BUILDING INFORMATION MODELING (BIM)

Unlocking the full potential of BIM services for rail infrastructure

SIEMENS

Turning data into value – BIM creates value over the entire lifecycle.

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Digital Track Services

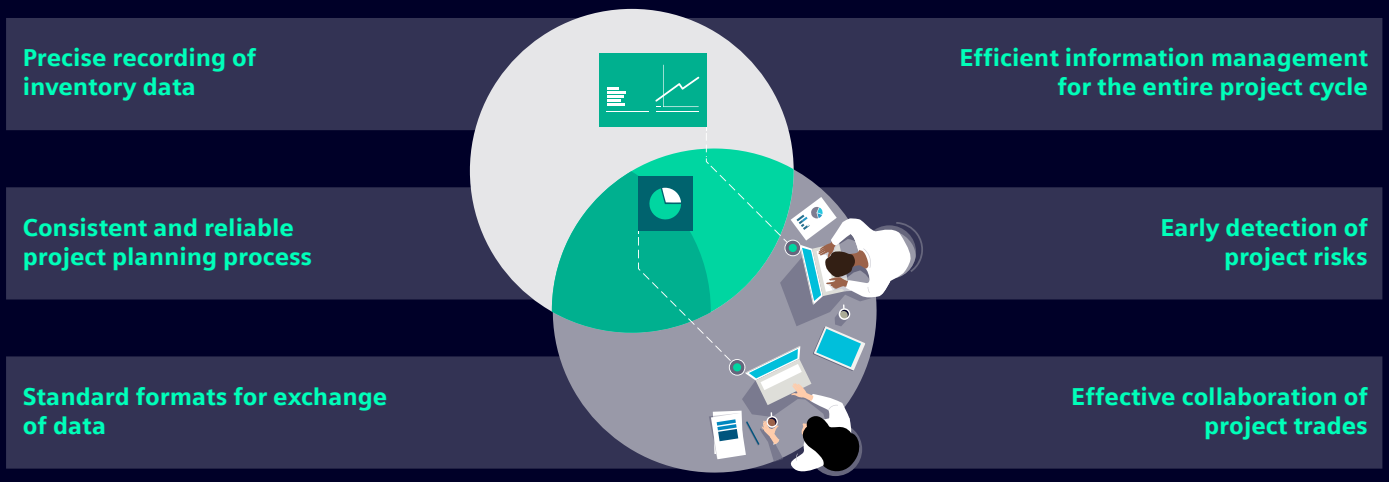
In railway signaling, building information modeling (BIM) refers to digitization of planning, construction and operation of infrastructure, buildings and wayside track elements. BIM is a collaborative working methodology that uses digital models of track layouts and buildings to capture and manage information. Transparent communication and sharing of information about product and system lifecycles among all participants is essential. The Siemens Mobility BIM use cases include data capturing, data preparation, 3D modeling and varied applications related to our trackside business.

Data capturing

For track scanning, we provide a range of equipment, including the scanner itself, a drone, and a backpack. The process is fast and flexible, ensuring that customers receive the desired data in the shortest possible time. The recorded data is then processed in a point cloud and corresponding photo data.

Data preparation

The post-processing is followed by the creation of a scaled double line track layout (SDLTL) based on digital site survey (DSS) data. Equipment data based on SDLTL (BIM stock model) can be exported in different formats such as PoE format. Paperless on-site activities (digital mounting) using an app for checklists on a mobile device round off the process to synchronize with design and engineering efforts.



Benefits of Building Information Modeling

Our experts work with the Autodesk and Bentley toolkits and use the BIM standard to complete the procedure. A consistent approach streamlines processes and eliminates potential risks. We have a range of different service packages available for our customers.

3D modeling

DSS data also forms the basis for creation of 3D models of complete lines, interlocking equipment and control rooms. Customers receive a visual and detailed overview of the lines, reducing risks at an early stage. Overall, we provide an up-to-date, functional and interactive platform based on 3D models of tracks and control rooms for simulation, testing, training with design purposes.

Further applications

Future functionality will build on data obtained by apps. For example, big data related to the equipment lifecycle (design and engineering, 3D models, and on-site activities) will be analyzed. Using this big data approach, we can provide new apps such as an installation status dashboard or a 3D model viewer that can be used for conflict-free planning and construction.

