International Conference

Lake Constance 5D–Conference 2016

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http://www.htwg-konstanz.de

From Digital to Reality
Using BIM in key German Rail (Deutsche Bahn) Projects

Presentation on 25.10.2016

Theme	***Time***	***Speakers***
Deutsche Bahn: BIM Strategy Overview • Optimization of major projects • Cost, schedule, and quality • Experience so far – ROI • Transition into project presentations	20 Min.	Heinz Ehrbar *Senior Consultant for Major Infrastructure Projects, DB Netz AG*
BIM Project: Hanover Central Railway Station • DB project introduction • DB Engineering & Consulting's experience • Focus: planning and modeling of existing structures and new construction	20 Min.	Introduction: Heinz Ehrbar Presentation: Mrs Dr. Maaser *DB Engineering & Consulting, Head of Project*
BIM Project: Filstalbrücke • DB project introduction • Max Bögl: Use of BIM and project experience • Focus: Implementation of BIM	20 Min.	Introduction: Igor Zaidman *Team-manager, DB Project Stuttgart-Ulm GmbH* Presentation: Dr. Schreyer, MAX BÖGL
Coffee break	30 Min.	
BIM Project: Rastatt Tunnel • DB project introduction - • ZÜBLIN, HOCHTIEF ViCon and ARUP: BIM approach, collaborative BIM implementation, and lessons learned • Focus: Method, implementation and integration of processes and data	25 Min.	Introduction: Sascha Klar *Manager of Major Projects, DB Netz AG* Presentation: Arnim Marx, ZÜBLIN Marc Thiel, HOCHTIEF ViCon Joerg Obergfell, ARUP
Summary • Strategies for reducing project complexity • Digitalization of technology and the future of infrastructure	5 Min.	Heinz Ehrbar *Senior Consultant for Major Infrastructure Projects, DB Netz AG*

" Deutsche Bahn is Germany's leading infrastructure entity and has played a pioneering role in the use of BIM. We plan to standardize complex projects on BIM in the next five years. Our team has made a huge commitment on this

- Heinz Ehrbar, *Senior Consultant for Major Infrastructure Projects, DB Netz AG*

"With the BIM pilot project we have taken the leap to digital planning and construction. We are now able to create an intelligent data cloud that will make quality data accessible to all stakeholders, increase transparency and efficiency, and allow for project control in real time. This enables us to minimize risks and build faster, better and cheaper. The 5D Conference will provide great insight into our experiences with BIM pilot projects"

- Minister Dobrindt

Hanover Central Railway Station (Hauptbahnhof Hannover)

Theme: The project lifecycle from DB's perspective

Background:
New EU public procurement laws require all EU Member States to use BIM on publicly-funded construction and infrastructure projects. To address these new requirements, a number of pilot infrastructure projects were selected to test new BIM methodologies and better understand how BIM can be adopted by rail agencies. These pilot projects tested BIM deployment in project operations and IT infrastructure, and examined the guidelines and legal standards developed for railway infrastructure companies (EIUs).

Railway infrastructure companies will follow the recommendation of the Reform Commission on major projects with the phased plan of BMVI. DB Station & Service AG will announce BIM methodology regulations that will begin in 2017. Currently, 33 projects are planned using this new BIM methodology. 63 other projects will later be included in the second phase of the pilot. One of the first pilot projects for large commercial stations is the renewal of the Hanover Central Railway Station.

Summary:
In order to meet the future requirements of a modern, accessible, and customer-friendly rail station, the Hannover Region and the City of Hannover decided to modernize the Hanover Central Railway Station. The revitalization of the station includes the basic renovation of the six existing platforms. Platforming roofing and weather protection systems are being added, while technical equipment is being updated or replaced. The project has brought together a number of different engineering disciplines, and the renovations are being carried out while the station remains operational.

