



DIGITAL TWINS CONTRIBUTE TO INFRASTRUCTURE RESILIENCE

Driving optimal outcomes for projects and communities

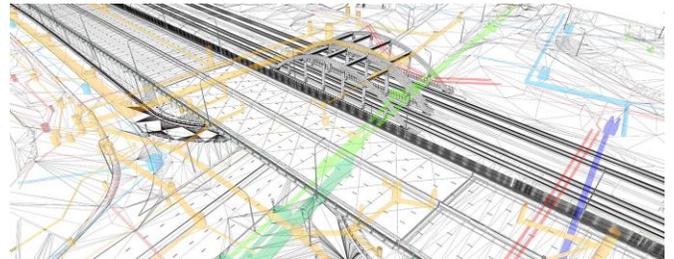
When planning for infrastructure, a key challenge and need is building in resilience. Recent experience with COVID-19 has highlighted the importance of infrastructure's adaptive capability; future unanticipated events will surely retest operational resilience to short-term shocks and long-term uncertainties. In the following Q&A, we spoke with Thomas Coleman, Manager of Technology Integration, WSP, to explore how digital twins can drive optimal outcomes for infrastructure projects and the communities they support.

What is a digital twin, and why are digital twins important in infrastructure projects?

Thomas Coleman: A digital twin is a virtual replica of an asset that incorporates associated real-time data during operation of that asset. It provides an immersive and integrated visualization of previously siloed information and enables use of modern digital analysis techniques, such as condition-based monitoring and predictive analysis, to plan for the continued functioning of infrastructure. For example, in 2015, WSP advanced the first phase of a digital twin of Chicago to support the O'Hare express rail project. This phase allowed the analysis of multiple rail routes within a 3D model to better understand and optimize the factors that affected express rail routes to O'Hare International Airport.

Whether for an entire city, a bridge, a highway, a building, a site with numerous buildings, or an airport, a digital twin provides for well-informed

decision-making throughout an asset's lifecycle. The ultimate vision for the application of a digital twin is to create a system of interconnected digital twins for infrastructure within a city, region—or nation, as envisioned by the United Kingdom, for example.¹



How do digital twins advance Building Information Modelling (BIM)?

Thomas Coleman: BIM is a process based on 3D modeling for planning, designing, constructing and managing infrastructure. Both BIM and a digital twin can be used to facilitate a collaborative working environment so that project teams and key stakeholders can visualize a wealth of project data upfront from a common knowledge base; and both assist with the diverse aspects of project development. However, BIM is not designed for real-time operational response, which is the distinguishing feature of a digital twin. In this way, a digital twin is the next evolutionary step of BIM.

A digital twin for infrastructure can be continuously updated with big data from multiple sources, enabling improved testing of what-if scenarios, analysis of the interdependency of multiple systems and simulation of risks and

¹ [University of Cambridge, Centre for Digital Built Britain, The Gemini Principles](#)

vulnerabilities—all toward the development of the asset’s resilience.

What tools support data collection for digital twins?

Thomas Coleman: Satellites, planes, drones, sensors and robotic devices are some of the geospatial tools that now provide cost effective, automated and continuous data collection beyond human capability. Typically, a digital twin starts out as a static 3D BIM model of an infrastructure asset. Drones with Light Detection and Ranging (LiDAR) can be used to generate a point cloud 3D model and accelerate the development of a 4D digital twin model, to apply the dimension of time, immersive visualization and machine learning analytics.

Potential use is expanding. The Covid-19 crisis has called attention to digital twins as a means to simulate the movement of people in buildings, transit stations and other public places, and enable heightened analysis of situational health risk—thereby highlighting digital twins as an indispensable tool for infrastructure planning and design.

Do digital twins bring gains beyond infrastructure development?

Thomas Coleman: Our global project experience with digital twin implementation demonstrates that increased data usability through geospatial techniques, big data, 3D modeling and cloud computing can lead to productivity improvements and cost savings. These gains come through analysis of the performance of processes and assets, identification of issues, and application of artificial intelligence for predicative analysis during the lifecycle of an infrastructure project.

The ease and cost effectiveness of big data collection and IoT does intensify the need to

manage data well, to maximize the value of data flowing into a digital twin.

Earlier you mentioned that digital twins provide an integrated perspective to inform decisions. How can these decisions help bring about sustainable outcomes for communities?

Thomas Coleman: By seeing infrastructure as an ecosystem, or a complex system of interconnected and interdependent elements, those involved in project planning, design and implementation can consider how multiple factors might affect outcomes not only for the infrastructure asset but also the environment and all the people in each community. Key stakeholders can then share their recommendations and shape the best decisions for the design, construction and operation of an infrastructure asset, and bring lasting benefits for society.

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