Digital Track Capturing

BIM unleashes the potential of data
BIM is not simply a tool – it unleashes the potential of data. BIM supports a new way of working in project planning, execution and operations guided by comprehensive data models in a common data environment.

The BIM methodology combines several different aspects, including a consolidation of geometry to represent real requirements and information on infrastructure elements.
DTC, which is part of the overall process, includes a LIDAR scanner, scan preparations, and measurements at the track as well as in rooms and buildings. DTC also includes first steps in post-processing of captured data.

The LIDAR scanner can be mounted with a bracket on any vehicle, such as a train, trolley or car. Depending on project requirements, other vehicles may be equipped with the measuring device.

Track2Cloud package

- Scanning of assets
- Railigent

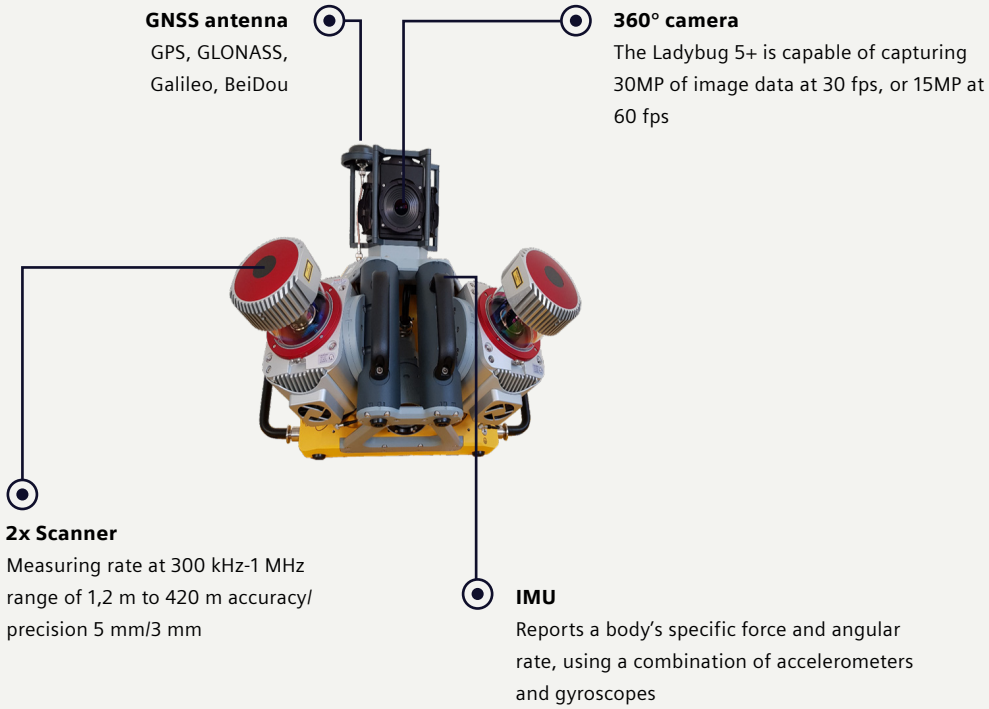
Track2Cloud Plus package

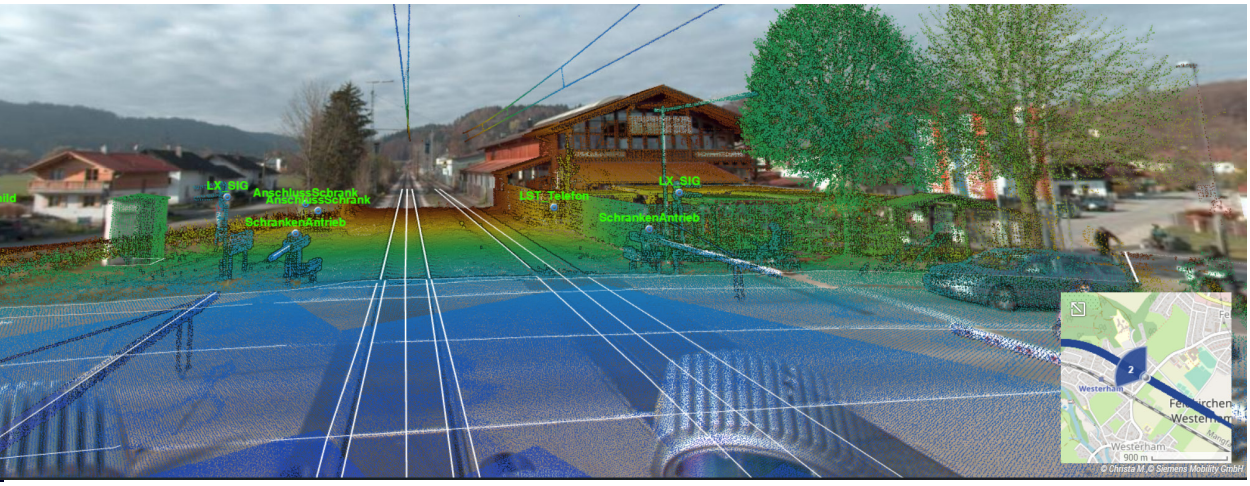
- Post-processing of point cloud
- Common formats e.g. LAS for point clouds, ESRI shape for object data
- Orbit Publisher via Railigent ISO Security certified

In the past, employees manually measured tracks using measuring wheels to capture information. Now employees can easily use a digital twin generated by DTC to leverage this captured data to conduct planning and processing from the office.

This enormous process enhancement will create a completely new and efficient workforce with powerful capabilities. The creation of the digital twin will also give rise to other valuable opportunities for enhancement. The collected data is processed on a web-based cloud platform that supports various formats.

We have developed in-depth knowledge that will support customers in creating a digital process organization.





Sample data of a digital track capturing

Data Preparation

