aggressive maritime environment, deep foundations for bridge piers should be precast, prestressed cylindrical piles 54" in diameter. MSE walls should be constructed to allow for completion of primary consolidation before construction of the pavement box. Wick drains should be used only at the location of ramp J to accelerate and minimize consolidation settlement.

Also included within the report is hydrological and scour analysis for the Shrewsbury River watershed and the Rt. 36 Highlands Bridge. Using statistical analyses and HEC-HMS modeling, the peak flows for the 100-year and 500-year storms were calculated to be 15,300 cfs and 24,500 cfs, respectively. Critical scour depth was determined to be 7.63 ft located at pier 3. To help delay the formation of the scour holes, it is recommended to use Type III riprap extending 2 times the pier width in all directions.