WHITE PAPER

# Beyond Machines:

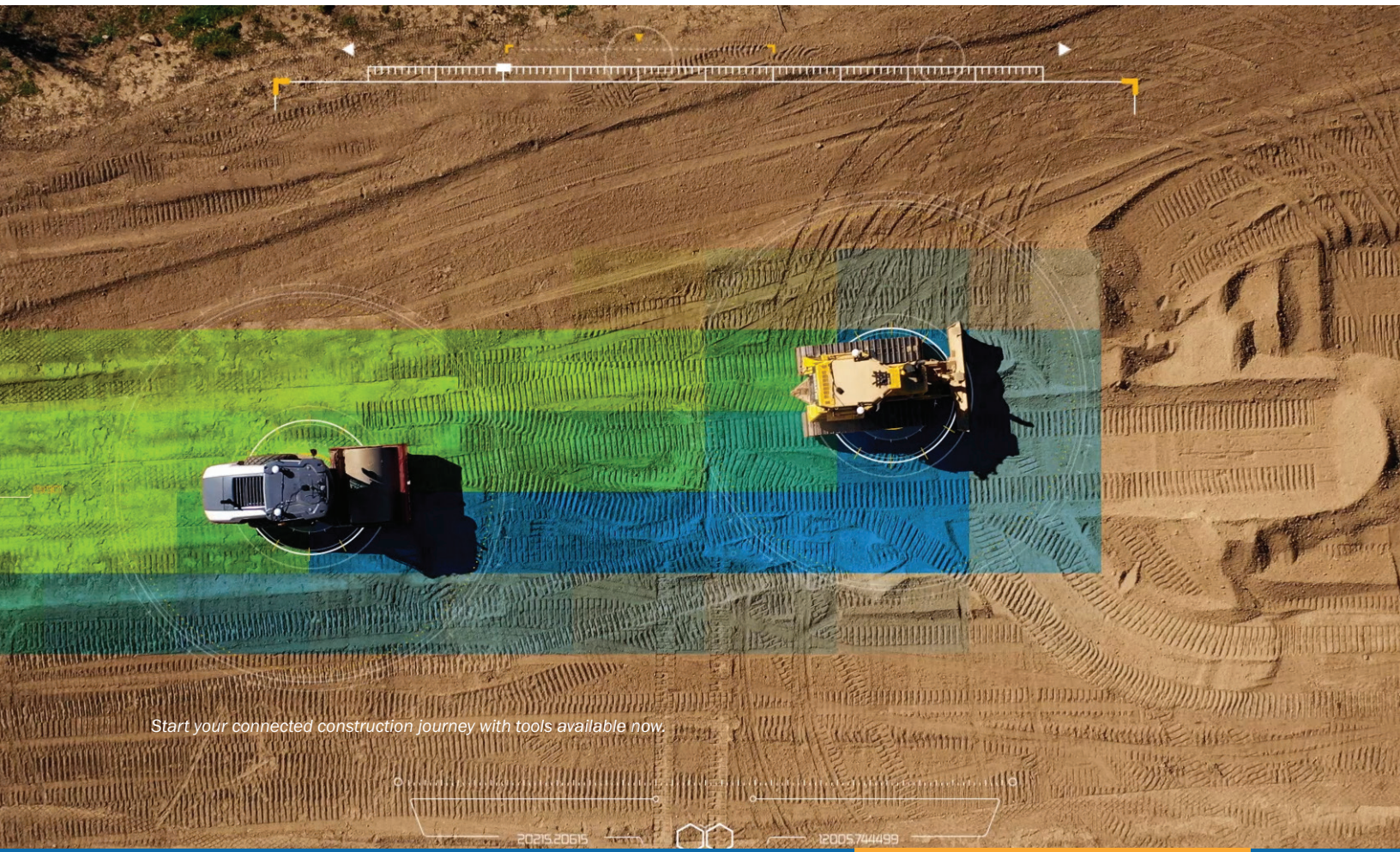
## Unleashing the full potential of connected construction

Trimble®

**Civil contractors today are tasked with doing more with less, working with fewer people, fewer machines, and under tight deadlines.** They also must keep an eye on the competition. What are they doing that seems to work?

