



STRUCTURAL HEALTH MONITORING OF SUSPENSION BRIDGES IN ISTANBUL

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The Bosphorus in Istanbul is a narrow seaway connecting Black Sea to Marmara Sea, and separating Asia from Europe. The two suspension bridges on the Bosphorus, the Ataturk Bridge (the First Bosphorus Bridge) and the Fatih Sultan Mehmet Bridge (the Second Bosphorus Bridge) are critical lifelines for Istanbul, a city with 15 million inhabitants, for they carry thousands of motor vehicles every day between the Asian and European sides of the city.

The Ataturk Bridge, commissioned in 1973, is gravity anchored suspension bridge with steel pylons and inclined hangers. It consists of a 1,074m-long main span and two side spans. Side spans are not suspended and rest on slender columns. The width of the deck is 33.4 m and the height of two steel towers is 165 m. The daily number of vehicles crossing the bridge is more than 200.000. An advanced Structural Health Monitoring (SHM) system was developed and installed on the bridge. The system consists of 168 sensors, recording 258 data channels from accelerometers, GPS sensors, tilt meters, strain gauges, force transducers, laser displacement sensors, thermocouples and weather stations; all streaming continuous data in real time. The monitoring system has been operational for three years.

The Fatih Sultan Mehmet Bridge, is also a gravity-anchored suspension bridge with steel pylons and vertical hangers. The deck is 1,510 m long and 39 m wide, the distance between the towers is 1,090 m and their height over road level is 105 m. The clearance of the bridge from sea level is 64 m. This bridge was installed in 2008 with a Structural Health Monitoring System, consisting of 44 channels of acceleration sensors, streaming continuous data in real time. The system is currently being supplemented with GPS and wind sensors. A special real-time data processing and analysis software is developed for this bridge to analyze the data and display the results in real time.

Currently, a third suspension bridge on the Bosphorus, to be called Yavuz Sultan Selim Bridge, is under construction. Located at the northern end of Bosphorus closer to Black Sea, this bridge will be a combined road-rail bridge. It will carry one railway and four motorway lanes in each direction. The length of the bridge will be 2,164m (main span 1,408m) and the width 58.4 m, which will be the widest in the world. The bridge will be instrumented with a Structural Health Monitoring System, providing almost 300 channels of continuous data from various types of sensors, including accelerometers, GPS sensors, wind sensors, strain gauges, tilt-meters, and a weather station.

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