The size, scope, and complexity of this project has made data availability essential for proper communication and collaboration between stakeholders. The Hanover Central renewal project is one of the first German railway projects to take advantage of BIM throughout the project lifecycle.

The project team's motto is "First build digital, then build real", a nod to how important technology and digital modeling is to the project's success. The project team used BIM and digital modeling to avoid design changes during the construction phase and the cost overruns and scheduling challenges that often result from those changes.

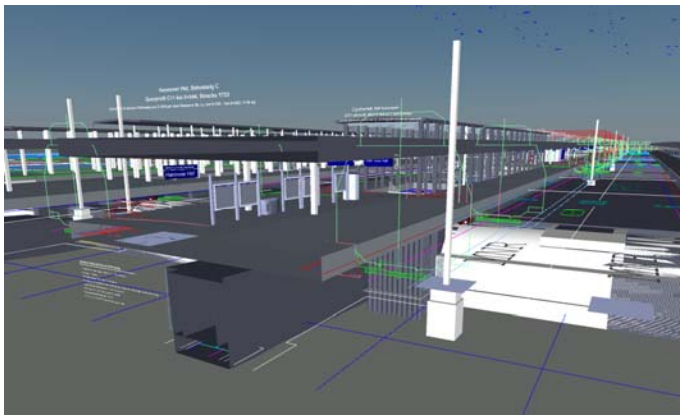


Figure 1_ Collaboration-model-status 05/2016

A key objective of the project is to promote greater transparency of information and data and the continuity and availability of data. At the start of the project, a complete digital inventory of the existing station was developed using 3D laser scanning and modeling. This provided a standardized information base that all stakeholders could access during the planning phase.

