BEHIND THE CONSTRUCTION FENCE | CONSTRUCTION DETAILS | TECHNOLOGY

BAB 49 BW 103 Goldbachtal Bridge

10.01.2019 / Deutschland / Uwe Fey

Civil engineering/ Infrastructure

Factbox

Client: Hessen Mobil Straßen- und Verkehrsmanagement Kassel

Contractor: PORR Deutschland GmbH

Architect: Leonhardt, Andrä und Partner, Dresden

Contract Type: Generalunternehmer

Project Type: Civil Engineering/Infrastructure . Bridge construction

Scope: Construction of a bridge 285 m long, using composite construction

Contract Volume: 20.45 million euros

Construction Start: 07/2017

Construction End: 10/2019

Location: Neuental-Bischhausen

Extending over the valley

In June 2017, Hessen Mobil Straßen- und Verkehrsmanagement Kassel commissioned PORR with the construction of the new Goldbachtal Bridge.

The entire value chain of PORR and precise calculations were required in order to submit the best possible price for this comprehensive contract. To ensure optimal project execution, new construction aids were developed and built.

Background

In July 2017, as part of the construction of the Federal Motorway 49 (BAB 49), Hessen Mobil Straßen- und Verkehrsmanagement Kassel awarded PORR, as the lowest bidder, the general contractor contract for the 285 m long Goldbachtal Bridge.

The contract includes preparing the construction site, earthworks and foundation works for the piers, as well as the embankments for the abutments. It also covers the construction of the superstructure as a composite cross-section with a steel trough and reinforced concrete deck slab, along with the installation of a concrete basin for water drainage. Finally, the scope also comprises passive protection systems made of concrete and steel on the caps, as well as the erection of glare protection walls in the area of the abutments.

PORR was able to offer the best price for this extensive contract thanks to the involvement of the company's entire value chain. The steel and civil engineering divisions of PORR Deutschland GmbH were involved, as was the PORR Spezialtiefbau department for the calculation of the specialist foundation works. During project execution, the steel construction and infrastructure divisions of PORR Deutschland also work closely together.

> In the course of the project, several new construction aids were planned and developed.
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> **Uwe Fey**
> Project Manager, PORR Germany

Components such as shifting rockers, a pre-construction beak for pushing the individual sections (image) or a pulling system with self-designed, horizontally operating strand jacks were newly developed and can now also be used for other projects. Source: PORR

Comprehensive preparation

Once the contract had been awarded, work began immediately on planning the site power supply, site facilities and construction roads. As the checked structural calculations and the project planning, including the material distribution plan for the steel superstructure, were provided by the client, PORR was also able to directly tackle the execution planning and the planning of the steel construction, the substructures and the construction aids. It was decided to redesign and manufacture the components required for the incremental launching. These included the shifting rockers on the abutments, on piers and in the production facility, the so-called cycle cellar. The investment also included a front fork for the incremental launching of the steel trough and the pulling system with self-designed, horizontally operating strand jacks. They will later become part of PORR's inventory in order to deepen the value chain for future similar construction projects using the company's own materials. In September 2017, work began on the construction site power supply and site facilities, which were completed a month later, as well as the construction roads. Due to the welding work required on the construction site to assemble the steel construction segments, a very powerful construction site power connection had to be created. For this purpose, the power cable was milled into the ground over a length of around 2,000 metres. The construction of the construction roads to and within the construction site was completed in February 2018.

The bridge takes shape

Immediately following the work preparation, special civil engineering began with the production of the bored piles on the pier axes. Although the drilling team had to fight their way through unusually hard rock, the specialised foundation engineering work was completed on schedule in May 2018. At the same time, the piers have been erected since March 2018. These were formed, reinforced and concreted using climbing formwork with 5 m climbing cycle lengths. The exposed formwork was constructed using a board structure with a rough-sawn surface.

