

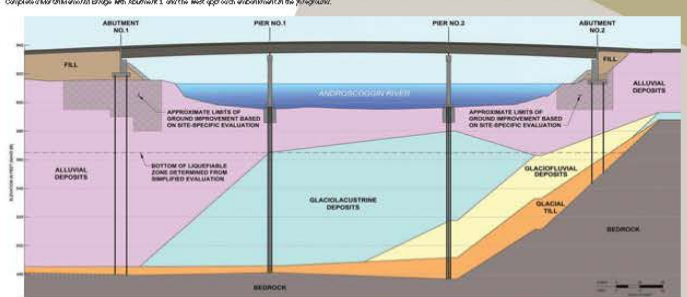
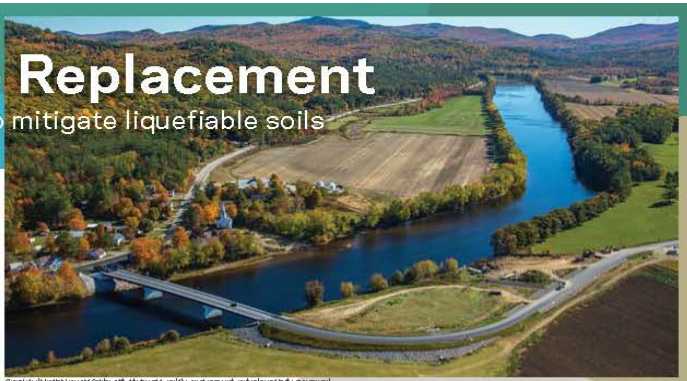
Special Recognition: Haley & Aldrich, Inc.

Haley & Aldrich, Inc. was awarded the second Special Recognition Award for Engineering Excellence for its work on the Martin Memorial Bridge Replacement in Rumford, Maine. Haley & Aldrich completed liquefaction susceptibility evaluations for the Maine Department of Transportation (MaineDOT) to determine the extent of liquefiable soils beneath the bridge. Based on the results of the initial evaluations as well as the approach embankment stability calculations, Haley & Aldrich concluded that large portions of the approach embankments were likely to fail during/after a seismic event. They judged that the most practicable liquefaction remedial alternative was vibro-replacement, and presented several alternatives for addressing the problem to MaineDOT. The ground improvement work began in October 2013 and was successfully completed in February 2014. This project represents the first time MaineDOT has used site-specific response and liquefaction susceptibility evaluations together with ground improvement techniques to mitigate liquefaction. Confirmatory test borings drilled within production ground improvement areas indicated that the minimum specified performance criteria were met or exceeded. The more complex technical evaluations resulted in the reduced likelihood of major adverse impacts to the bridge caused by future earthquake events, and saved the project an estimated \$650,000 in construction costs.

Martin Memorial Bridge Replacement

Detailed seismic analyses result in cost savings to mitigate liquefiable soils

RUMFORD, MAINE



SITUATION

Replacement of the 60-year old Martin Memorial Bridge consisted of 1,600 lf of new approach embankment/roadways and a new 500-ft long, three-span bridge supported on two abutments and two piers. Standard LRFD evaluation methods indicated that a 50-ft thick zone of loose soil would be susceptible to liquefaction and strength loss during the design earthquake.

CHALLENGE

Reduce the overall extent of liquefaction susceptible soil by completing detailed, site-specific seismic response analyses and liquefaction evaluations.

SOLUTION

Rock motions were developed for the site, and one-dimensional, site-specific seismic response and liquefaction susceptibility analyses were performed to better define the lateral and vertical extent of liquefaction-susceptible soils. The analyses reduced the thickness of liquefaction-susceptible soil by 5 to 30 ft and also lowered the design response spectrum. This allowed the bridge to be designed for a less severe seismic design category and resulted in the use of fewer piles to support the bridge.

Based on our evaluation of the nature/consistency of the liquefaction-susceptible soils, overall technical feasibility, post-construction performance requirements and cost, vibro replacement was determined to be the most practicable ground improvement technique to mitigate liquefaction. Ground improvement work began in October 2013 and completed in February 2014. Confirmatory test borings drilled within the ground improvement areas indicated that the specified performance criteria were met.

RESULTS

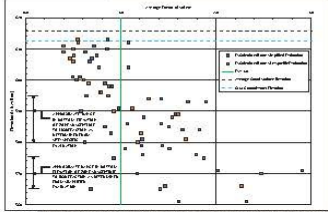
This project represents the first time MaineDOT used site-specific response and liquefaction susceptibility evaluations along with ground improvement techniques to mitigate liquefaction, resulting in an estimated \$650,000 in project cost savings. The bridge opened in June 2015.



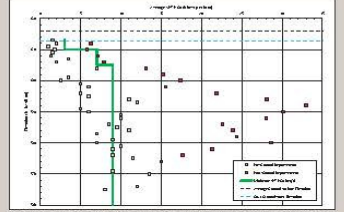
Ground improvement work being completed along the west approach embankment and in the vicinity of Abutment 1.



Ground improvement work being completed along the west approach embankment in the vicinity of Abutment 2.



Plan view of ground improvement and test borings in the vicinity of Abutment 1.



Standard penetration test data for the pre- and post-ground improvement at a cross-section in the vicinity of Abutment 1.

- OWNER: Maine Department of Transportation, Augusta, ME
- BRIDGE DESIGNER: TranSystems Corporation, Boston, MA
- GEOTECHNICAL CONSULTANT: Haley & Aldrich, Inc., Portland, ME
- GENERAL CONTRACTOR: Wyman & Simpson, Inc., Richmond, ME
- EARTHWORK CONTRACTOR: R.J. Grondin & Sons, Gorham, ME
- GROUND IMPROVEMENT CONTRACTOR: H.B. Fleming, Inc., South Portland, ME

