



Construction of bridge in Rheinfelden, Germany

Fehling + Jungmann GmbH, Kassel, Germany

# Challenging arch structure

Roadways and engineering structures must increasingly adapt to an ever denser transport network. More and more often, this means civil engineering structures have to be oblique in design. Modern CAD and calculation software help meet such requirements in, for instance, bridge construction. Engineers from Fehling + Jungmann found a clever solution to this problem when planning the A98/A681 flyover in Rheinfelden on the High Rhine using Allplan's 3D general arrangement and reinforcement design modules.

At first glance, the planning work implemented by Fehling + Jungmann GmbH for the Baden-Württemberg Highways Agency seems rather unspectacular. However, the remarkable thing about it is that both the general arrangement and the reinforcement for the oblique arched bridge were planned entirely in 3D using Allplan. This well-established engineering company based in Kassel specialises in construction engineering with general arrangement and object planning, building materials and building dynamics and has 35 employees. Four workstations are equipped with Allplan Solid Construction and Allplan Terrain for digital 3D terrain modelling. Last year, one of their projects was the A98/A681 flyover in Rheinfelden on the High Rhine. Construction of the bridge, at a cost of approximately 3.7 million euros, should be completed by April 2010.

The section of the A98 autobahn on top and the section of the A681 autobahn underneath intersect at an angle of 57.15 degrees. The planners opted for an arch and frame design with two separate, longitudinally prestressed superstructures. The footings for the imposts of the reinforced concrete arch were created in the deep bedrock using micropiles. Hence the structural system comprises a continuous oblique plate whereby the middle section creates an arch.

#### **Efficient reinforcement in 3D**

"With this project, the challenges lay in the obliqueness of the structure and in the expansion of the northern superstructure," explains Tillmann Bernhardt, project manager at Fehling + Jungmann. This resulted in a variety of difficulties with respect to configuration of the reinforcements in the reinforced concrete arches, the prestressed superstructures, tendon configuration and the footings for the arch imposts. The abutment footings were based on bored piles. For this, the bedrock horizon was spatially displayed in Allplan following prior ground surveys in order to determine both the bored pile lengths for the abutments and the lengths of the micropiles into the load-bearing bedrock.

"Deciding whether to work in 2D or 3D depends on the phase of work and, more importantly, how many modifications are anticipated," explains Tillmann Bernhardt. "For the design documentation, we usually work in 2D because we expect plenty of modifications at this stage."

Implementation planning is generally carried out in 3D. Parallel to the 2D layout, the 3D view is often run in the background for determining heights, for example. Another of Allplan's strengths is surveying. Such survey data can also subsequently be used as normal. The advantages of 3D come into play during implementation planning in particular. You can tell immediately by visual inspection if the basic conditions no longer tally. This means errors are kept to a minimum.

#### **Powerful all-round solution**

"I do not know of any other program that allows you to implement 3D reinforcements as efficiently as Allplan," explains Tillmann Bernhardt. It is particularly beneficial if additional employees become involved at short notice because it does not take long to learn how to use the software. 3D visualisation allows you to get to grips with the project in no time at all and to optimally exploit individual strengths. 3D has proved successful for determining volumes for concrete cubatures and GA areas as well. "It is easy for us to provide the values during the construction phase. This is of great benefit for both implementation planning and design development: without Allplan, these sometimes very complex calculations would take a long time," explains Tillmann Bernhardt. Another key advantage of working in 3D is the ability to create a spatial PDF and send it by e-mail to project participants. It is so much easier to solve problems than with 2D displays. Project manager Tillmann Bernhardt explains, "This is not necessarily the norm for an engineering company. Our company has gained much respect from our customers thanks to this way of working." Tillmann Bernhardt values Allplan as a good all-round solution that competently covers all the key areas of construction engineering. Other programs may be powerful when it comes to reinforcement, for example, but not surveying. This means having to run various programs simultaneously, which makes keeping data consistent a very laborious job associated with a high risk of error.

Building client: Federal Government  
Construction firm: Bickhardt-Bau AG, Kirchheim  
Design documentation/development: Department 43 - Civil Engineering, Freiburg City Council  
Structural/constructional assessment: Josef Steiner, Ingenieurgruppe Bauen  
Structural analysis: Krüger + Jungmann GmbH, Weimar  
Working drawings: Fehling + Jungmann GmbH, Kassel