SSF Ingenieure

BIM

DIGITALISATION OF PLANNING AND CONSTRUCTION

BIM

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CONSTRUCTION

BIM
Digitalisation of planning and construction

Holistic planning and consultation

The highest degree of quality, economic efficiency, and sustainability are the guidelines of our actions as a future-oriented engineering company. In the planning and implementation of high-quality buildings, we combine functionality, aesthetics, and technical implementation. Economy also stands for the balanced design of timeless and durable buildings. In doing so, we focus on the creative and ecological use of the building materials of the present and the future.

BIM: efficient knowledge management in the planning and construction process

Ideally, all information (attributes) required for planning, structural implementation, and management of a building object flows into a virtual building model from the very start of the project. All data is continually available in the respective planning/project/execution and operation phase. Model-based planning of a digital twin replaces drawing-based planning in 2D. Construction processes are simulated at an early stage (4D-BIM), and construction costs (5D-BIM) are determined on the basis of maximum information transparency. In the future, sustainability assessments (6D-BIM) and, in particular, the operational management of structures (7D-BIM), will become more important.

BIM at SSF Ingenieure

For us, BIM is more than just the digital model of a building. As a planning and control method, we use BIM for efficient knowledge management throughout the project cycle. In accordance with the motto »First plan digitally and then build for real«, we put digital planning in the foreground. For this purpose, colleagues from the SSF Group work together in interdisciplinary teams – consisting of structural engineers, architects, building technicians, geotechnical engineers, spatial and environmental planners, and surveyors – in a virtual project space.

The focus is on interdisciplinary and continuous exchange between all project participants (level of best cooperation) via sub-models/subject models and is superordinate to the overall coordination model. Regulations on digital cooperation, data structures, and the common digital working platform CDE are reflected in the BAP and support the cooperative and collaborative exchange of information right from the start. With BIM, we can present our client with a realistic, easy-to-understand model at an early stage and show the progress of the project.

This also allows the public to be involved at an early stage of planning. A project to be planned becomes more vivid, and the understanding of the building is greater on both sides – an ideal basis for discussion for contractor and client. As a pioneer in the use of innovative construction methods and solutions, we are actively shaping the digital transformation process in civil engineering: at SSF Ingenieure, new positions are created, employees are trained internally and externally, standards are developed, and interdisciplinary cooperation is promoted. Creating awareness for the digitalisation of planning and building – among employees, project partners, and the public – guides our daily work as planners and consultants.

Future-oriented planning and consulting with BIM

The longest period of a building is its use – the foundation stone for this is laid in the planning stage. The use of BIM improves our consulting services when it comes to planning, construction, building operation, and use. Risks in construction as well as in terms of costs and deadlines are minimised thanks to a transparent planning and construction process. By compiling and accessing all project-relevant data on a daily basis, we are able to determine the data/cost status very accurately and to design more efficient and economical structures to the highest quality standards – even for structures with a high degree of difficulty and complex geometries and circumstances – by means of continuous planning optimisation. Planning changes are entered directly into the model and are available in real time. This results in structures of outstanding quality as well as a shorter planning, approval, and construction process.

Advantages of BUILDING INFORMATION MODELLING

BIM supports our pursuit of the highest quality, sustainability, and economic efficiency. BIM enables us to develop even better solutions for complex and multiple issues in future-oriented construction.

An overview of the advantages of the digital planning method:

- Prompt examination of variants and earlier optimisation opportunities
- Earlier and simpler collision check (error detection) and thus error prevention
- Adherence to schedules through precise advance planning
- Increase of cost loyalty through early cost certainty
- Transparency of the information flow in the planning and construction process
- Simplification of communication and cooperation
- Documentation of the planning and change process in a project
- Quality assurance through increased planning depth
- Clear project presentation to improve the comprehensibility of the structure/component for contractors, clients, and the public
- Extensive data processing options by construction company/building contractor

BIM

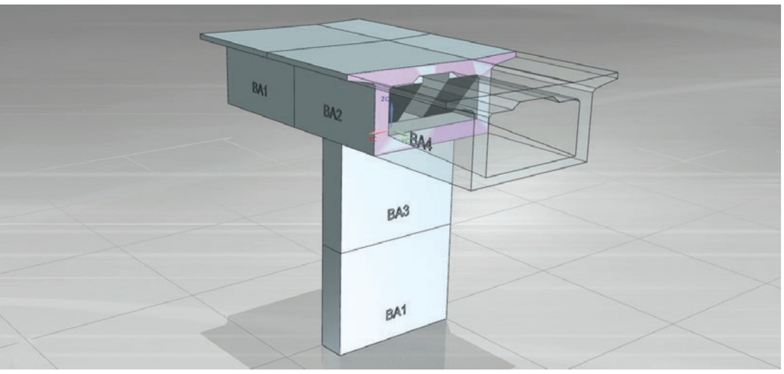
REFERENCE PROJECTS

Reconstruction of Filstal Bridge

NBS Stuttgart – Ulm

Building contractor	DB Projekt Stuttgart – Ulm GmbH
Supporting width	44.00 m + 95.00 m + 150.00 m + 93.00 m + 58.00 m + 45.00 m
Total length	485.00 m
Planning period	2013 – 2019
Completion	2022
Scope of services	Object planning of engineering structures: draft design // structural engineering: preliminary (partially), draft and final design for the integral structure in joint venture

The approx. 485-metre-long, two-track and semi-integrally designed structure crosses the Filstal valley with two separate superstructures, up to 80-metre-high Y-columns, and a main span of 150 metres and connects to tunnel structures on both sides.
The structure is being built as a single-girder box girder cross-section using an overhead movable scaffolding system and auxiliary supports up to 80 metres high. The raking supports of the Y-columns are subsequently concreted and monolithically connected to the superstructures.



The high axle and brake loads typical for railways, the future line speed of 250 km/h with slab track as the superstructure system (in conjunction with the concept of a semi-integral bridge), the Y-columns with very flat diagonal braces, and the difficult topographical as well as geotechnical boundary conditions lead to extraordinarily high demands on planning, work preparation, construction, and manufacturing.

BIM topics

This project is one of the four BIM pilot projects of the BMVI

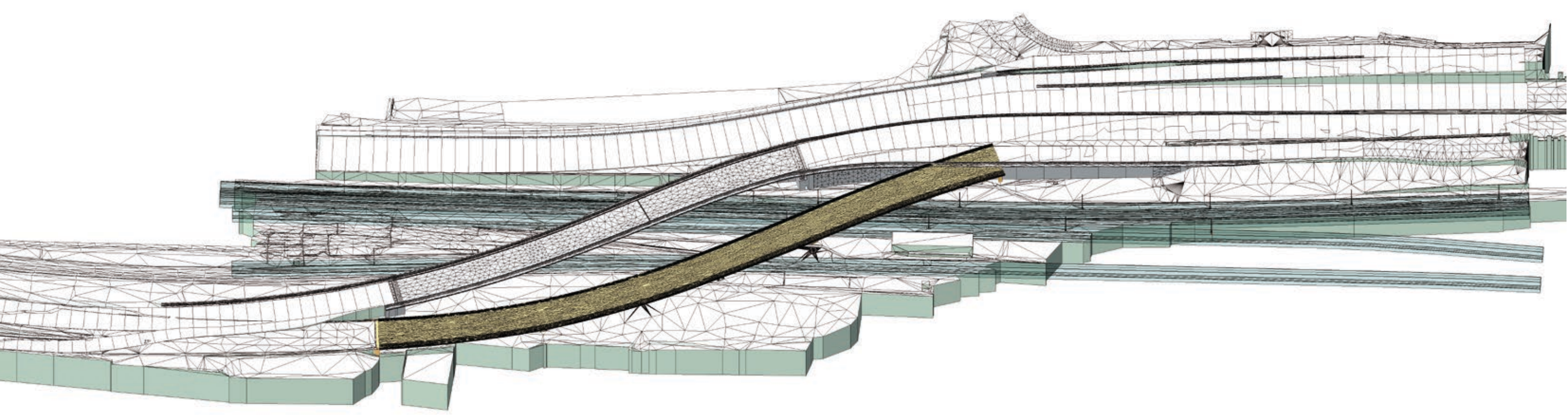
- Planning with Siemens NX
- 4D construction sequence and status message, display of individual objects of the construction process (e.g. structures, auxiliary scaffolding, excavation pits, and construction roads), and linking of individual objects with the construction schedule
- Transparent and complete settlement of flat-rate partial lots with BIM, parallel settlement of unit-price partial lots both conventionally and with BIM, and comparison of the two settlement methods
- Mobile cloud-based BIM application with access via iPad app and web portal, provision of digital information via the »BIM 360 Field« software, and documentation of the construction work on site
- Connection of the plan management platform (EPLASS) to BIM applications (optional), and link between the 3D model and the associated plans at the component level
- Integration and tracking of the planned run status in the 3D model

Replacement of the Westend Bridge

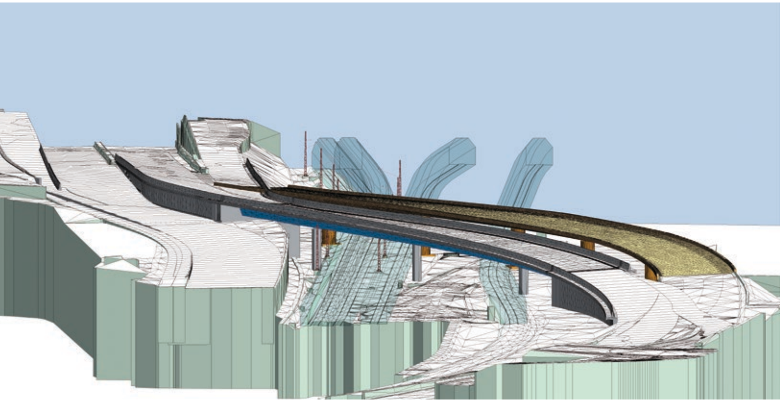
A100 Berlin

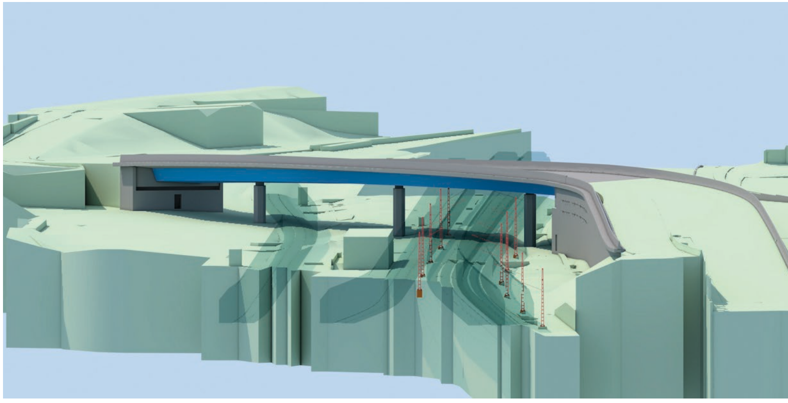
Building contractor	DEGES Deutsche Einheit Fernstraßenplanungs- und -bau GmbH
Supporting widths	38.50 m + 47.50 m + 41.50 m + 30.00 m
Total length	157.50 m
Planning period	2016 – 2018
Completion	2022
Scope of services	In joint venture // object planning of engineering structures: preliminary, draft and approval design; preparation of tenders // object planning of traffic facilities: draft, approval and final design; preparation of tenders // structural engineering: preliminary and draft design; preparation of tenders // technical equipement: preliminary and draft design; preparation of tenders // equipment trades, overhead line systems, and suburban railway current, control and safety technology, 50 Hz systems, logistics concept, lockout planning and registration

The 157.50 metre long Westend Bridge is located in the densely built-up inner-city area on the section of the A100 motorway in the northern direction of travel between the Kaiserdamm and Spandauer Damm junctions. Because of the significantly higher traffic load in recent years, the service life of the Westend Bridge has been reached. The existing structure must therefore be replaced by a new construction.



Building under traffic is particularly challenging because of the confined space conditions and the crossing of long-distance and suburban railway lines and complex traffic interchanges and because there is no possibility of half-sided renewal in the presence of traffic. To solve the complex design task, the BIM planning method was agreed with the client. The composite structure will be constructed as a four-span, continuous deck bridge with an S-shaped ground plan curvature (R ~ 250 m).
In addition, the replacement of five retaining wall structures of 80 - 190 m is necessary.





BIM topics

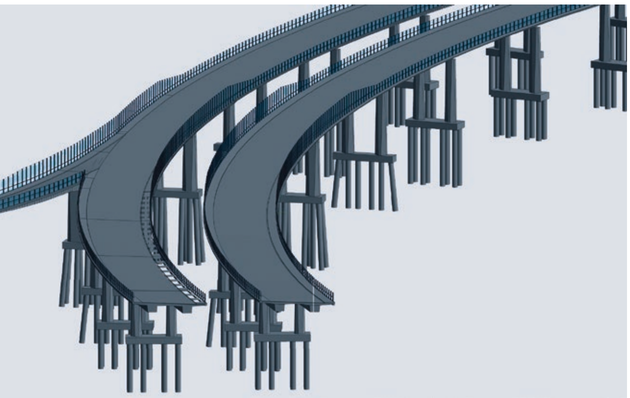
- Planning with Autodesk Revit
- Creation of a model of the current state (consisting of individual sub-models) with transfer of as-built documents from analogue or unsuitable digital as-built documents into the model
- 3D model creation in draft design
- 3D collision check and quantity determination
- 4D modelling to represent the construction process
- 5D modelling to represent cost progression
- Transfer of the environmental planning into the 3D model
- Object-based quantity determination in the draft
- Representation of the demolition phases in the overall model
- Creation of 2D plans from 3D models for the preparation of RE and RAB-ING designs

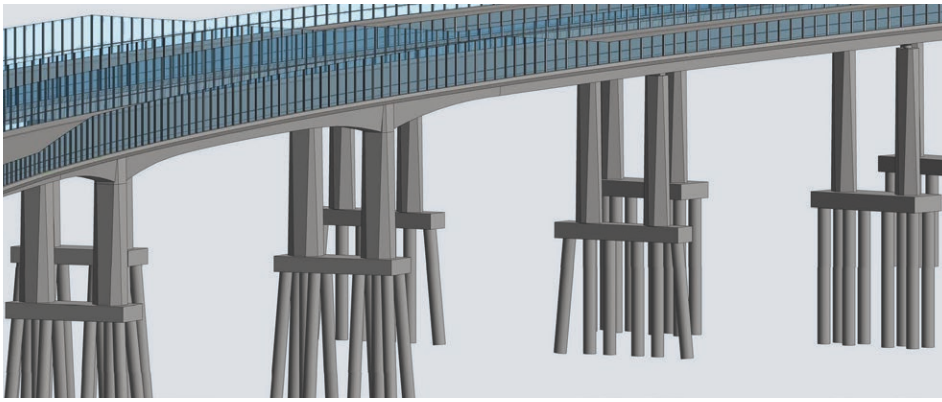
Reconstruction of the Wehretal Bridge

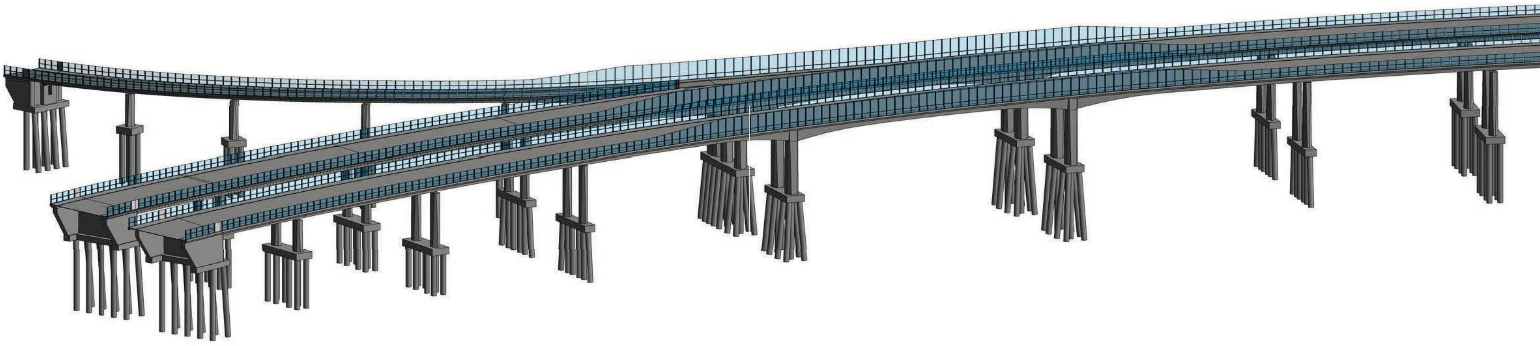
A44 Waldkappel interchange – Ringgau interchange

Building contractor	DEGES Deutsche Einheit Fernstraßenplanungs- und -bau GmbH
Supporting widths	30.00 m + 2 × 43.00 m + 55.10 m + 67.50 m + 56.00 m + 8 × 43.00 m + 30.00 m
Total length	668.60 m
Planning period	2013 – 2015
Completion	2020
Service type	Object planning of engineering structures: basic evaluation; preliminary and draft design; preparation of tenders // structural engineering: preliminary and draft design; preparation of tenders

The viaduct over the Wehretal valley in the course of the new construction of the A44 Kassel – Herleshausen motorway will be designed as a two-part cross-section, each with a two-web pre-stressed concrete slab beam with integral pier connection and an integrated ramp structure for the Eschwege junction. In the area of the weirs, the superstructure is given a haunched course in accordance with the larger supporting width.
The bridge is located between the two tunnel structures Trimmberg and Spitzenberg and crosses the DB line 3600 Frankfurt (Main) Hbf – Göttingen, the B27, the B452, and various farm roads.







BIM topics

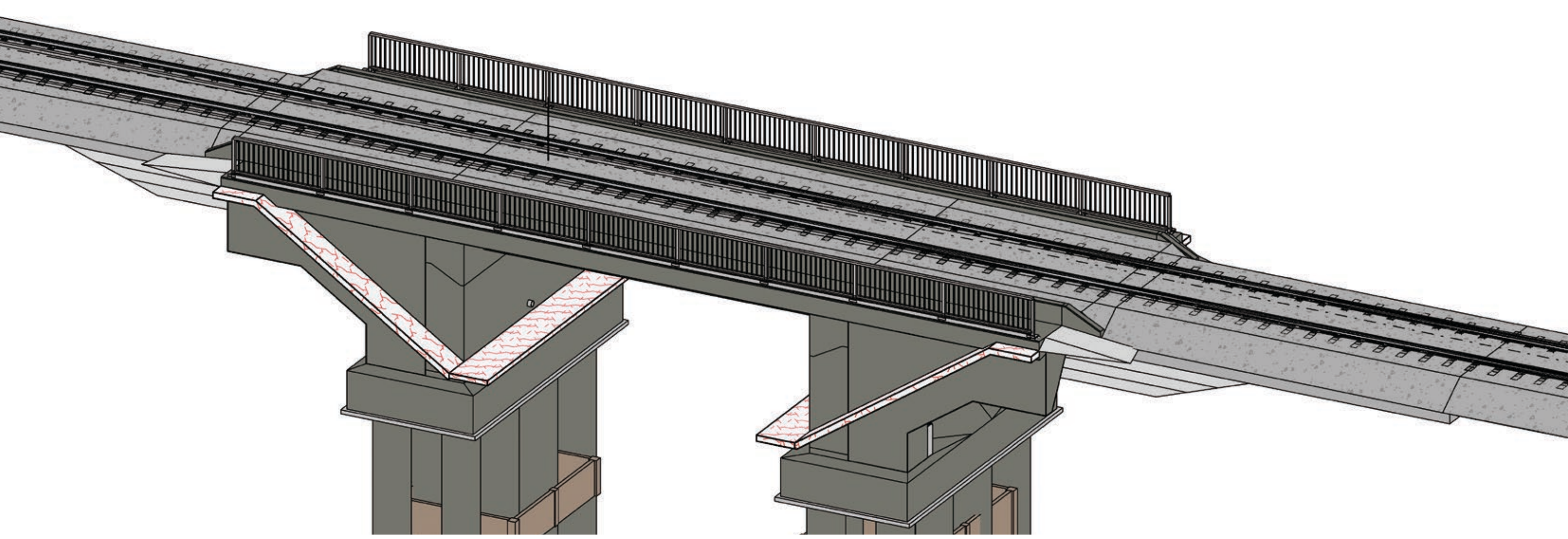
- Planning with Autodesk Revit
- All draft designs can be derived from the 3D model
- Individual construction phases can be clearly displayed on the 3D model for coordination purposes
- Simple transfer of masses and areas of individual components
- Use of the 3D model as the basis for the static calculation
- With the overall 3D model, it was possible to coordinate all structural influences as well as the necessary traffic routing and track relocation with each other
- Simple coordination with geotechnical experts using the 3D model