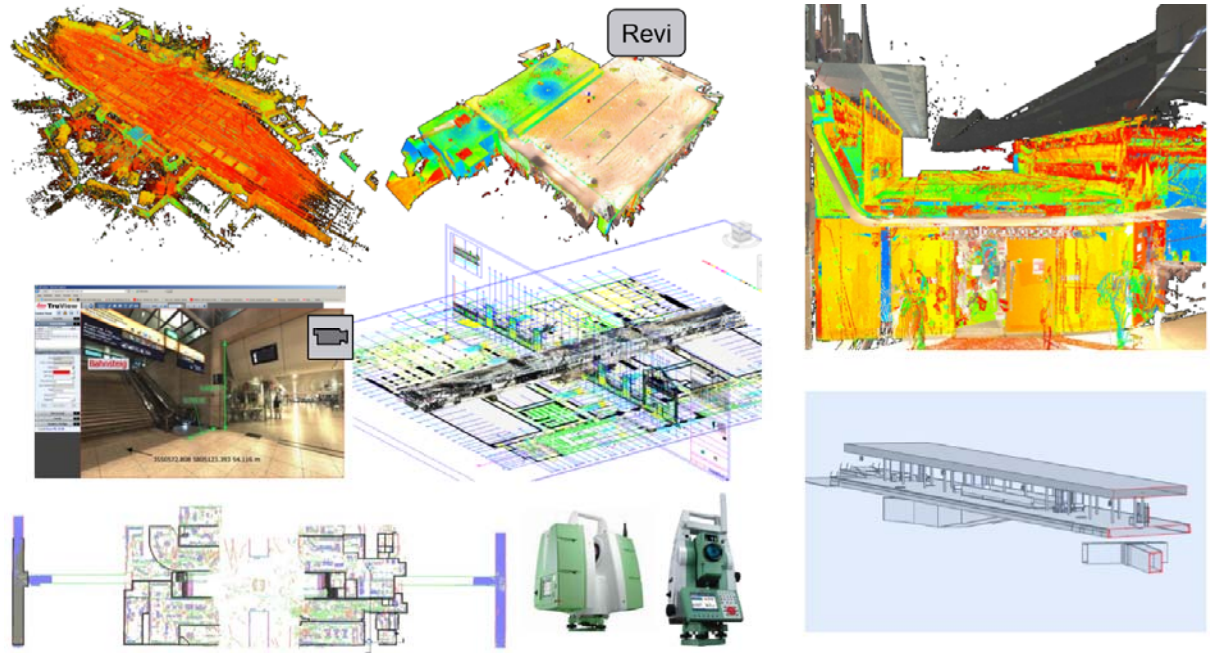


Figure 2_from 3D-LaserSan to virtual 3D-as built model

The project team made sure to include domain experts early in the planning process. This helped to identify the necessary technical scope of the project. The use of low- and high frequency radar systems brought early insights into the building structure, such as the location of reinforcements and anchorages. This mapping allowed the project team to identify existing elements that may have caused difficulty later on in the construction process, including the presence of cable, vessels, pipes, metal objects or cavities that were not illustrated on previous models (Figure 3).

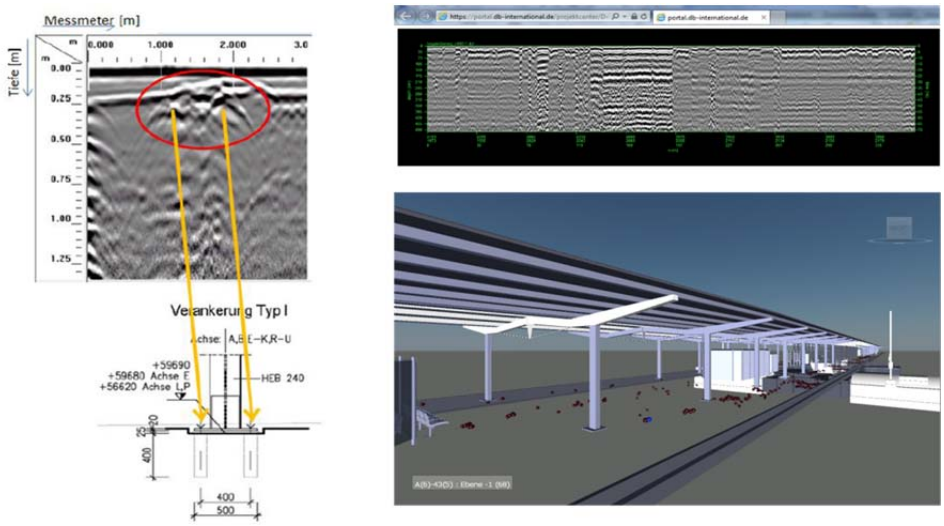


Figure 3_Capturing existing information w/ Georadar/Radargram

To gain a deep understanding of the project requirements, stakeholders share information on a single collaboration platform that can be accessed by all. While other contractors or projects may only use 3D modeling during the tender or pursuit process, the project team was sure to share all 3D models with all stakeholders so information can become a central link for inventory and project documentation. The project currently consists of nearly 20,0000 inventory documents that can be access by all stakeholders.

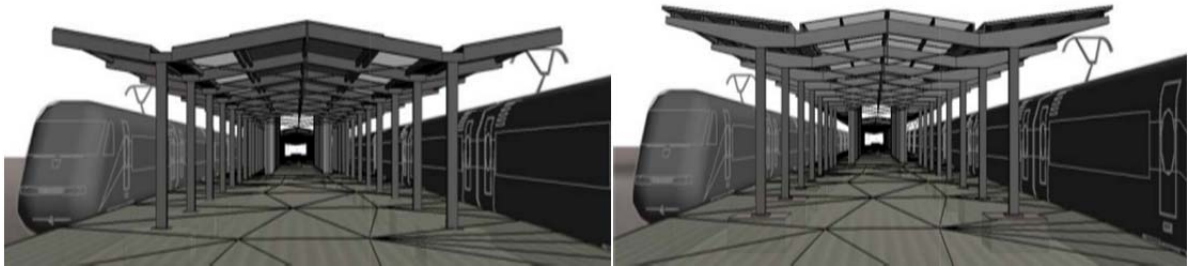


Figure 4_ (Visualizing planning alternatives)

