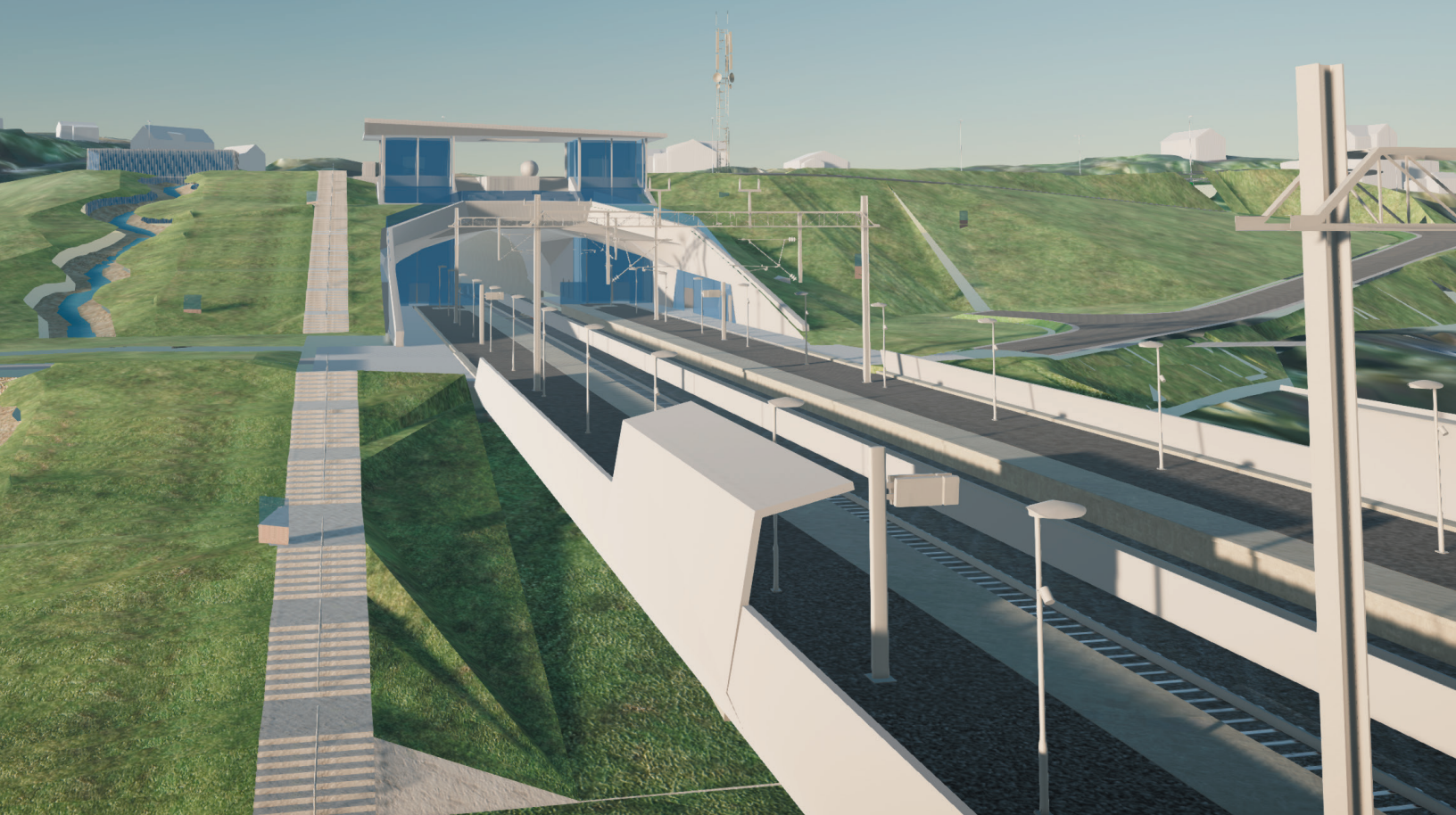
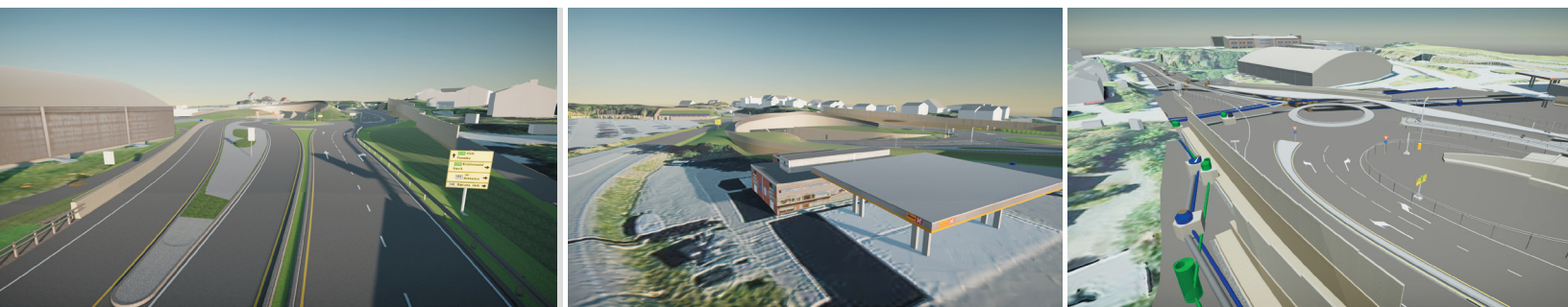


