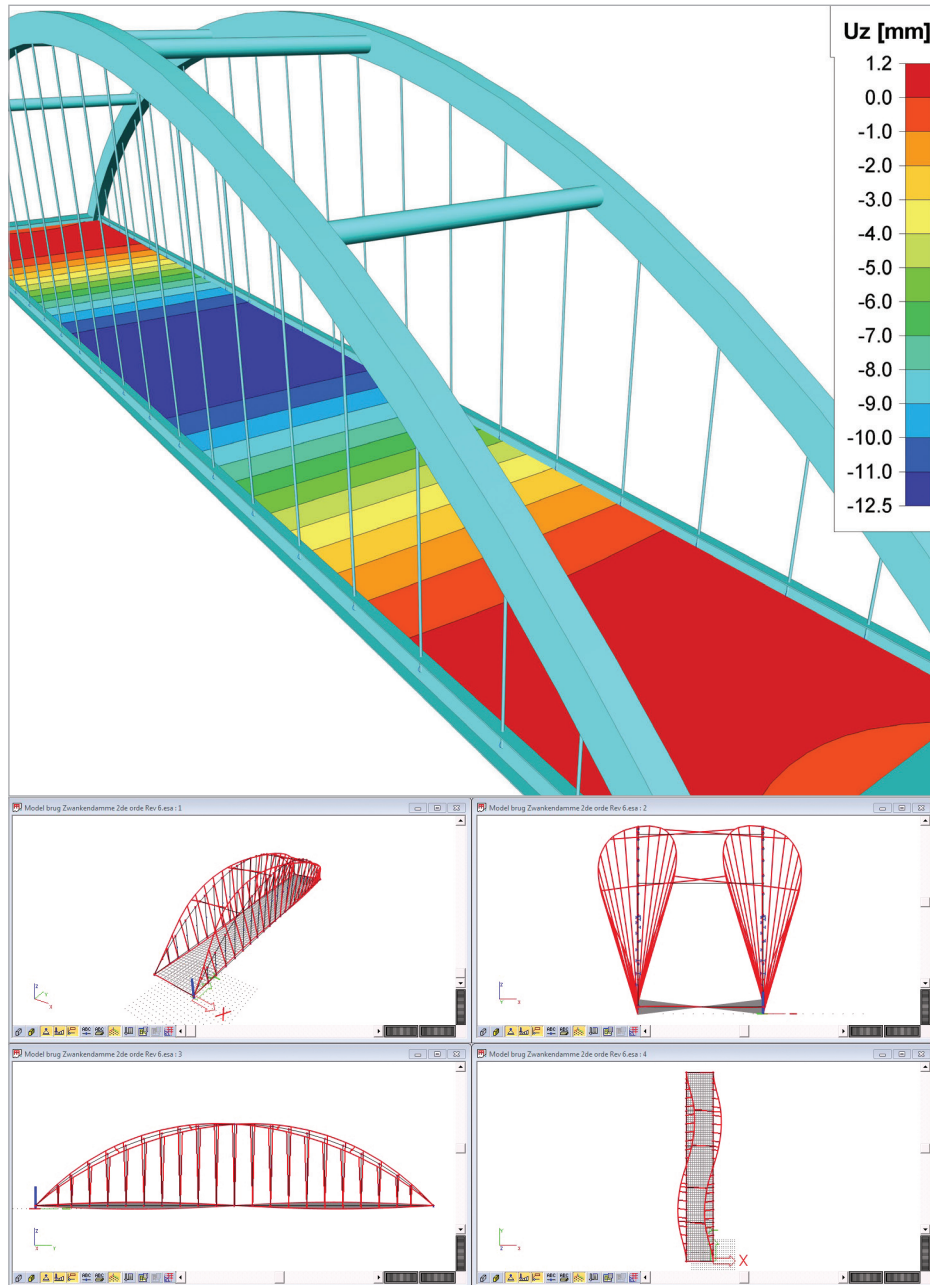


# Bowstring Bridge - Zwankendamme, Belgium



## Description of the bridge type and its characteristics

In order to respond to the expansion of the Port of Zeebrugge and the need for more capacity in container traffic, the number of tracks of the “Bundel Zwankendamme” has to be increased. Simultaneously, the safety will be increased by replacing the level crossing situated at Wulfsberge with a road bridge crossing the railway tracks. The solution of a large single-span bridge was chosen: a bowstring bridge in steel with tie rods and prestressed concrete decks. The abutments are in concrete and founded on piles.

