

# Network Rail Uses Digital Twins for the Transpennine Route Upgrade

Bentley's iTwin<sup>®</sup> Technology Helps to Save an Estimated GBP 1 Million in the First Six Months

## MODERNIZING A VITAL RAIL ARTERY

Transpennine Route Upgrade (TRU) is a GBP multibillion railway upgrade program that aims to deliver passenger-focused benefits across the Transpennine route between York and Manchester via Leeds and Huddersfield.

The program will modernize the more than 100-kilometer rail line, increasing capacity and shortening travel time for passengers between rural and suburban stations and their nearest major urban centers including Newcastle, Hull, and Liverpool, making commuting by rail a reasonable option.

The Transpennine route serves 23 stations, crosses over and dips under 285 bridges and viaducts, passing through six miles of tunnels, and over 29 level crossings. Supporting economic growth in the north of England, and delivering real benefits for passengers and communities along this pivotal rail artery, TRU will transform the line into a high-performing, reliable railway, to deliver greater punctuality, more trains, and improved travel times.

Known for international rail development, Jacobs was selected as part of an alliance with Network Rail to lead the technical design authority on the project, providing digital engineering and asset management services for the TRU program.

They set out to create a route-wide digital twin to support the safest, most efficient design, construction, and handover process ever completed on a major railway upgrade. "We aim to deliver a safer, more reliable railway with greater capacity that truly meets Network Rail's vision of putting passengers first," said Steven Yule, practice group lead at Jacobs and digital development lead on the Network Rail Transpennine Route Upgrade.

## MANAGING MASSIVE DATA, MULTIPLE SYSTEMS, AND A MULTIDISCIPLINE TEAM

With TRU assets spread across multiple systems used by more than 1,300 staff from multiple organizations in different locations, the program posed significant risks in implementing a consistent approach to design and development. Jacobs needed to manage and share more than 6,000 models, over 600 datasets, point clouds, and reality data across the geographically dispersed team, as well as with a multitude of stakeholders and decision makers.

Faced with coordinating massive amounts of data among the multidiscipline team, compounded by data interoperability and accessibility issues, Jacobs realized that paper-based processes and Excel spreadsheets were inefficient and could potentially cause safety hazards and disruption to passenger service. "The route passing through England's Pennine Hills incorporates some isolated areas for whom the disruption of railway service during the upgrade could have a significant impact," said Joao Barbeiro, digital engineering lead for TRU at Jacobs.

To support the safest and most efficient lifecycle processes, TRU wanted to establish a digital twin. Therefore, they needed a user-friendly, connected digital solution that could bring together the voluminous data and scattered, multidiscipline team.

They sought interoperable technology to implement robust data governance and structure. It had to be supported by real-time communication to enable data-driven decision-making for optimal railway performance, reliability, maintenance, and asset management. Additionally, the digital twin would provide unprecedented value to users. "We were always adamant our solution should incrementally unlock value at all lifecycle stages," added Yule.

## PROJECT SUMMARY ORGANIZATION

Network Rail + Jacobs

## SOLUTION

Rail and Transit

## LOCATION

Manchester, Leeds, York, United Kingdom

## PROJECT OBJECTIVES

- ◆ To generate a route-wide digital twin to deliver digital engineering and asset management for the Transpennine Route Upgrade.
- ◆ To improve data accessibility and deliver the highest quality information ever for a major railway upgrade.

## PROJECT PLAYBOOK

iTwin Capture Modeler, iTwin Platform, iTwin Design Insights, iTwin Design Review, iTwin Design Validation, MicroStation<sup>®</sup>, OpenBuildings<sup>®</sup> Designer, OpenRail™ Designer, ProjectWise<sup>®</sup>

## FAST FACTS

- ◆ TRU is a GBP multibillion rail upgrade program to deliver benefits for passengers and communities along this pivotal rail artery in Northern England.
- ◆ To bring together all the data and disciplines, Network Rail tasked Jacobs with implementing a route-wide digital twin.
- ◆ TRU's digital ecosystem based on the Bentley iTwin platform enables users to follow, feed, and analyze the design and asset data in real time.

## ROI

- ◆ Using iTwin technology improved information accessibility for over 1,300 staff by 40%, saving GBP 1 million in the first six months of implementation.
- ◆ TRU's digital twin enabled team members to identify potential clashes early and optimize construction scheduling to minimize passenger disruption.
- ◆ TRU's digital twin increased data accessibility, enhanced efficiency, and enabled better decision-making, reducing cost and risk.

