DOI: 10.24904/footbridge2017.09919

ARCHITECTURAL CONCEPT OF A CABLE-STAYED, MOVEABLE FOOTBRIDGE

Paweł HAWRYSZKÓW

Assistant Professor
Wrocław University of Science and Technology
Wrocław, Poland

pawel.hawryszkow@pwr.edu.pl

Wojciech ZIELICHOWSKI-HABER

PhD, Civil Engineer
KPS
Leeds, United Kingdom

w.zielichowskihaber@gmail.com

Aleksandra RUTECKA-BLIMKE

Architect
Rutecka-Blimke-Zachariasz Architects
Warsaw, Poland

olarut@wp.pl

Anna ZACHARIASZ

Architect
Rutecka-Blimke-Zachariasz Architects
Warsaw, Poland

anaza2@o2.pl

Keywords: conceptual design; cable-stayed structure; moveable footbridge

Abstract

The footbridge under consideration in the paper (Fig. 1 ÷ 3) was the entry for an international competition for the design of a moveable pedestrian bridge [1, 2] over the Motława River in Gdańsk (Poland). The design competition has attracted great attention due to the prestigious location of the footbridge in the centre of the historic vibrant landscape of Gdańsk.

The footbridge over the Motława River which linked the Gdańsk Old Town and the Ołowianka Island was designed as a three-span structure. The footbridge comprises a short span on the side of the island of Ołowianka with a length of 9.50 m, the swing span of 49.0 m and a second short span on the side of the Old Town of 15.0 m in length. The navigation clearance between piers is 40 m and the total width is 6.80 m.

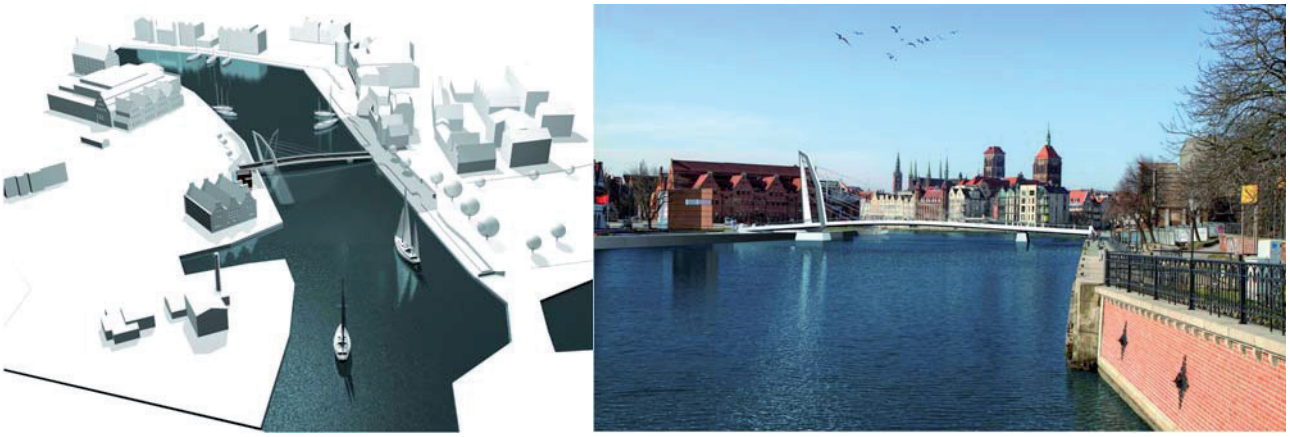

Fig. 1. Bird's eye view on the footbridge with the city's landscape and its architectural visualisation.

The swing span of the footbridge was proposed as a cantilever spar cable-stayed structure comprising an asymmetric pylon which was fully fixed in a rotating deck. The height of the pylon is 17.35 m. The pylon was architecturally shaped as a sail which refers to the River Motława's function, serving as a ship canal and a marina. The cable-stayed arrangement consists of five pairs of cables supporting the deck and five cables bracing the pylon arms together. The stay cables are arranged in a harp form. The side span at the Ołowianka Island was designed as a cantilever structure and the span on the side of the Old Town was proposed as a simply supported beam. The following construction materials were used: galvanised steel for the footbridge superstructure, reinforced concrete for its substructure and tropical wood for the deck surface.

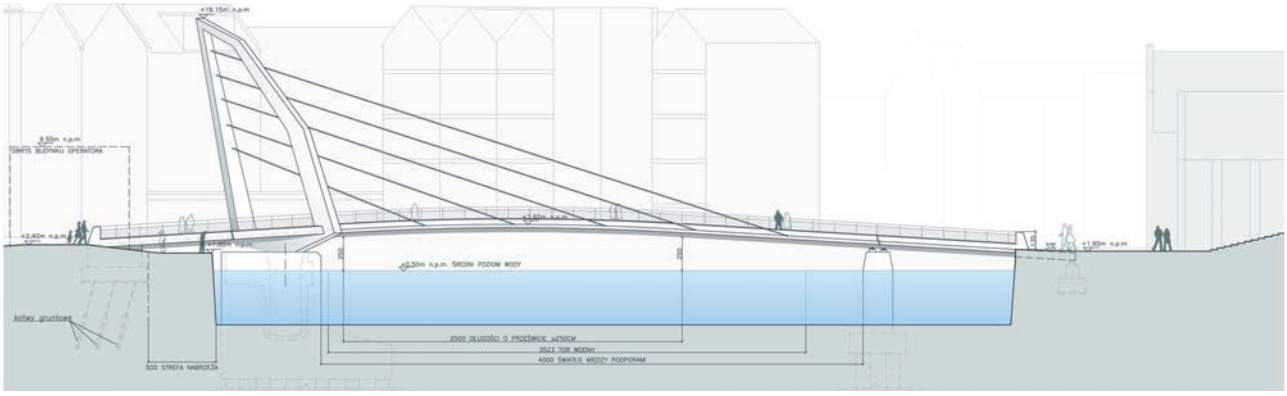

Fig. 2. Side view of the footbridge.

The footbridge was designed as per the ultimate and serviceability limit state requirements to the Eurocodes and Polish Standards with the use of two computational models. The proposed footbridge was thoroughly analysed in terms of its structural integrity with the help of FE-based computer models for its superstructure and substructure was finally value engineered to provide the robust, buildable and cost-competitive solution.

Fig. 3. Architectural visualisation of the footbridge in daylight and at night.

The key assumption for design development was to fit the footbridge into the historic landscape formed by soaring buildings. The design aimed to emphasise the harbour nature of the city by proposing the concept of sail-shaped pylon which referred to the regatta of Gdańsk. As a result, compelling and elegant design concept of the superstructure was proposed with the pylon constituting a distinctive landmark (yacht with sails). The conceptual design of the footbridge, undertaken by the young project team, successfully competed with some renowned design consultancies. The motive of the sail and the low-relief in the form of a wind rose, proposed on an approaching walkway on the side of the Ołowianka Island originated in the "Four wind sail" name for the footbridge.

References

[1] KOGLIN T.," Movable Bridge Engineering", John Wiley & Sons, July 2003.

[2] AL-KHAFAJI T., ZOBEL H., " Mosty ruchome", Wydawnictwo Naukowe PWN, Warszawa 2015.