The characteristics of the bridge are:

- A single span of 87.98 m.
- Steel grade S355J2G3.
- The cross-sectional view.
- 2 lanes for vehicles, each 3.5 m wide.
- An emergency lane, 1 m wide.
- A cycling path, 3 m wide: two-way traffic, also intended for occasional pedestrians.
- A high safety barrier (type IVB) and safety kerb (type IVA) will be installed for road traffic safety.
- Four pot bearings will support the bridge.
- Each abutment is supported by 60 concrete screw piles with a 60 cm diameter: 48 are vertical and 12 at a 1/10th angle. All have the length of 18 m.
- The bridge is made of 560 tonnes of steel.

## The bridge concept

As there will be a set of railway tracks under the bridge, it is not possible to build intermediate pillars. They would restrict the options of the track layout and they would have a minimum distance to the railway tracks.

In addition, they would need to be dimensioned to cope with the considerable accidental collision forces.

For the 88 m span the arch bridge is the best option from a financial point of view. The construction height (distance between the upper side of the road and the bottom of the main girder) is very small for this kind of span, only 85 cm.

The bridge has to be able to carry extraordinary loads of 360 tonnes, hence 12 axles of 30 tonnes.

The choice was made to provide one mixed cycling path rather than two single paths + footpath because all the cycling routes are on the south side of the bridge. The north side contains nothing but industrial sites. Intense usage by pedestrians is not expected.

Finally, the bowstring bridge is to be welded and assembled in place with minimal interference with the railway traffic.

The bridge will be put in place during a weekend when railway traffic is interrupted, so with minimal disturbance.

## Calculation techniques, technical specifics

3D modelling of the bridge was carried out in Scia Engineer 2011 to ensure the most accurate tension calculations.

A global model has been built to calculate the strength, stiffness and fatigue of the main steel structure and the prestressed concrete decks.

Geometry, material properties, preconditions and loads were all uploaded into the program.

A second-order check was also carried out in Scia Engineer.

Everything has been dimensioned and checked according to the Eurocodes.

This includes the following elements:

- Bearings
- Profiles
- Second-order check
- Prestressed decks
- Steel joints
- Several connections
- Abutment
- Girders between the arcs

## Used modules

- Steel code check (EC)
- Stability
- Physical non-linear conditions

Contact Alex Lefevre  
 Address Frankrijkstraat 85  
 1060 Brussel, Belgium  
 Phone +32 2 525.23.59  
 Email alex.lefevre@infrabel.be  
 Website www.infrabel.be



Infrabel is responsible for the Belgian railway network. Every day, 12,364 employees ensure optimum performance of our equipment: railways, catenaries, switches, signals, crossings, etc. Mobility and accessibility in Belgium are our primary tasks, which is why we keep expanding our railway infrastructure. Our mission: to develop a safe and high-quality railway network for all the trains of the future. In our role as infrastructure manager and operator of the Belgian railway network we distribute the available capacity on the railway lines and coordinate all the trains running on Belgian territory. In our endeavour to create optimum opportunities for train traffic we are expanding the railway network so as to make it a strong link within a sustainable transport system. The central location of our railway network within Europe offers plenty of opportunities for the socio-economic development of our country. Infrabel makes good use of these opportunities and through numerous projects continues to turn the Belgian railways into an indispensable means of transportation.

Project information

Owner Infrabel  
 Architect Infrabel I-I.53  
 General Contractor West Construct: Besix, Aelterman  
 Engineering Office Infrabel I-I.53  
 Location Zwankendamme, Belgium  
 Construction Period 10/2012 to 02/2014

Short description | Bowstring Bridge

For the container traffic in the Port of Zeebrugge there was a big need for an extra set of tracks. The new set of tracks would disconnect the village of Zwankendamme from the N 31 road. To maintain the connection there was the need to build the bridge. We chose a bowstring bridge because there is a span of 88 m and for this range a bowstring is the most economical solution. As there will be a set of railway tracks under the bridge, it is not possible to build intermediate pillars. They would restrict the options of the track layout.