# The Ultimate Guide to Model-Based Construction for Civil Contractors

3 Ways Civil Contractors Can Overcome Project Hurdles and Seize Infrastructure Project Opportunities through using the Model in Construction





As the contractor, you hold a lot of responsibility for on-time and on-budget project delivery. But you also have the power to influence workflow improvements throughout the design and construction process. **Through this guide, we'll outline current challenges in infrastructure and identify the sources of inefficiencies and cost overruns and find ways to eliminate or reduce them.**

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American infrastructure is aging, and the need for significant investment provides a huge opportunity for civil contractors. The new administration has earmarked [\\$2 trillion for infrastructure projects](#). While we wait to see what the actual federal investment will be, there is vigorous support for infrastructure projects at the state and local level. In 2019, there were [305 ballot measures supporting infrastructure projects](#), of which roughly 90% were approved by voters.

As these opportunities unfold, you'll also be under immense pressure from project owners to complete projects on time and on budget despite increasing scope and complexity. As the centerpoint between designers, owners, suppliers, and subcontractors, you already manage a complex web of stakeholders. New trends are making that web much more intricate. Owners are already incorporating technology like IoT (internet of things) devices to capture real-time data, and many are bracing for the future demands of electric and autonomous vehicles. These innovations expand the network of stakeholders and data inputs required for each project.

Initiatives like Every Day Counts (EDC) from the Federal Highway Administration (FHWA), now in its 6th iteration (EDC-6) for 2021-2022, are promoting greater efficiency at the state and local levels by encouraging the use of digital construction techniques that improve

project outcomes. One of those outcomes is lower total cost of ownership (TCO), a metric that owners are increasingly concerned with. Sixty-nine percent of construction companies say that a [growing customer focus on TCO will cause disruption](#), and 90% expect the shift to occur in the next ten years. This is adding additional pressure on civil contractors to identify the sources of inefficiencies and cost overruns and find ways to eliminate or reduce them.

Achieving that goal is no easy feat when you're orchestrating large and lengthy projects involving a diverse group of stakeholders and siloed workgroups. Facilitating communication and collaboration among the many external and internal stakeholders involved is challenging enough, particularly when each is using their own processes and software tools. Most projects typically lack a single source of truth, where data is only entered once and all stakeholders can access the most up-to-date information.

It's challenges like these that continue to hurt productivity and project delivery. They also hold the potential to jeopardize the integrity of the work and the safety of others. As a result, your job is even harder than it needs to be. But there's a better way. Read on to learn how you can overcome the obstacles and seize the opportunities before you.