Enter connected construction. It's a broad concept with a defined purpose: creating digital workflows to give your team one dashboard with the right information at the right time. This is not a dream; you can accomplish this with tools that are available now.

This white paper is designed to give you a sampling of the possibilities, take you through your first steps and give you a beginning blueprint to start your company on the connected construction journey.



*Start your connected construction journey with tools available now.*

# How Not Being Connected Hurts Your Business

**YOU'VE JUST BEEN BEAT OUT ON A BID** – again – by a competitor you've been paying a lot of attention to lately.

Something is different about this contractor. They get stuff done. Their field and office are in sync. Their crews always seem to know what to do next. Everyone is working on the same page.

Editor's Note: This is the first of a series of articles on connected construction. Two other articles in the series include **How to harness the power of connected construction** and **Taking the first steps toward connected construction**.

## *What do they know that you don't?*

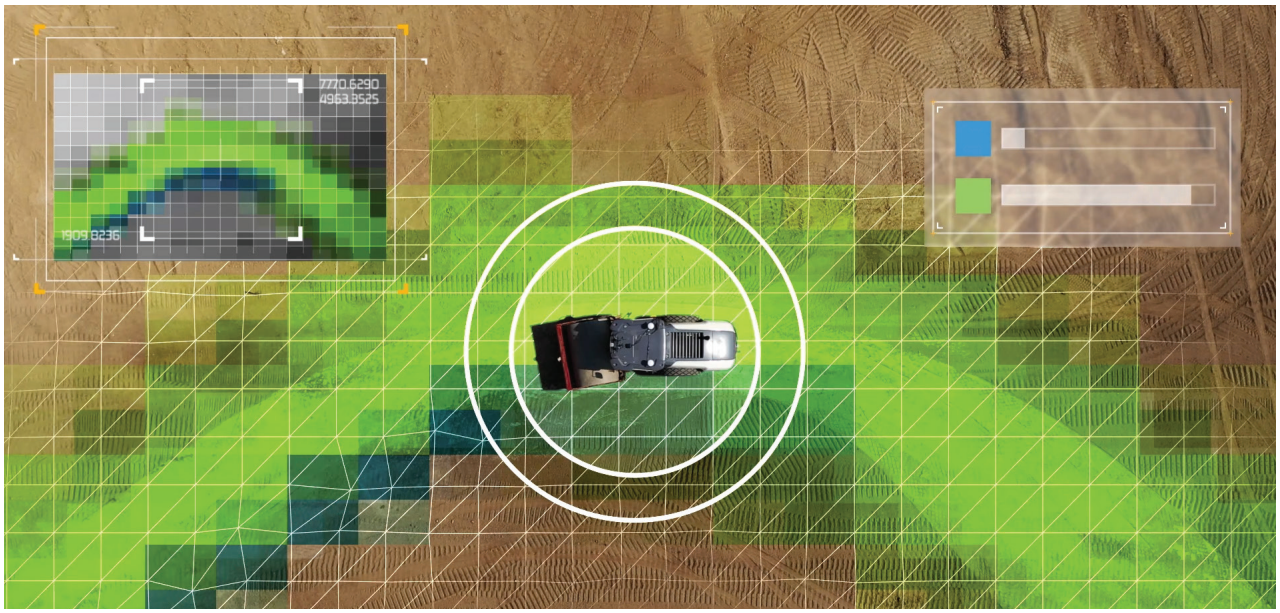
## Think Beyond the Machines

GPS-enabled grade and machine control are an essential part of earthmoving operations.

The reason is simple. The ROI on both grade control and machine control technologies is readily apparent:

A **2015 CalTrans research project** on GPS grade control laid out some eye-popping numbers: up to **66% time savings in grade checking** over manual methods and up to **85% time savings in the reduction or elimination of stakes** compared to conventional staking.

Trimble conducted a **2023 study** on using one type of machine control, assisted steering on soil compactors. The result, compared to manual steering: **compaction time decreased an average of 29.4%**, and **fuel consumption dropped by an average of 26.46%**.



