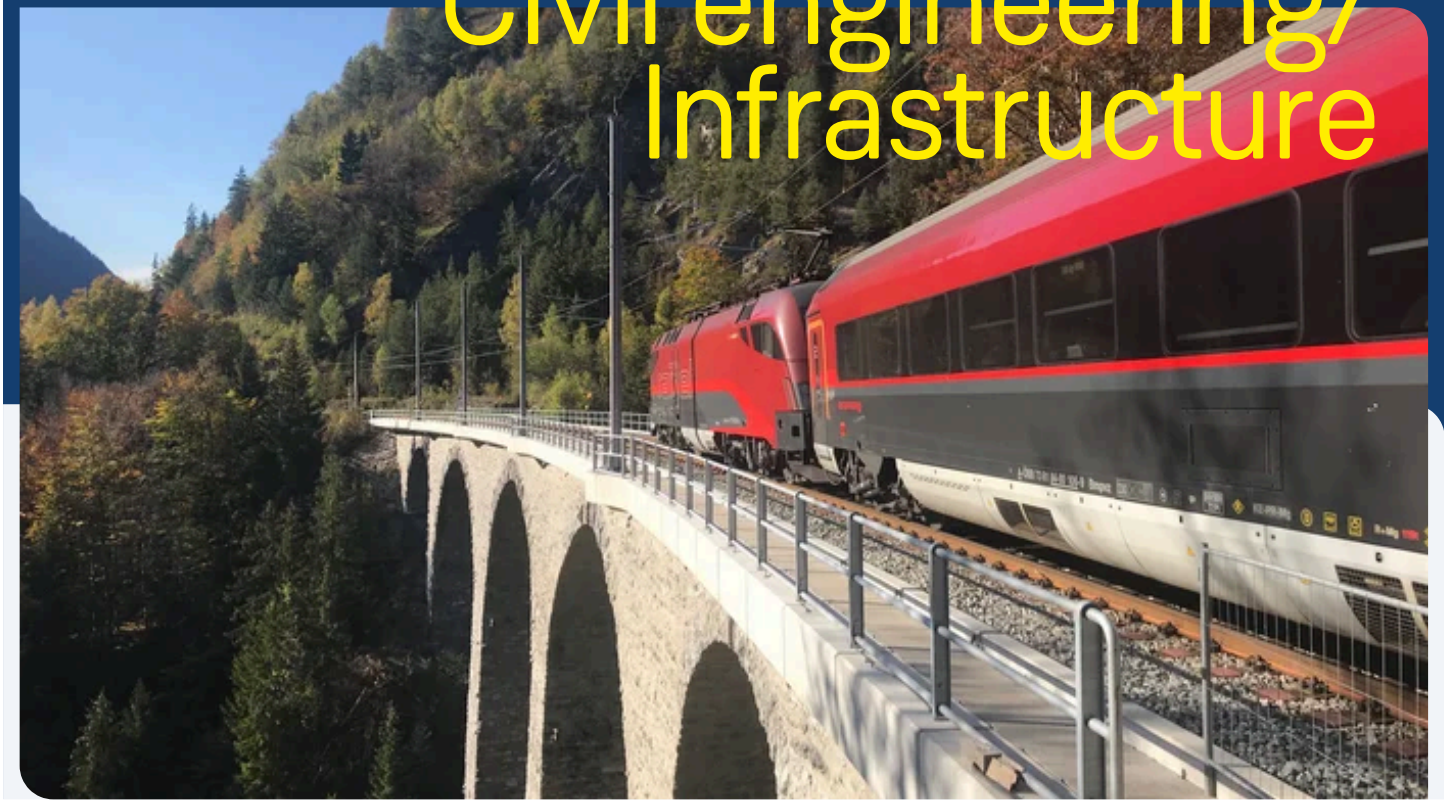
BEHIND THE CONSTRUCTION FENCE | CONSTRUCTION DETAILS | TECHNOLOGY

Schmiedtobel viaduct

25.02.2019 / Österreich / Florian Sterner, Stefan Plankensteiner

Civil engineering/ Infrastructure



Factbox

Client: ÖBB Infrastruktur AG

Contractor: PORR Bau GmbH . Niederlassung Tirol

Contract Type: Baumeisterleistungen

Project Type: Civil engineering/infrastructure . Bridge construction

Scope: Structural reinforcement and widening of a 130m-long railway viaduct, rehabilitation of 4,000m² of natural stone masonry and construction of a 450m-long access road