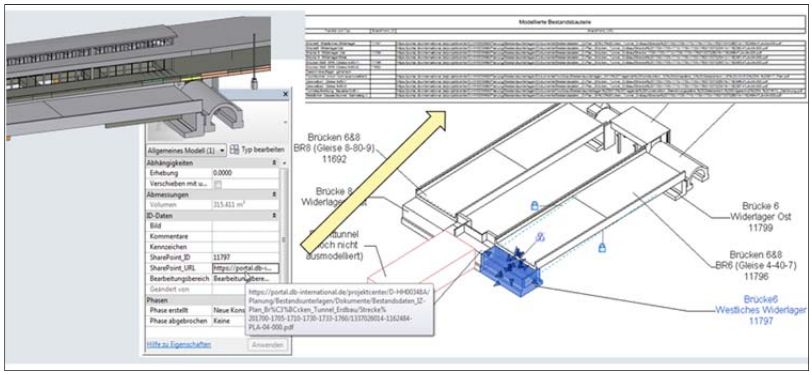


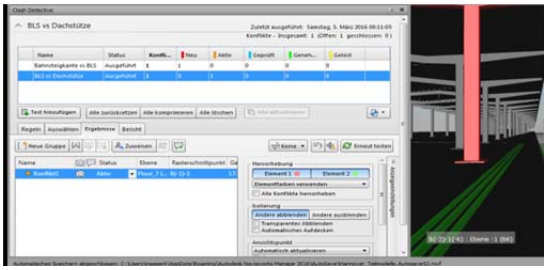
Figure 5_ (link of existing model and DMS)

The application of BIM methodology on the Hanover Central Rail Station project contributes to higher transparency of information and data, which helps to avoid information gaps. For example, the early

detection of design errors by model-based clash detection helped eliminate hurdles that could have created considerable complexity during construction. (Figure 6)

BLS vs Dachstütze	Toleranz	Interferenzen	Neu	Aktiv	Geprüft	Genehmigt	Gelöst	Typ	Status
	0.600m	1	0	1	0	0	0	Freiraum	OK

							Element 1				Element 2			
Bild	Konfliktname	Status	Abstand	Rasterposition	Beschreibung	Interferenzpunkt	Element-ID	Layer	Element Name	Element Typ	Element-ID	Layer	Element Name	Element Typ
	Konflikt1	Aktiv	0.177	B-1 : Ebene -1	Freiraum	x:3845.329, y:2188.374, z:59.776	*Element-ID:* 2995775	UK Bahnsteigdach Ostkreuz	Sytem Ostkreuz_Rahmen	Tragwerksstützen: Sytem Ostkreuz_Rahmen: Sytem Ostkreuz_Rahmen	*Element-ID:* 504387	<Keine Ebene>	CP2-GI7	Allgemeines Modell



The information and best practices generated during the Hanover Central Rail Station project will be used to influence future BIM standards and help make upcoming rail projects more efficient. DB Station & Services AG will use this information, along with customer requirements to plan future station improvements, and they have created BIM specification and performance profiles for small and medium-sized stations that are available online (http://www1.deutschebahn.com/sus-infoplattform/start) and continuously updated.

Application fields:

- **Quality and safety requirements**
  - 3-D visualization and inventory properties, variants, conflict management,
  - Increase project transparency through visualization,
  - Association request management system with 3D modeling
  - Clash detection

- **Consistent use of digital models on different subjects**
  - Creation of topographic maps with ground-penetrating radar to identify cable routes 50 Hz, LST, TK, media, air-vent
  - Structural Models
  - Video surveillance
  - Construction simulation, process simulation to optimize the construction process (link to the construction schedule)
  - 3D Dashboard
  - Model-based performance tracking, project accounting and project management
  - improved requisition management through development of 3D planning models and links to asset management systems

