ALLPLAN in practice | Infrastructure

REOPENING OF THE SIEMENSBAHN: A MAMMOTH PROJECT FOR THE CAPITAL REGION

About 50 years after it was shut down, the Siemensbahn is set to be reopened. It's a mammoth undertaking that poses unique challenges, especially when it comes to building within this historic, protected infrastructure.

Berlin is one of the fastest growing cities in Germany. To keep pace with this growth, the states of Berlin and Brandenburg, together with Deutsche Bahn and the Berlin-Brandenburg Transport Association (VBB), are pursuing this joint i2030 project to adapt the rail infrastructure in the capital region. The reopening of the Siemensbahn is one of the nine major sub-projects of the initiative. The double-track line was built between 1927 and 1929 by Siemens & Halske to connect Berlin's Siemensstadt in eastern Spandau. It was shut down during the 1980 railway strike. Operations have been suspended ever since, and the existing infrastructure has not been maintained. However, the railway land was never rezoned – fortunately, because the old S-Bahn connection will be urgently needed again by 2030. By then, Siemens AG plans to build a massive "Smart Campus" called Siemensstadt Square, which will create one million square meters of new commercial, residential, and production space. In 2029 – roughly 100 years after its inauguration – the Siemensbahn is therefore set to resume operations.

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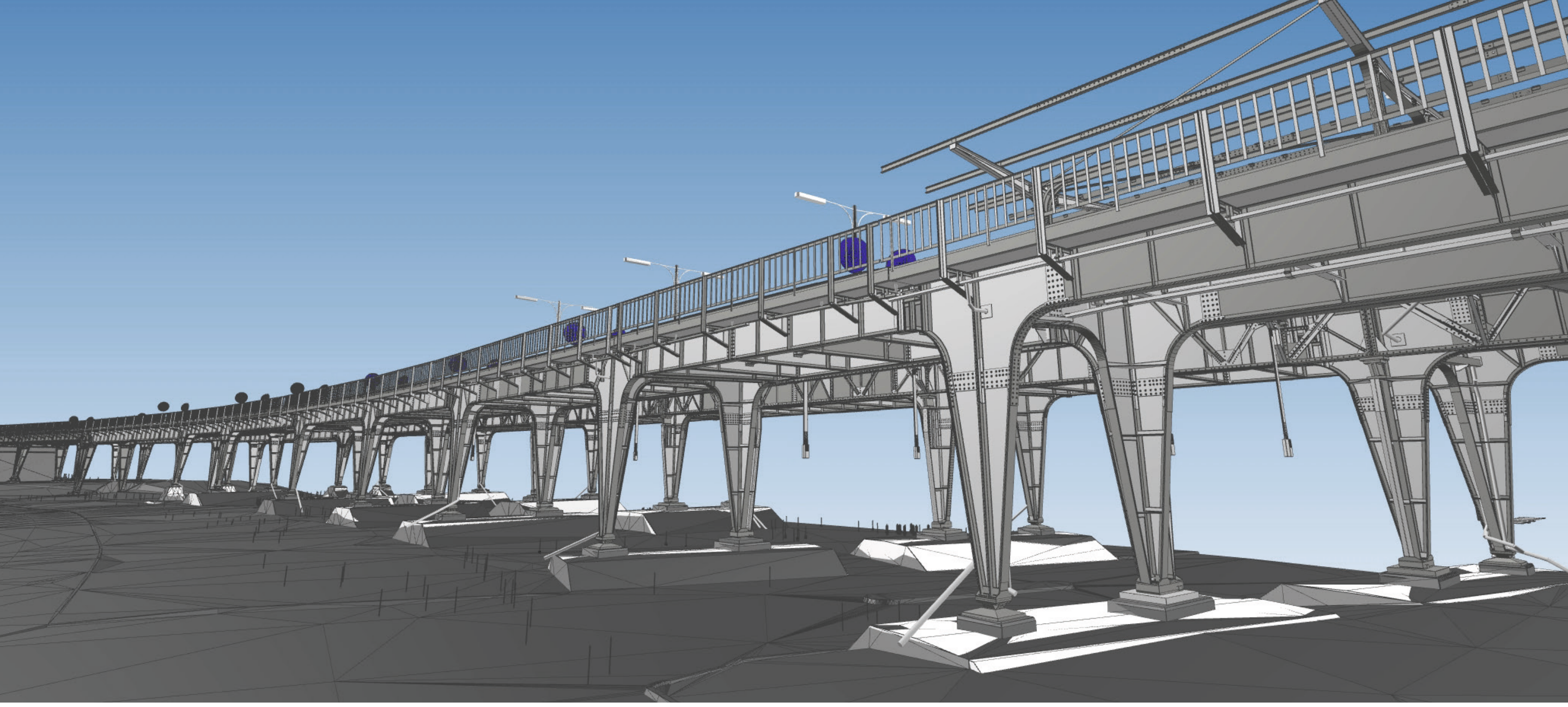