Contract Volume: 2,6 million euros

Construction Start: 03/2018

Construction End: 10/2018

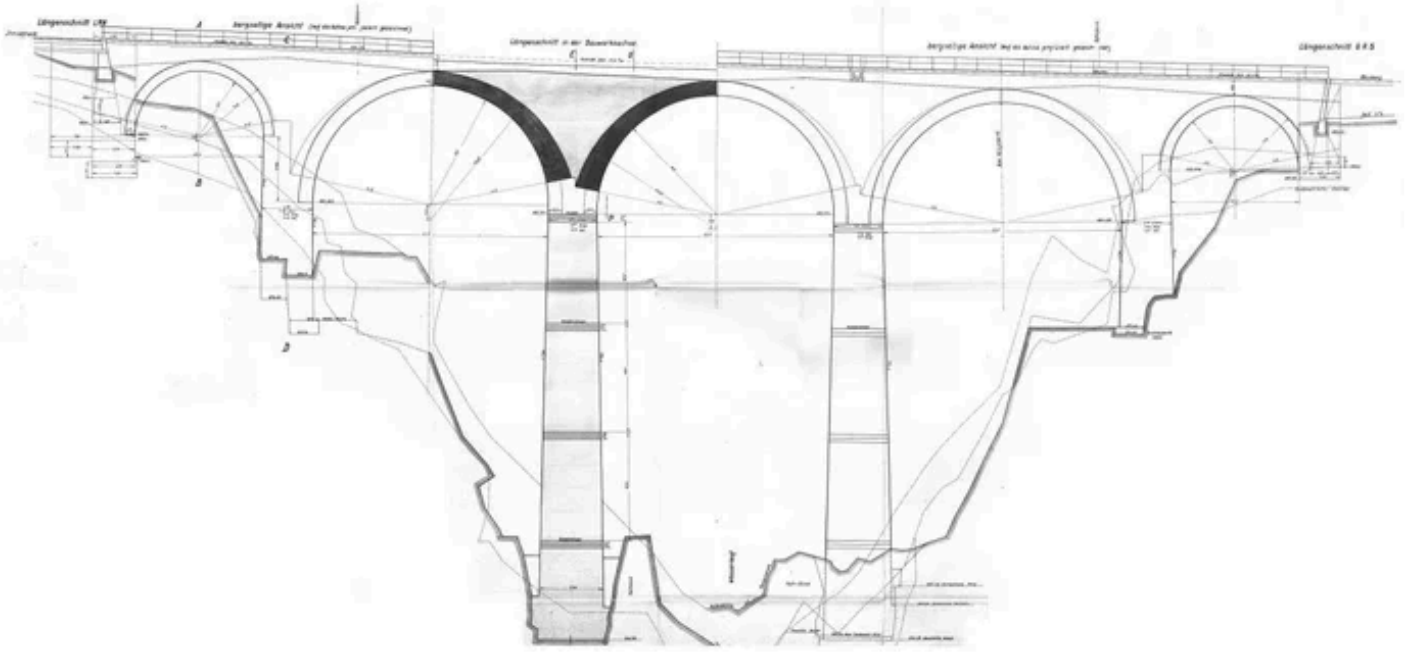
Renovation of the highest viaduct on the Arlberg Railway

Under extreme time pressure and in extremely confined spaces, PORR renovated the Schmiedtobel viaduct on the Arlberg Railway, which is over 130 years old.

In addition to reinforcing and widening the supporting structure, the renovation of the viaduct also included the renovation of 4,000 m² of masonry and the construction of a 450 m long access road. The structural renovation had to be completed within just two weeks.

Background

In recent years, PORR has carried out a large number of tramway projects for Wiener Linien. At the end of May 2018, another project with a contract value of EUR 1.4 million was secured. The contract included the renewal of the tracks and switches, the concrete track slab, the surface covering, and two stops at the “Am Spitz” intersection, where three busy roads meet: Brünner Straße, Prager Straße, and Floridsdorfer Hauptstraße. Due to the high volume of traffic, the project was divided into four construction phases lasting two to four weeks. The project was carried out by the Railway Construction, Track Construction EAST department. Minor surface work was carried out by PORR Civil Engineering, Vienna branch.



