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Marmara Earthquake Rehabilitation Program (MERP) : A Detailed Geophysical Study for Disaster Risk Management and Mitigation

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The 17 August 1999 **M**=7.4 Izmit and 12 November 1999 **M**=7.1 Duzce earthquakes killed 18,000 people, destroyed 15,400 buildings, and caused $10-25 billion in damage. But the Izmit event is only the most recent in a largely westward progression of seven large earthquakes along the North Anatolian fault since 1939. Just southwest of the region strongly shaken in 1999 lies Yalova, a rapidly growing city that has been heavily damaged by earthquakes eight times during the past 2 centuries.

In June 2005 and in the framework of the project, entitled "MARMARA EARTHQUAKE REHABILITATION PROGRAM – MERP" founded by the European Union, the Division of Natural Resources & Natural Hazards of the Centre for Technological Research of Crete (CTRC) and the Laboratory of Geophysics and Seismology of the Technological Educational Institute of Crete, performed a surface geophysical investigation on the broader area of the Yalova city in Turkey, as part of a preliminary risk assessment project of the properties of soil and ground water at the site under investigation. Geophysical data were used to help determine the dominant direction of fracture strike, subsurface structure of the city, locations of possible fracture zones or conductive lithologic layers which could be easily correlated with liquidation phenomena.

The direct-current-resistivity (dc-resistivity) methods were used to evaluate dominant bedrock fracture orientation and to define the exact depth of the bedrock. ERT was used to determine the depth and spatial extent of electrically resistive/conductive anomalies, interpreted as lithologic differences and to provide information on subsur-

face structure. Seismic refraction method and Spectral Analysis of Surface waves were applied in order to define the velocity (P and S-waves) distribution in 2D section. Additionally, HVSR measurements were acquired to estimate the corner frequency and to classify the ground depending on the calculated amplification factor. The above mentioned methodologies were used for the geophysical and geotechnical site classification.

Final geophysical models were evaluated using all the available geological and geotechnical characteristics based on the geological formations comprise the valleys in Yalova and the in-situ and laboratory test data from 170 geotechnical boreholes in the area under investigation.

After all measurements were processed and using the geological and geotechnical data, an effort was made to group sites with similar behaviour. Five groups of similar geological structure were obtained, namely Group1 (Mudstone, Sandstone), Group2 (Sandstone, conglomerate, mudstone), Group3 (Fine sand, list, clay), Group4 (Slightly cemented gravel, sand and silt) and Group5 (Sand, silt and clay).

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