# Challenges We See in the Industry



10%  
of materials are wasted



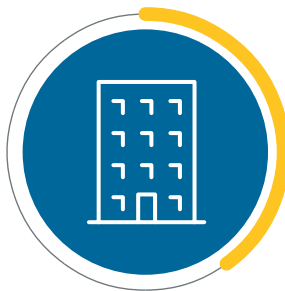
40%  
of projects are over budget



30%  
of construction is rework



90%  
of projects are late



40%  
of buildings are under-utilized



40%  
of jobsite work is unproductive

# The Pressure Is on to Deliver Infrastructure Projects on Time and on Budget


American infrastructure is in dire need of improvement and innovation. It's estimated that there's a \$386 billion backlog for [highway and bridge projects](#) alone. Local, state, and federal agencies have begun to embrace digitalization and new funding opportunities to address this backlog. Experts predict that the COVID-19 crisis will [accelerate these disruptive trends](#) even more, transforming the construction ecosystem rapidly and permanently.

## FHWA promotes 3D models and digital as-builts to improve project delivery

Project owners are increasingly focused on improving productivity to hasten the delivery of infrastructure projects. And they're looking to technology to address the problem. For example, the FHWA now encourages the use of [3D modeling](#) due to its cost-effectiveness and ability to accelerate the completion of highway projects. Engineered 3D modeling and specifically the use of BIM (building information modeling) helps contractors reduce errors, save time and cost, and increase coordination and cooperation among the many stakeholders involved in civil projects. In fact, many transportation agencies are now requiring the signing and sealing of 3D models instead of 2D plans.

The [FHWA's EDC initiative](#) further raises the stakes on productivity by suggesting bi-annual improvements in the way projects are managed and constructed at the state level. Among the innovations under EDC-6 for 2021-22 are e-ticketing and digital as-builts. E-ticketing, a paperless process for materials ticketing, streamlines the production, transmittal, and sharing of materials data. It also provides a contactless means of exchanging information, which has become even more relevant in light of COVID-19.

Digital as-builts serve the same purpose as traditional as-builts, providing an accurate representation of what was actually built when construction is complete. But when you're able to produce as-builts digitally, you extract even more value from them. Producing a digital as-built requires a model-based design approach, which closes siloes between stakeholders throughout the construction lifecycle and yields benefits such as earlier identification of design challenges and reduced rework. The digital as-built also provides an accurate model of existing conditions. These benefits ultimately result in greater cost control and more efficient project delivery, which are in the best interests of contractors and owners alike.



When compared side-by-side against traditional methodology, using digital as-builts as part of a BIM workflow can reduce the number of drawings required for a project by up to 90%, and reduce the portion of the project budget dedicated to change orders by 11.5%.

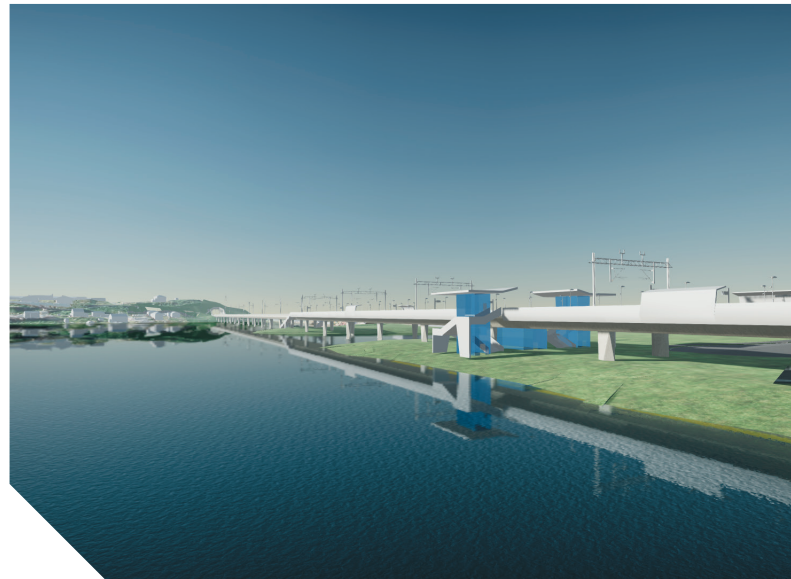
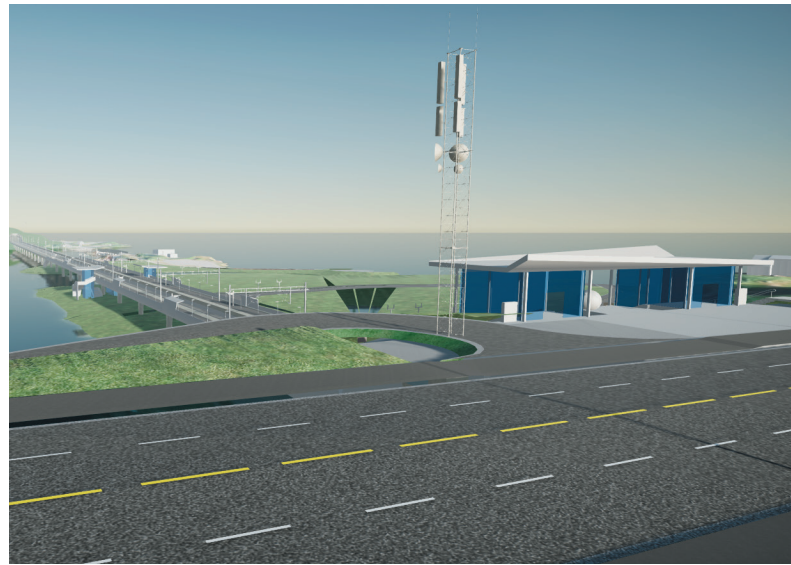
The digital as-built starts with a central BIM model. As changes are made during the course of construction, they're captured in this model, effectively creating a living record of the work performed. The digital as-built can also be made more valuable by incorporating 4D (scheduling) data, 5D (cost) data, and even 6D granular project data to make management and maintenance of the asset easier and more efficient, as well as to inform future project additions and improvements.