As-built plan of the "viaduct over the Schmied-Tobel" built in 1883 Source: ÖBB

> In order to reach the construction site, we had to renovate, gravel and extend an approx. 550 metre long forest road.

Florian Sterner
Site manager, PORR Bau GmbH

Extensive preparatory work in difficult terrain

As the construction site was only accessible by rail or on foot, the first step was to build a construction site access road. For this purpose, an approx. 550 m long forest road was renovated, ballasted and extended to a plateau south of the railway on the eastern side of the viaduct. A storage and turnaround area was created at the end of the access track. Both the forest path and the storage area will be available to ÖBB for maintenance measures after the rehabilitation of the Schmiedtobel viaduct.

The Schmiedobel Viaduct before the start of construction Source: PORR

For foundation work reasons, the prefabricated edge beams were produced in March 2018, transported by rail during a short interim track possession period and stored on the west side of the viaduct until installation. As the renovation work on the vault and viaduct masonry could only be carried out outside the track closure, the entire bridge structure was scaffolded between June and July 2018. The extremely steep terrain up to the pier bases posed a major challenge for the scaffolders. In order to transport the total of 320 tonnes of scaffolding material, a material cableway was stretched across the gorge. In addition, a bracket scaffold including railings was attached to the existing masonry at carriageway level, which would subsequently serve as demolition, working and protective scaffolding.

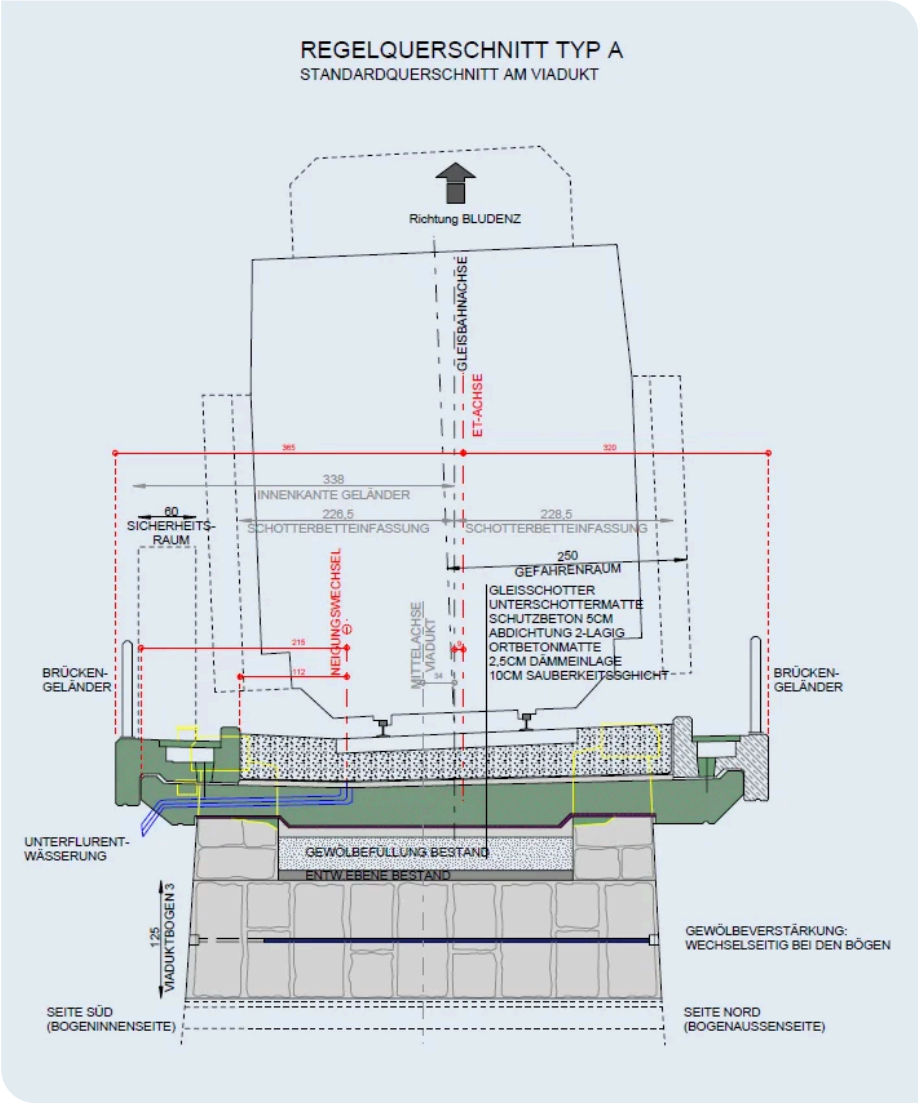
The Schmiedtobel viaduct was scaffolded with a total of 320 tonnes of scaffolding material. Source: PORR

