

How Digital Project Delivery Paves a Clear Path to a Complex Future

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DIGITAL PROJECT DELIVERY IS PUSHING THE BUILT ENVIRONMENT'S EVOLUTION, PROMISING BETTER COLLABORATION AND MANAGEMENT OVER AN ASSET'S ENTIRE LIFECYCLE.

Architecture, engineering, and construction (AEC) firms face myriad challenges, including a skilled-labor shortage, low margins, policy complexity, and unpredictability in securing building materials. This results in projects getting delayed, teams working in silos, lost time, lost money, and an environmental impact that has become unjustifiable in today's world. McKinsey Global Institute reports a global productivity gap of \$1.2 trillion, which can be mitigated simply by improving the performance of the industry. The industry is snapping into action: Investing in new ways of working driven by technology has more than doubled in the past decade.

Although many software, hardware, and cloud-based tools will contribute to this shift, ultimately the biggest change will be digital project delivery: digitized workflows that enable better collaboration and seamless flow of data throughout the project lifecycle - from planning and design to construction and operation. During the past 20 years, the building information modeling (BIM) process has established digital workflows across the AEC sector; 60% of architects and 51% of MEP and structural engineers use it. In a recent KMPG survey, 42% of construction industry expert respondents say that BIM has the greatest potential for high returns. And in a recent Deloitte survey, 43% of engineering and construction executives



predicted greater investments in new design processes, such as focusing on BIM, in the next year. Digital project delivery accelerates and expands the adoption of BIM in design to construction and ultimately into operations of capital assets.

Digitizing every decision that goes into creating a building or piece of infrastructure is a tall order with an intense learning curve - one that offers unparalleled rewards, including greater efficiency, reduced risk, better quality, improved communication, and information accessibility. The methods used to design capital assets in the past - a pile of construction drawings over here, hand sketches over there, 3D models on one network, a series of change orders from the client on another network, and reams of PDFs in-between - coalesce into a single digital environment, where their accessibility

and mutability will create digital assets just as responsive and efficient as the data itself.

What Is Digital Project Delivery?

Quite simply: Digital project delivery is a way of working in which projects are conceived, planned, designed, built, and operated in an interactive digital space that all stakeholders can access. This includes every team member: the client, architects, engineers, builders, trades, and even local residents.

Digital project delivery encompasses design collaboration, design management, and construction management. Design collaboration has a narrow focus within the design team, allowing content creators to work together through a managed process centered around a common digital model. Design management is broader, allowing individuals who work outside of a project's content creation to manage risk, cost, and safety and identify roadblocks through a common data environment.

WHAT IS A COMMON DATA ENVIRONMENT?

A common data environment (CDE) is a central repository where project data and information are stored. It allows project teams to better collaborate around a digital process, from the initial ideation through design, construction, and operations. A CDE extends the value of data created through the BIM process; it can encompass 3D models, construction documentation, project contracts, schedules, change orders, and more. At all points, this shared language of data is structured and streamlined for real-time collaboration, which enables data-driven decision making and mitigates project risk.

A CDE also improves communication across project stakeholders and enables the digital handover of an asset as a digital twin to extend the value of the BIM process into operations.

Of firms that use BIM, 80% say they're already using some form of a CDE. But there's much progress to be made. Almost a third of construction professionals report that none of their software solutions are integrated, and, globally, 52% of rework is still caused by poor data and communication.

WHAT IS A DIGITAL TWIN?

A digital twin is a digital representation of a physical asset: a building, a highway, a bridge, or a water treatment plant. Far from being just a visual and geometric representation of an asset, this digital model is enriched with critical asset data that defines its formal and material characteristics, the manufacturer, installation date, and so on.

Digital twins enable the visualization, monitoring, and optimization of assets by connecting them to real-time data. A digital twin might track how much water runs through a piping system or analyze energy consumption of a building. Derived from BIM, digital twins with the addition of artificial intelligence and machine learning are becoming sophisticated enough to autonomously troubleshoot problems and simulate what-if scenarios.

COORDINATING DATA ACROSS DESIGN TEAMS - AND IN THE CLOUD

The collaboration and coordination of design-team members can be optimized through the cloud. The benefit of being a cloud-first offering is that project team members can collaborate anywhere, anytime. Builders can bring the model onto the construction site to compare what's being built to what the architects and engineers have designed. The model allows subcontractors - like plumbing, electrical, HVAC, and other trade professionals - to double-check how unforeseen conditions on the construction site could affect their work before it even begins.

Why Does Digital Project Delivery Matter Now More Than Ever?

Digital project delivery offers powerful benefits for every member across the project ecosystem. For architects and engineers, co-developing a design through BIM means that all disciplines can collaborate effectively and efficiently around a common and coordinated model. This can identify problems earlier and address inaccurate assumptions well before the project is being built, which reduces the cost of errors and changes in the field.

