



**Mueser Rutledge
Consulting Engineers**



MRCE's engineers install inclinometers at the site in summer of 2010. The data received will be utilized in the seismic study.

Queensboro Bridge Seismic Retrofit

New York, NY

The Queensboro Bridge, also known as the 59th Street Bridge, is a landmark two-level double cantilever truss structure linking the boroughs of Manhattan and Queens across the East River. Built in 1909, the 7,449 ft long bridge is a major crossing and serves some of the busiest arteries of New York City. As such, the New York City Department of Transportation (NYCDOT) classified Queensboro Bridge as a “Critical Bridge” and has initiated a program for its reconstruction. Mueser Rutledge Consulting Engineers (MRCE) is part of the team evaluating its seismic performance.

MRCE's Services:

- **Perform comprehensive seismic study** to characterize the subsurface soils at the site, identify seismic hazards, and provide ground motions and foundation impedances incorporating soil amplification and Soil-Structure Interaction (SSI) the global model of the bridge.
- **Develop extensive subsurface investigation plan** to supplement existing geotechnical information from past subsurface explorations, consisting of borings, SeismoCone Penetration Test (SCPT) and Crosshole Seismic (CS) test. SCPT and CS tests will yield valuable shear wave velocity data essential for site response analysis. Undisturbed samples of slightly plastic fine-grained soils (silts and clays) will be collected for state-of-the-art cyclic triaxial tests will be performed to evaluate liquefaction resistance of these fine-grained soils.
- **Develop appropriate sets of ground motions** based on combinations of the different site response analyses for the bridge analysis. Due to the importance of the bridge, the variable soil conditions at the site, and the expected significant soil-foundation-bridge interaction effects, one-dimensional (1-D) and two-dimensional (2-D) site response analysis will be performed to determine the free-field ground motions along the bridge alignment. The site response analysis will account for time delays and phase shifts of earthquake motions along the alignment to derive differential motions resulting from the topography and site conditions at each support.
- **Conduct foundation analyses considering soil-structure interaction effects** for all bridge foundation elements to derive 6x6 impedance matrices for each foundation element taking into account foundation details, soil nonlinearities, kinematic effects, and base uplift.
- **Evaluate the geotechnical vulnerabilities** of the bridge including liquefaction potential, lateral spread, lateral stability, and dynamic settlements.
- **Design seismic retrofit solutions** for the main masonry piers and all other approach bridge foundations and verified by analyses of the retrofitted bridge model.