“iTwin Services represents the heart of our connected environment that has enabled us to optimize program delivery through our digital twin approach.”

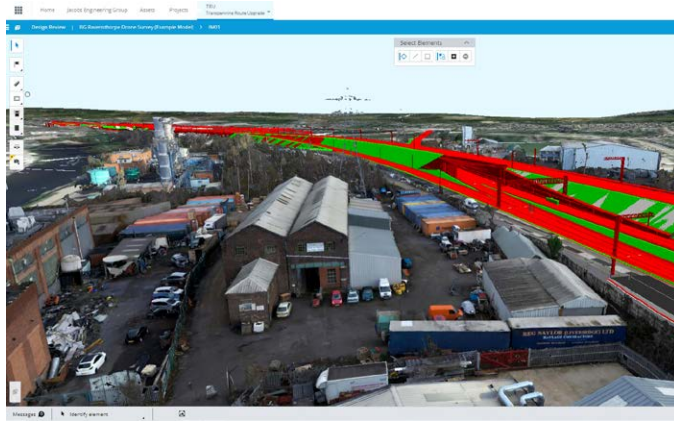
–Joao Barbeiro, Digital Engineering Lead for Transpennine Route Upgrade, Jacobs

## UNLOCKING THE POWER OF A DIGITAL ECOSYSTEM

TRU selected Bentley's iTwin Platform, seamlessly integrating it with ProjectWise, iTwin Capture Modeler, multiple authoring applications, and internal databases. This integration allowed them to federate large volumes of data and make it available to the entire team. Using Bentley's interoperable technology, they created a route-wide digital twin, pushing the boundaries of a digital rail environment to establish a connected digital ecosystem.

The integrated solution consisted of an ecosystem of hardware, software, and suppliers to produce an outcome whose value is greater than the sum of its parts. It resulted in a connected data environment that links with TRU's central data warehouse to establish a single source of truth with the iTwin Platform at its core. “The final element is Bentley's iTwin, which acts as the beating heart of the connected ecosystem,” said Yule.

The implementation of iTwin Platform provided a step change in supporting the development and extending functionality of the digital twin. The digital twin enabled engineering in a virtual environment that empowered collaboration, delivered value through innovation, and ensured sustainability to truly unlock the power of a digital ecosystem. “It has unlocked greater value by [providing] a wide range of disciplines engaged in the program with an environment in which they can follow, feed, and analyze the design and



Using iTwin technology improved information accessibility by 40%, saving GBP 1 million in the first six months of implementation.

asset data in real time,” said Barbeiro. The TRU digital ecosystem enables a virtual representation of the assets, accessible and maintainable in real time through the web-based iTwin Platform. The digital combination of multiple static and dynamic data sources, analytics, and visualizations provides enhanced understanding and insights across railway disciplines, systems, and networks.

## DIGITAL TWINS SET INDUSTRY BENCHMARK

Jacobs supported TRU to develop a more holistic digital twin concept that centers around the transformation of people, processes, technology, and data. They created a connected railway where the right data can be obtained by the right people, at the right time, minimizing risk in design and construction activities. “What we've created is a platform where people have confidence and trust in the data, and that confidence and trust is probably the most important element,” Yule said.

Working in the connected digital ecosystem empowered multidiscipline team members to confidently make decisions based on trusted and accurate railway data and asset performance. With the iTwin Platform at its core, the solution improved information accessibility by 40%, saving more than 20,000 hours and an estimated GBP 1 million within the first six months of implementation. The increased data accessibility enhanced efficiencies and enabled better decision-making to reduce costs and risks during the design phase.

Using the digital twin, TRU can identify potential clashes early and optimize construction scheduling, minimizing passenger disruption and enabling the route to continue serving its customers, all while reducing carbon impact throughout the construction phase. Asset monitoring and enhanced data analytics will produce further benefits during operations. Having federated models supported by trusted data is enabling the TRU program to target the highest quality handover ever provided by a major railway in the United Kingdom. The digital twin provides an unprecedented opportunity for the program to utilize the data to promote better asset management and more efficient and safer operations, ultimately enhancing passenger experience and setting a benchmark for the wider railway industry. “The benefits achieved are likely to not only impact the present TRU program, but also have the potential to change the culture and approach to future [railway] infrastructure programs,” said Barbeiro.