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IZMIT Bay Suspension Bridge – Wind Induced Vibrations

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Abstract

This paper describes the studies and the countermeasures against the vibrations on the cables of IZMIT Bay bridge (now named "Osman Gazi Bridge") in Turkey. First, the vibrations observed in the structure are summarized together with the data measured on site by accelerometers, GPS etc. Through studies about the efficiency of possible anti-vibration devices, appropriate considerations have been adopted and those are working very properly so far.

Keywords: IZMIT Bay Bridge, Cable system, Wind-induced vibration, Anti-vibration device

1 Introduction

The IZMIT Bay Bridge (now named "Osman Gazi Bridge" in honor of Osman I (1259 - 1326) who founded the Ottoman Empire in 1299) located in northwest Turkey. It consists of the North Approach Viaduct, the Suspension Bridge and the South Approach Viaduct, and carries the Gebze-Orhangazi-Bursa-Izmir motorway across the Sea of Marmara at the Bay of Izmit between the Diliskelesi peninsula on the north and the Hersek peninsula on the south (Figure.1). The bridge construction has started in January 2013 and opened for the traffic at the end of June 2016 [1]. The bridge is located in high seismic zone in which magnitude 7.4 Izmit earthquake took place in 1999. North Anatolia fault is close to the bridge site, around 2 km away from the south anchorage area, and the south anchorage is in the secondary fault zone.

The bridge is arranged as a three span continuous suspension bridge having a total length of 566+1550+566=2682 m. The deck is a hexagonal closed steel box girder with a width of 30.1 m and a depth of 4.75 m. It is carrying three lanes of highway traffic in each direction. The walkway for maintenance cars with a width of 2.9 m is at both sides of the steel deck as similar to 1st and 2nd Bosporus bridges.

The tower is 236.4 m high steel structure due to the high seismic demands and short construction time. The tower consist of closed box section legs inclined by about 1:80 and two rectangular closed box cross beams in the middle and at the top. Inside of the tower is protected by a dehumidification system. The leg is divided into 22 blocks to meet the fabrication and the erection demands, and the blocks upper than EL+146 m are further divided into 4 panels to keep weight of each panel less than 46 ton which is the capacity of the tower climbing crane. The hybrid connection is adopted at each horizontal joint, i.e. a weld connection to skin plates and a bolted one to vertical stiffeners inside the tower, and the vertical joint between panels is connected by HSFG bolts. The Full Active Mass Damper (AMD) has been installed to the tower to mitigate vortex-induced

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