*Machine control technologies such as assisted steering on soil compactors yield real results, including a 26%-plus decrease in fuel consumption. Machine control technologies are a great first step, but connected construction asks the question: how can you use this data across your office and field operations?*

Machine control technologies are a great first step, but connected construction asks the question: how can you use this data to improve your entire operation?

For instance, using the above example, your estimators are seeing the real-time information coming off your assisted-steering soil compactors. They now know your soil compaction crews can accomplish more in less time using less fuel. What impact would that have on their bidding?

*That's only a small part of the possibilities.*

Model updates are part of the ebb and flow of construction projects, and making sure everyone is working off the same model is a common pain point. Getting data into the field efficiently and then getting field addendums and job changes back to the office so they can inform scheduling can be a struggle.

And that's just the data flow on one jobsite. Multiply those issues across the several jobsites that are currently in various stages of construction, and then across all the stakeholders on a project (owner, engineer, subcontractors, etc.), and the data flows – and especially the chances of disconnects – are both multiple and complex.

## Enter connected construction

Let's stop for a minute and ask what connected construction means.

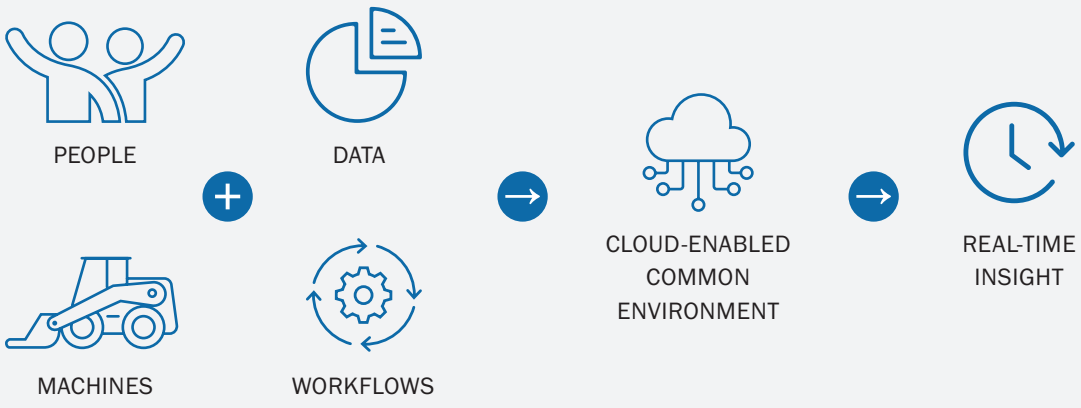
The paths are many, but the vision for connected construction is the same: to create a single source of truth in your organization, so the right people are empowered with the right data to make the decisions at the right time. No more silos.

The idea is to bring your people, data, machines, and workflows together into a cloud-enabled common environment. Everything is connected to deliver real-time data to inform your daily business decisions.

By implementing connected construction systems, Trimble customers have reported up to 50% less rework, 30% cost savings and 50% efficiency gains in various studies.

One goal of connected construction is to have data flows between departments through all phases of a project. Another goal: to make sure your team has the exact data it needs to make informed decisions now, when changes will have the greatest impact.

### How Connected Construction works



## All parties in sync

In short, connected construction is connecting people. Different shifts and crews can quickly get up to date on what has gone before.

For instance, the **Peace River Hydro Partners** (PRHP) joint venture used several technologies to construct a dam and hydroelectric generating station, a project that involved multiple earthmoving shifts.

Realizing field/office disconnects, PRHP shifted away from using USB thumb drives to relay in-field scanning information to the office. Instead, it added SIM cards to the controllers so scanning data could be immediately transmitted back to the office. Equipped with grade control technology, each machine gathered survey data.

Logging into the machines via a data hub at the end of each day, the survey general foreman downloaded the data and used a project and Trimble Business Center™ to compare the work to the project's 3D model.

After confirming the work was completed as designed, he then isolated high spots and uploaded an updated excavation design. Operators could see immediately what areas needed to be addressed.