Data potentials
After Digital Track Capturing, the next step in our BIM process is to perform a digital site survey (DSS) based on point cloud and image data. This provides the representation for all relevant signaling objects across the track as well as in the track environment and the control rooms. On the basis of the generated as-built model, the integration of BIM can be carried out within the scope of infrastructure projects.

Our holistic tool chain provides the basis for data preparation. The entire data preparation process takes place within a global coordinate system. The result of this method is that each element and line has x, y, z data (from the predefined CRS) already in the background.

With this information in the background, collaboration with other trades, departments, companies and platforms can be ensured with a maximum of precision and a minimum of misunderstandings. Our team can create a full-scale track layout using one-to-one transfer of the track characteristics. In fact, we can offer a complete DSS. This precise solution enables a service package for our customers that provides significant added value while greatly reducing time spent on the track. Thus, the impact on train operation is minimal compared to a regular site survey.

BIM represents a major breakthrough in digitizing the railway industry. Early-stage planning and changes are now possible.

DSS
With fully scaled data our expert team can construct a site plan for the customer's use. Our tool landscape provides all the features, including automatic object recognition of rail infrastructure elements based on artificial intelligence.

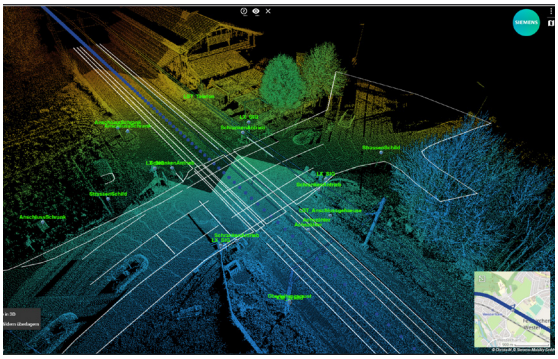
DTC und DSS
In addition, we offer for our customers DTC services along with a survey. We provide the necessary tools and kick-start the process at the beginning. We remain in contact with the customer throughout the process.