The Siemensbahn, which has been out of service since 1980, is set to be reopened by 2029 – 100 years after its opening – to provide access to the new Siemensstadt Square, among other things.

The Siemensbahn engineering consortium, consisting of Sweco GmbH and KREBS+KIEFER Ingenieure GmbH, is responsible for planning this major project. KREBS+KIEFER is the technical lead for the overall project and is also taking on the project management for the structural engineering (KIB).

A Mammoth Task in Three Phases

Starting at the Jungfernheide junction, the Siemensbahn runs for approximately 4.5 kilometers through the districts of Spandau and Charlottenburg-Wilmersdorf. In addition to Jungfernheide Station, the route includes the Wernerwerk and Siemensstadt stops as well as Gartenfeld Station. During earlier renovation and infrastructure measures, individual structures had already been dismantled. The reopening must therefore adapt to a changed existing structure in several places and integrate existing structures, new construction, and operational requirements. The Siemensbahn's structures in the Spandau district have been listed as a historic site since September 28, 1995. As a result, the project must be delivered within a protected historic environment. The reopening plan encompasses all facilities necessary for the operation of the Siemensbahn.

The project is divided into three planning sections. **Section 1.1** covers the route from Jungfernheide to the Spree riverbank in Spandau. Several new structures are planned, including a third platform edge with a canopy and an additional S-Bahn track at Jungfernheide Station, as well as new railway overpasses across the Spree at Tegeler Weg and over the Spree. In addition, replacement structures will be built for existing bridges, retaining structures, and a turning loop between Jungfernheide and Lise-Meitner-Straße. Furthermore, existing railway infrastructure will be dismantled or repaired.

Section 1.2, the heart of the Siemensbahn, involves the approximately 800-meter-long, historically protected riveted steel viaduct. Plans include the repair and reinforcement of the historic steel structure, as well as the modernization of the Wernerwerk station, which will feature a platform canopy, access points, a station building, and barrier-free access.

The **third section (1.3)** runs from Popitzweg to the Gartenfeld terminal station, primarily on a railway embankment. The construction work includes a four-track storage yard with an enclosure at the terminal station, as well as the comprehensive repair of the Rohrdamm overpass with the Siemensstadt stop and the Gartenfeld station, including platform canopies, access points, and station buildings.

PROJECT INFORMATION AT A GLANCE

- **Used software:** ALLPLAN
- **Client**: DB InfraGO AG
- **General planning** Ingenieurgemeinschaft Siemensbahn (Sweco GmbH | KREBS+KIEFER Ingenieure GmbH)
- **Scope of work:** Phases 1–4 and part of Phase 5
- **Project start:** October 2021
- **Start of construction:** Fall 2026

This massive project is divided into three construction phases. Construction phases 1.2 and 1.3 present special challenges due to historic preservation requirements.

Renovation of Existing Structures: An 800-meter-long Historic Structure with Numerous Defects

Since large sections of the Siemensbahn are listed as historic monuments, a significant portion of the project involves construction within an existing structure. One example of this challenging planning task is the approximately 800-meter-long viaduct in planning section 1.2. Built in 1928, the railway overpass consists of individual structural spans comprising a total of 71 individual structures – including the Wernerwerk station.