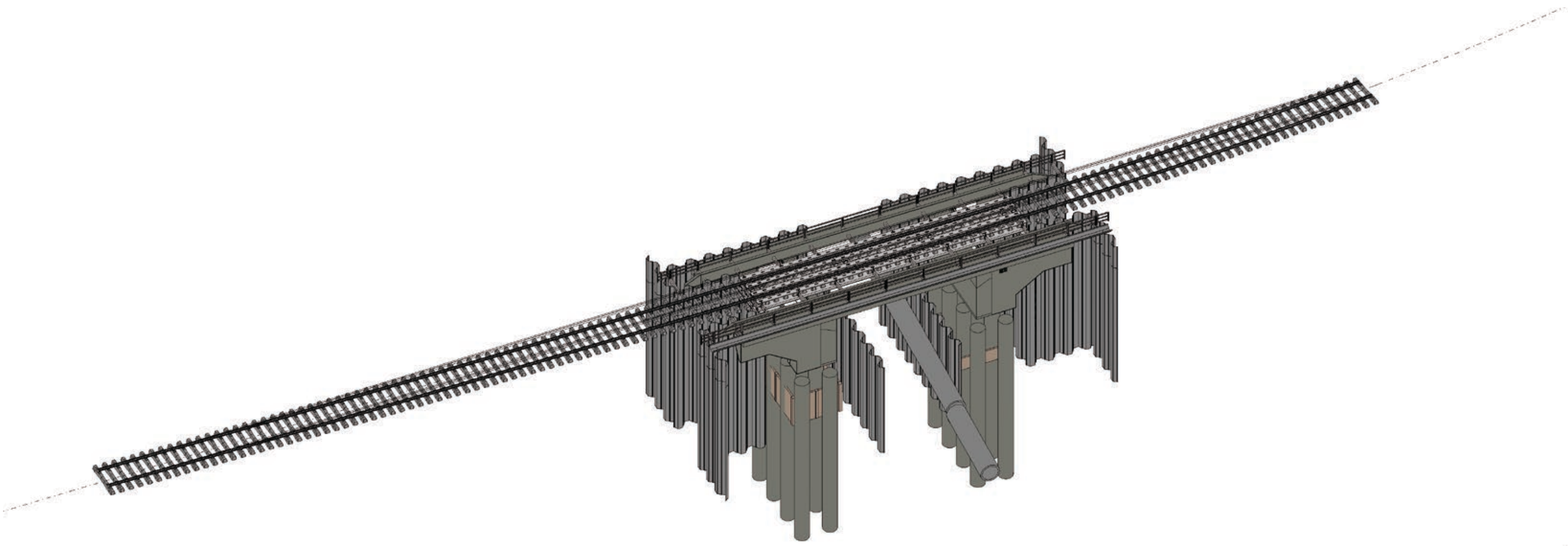
Renewal of the railway flyover

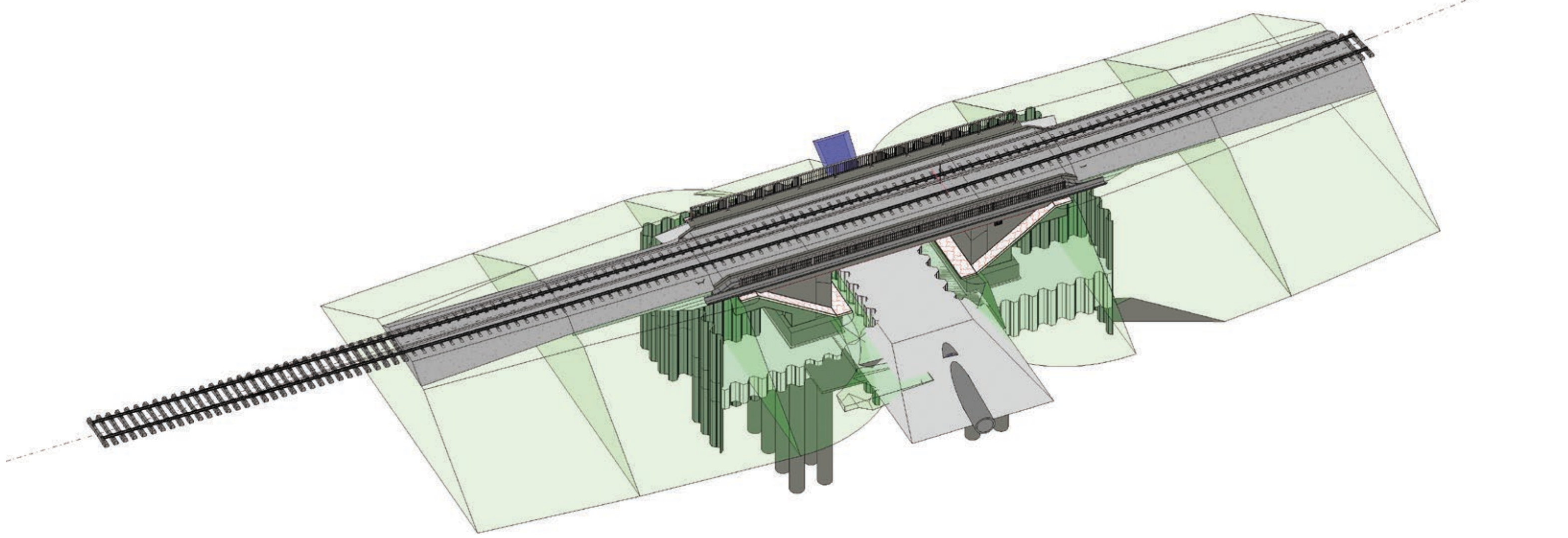
over the Höhenstädter Bach stream
Railway line 5832 from Passau to Neumarkt - St. Veit

Building contractor	DB RegioNetz Infrastruktur GmbH – Southeast Bavaria Railway (SOB)
Supporting widths	9.0 m
Total length	21.30 m
Planning period	2017 – 2019
Completion	2020
Scope of services	Structural engineering: basic evaluation; preliminary and draft design; preparation of tenders; evaluation of tenders

The railway flyover over Höhenstädter Bach is located at railway kilometre 18.542 of the non-electrified, single-track line No. 5832 from Passau to Neumarkt - St. Veit, which, with its total of 95 km, is considered the longest secondary railway in Bavaria.
The new bridge will be constructed as a deep-founded reinforced concrete half-frame with a continuous ballasted superstructure as well as a service and escape route.
For the given boundary conditions, the impact on railway operations is kept low by constructing the new railway flyover under an auxiliary bridge. For the entire measure, only two check intervals lasting several days are required.
Before starting the actual work on the structure, the Höhenstädter Bach stream must first be piped in the area of the construction measure (DN 1000).







BIM topics

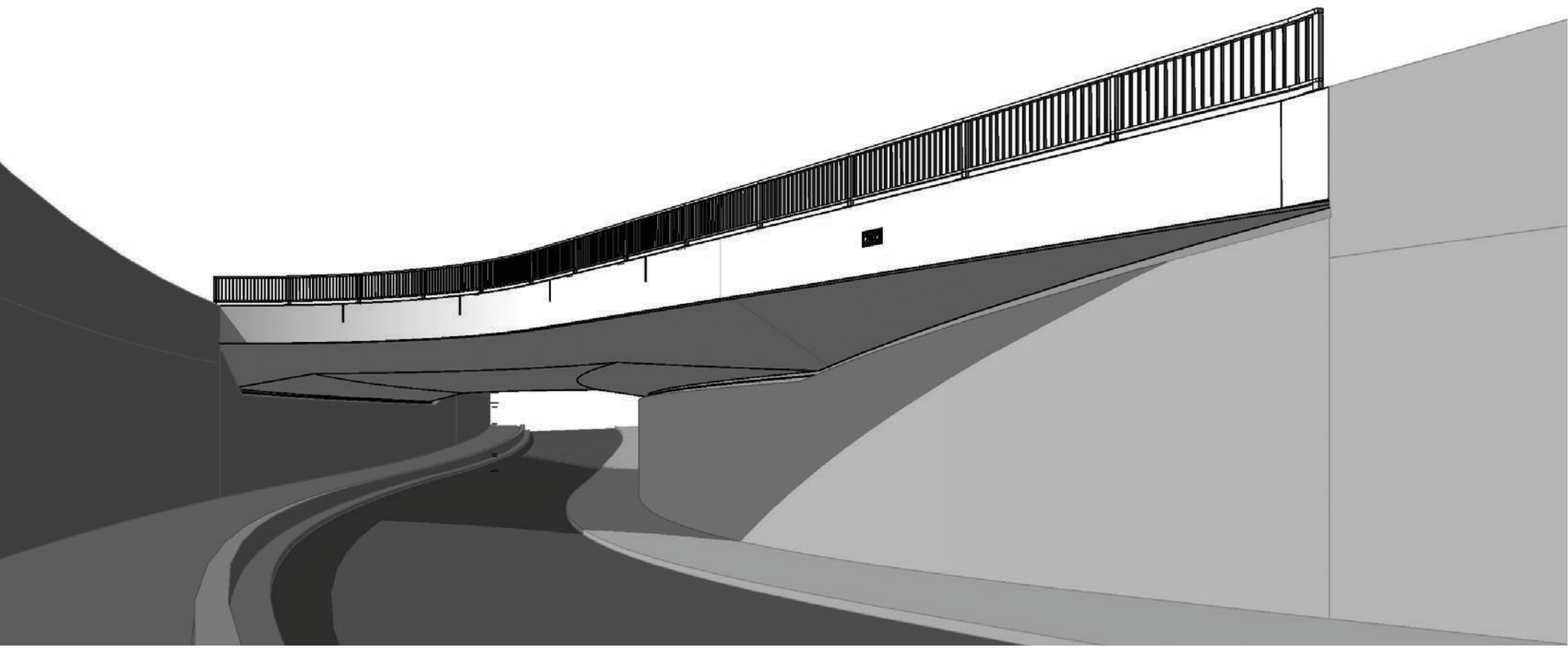
- Planning with Autodesk Revit
- Derivation of all draft designs from the 3D model
- Individual construction phases can be clearly displayed on the 3D model for coordination purposes
- Simple transfer of masses and areas of individual components
- Use of the 3D model as the basis for the static calculation
- Collision control

Level crossing removal and reconstruction of

railway flyover in Nabburg
Railway line 5860 Regensburg central station – Weiden

Building contractor	DB Netz AG
Supporting widths	18.00 m orthagonally
Total length	> 32.3 m
Planning period	2018 – 2020
Completion	2024
Scope of services	Object planning of engineering structures: draft design; preparation of tenders; evaluation of tenders // structural engineering: draft design; preparation of tenders

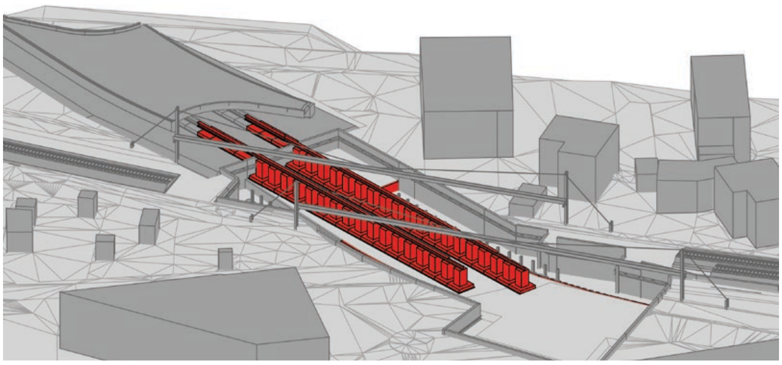
In the course of the extension of the St2040 in the urban area of Nabburg, the State Building Authority Amberg-Sulzbach is planning to remove the grade-separated level crossing in Georgenstraße. The road runs through the measure in a trough structure, which is structurally separated from the bridge structure of the railway and is processed separately. The planned groundwater basin of the state road connects Austraße and Turnhallenweg.

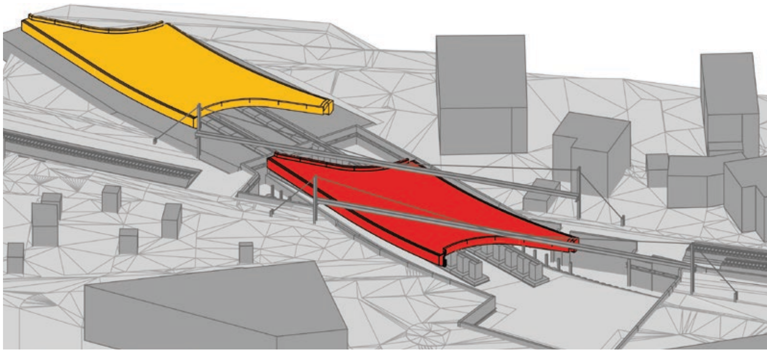


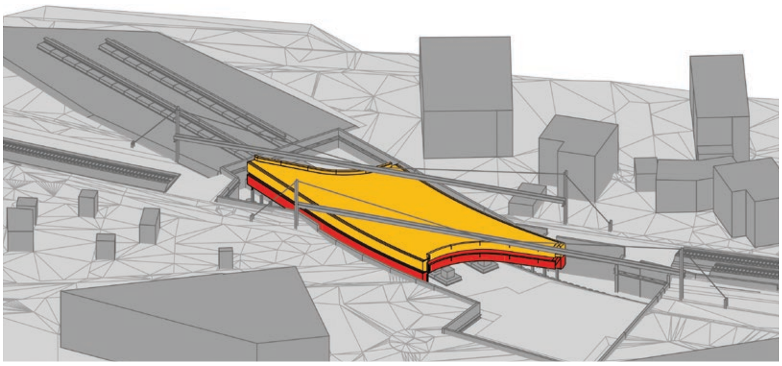
In this area, the railway line crosses the planned route of the road, making a railway flyover necessary. The railway flyover is planned as a two-track, oblique-angled reinforced concrete frame on drilled pile foundations. The cut-and-cover method is used. The superstructure will be constructed next to the track and moved to its final position during a check interval. The concreting of the frame corners takes place in the protection of auxiliary track bridges. The construction height of the superstructure is 1.45 metres in the field and 1.95 metres at the haunched edges.

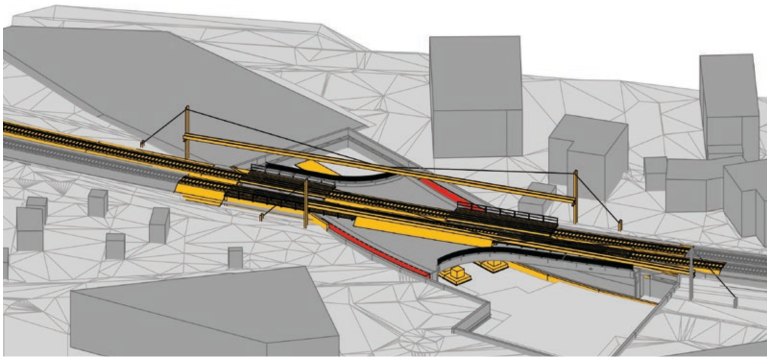
BIM topics

- Planning with Autodesk REVIT
- Derivation of all draft designs from the 3D model
- Individual construction phases can be clearly displayed on the 3D model for coordination purposes
- Simple transfer of masses and areas of individual components
- Use of the 3D model as the basis for the static calculation
- Continuous collision control









Reconstruction of Kattenohl viaduct

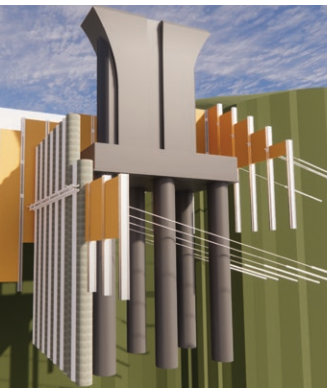
A45 Hagen-Süd interchange – Lüdenscheid-Nord interchange

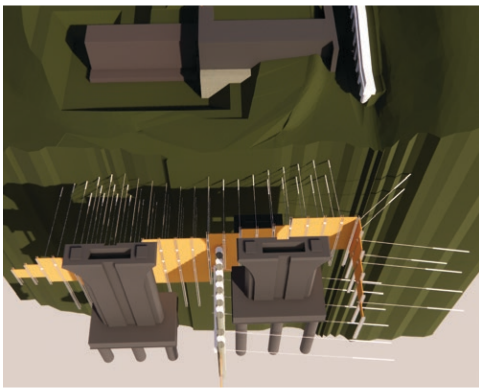
Building contractor	Straßen.NRW, Regional branch Südwestfalen, ASt. Hagen
Supporting widths	540.00 m + 199.50 m
Planning period	2018 – 2021
Completion	2023
Scope of services	Object planning of engineering structures: basic evaluation; preliminary, draft and final design; construction aids and excavation pits, including drill levels // structural engineering: preliminary; draft and approval design, final design; construction aids and excavation pit, including drill levels

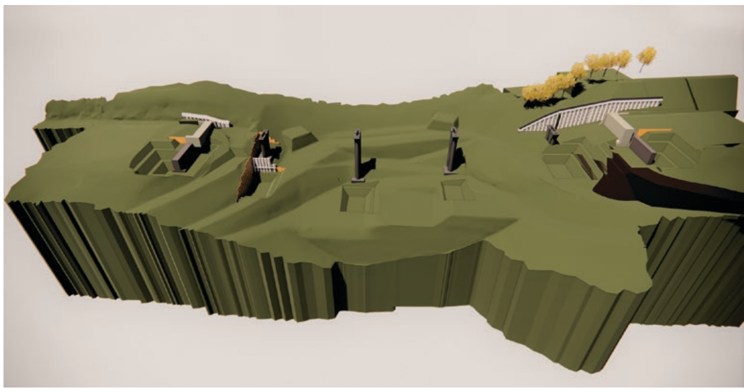
Planning of the excavation pits/construction aids

In addition to the two abutments, the design of the Kattenohl viaduct provides for eight pier locations (four pier axes) founded on large bore piles. For their accessibility, construction roads and crane sites were built as preliminary measures – partly as steep slopes with reinforced soil. The subsoil consists of weathered rock, overlain by slope debris of varying thickness. The detected strata and fissure surfaces in the rock run so unfavourably that extensive securing measures for the excavation pits are necessary.

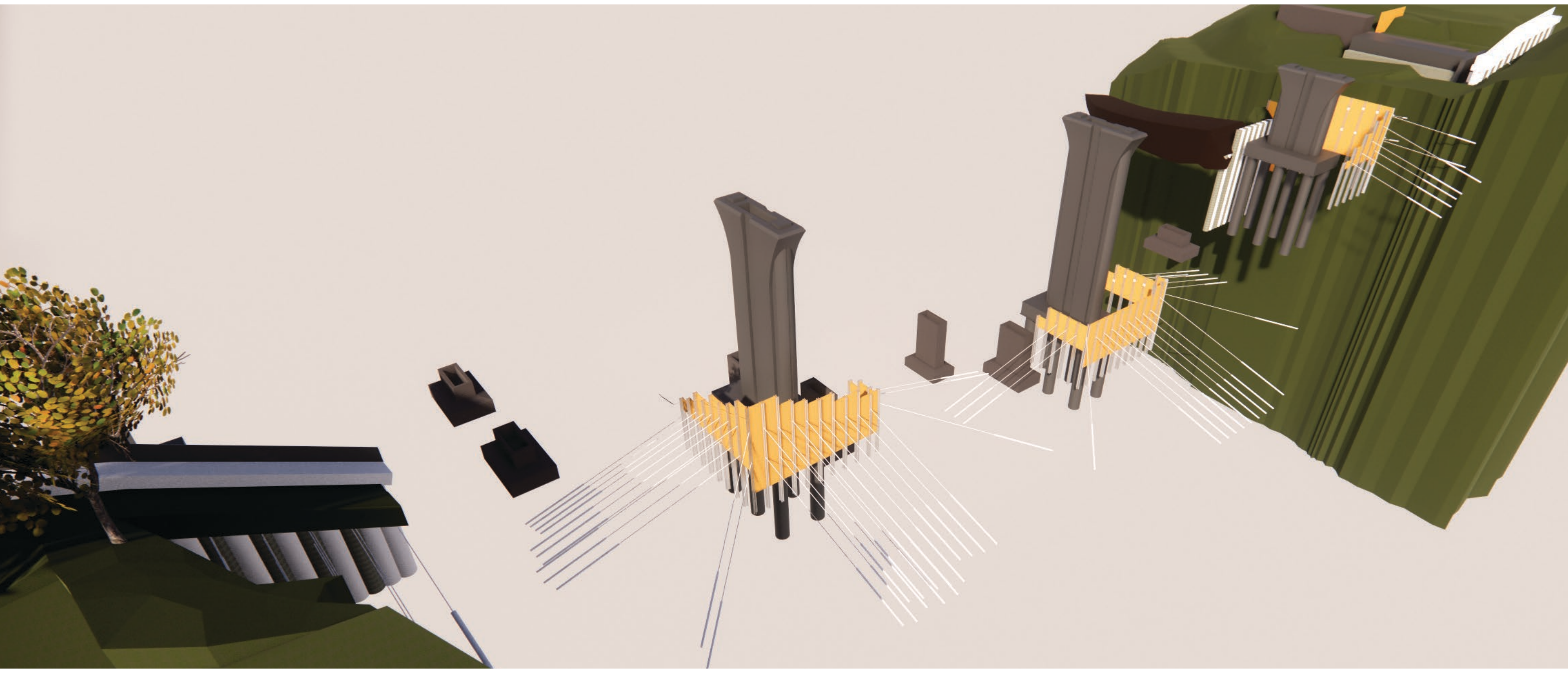
Because of the highly mobile terrain with flanks that in part slope steeply towards the west, the geometries of the required excavation pits for the substructure sites are extremely demanding (e.g. sides of very different heights and intersecting different layers of the subsoil). The unfavourable subsoil conditions lead to heavy shoring structures in some areas; this, in turn, requires large embankment fillings for the drilling levels.