DSS package

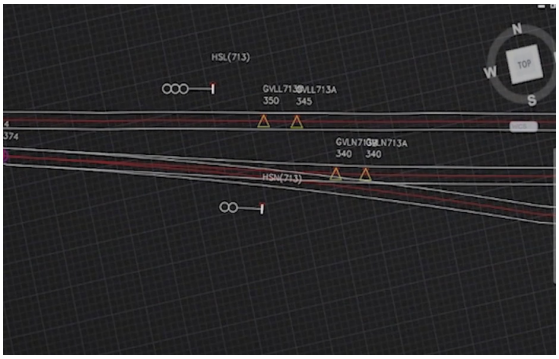
- Track survey based on scanned data DTC: less risk; less impact on operation; faster than conventional measuring methods

Layout plan (DTC, DSS) package

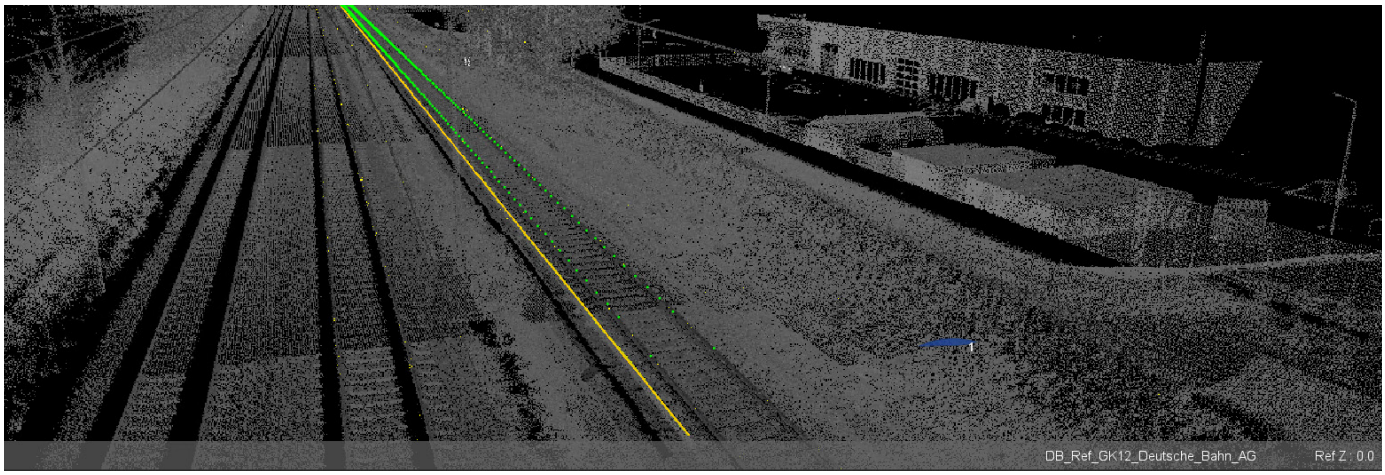
- Digitization of planning, construction and operation of infrastructure, buildings and route elements by digitally capturing and building digital infrastructure models (e.g. BIM as-built model)

