Railway bridge Grubental, traffic project German unity 8.1, Germany

Allplan in practice

NICE AND SLENDER OVER THE VALLEY

When traveling by train, we are often led even deeper into the landscape away from this immense infrastructure.

So many beautiful sights can be enjoyed when being safely carried along on rails through mountains and valleys. Trains of course require infrastructure, even if the travelers immersed in the passing panorama hardly notice it. However, the Grubental Bridge near Goldisthal shows that even this infrastructure can sometimes be worth a look.

The section of the new line Ebensfeld–Erfurt was planned by the engineering office schlaich bergermann partner and was carried out by the Goldisthal Railway Bridge consortium (Bickhardt Bau AG and Ed. Züblin AG). Situated about five kilometers southwest of Goldisthal in the Thuringian Forest, the 215-meter long structure spans the Grubental Valley at a maximum height of 35 meters and connects the Goldberg Tunnel with the Dunkeltal Bridge. At the same time, it seems incomparably more delicate and elegant when compared with the neighboring bridge built at almost the same time. The Grubental Bridge owes its slim design to a semi-integral construction method, which largely does without bearings and joints between the superstructure and substructure. It is thus one of the

first of its kind in Germany, but at the same time ties in with the tradition of the historic jointless and bearing-free railway viaducts. The superstructure consists of two-stage, pre-stressed T-beams and is monolithically connected to the truss frame arc and the reinforced concrete pier slabs and is only connected to the abutments at the ends via slide bearings. This monolithic construction method allows for extremely slim piers and a construction height of just 2.4 meters. The truss frame designed as a two-hinged arch also contributes to the elegant appearance, whose slender legs sprawl out lightly to the horizontal element.

The elegance of the bridge is not only intended to be aesthetically pleasing for bridge lovers, but it also serves the valley landscape, which is impaired as little as possible by the structure. However, visual stimuli is not everything that the Grubental Bridge has to offer. Stiffness and vibration behavior are optimally matched to each other. Moreover, due to the balanced load-bearing geometry the tracks could be guided over the joints without rail expansion joints. The bridge construction thus also benefits future rail travelers who will probably hardly be aware of it, except for riding at a height of 35 meters. However, the 215 meter long ride at speeds of up to 300 km/h is also quickly over.

That's how easy and elegant the Grubental Bridge is, how sophisticated its design is. After all, it was necessary to bridge a narrow valley bordered by steep slopes at an angle of about 50 degrees. Thanks to Allplan Engineering, it was possible to record the difficult terrain situation in a digital terrain model (DTM) in no time. For this purpose, the measurement data provided by the client was read into the site plan module and processed accordingly in the "Digital terrain model" module. Of course it is all automated and can be georeferenced. The DTM created in this way was already used in the starting phase in order to, for example, carry out a collision test with the powerful horizontal element foundations, which were also generated in a 3D model in Allplan Engineering. Thus the terrain-related, geometrically challenging excavation planning, including the mass determination, was easy to handle and the complex terrain sections were easy to deduce.

"It is often not necessarily the spectacular features that a CAD program can generate," says Jürgen Schilling, design engineer at schlaich bergermann partner, "but rather the ability to manage everyday work in a practical, efficient and 'safe planning' manner." Accordingly, the engineers were delighted to learn about the practical ability to store drawings structured by type (such as setting out plans, general arrangement drawings, etc.), which made dealing with the many drawings easy and clear. Furthermore, they also benefited from a smooth exchange of data with external

entities (e.g. supplier companies) via the DXF interface as well as from a problem-free transfer of existing plans. The standard-oriented representation of dimensions, texts, hatching, etc. made a smooth trial run possible. The completely georeferenced work in Allplan Engineering ensures that, for example, the overhead power station stands where it should be.