Tight time window
for the refurbishment of supporting structures

The viaduct consists of three larger arches in the centre with a span of 26.6 m and two smaller outer arches in front of the respective abutments. Around 80 cm thick side walls are built on top of the 4.5 metre wide arches. The space in between was filled with fill material and partially tamped concrete. A drainage level runs in the roof profiles along the viaduct. The water is drained away from the respective low point in the centre of the arch.

> We completed the structural refurbishment in just two weeks.
>
> **Florian Sterner**
> Site manager, PORR Bau GmbH

After ÖBB's preliminary work, such as dismantling the overhead line and removing the track grid, PORR was able to begin with the rehabilitation of the supporting structure. This began with the horizontal cutting of the arched walls to the new lower edge of the supporting structure. This was followed by the removal of the railings including the cable trough, the removal of the track ballast as well as the dismantling of the side walls and the filling of the vault.



Standard cross-section of the reinforcement measures Source: ÖBB

The entire structural renovation had to be carried out within a two-week track closure in August. Source: PORR

After creating the clean layer on the arch filling and laying 2.5 cm thick elastomeric insulation panels, the construction of the supporting structure could begin. To this end, the viaduct was reinforced in five construction phases with a 45 cm thick in-situ concrete slab that was widened to 6.3 metres. The formwork, reinforcement and concreting work required for this was carried out in a staggered three-day rhythm. A new two-layer seal for bridge drainage was then applied and the upstream prefabricated edge beams with integrated cable troughs were installed. After producing the protective concrete, laying the under ballast mats as well as other completion work, the carriageway renewal was finalised with the ballasting of the track ballast bed. Finally, the tracks were laid as well as the overhead line restored.

The entire renovation of the supporting structure had to be carried out within a two-week road closure in August. The extremely tight and hourly construction schedule presented PORR's construction site personnel with enormous logistical and technical challenges. Nevertheless, the Arlbergbahn was reopened to traffic as planned on 3 September 2018.

330 m³

Frame slab (in-situ concrete)

4.000 m²

HDW/ Sandblasting natural stone masonry

Technical data

Brückenlänge	130 m
Brückenfläche	890 m²
Abtrag Natursteinmauerwerk	170 m³
Abdichtung	890 m²
Elastomerlager-Dämmplatten	680 m²
Schutzbeton	580 m²
Verbauter Betonstahl	50 t
Fertigteilrandbalken	113 Stk.
Brückengeländer	255 m
San. Natursteinmauerwerk	3.000 m²
Niro-Anker dm 20 mm	520 m
Zufahrtsweg neu	450 m
Ungeb. Tragschicht	1.700 m³

Rehabilitation of the masonry

Before the carriageway could be renewed, the PORR experts had to reinforce the arched vault with 126 transverse prestressing elements. To do this, 20 mm diameter stainless steel rods with rolled threads were inserted into 4 metre long horizontal boreholes and filled with cement mortar. All masonry surfaces were then cleaned with high-pressure water jets. Damaged mortar joints were removed by hand and then closed with dry shotcrete. To complete the renovation work, the masonry surfaces were sandblasted for a uniform appearance.

The entire masonry was cleaned with high-pressure water jets and then sandblasted. Source: PORR

Conclusion

PORR was able to impressively demonstrate its experience and expertise in infrastructure and bridge construction on this project. The biggest challenges during the rehabilitation of the Schmiedtobel viaduct were the very confined space conditions, the topographical location of the construction site in a stream trench, as well as the extremely short runtime for the structural renewal. Thanks to the excellent cooperation of all project participants, all work was nevertheless completed on schedule in October 2018.

Gallery