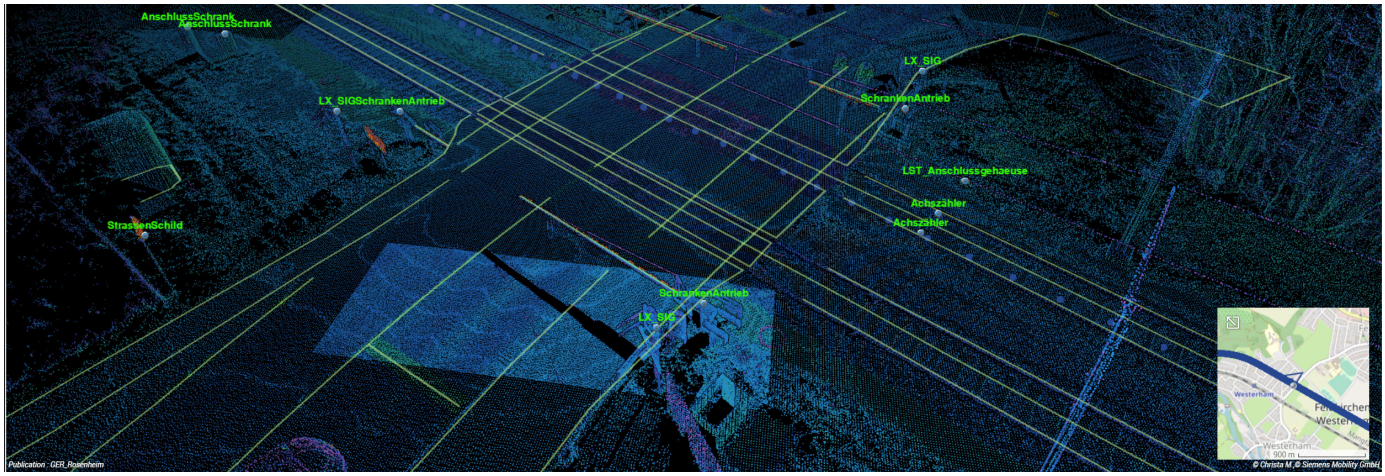


Track survey based on scanned data



Scaled double line track layout (SDLTL) with georeferenced wayside track elements





Example for implementing a level crossing area for digital route inspection

3D Modeling

Supporting collaboration and enhancing simulation
Data collected on the current state can be displayed transparently in a 3D model and used with low power laptops via browser. BIM allows us to realize data models for planned assets and locations as well as associated attributes and create virtual copies of assets.

This virtual planning is created generatively using scaled double line track layout (SDLTL) data. Accepted standards are applied to the content so far as they exist. After building and implementing the current state, the resulting 3D model is continuously updated as design engineering and installation progresses (digital planning and construction).

Three variations of the 3D model are available with different levels of detail:

1. Basic

- Tracks and elements (control and safety technology, level crossings, scope content [signaling])

2. Detailed

- Basic service package + detailed environment (surroundings of the track such as roads, paths, forests, etc.) inclunding processing of digital terrain models as well as GIS/ ALKIS data

3. Advanced

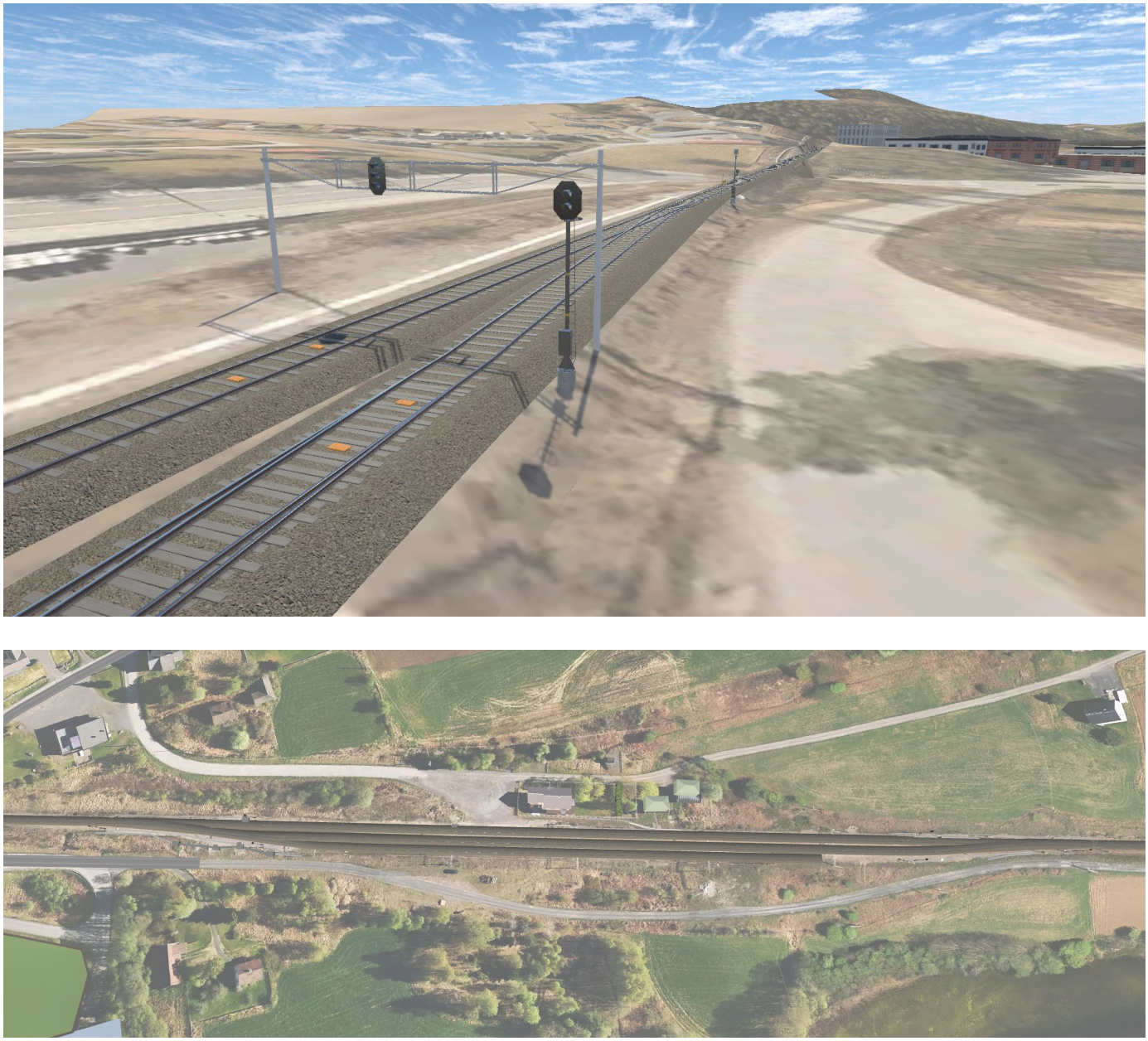
- Detailed service package + additional 3D objects (Inclusion of objects of additional trades such as overhead line poles, switch boxes, roadside level crossings, etc.)

