Civil Engineering Means *Going Digital* for Two Jacobs Engineers

Jacobs Engineers Steven Yule and Joao Barbeiro Innovatively Embrace Digital Technology on U.K. Rail Program

The Transpennine Route Upgrade (TRU) is a multibillion-pound railway upgrade program that aims to deliver passenger focused benefits across the TransPennine mainline, between York and Manchester via Leeds and Huddersfield. This vital rail artery stretches over 100 kilometers and not only forms the most direct existing rail link between Manchester and Leeds, but is also used to link a wider set of economic centers, such as Newcastle and Hull in the east, and Liverpool in the west.

The Transpennine route serves 23 stations, crosses over and dips under 285 bridges and viaducts, passes through six miles of tunnels, and crosses over 29 level crossings.

TRU will transform this line into a high-performing, reliable railway providing passengers with greater punctuality, more trains and improved journey times. It will support economic growth in the North and deliver real benefits for passengers and communities along this pivotal rail artery. Jacobs is a global technical professional services firm headquartered in Dallas, Texas, United States, known for their rail development internationally. Jacobs is part of an alliance on TRU along with Network Rail, leading the technical design authority on the TRU project.

The program teams used Bentley Systems' digital twin technology to create a 3D digital representation of the entire railway route, for use in design, construction, and potentially future maintenance. They created a digital ecosystem accessible to all project teams via a connected data environment. Two of the people behind such a ground-breaking program are Jacobs employees Steven Yule and Joao Barbeiro.

From Building Design to Bridge Rehabilitation

Yule is the senior associate director and practice group lead for intelligent asset management and assurance (IAM&A) in strategic consulting at Jacobs, where he has worked for nearly five years. He is a chartered civil engineer and fellow of the Institution of Civil Engineers in the United Kingdom, an honor rarely bestowed upon those under the age of 40.

Yule earned his Master of Engineering in civil and structural engineering from the University of Liverpool. After graduating, he entered a leadership graduate program with Amey, a leading infrastructure services and engineering company, for two and half years. While Yule originally wanted to work with buildings, he started his career working in bridge rehabilitation design. Then, he moved to Qatar for about five years to work on highway and rail developments before returning to the U.K.

Yule leads the overall digital asset management effort on the TRU project, of which Barbeiro is a team member. He came to work on TRU through his familiarity and experience with all aspects of a project's lifecycle: design, construction, handover, operations, and maintenance.

“I was fortunate in different parts of my career to work on different stages—in my early career, it was in design. And then, I went overseas and had a chance to work more on the operations and maintenance side of infrastructure,” explained Yule. “Then, more recently, I’ve become more involved in asset management.”

Yule has been involved in making asset lifecycle decisions at some level while working on every engineering project throughout his career. Consequently, he has an intrinsic understanding of the importance of data and infrastructure lifecycle considerations.

Engineering Sparks a Passion

Barbeiro is the digital delivery – digital innovation consultant for transportation at Jacobs and has worked there for about three years. Touted as a building information modeling (BIM) specialist, Barbeiro’s role spans rail, highways, and aviation.

Born in Castelo Branco, Portugal, Barbeiro was exposed to engineering at an early age. His father was a bridge engineer who worked on sizable international projects. Barbeiro has vivid childhood memories of his father taking him to view these impressive bridge works.

“I do think it influenced me, going to those places,” Barbeiro said. “By seeing it, I actually tried to replicate and go even further within that engineering space.”

With a spark and passion to become an engineer, he set off to study at University of Coimbra, one of the oldest universities in Portugal. Barbeiro received his Master of Science in civil engineering with a specialization in spatial planning, highways, and transportation. For his thesis, he analyzed and modeled complex transportation systems, traffic incidents, actuated control systems, and the implementation of automated public transport systems.

“That [project] was the first linkage between engineering and the digital space, even though at that time it was not as evident for me as it is today; but that was really the first linkage point between what we can actually do with civil engineering that is not the usual engineering that I was used to,” Barbeiro said.

After he graduated, Barbeiro remained in Coimbra for several years before moving to the United Kingdom. Prior to joining Jacobs, he worked on several large infrastructure projects for different engineering firms.