The available building sites are tangentially affected by taboo areas (e.g. grid gas lines or forest areas that are not in public ownership). These may not be used for the excavation pits nor may anchors be placed in the ground below the taboo areas.



BIM topics

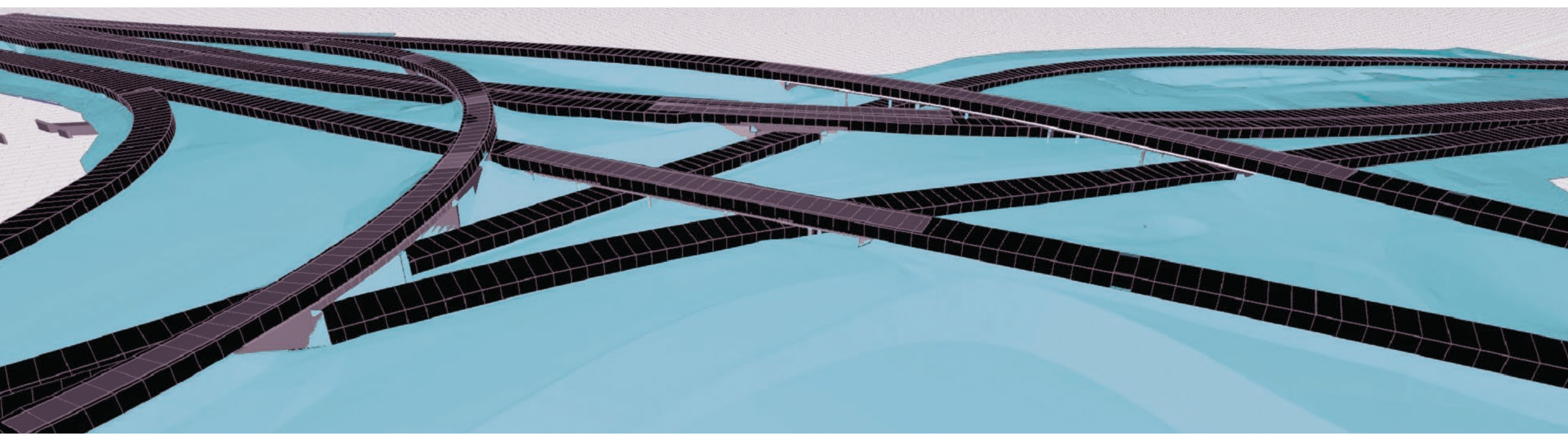
- Planning with Autodesk Revit
- Application of the BIM method in the geometric planning of the excavation pits and the temporary fills for the drilling levels in order to be able to produce economic excavation pits in this inhomogeneous environment and to correctly determine the excavation and backfill masses
- Use of the 3D model for accurate dimensioning and early identification of optimisation opportunities
- Accurate calculation of the excavation pit walls and selection of the most economical securing method by deriving the cut stratification of the foundation soil (separately for each side of the respective excavation pit)
- Number-based cost determination of the possible excavation variants and the selection of the most economical method through mass determinations derived directly from the 3D model

Reconstruction of the Heumar motorway junction

A3/A4/A59 motorway ring Cologne

Building contractor/client	Ministry for Transport of North Rhine-Westphalia DEGES Deutsche Einheit Fernstraßenplanungs- und -bau GmbH
Total length	8.4 km
Planning period	2015 – 2022
Completion	2021 (2030)
Scope of services	Object planning of engineering structures: basic evaluation; preliminary and draft design (partially); preparation of tenders // structural engineering: preliminary and draft design (partially); preparation of tenders // feasibility studies, overall project management, overall BIM coordination

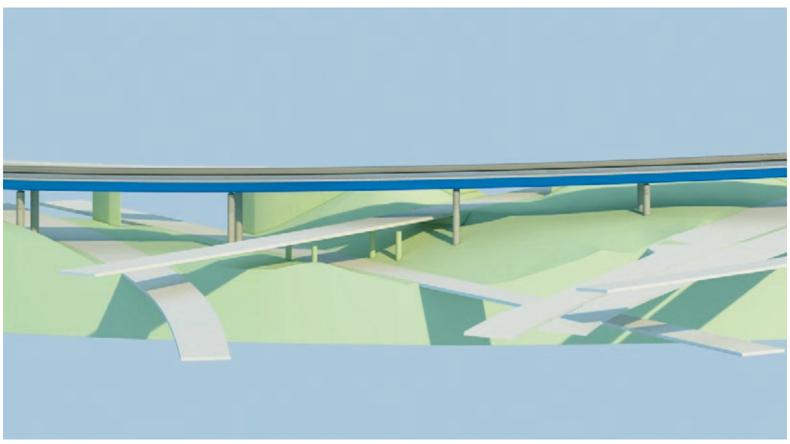
The Heumar motorway junction connects the A3 (Oberhausen – Frankfurt am Main), A4 (Aachen – Olpe) and A59 (Oberhausen – Bonn) motorways and is part of the Cologne motorway ring.
The Heumar motorway junction is highly complex and featuring numerous bridges serving the various overlapping traffic relations between the motorway lanes in the directions of Aachen, Bonn, Frankfurt, and Oberhausen and the intersection of further roads of the subordinate network as well as rail traffic facilities and traffic routing across four levels.
Because of its location in the south-eastern part of the Cologne motorway ring in the Cologne urban area and its proximity to Cologne/Bonn Airport, it is of particular importance with respect to both regional and supra-regional passenger and freight traffic.

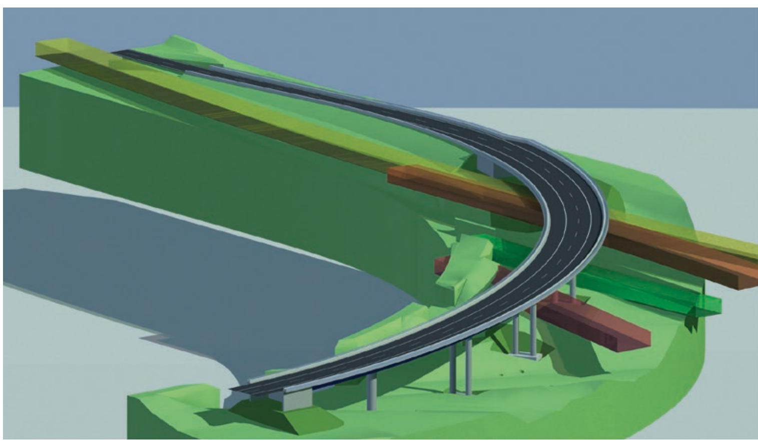


The high traffic volume represents a considerable load, especially for the bridges; this was not predicted at the time of construction. In recent years, the substance and stability of all bridges in the Heumar motorway junction have been checked. The deficiencies identified are quite serious; all structures therefore need to be replaced in the short to medium term. The structures in the north, which cross the A3/A4/A59 via the route of the Cologne transport authority (KVB) as well as the three structures connecting the A4 to the A3/A4 heading north, have already exceeded their remaining useful life and must be replaced in the short term.
The aim of the reconstruction is to maintain the Heumar motorway junction as a central junction in the North Rhine-Westphalian motorway network, to secure its connection and performance quality (also with regard to the increasing traffic volume), and to improve road safety. The reconstruction must be carried out without reducing the number of lanes and without significantly restricting traffic.

BIM topics

- The BIM method is a good choice because of the complexity of the Heumar motorway junction and because traffic cannot be interrupted
- Modelling of existing structures and planning of traffic facilities and structures
- Model-based variant evaluation of the structures
- Representation of construction sequences/traffic routing, including all intermediate construction states as a basis for traffic simulation
- Model-based cost calculation
- Model-based approval procedure in coordination with BMVI and Straßen.NRW if necessary
- Integration of specialist planning for subsoil and environment
- Common CDE for BIM coordination
- Overall BIM coordination
- Public relations work



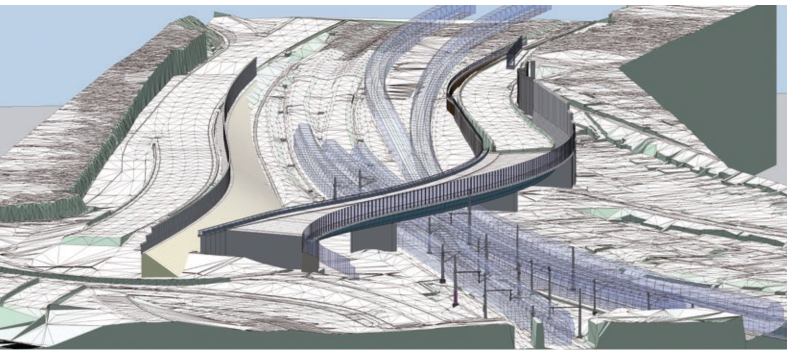


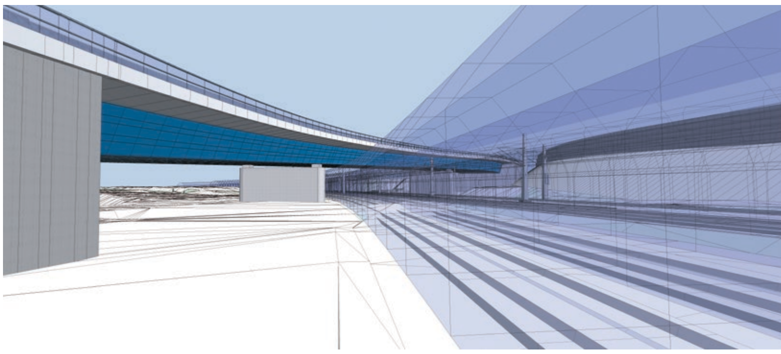
Reconstruction of the Funkturm motorway junction

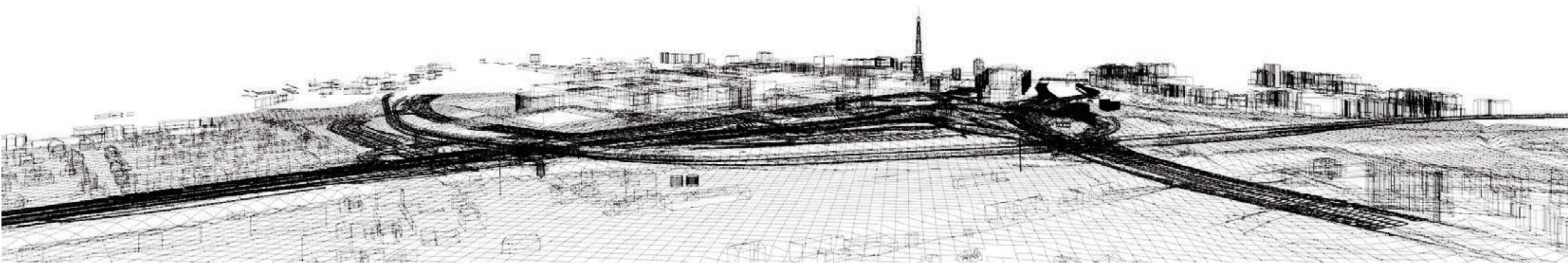
A100/A115 Berlin

Building contractor	DEGES Deutsche Einheit Fernstraßenplanungs- und -bau GmbH
Total length	1.9 km
Planning period	2019 – 2023
Completion	2030
Scope of services	In joint venture // object planning of engineering structures: preliminary, draft, approval and final design; preparation of tenders // structural engineering: preliminary and draft design; preparation of tenders // BIM planning in all work phases // coordination of railway trade services

The Funkturm motorway junction in Berlin links the two federal motorways A100 and A115 in the city centre and is the busiest motorway junction in Germany.
The objectives of the reconstruction measure are the fundamental renewal, an optimisation for handling the considerable traffic volumes through unbundling, and the reduction of the number of junctions to the subordinate inner-city network of the A100.
The urban location with the connection to Messe Berlin as well as the location next to and above railway junctions, residential areas and gardens, listed buildings, and ground monuments result in numerous factors to be taken into account. During the construction work, traffic must be maintained as far as possible. The construction measures require intervention with the railway facilities and thus also with inner-city railway traffic (suburban railway). However, this is needed at the same time to relieve traffic on the motorway.







The plans include:
18 traffic facility sub-objects
7 drainage sub-objects
27 engineering structures (bridges and tunnels)
22 supporting structures
Noise protection walls
11 temporary traffic facilities and engineering structures
43 demolition structures

BIM topics

The integration of the Funkturm motorway junction into the surrounding urban space is an essential planning criterion. The geometric and local boundary conditions suggest the use of the BIM planning method. The appearance of the inner-city motorway junction with its four levels, overlapping railway facilities in several levels and branches, the AVUS service area, and the unconventional linking of city roads is highly complex. A presentation in three dimensions makes the project more manageable for all involved. With the help of the model, all construction sequences and traffic routing phases can be mapped without collisions and taking into account all relevant interfaces. This simplifies coordination between the parties involved and can also be used to explain the construction project in a comprehensible way to the public and the citizens involved in the context of public workshops. Because of the complexity and the large number of planning participants from different trades with varying experience in BIM, the project also poses a special challenge to the technical interfaces and the BIM coordinators.

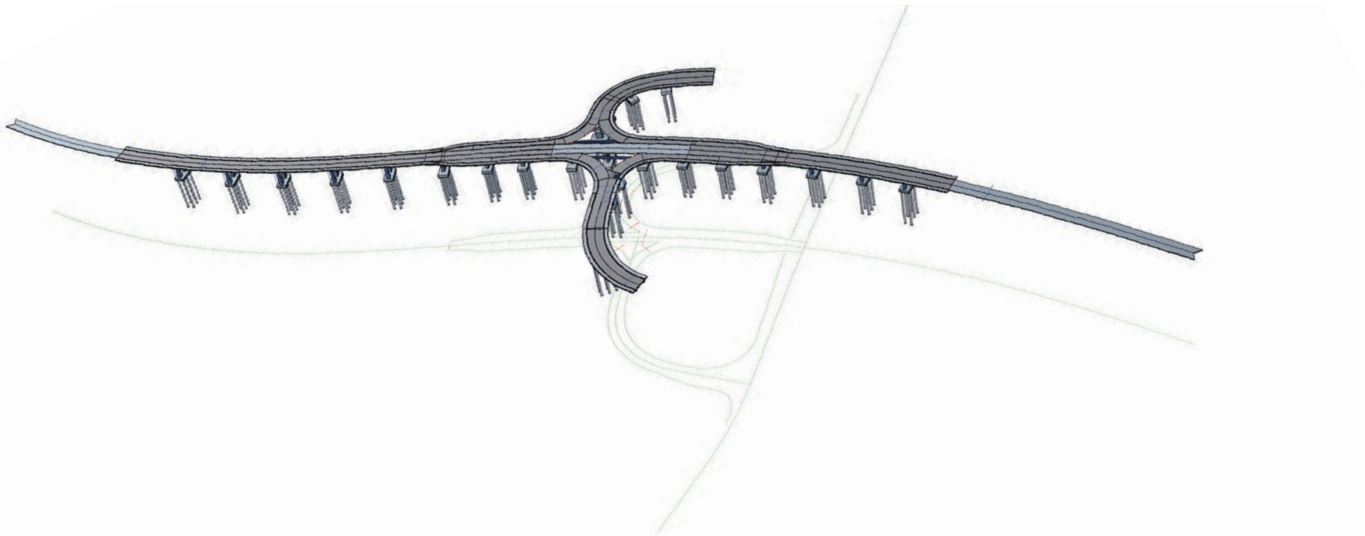
- Modelling of traffic facilities and structures
- Integration of specialist planning for rail, environment, noise, and design
- Integration of the required GIS data into the BIM model
- Construction sequence/traffic routing, including consideration of construction conditions and proof of the logistical and traffic-related functionality of the construction phases/traffic routing
- Use of a CDE for BIM coordination
- Piloting of the digital approval procedure
- Public relations work

Bridge across Aicherpark

B15 Rosenheim western bypass

Building contractor	State Building Authority Rosenheim
Supporting widths	14.00 m – 31.00 m
Total length	B 15: 460 m/ramps: 220 m
Planning period	2013 – 2020
Completion	2022
Scope of services	Entire construction project: object planning of engineering structures: basic evaluation; preliminary design // structural engineering: basic evaluation; preliminary design // services for project management, building logistics and construction operations planning, scheduling, cost updating and tracking, plan run, building contractor representation, public relations work for the overall measure, site management, supervision, Betra 4.2 rail supervisor, building contractor representative with authority to issue instructions Partial structure 2 (BW3.4 over Aicherpark and the DB line): object planning of engineering structures: preliminary and final design; preparation of tenders; supervision // structural engineering: preliminary, approval and final design; preparation of tenders // site management

The structures are constructed as multi-span, continuous deck bridges made of airtight welded steel box girders. The lines and inclinations of the substructures are continued on the superstructure through the sloping outer sides of the cornices and through the sloping position of the noise protection walls, thereby creating a uniform appearance of the structure. Four box-shaped abutments, each with a maintenance walkway, made of reinforced concrete, and 28 pier locations as massive single supports and reinforced concrete supports with hammer heads made of steel are planned for the 32 support locations.



The soft and unstable lake clay subsoil posed the greatest challenges for the structure. A mixed foundation was therefore chosen. This consists of bored piles, drainage columns, and displacement columns, each with a maximum length of 50 m and a sheet pile box embedded 10 m deep on average.