This feature became critical as work transitioned between day and night shifts; operators now knew exactly where the previous operator had excavated, and rework was reduced to a minimum. As a result, work progress was fluid and there was no confusion about where to work next. And using system reporting features, the project management team could easily keep up with the excavating crew's progress.

## Small problems don't become big ones

Connected construction also gives you the ability to recognize small problems before they become big ones.

Finding out about a cost overrun four weeks after it happens is rarely helpful. "Contractors want to know the score of the game while it's being played," says Casey Cyrus, product management director, civil construction, Trimble.

For example, today's technologies allow you to track your bid estimates against real-time job performance. As a connected dozer grades, its progress can be tied back both to billables in accounting and your performance metrics. If the dozer is moving 1,000 cubic meters per hour and you bid the job at 1,200 cubic meters an hour, you can quickly address it.

Demolition and site contractor S.J. Cantwell, Newington, New Hampshire gets immediate production data directly from its machines and from electronic field logs. The information helps the company pinpoint issues early on.

**"B2W Track™** allows the guys in the office to see the production that we're doing out in the field, which only betters their estimate," says Codey Rich, S. J. Cantwell site foreman. "And it allows us in the field to see our numbers and productions and how we can tweak things to make it more profitable for everyone."

Knowing what's really happening allows quick adjustments, adds S. J. Cantwell estimator, Jeff Sparkowich, lead estimator. "Maybe the plan we thought was a great idea didn't work last week. Let's switch it up. Let's move some equipment around and make a better plan."

## Making sure what gets collected gets used

When different functions in your company have a one-track mission a lot of data is left on the table.

Let's say your crew supervisors are feeding labor hours into payroll via paper or automated forms. Once payroll has input the numbers and payroll is processed, how else is that data used?

Look at machine hours. Using manual processes, machine hour reports could come into the office any number of ways, including emails, texts, even scraps of paper. Again, once that data is put into the main office accounting or equipment management system, who else has access to it? Can your estimators, project managers and superintendents use it?

An **FMI study** outlined the missed data opportunities in the engineering and construction community: 96% of all data goes unused, 30% of companies are using applications that don't integrate with each other and 90% of the data generated is unstructured.

It doesn't make sense to be stingy with data.

## True collaboration with owners

Construction is collaboration. Not only do internal teams need to share data, so do external entities.

When cloud-provider Box visualized **how construction companies shared data** both internally and externally the result looked like an octopus. While other industries in the Box report had large central cores of data sharing, information transfer at the construction firm branched out in several directions, including project owners.

And as digital workflows are proving their capabilities, many owners are leading the push to connected construction.

A Trimble/Dodge Construction Network survey illustrates this drive from owners: 69% of owner organizations surveyed say they require digital documentation in their contracts. These owners say, however, they have their most frequent connectivity breakdowns with general contractors and construction managers (51%) and specialty trade contractors (39%).

What if you could counter this reality? A contractor that is aligned with the connected construction journey becomes a contractor that's easy to do business with. And those contractors rise to the top when owners consider future projects.

**Next up:** How to harness the power of connected construction.

*A contractor taking advantage of connected construction tools is easy to do business with.*

# How to Harness the Power of Connected Construction

**THE PAIN POINTS ARE MANY ON A CONSTRUCTION PROJECT.** The pipe scheduled for installation this week is still in transit. Two crews are short of machine operators. The concrete you poured yesterday will need to be redone.

One person becomes the go-to source in a company or on a site, and their phone never stops ringing: When is the fuel truck coming? Can we get a rental to replace the down excavator? What needs to be done next?

Time is wasted. It's wasted chasing down information, doing a task that someone else has completed, dealing with rework.

## Why construction wastes so much time...

Many times, what's worked in the past continues to be done even if there is clear evidence it is no longer working. You may feel that your frustrations are uniquely your own, but there's a high likelihood that they are repeated to some degree throughout the construction industry.

**"Everyone's trying to do more with less," says Steve DiBenedetto, Trimble Civil Construction field solutions software product manager. "Contractors want to know how they are performing. Where are there gaps? Where are we not being efficient?"**

Editor's Note: This is the second in a series of articles on Connected Construction. To view the first story, "**How not being connected hurts your business**," **click here**.

