

Basel Rhine Tunnel, overpass of the port railroad at the Hagnau junction (3D model)

CAD BIM software Allplan

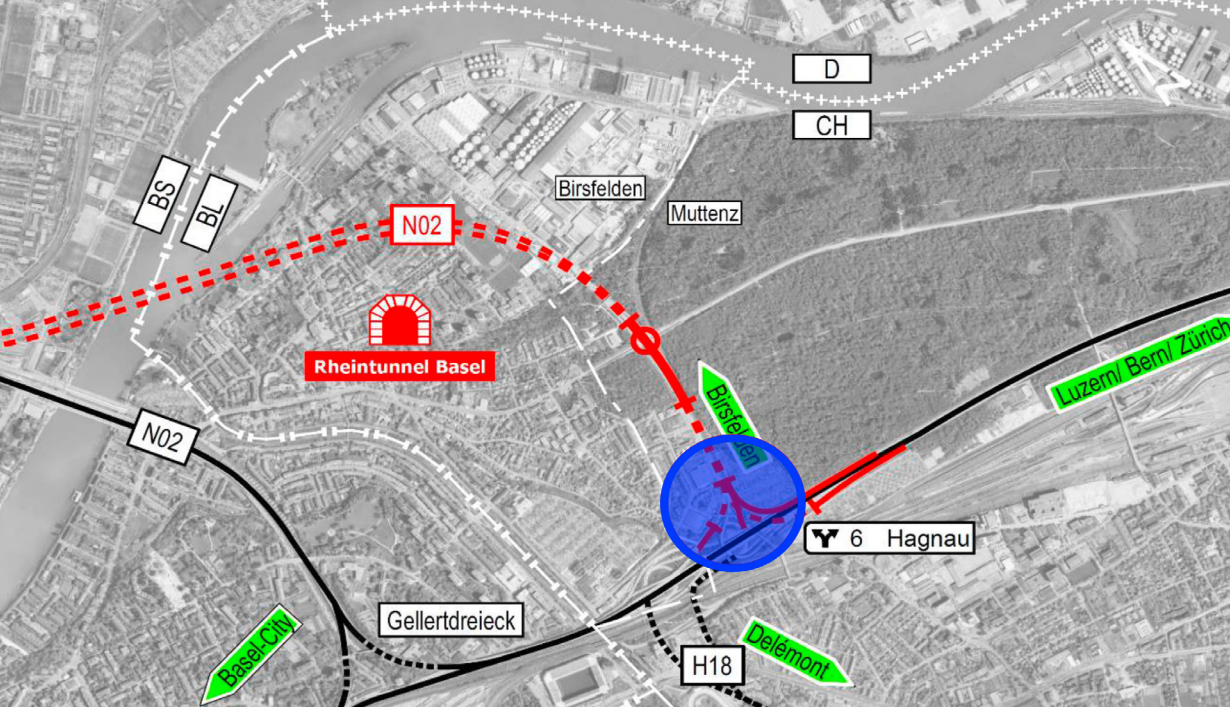
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### Allplan in Practice

## BASEL RHINE TUNNEL MODELED IN 3D

A new tunnel is to be built to relieve the chronically congested Basel city highway: the Federal Council approved the Basel Rhine Tunnel project at its meeting on November 11, 2020. The new link between the Hagnau and Wiese junctions will cost around 2.36 billion Swiss francs and is scheduled for completion from 2029. The construction period is estimated at around 10 years. The actual start of construction depends on the prioritization of the extension projects by parliament as part of the Strategic Development Program (STEP) National Road 2022 and on the duration of the approval process. The Rhine Tunnel comprises a two-lane

tube in each direction of travel. The one in the direction of France / Germany starts at the Birsfelden junction and ends north of the Badischer Bahnhof station. There, the lanes connect to the existing bridge structures. From the direction of France, the Klybeck exit will be used as a connection for the Rhine tunnel. From Germany, a new exit ramp will be built at the existing border bridge. Thanks to the new connection, the urban road network can be relieved and traffic safety increased. The project also envisages improving noise protection with sound-absorbing cladding and a low-noise pavement.



Situation Rhine tunnel Basel, overpass of the port railroad at the Hagnau branch (blue circle)

## COMPLEX GEOMETRIC STRUCTURES

Rapp AG is a member of the Basilea engineering consortium (partners: Gruner AG, moving AG, Bänziger Partner AG) and is working on a large part of the engineering structures in front of the tunnel portals on behalf of the Federal Roads Office FED-RO. As Larsen Szulerski, team leader for structural civil engineering/artificial structures and project manager at Rapp, explains, the task is extremely complex for several reasons: "The new artificial structures and the currently existing road alignments lie on top of each other on up to four levels. In order to be able to recognize spatial dimensions, our 3D model is of great benefit for identifying spatial collisions." In addition, the building structure has many complex geometric shapes, which have irregular forms in all directions. "Thanks to the Allplan Bridge software, we can also process these efficiently within the dynamic design process," says Szulerski, who is convinced of the benefits.

