Trimble

Why BIM Needs Digital Twins

What does it mean to unite a project under one, interconnected network? The catch-all term for device connectivity is Internet of Things (IoT), but the real-world logistics of actually executing project connectivity extend far beyond a mere buzzword. What steps can be taken, in the office and in the field, to improve company-wide congruence?

The practicality of implementing jobsite connectivity is, in part, hinged on an emerging industry trend: digital twins. Digital twins help materialize the intangible, realize IoT ROI, and are an important facet of connected jobsites. The acute information they provide help all project phases work more efficiently. Improved collaboration, centralized information delivery, physical asset optimization, and more — put simply, digital twins streamline detail delivery and democratize project information.

Let's unpack what, exactly, digital twins are, how they are being used in the construction industry, and ultimately come to an understanding of how this technology can enhance an existing BIM infrastructure.

What is a Digital Twin?

The term digital twin is fairly intuitive. In layman's terms, it means exactly what it sounds like: a digital twin is a digital representation of a physical asset. This is to say that a digital twin is a digital equivalent of a real-world component on the jobsite. It could represent something as macro as an entire structure all the way down to something as micro as a length of pipe and everything in between.

Digital twins are up-to-date copies of physical objects that deliver information on the object's properties and states. Information can include physical orientation such as shape, position, gesture, or motion, as well as insight into other statuses, interactions, and updates. Digital twins align the real world with the virtual world and help illuminate the impact the environment has on a given physical asset.

A digital twin is more than just a schematic. This digital tool is dynamic — it offers more understanding than a mere blueprint since digital twins are capable of recalibrating automatically. As a physical asset adjusts to a new environment, user interaction, updated calibrations, etc. the digital twin adjusts accordingly. A digital twin is able to learn from multiple sources and update to represent the status, condition, and position of its real-world counterpart.

What is Internet of Things?

To fully understand the utility of digital twins you have to understand the framework that makes them possible: Internet of Things (IoT).

In order to promote a continuous stream of information between a component and its digital twin, the physical asset itself must be Internet-enabled. This might seem obvious, but the practical nature of digital twins is not always immediately apparent.

IoT describes when a device is embedded with technology that allows it to communicate and interact over the Internet. This allows the asset to be remotely monitored and controlled, and, for the purposes of digital twins, enables real-time updates to corresponding digital models.

Think of it this way: a digital twin is a representation of a physical asset; IoT is the network of interconnected devices that makes digital twins possible. When these initiatives are successfully aligned, you can benefit from on-the-spot data collection and ensure your digital models are accurately representative of their real-world counterparts.

3D models of physical objects can be considered digital twins when they are integrated into a data-gathering, IoT ecosystem. Sensors in the field collect data on the status of physical assets and update the digital simulation automatically. This allows digital twins to update on the fly as real-world conditions change.

For example, when an IoT device delivers up-to-date information to a digital equivalent, the 3D model is then able to directly represent that physical asset on the spot. This helps monitor asset status and, better yet, visualize IoT connectivity.

This has countless applications, and most construction project assets can benefit from a dynamic, digital counterpart. An adaptable digital model, which directly represents its real-world companion, helps increase analytical capabilities throughout all phases of a construction project.

Digital twins learn, and update, according to multiple sources — more data means greater digital twin accuracy. This means that the success of a digital twin is closely aligned with the breadth of your IoT environment. When integrated into an expansive, reliant network of interconnected devices, you can trust a digital twin is receiving appropriate, accurate data.

Digital Twin Applications

The inherent symbiosis of IoT and digital twins helps establish a connected jobsite, and this relationship can help break down the procedural barriers that divide project phases.

For example, consider the following uses of digital twins and how they are made possible through automatic data gathering:

- **RESOURCE MANAGEMENT:** A consistent flow of information from the field helps monitor resource allocation. With the aid of automatic data delivery, you can predict resource bottlenecks and adjust in turn. This helps the jobsite run more efficiently and affordably.

