Grontmij

Contact Anne-Caroline Kiekens, Bart Van de Sijpe
Address A. Gossetlaan 28A
1702 Groot-Bijgaarden, Belgium
Phone +32 2 383 06 40
Email anne-caroline.kiekens@grontmij.be
Website www.grontmij.be

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Feasibility Study of Vilvoorde Viaduct - Brussels, Belgium

This project concerns a feasibility study of an extension of the capacity of the Vilvoorde viaduct. Currently there are three lanes in each direction. The study examined the possibility for four lanes in each direction. The fatigue phenomenon was also investigated.

Geometry

The Vilvoorde viaduct consists of two adjacent bridges, each 20 meter wide. The total length of each bridge is about 1.700 meter. Coming from the direction of Strombeek-Bever, four parts can be distinguished:

- Part A consists of a composite steel - concrete structure with a total length of 288 meter.
- Part B consists of a steel caisson with a steel orthotropic deck. This part has a total length of about 880 meter and contains the largest span of 162 meter.
- Part C with an identical structure as part A has a total length of 400 meter.
- Part D is a superstructure of prestressed concrete with a total length of 130 meter.

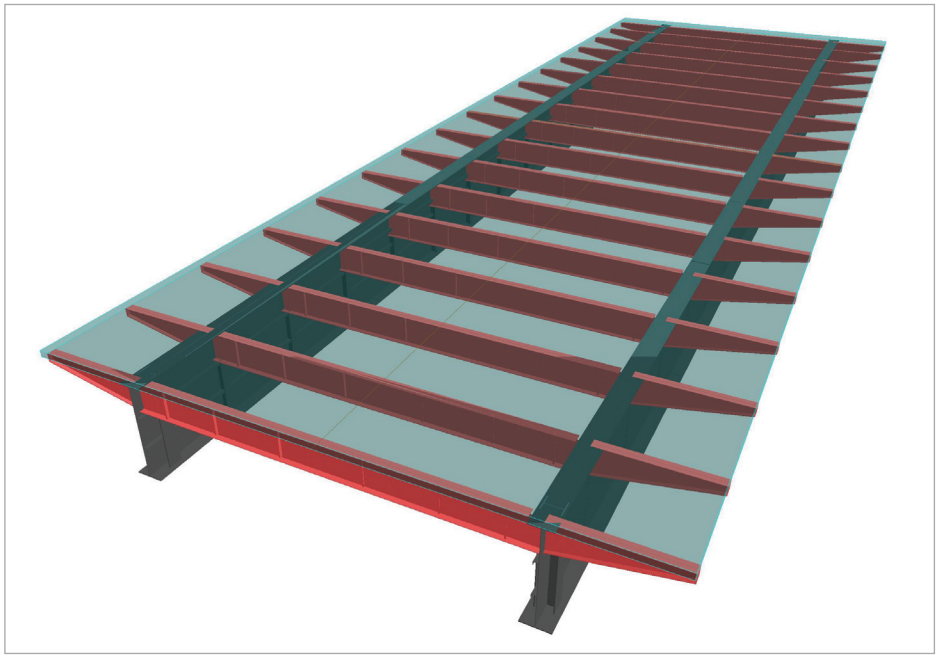
Parts A and B were investigated in the study. Part A consists of 5 spans of 58 meter.

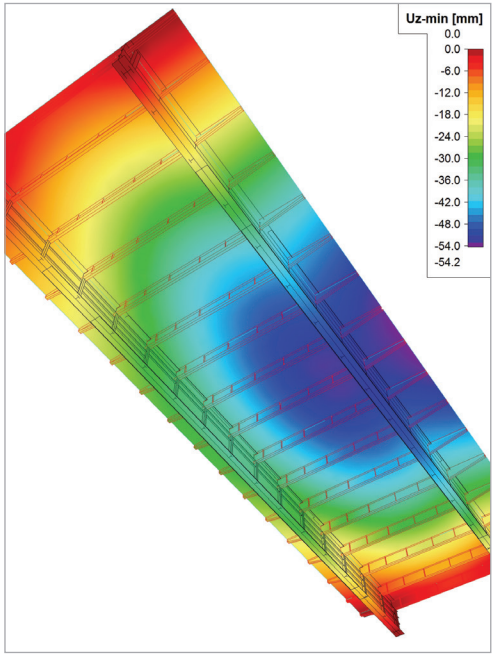
The supporting structure is a composite beam composed of:

- A steel substructure composed of two main girders and 17 cross beams. The main girders have a height of 3.2 meter and were prestressed during construction phase.
- A concrete slab with a thickness of 220 millimeter.

Part B consists of a steel caisson with an orthotropic steel deck. The steel caisson has a width of 8 meter and a height of 5.6 meter. On each side of the box, the deck has a cantilever of 6 meter. The part B is a hyper static structure from pillar 6 till pillar 13 and has a total length of 880 meter. The spans vary from 90 to 162 meter. Part B is fully curved with a radius of 700 meter.

The viaduct was built in 1977 and was originally designed for 4 lanes. Until now, with the exception of a short period for maintenance, there were only 3 lanes on the viaduct. Meanwhile, the design methods have evolved to take into account the busy traffic and the heavier axle loads and there is a better understanding of the fatigue phenomenon.





Part A

For part A two different models were made in Scia Engineer. A first model was to investigate the time dependent effects of the concrete. A second model was to analyze the mobile loads. The model was made with 2D plate elements.

Part B

Part B of the bridge was also modelled in Scia Engineer. To make a workable model that was also sufficiently accurate, different levels of refinement were used. For the area under investigation the level of refinement was high. However for parts further away from the investigated zone, the level of refinement was reduced, for example by modelling the longitudinal stiffeners in the thickness of the plate. It was always verified that the self-weight of the structure was correct. The validity of the various refinements was separately tested in different models.

Software: Scia Engineer

Feasibility Study of Vilvoorde Viaduct

Brussels, Belgium

Project information

Owner	Belgian state
Engineering Office	Grontmij
Construction Period	From 1977 to 1978
Location	Vilvoorde, Belgium

Short project description

The project is about the viaduct of Vilvoorde, part of the R0 Brussels beltway and built in 1977. It concerns a feasibility study of an extension of the capacity of the Vilvoorde viaduct. The study examined the possibility for four lanes in each direction and investigated the fatigue phenomenon. Parts A and B were modelled in Scia Engineer. Part A consists of a composite steel - concrete structure with a total length of 288 meter. Part B consists of a steel caisson with a steel orthotropic deck. This part has a total length of about 880 meter and contains the largest span of 162 meter.