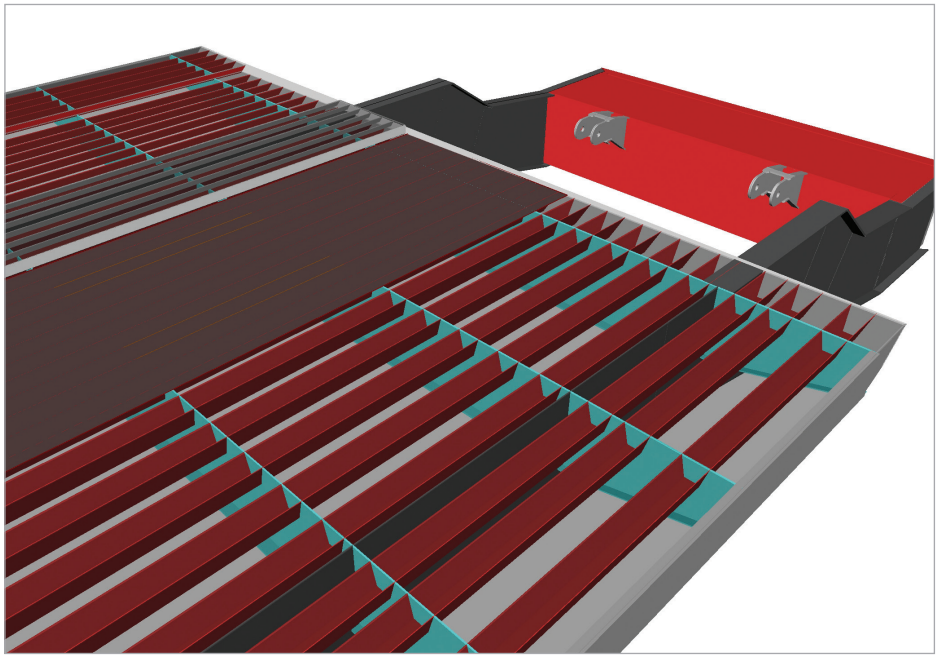
Ingenieursbureau Oranjewoud B.V.

Contact ir. George Bitter, ing. Hans Zuidema
Address Postbus 10044
1301 AA Almere, The Netherlands
Phone +31 36 5308000
Email george.bitter@oranjewoud.nl
Website www.oranjewoud.nl

Oranjewoud: A world of opportunity!
Comfortable living, work, travel and recreation are only possible with a proper understanding of space. Oranjewoud's fields of activity consequently range from urban development, mobility, construction and property to rural development, water, the environment, safety, sport and recreation.
We operate in the Netherlands and on an international scale too. Oranjewoud was a major force in land management under Frisian management some 60 years ago. Our organisation has developed into an all-round partner and is much more than just an engineering consultancy.

Mission
Oranjewoud aims to be a leading partner in the development and application of sustainable and integral solutions relating to all aspects of our living environment, such as home, work, recreation, mobility and the environment.

Core values
Enterprising, People-oriented, Development, and Character.



Software: Scia Engineer

Bridge Renovation Project - Dordrecht, The Netherlands

As part of the project "bridge renovation", a project of the Netherlands Directorate-General for Public Works and Water Management (RWS), potential measures are under consideration for drawbridges exhibiting fatigue issues.

In addition to total replacement of the bridge decks, another option would be to reinforce the existing decks by gluing a steel plate onto the slow lanes. The required remaining service life of these bridges should be 30 years.

One of the bridges under consideration is the Wantij bridge on the Dordrecht ring road (N3).

Deck structure

The orthotropic deck is made from a 12 mm thick steel plate. This plate is supported by stiffeners spaced 600 mm centre-to-centre. These are trapezoidal profiles made from 6 mm sheet material, with a height of 250 mm and a width of 300 mm. The profiles are welded between the cross girders.

The deck is reinforced by a 6 mm thick steel plate that is glued to the 'slow lane'. This is the right-hand lane of the main roadway. This lane will be subjected to the heaviest loads from cargo traffic.

The stiffeners are supported by six cross girders. These are supported by two main girders which extend to the counterweight. The spacing of the cross girders is 2.905 mm.

The main girders are manufactured from composite I-beams and have a structural height of approximately 2.05 m at the main bearing, decreasing to 1.30 m at the roadway. The cross beams are also designed as a composite I-beam.

The main bearings of the deck are positioned both on the inside and outside of the main girders. This limits the torque in the main girders. The deck has a span of 15.5 m and a width of approximately 8.5 m. The width of the deck is 15.2 m.

Use of Scia Engineer

A global model has been built to calculate the strength, stiffness and fatigue of the main steel structure and the deck superstructure.

Three models were created:

1. Strength and fatigue calculation model for a reinforced deck outside of the motion cycle (due to traffic).
2. Fatigue calculation model for an existing deck outside of the motion cycle, to determine fatigue damage up to the present day.
3. Fatigue calculation model for a reinforced deck outside of the motion cycle, to determine future fatigue damage.

Furthermore, local models are created to calculate the strength and fatigue of the glue line between the reinforcing plate and the deck plate of the bridge.

Fatigue tests were performed by TNO and Lightweight structures BV to determine the fatigue strength of the glue line. To determine the Sigma (N)-curve as a boundary value we created a Scia Engineer model of the test setup and used the test results.

Results:

- The strength and stability of the structure were checked using the steel code check in Scia Engineer.
- A stiffness control is performed.
- The glue line is checked with the local models. To this end the results of Scia Engineer are compared with the results from the fatigue tests.

Bridge Renovation Project

Dordrecht, The Netherlands

Project information

Owner	Directorate-General for Public Works and Water Management (RWS)
Engineering Office	Ingenieursbureau Oranjewoud B.V.
Construction Period	From 2011 to 2012
Location	Dordrecht, The Netherlands

Short project description

The project is about the strengthening or replacing of 3 bridges. In addition to total replacement of the bridge decks, another option would be to reinforce the existing decks by gluing a steel plate onto the slow lanes. A global model has been built to calculate the strength, stiffness and fatigue of the main steel structure and the deck superstructure. Furthermore, local models are created to calculate the strength and fatigue of the glue line between the reinforced plate and the deck plate of the bridge. To determine the Sigma(N)-curve as a boundary value we created a Scia Engineer model of the fatigue test setup.