### 7 Unmistakable Signs of Jobsite Disconnects

1. Misalignment between labor/equipment/materials and schedules
2. Slow payables/receivables
3. Errors and inefficiencies
4. Low margins
5. Duplicate work
6. Lack of visibility
7. Too much downtime

*Source: "The AEC Professional's Guide to Connected Construction," Trimble.*

Construction is a highly fractured activity. In addition to organizing a project with several outside entities – including owners, engineers, and subcontractors – each internal role has its own priorities. What's important to an equipment manager may be lower on the list for a project manager, a crew leader or estimator.

Because of this fragmentation, linking office management, field operations, finance/accounting, administrative/payroll and estimating offers immense opportunities.


*Construction is a highly fractured activity but by using digital workflows to link the various departments, contractors can enjoy increased efficiencies and better-informed decision making.*

## ...and why it doesn't need to.

Despite the different roles on a construction site, there is a common goal: to get a quality project done on time and on budget. And not on just one project, on all of them.

Making good decisions underlines that goal.

When asked to name the top benefits of using digital workflows, contractors cited "increased efficiency" and "better-informed decision making," according to a **Trimble/Dodge Construction Network survey**.

Contractors who've taken the connected construction journey would agree.

When Veit, a civil construction firm out of Rogers, Minnesota, realized it was taking an unorganized approach to office and field collaboration tools, it began to form a more standardized approach. A digital plan collaboration tool allowed the company to shift from paper drawings, making them easily shareable across teams. The company created standard templates used on every project, containing information on how the project was bid, and all subcontractors, RFIs, submittals and field reports, along with contact information.


*A common goal on a site is to have the project done on time and on budget - for every project.*

While Veit had used its field management software to track man-hours, by standardizing inputs it was able to get the data it needed to take the most cost-efficient approach and add automation to the payroll process. The latter saved the company an estimated eight hours a week, estimates Britton Lawson, director of construction technologies at Veit.

The company's fleet management software also gave visibility to submitted repair requests. Low-priority maintenance items could be planned, and parts ordered. While on a dispatched call, this allowed field technicians to tackle minor items along with critical ones. This and other features allowed Veit to save another eight to 10 hours per week.

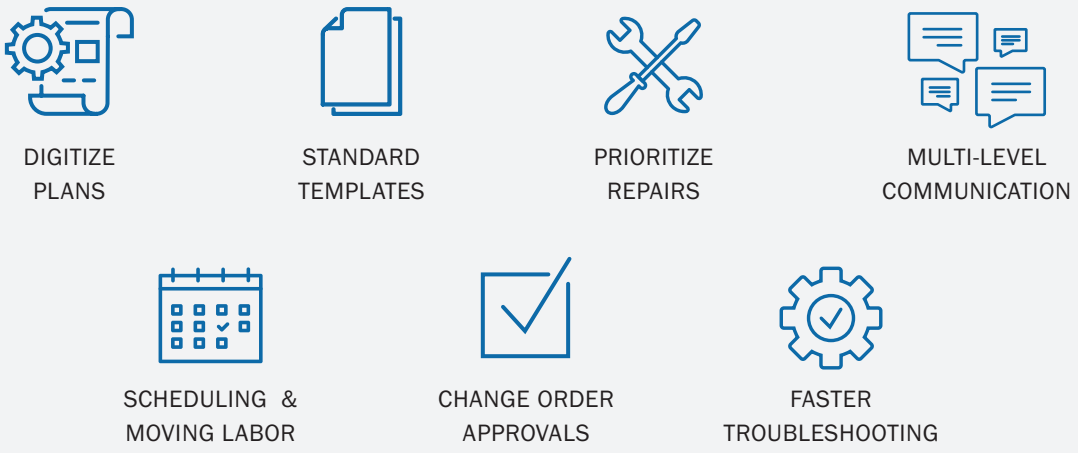
All of this has changed how Veit manages projects, Lawson says. Everyone understands what "was envisioned, what kind of equipment, how many yards per hour, what benchmarks," he adds. "If I know that I'm supposed to hit 400 yards an hour, I can set myself up for success to do that."