The piers have a height of almost 30 metres. Image source: PORR

An excavation of around 25,000 cubic metres had to be removed for the cycle cellar and stored to the side for refilling. Source: PORR

Work also began in March 2018 on the 160 metre long and 30 metre wide cycle cellar for the assembly of the steel construction. At the same time, the embankment fill for the abutments was constructed. The foundation body of the abutment was integrated into the embankment backfill. This is founded on the load-bearing slope debris and consists of unreinforced concrete. This foundation body will be built up in the course of the dam construction as an underfill for the abutment foundation. Around 3,000 m³ of concrete was used for each abutment.

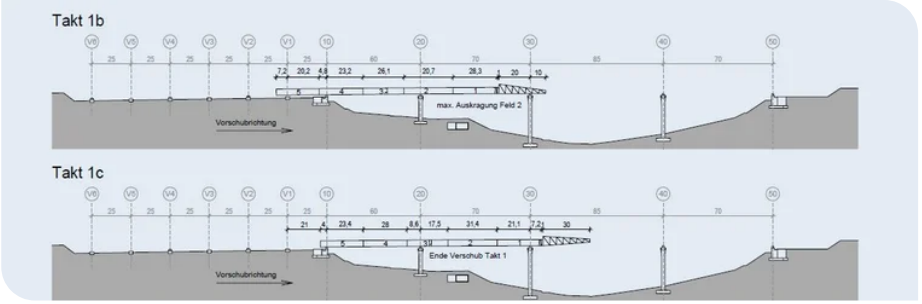
Complex steel work with our own construction tools

The eleven prefabricated steel components for the first section, cycle 1, of the east superstructure were aligned in mid-April 2018. The delivery of the steel components, which weigh up to 85 tonnes and are 35 m long, posed an enormous logistical challenge. PORR began constructing the abutments in May 2018, but first the embankment with a cubic capacity of around 20,000 cubic metres had to be backfilled up to the lower edge of the abutment. The abutment with a height of just over 10 metres was then formed, reinforced and concreted, so that it could be completed "just in time" for the first shunting.

From mid-April to July, the first east section was welded on site, tested and pushed out of the cycle cellar to make room for the directly adjacent second section of the east superstructure. Six weeks of locksmith and welding work, ultrasonic and X-ray testing of weld seams as well as corrosion protection work were required before the first cycle could be shifted. New construction aids were also used for the first time in the form of the shunting rockers, the stem beak and the pulling system, including strand jacks, which were developed together with the work preparation team. After the first shunting operation, the steel components for the second section of the east superstructure were unloaded, assembled and moved until September. Following the shifting work, the east superstructure, which was inserted in a 30 cm higher position due to the height of the shifting rockers, was lowered to the target dimension and the cycle cellar was converted so that work could begin on the west superstructure.

Gallery

After the first shunting operation, the steel components for the second section of the east superstructure were unloaded, assembled and moved until September. Following the shunting work, the east superstructure, which was inserted in an elevated position of 30 cm due to the height of the shunting rockers, was lowered to the target dimension and the cycle cellar was converted so that work could begin on the west superstructure.



Erection of the formwork carriage (Weise Dortmund) for the production of the composite carriageway slab. Source: PORR

A look into the future

The abutments and piers are currently complete. The steel components for the west superstructure have been moved or are ready for assembly on the construction site. The formwork carriage for producing the carriageway slab has been fully assembled and will be producing the carriageway slab using the so-called pilgrim step method from December 2018. This involves first concreting the carriageway slab in the centre of a bridge span and then the carriageway slab above the pillar.

In spring 2019, production of the caps will begin using PORR's own cap formwork carriage, which was also designed in 2018 for the Rothof and Goldbachtal bridges. Corrosion protection work will also begin on the inside and outside of the steel trough. The surfacing work and superstructure equipment will follow in summer 2019.

80.000 m³ (approx.)

Excavation volume

19.100 m³

Concrete incorporated

Technical data

Construction pit depths	Up to 12 m
Bridge lengths	2x 285 m
Asphalt	1260 t poured asphalt MA
Bored piles	D 1500 mm, L up to 18.50 m
Steel incorporated	2.700 t
Reinforced concrete	2.200 t