- **Analysis of existing conditions**
  - 3D laser scanning
  - 3D BIM modeling (as built)
  - Geo radar
  - Geometric positioning of inventory documents in the BIM model

- **Model evaluation / analysis**
    - Digital control of costs, risks, and scheduling through flow simulation (linked to the construction schedule), and BIM cost estimation models
    - Creation of reliable data through transparent and systematic processing of existing data by linking a DMS and creating a common data environment

- **Model-based interdisciplinary collaboration**
    - BIM project implementation plan (BAP) for the definition of digital processes
    - Common Data Environment
    - improving the quality and information content: creation of a same information and communication object of all parties during the project execution through a collaboration platform (single source of truth)
    - discipline bound compartment models using shared coordination model

Filstalbrücke:

Theme: BIM implementation, use of BIM and experiences from the perspective of the construction company Max Bögl.

The Max Bögl Group uses BIM to save time and improves project quality

Since the launch of the pilot project Filstalbrücke, the Max Bögl Group has expanded the use of BIM to cloud-based solutions to optimize collaboration at the construction site. "With BIM in the cloud, our control over construction projects improved considerably", says Maximilian Schütz. "We can easily track defects and see how well our subcontractors work. If in the future there are problems with a building, we can easily understand what led to these problems. All deficiencies and vulnerabilities can be associated with specific positions in the model or plan. "

Summary
The firm focuses on linking information and/or properties of components intelligently with 3D modeling (centralized information management). Linked information and properties lead to different applications and use cases for a variety of project participants, generating significant efficiency gains. Collaboration takes a high priority.

Field Applications:
4D construction sequences and status reporting

- The 4D construction schedule is based on the current 3D model and the agreed construction schedule.
- Representation of individual objects such as buildings, auxiliary scaffolding, excavation and construction roads are linked to individual objects within the construction schedule

Billing based on BIM

- Transparent and full settlement of flat partial projects (lots) with BIM.
- Parallel invoicing for unit price and partial lots using both standard methods and BIM methods

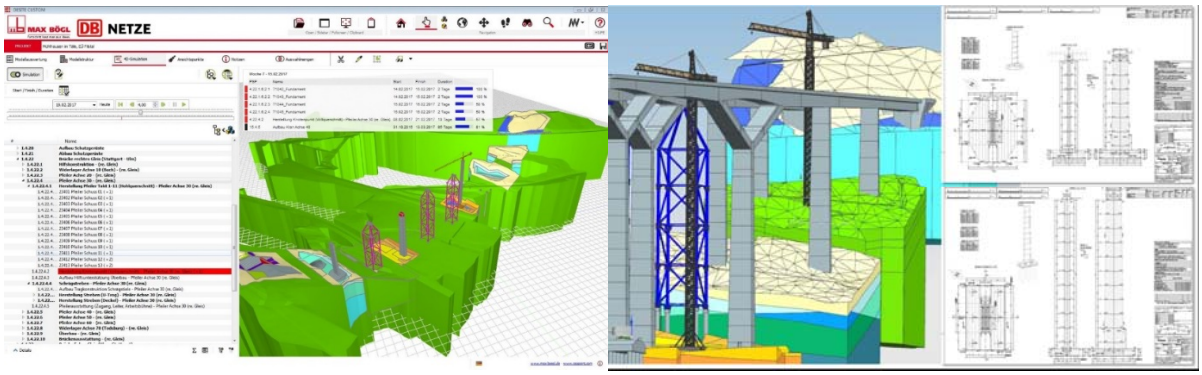
Mobile cloud-based BIM applications with access via iPad App and Web Portal

- Provisioning of digital information on Autodesk's "BIM 360 Field" software
- Documentation of the construction work on site
- Process support for quality management and defect detection

Connecting plan management platform to BIM applications

- Joint development of the necessary IT module by DB and AT
- Link between the 3D model and the associated plans at component level

- Integration and execution of runout status in the 3D model



Rastatt Tunnel:

Federal Ministry of Transport's largest BIM/digital infrastructure pilot project

"The use of BIM in the Rastatt Tunnel pilot gave us experience in modeling a complex infrastructure system. The data models produced will be used in future projects to further drive the standardization of BIM in infrastructure."

