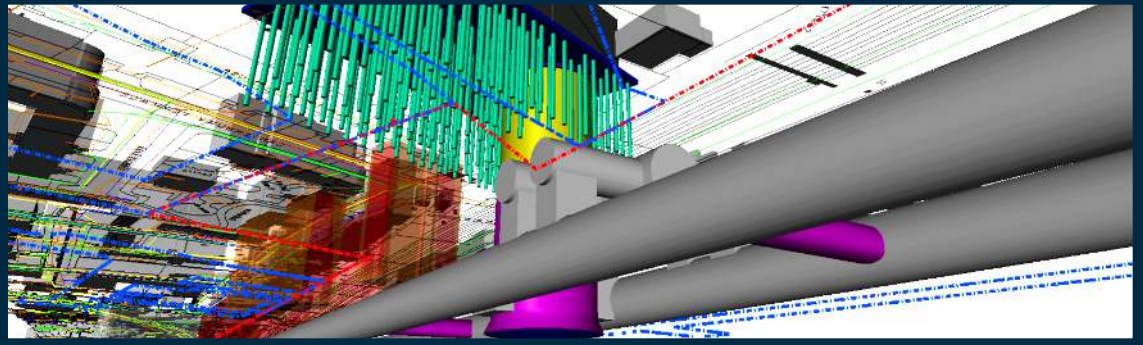


Bentley[®]
Advancing Infrastructure



Project Summary

Organization

Skanska Costain STRABAG JV

Solution

Rail and Transit

Location

London, United Kingdom

Project Objectives

- To implement robust BIM processes to meet challenging client data and modeling requirements for civil works.
- To establish a connected data environment and digital workflow system for an international, multidiscipline team.
- To create a digital blueprint for future infrastructure projects after executing this project.

Project Playbook

AssetWise[®], gINT[®], MicroStation[®], Navigator, OpenBuildings[™] Designer, OpenRail[™] Designer, OpenRoads[™] Designer, ProjectWise[®]

Fast Facts

- A comprehensive 3D BIM approach involved contractors earlier in the HS2 high-speed rail network project.
- Bentley technology facilitated a structured digital data approach that will serve as a blueprint for future railway projects.

ROI

- A connected data environment streamlined workflows and allowed for early detection of errors to save GBP 1 million.
- Bentley's integrated BIM applications facilitated data extraction for accurate material quantities and cost estimates, reducing waste.
- Leveraging iModel technology shortened design review time by 20%, saving GBP 500,000.

Skanska Costain STRABAG JV Uses BIM Processes for Civil Works on Europe's Largest Railway Project

Leveraging Bentley's Open Applications in a Connected Data Environment
Reduced Costs

A New High-speed Railway

High Speed 2 (HS2), the new high-speed rail network that will run through London, Manchester, and Leeds, is expected to be the backbone of Britain's transport network, tripling its capacity by carrying more than 30,000 passengers per day. At a cost of GBP 56 billion, it is the largest construction contract in Europe to date and, at a speed of 250 kilometers-per-hour, will have the fastest trains on the continent. The rail line spans 531 kilometers in length, with 46 kilometers of tunnels, hundreds of bridges, and numerous shafts and portals. This project is one of the most complex and challenging railway initiatives that the United Kingdom has ever undertaken. Tasked with saving the government GBP 500 million in digital efficiencies, HS2 is committed to applying global best practices in design and construction, setting strict data and modeling requirements in accordance with PAS 1192 BIM standards.

Skanska Costain STRABAG JV (SCS) was contracted to perform civil works and bring worldwide high-speed rail experience to the first phase of HS2, namely the line running 230 kilometers north to south between London and Birmingham. The contract mandated early contractor involvement with the designers to formulate and achieve approval of a conceptual design scheme for 26 kilometers of high-speed railway within 14 months. Featuring 20 kilometers of tunnels, several bridges, and five kilometers of earthworks, the estimated GBP 1.5 million project presented engineering and coordination challenges to optimize efficiency and meet the client's digital BIM demands. SCS needed interoperable technology to implement a comprehensive, collaborative BIM strategy to accommodate the existing British railway systems and approximately 6,000 utility assets, as well as to coordinate a geographically-dispersed, multidiscipline team.

Implementing a Robust BIM System

The project team consists of six companies and over 550 staff, spanning four countries. "We have 59 nationalities, so quite diverse cultures on the team, and we like to think BIM is the common language we all speak," commented Peter Ruff, head of BIM for SCS. SCS digested the project requirements from HS2 and developed a BIM execution strategy that engaged

the entire team, with modeling guidelines and procedures ranging from 4D construction management through logistics and operations. The team began by generating a content plan that defined the model breakdown and structure, starting with the asset to be added to the model, and then the elements to be incorporated. The contractors and designers created a library of components shared within ProjectWise through OpenBuildings Designer as the principal modeling application. Establishing a data library in one location enabled more effective workflows for all involved team members. This custom component library ensures that all elements are identical and that model data is based on predefined criteria, certifying consistency and accuracy for estimates, planning, constructability, and safety.