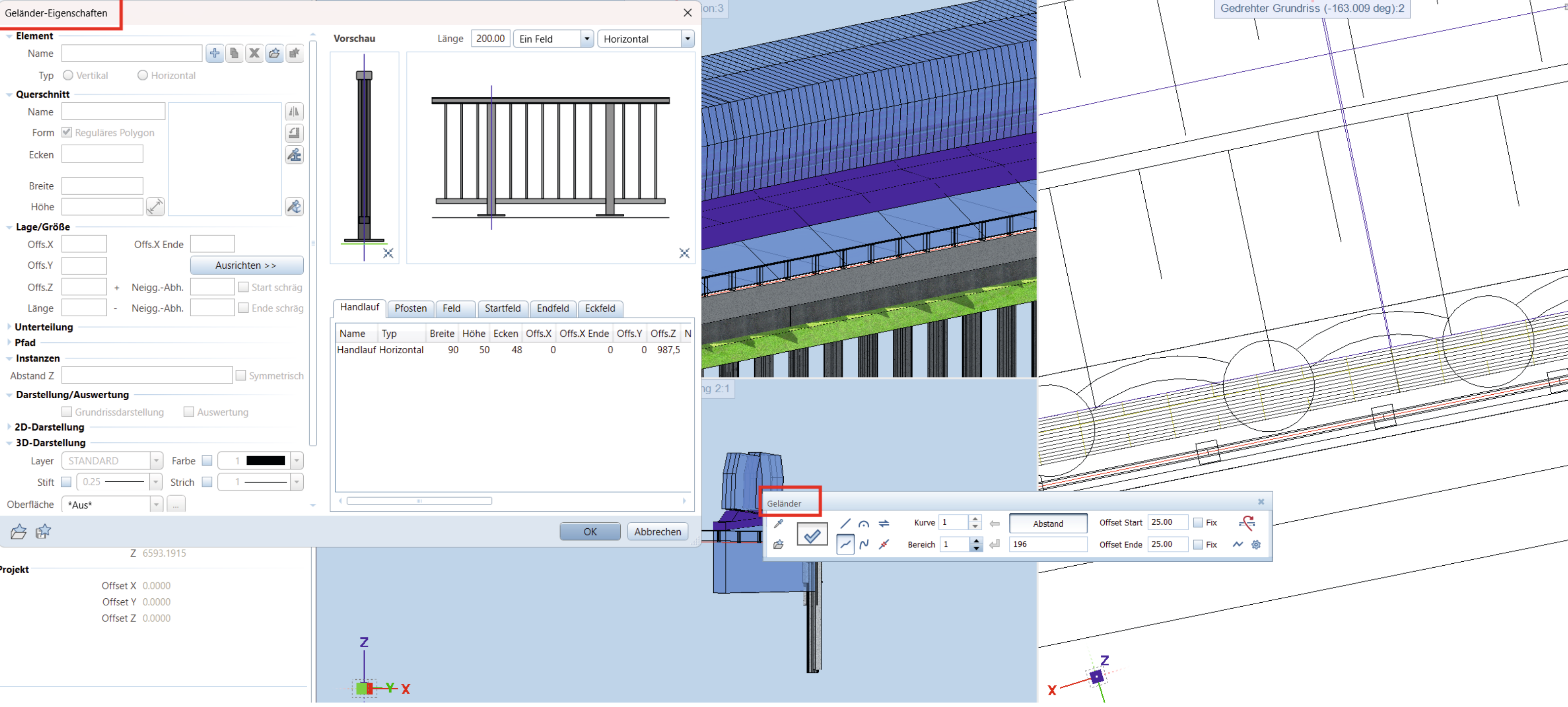
Given the scope and complexity of the project, it is hardly surprising that the reopening of the Siemensbahn requires far more specialized expertise than traditional new construction planning. Section 1.2 in particular presents engineers with extraordinary challenges: here, historic structures, decades of deferred maintenance, and the highest standards of historic preservation meet modern engineering. A closer look at the extensive and detailed plans for the steel viaduct reveals what this means in detail – and how KREBS+KIEFER is overcoming these challenges.

