

Performance of Improved Ground and Reinforced Soil Structures during Earthquakes –
Case Studies and Numerical Analyses

by

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ABSTRACT

The 1999 Kocaeli Earthquake (M=7.4) struck northwestern Turkey on August 17, 1999 and caused significant damage in urban areas located along Izmit Bay. The sites that suffered the greatest damages were located primarily in areas of poorest soil conditions, typically containing soft clays and silts and/or loose, liquefiable sands. Because the affected region is heavily developed with infrastructure and there is a preponderance of poor soils, a wide range of soil improvement measures had been used to mitigate anticipated earthquake damages throughout the region. Following the earthquake and significant aftershocks, Virginia Tech researchers traveled to Turkey to investigate the affected area to document geotechnical field performance. Primary focus of the Virginia tech team was given to investigating the performance of improved soil sites and reinforced soil structures. The sites were subjected to ground motions ranging from about 0.10g to 0.35g. The site locations ranged from 0 to 35 km from the zone of energy release. This dissertation presents in detail, the findings from the two most instructive sites. The investigation of these sites involved field reconnaissance, field and laboratory testing of soils, seismic analysis, numerical modeling, and other analytical work.