## PROCESSING OF THE OVERPASS PORT RAILROAD

Since 2018, Rapp AG has been working with ALLPLAN software; for example, when designing the overpass of the port railroad. This is a three-span bridge of around 80 meters in length with a trough cross-section prestressed in the longitudinal direction. In plan view, the structure crosses the new roadway in the direction of the Rhine tunnel in a very circular manner. Adjacent to it are retaining walls with complex geometric shapes. The

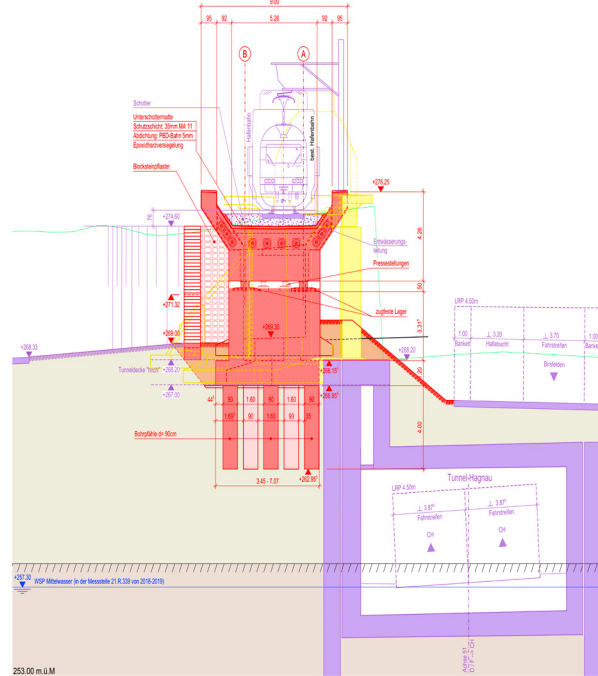
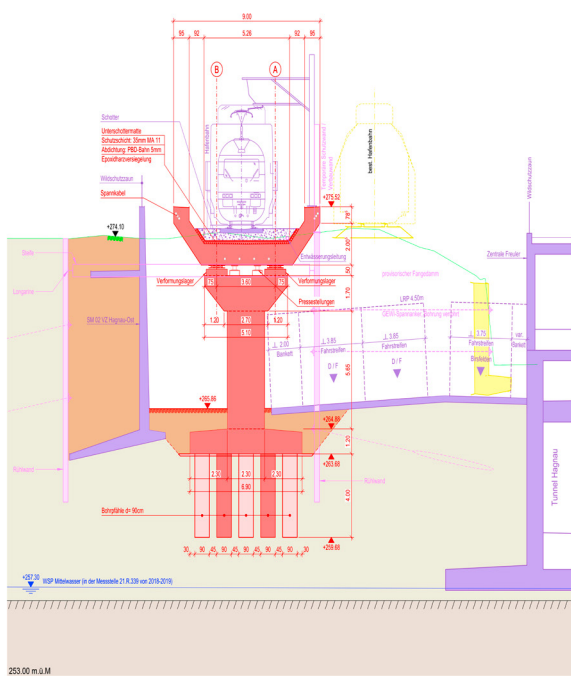
overpass is founded on drilled piles, the construction of which is anything but simple, as Florian Burk, project engineer at Rapp, explains. "Some of the substructures are being built directly next to an operating rail line within an excavation pit that is about 10 meters deep. In the construction sequence, the new bridge slab will be built next to the operating rail bridge and moved to its final position with a transverse thrust during a four-month closure of rail operations," he says.

### 3D models facilitate the planning process

Allplan Bridge is used to model this bridge project together with the adjacent retaining walls in 3D. It already has a high level of detail in the early phases of detailed design. "One of the big challenges is the complex geometric shapes. The trough shape of the bridge merges into the retaining wall and its line then runs out in the portal structure of the tunnel," explains Florian Burk. But the 3D model makes a lot of things easier, as team leader Larsen Szulerski points out. "The self-checking, the detection of collisions, the generation of sections at any desired point and the possibility of realistic visualization are immediately apparent," he notes.

### Adjustments are made automatically

There are also other advantages of Allplan Bridge, as CAD designer Sebastian Kunz from Rapp explains. "Thanks to the parametric model, changes are made quickly and efficiently, as is usual in projects of this type. The change only has to be made at one point, and subsequently all elements linked to it are automatically adjusted. And it was also helpful to be able to map the excavations in Allplan



Cross section 2  
(axis 30) and  
cross section 3 (axis 10)

CAD BIM software Allplan

Bridge," he says. The CAD designer is a member of the "track group." Larsen Szulerski defines the task of the track group as follows: "Their job is to help us as a team move forward in our use of the software by tracking down current issues, looking at what's new in the latest versions, and sharing what they learn with everyone."