Integrating OpenRail Designer and AssetWise during the early design stage allowed the team to align a fine level of detail within the 3D models that could be integrated with ProjectWise where everything is registered, documented, and managed, according to project milestones. Navigator facilitated model reviews using iModels to publish the information as a visual package with linked documentation that enabled better understanding of the scope of work for more informed decision making. Using AssetWise to link specific asset information directly to the design model facilitates an asset-centric approach to enable early involvement of operations and maintenance and sets the stage for full lifecycle BIM. SCS transformed its written collaborative plan into an integrated, robust BIM system that ensures consistency, accuracy, and efficiency with Bentley's interoperable BIM applications.

Connected Data Environment Delivers Benefits

SCS used ProjectWise and AssetWise to establish a connected data environment, providing the project team real-time access to trusted information wherever and whenever it is needed through Bentley's integrated modeling applications. "We wanted to make sure that everyone, designers and contractors, can use this information," Ruff explained. Using ProjectWise CONNECT Edition and other connected applications allowed SCS to

“Using Bentley solutions has allowed us at SCS to realize our mission statement of creating a project that will be seen as the ‘Digital Blueprint of Future Infrastructure Projects’”

*– Peter Ruff,
Head of BIM for SCS*

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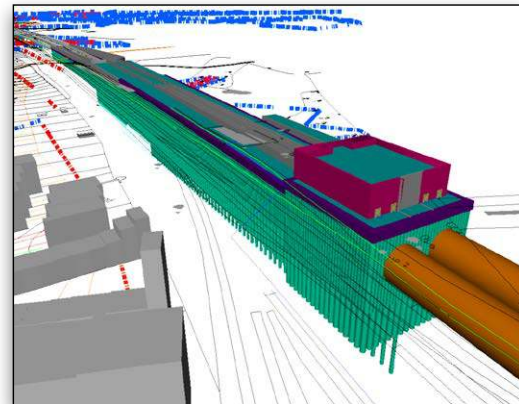
explore new features such as Deliverables Management, enabling file and data coordination within the team and with other stakeholders, such as Network Rail, London Underground, other HS2 contracts, and Crossrail. Working in the connected data environment facilitated early contractor involvement and streamlined digital workflows, increasing productivity and design assurance among the multiple disciplines involved.

Leveraging Bentley applications in a managed workspace optimized internal and external coordination, resulting in early clash detection and resolution of potentially costly errors to save an estimated GBP 1 million. The different organizations involved used the 3D design models as a focal point for design and constructability reviews and analyses using Bentley’s iModel technology. Having all the required information, including models and data in a single digital location reduced design review time by 20% to save an estimated GBP 500,000. Lastly, the connected data environment optimized collaboration and ensured data consistency, reliability, and accessibility to save more than 50% of time previously spent searching for disparate information.

Structured Digital Data Improves 5D Estimates

“One of our key areas that we wanted to improve was our 5D approach, where we use the BIM models to estimate and price from,” Ruff said. Information relating to materials and other cost-relevant data within the connected data environment are incorporated into the BIM model, so the models can drive estimations. The structured digital data requires no manipulation, and all stakeholders are pulling information from the same models, ensuring consistency and transparency. SCS can automatically extract and dynamically filter data by material type, asset, element, and even asset attribute with Bentley applications. The team can also calculate volumes and linear measurements before exporting the information to Excel and other databases for accurate material quantities and cost estimates. The direct use of the engineering models for 5D estimating reduced design changes by 50%, compared to traditional methods, and used 75% less resources than planned, resulting in GBP 300,000 savings.

In addition to estimating material costs, SCS also needed to estimate carbon costs to meet client-imposed carbon savings of 50%. Working in the connected data environment facilitated data feeds to the carbon team to accurately calculate and analyze the carbon scheme. The material quantity and costs change as the design is modified, which causes the carbon footprint to change as well. With



Perspective view of Ruislip Portal and head house on HS2's southern section

structured data aligned to industry standards, SCS can quickly understand and focus on the areas most impacted by carbon, optimizing materials and associated costs, while reducing waste.

A Digital Blueprint for the Future

Using Bentley applications to implement a collaborative BIM strategy underpinned by standard digital workflows improved data quality from 40% on previous projects to 98% on this HS2 project. Furthermore, executing this strategy saved 250 drawings and reduced planning time by 30%. In addition to the technological achievements, BIM processes changed the approach to railway infrastructure projects, empowering collaboration among all companies, and the resulting benefits ensure that this new method of working is adopted in the future.

Through digital processes established in a connected data environment, SCS integrated the roles of all project stakeholders and delivered a structured information model that can be accurately leveraged throughout the entire project to realize a full BIM lifecycle. The successful collaborative engagement between designers and contractors during the early contractor involvement phase can be used as an industry example.

“Using Bentley solutions has allowed us at SCS to realize our mission statement of creating a project that will be seen as the ‘Digital Blueprint of Future Infrastructure Projects’” explained Ruff. “They have allowed us to create, manage, and leverage intelligent BIM models and the data housed within them on a complex project and see a significant increase in productivity, efficiencies, and collaboration between a large team and a multistage contract.”