Design of a 120 m high GFRP Landmark tower

Liesbeth Tromp, Ernst Klamer, Kees van IJselmuijden, Ton Boeters.

Royal HaskoningDHV, Rotterdam, the Netherlands

Contact: Liesbeth.Tromp@rhdhv.com

Abstract

As an entrance gate to Jeddah (Saudi Arabia), at the new separated junction on the King Abdul Aziz Square, an architectural landmark structure has been designed with a record height of 120 m. The structure consists of two tall curved pylons at each side of the road that are connected at approximately 20 m from the top. The cross section has an airfoil shape and is designed as a stiffened shell structure. Glass Fiber Reinforced Polymer (GFRP) is used as the main construction material. GFRP is a durable and sustainable construction material. Using GFRP the weight of the towers is minimised, saving substantial material and costs in the foundation. More importantly, using GFRP rather than steel, the maintenance of the structure is minimized, thus preventing hindrance of traffic. In this paper the reference design of the Landmark is described and choices that have been made in the design and the design method are explained.

Keywords: Glass Fiber Reinforced Polymer (GFRP), tower, low maintenance, CFD, design, lightweight engineering, structural analyses, earth quake.

1 Introduction

As an entrance gate to Jeddah (Saudi Arabia), at the new separated junction on King Abdul Aziz Square, an architectural Landmark structure has been designed with a record height of 120 m. The curved shape of the Landmark is emphasized by illuminating the structure during the night, see Figure 1. The structure consists of two tall, curved pylons at each side of the road that are connected at approximately 20 m from the top. The pylons have an airfoil-like cross section and are leaning backwards in the direction of the road. They resemble pylons of a cable stay bridge, but have no supporting function for the Balanced Cantilever Bridge. The pylons are each connected to bridge deck by seven cables designed to have minimum force interaction with either structure.

Figure 1. Visualisation Landmark tower by night

The Landmark tower is located in an earthquake sensitive area.

The cross section is designed as a stiffened shell structure. Finite element analysis have been carried out to determine the dimensions and the

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