For all members of the project team, digital project delivery helps them be proactive instead of reactive: to use data to distribute responsibility across an entire team evenly so each player can anticipate and solve problems using their expertise throughout the process. When data is transparent, searchable, and exportable, teams can access information earlier to make better decisions that drive better outcomes.

WHAT CHALLENGES CAN BE ADDRESSED WITH DIGITAL PROJECT DELIVERY?

- » The pandemic has brought radical change to the way people work; it's now essential to offer flexible work hours across home and office time. As people settle into new rhythms - with work happening at home offices, traditional corporate headquarters, and on jobsites - working in the cloud with digital project delivery is seamless.
- » Wage inflation, labor shortages, and spiking material prices are pushing owners and operators to improve efficiency and close the productivity gap.
- » Projects are becoming more complex and difficult, and AEC firms are being forced to deliver them with fewer people. There are also more contract rules and digital security protocols than ever before. To manage growing complexity with a shrinking labor pool, AEC firms are looking for a CDE that can manage and document projects.
- » If one AEC firm isn't using digital project delivery, its competitors probably are. As they do, growing industry standards, such as ISO19650, are coming into play. AEC firms need to transition to digital project delivery just to keep up with the way business is done.
- » Projects using digital project delivery offer the potential to be designed and built with less material, in less time, for less money. A recent Autodesk survey reported that approximately half of BIM users experienced reduced design time and reduced emissions from projects when they used a digital process. And 55% said their workforce was able to take on additional capacity.

What Are the Benefits of Digital Project Delivery Today and in the Future?

Digital project delivery provides a work environment free of

silos that enables more interaction with team members and less time to deliver projects than traditional ways of working. As projects progress, they accumulate hordes of data that can be leveraged to create operational value for current and future projects.

- » **When design is digitized, the result is a single source of truth:** a dynamic model that all team members can access and revise. Operating within a common model erases nearly all ambiguity and miscommunication inherent in more fragmented design processes, leading to better decision making, fewer errors, and less rework.
- » During construction, this means that mistakes are spotted before concrete is poured and steel beams are welded into place. With a shared and dynamically updated model, builders can constantly check the accuracy of their work.
- » After just a few projects, firms that use digital project delivery will find themselves with a wealth of data on how their projects are designed and built. They can understand what works well and where the pain points are at a much greater depth and detail than working in analog processes. This persistence and accessibility of data makes it a great tool to navigate future challenges such as creating more accurate cost estimates and timelines.
- » With digital project delivery, AEC firms can automatically triage issues and RFIs instead of having to manually pick through thousands of issues and distribute them to the right teams.
- » With parametrically enhanced building models, changes to one part of the design can automatically ripple throughout the rest of it, reducing the need for manual work.
- » According to a recent Deloitte survey, 60% of construction firms are experiencing project delays due to labor shortages. In the face of labor shortages and skyrocketing material prices, digital project delivery means fewer change orders and less labor-intensive upfront coordination.
- » Especially for public assets, AEC firms and their clients aren't just dealing with each other. Digital design can help communication with nondesign stakeholders and the general public, like showing off an interactive model at a community meeting. An Autodesk survey shows that 54% of respondents think digital project delivery can help increase stakeholder buy-in.

- » With digital project delivery, the process of planning the design and construction of a building is less carbon-intensive. There is also a decreased need to print files or travel for face-to-face meetings.
- » The well of data collected using digital project delivery can also be used to refine operational efficiency as new capital assets come online. A more accurate understanding of how assets run can mean more efficient maintenance and operations protocols after construction.

Digital Project Delivery in Action, Across the Globe

A look into how digital project delivery changes design and construction reveals that there's no part of the process left untouched. From enhancing parametric design to automating design changes, communicating with fabricators, and representing site conditions with unparalleled accuracy, each project has a unique story to tell.

POLO ARCHITECT CUTS PROJECT MISTAKES IN HALF, THANKS TO BIM

The Elysia Park project in Edegem, Belgium, is a 345-unit development with beautiful views of gardens, a pond, and a park. Designed by POLO Architects, it's being built in four phases: The first two were built with BIM but without a digital project delivery collaboration model that connected all team members. In these phases, the architects exported the BIM model via WeTransfer to the client at regular intervals. From there, the client marked up the model by hand, which then had to be retranslated into the model later. Sometimes, the model's mark-up would already be outdated by the time the client got to it.

The process left lots of room for misunderstandings and omissions, so POLO adopted BIM Collaborate Pro for the third and fourth stages of the project, looping their clients and subcontractors into the workflow. With everyone working on the same digital model and all changes to that model viewable by everyone, POLO and its building team have cut the number of mistakes by 50% and have seen similar reductions in the timelines for certain stages of the project.