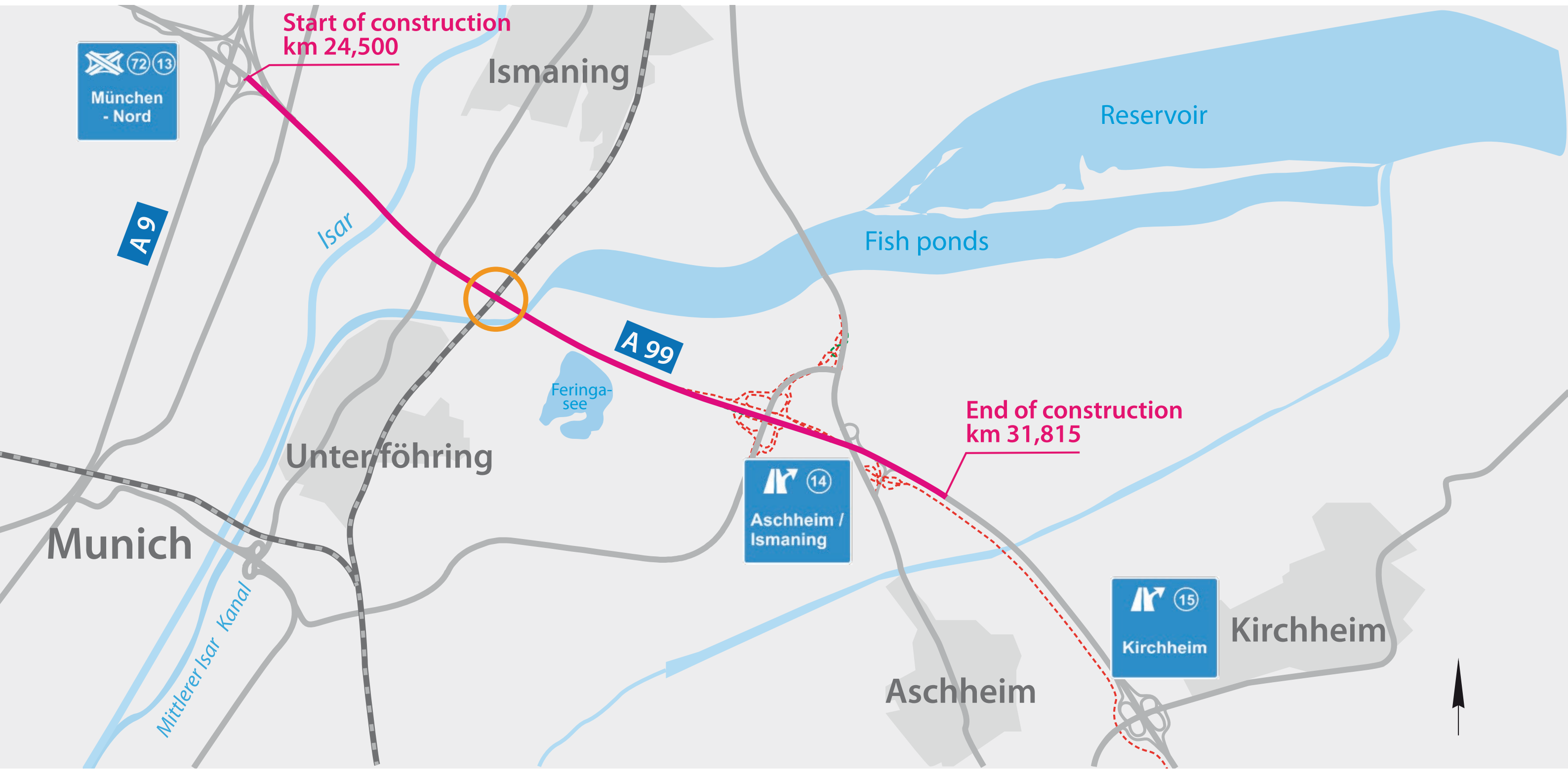
BIM topics

- Planning with Siemens NX
- Difficult geometry of the bridge, including widening ramps (including steel composite core construction)
- Derivation of all design and form work plans from the 3D model
- All execution plans were derived associatively
- Individual construction phases on the 3D model and thus easier to coordinate
- Simple transfer of masses and areas of individual components (better coordination; for example, with workshop planner steel construction)
- Use of the 3D model as the basis for the static calculation for special details
- With the overall 3D model, it was possible to coordinate all structural influences during production
- Coordination with geotechnical experts using the 3D model

Replacement of structure 27/1

via the railway line 5556, A99, eight-lane extension of München Nord motorway intersection – Haar interchange

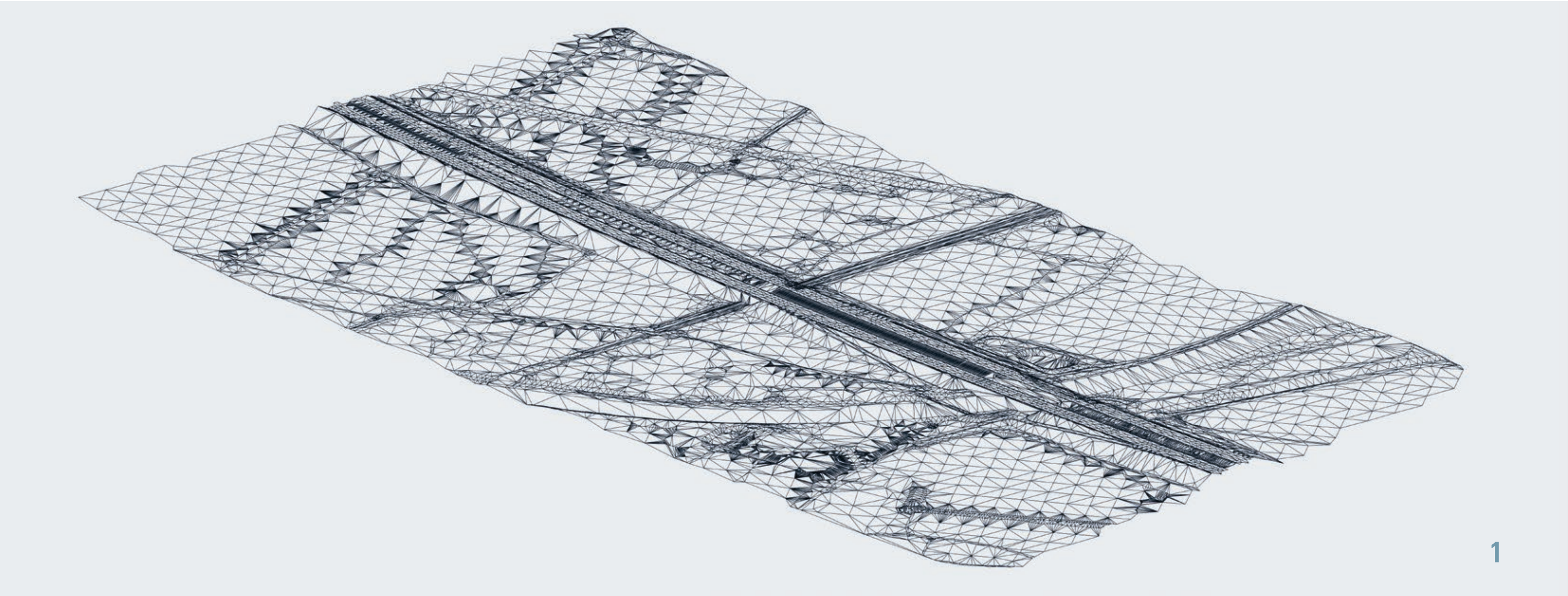
Building contractor	Southern Bavarian Motorway Directorate
Supporting widths	11.30 m
Total length	48.50 m
Planning period	2015 – 2017
Completion	2018 (Construction phase 1)/2019 (Construction phase 2)
Scope of services	Object planning of engineering structures: basic evaluation; preliminary and draft design; preparation of tenders; supervision // structural engineering: basic evaluation; preliminary and draft design; preparation of tenders // supplementary BIM services (participation in the preparation of the AIA for the various project phases, preparation of BAP, BIM planning and coordination); demolition concept



The A99 is the motorway bypass around Munich. It takes traffic flows from five motorways and routes them past the Munich urban area. The current traffic load is around 150,000 vehicles per 24 h. The A99 is currently widened to six lanes and the hard shoulder has been temporarily released for use in this area since 2005. Despite this improvement, the existing roadway cross-section cannot cope with the increasing traffic volumes in the medium term. The Southern Bavarian Motorway Directorate is therefore planning to widen the A99 to eight lanes on a stretch of 18.6 km between the Munich North motorway intersection and the Haar interchange. In addition to the renewal of the bridge structures and the superstructure, noise protection measures such as the construction of a noise-reducing road surface and higher noise protection walls are planned. In cooperation with a partner company in the SSF Group, Prof. Schaller UmweltConsult GmbH (PSU), the integration of BIM and GIS engineering planning and environmental data is tested in practice.
The focus was on the requirements for smooth mutual data exchange between engineers and environmental planners in order to optimise and monitor all relevant environmental issues – from the start of planning to project implementation to completion.

BIM topics

- Planning with Autodesk Revit
- 3D acquisition of the existing structure for demolition planning – construction in the existing structures in the presence of traffic
- Cost estimation and cost calculation based on the model (volume, surface, attributes)
- Better coordination with geotechnical experts using the 3D model
- Derivation of the essential building plans from the consistent 3D model
- The 4D model is created by linking the 3D model with the construction process
- Individual construction phases with the necessary traffic routing can be clearly displayed on the 3D model for coordination purposes
- Simple transfer of masses and areas of individual components
- Simulation of the course of costs over time: 5D model linking the 4D model with the costs of producing the components in question
- Use of the 3D model as the basis for the static calculations
- Prospects for the future: use for maintenance/operation/repair – transfer of data to SIB structures, storage of the model, integration into the GIS system used by the client



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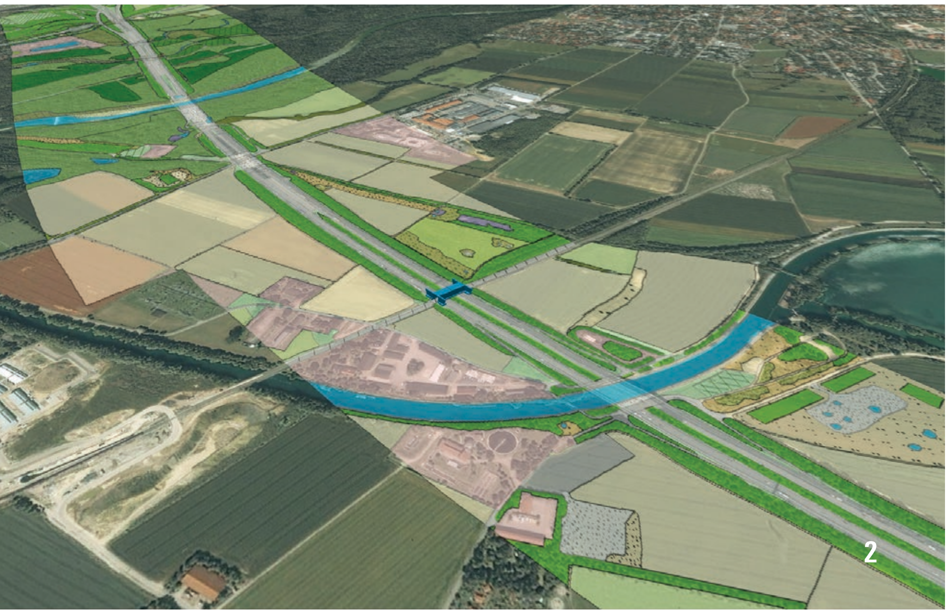
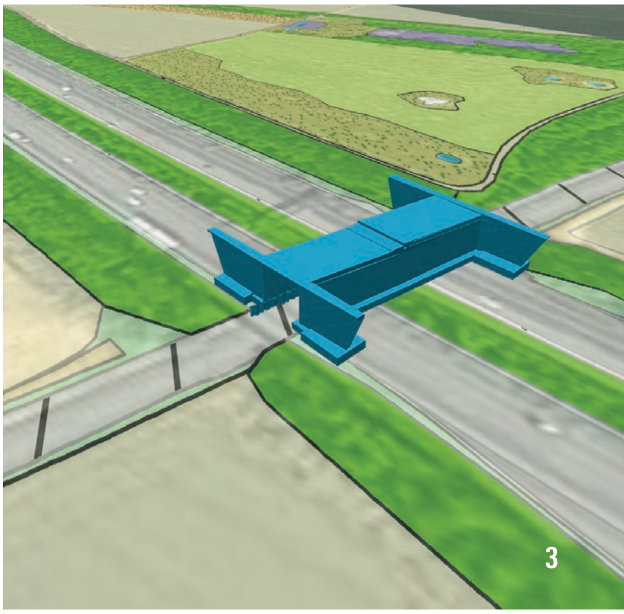
BIM and GIS data integration and evaluation

- Easy transfer of BIM data into the GIS environmental database with the ArcGIS FME/ETL process, georeferencing
- Data exchange between BIM and GIS data
- Establishment of a jointly usable 2D and 3D geodata structure for engineering and environmental planners
- Integration of the elevation models and survey data
- Integrated analyses and visualisation of the structure in the landscape

In the future, these could include

- Effectiveness analyses, intervention assessment, environmental impact assessment
- Nature and species protection requirements
- Landscape conservation planning and execution planning
- Landscape conservation compensation and replacement measures
- Ecological building supervision and ecological monitoring





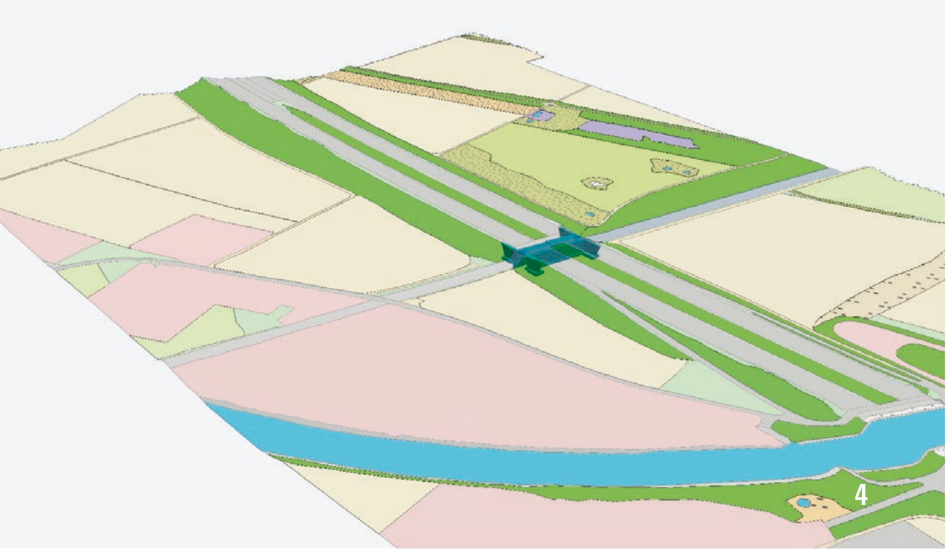


Fig. 1 TIN elevation model generated from survey data

Fig. 2 BIM bridge planning model imported into the 2D GIS geodatabase

Fig. 3 Integration of the structure into the scope of the accompanying landscape conservation plan

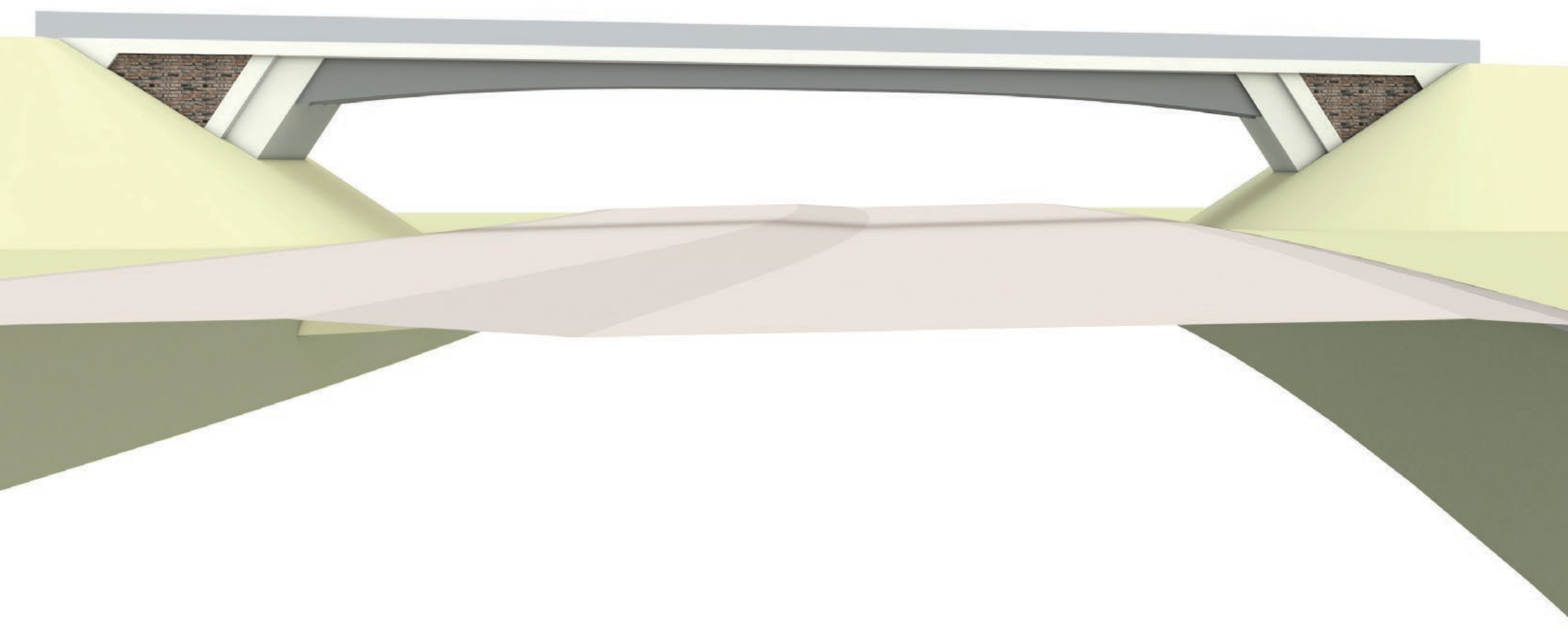
Fig. 4 Integration of the structure and the TIN data into the 3D GIS geo and planning data model

A20, reconstruction north-west bypass Weede to Elbtunnel

Section 4: B206 (Wittenborn) – A7, VKE A044
Section 7: A23 (Steinburg motorway intersection) – B431 (Glückstadt interchange)

Building contractor	DEGES Deutsche Einheit Fernstraßenplanungs- und -bau GmbH
Planning period	2020 – 2021
Completion	before 2026
Route length	35.1 km
Scope of services	Object planning of engineering structures: preliminary and draft design; preparation of tenders (optionally) // structural engineering: preliminary and draft design // BIM as a special service – creation of a fully parametric model for the construction of all overpasses and selected motorway bridge constructions

As the western continuation of the A20 Lübeck – Szczecin Baltic Sea motorway over the Elbe into Lower Saxony and a connection to the A26, the A20 will form an important east-west link in northern Germany and connect the German seaports on the North Sea and Baltic Sea as a hinterland link. These are Sections 3 to 8 from Weede to the connection of the planned Elbe tunnel on the Lower Saxony side of the Elbe and are yet to be built.



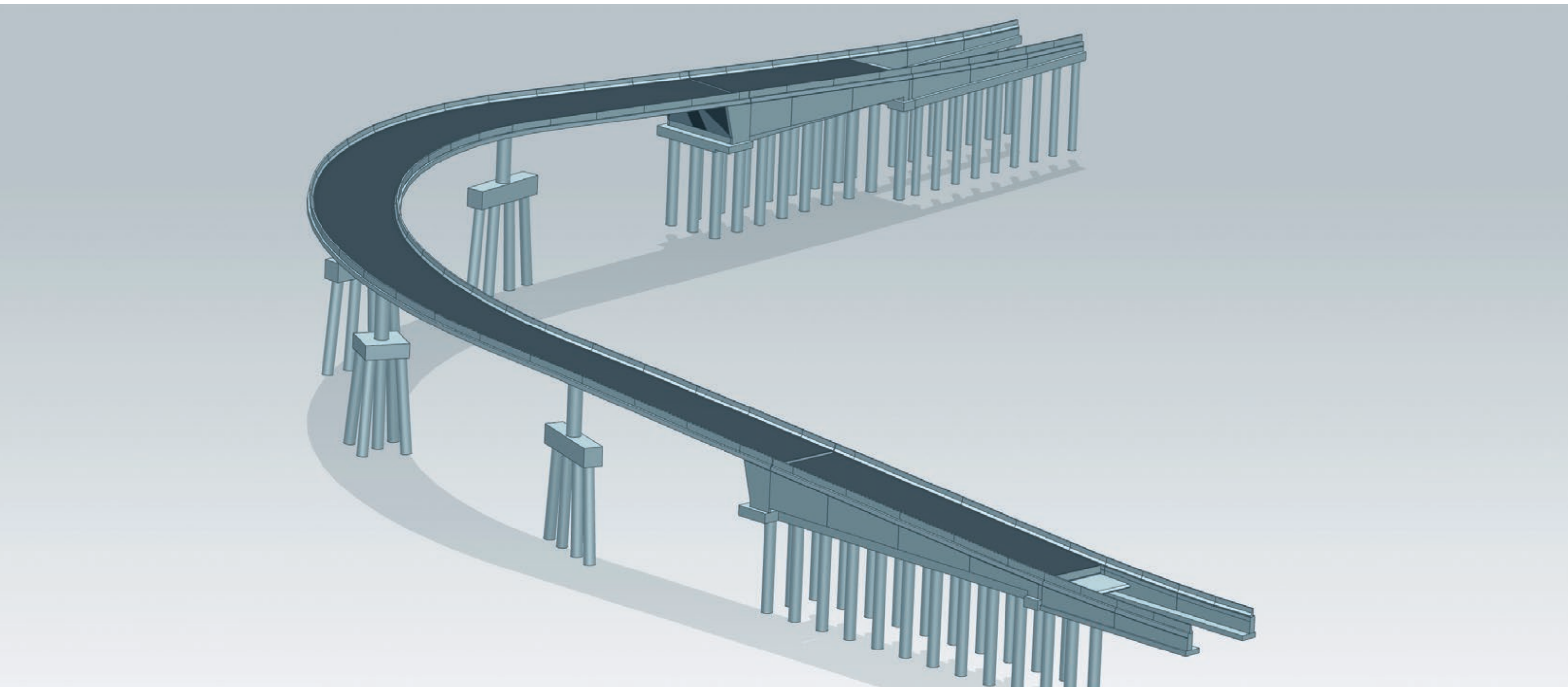
When the project was taken over by DEGES, a »Feasibility Study Ü-Bauwerke« on the omission of the central supports was prepared. According to this feasibility study, the decision was made to realise all the overhead structures as long-span frame structures. Furthermore, DEGES commissioned an overall design concept for this track section; this was presented to the state of Schleswig-Holstein. The design concept basically provides for a frame solution with frame stems inclined towards the BAB but allows for leeway in the interpretation of the WL arrangement and transom integration.
SSF was commissioned with the draft design on the basis of parameterised BIM models for a standard construction method of 13 overhead structures, one green bridge, and 18 A-structures in selected sections.