The superstructure consists of riveted steel structures with a trough cross-section (external main girders as solid-web girders with an orthotropic deck slab in between). The main girders are assembled from riveted individual plates and angle sections. In the transverse direction of the bridge, cross-beams span between the main girders; these consist either of riveted individual plates and angle sections or of rolled sections. Additional longitudinal girders, consisting of I- or U-sections, run parallel to the outer main girders. On top of the longitudinal girders are domed plates, which form the foundation for the superstructure.

Some 50 years without maintenance or repairs have taken their toll. Condition surveys conducted in 2023 revealed numerous instances of damage. These include, among other things, signs of corrosion – particularly crevice and surface corrosion – deformations in structural components, war damage, and notches. In addition, missing or damaged fasteners and gusset plates were found on the upper and lower flanges of the main girders in the area of the structural transitions. Other defects include damaged transition structures, deformed and damaged railings, and inadequate and partially incomplete drainage. Even massive structural elements exhibit damage such as cracks, voids, and concrete spalling with exposed reinforcement. Additionally, the bearings show signs of corrosion and misalignment.

Measures for the repair of the historic steel viaduct

The existing substructures of the railway viaduct will be preserved as much as possible and repaired. As part of the repair of the piers, the bearing supports will be replaced and new bearing bases erected. The brick cladding on the piers at Siemensdamm will be completely removed in a manner that preserves the structure's integrity; this will be followed by concrete repair of the



Phase 1.2 involves an approximately 800-meter-long, historically protected steel viaduct consisting of a total of 71 structures – including the Wernerwerk station.

load-bearing concrete piers and restoration of the historic brick cladding. Damaged or missing parts will be replaced with new ones modeled after the existing structure.

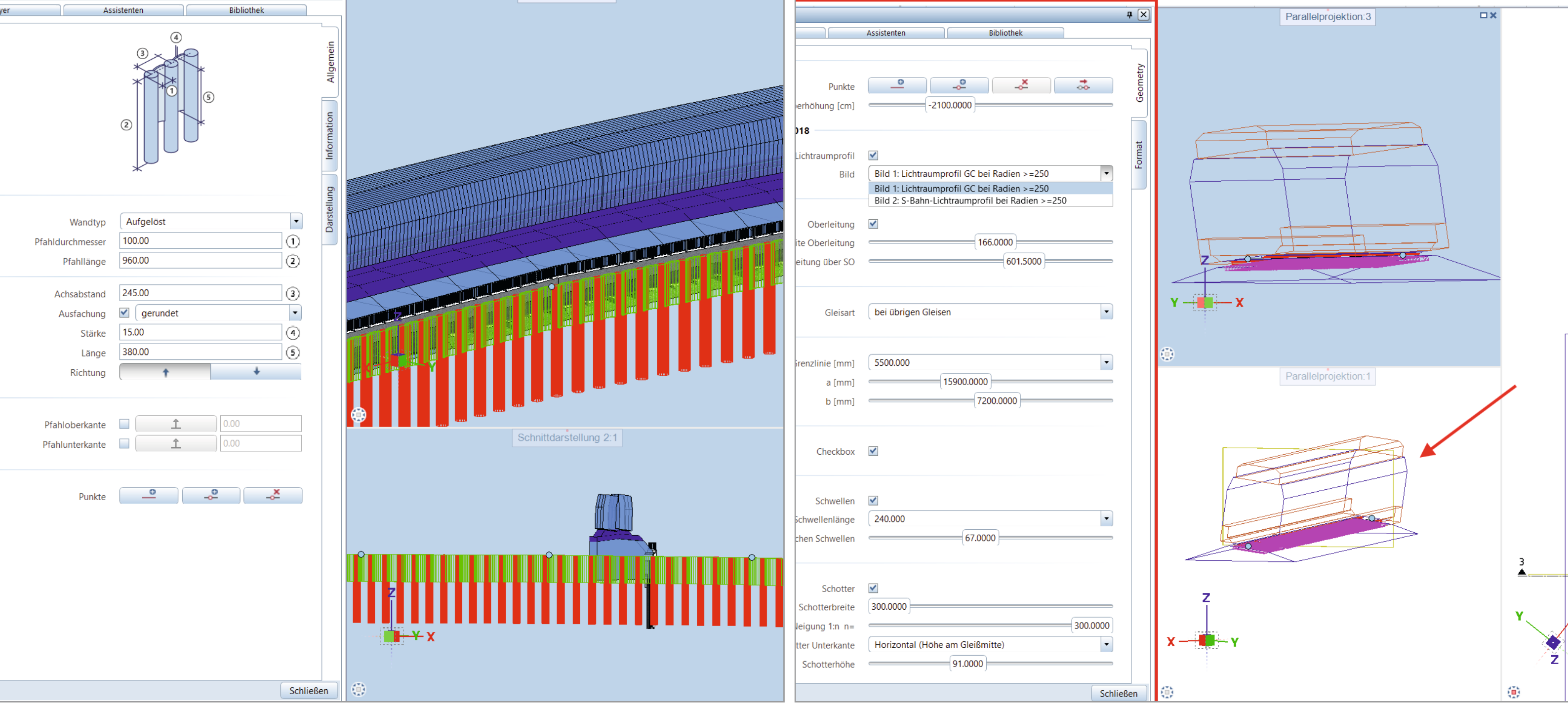
As originally planned, two tracks are scheduled for the reopening of the line. The cross-sectional design takes into account the existing conditions and the constraints present in the existing structure. The superstructure's load-bearing framework will largely be preserved and reinforced according to structural and engineering requirements. Deformed or severely damaged components must be replaced. The domed plates will be repaired and, in exceptional cases, replaced. The fasteners will also be repaired; however, due to historic preservation requirements, damaged riveted joints in visually prominent areas will be replaced with new rivets, and in less prominent areas with set screws. The same applies to overloaded riveted joints. To minimize the gap between the ballast edge plates and the main girders, the ballast edge plates will be supplemented with ballast retaining plates. Four of the viaduct's 71 structural segments are so severely damaged that they must be rebuilt based on the existing structure.

