HAYWARD BAKER
Geotechnical Construction

KELLER

Project Summary

Vibro Concrete Columns

Route 9
Chestnut Neck, NJ

Through Atlantic County, NJ, Rt. 9 traverses several inlets of the Atlantic Ocean before it merges with the Garden State Parkway. The section of Rt. 9 crossing Nacote Creek was undergoing conversion from a 2-lane road to a 4-lane divided highway. The existing bridge was demolished to accommodate the wider replacement bridge.

The approaches for the new bridge consist of Mechanically Stabilized Earth (MSE) walls with heights between 10 and 28 feet. At the south approach to the bridge, significant amounts of organic soil and peat were observed during construction testing. The thick organic layer would cause unacceptable settlement of the MSE wall. Therefore, wall loads needed to be transferred to the underlying dense sand.

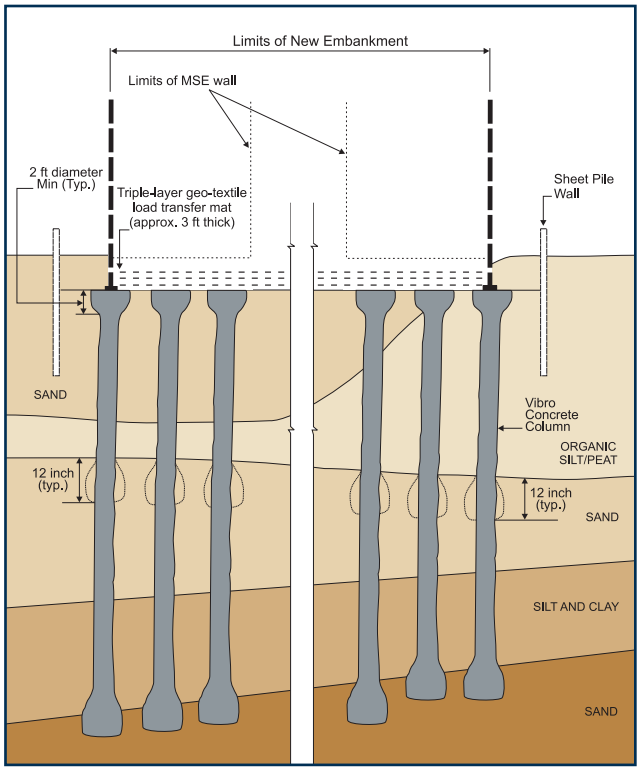
Reconsidering Driven Piles and Drilled Shafts

Driven piles along the 600 foot wall alignment would be very expensive, especially if a reinforced concrete mat was utilized. Drilled shafts, installed through the soft organics, would also be expensive and would likely "neck" such that a continuous column diameter could not be relied upon.

The VCC Design Advantage

To provide economical and sound support, Vibro Concrete Columns (VCCs) were installed below the MSE wall. The columns, placed on a 5 feet and 7.5 feet square grid pattern below the highest section of the wall, were installed to depths of 15 feet and 28 feet such that the load could be transferred to the dense sand below.

Above the VCCs, a load transfer mat consisting of three layers of geo-textile embedded in a well-graded sand fill was placed. The mat was approximately 3 feet thick, and was relied upon to transfer the entire MSE wall load to the columns.



Above: Significant amounts of organic soil and peat would cause unacceptable settlement at the south approach of the bridge. The VCCs solved this problem.

Top: The approaches for the new bridge consist of MSE walls with heights between 10 and 28 feet.

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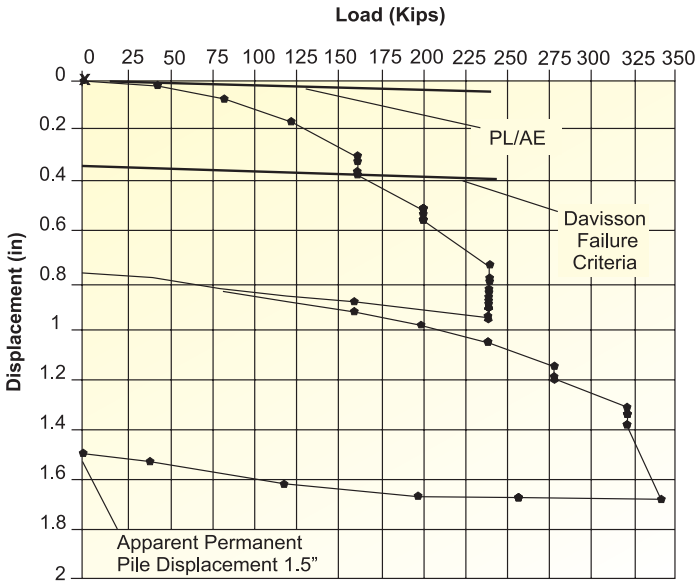
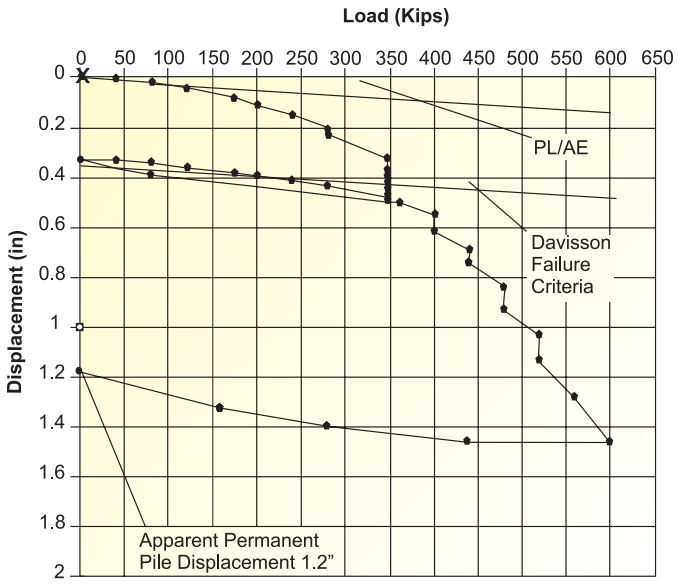
Route 9, *continued…*





Left: Load test result for 15 feet VCC. Load tests were performed prior to production at the site.

Above: Load test result for 28 feet VCC. The VCCs proved to be an excellent, cost-effective solution.

As the height of the wall decreased, the spacing of the VCCs widened to 7.5 feet. The decreasing MSE wall height allowed for the reduction of VCC loads whereby columns could be seated in the upper clay layer instead of the lower sand, therefore curtailing cost.

An expanded base was constructed at the top and bottom of each VCC shaft. Expanded base piles are excellent attributes of VCCs because the edge spacing can be reduced for geotextile/geogrid reinforced mats, and load bearing capacity is increased due to the larger bearing area. Expanded base piles have been proven to increase capacity in several ASTM D1143 load tests.

Quality Control

Two VCC load tests were performed prior to production at the site: the first, on a 15 feet deep column, and the second, on a 28 feet deep column. The 28 feet column, while performing considerably better, required pre-drilling to achieve the deeper depth.

Conclusion

The Vibro Concrete Columns provided a cost-effective alternative to driven piles and drilled shafts, with excellent results confirmed by geotechnical instrumentation.

Owner
New Jersey Department of Transportation

Engineer
Parsons Brinckerhoff, Princeton, NJ

Contractor
J.H. Reid General Contractors, South Plainfield, NJ

Hayward Baker Locations

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