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DUBAI CANAL FOOTBRIDGES: AN ENGINEERING REPLY TO A STUNNING ARCHITECTURAL CHALLENGE

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Summary

As part of a worldwide team of companies involved in the development of the Dubai Water Canal, Redaelli has supplied and installed cable systems for two of the five pedestrian bridges included in the project. This paper summarizes main characteristics and challenges of the supply and installation of cables for this outstanding international cooperation. First the suspended footbridge FB01 and then the arch footbridge FB02 are analysed separately, to provide a clear overview of both structures.

Despite the strict project schedule (the entire development was completed in three years), cables supply and site operations were concluded within the demanded timetable, with all technical and quality requirements successfully achieved.

Keywords: footbridge; arch bridge; cable-suspended; full locked coil cable; architectural design

1. Introduction

The Dubai Water Canal is one of the major contemporary architectonic masterpieces. A skilled global team has cooperated to create a new navigable waterfront, which cuts through the emirate, making the Business Bay District a new island in the Arabian Gulf.

The canal is 3.2 km long, with a 6.4km long waterfront. The full length of the canal has five pedestrian bridges, all with unique aesthetic requirements and all fitted with electric elevators and escalators on both sides. Due to the massive scope of the Dubai project, a working group of international companies was formed, involving 4.600 workers. Redaelli have supplied and installed cable systems on both arch and cable-suspended pedestrian bridges.

2. Footbridge FB01 and Footbridge FB02

2.1 Main Characteristics of the structure

The first pedestrian bridge (FB01) is a metal bridge suspended by steel cables, with a total span of 120 m and a deck width of 6 m, characterized by the special design of the masts. The 69 m main span hangs from two 22m high pylons with a distinctive Y-shape. The eccentricity between footbridge and upper anchorages on the pylons gives the catenary effect on the plan view. Due to the y-shape mast configurations, the angles are not vertical but inclined with an angle close to 45°.

The second pedestrian bridge (FB02) is a huge arch structure with a 205 m span and 40 m high. The deck has a distinctive S-shape design, with eccentric steel hangers' arrangement, which permits to create a grandest architectural signature even viewed from a distance. The s-shape outline of the deck marks out the structure, together with the hangers' configuration. All cables are anchored to the arch centreline at the topside, whereas the bottom anchorages are located on the left side of the deck for the first half of its length and to the right sides of the deck for the other half.

2.2 Cable Systems

Redaelli supplied back span and main span full locked coil cables and rod system for the hangers of FB01 and full locked coil cables for the hangers of FB02.

Cables are manufactured using hot-dip galvanized high strength steel round wires, spun in opposite directions around a central core. Full lock coil cables (FLC) have external layers of Z-shaped wires, which provide self-locking of the cable section. Adjustable sockets allow for a regulation on the final cable length during installation and tensioning operations. In order to permit possible adjustment in the alignments of the structures, clamps and anchorages of these footbridges are designed with special spherical bearings.

2.3 Site Operations

Cables related site operations included installation and tensioning.

Cable tensioning is performed with all cables installed and structures placed on temporary supports. An increasing force is applied to the cable using jacking systems until the target force-geometry is achieved. Throughout cable tensioning process, the geometry of the footbridge is strictly monitored to verify that the actual displacements of the structure comply with the designer tensioning procedure.

3. Conclusions

The Dubai Water Canal is a challenging project, which aims to realize a land marking architectural design within an extremely tight design and construction plan. Despite all challenges derived from these requirements, the overall project succeeded and accomplished all technical and timing demands.

Cables were supplied as a high quality prefabricated system, produced under factory controlled conditions which permit to achieve the strict tolerance required by the coupling with spherical bearings. This prefabricated system has a simple and more rapid installation and tensioning process, thus minimizing both cost and time of site activities. These parameters were vital in the completion of pedestrian bridges FB01 and FB02 and therefore made Redaelli a successful player in the grand global team that cooperated to deliver this magnificent project.



Fig. 1. View of FB01 and FB02 from the waterfront.