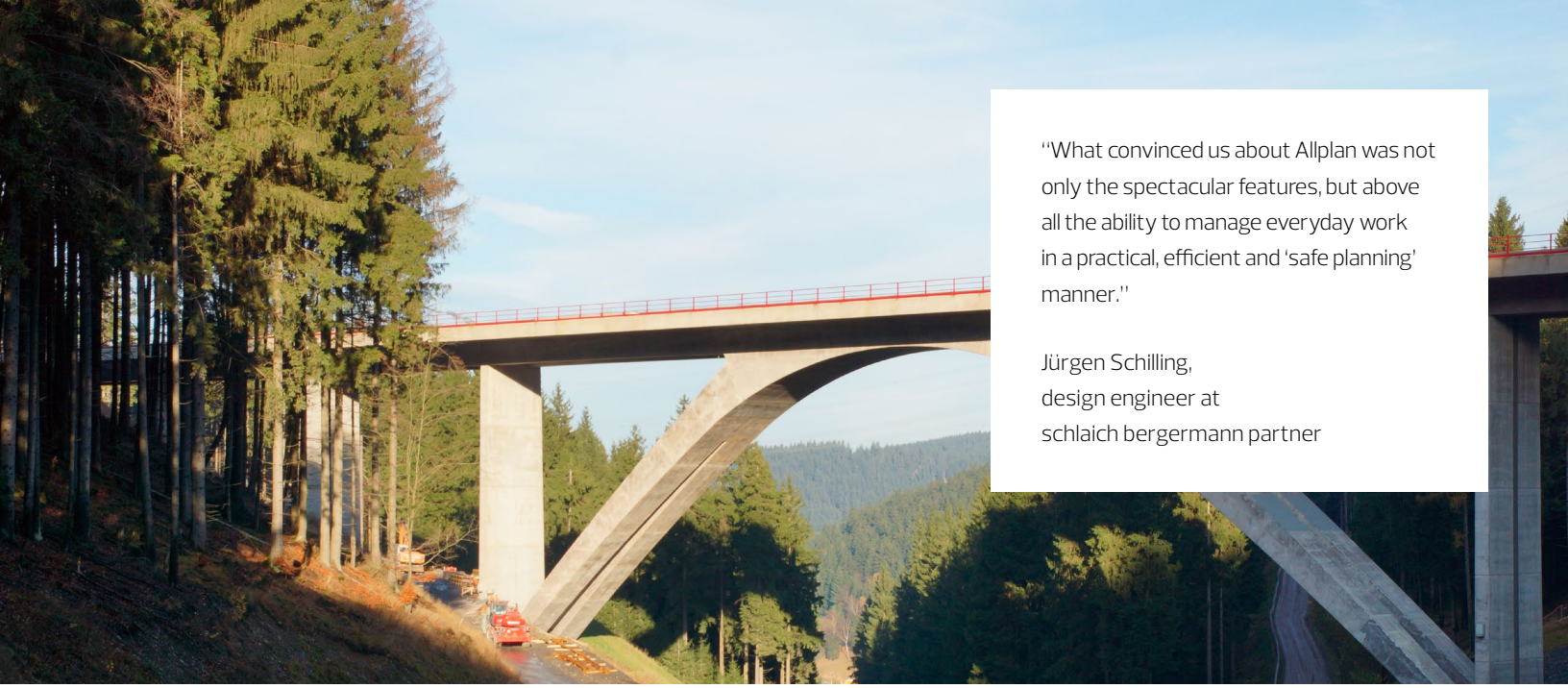
In addition to the many positive properties of this masterpiece of modern engineering art already mentioned, there is still one more that the client (DB Netz AG) will certainly appreciate: sustainability. Due to the semi-integral construction method, the railway overpass is particularly low-maintenance and thus will save costs in the long term. It was therefore an all-round successful bridge construction that as a result was nominated for the German Bridge Construction Award 2016 and was awarded the Ulrich Finsterwalder Engineering Construction Award 2015.

PROJECT INFORMATION AT A GLACE

- **Focus:** Bridge construction
- **Software used:** Allplan Engineering

PROJECT DATA

- **Location:** Ebensfeld – Erfurt, new line
- **Client:** DB Netz AG
- **Building companies:** Consortium Railway Bridge Goldisthal (Bickhardt Bau AG and Ed. Züblin AG)
- **Draft and design planning:** schlaich bergermann partner
- **Start of construction:** 2009
- **Completion:** November 2013
- **Length:** 215 m
- **Arched span:** 90 m
- **Nominal span:** 25 m
- **Bridge width:** 14.10 m
- **Bridge area:** 3,035 m^2
- **Clear height:** max. 35 m
- **Speed:** max. 300 km/h



"What convinced us about Allplan was not only the spectacular features, but above all the ability to manage everyday work in a practical, efficient and 'safe planning' manner."

Jürgen Schilling,
design engineer at
schlaich bergermann partner

THE CUSTOMER

schlaich bergermann partner are independent consulting engineers. For more than 30 years, their goal has been the drafting and design of sophisticated structures. These range from expansive lightweight roof structures, various bridges, slim towers, innovative high-rise buildings to future-oriented solar power plants. As generalists, they want to work cooperatively together at eye level with everyone involved in the planning: clients, architects, specialist engineers, industry and workers. With personal commitment, as a team on the basis of many years of experience and with scientific engineering curiosity. Their main three points of focus are building, solar energy and testing. They bear the uniform script of schlaich bergmann partner.

ABOUT ALLPLAN

ALLPLAN is a global provider of BIM design software for the AEC industry. True to our "Design to Build" claim, we cover the entire process from the first concept to final detailed design for the construction site and for prefabrication. Allplan users create deliverables of the highest quality and level of detail thanks to lean workflows. ALLPLAN offers powerful integrated cloud technology to support interdisciplinary collaboration on building and civil engineering projects. Around the world over 500 dedicated employees continue to write the ALLPLAN success story. Headquartered in Munich, Germany, ALLPLAN is part of the Nemetschek Group which is a pioneer for digital transformation in the construction sector.

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