The numerous bridge bearings will be inspected and, if necessary, repaired or replaced. New transition structures are also planned between all bridge structures. A waterproof coating will be applied to the ballast trough to seal the deck. The steel superstructures will undergo a complete structural overhaul and be treated with new corrosion protection solutions. The color scheme is based on the original design. The drainage system – consisting of mesh openings in the domed plates and an open collection pipe – will be largely retained. Only the drainage pipes, most of which are damaged, will be replaced and designed as closed systems.

Technologically complex planning with large amounts of data

The entire project is being implemented using Building Information Modeling (BIM). The basis for the technologically complex planning in Section 1.2 consists of highly detailed as-built models of the steel viaduct. These were created by the subcontractor ARC-GREENLAB based on comprehensive laser scans. The extensive as-built models in LOD 400 for the entire 800 meters of the viaduct were developed through very close collaboration between the surveying firm and KREBS+KIEFER. Kay Franke, department head at KREBS+KIEFER, explains: "As planning progressed, it was repeatedly necessary to compare the as-built models with the point clouds and verify whether the modeled sheet thicknesses or other dimensions were also traceable in the point cloud. For this, we also use the Scalypso interface in ALLPLAN."

The enormous amounts of data resulting from the high level of detail in the models presented a particular challenge. Although the 71 structures were implemented as individual sub-models according to their geometric breakdown, the modeling alone included 150,000 rivets, all of which were



Complex modeling: Planning for the 800-meter-long steel viaduct requires highly detailed as-built models (LOD 400). Among other things, over 150,000 rivets must be correctly positioned in the relevant areas based on measurements.

correctly positioned in the relevant areas based on measurements. To ensure sufficient performance during processing, the rivets for each structure were therefore also represented as separate sub-models. In addition, the existing models were divided into demolition, remaining structure, and new construction for planning purposes.