BIM topics

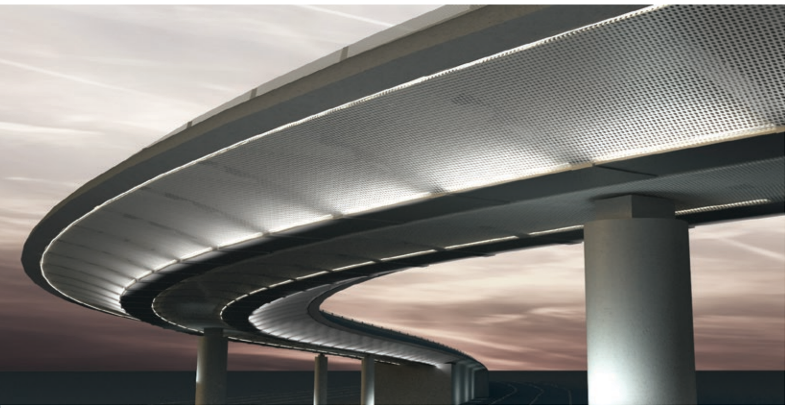
- Planning with Allplan Bridge
- Parametrised model creation, with the help of which the 3D modelling can be carried out in the »specialist model planning« of the individual bridges
- Objective: with the help of an input platform, all comparable structures can be modelled in a semi-automated way
- Use of self-developed add-ons on commercially available BIM software in order to transfer the planning of the structures from a manual to a serial mode of operation using BIM

Flyover – Viaduto São Paulo, Brazil

Building contractor	WTorre São Paulo Empreendimentos Imobiliários S.A. São Paulo, Brazil
Supporting widths	28.00 m + 28.00 m + 28.15 m + 35.00 m + 34.00 m + 32.00 m + 29.15 m + 41.00 m + 15.00 m
Total length	270.30 m
Planning period	2011 – 2012
Construction	2011 – 2013
Service type	Object planning of engineering structures: preliminary, draft and final design; preparation of tenders // structural engineering: preliminary, draft, approval and final design; preparation of tenders // lighting design, »facade planning« // assembly monitoring of VFT girders



In connection with the construction of the luxury shopping mall »Complexo WTorre JK« in the business district »Morumbi«, the access situation of Avenida Presidente Juscelino Kubitschek into Marginal Pinheiros/Av. das Nações Unidas, which is one of the main traffic arteries of São Paulo, was redesigned. A new ramp bridge (flyover) was built as a direct traffic link between Av. Kubitschek and the superordinate lane of Av. das Nações Unidas.
The pre-stressed concrete bridge, which is strongly curved (inner radius 55 m) and features a vertical curve, accommodates two lanes. The structure was designed semi-integrally with a clamp at both abutments and dynamic abutment shapes.



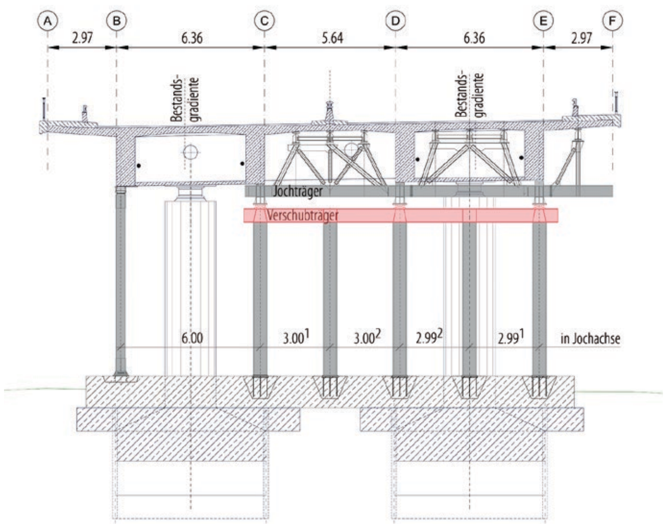
BIM topics

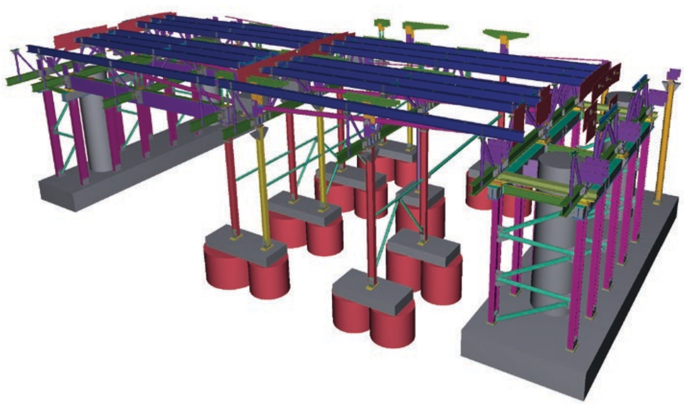
- Planning with Siemens NX
- Sophisticated design with a narrow routing radius of 65 m and spatial routing parameters
- Superstructure with perforated sheet cladding and LED lighting
- Complete, continuous 3D planning from the beginning of the design to the execution planning using a model (including form-finding and construction variants)
- Creation of construction sequence simulation in the context of fitting the bridge into an 11-lane urban motorway under difficult spatial and traffic conditions
- Derivation of the design and form work plans completely from the 3D model
- Use of the 3D model as the basis for the static calculation
- Use of the 3D model as the basis for an exact mass determination
- Use of the 3D model for a three-dimensional clearance calculation
- Use of the 3D model for workshop planning of the perforated sheets (approx. 230 different sheets because of the spatial curve)

A671, Hochheim foreshore bridges

Building contractor	Hessen Mobil – Roads and Traffic Management Darmstadt
Total length	approx. 750.00 m
Planning period	2016 – 2020
service type	In joint venture // planning of the temporary prop with the later transverse launching of the existing structure // object planning of engineering structures for temporary prop: basic evaluation; preliminary, draft, and final design; preparation of tenders; evaluation of tenders // transverse launching: basic evaluation; preliminary and draft design // structural engineering for temporary prop: structural engineering: preliminary, draft, approval and final design // analysing of construction stages // transverse launching: preliminary and draft design

The A671 in Hesse crosses the Main near Hochheim. To the north of the three-span steel bridge over the Main, the foreshore bridges made of pre-stressed concrete are connected. An expert report from 2015 documents massive defects in the overpass, which was built in 1965. The bridge must therefore be renewed. However, it was not possible to implement the planned replacement construction by the end of the remaining useful life at the end of 2019 because of a lack of building rights. As a result, all four main girders of the existing bridge structure had to be temporarily propped so that traffic could continue to flow.





In order to simplify assembly and disassembly, steel scaffolding was used as a temporary prop. These consist of singular supports in the field areas and in the stock pier axes.
The spacing of the supports is designed in such a way that the superstructure, after failure of the prestressing, can transfer the unsupported loads only via the existing slack reinforcement. In the field areas, steel yokes support the three eastern main bridge girders. Single columns are sufficient to support the western bridge girder – because of the construction method of the new replacement structure.
The construction method for the subsequent replacement structure provides for the existing superstructure to be divided longitudinally by a separating cut prior to the start of construction and the existing western girder to be demolished. The eastern superstructure section will be moved out to the side after construction of the new west superstructure. For technical and economic reasons, the support frames in the support axes are therefore designed to be suitable for subsequent transverse launching.

BIM topics

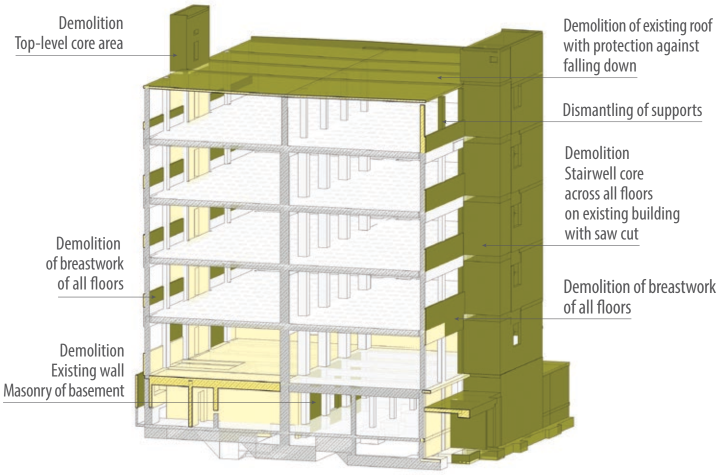
- Setting up a 3D steel construction model as part of the design and tender planning for handover to the steel construction contractor (acceleration of material orders and workshop planning/work preparation)
- Checking of workshop planning (1,100 plans) for compliance with approval planning
- Supervision of the construction work
- Consultation monitoring

Conversion and extension of an office building

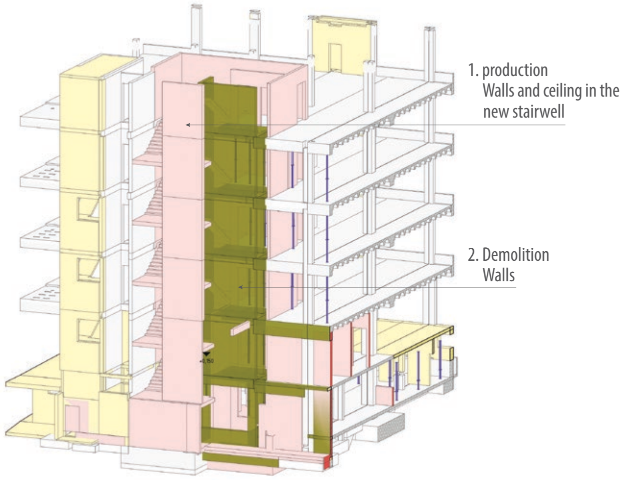
in Falkensteinstraße, Berlin-Kreuzberg

Building contractor	Victoria Mühlenwerke GmbH, Berlin
Architects	CODE OF PRACTICE architects, Berlin
Planning period	2019 – 2020
Planned completion	2023
GBV:	24,600 m^3
Useful area:	7,450 m^2
Service type	Feasibility study, 3D as-built model // structural engineering: preliminary, draft and approval design // overall project management

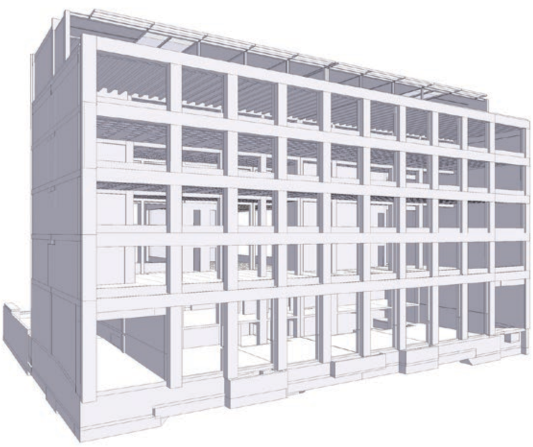
The 1950s warehouse building owned by Victoria Mühlenwerke GmbH, in direct view of the historic Oberbaumbrücke, is to be converted into office and retail space. Planning provides for additional office space to be created by adding a new structure in the area of the inner courtyard. In addition, the infrastructure of the adjacent inner courtyards of the building complex on Schlesische Straße 38 is to be upgraded.
Within the framework of a design phase, three architectural firms developed a design concept for the construction task. The winner was subsequently commissioned to carry out object planning up to Work Phase 4. SSF Ingenieure was commissioned by the building contractors to carry out structural engineering up to Work Phase 3 and up to Work Phase 4 for the existing building.
The entire property consists of two existing buildings and a new building complex, each of which is decoupled from the other via a separating joint and is thus structurally independent. The two existing buildings have five full storeys and a single-storey basement. The existing underground car park will be demolished and replaced with a new underground car park. This will also form the foundation level for the new building complex.
In the course of the construction work, the existing buildings will be gutted, new access cores will be installed, and an additional storey will be added. The ground floor will be opened up to the street by demolishing the high basement ceiling, thereby creating high-quality retail space at the same level as the pavement.
The new six-storey building on the inner courtyard side is based on the newly constructed underground car park, which was planned using the WU construction method. In order to create the greatest possible transparency, the ground floor of the new building is designed as a column-free bridge structure that supports the rising storeys. The architectural design provides for large exposed concrete surfaces in the existing and new buildings. This requires detailed planning of the demolition and reinforcement measures, especially in the existing structures.



Gutting of the building



Conversion and construction of a new building core



Final state after conversion measures

Façade view

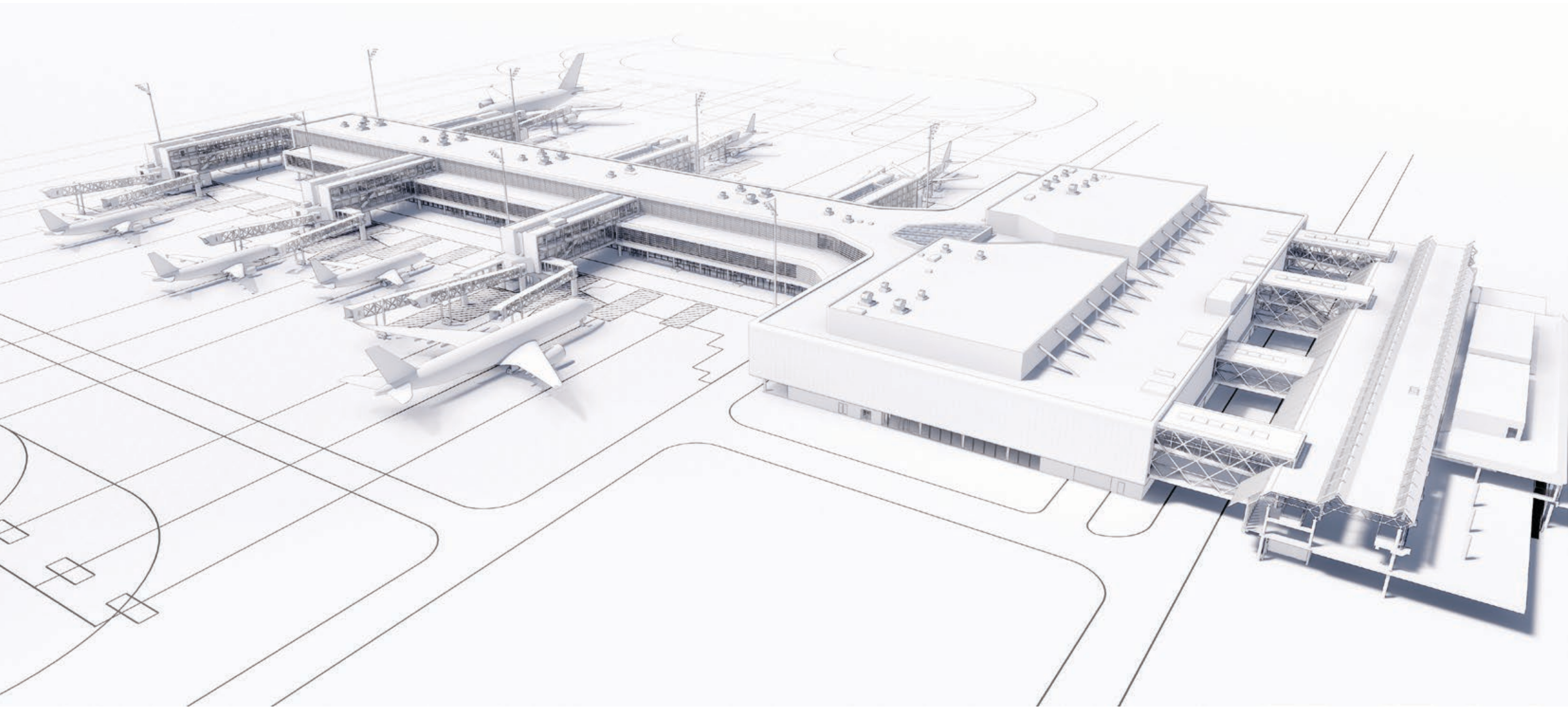
BIM topics

- Planning with Autodesk Revit
- 3D replica of the existing structure based on as-completed drawings and resurvey
- 3D structural modelling in preliminary and draft design
- Model as a basis for discussion and decision-making for the planned reconstruction measures
- Combined representation of existing structures, demolition, and new construction measures
- Representation of building conditions with building aids
- 3D collision check and quantity determination as basis for cost accounting
- Derivation of 2D plans from the 3D model
- Use of the 3D model as the basis for the static calculation

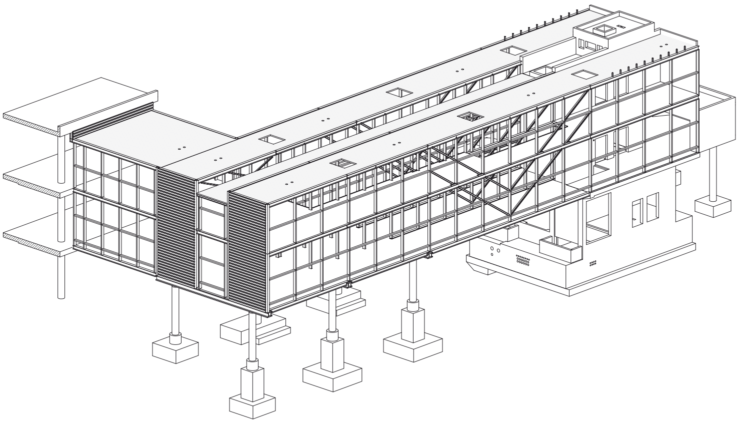
Munich Airport, extension of Terminal 1

Attractive hub for connections all over the world

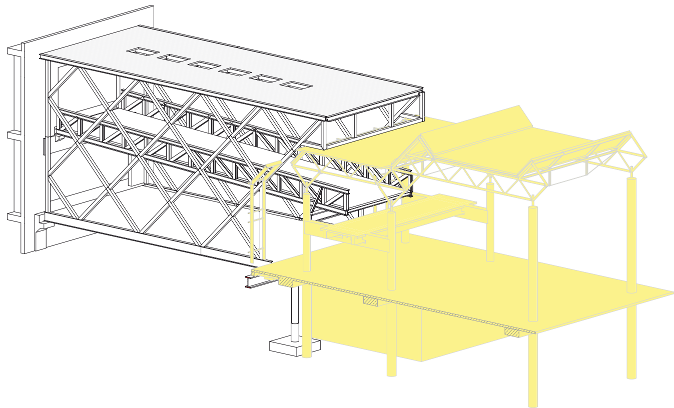
Building contractor/client	Flughafen München GmbH
Architects	slapa oberholz pszczulny architekten and JSK Pszczulny & Rutz Architekci
Planning period	2016 – 2024
Completion	expected in 2024
Gross floor area	96,000 m²
Scope of services	In engineering consortium // general planning of all trades, preliminary, draft, approval and final design; preparation of tenders; evaluation of tenders; supervision // in particular the service profiles of buildings and interiors, object planning of engineering structures, technical equipement, technical equipement // special services: excavation pit planning, facade planning, building physics, room and building acoustics, sound insulation, visual communication, sustainability, building logistics, fire protection, sampling management, door management, commissioning management, schedule and cost management



The new building, which is more than 340 m long and transparent, connects at right angles to the existing Terminal 1 and is accessed via four connecting bridges. The homogeneous structure, divided into three levels, rests on a recessed pedestal and rises floating above the surrounding runway. With its glazed outer façade, the pier appears immaterial and weightless, especially at nightfall, and allows exciting views of the building's interior from the aircraft for all arriving and departing passengers.
The reduced, deliberately understated architecture of the new pier is based on the airport's existing buildings and transfers their central design elements into a modern design language.



Fixed passenger bridge with bridgehead structure



Connecting bridge with connection to the existing structure

Support structure
The terminal is designed as a multi-storey reinforced concrete structure with flat ceilings and a column grid of 9.60 m as well as a basement.
The central glass skylight with a steel substructure has a span width of approx. 22 m.
The two-storey passenger and connecting bridges are steel or steel composite structures with span widths of up to approx. 22.50 m and are connected to the new bridgehead structures and the existing buildings.

Existing structures
The existing Terminal 1 building will be structurally adapted and reconstructed in the area adjacent to the new building, while preserving the existing architecture and structural design, in order to integrate the connecting bridges and to accommodate the changed routing and function.