By providing a single source of truth that connects to design, construction, and operations and maintenance you create a more automated, integrated living asset model. Owners can then use the digital as-built to streamline the process of contextualizing the vast amount of data available to them. As the efficiencies realized through incorporating digital as-builts into civil BIM methodologies continue to be shared, you can expect project owners to increasingly expect or require their use.

## Private infrastructure investment is raising the bar higher

New entrants to the infrastructure game are also raising the bar on expectations. From 2014 to 2019, [private equity raised more than \\$388 billion to fund infrastructure projects](#), including \$100 billion in 2019 alone, a 24% increase from 2018. These private-sector investors have a bias toward efficiency and productivity and expect the use of digital technologies and data to streamline operational processes.

Even traditional infrastructure project owners can't dispute that these improvements are sorely needed. The perception of inefficiency, insufficient collaboration, and poor cost control casts a shadow over their ability to secure project funding. The sharp increase in construction costs further highlights the urgency. When adjusted for inflation, [highway spending increased](#) from \$8 million per mile in the 1960s to \$30 million per mile in the 1990s. Furthermore, a lack of collaboration is a primary driver of cost overruns. In a 2020 survey of more than 540 contractors, seven in 10 said poor jobsite coordination is to blame when projects ran late and over budget.



# 3 Hurdles Civil Contractors Must Overcome to Meet the Infrastructure Opportunity

While owners feel the pressure to reduce costs and complete projects on time, much of the onus is on contractors to help them be successful. Yet, even if you have the best of intentions, there are three obstacles that can stand in the way of delivering better projects.

## 1. DISCONNECTED AND INEFFICIENT WORKFLOWS

While other sectors have made significant strides in productivity over the last couple of decades, construction continues to lag behind. This productivity problem is due in part to the notorious disconnects between the field and office.

Only 8% of engineering and construction firms have access to complete project [data through their project management information systems](#), while 47% report that they use separate systems requiring manual reconciliation and updates.

When workflows are disconnected, changes are difficult to track. Every change must be accounted for in multiple places, and designs are often duplicated for the purposes of interactivity and sharing, which leads to errors and even more inefficiencies. Without a centralized way to capture and communicate changes throughout the project, it's difficult to achieve the [gains in productivity](#) and efficiency needed to make a meaningful difference.

## 2. LACK OF COLLABORATION AMONG STAKEHOLDERS

In the ideal scenario, you'd receive complete and accurate designs that can be reliably sent to the field without changes. But this is not realistic, and many designs require modifications to be constructible. This issue is compounded by the fact that teams typically work in silos and use their own processes and systems, which creates even more potential for miscommunication and misinformation.

Lack of collaboration means that design changes made during construction may never make it back to the office or into the original design. Furthermore, when teams don't work together, everyone is limited in their ability to spot potential issues, increasing the potential for RFIs and rework that hurt the schedule and budget. According to FMI, 35% of construction costs are attributed to waste and rework because of these persistent issues.