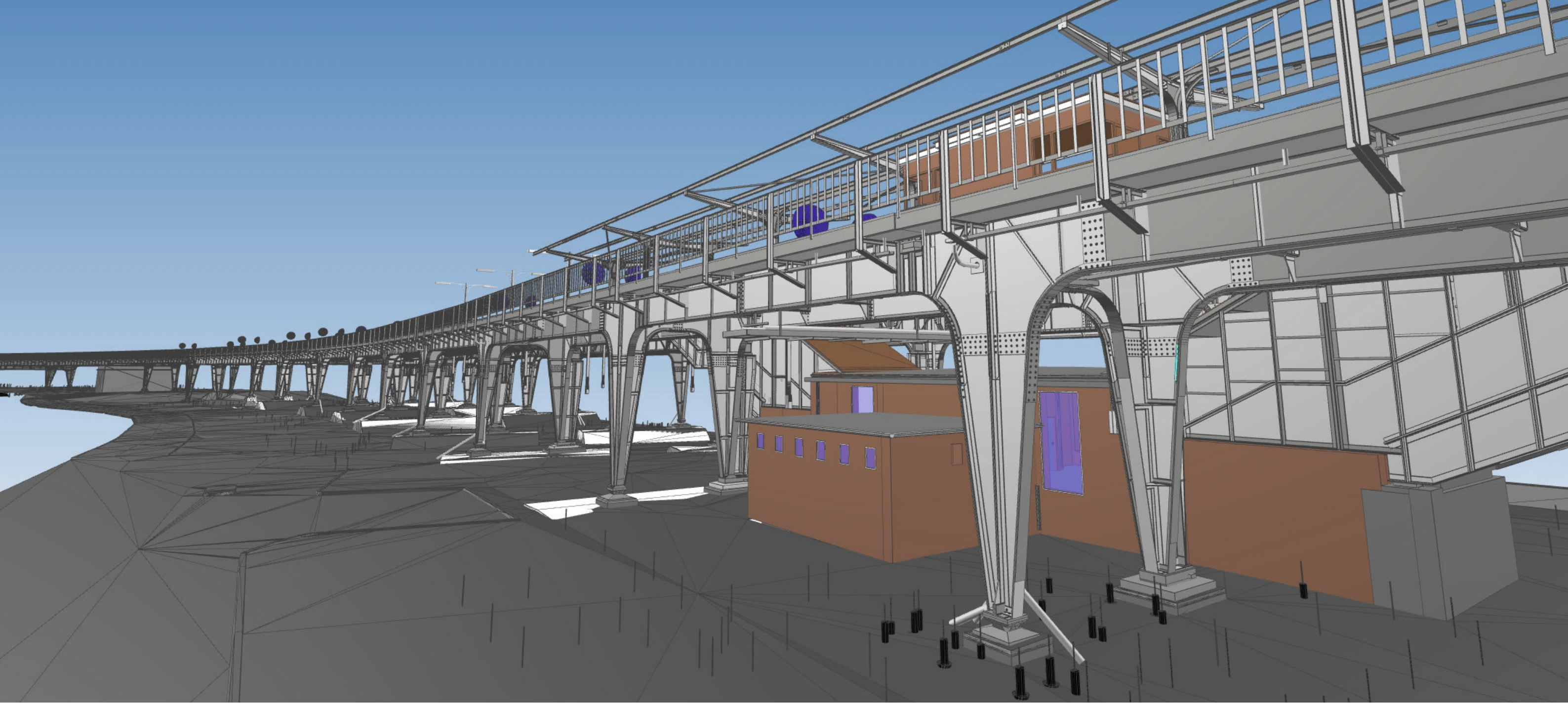
Custom-programmed solutions: Greater efficiency with PythonParts

In addition to the large volumes of data, the multitude of repetitive planning steps proved to be a challenge. Here, too, KREBS+KIEFER found a solution in ALLPLAN. "The length and scope of the steel viaduct, with its geometric challenges, quickly led us to accelerate recurring tasks using PythonParts developed in-house," explains Kay Franke. This includes, for example, automated attribution according to SOM 2.1. The in-house tool assigns attributes to components based on pre-defined property sets and uniquely defined attribute identifiers. In addition, a mapping file is automatically generated, which serves as the basis for a standards-compliant IFC export.