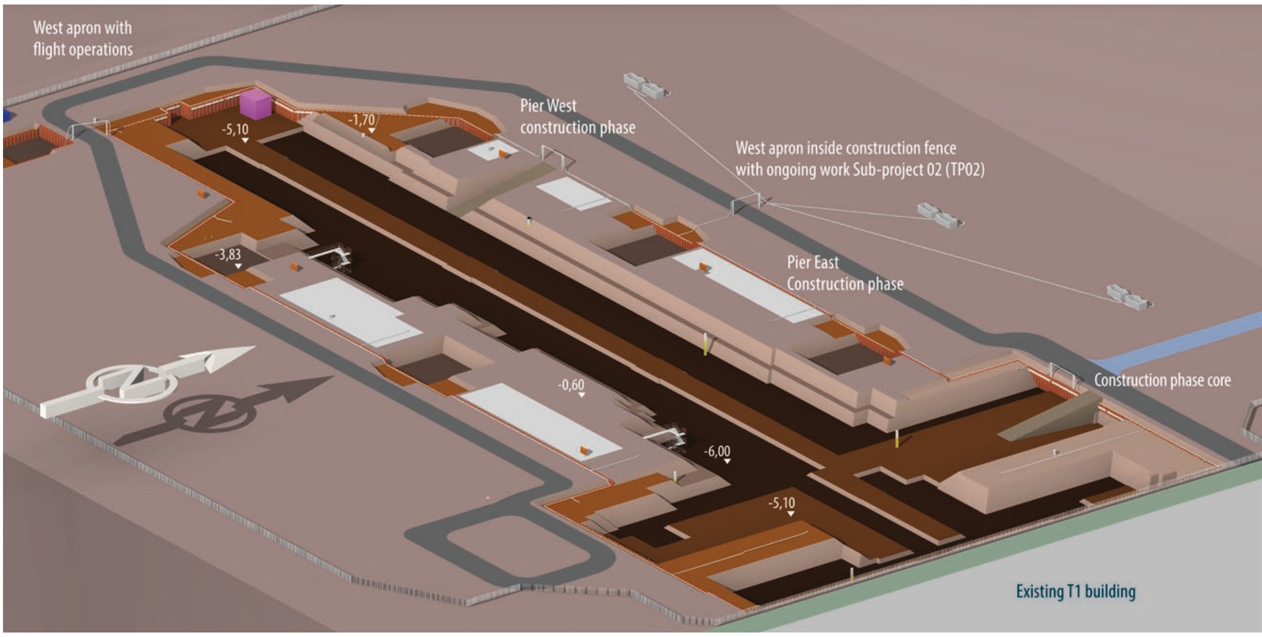
Excavation pit

Scope of services SSF:	Object and structural engineering Work Phases 1 - 8
Planning period:	2017 - 2020
Construction time:	2019 - 2020
Area:	approx. 40,000 m²
Building pit lining:	approx. 1,000 linear metres

- Execution as sheet pile lining optimised excavation cuts with and without grouted anchors as well as with the addition of upstream embankments
- Groundwater level: approx. 2 m below ground level
  - Integration up to approx. 6 m deep into the existing groundwater
  - Lowering of the groundwater table through closed dewatering as well as through open dewatering for localised lowering.
- Highest requirements for low-vibration installation because of the systems engineering in the adjacent existing terminal building (e.g. highly sensitive X-ray equipment in baggage and passenger control)
  - Construction of sheet piles with rinsing aids and pilot holes
  - Extensive vibration monitoring of sheet pile installation

BIM topics

- Continuous derivation of the excavation pit, form work, steel construction, and detail planning of the building complex from the 3D model with Autodesk Revit
- Application of the BIM method in geometric planning of the excavation pit, including shoring and anchors
- Transfer to the excavation model of the shafts and pipes required for excavation drainage
- Use of 3D functionality for design control and visualisation of complex geometries
- Use of the 3D model as the basis for the collision check with regard to TGA planning and constant exchange with the models of other specialist planners
- Use of BIM functionality for mass determinations (concrete cubature, reinforcement quantities, and steel tonnages for the preparation of the tender)
- 3D system model of the integrated steel structure as the basis for workshop planning
- Use of the 3D model as a basis for the static calculation and creation of the position plans, including the use of parameters (e.g. position number, concrete quality, exposure class, and reinforcement content)
- Use of a CDE (BIM360) for BIM coordination


West apron with
flight operations
-5,10
-1,70
Pier West
construction phase
West apron inside construction fence
with ongoing work Sub-project 02 (TP02)
-3,83
Pier East
Construction phase
-0,60
Construction phase core
-6,00
-5,10
Existing T1 building

Reconstruction of Munich Volkstheater

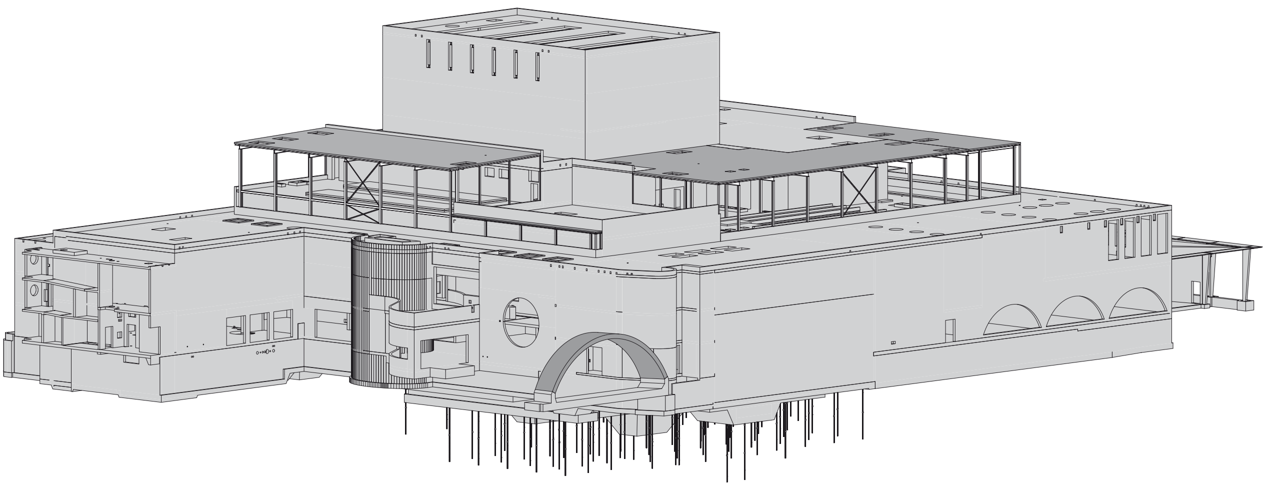
Building contractor	City of Munich
Client	Georg Reisch GmbH & Co. KG Construction Company
Architect	LRO Lederer Ragnarsdóttir Oei GmbH & Co.KG
Planning period	2018 – 2020
Completion	2021
Main usable area	10,300 m²
Gross floor area	30,000 m²
Gross volume (GBV)	162,000 m³
Scope of services	Structural engineering: basic evaluation; preliminary, draft, approval design and final design; preparation of tenders; supervision // engineering checks, verification of structural fire protection with fire protection design, planning of excavation pit and foundation of the central tower crane, BIM structural model

The reconstruction of the Munich Volkstheater venue on the former site of Munich Viehhof will create a complex for the main and auxiliary stages, rehearsal stages, dressing rooms, foyer, administration, workshops, and storage as well as catering and an underground car park. A children's theatre workshop, artists' flats, and offices for the artistic director and administration will be partially integrated into the existing listed building, which is also being renovated.
The connection to the existing listed building is made in the main entrance area on Tumblingerstraße via the arch built on a centring. The courtyard area between the new building and the existing building will be used as an entrance area and beer garden.

The supporting structure of the new building will essentially be a reinforced concrete structure, partly with composite ceilings and steel roof structures with supporting widths of up to 20 m to accommodate the diverse usage requirements:

- Roofing of the main stage (stage tower) – steel structure, four-part girder with a span width of approx. 20.20 m, transfer of additional loads from stage technology and fly loft
- Ceiling of auditorium – combined reinforced concrete/steel composite structure; reinforced concrete frame girder with a span width of approx. 25.50 m; additional loads from the building services control centre

The foundation slabs in the groundwater had to be partially secured with buoyancy piles.



BIM topics

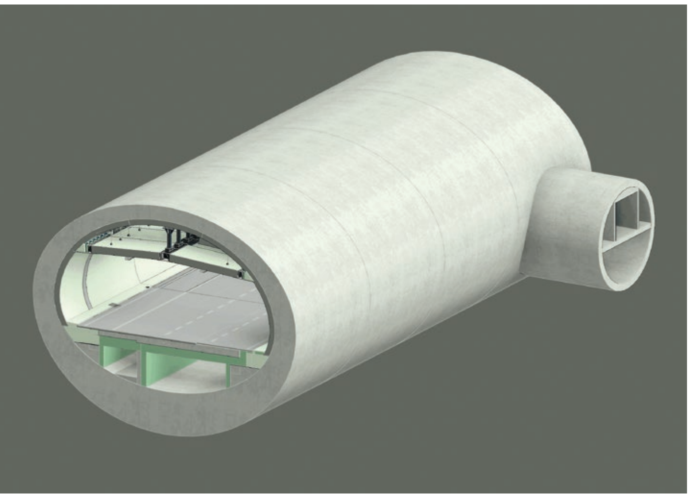
- Continuous derivation of the form work, steel construction, and detail planning of the building complex from the 3D model with Autodesk Revit
- Use of 3D functionality for design control and visualisation of complex geometries
- Use of the 3D model as the basis for the collision check with regard to TGA planning and constant exchange with the models of other specialist planners
- Use of the BIM functionality for mass determinations (concrete cubature and reinforcement quantities for the preparation of the tender and for the settlement of costs between the client and sub-contractor)
- 3D system model of the integrated steel structure as the basis for workshop planning
- Use of the 3D model as a basis for the static calculation and creation of the position plans, including the use of parameters (e.g. position number, concrete quality, exposure class, and reinforcement content)

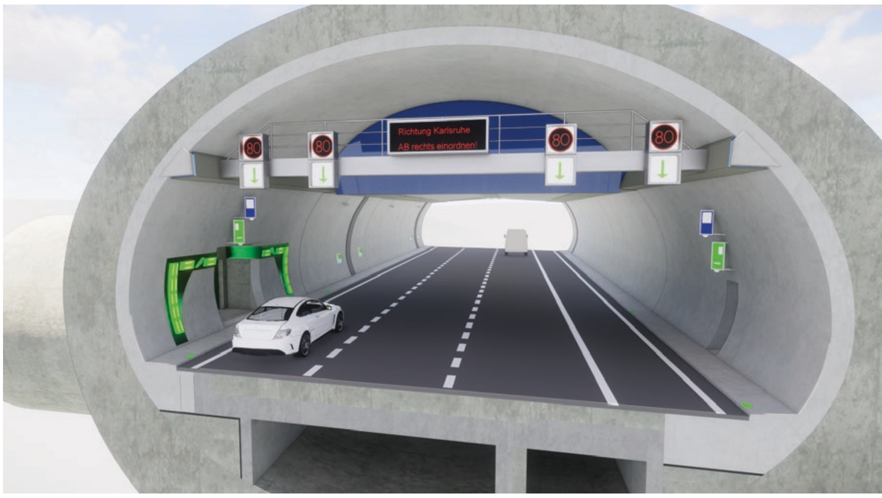
Reinforcement of the inner shell of the Engelberg base tunnel

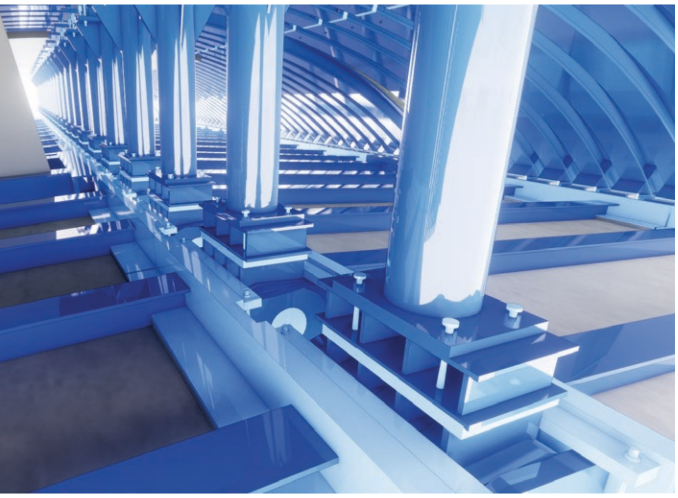
A81 Leonberg motorway junction

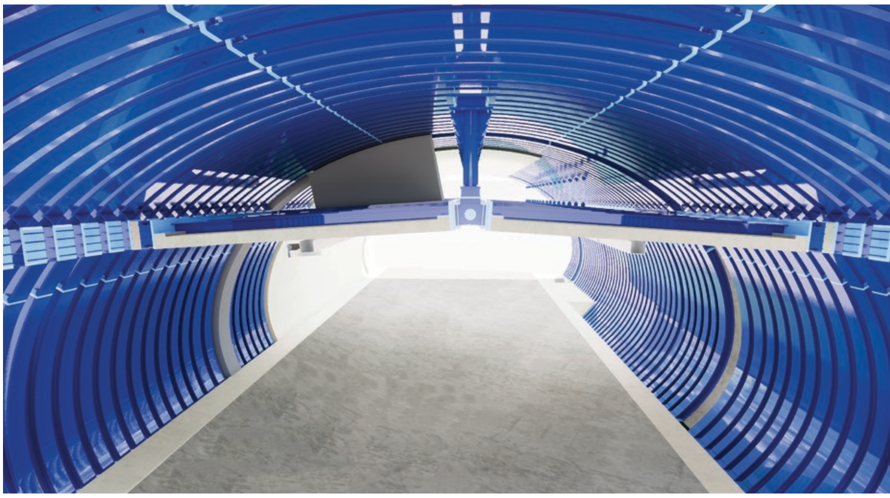
Building contractor	Regional Council of Stuttgart
Total length	West tunnel (direction of Singen): approx. 2,530 m; East tunnel (direction of Würzburg): approx. 2,520 m
Planning period	2017 – 2018
Completion	2022
Scope of services	Object planning of engineering structures: final design; preparation of tenders; partially supplement preliminary and draft design // structural engineering: approval and final design for standard blocks (reference design), final design for six special blocks (reference design); preparation of tenders // technical equipment: final design; preparation of tenders // BIM as an additional service

The Engelberg base tunnel near Leonberg is part of the A81 federal motorway and is located directly north of the Leonberg triangle near Stuttgart. The tunnel is used by 110,000 vehicles every day and is of central importance for traffic access from the greater Stuttgart area.
The Engelberg base tunnel was built from 1995 to 1999 as a two-tube tunnel with a length of approx. 2,500 metres using the mining method.









After almost 20 years of operation, both tunnels show considerable damage over a length of approx. 180 metres in the inner lining and the slot channels in the form of deformations in the area of the anhydrite-bearing rock. These require extensive structural retrofitting of the inner shell according to the resistance principle as a steel/steel composite construction with an additional inner shell.

The upgrading of the Engelberg base tunnel also includes a comprehensive optimisation and supplementation of the existing operational equipment of the entire tunnel to the current state of the art in accordance with RABT 2016.

SSF Ingenieure, as part of a planning consortium, provided the above-mentioned general planning services for the upgrading of the Engelberg base tunnel.

BIM topics

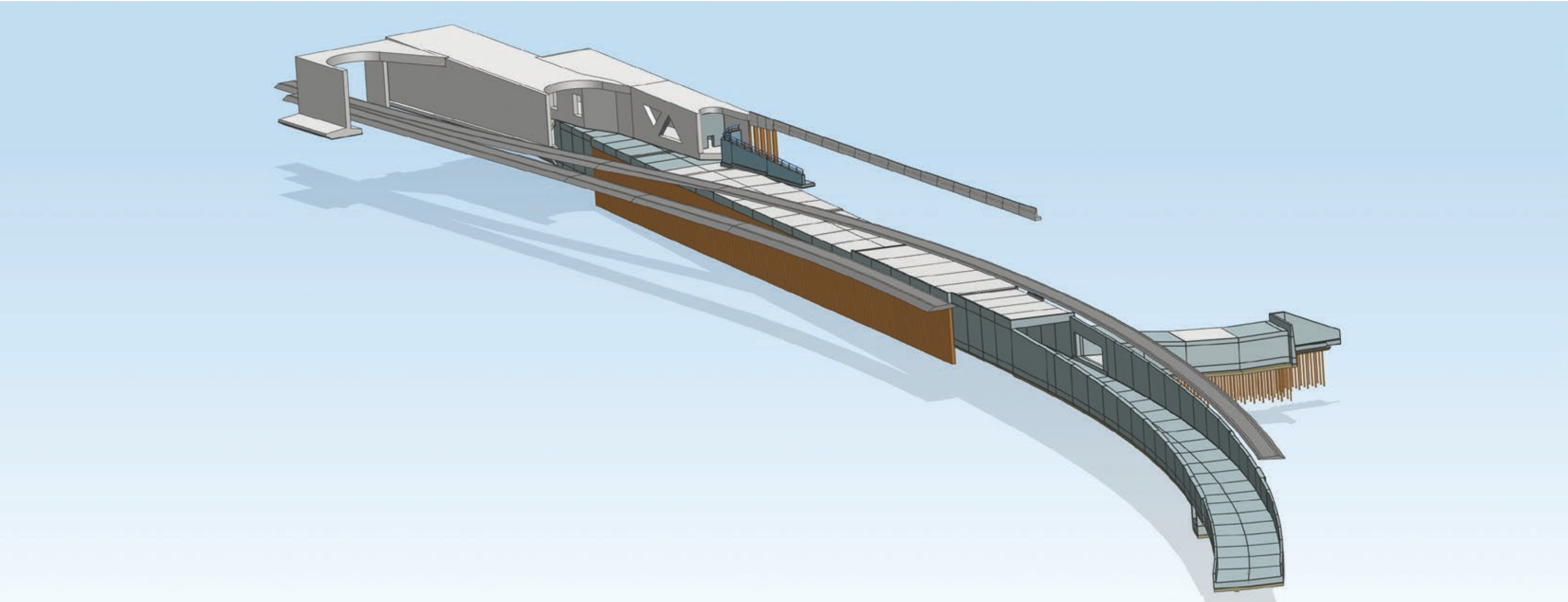
- Adaptation of 2D data into 3D Revit data
- Mapping in BIM model/illustration of the complexity of structural retrofitting
- Detail design triple spherical bearing/spherical bearing/ridge support
- BIM data use for adaptation as virtual reality for virtual »walking« through the tunnel in the part to be upgraded
- Modernisation and retrofitting in ongoing traffic
- Traffic routing for all construction phases

Feuerbach Tunnel Stuttgart

Double-track mainline tunnel PFA 1.5 Stuttgart

Building contractor	DB Projekt Stuttgart – Ulm GmbH
Tunnel length	238 m
Planning period	2015 – 2020
Completion	2020
Scope of services	Object planning of engineering structures: preliminary, draft and final design; preparation of tenders // structural engineering: preliminary draft, approval design and final design; preparation of tenders // object planning of traffic facilities: draft and final design // general planning and construction-accompanying track superstructure and civil engineering in traffic facility planning

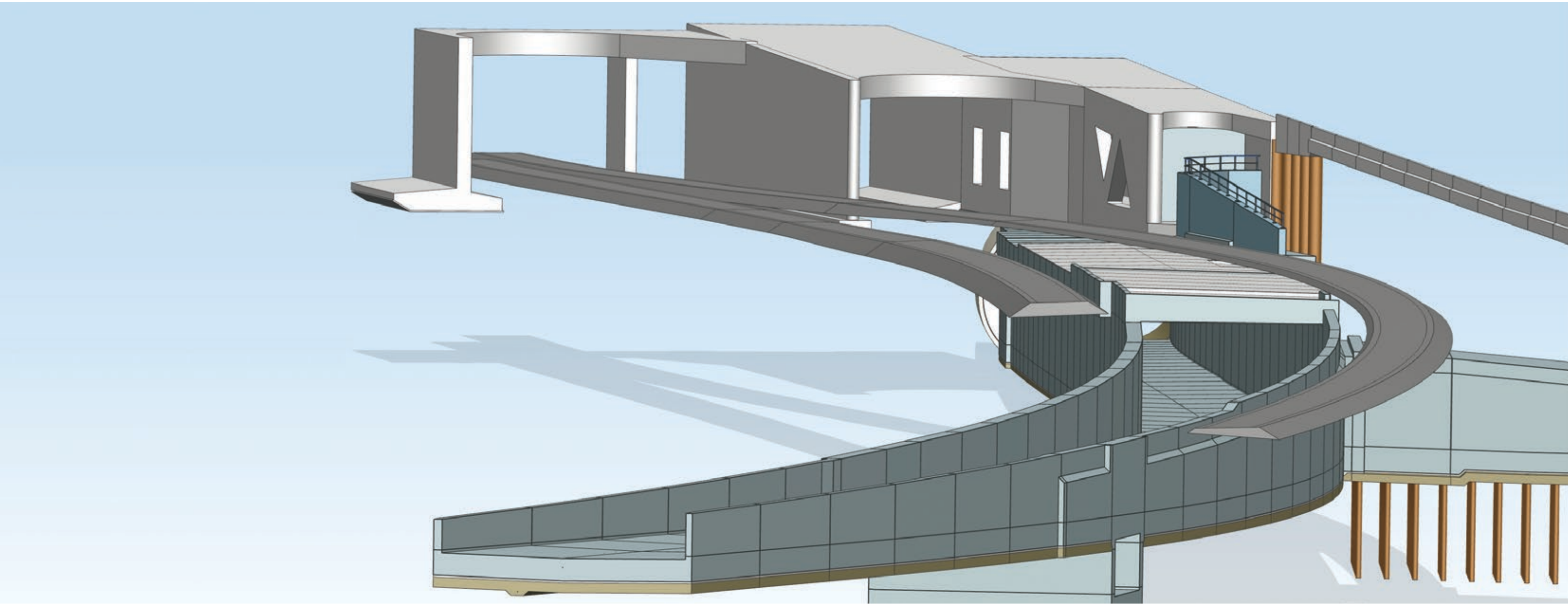
Using mining techniques, the Feuerbach tunnel will be double-tracked over a length of approx. 238 metres from the portal of the tunnel to the trough structure.
Blocks 1 - 9 will be built in a special construction method in the area of the existing suburban railway tunnel.