  Technological solution: A labor management platform collects data from readers placed at entry and exit points placed onsite and automatically reflects this data within a digital platform. This software allows managers to automatically track workers' time, gain insight into entry/exit, and even customize entry criteria to prevent unauthorized jobsite access.

- **PREDICTIVE ADJUSTMENTS:** Compare as-designed models against as-built structures and discover upcoming discrepancies. Use this information to inform future decisions and adjustments.

  Technological solution: Mixed reality overlays project data onto the physical environment to help contextualize 3D models. This helps bring 3D content off the computer screen and make sense of it within the real-world — improving the efficiency and accuracy of 3D design review, coordination, collaboration, and project management.

- **PROGRESS MONITORING:** All too often, important details get lost in translation as a model progresses down the chain of command. Digital twin technology offers accurate, real-time updates of building progress that will reveal any deviations from 3D models.

  Technological solution: Collect and share layout data across the entire construction workflow by integrating a **suite of layout tools.** For example, pair layout scanning technology with a collaboration platform to collect jobsite data in realtime, keep models up-to-date, and enable technicians to share layout information and as-built models with other project phases. There are numerous applications for digital twins in construction beyond this list. What's important to note is that this technology offers unprecedented data delivery, which helps shape informed decision making. Ultimately, digital twins establish a feedback loop between stakeholders and the jobsite to help unify all project phases.

Digital Twins & BIM

BIM, on its own, is an immensely powerful tool. Architects, fabricators, structural engineers, and more depend on this technology to visualize building components and share project information. However, when buttressed by an IoT framework, BIM takes on a whole new level of utility.

This is no big secret — a connected jobsite is an efficient jobsite. Supported by a robust IoT ecosystem, BIM becomes a project-wide information delivery tool that can help uncover new efficiencies. From project bidding to building, when 3D models are elevated to digital twins, BIM can convey a diversity of details that all construction phases need to get the job done.

Common procedural challenges that can be mitigated through effective digital twin and BIM integration include:

- **ASSET INSIGHT:** Digital twins are, first and foremost, analytical tools. These simulations help make sense of raw data by visualizing the status, working condition, and position of physical assets. This offers unprecedented insight into the condition of field investments and helps inform future operations.

- **TEAM CONNECTIVITY:** Historically, construction phases tend to work in isolation. Disparate processes, separate goals, and vast skill gaps make project-wide collaboration unrealistic. Digital twins offer a better way — a visual common ground that offers invaluable cohesion through which construction phases can communicate more effectively. Component dimensions, model details, working condition, and more can be embedded into content-enabled models.

- **OPTIMIZIED FABRICATION:** Having the most up-to-date product information embedded into content-enabled models allows for "digital twin builds" — the quickest, most efficient, and most accurate fabrication possible. This reduces errors and rework, along with the time and money they waste. And, on-site scheduling is enhanced through real just-in-time production and delivery of fabricated components.

- **ONGOING SUPPORT:** When the project is complete, digital twins can be handed over to the client to help support ongoing structural enhancements. For example, if a client is interested in the environmental impact of their structure, a digital twin can track energy demand, CO2 emissions, and indoor air quality to help shape future green initiatives. A digital twin can be a value-added asset for clients looking to leverage data in future optimization projects.

Digital twin methodology is one way to help elevate BIM beyond mere CAD display. IoT empowers BIM models to track, store, and display complex data, and effectively turns models into "living" documents that update automatically.

Make models more meaningful with digital twin integration. Construction projects can reap the benefits of an intuitive, interconnected network of physical assets — investment monitoring, real-time updates, predictive capability, and more stem from digital twin integration and help construction teams work smarter, not harder.

Trimble is here to help you improve jobsite connectivity. Through our software solutions you can make BIM a project-wide asset, improving collaboration across all project phases. Our **Constructible Process** helps optimize the entire design, build, and operate lifecycle, and unite stakeholders under one central goal: a more efficient, affordable build.