

Arcadis Automates Design of Common Bridge Solutions along the U.K. Rail Network

Bentley's Open Modeling Applications Provide a Flexible, User-friendly Digital Platform Expected to Reduce Typical 3D Modeling by 95%

- *To better serve their clients, Arcadis initiated a project to automate and digitize common railway bridge solutions.*
- *Leveraging Bentley's applications, Arcadis developed automation tools, improving modeling efficiencies for footbridges and underbridges.*
- *Their success was predicated on creating a connected digital ecosystem, enabling dynamic integrated workflows and early engagement of the entire supply chain in the modeling process.*

Automation of Common Railway Bridge Solutions

Arcadis provides design consultancy services across the entire United Kingdom railway network, a significant part involving the renewal of existing rail bridges that may be under capacity, are maintenance liabilities, or are deemed unfit for purpose. They identified footbridges and U-type underbridges as the most common bridge upgrade design solutions they provide for their U.K. railway clients. "Network Rail's standard steel footbridge design is a common sight across the network [...] and is the default solution for many scenarios, [while] the U-type underbridge is a commonly used solution for small to medium span ranges for rail underbridges," said Michael Bardin, associate technical director at Arcadis.

Many of Arcadis' engineering and modeling solutions for these bridge schemes have evolved over the past 30 years. Historically, developing such detailed 3D civil models would be left until late in the design program to complete. With their clients wanting more detail and data earlier in the design process, Arcadis embarked on a project to develop automation tools to rapidly produce these detailed 3D engineering models and allow the entire supply chain to engage earlier. "Using automation techniques, we can engage with the project ecosystem with in-depth and more reliable data early," said Bardin.

Flexibility, Accessibility, and Interoperability

Flexibility, accessibility, and interoperability were key to automating and streamlining bridge engineering workflows and providing more reliable data early in the design process to optimize the entire project lifecycle. Arcadis realized that new tools had to be user-friendly, provide full flexibility for controlling the geometry of bridge solutions, and automatically generate model outputs with a high level of detail. The design input also required the flexibility to be deployed as a stand-alone solution, and at any stage of the design process, whether for greenfield sites or integration with existing rail infrastructure. "Providing flexibility to the user in how these tools are deployed allows them to be used in a wide variety of situations," said Bardin.

Arcadis attempted several different technology approaches, with each presenting file compatibility and coordination issues across disciplines and clients. Their U.K. rail clients also mandated that

models and design drawings be delivered in a DGN format, which many of the software platforms that Arcadis tried could not accommodate. Invariably, the design models had to be exported from native formats and converted, limiting collaboration and leading to issues with drawing presentation and design assurance. Arcadis needed a collaborative digital platform that provided the flexibility and interoperability to automate and streamline design processes for rapid 3D modeling of these frequently used bridge types for varying railway projects.

Leveraging OpenBuildings Facilitates Automated Workflows

“OpenBuildings was the perfect choice to solve these issues,” said Bardin. Specifically, the GenerativeComponents feature in OpenBuildings allowed Arcadis to produce additional scripting, versatile configurations, and automation of design calculations. Leveraging OpenBuildings with ProjectWise, Arcadis developed a suite of automation techniques and tools that allowed for rapid 3D modeling of typical bridge elements for footbridge and U-type underbridge solutions in a connected digital ecosystem. “Using [OpenBuildings], we have developed a script that allows for the rapid 3D modeling and setting of these frequently used bridge types,” said Bardin.

The collaborative digital approach and user-friendly interface eliminated the need for file conversion, optimizing change management and allowing teams, stakeholders, and suppliers to engage early in the design stage. Working in a fully accessible, digitally integrated environment, enables dynamic modeling with design changes in real time, and supports managed workflows, providing a high level of control and the ability to explore flexible design schemes.

A Paradigm Shift in Design Approach

For both footbridge and U-type underbridge design solutions, using Bentley’s applications to develop automation tools reduced modeling time from two weeks to a matter of minutes to generate a fully detailed model, ensuring an optimal design solution. “This can all be undertaken in very early design stages, eliminating the risk of potential clashes and additional design challenges further along in design development,” said Bardin. Having more reliable data early improves cost estimation and material efficiencies, facilitates carbon analysis, and enables identification of potential constructability issues, driving more sustainable workflows and infrastructure.

“The development and success of these automation tools using [OpenBuildings] is the start of a paradigm shift in how we, as an organization, approach our designs,” said Bardin. Combining user guide documents and videos to implement their automation techniques, Arcadis has developed connected, digital bridge solutions, resulting in a powerful and user-friendly tool kit that is no longer the preserve of a select few, and is accessible to stakeholders, teams, and suppliers. The ability to engage and coordinate early within a digital 3D environment enables the entire project to visualize the civil engineering solution early. Deploying the automated workflows on subsequent projects is expected to reduce typical modeling by 95%.



[Image Link](#)

Image Caption: The ability to engage and coordinate early within a digital 3D environment enables the entire project team at Arcadis to visualize the civil engineering solution early. *Image courtesy of Arcadis.*

Author: *Steve Cockerell is industry marketing director, rail and transit, with Bentley Systems. He can be reached at Steve.Cockerell@bentley.com.*

2022 *Going Digital* Awards Founders' Honor

© 2023 Bentley Systems, Incorporated. Bentley, the Bentley logo, GenerativeComponents, and OpenBuildings are either registered or unregistered trademarks or service marks of Bentley Systems, Incorporated or one of its direct or indirect wholly owned subsidiaries. All other brands and product names are trademarks of their respective owners.