Because the tender design had to be fundamentally changed here, this area was optimised in a special variant investigation. The present draft design comprises Blocks 1 - 28. Of these, Blocks 10 - 24 will be built using the cut-and-cover method (as opposed to the tender design), while Blocks 25 - 28 will be built using the open construction method as originally planned. The construction of Blocks 1 - 9 is being carried out in a quasi-mine construction method.

BIM topics

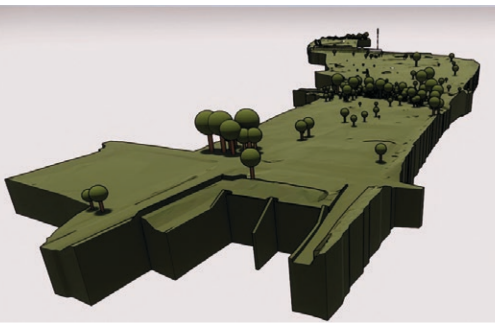
- Planning with Siemens NX
- Difficult geometry of the undercut of the existing tunnel (connections existing/new structures)
- All draft designs can be derived from the 3D model
- The 3D model allows for better coordination of the individual construction phases with the construction company
- Simple transfer of masses and areas of individual components
- Use of the 3D model as the basis for the static calculation
- Using the overall 3D model, all constructional influences during the tunnel underpass – excavation, construction support structures, required traffic routing and track relocation – were coordinated with each other.
- Simple coordination with geotechnical experts using the 3D model



Allach Tunnel

A99 Munich/Allach motorway junction – Munich/Feldmoching motorway junction

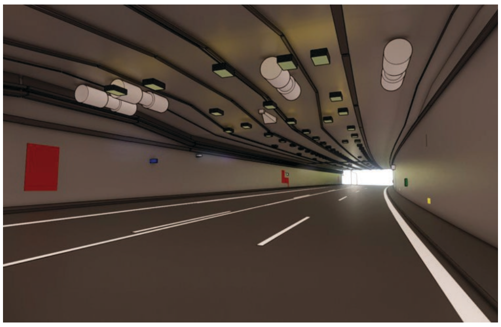
Building contractor	Southern Bavarian Motorway Directorate
Total length	1,030 m
Planning period	2018 – 2020
Scope of services	BIM modelling // project management, including scheduling, building operations, and building logistics planning, both for the Allach tunnel and for the adjacent sections of the A99 // cable civil engineering, object planning of engineering structures and traffic facilities (Wagner Ingenieure - SSF Group), structural engineering: basic evaluation; preliminary, draft, and approval design // planning of traffic routing during the construction period, as-built survey of the A99, the tunnel surface, and the entire tunnel tubes

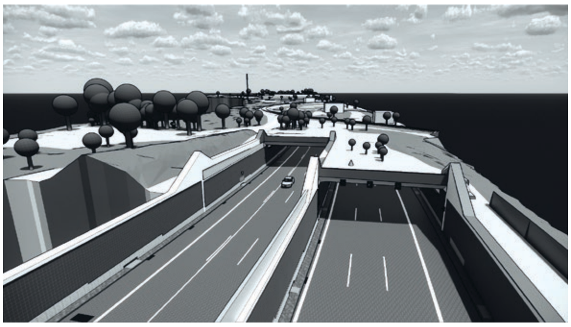


Planning for the hard shoulder to be temporarily released for use on the A99 between the München/Allach motorway junction and the München-Feldmoching motorway junction. The temporary increase from six to eight lanes will reduce congestion times on the heavily used route and expand the insufficient capacity of the tunnel. In the course of this measure, the Allach tunnel is to be upgraded and partially renewed. Associated with this are various engineering interventions and a comprehensive chloride remediation.
SSF Ingenieure is responsible for the creation of the 3D model of Allacher Tunnel, including terrain modelling on the surface, underground cable construction planning above the tunnel (including the associated engineering structures), and the overall consolidation of all trades as well as the optimisation of the individual trades during construction. In addition, the work required on the adjacent sections of the A99 will be recorded and harmonised in terms of both scheduling and construction operations.

BIM topics

- Planning with Autodesk Revit
- Creation of BIM model, including surface measurement
- Incorporation of segments on the surface
- Consolidation of trades, including services for chloride remediation walls/conversion drainage
- Consideration of possible construction conditions depending on traffic routing
- Optional: representation of the construction sequence of all finishing and technical trades/finishing trades



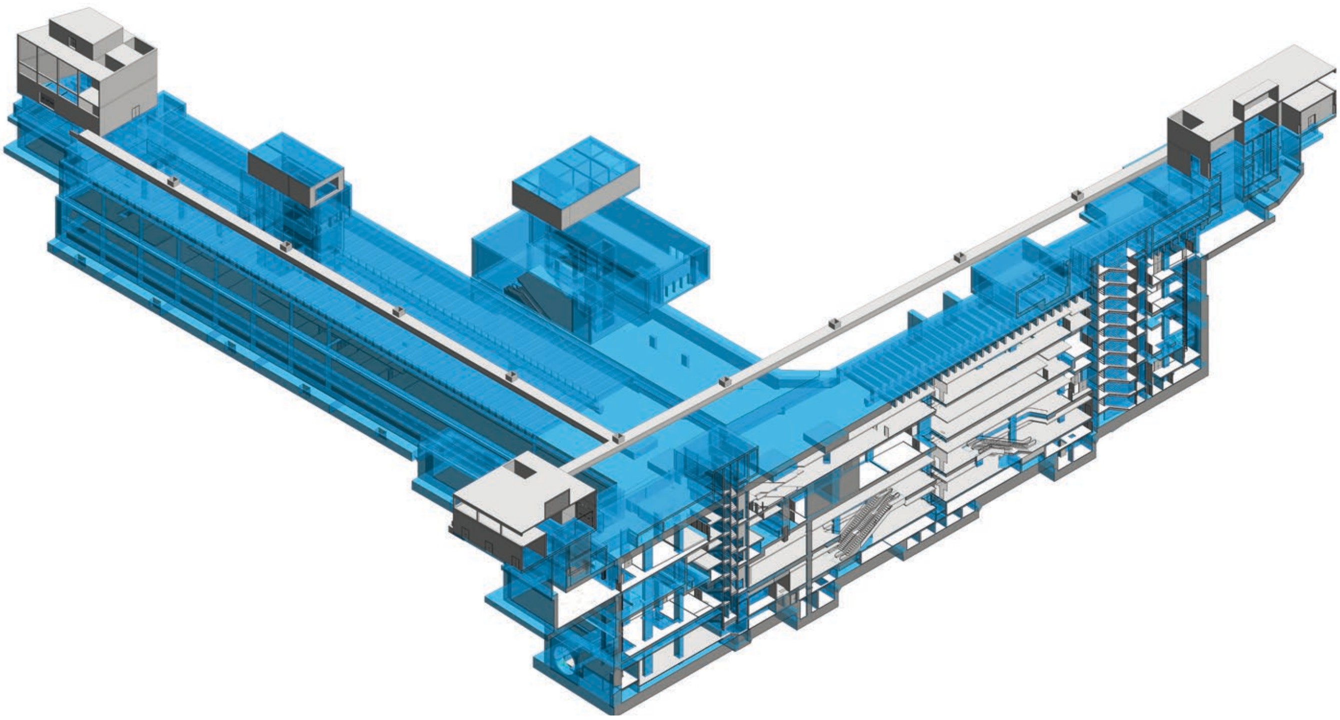


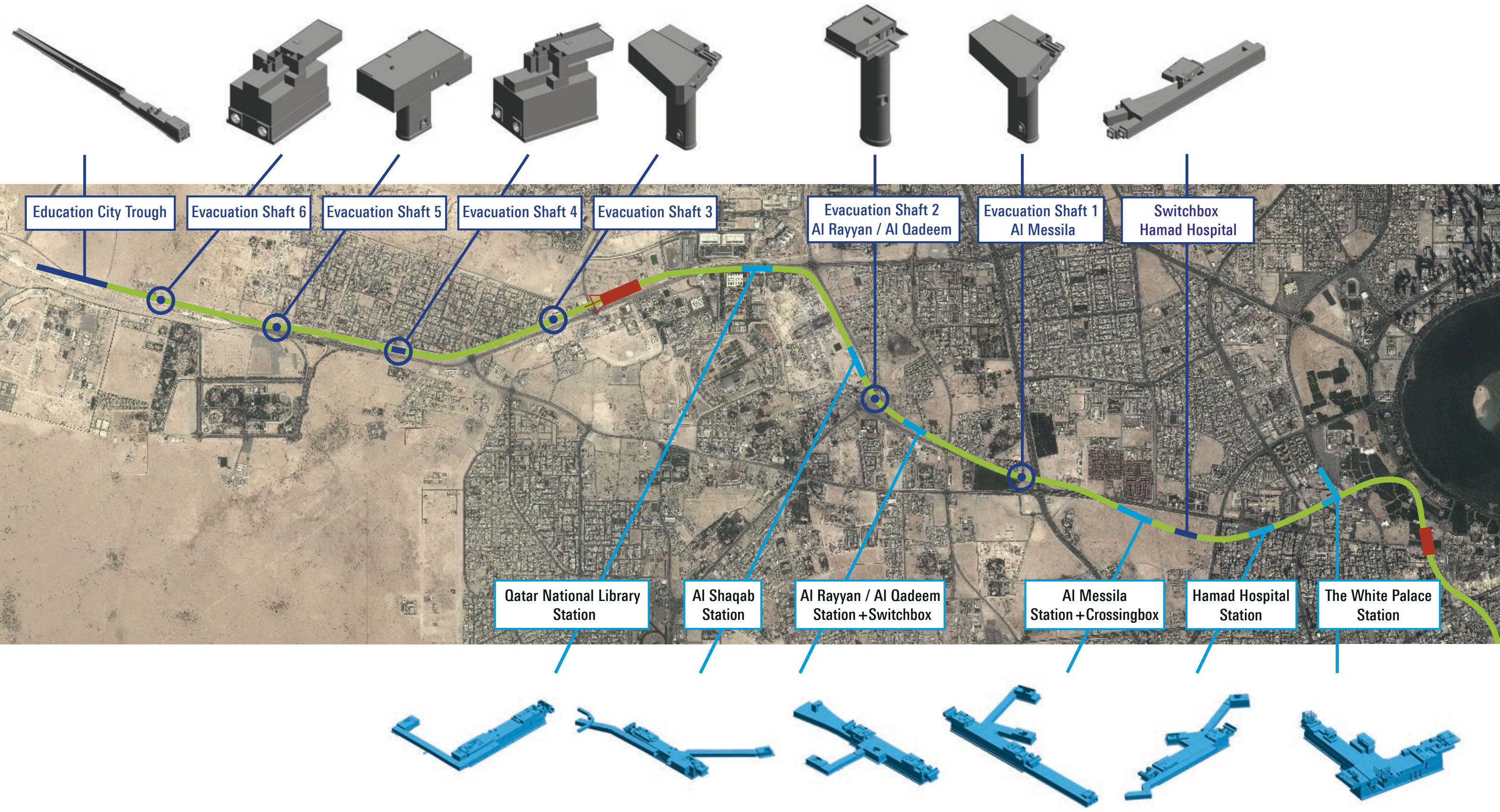
Metro Doha, Qatar

Planning and realisation of the underground line Education Line/Green Line

Building contractor	Qatar Railways Company
Client	Joint venture of the companies PORR AG Austria, Saudi Binladin Group Saudi Arabia, and the local construction company Hamad Bin Khalid Contracting Company (PSH)
Total length	18.5 km
Planning period	2013 – 2018
Construction	2014 – 2019
Service type	Object planning of engineering structures: basic evaluation; preliminary, draft, approval and final design; preparation of tenders; evaluation of tenders; supervision // structural engineering: basic evaluation; preliminary, draft, approval and final design; preparation of tenders

In Doha, the capital of Qatar, a modern underground network was built.
The billion-dollar project, which was put out to tender in 2011, is an integral part of the Qatar Rail development programme. The four main lines of the metro network – about 90 km of track (50% tunnels) and about 30 stations, 24 of them underground – are run underground in the centre of Doha and mainly above ground on the outskirts.



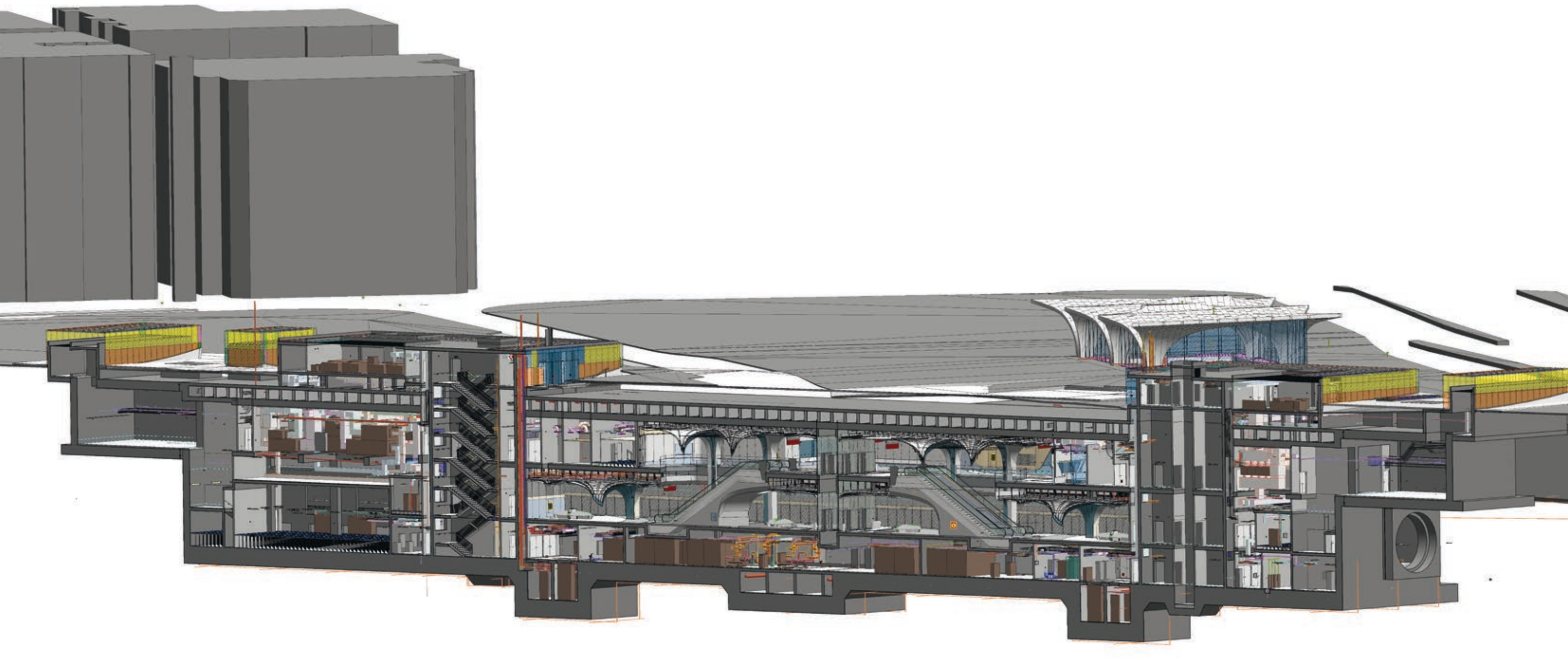


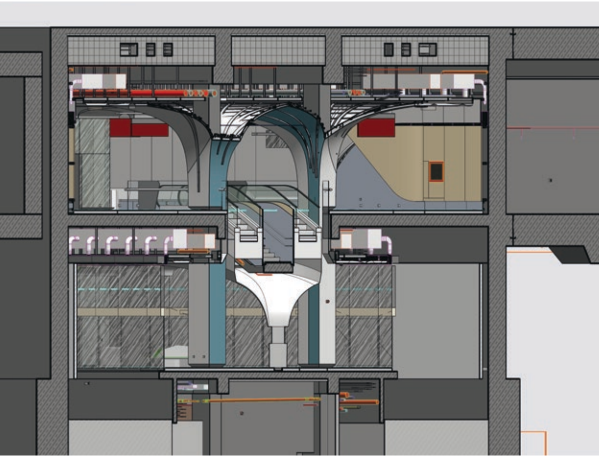
The Green Line (also called the Education Line) is the underground part of one of the four main lines of the Metro-Doha project. The total length of this underground line is approx. 18.50 km, and the cross-section is a twin-tube tunnel. In addition to six underground station buildings, 10 emergency exit shafts and track changing facilities are being built along the line. The project is being realised as a design-and-build contract by a joint venture of PORR AG Austria, Saudi Binladin Group Saudi Arabia, and of the local construction company Hamad Bin Khalid Contracting Company (PSH).

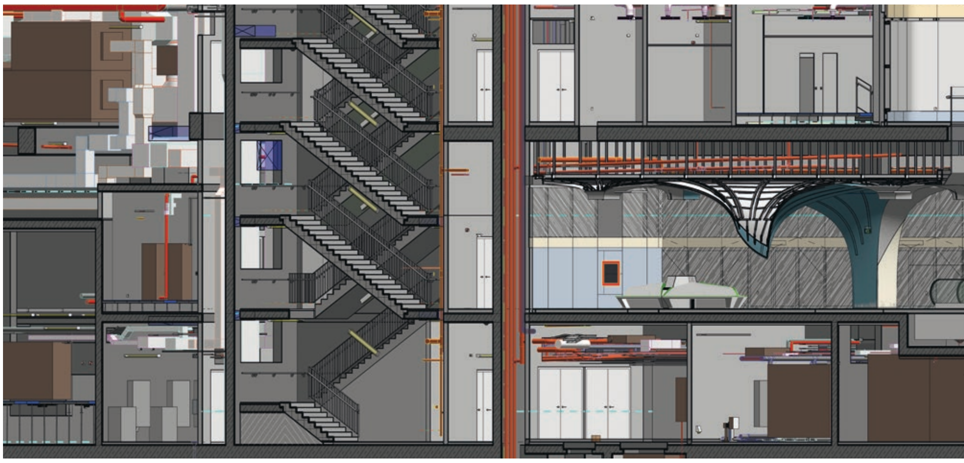
The conceptual design of the structures was handed over by the building contractor Qatar Rail with 2D planning documents. The scope of the contract includes overall planning – from the draft design and the preliminary design (basis for the building concept with room layouts and final definition of the uses in coordination with all parties involved) to execution planning, the detailed design of the individual trades.

In order to meet the high requirements, Building Information Modelling (BIM) served as the guiding technology for all those involved in construction.

After the tender documents were only available in 2D in the processing depth of conventional planning, design and execution planning were implemented throughout with BIM in order to also support the subsequent operation and maintenance of the metro system.
SSF Ingenieure was commissioned with overall planning and the disciplines of geotechnics, supporting structure (excavation pits, stations), and architecture for the design of the stations and the areas that are not publicly accessible. Other disciplines such as landscape planning, building services, and tunnel planning were carried out by separately commissioned planners (from London, Paris and Vienna). In the challenging project, planners and design management each provided their BIM managers, who were responsible for BIM coordination among themselves and implementation in the respective company.
Because both the architecture and the structural engineering were provided by SSF Ingenieure, the BIM coordination of these two disciplines was carried out by a coordinating BIM manager.







