

Seismic Behavior of the Edirnekapı Mihrimah Sultan Mosque in Istanbul

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ABSTRACT

The Mihrimah Sultan Mosque in Edirnekapı, Istanbul is a 16th century building by Architect Sinan. The building was damaged in the earthquakes of 1719, 1766, 1814, 1894 and 1999 during which many masonry buildings in the city were also affected as indicated by historical records. A large earthquake is expected to hit Istanbul in the near future. For this reason, evaluation of the earthquake safety of Istanbul's historical structures is very important. This paper dwells on our studies on the Mihrimah Sultan mosque, which can be summarized under three main titles: (1) Structural analyses; (2) Structural health monitoring; and (3) Assessments using non-destructive testing methods. The structural analyses were carried out with the help of finite and distinct element methods. They involved linear and non-linear analyses under real and simulated earthquakes representative of local earthquake hazard conditions. The damage and collapse mechanisms of the elements of the mosque were investigated. The structural health monitoring system is a 27-channel accelerometric network, the data from which were used to assess the dynamic response properties under recorded earthquakes as well as to investigate the effect of atmospheric conditions on structural response. Ultrasonic tests were carried out in different sections of the minaret. For monitoring static structural deformations, 3D laser scanning technology is employed. The scanning campaigns are repeated periodically under normal conditions. The system is envisaged to be used as the main tool in the assessment of the extent of earthquake damage in case a seismic event affects the structure.