

Innovative geotechnical solutions to meet the demands of the 1915 Çanakkale bridge

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ABSTRACT

The 1915 Çanakkale suspension bridge with a world record main span of 2023 m crosses the strait of Dardanelles linking Asia and Europe. Innovative solutions were called for to meet the onerous geotechnical challenges: (i) soft Holocene lagoon deposits (sand, silt, clay, peat) with liquefaction risk in the top layers, (ii) highly seismic region of the North Anatolian fault zone, (iii) water depth in excess of 80 m, (iv) ship impact loads from the very busy Dardanelles strait, (v) movable sand ridges and risks of near-shore slope instability and (vi) very variable depth to weak bedrock of Miocene Mudstone and Sandstone. Detailed ground investigations and site walkovers allowed an optimised alignment taking advantage of rock outcrops on both sides of the strait to avoid piling in the Lagoon deposits. The anchor blocks are enormous concrete structures featuring innovative application of barrettes (Asian side) to enhance the sliding resistance in the weak rock and placement of backfill as counterweight on the rear of the European Anchor Block, which is placed into the rock outcrop. The tower foundations are hybrid solutions with steel pile inclusions for soil improvement and a gravel bed acting for load transfer to the piles and as a horizontal fuse between the caisson base and free-standing piles. The paper describes the solutions to the design and construction challenges related to towers and anchor blocks foundations imposed by the world record main span, the short construction period, the seismic setting, and the ground conditions.

Keywords: 1915 Çanakkale bridge, geotechnical engineering, tower foundations, anchor block foundations, alignment optimisation.

1 INTRODUCTION

Due to the world record span length of the 1915 Çanakkale Bridge, the overall solution as a suspension bridge was a given. The challenge facing the geotechnical design engineers was to make bold decisions on the position of towers and anchor blocks and the foundation method for towers, anchor blocks and side span/approach piers based on the available feasibility study and the specified alignment corridor together with ground investigations carried out during the tender period. To await the detailed ground investigations would jeopardize the overall programme.