ARCADIS SAVES 1,000 DESIGN HOURS IMPROVING LAKE ERIE WATER INFRASTRUCTURE

In 2014, when severe algae bloomed in Lake Erie and made the water dangerous and undrinkable for 500,000 people in and around Toledo, OH, the governor declared a state of emergency and Red Cross set up water distribution centers. It fell to Arcadis to fix the region's water treatment infrastructure so this wouldn't happen again. The solution was to build two new water-retention basins that would boost the Collins Park Water Treatment Plant's daily capacity by 40 million gallons while also addressing other upgrades and keeping the existing plant operational.

This infrastructure was built in the 1940s and '50s, so existing documentation of it was severely outdated. Arcadis used Autodesk ReCap to provide 3D scans of the site and Autodesk InfraWorks to layer in GIS data for the plant's surfaces and utilities to capture existing site conditions. Once a 3D model was generated from these scans, it could be explored both offsite and onsite with a graphic overlay. Wearing a Microsoft HoloLens headset, the construction team could virtually travel inside the 3D models using augmented reality, overlaying this imagery with the real jobsite to see how the plans either aligned or conflicted with real-time conditions.

With contractors spread from Ohio to Florida - and the entire process upended by the pandemic - this BIM Collaborate Pro effort could continue seamlessly on the cloud and meet the project's urgent timeline. Across all team members (architectural, structural, mechanical, HVAC, electrical, I&C, and civil site work), project coordination reduced lag time from file transfers by 80%. Arcadis estimates it saved more than 1,000 design hours on its way toward completing the basins on schedule in 2020.

VOLKERWESSELS CONNECTS BIM AND GIS DATA FOR POWERFUL RAILWAY INSIGHTS

Zwolle-Herfte railway expansion project in the Netherlands is massive: one of the largest railway junctions in the nation, stretching 2 kilometers and serving eight train lines. The international construction company Volkerwessels was hired to relieve pressure from this bottleneck by doubling its capacity, adding a tunnel, and replacing old steel railway bridges, all while the trains are still running.

This job required the usual suite of digital design and collaboration tools. Given the very large, complex site that crosses over multiple bicycle paths, roads, and canals, the team also needed to integrate geospatial data into its digital project delivery. ESRI's GIS data (used to map underground utilities, ground-level surroundings, and more) was integrated into the digital project delivery with Autodesk's ArcGIS Connector for Civil 3D.

This interaction proved transformative for the project. Connecting BIM and GIS data with scheduling data provided powerful insights into where to divert trains while tracks are being rebuilt, which benefited phasing and scheduling—key aspects of rail projects, where minimal impact on train operations is vital. And any geospatial information clashes, such as conflicting cabling or gas-pipe routes, could be more easily identified and addressed by designers without needing to visit the site or request additional information from a GIS team member.

WESSEX WATER SHAVES PROJECT SETUP TIME FROM DAYS TO MINUTES WITH BIM

Wessex Water is the only water company in the UK that acts as an owner, operator, designer, and contractor, serving 2.8 million people in southwest England. This unique status means that the company is especially focused on lifecycle management of its infrastructure, as well as the environment and ecology of its community.

When Wessex Water began looking for a CDE, the company settled on BIM 360 and Autodesk Construction Cloud to generate and leverage better data to improve these outcomes. Immediately, the company found that setting up projects in its design and collaboration tools went from taking a few days to a few minutes. Wessex Water initially used these new tools with its watermain-laying team, servicing assets that are already in the ground. The company also used BIM 360 as a document management system with its Engineering, Procuring, and Construct team. The design-review process also benefited from BIM 360, as external design reviewers no longer had to shuttle revisions across different platforms or handwritten notes.

The Promise of an Integrated Future With Digital Project Delivery

The technological horizon of digital project delivery will evolve as projects generate more data - and with the ability of AEC firms, owners, and operators to interpret it. As digital project delivery advances, it won't be just managing more files, it will be managing granular project and asset data as divisions between file types and platforms fall away and front-end interfaces pull data from a rich cloud information model. As the industry moves from a product- and files-based digital delivery process to a data- and platform-based digital delivery process, it will further unlock the value of the data and dramatically expand the scope of what's possible to become what's probable.

Digital project delivery already is an essential part of the AEC industry today and will become indispensable in the future. It will touch all aspects of designing, building, and maintaining the built environment. A boon of data, when not effectively used, is really no boon at all. Digital project delivery will mean better insights, leaner operations, more transparency, smarter decisions, and a clearer path to sustainability. And that's good news for everyone. 



About the Author

Theo Agelopoulos serves as vice president of Autodesk's AEC design business, which includes AutoCAD and building and infrastructure design. During the past eight years, he has led Autodesk's AEC design business growth and played a key role in Autodesk's overall business model transformation. Agelopoulos has extensive knowledge enabling digital transformation through technology. He has several decades of experience in various technology-based disruptions that have impacted the AEC industry, including CAD, BIM, GIS, cloud, reality capture, artificial intelligence/machine learning, and digital twins.

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