### 3. LIMITED VISIBILITY AND TRANSPARENCY OVER THE PROJECT

Poor data visibility hampers decision making and reporting, and often requires you to dedicate resources to gathering, entering, and sharing data. Without visibility into key project data, both at a macro and micro level, you can't feel confident that you know where the budget and schedule stand. And you can't respond to the pressure to reduce costs, risk, and inefficiencies when you lack insight into the factors causing delays and cost overruns.

You're accountable for keeping teams on track and adapting to evolving conditions, but without a single source of truth, maintaining good governance and controls is a constant uphill battle. When KPMG studied the [future-readiness of E&C firms](#), they found that the top 20% innovators, defined by their willingness to "constantly seek opportunities to improve performance and anticipate change and risks," are harnessing technology to improve governance and controls. They use technology to streamline processes and give them [better control over the activities on the jobsite](#). Sixty-nine percent have integrated project management systems with multiple tools for projects and portfolios and they report that two-thirds of their projects come within 90% of their planned schedule.





## Ensure More Successful Infrastructure Projects and Gain a Competitive Edge with Civil BIM Collaboration

While many have grown accepting of these challenges, writing them off as simply part of the job, you can rise above the competition by using technology to your advantage. You can improve productivity, increase collaboration, and gain the visibility over projects you've always wanted with BIM collaboration.

### Achieve greater productivity and efficiency

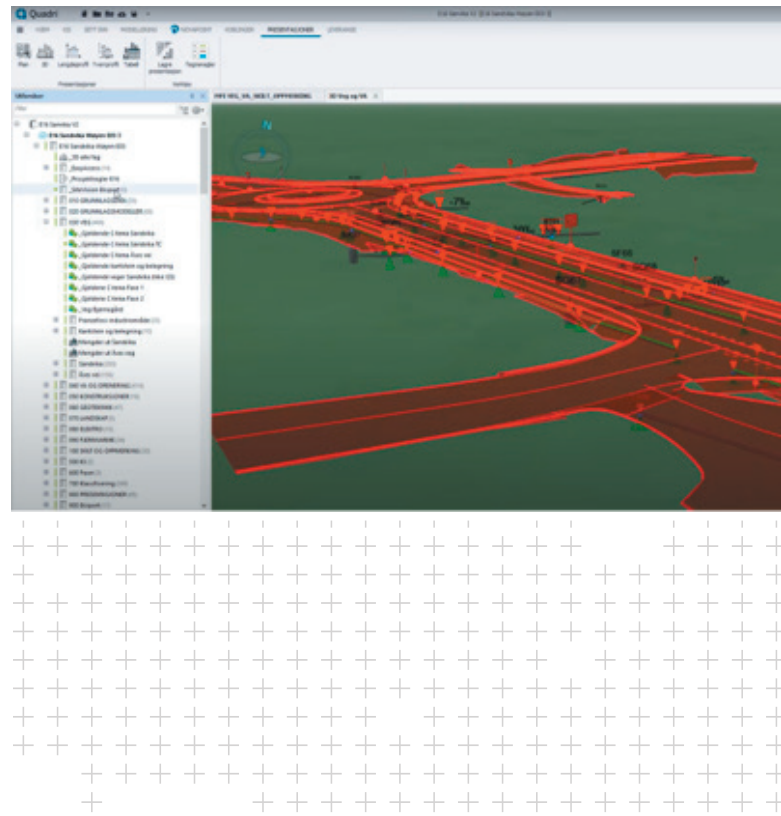
A BIM collaboration platform allows you to address the productivity challenges that plague most civil infrastructure projects. All teams—from design through construction to management and maintenance—can work in a single shared BIM model. This central model acts as the single source of truth for the project throughout its lifecycle, significantly streamlining workflows and removing silos between stakeholders.

By giving designers access to accurate and complete project data, a BIM collaboration platform improves design efficiency. Imagine working with [constructible designs](#) that are ready for the field. It's possible with a central collaboration platform. Furthermore, as construction progresses, the model can be continuously updated to reflect the current as-built, creating a continuous feedback loop. When team members are working together, issues can be identified and resolved much earlier in the process, increasing productivity and reducing costly rework, RFIs, and waste.

