



Structural Design of the Vroenhoven Bridge, Riemst, Belgium

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Summary

The once-standing, now-demolished bridge of Vroenhoven had become an obstacle for water traffic due to the enlargement the Canal Albert to a clearance gauge for vessels up to 9000 tons, linking Liège and Antwerp. The existing bridge and nearby bunker were classified in 1995 as unique remnants of the battle on 10 May 1940 when Germany invaded Belgium. In spite of this classification, the government decided to replace the existing bridge. The new project consists of two distinct large-scale elements: a bridge and building. The building enabled the conservation of the classified bunker. The new bridge is a cable-stayed bridge with a total length of 195m including 3 spans. The width of the composite bridge deck is 18,24m.

This article will describe the principle characteristics of the project and the ways in which the conservation of a classified feature significantly influenced the phasing of the construction, and the design consequences.

Keywords: bridge, bunker, composite bridge deck, construction phases.

1. Introduction

The new bridge in Vroenhoven replaces an old classified structure crossing the Albert Canal in Belgium. It is in fact on this very spot that the first battle took place and Germany invaded Belgium at the beginning of the Second World War. The bridge with a span of 40m compromises free transit through the canal to a width of 27m. However a clearance gauge for water traffic of 86m was necessary to compete, and to satisfy the new water traffic requirements. The project put forward took into account these security requirements for shipping and the historical value of the site.

2. Description of the structure

The new bridge is a cable-stayed bridge with a total length of 195m consisting of three spans: the main span supported by the stay cables of 107m and two secondary spans of respectively 40m and 48m.

The width of the composite bridge deck measures 18,24m and consists of two steel trapezoidal box girders connected with transversal beams, a concrete bridge deck with varying thicknesses between 22cm and 30cm connected to the steel structures by means of headed concrete studs, type Nelson. The use of these two steel box girders with varying heights between 1,80m and 3,10m provided a physical barrier between heavy traffic and cyclists and pedestrians on the other hand. The changing structural height of the girder explains the structural behaviour of the bridge and reveals the distribution of forces in relation to its users.

The footpath and cycle path are situated on a lighter cantilever structure provided by a glazed railing. The stay cables are an extension of the principal load-bearing structure. The stay cables are steel boxes with a rectangular section and varying heights inclined outwards originating from the steel box girders.

The abutment side Maastricht has a traditional typology: reinforced concrete founded on well foundations. The mid support is a reinforced concrete column, clamped at its base, where the

foundations are realized by secant piles with a diameter of 120cm. A forked steel structure, constructed with trapezoidal steel boxes of varying heights connects the concrete column with the steel box girder of the bridge deck.

On the side of Riemst the bridge is supported on a building which serves as both a museum and a bridge support. The building is extended under the bridge and marks a powerful visual (between the structure and site) and historical link. The museum contains multifunctional spaces, a bar and a restaurant. An amphitheatre allows for the organization of larger-scale cultural activities. The exterior walls, extending 170m, are made of relief concrete in tints of white and yellow, and serve as climbing walls. The central point in the building is the information centre. An artistic integration under the existing classified bunker tells the history of the war. The bunker looms above the building as the silent witness of the German invasion that took place 70 years before.

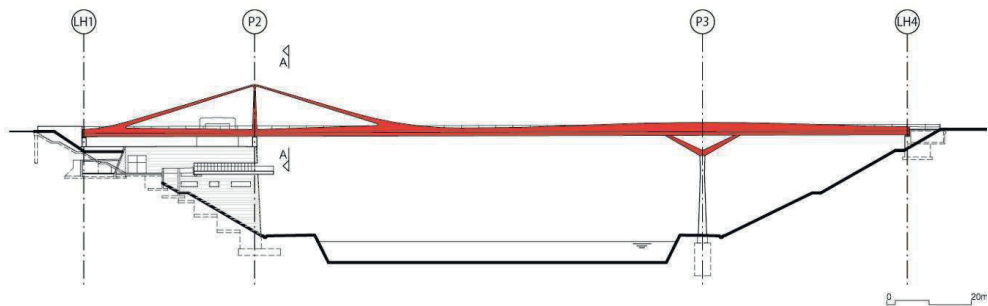


Fig.1 : The bridge of Vroenhoven - Elevation

3. Construction stages

Given the impact of the construction on its surroundings, different construction stages to be respected by the contractor were essential for the project. The construction stages had a large impact on the assumptions to be made for the structural analysis. The main stages in the construction were:

- The displacement of the classified bunker, because the bunker was located within the clearance gauge of the new bridge and its conservation as a remnant of the battle on 10 May 1940.
- The longitudinal launching of the new bridge, to minimize the impact of its construction on the road and water traffic and to allow the construction of the museum and the future bridge supports where the old bridge was located before.
- The demolition of the existing bridge, to enable the construction of the building, the future supports of the bridge occurred on the exact site as the supports for the existing bridge.
- Construction of the building, which supports the bridge and to accommodate other functions. The building contains three levels with a total height of 25m and large retaining walls with a total length of 170m. The walls of the building were made of tinted relief concrete forming a coherent and harmonious addition to the site.
- The transversal shifting, once the final bridge supports on each side of the canal and on the building were realized, it was possible to slide the new bridge in its final position. This shifting consisted of a lateral movement of the entire bridge over 25m.