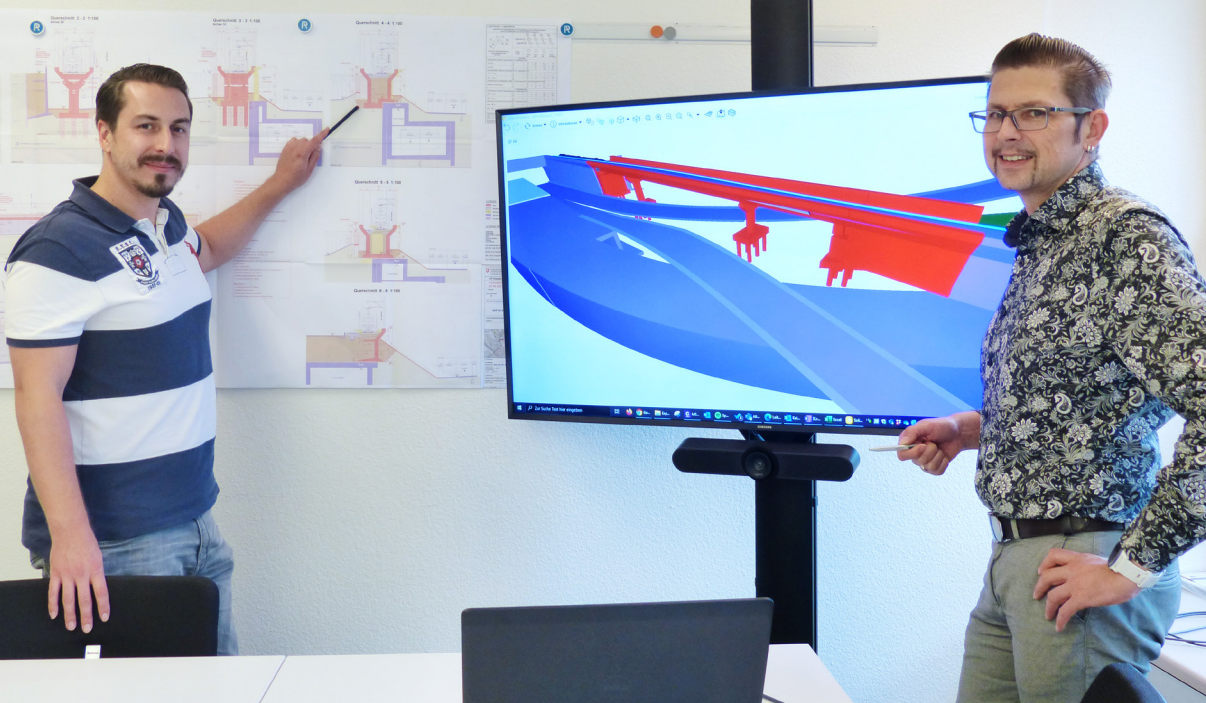
### Courage and openness

But one thing in particular challenged Sebastian Kunz: the modeling of a body on two edges. "This involved modeling the retaining wall, whose foundations (lower edge) are oriented to the road alignment and whose wall head (upper edge) is oriented to the terrain above," explains the CAD designer. The data from the route planning, which is processed by a partner office of IG, was imported into the model as far as possible and supplemented where necessary. Team leader Larsen Szulerski is more than satisfied with what has been achieved so far: "We have been in an ongoing learning process for the past two years and are happy about any progress. This can be measured not only in terms of improved efficiency, but much more in terms of the new possibilities that ultimately lead to a higher quality of our work. On this path, however, we must have the courage and openness to try out new things. That's the only way we can continue to develop."

### PROJECT INFORMATION AT A GLANCE

- > **Two-lanes tube in each of two directions** between Hagnau and Wiese
- > **Connection north: today's Klybeck exit and Ramp bridge meadow**
- > **Connection south: Birsfelden feeder road**
- > **Investment costs: CHF 2.36 billion**
- > **Expected construction period: 2029 – 2040**





Florian Burk, Project Engineer and Larsen Szulski, Project Manager, Rapp AG, Basel

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## THE ENGINEERING OFFICE

Rapp AG, headquartered in Basel, currently employs 430 people and combines a diverse range of services under one roof. The largest departments include Infrastructure/Environment and General Planning/Construction Management. The company was founded in 1896 as a civil engineering company. Since the sale of the construction company in 1996, Rapp has been a pure planning company. "As an inspiring driver and reliable partner, we design sustainable living spaces for tomorrow." This statement applies to Rapp AG, which, with Larsen Szulski as

team leader of constructive civil engineering/artificial structures, includes the Rhine Tunnel project. "With 180 employees, we are one of the largest specialist division groups. What sets us apart is the diversity of the projects we get to work on for our customers." In 2018, Rapp AG decided to change its software and chose Allplan. One of the main reasons was the BIM capability of the software. Since then, all projects at Rapp have been planned in 3D with the perspective of further attribution and extended application possibilities.

## 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 600 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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