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Structural design of The Icon Hotel in Dubai, UAE

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This paper presents aspects of the structural engineering behind The Icon Hotel, a 42-storey tower set to form part of the Dubai Promenade in Dubai, a new waterfront development by Nakheel. With its unique 'doughnut' shape, this building has significant design and construction challenges. It is designed to accommodate hotel and residential occupancies together with the associated mechanical floors. The building's primary structural system consists of two concrete core walls placed 96m apart at either end of the building and partially coupled by three mega steel trusses at upper mechanical floor as well as three long-span steel arches located at the top level to form the required shape of the building. Several design parameters such as the main gravity and lateral load resisting systems, floor system, and axial column shortening are discussed. In addition, the site geotechnical conditions, wind tunnel study and seismic hazard study output are

also presented. Performance based seismic design analysis is also used to evaluate the building behaviour during future anticipated earthquakes. This paper discusses the technical complexities and innovative structural solutions which underpin this piece of cutting edge architecture.

Introduction

The Icon Hotel, one of the world's first wheel shaped buildings, will be a new distinctive symbol not only for Dubai but for the whole of the UAE. This project is considered as a jewel among a series of Nakheel's luxurious developments in Dubai. The location of the hotel within the Dubai Promenade with exposure to the Gulf and unique location within Dubai Marina, the world's largest man made Marina, adds to the value and the exclusivity of the hotel. The hotel is designed to be 5-plus star and includes 204 guest rooms and 261 free-hold branded serviced apartments together with two mechanical floors located at levels 8 and 34. Fig 1 shows the architectural rendering of The Icon Hotel.

Various options were studied at the concept design stages for the stability, floor plates, vertical elements and foundation. After analysing their merits together with input from LERA (Leslie E. Robertson & Associates), who were appointed by the client as third party reviewers, the structural system finally selected for the project is discussed in the following sections of this paper. The pre-construction advice by Samsung Corporation on construction methodology also played a vital role in establishing the optimum structural solution. The construction of this project has been currently placed on hold, while the engineering design phase is almost complete.

Structural system

The wheel shaped tower is 160m high with an external diameter of 165m, an internal diameter of 78m and a depth of 35m. Several special structures such as an atrium, ballroom, and sky-lift are also attached to the building which are described here. Fig 2 shows the 3D ETABS (Computers and Structures, Inc, 2009) model of the tower.



1 Dubai Promenade featuring The Icon Hotel (architectural rendering)