-Sascha Björn Klar, Head of BIM pilot project Tunnel Rastatt, major project ABS / NBS Karlsruhe - Basel:

Topics: BIM Approach, Collaborative BIM Implementation, and lessons learned from the perspective of ZÜBLIN, HOCHTIEF ViCon and ARUP

Background:
The northernmost stretch (StA 1) of the expansion and new (ABS / NBS) Karlsruhe-Basel is 16 kilometers long and connects Karlsruhe to Rastatt South. The largest single structure of StA 1 is the Rastatt Tunnel. Construction began in the north with the 800 meter long section near Ötigheim. The subsequent 4,270-meter tunnel passes under the city of Rastatt and ends in the south with the 895-meter-long tunnel in Niederbühl. The maximum slope allowed for the project is 12.3 meters per thousand meters. Due to the topography of the area, the tunnel tubes have a maximum coverage of 20 meters.

The structural work was supported by the DB Netz AG ARGE Tunnel Rastatt under the technical direction of the company Ed. Züblin AG and the commercial leadership of the company Hochtief AG. Tunneling started in May 2016, and is expected to be complete by mid-2018.

Summary:
DB Netz AG will use BIM for all phases of the Rastatt Tunnel project, marking the first time the agency has used BIM so extensively. The usage of BIM is funded and promoted by the Federal Ministry of Transport and Digital Infrastructure (BMVI). The Rastatt Tunnel is the largest of four nationwide pilot projects in which these new digital methods are being tested.

The Rastatt Tunnel planning phase was completed in April of 2016. DB Netz AG can now access 5D BIM models for the tunnel project. These models contain 35,000 documents which are linked to 3,000 different activities and 3,500 specifications. The project already represents the first time such a complex project has been successfully modeled and mapped prior to construction, and is an important first step in the standardization of BIM on major German infrastructure projects.

The recent results of this pilot project show that solutions can be based on empirical data, and policies can be developed to push the standardization of BIM in infrastructure ahead. To gather more insights in dealing with BIM, Netz AG and DB will work together on future BIM pilot projects. The collection of

data allows for an assessment of the optimization potential over the entire life cycle of infrastructure from all pilot projects.

The creation of BIM services and modeling in the planning phase of the Rastatt Tunnel pilot were carried out in close collaboration with the ARGE Tunnel Rastatt. The two consortium partners worked with the BIM/5D planning department of Züblin Central Technology and the standalone BIM consulting firm Hochtief ViCon GmbH. These firms bring years of experience in BIM-based project work. Additionally, a consultancy agreement was created with Arup, a company with experience in both the enterprise implementation of the BIM methods and in the use of BIM in international projects in to support of DB Netz AG. The cooperation with designated partners was very cooperative and successful.

The project will benefit greatly from the full application of BIM technologies, and DB Netz AG is focusing on building strong partnerships with engineering firms and contractors and encouraging close collaboration between stakeholders. The Rastatt Tunnel projects displays the DB's willingness to contribute to the implementation of the "Roadmap for Digital Design and Construction" developed by the Federal Ministry of Transport and Digital Infrastructure (BMVI).

Field application and objectives:
BIM project implementation plans (BAP) that define digital processes and the use of a common information platform (Common Data Environment) can improve communication throughout the project lifecycle.

3D modeling should be used as the basis for all other BIM applications to increase project transparency through visualizations. 4D modeling (which links 3D models to construction schedules) can further optimize the construction process, and 5D modeling (which links costs to 3D models and project schedule) can be used to show the cost curve during construction.