Barbeiro was introduced to the construction side of engineering while working on the Mersey Gateway Bridge, which is a large cable-stayed bridge between Manchester and Liverpool. He then went on to work as the BIM lead on High Speed 2, a high-speed railway that links 21 destinations from Birmingham to York. With each project he’s tackled, Barbeiro said his knowledge and skills expanded.

“Without a doubt, the Transpennine Route Upgrade is where I believe I’ve actually been able to start pulling all of these things together,” he said. “I think the flexibility that we have on this program allowed us to think beyond the boundaries we are used to on more fixed projects. With

this project, we are more able to explore beyond these boundaries and look much further in terms of how we can actually deliver a project in a digital environment."

Working on TRU

Leading the digital and asset management component of the TRU project, Yule merged the asset management team with the digital engineering team, and both the engineers and the leadership embraced this unique approach.

"Having rich data where you take information on these assets and previous surveys and pull all that data together in a common environment – it not only makes [a] civil [engineer's] life easier. I think it means we can make better decisions, quicker decisions, more effective decisions and the benefits of that are that things are safer and a better value for clients," Yule said.

He and his team created the digital ecosystem upon which all project contributors could access timely data. A digital twin used for design and construction, the connected data environment empowered multidiscipline team members to confidently make decisions based on accurate railway and asset performance.

"What we've created is a platform now where people have confidence and trust in the data, and that confidence and trust is probably the most important element," Yule said.

They also worked with Network Rail to create a broader, more holistic digital twin concept that centers around the transformation of people, processes, technology, and data. "We're making sure we leave a positive digital legacy, not just a positive physical legacy," explained Yule.

A part of Yule's team, Barbeiro is the digital engineering and information management lead on TRU. In addition to working with delivery partners and acting as the point of contact, Barbeiro spearheaded the project's digital strategy, ensuring actions made today do not prevent technological developments in the future. Not only does he look at where he can improve existing digital processes, he identifies areas of the program that can be advanced into something original and pioneering in the digital space.

The Future is Digital

Yule said he was never fully certain what he wanted to do in his career, but this uncertainty made him more open to new ideas and ways of working.

"It's probably been the most positive experience I've had in working on a large infrastructure project," Yule said about working on TRU. "It's just a different way of doing things, a different way of thinking. There's lots of scopes for this solution to develop and evolve as the project develops and evolves to meet different needs at each stage of the project lifecycle."

Looking forward, Yule seeks to continue working in asset management across all civil engineering projects, and Barbeiro will continue working as a digital leader, seeking to gain insight on how to better deliver transportation projects and meet sustainability requirements.

“Civil engineers now have to be digitally enabled. Digital is a part of civil engineering now. It’s not something we can opt in or out of,” said Yule. “It’s not just the future. It’s here now. It’s fundamentally changing the sector from my perspective.”

For more information, contact Christine Byrne at christine.byrne@bentley.com, or +1 203-805-0432.

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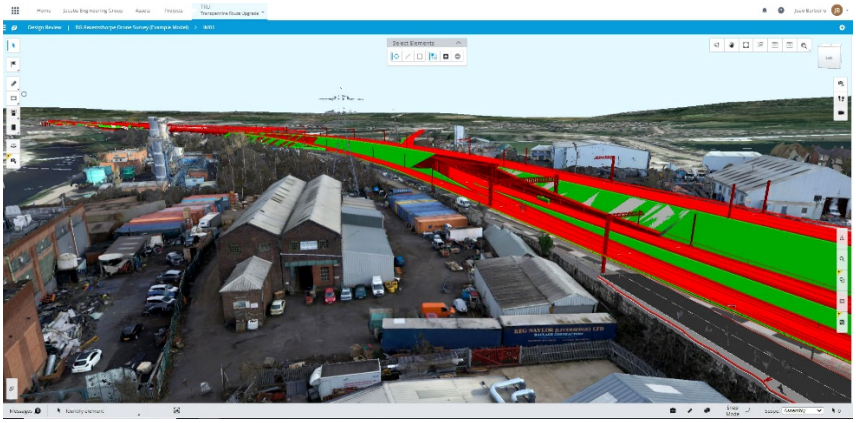

Caption: Steven Yule and Joao Barbeiro of Jacobs worked on the groundbreaking Transpennine Route Upgrade (TRU), a multibillion-pound railway upgrade program that aims to deliver passenger focused benefits across the TransPennine mainline, between York and Manchester via Leeds and Huddersfield.
Image courtesy of Jacobs.