Another ALLPLAN tool developed in-house by KREBS+KIEFER allows for the parametric modeling of transverse and longitudinal joints. This not only saves time but also ensures high quality and precision in the design. In addition to standardized cross-sections in accordance with Deutsche Bahn guidelines (DB-Ril), non-standard parameters can also be flexibly defined.KREBS+KIEFER also used the internally developed PythonParts "XY Extrude Along 3D Path" and "Clearance Profile According to Ril." The former is an extension of the standard "Extrude Along Path" command, which allows the engineering firm to create 3D components – such as special DB-Ril transition structures – much more efficiently. Normally, an extrusion requires a precise orthogonal alignment of the profile to the axis, which is often difficult to achieve in practice. The tool now automates this alignment and generates parametric components whose profile, axis, and geometry can subsequently be flexibly adjusted. The "RIL Clearance Profile" tool complements this functionality by automatically generating DB-RIL-compliant clearance profiles or project-specific special profiles based on guideline parameters.

Better reviews with the "Storage hall for typical details"

To represent reference details in Service Phase 3, frequently recurring details and typical damage patterns were modeled separately as 3D typical details. These were organized in a dedicated model area, referred to internally as the "storage hall for typical details." "Since not all details (especially in Phase 3) can be modeled at the specific location on the structure, we reserved a special space in the area of the coordinate origin where the typical details can be modeled separately. This allows details to be documented in a traceable manner, updated efficiently, and, if necessary, clearly assigned to specific areas of the structure," explains Kay Franke. "A simple example of this is the replacement of rivets or concrete repairs."



For planning in ALLPLAN, KREBS+KIEFER uses numerous in-house developed tools to automate processes and thus increase precision and efficiency.

To better integrate inspection instances, "hemispheres" were added to the models for the relevant standard sections. Most IFC viewers have the ability to cut along a surface. However, since this is not always necessarily perpendicular to the desired cut, the pre-defined hemispheres allow inspection instances to be provided with the desired section view directly.

BIM Sets the Course for the New Siemensbahn

The precise building models that KREBS+KIEFER were able to create using ALLPLAN and custom PythonParts form the basis for successful BIM-based planning of Section 1.2. Through the consistent application of BIM methodology throughout the entire Siemensbahn reopening project, interfaces and planning challenges could be identified and resolved at an early stage. Key use cases include construction sequencing and scheduling (4D), the creation of traditional design documents, and quantity and cost estimation (5D).

For its outstanding planning, the Siemensbahn engineering consortium – comprising Sweco and KREBS+KIEFER – together with subcontractors ARC-GREENLAB and GI-CONSULT 2025, was honored by Building Smart with the BIM Champions Award in the Planning category.

„ALLPLAN offers us a wide range of possibilities through PythonParts to adapt the planning software to our needs. This has enabled us to create a broad portfolio of customized solutions and tools. Each of these makes our workflows a bit more efficient, saving us hundreds of hours per project compared to working with standard tools alone.“

Kay Franke, Department Head at KREBS+KIEFER

The client

KREBS+KIEFER provides engineering services for the most demanding construction projects. The scope of services extends far beyond standard engineering services and covers the entire construction lifecycle – from concept through planning and implementation to maintenance. Approximately 800 employees at 16 locations contribute their specialist expertise through direct, personalized support to achieve the best solutions for clients and partners. In line with its corporate mission statement, "MAKING ROOM FOR THE FUTURE," the company, founded in 1950, prioritizes innovation, diversity, and competence as its core values.

About ALLPLAN

ALLPLAN is a global provider of AEC software with BIM solutions for architecture, structural engineering, detailing, fabrication and construction. True to our "design to build" claim, we provide tools that enable earlier data-driven design decisions, support digital fabrication and leverage information throughout the entire construction process. Integrated cloud technology further optimizes interdisciplinary collaboration on building and infrastructure projects. Our innovative workflows empower architects, engineers, and construction professionals to deliver their projects more productively, safely, and eco-consciously.

Around the world, over 700 dedicated employees continue to write the ALLPLAN success story. Headquartered in Munich, Germany, ALLPLAN is part of the Nemetschek Group – a pioneer for digital transformation in the construction sector.

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