## Increase collaboration and communication

A BIM collaboration tool allows you to break down barriers between the field, office, and owners by giving all stakeholders access to a single source of truth about the project. Each party gains real-time access to the most-up-to-date, complete, and accurate data, eliminating the redundancies and mistakes that come with manual data sharing. Instead of playing messenger between stakeholders, you become a facilitator who enables them to access the information they need when they need it.

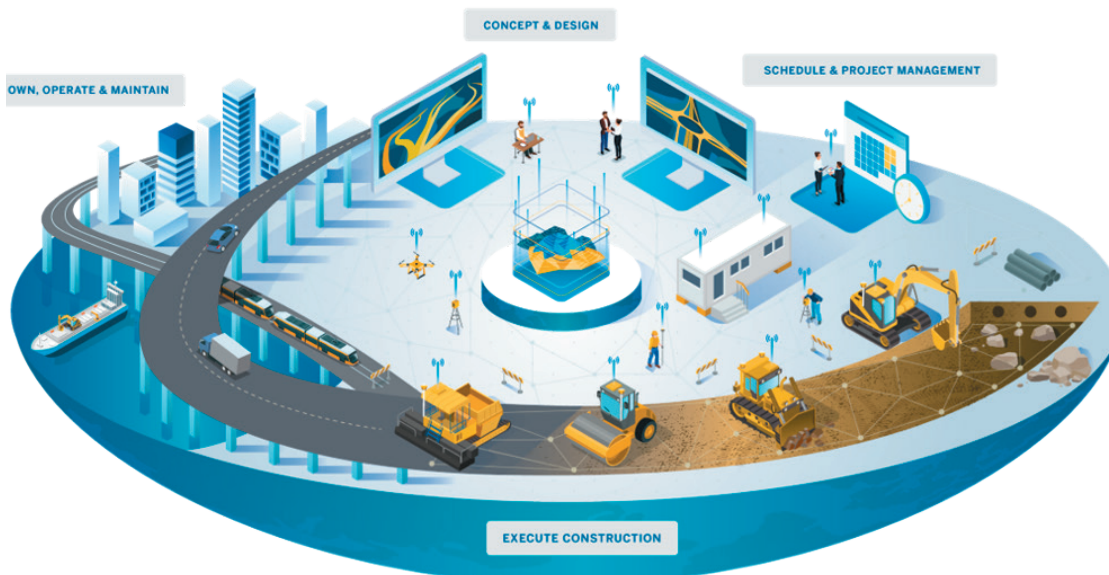
By collaborating in a single 3D model, each stakeholder can interact with the asset virtually and have the confidence that they're making decisions based on current information. The shared model eliminates the risk that comes with duplication and manual data sharing. With data flowing seamlessly between all parties, you can reduce or reallocate resources that you would have typically needed to execute on those time-consuming tasks.



## Gain visibility across the entire project

Having a continuously updated and single source of truth about the project gives you simplified oversight of who's done what and when they did it in real-time. When owners ask for project data and reports, the information you need is accessible in a centralized platform.

**Better data visibility in the field** also helps you control costs. For instance, the 3D design model can indicate the exact location of a concrete footer, and the excavator can use the GPS location data directly from the model to determine where to start digging. The model can also provide details about the type of rebar and amount of concrete needed and the locations of utilities in the area. Your workers spend less time trying to interpret the design, and you have greater confidence they've done the work correctly the first time. These incremental time savings add up, reducing costs and preventing surprises out in the field.



# Learn How Civil Contractors are Using BIM Design Collaboration to Deliver Better Projects

A cloud-based [BIM server and collaboration platform](#) like Trimble Quadri frees up your teams to focus on tasks that move the project forward instead of wasting time on unproductive work like recreating models, chasing down information, and manually entering data into disparate systems. The improvements you can achieve in productivity, collaboration, and visibility make your job easier and make your company a more competitive vendor for complex infrastructure projects.

BIM design collaboration is a core—and oftentimes required—component of infrastructure projects in other parts of the world like Norway. With the FHWA leading the charge, it's anticipated that similar requirements will come to the United States in the near future.

**To accelerate the adoption of digital construction and move from design to construct with confidence, learn more about Trimble's proven BIM collaboration solution.**

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[constructionsoftware.trimble.com](https://constructionsoftware.trimble.com)