The 3D model can be viewed in two ways with different functionalities. The first option is a customized web viewer, which contains certain collaboration functions and the ability to access linked metadata including attribution according to the requirements of a semantic object model.

The second option is a locally installed viewer, which corresponds in part to the author view of the 3D plan and contains not only the previously mentioned features but also an extensive range of 3D visualizations.

Game engine

The visualized data in the 3D model can be further processed in the next step: the simulation engine. Through standard interaction with the route data (infrastructure objects), the train driver, for example, can be given a realistic and navigable route profile and the commissioning of the tracks and interlocking rooms. This enables an early-stage design review, along with the gathering of local knowledge about the interlocking spaces and specific knowledge of the track. In addition, collision points can be determined and corrected in the planning.



Virtual representation: track illustration in a 3D model

Complementary applications and services

Digital operation & maintenance

Applications
Apps based on the generated infrastructure model can easily be installed on smartphones or laptops to deliver even more value. The following apps are already available.

Digital mounting
This service provides input that centralizes all activities in a live database. The generated data, which is updated automatically, indicates construction progress and can be digitally managed. The resulting added value is the provision of up-to-date reports that ensure all project participants, as well as the customer, receive consistent information. This information includes equipment lifecycle data for all on-site activities as well as information on the 3D model. In addition, it includes valueenhancing benefits of collaboration, process transparency and automatic documentation.

BIM Connect Dashboard Package
Customers can also visualize their BIM data thanks to the system performance dashboard. In essence, the dashboard displays live data that it receives from connected field elements (e.g. different subsystems).

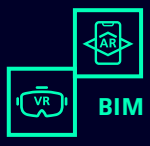
Two types of dashboard applications are available: the first is the analytical part of Siemens Railigent, which generates evaluations, forecasts and recommendations, and uses secure storage capacity. The second is the 3D model web viewer, which can generate metrics on track-based content. Evaluations of project progress and work planning along with other possible collaboration activities are available.

The first option enables the creation and subsequent virtual runthrough of buildings or interlocking rooms. Knowledge is gained through virtual movement in space and a certain amount of information, based on the static data, is gathered for training purposes. In addition, the 3D models are filled with live data from the connected assets.

Using static data about the connected assets, their exact locations on the track can be mapped. The resulting advantage is that, in difficult weather conditions, required clearance work can be considered at an early stage. Asset information is easy to access, with a list of components immediately visible so that parts can be reordered as quickly as possible. All of this improves and extends the product lifecycle.

Simulation Advanced Package

- Virtual Reality maintenance support with real interaction based on engineering data
- Train driver simulator



BIM Connect AR / VR Package

- Maintenance support with Virtual/Augmented Reality technology
- Train driver support with VR & AR technology
- Damage prevention apps (e.g. Snow Removal)

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Order No. MORI-B10002-00-7600