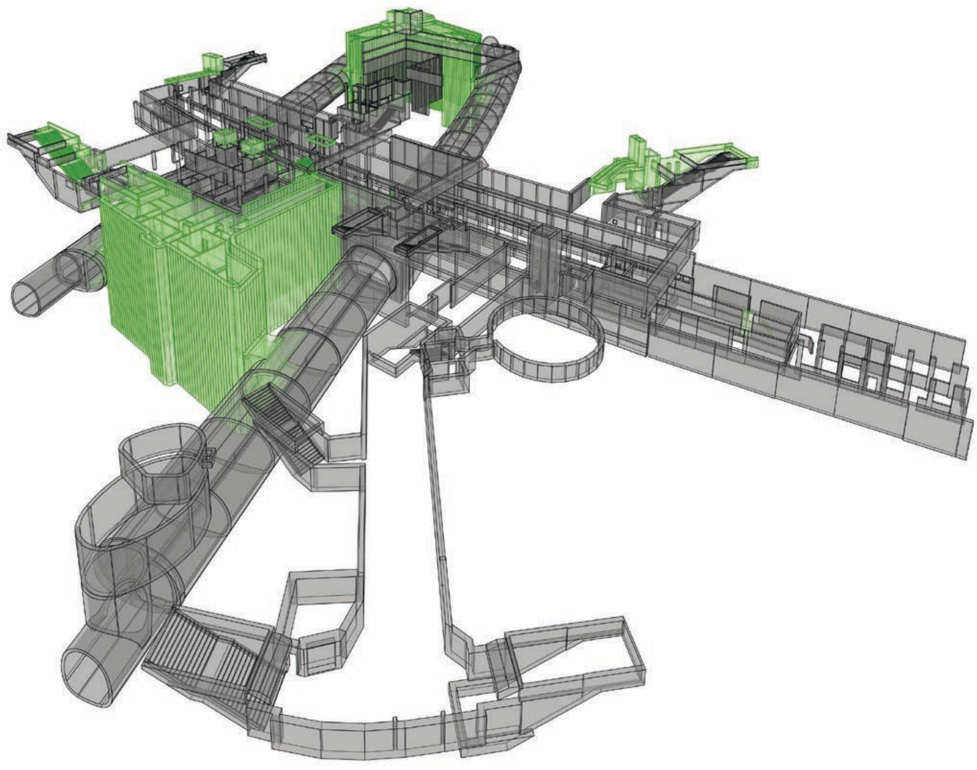
BIM topics

- Plan bases go back to conventional tendering, digital plan documents in 2D
- Three-dimensional tracking of the tender design
- Transfer to a preliminary design according to BIM standards
- Partial visualisation in the PD phase for decision-making regarding the architecture
- Model serves as a basis for discussion and decision-making for the planned expansions
- Continuous and integral BIM planning of the architecture and supporting structure
- Creation of a compilation file in Revit (management of model standards), a file that contains all component catalogues for creating the models as a template
- Analogous to the BIM guidelines, the properties of these individual component catalogues, the Revit families, are developed
- In addition to the Revit families, the compilation file also contains templates for views, pin configurations or tables; all models generated for the project are fed from this file

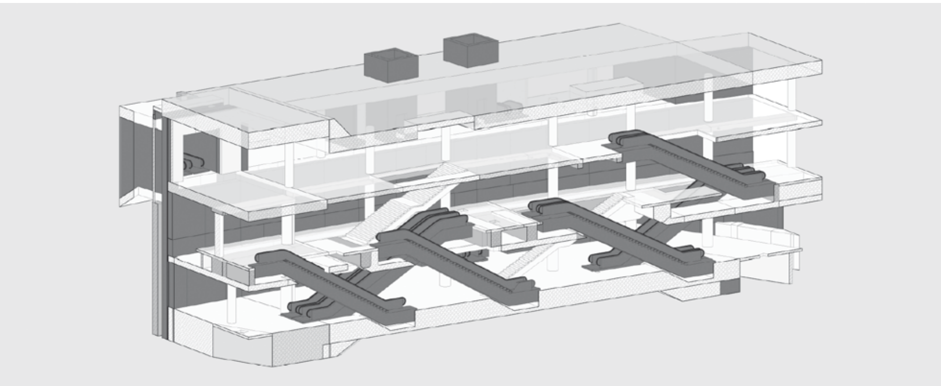
Modernisation of Sendlinger Tor underground station, Munich

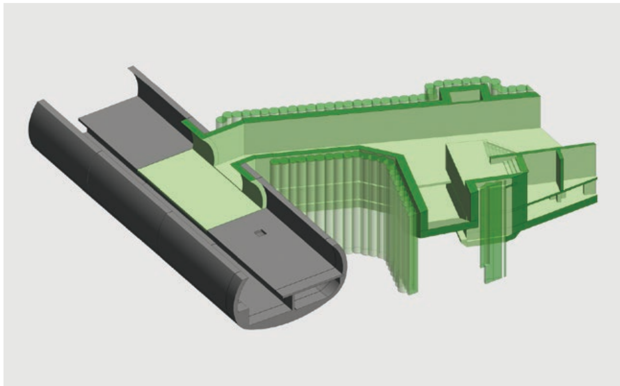
Building contractor	Stadtwerke München GmbH
Planning period	2012 – 2017
Construction	Up to 2022
Service type	Object planning of engineering structures: preliminary, draft, approval and final design; preparation of tenders // structural engineering: draft, approval and final design; preparation of tenders // BIM management

Complex conversion and modernisation measures are being carried out to increase the performance of the building, parts of which are over 45 years old. All three levels will be redesigned and expanded, made accessible, and adapted to current standards in terms of fire protection. The measures include the dismantling of the service rooms in the connecting corridor between the two platforms so that more space is created for passengers. In addition, the central transfer area between the U1/U2 and U3/U6 underground lines will be reconstructed, and the routing of the complicated branches of fixed stairs and escalators will be changed in such a way that passengers are distributed in the best possible way and congestion and crossings on both platform levels are avoided as far as possible.



In addition, two new extension buildings are being built; these will house the new operating and technical rooms and serve as exits. This is the south-east cross passage (Blumenstraße exit) on the one hand and the north-west cross passage (Sonnenstraße exit) for the connection of the underground lines U1/U2/U3/U6 on the other.
All conversion work will be carried out during ongoing operations (underground, tram, and road traffic above ground). This requires deep excavation pits with overcut bored pile walls, back-anchored or braced, as well as icing-up at the connections of the new cross passages to the existing tunnel tubes.





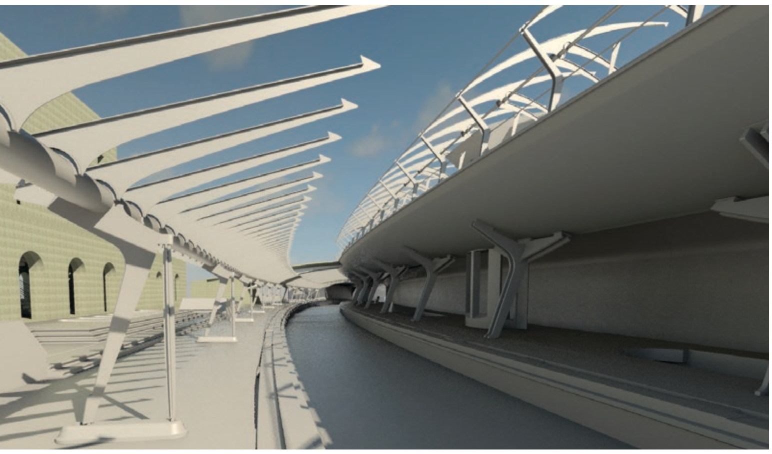
BIM topics

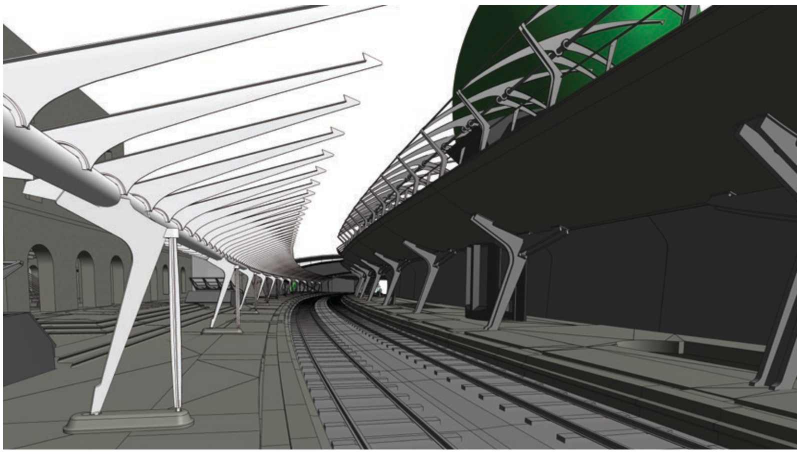
- Planning with Autodesk Revit
- Plan documents date back to the end of the 1960s, few digital plan documents available
- 3D replica of the existing building on the basis of hand-drawn plans and resurvey
- Representation of existing structures/demolition measures/new structures/final condition
- Partial visualisations
- Model serves as a basis for discussion and decision-making for the planned reconstruction measures
- Complete 3D planning of the planned conversion/modernisation work with Autodesk Revit
- Linking of 3D planning data with 3D building logistics tool for displaying the construction status (4D planning)
- Planning and construction of the conversion/modernisation measures with sustainably low expenditure for maintenance and servicing as well as lasting functionality, robustness, and durability

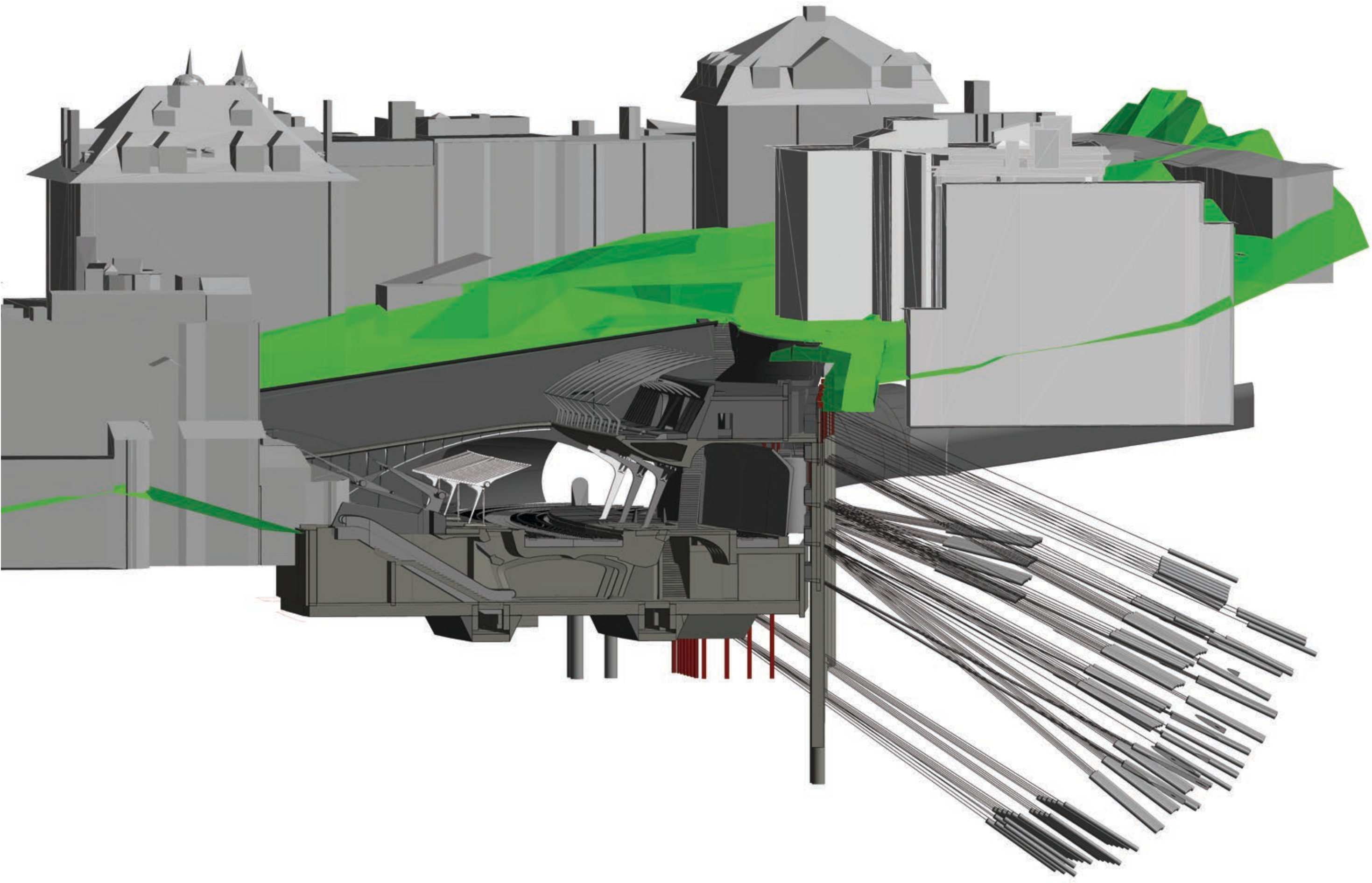
Extension of the Zurich-Stadelhofen railway station, Switzerland

Building contractor	Swiss Federal Railways SBB AG
Planning period	2017 – 2021
Completion	2035 (planned)
Route length	3.5 km
Scope of services	Preliminary project (SIA phase 31, corresponds to object planning engineering structures: preliminary design // object planning of traffic facilities: preliminary design // structural engineering : preliminary design) // BIM preparation and advice to the building contractor // BIM modelling of existing structure and new construction model

The project comprises the extension of the existing, inner-city Zurich-Stadelhofen railway station and its adjacent tunnel sections by a fourth track. This is planned in combination with a second, single-lane Riesbach tunnel between Zurich-Stadelhofen and Zurich-Tiefenbrunnen. The additional track is to be connected to the Zurichberg tunnel with a connecting tunnel in order to increase flexibility.
The track will be built on the ground side of the existing railway station partly in open but mainly in closed construction. Construction is taking place under operation and in tightly limited space conditions.







BIM topics

- Modelling of the existing station structure together with its surroundings in the area of intervention (including terrain, subsoil, service lines [divisions], and surrounding buildings) as a basis for the further work phases in the course of the preliminary project (SIA phase 31, corresponds to Work Phase 2 according to HOAI)
- Pre-modelling of the new components as a rough model for the architectural competition

Berlin suburban railway, S21 project, construction phase 3a

Potsdamer Platz – Yorckstraße/Yorckstraße (Großgörschenstraße)

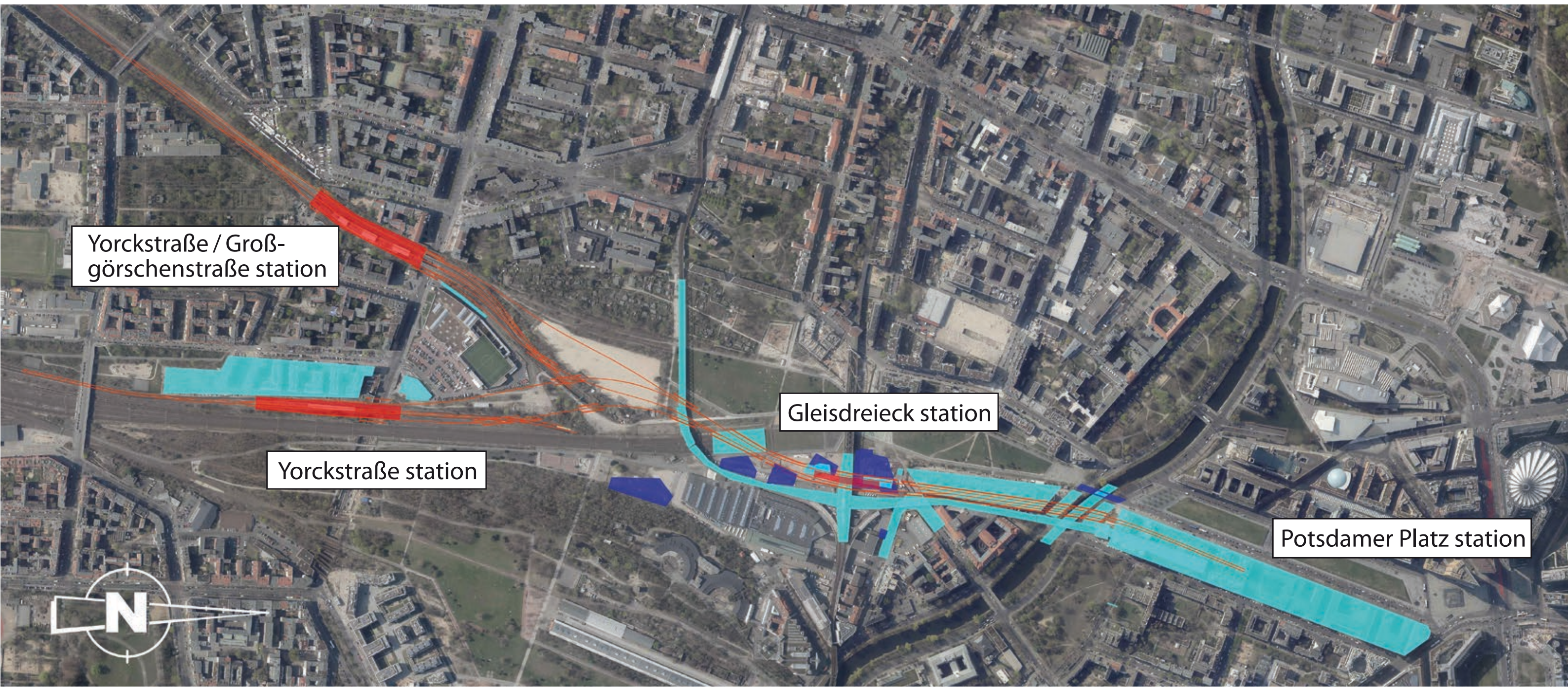
Building contractor	DB Netz AG, RB Ost
Total length	2.1 km
Planning period	2020 – 2023
Completion	from 2030
Scope of services	In joint venture // object planning of engineering structures: basic evaluation; preliminary design; optionally: draft and approval design; preparation of tenders; evaluation of tenders // object planning of buildings: basic evaluation; preliminary design; optionally: draft and approval design; preparation of tenders; evaluation of tenders // structural engineering: basic evaluation; preliminary design; optionally: draft and approval design; preparation of tenders // sectoral planning of technical track equipment: basic evaluation; preliminary design; optionally draft and approval design; preparation of tenders; evaluation of tenders // technical equipment: basic evaluation; preliminary design; optionally: draft and approval design; preparation of tenders; evaluation of tenders // object planning of traffic facilities: basic evaluation; preliminary design; optionally: draft and approval design; preparation of tenders; evaluation of tenders // subsoil assessment and geotechnical consulting // surveying during planning // LBP, EIA report, expert report on species protection // BIM planning in all work phases

The main purpose of the new suburban railway line S21 is to provide a fast direct connection to the central station and the central area of Berlin as a north-south link. In addition, the second north-south connection in the suburban railway network of Berlin is indispensable for increasing the frequency of services, especially against the backdrop of the »growing city« with rising population figures and the ever-increasing popularity of the capital as a tourist destination.

Key objectives:

- Direct suburban railway connection of the Potsdamer Platz regional centre to the central station
- Relieving of congestion at the Friedrichstraße suburban railway station
- Connection of the newly emerging Gleisdreieck quarter with the S21 suburban railway station Gleisdreieck both to the central station and further north and south.

The project objective of the 3rd construction phase is the construction of a new 2.1-kilometre-long two-track tunnel-bridge line between the railway stations Potsdamer Platz and Yorckstraße as well as Yorckstraße/Großgörschenstraße. After leaving the Potsdamer Platz underground station, the route runs through the city centre via Gleisdreieck until it rejoins the existing line at Yorckstraße. In the Gleisdreieck area, a new railway station with a traffic stop and connection to the underground will be built, and the Yorckstraße and Yorckstraße/Großgörschenstraße railway stations will be expanded and renovated.



BIM topics

- Challenging inner-city transport infrastructure project
- New railway line in a dense inner-city space, partly above ground
- Variety of above-ground and underground constraint points
- Urban compatibility/inner-city buildability and logistics
- Implementation of interdisciplinary planning according to the BIM method for the best possible realisation of the project under the given extremely challenging boundary conditions

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SSF Ingenieure

SSF Ingenieure AG
Consulting Engineers
Munich · Berlin · Halle · Düsseldorf · Regensburg · Hamburg

ssf-ing.de

Munich
+49 89 / 3 60 40 - 0
Domagkstraße 1a, 80807 München
muenchen@ssf-ing.de

Berlin
+49 30 / 4 43 00 - 0
Schönhauser Allee 149, 10435 Berlin
berlin@ssf-ing.de

Halle
+49 345 / 21 14 - 0
Schillerstraße 46, 06114 Halle
halle@ssf-ing.de

Düsseldorf
+49 211 / 20 54 10 - 60
Graf-Adolf-Straße 61, 40210 Düsseldorf
duesseldorf@ssf-ing.de

Regensburg
+49 941 / 20 60 29 - 0
Untere Bachgasse 15, 93047 Regensburg
regensburg@ssf-ing.de

Hamburg
T +49 40 / 36 00 626 - 70
Wandsbeker Allee 77, 22041 Hamburg
hamburg@ssf-ing.de

SSF Group

Baugeologisches Büro Bauer GmbH
Engineering, hydrogeology and geotechnics, Munich
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