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Izmit Bay Suspension Bridge – Deep Water Tower Foundations

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Abstract

This paper describes the concept development and subsequent detailed design of the deep water tower foundations for the Izmit Bay suspension bridge with a main span of 1550m. The foundation concept developed is an innovative design combining a traditional cellular concrete caisson with two cylindrical steel/concrete composite columns. Because the foundation concept is particularly optimized for resisting severe seismic loads the paper focusses on the required advanced modelling of soil-structure-interaction in relation to non-linear seismic time history analyses. The marine environment and deep water represents important challenges in relation to construction and long-term durability. The paper describes innovative solutions to deal with these challenges.

Keywords: Suspension Bridge; Seismic Design; Caisson; Soil-Structure-Interaction; Impressed current cathodic protection.

1 Introduction

The Izmit Bay suspension bridge will be located in Turkey between the Diliskelesi peninsula on the north side of Izmit Bay and the Hersek peninsula on the south side. With a main span of 1550 m, (see Fig. 1), it will be the 4th longest spanning suspension bridge in the world by the planed time of inauguration in early 2016. The bridge is part of the new Gebze-Orhangazi-Bursa-İzmir motorway across the Sea of Marmara at the Bay of Izmit.

2 Challenges for the tower foundation design

The most important challenges for the tower foundation design of the Izmit Bay suspension bridge are as follows:

- Poor (soft) soil conditions
- Severe seismic conditions
- Large ship impacts to be resisted
- Marine operations in deep water
- Short construction period
- Durability in marine environment

The ground profile ranges from dolomitic limestone at ground level on the northern side of the Strait to a kilometre thick sandwich of silty sand and clay layers overlying the bedrock on the south side. At both tower foundation locations the bedrock is deep below the seabed, however, considerably deeper at the south side leading to different conditions in relation to seismic response. The top of the soil deposits are very loose/soft and susceptible to liquefaction under seismic loads.

A major right lateral strike slip fault forms the tectonic boundary between the Eurasian plate and the Anatolian block of the African plate. The northern part of the Anatolian fault occupies the Izmit Bay and projects across the bridge alignment

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