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Izmit Bay Suspension Bridge – Finding and Consideration for Vibration control of Tower by Active mass damper

Manabu INOUE, Takeshi KAWAKAMI, Yusuke TAKAI, Oguz BERBER
IHI Infrastructure Systems Co., Ltd., Istanbul, TURKEY

Ryuki IZAWA, Satoshi OIZUMI
IHI Infrastructure Systems Co., Ltd., Tokyo, JAPAN

Ali Nebil OZTURK, Fatih ZEYBEK
NOMAYG JV, Yalova, TURKEY

Contact: manabu_inoue@iis.ihi.co.jp

Abstract

This paper presents the anti-vibration system to mitigate vibrations of the steel towers of IZMIT Bay Bridge in Turkey during the construction. The site performance tests have been carried out to ensure AMD performance. The comparison of the design assumption and the site measurement is made and possible future development is considered.

Keywords: IZMIT Bay Bridge, Steel tower, Full active mass damper, Wind-induced vibration

1 Introduction

The Izmit Bay Bridge, consisting of the North Approach Viaduct, the Suspension Bridge and the South Approach Viaduct, will carry the planned Gebze-Orhangazi-Bursa-Izmir motorway across the Sea of Matmara at the Bay of Izmit between the Diliskelesi peninsula on the north and the Hersek peninsula on the south in Turkey. The bridge construction has started in January 2013 and will be completed in early 2016. Anatolia fault is close to the bridge site, some 2km 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=2682m. The deck is a hexagonal closed steel box girder with a width of 30.1m and a depth of 4.75m and is carrying three lanes of highway traffic in each direction. The walkway for maintenance cars with a width of 2.9m is at both sides of the steel deck as similar to 1st and 2nd Bosporus bridges. Each main cable consists of 110 nos. of prefabricated parallel wire strands each having 127 wires with a diameter of 5.91mm.

The tower is 236.4m 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+146m are further divided into 4 panels to keep weight of each panel less than 46ton which is a 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 vibration (VIV) caused by wind in the bridge transverse direction with some specific wind speed.

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