For S. J. Cantwell, Newington, New Hampshire, it was important to have a system that communicated on several levels, from machine to office and back again. “We can see the production of a machine and what it’s doing every day,” says Jeff Sparkowich, lead estimator. “Our operators are able to see what they’re building while they’re doing it instead of having to get out and look at a plan. You save tons of time there. You don’t need to have extra labor because your grades are right there in front of you.”

S. J. Cantwell’s software captures labor and equipment hours, what material was used, machine use and production rates for each job. This data provides insight for scheduling and moving labor between jobs. Management can quickly see whether things are on track and adjust. Change order processing has been simplified. Using a tablet, a team member can present change orders to GCs to sign on site, which then goes to the estimator.

Pat L’Heureux, project manager with Severino Trucking, Candia, New Hampshire, says going to a cloud-based survey and construction model has been a huge time saver. Troubleshooting an issue used to take as much as three hours including travel time. The same task can now be accomplished in five minutes.

“Design changes are quickly sent to field devices, providing connection throughout your organization,” L’Heureux says.




## What can connected construction do?

Think of connected technology as an accelerator. It gets rid of silos and information disconnects. It lets you know the score of the game as it's being played.

**Lawson says Veit** adopted the connected workflow approach around seven years ago. "The problem was always getting data into the field efficiently, and then with addendums and job changes, getting that data back," he says.

Now, Veit equipment is connected to the Internet. When a design changes, those changes are pushed through the cloud to machines and rovers. "It's become the expectation that when a machine pulls up on a lowboy they can get a design fast," Lawson says.

"It's opened up mapping data and as-builts to come back fast, so we can turn those things around," Lawson says. And it has helped the company manage its manpower. "It's been one of the greatest successes for us because we've been able to keep our survey headcount down. I wouldn't want to live without it."

**Aldridge Electric**, Libertyville, Illinois, used a cloud-based workflow to install 1.2 million feet of conduit along with cable, duct banks and manholes at a data center in Dekalb, Illinois. Starting

with grade control platforms for two excavators, the company quickly added systems for two more machines.

"It's important that we are clear about where we'll be and how long it's going to take," says Jeff Buckley, Aldridge PreFab/BIM program manager. In addition to machine grade control, surveying systems and 3D modeling, the company has added augmented reality that enables the team to see spatial data in a real-world context.

"What we really like about it is the connectivity and the communication between the office so everyone knows they're using the latest drawings," Buckley says. "While the AR is still a new technology for us, we are already seeing value."

AR has become a visual representation of what's in the model versus what's in the field, allowing Aldridge to show team members how an installed item should look. "It's a great way to make sure there aren't any obstacles or concerns, which minimizes the chance of delays," says Devin White, BIM coordinator at Aldridge.

## Working from the same to-do list

Connected construction – again, making sure your people are working on the same to-do list – will not look the same from contractor to contractor.

And it's not just for big companies. Although the software/hardware solutions used will vary, the cost savings, process and workflow alignments can be applied to contractors of any size.

**Next up:** Taking the First Steps Toward Connected Construction

*Connected construction is useful for contractors of every size.*

# Taking the First Steps Toward Connected Construction

**EVERY CONTRACTOR COMES TO** connected construction with different expectations.

Fortunately, there are multiple entry points. For instance, if you have a few machines with grade control, expanding your connected fleet could be an initial step.

You may be considering what's available to solve your most immediate pain point.

Or you want solutions that will help you scale your business.

Start with what you know best: your needs, your organization, your team. Then start to envision where you could go.

And don't think you're too small to take advantage of connected construction. Smaller organizations, involving smaller teams, have a flexibility that can adapt quickly to new processes.

## Avoid frustrating searches

Just typing "connected construction" in an online search will lead to frustration.

First, it's a broad concept. Several companies say they offer connected solutions, but in reality, they are more of a point solution – a specific app, for instance, for a specific task. Second, sorting through the options takes time, time you'd like to use to get a plan rolling.

This is where a technology provider provides a valuable handhold. They determine your needs and desires and come up with a plan that meets your goals. Once you've selected your solution, they'll get your people up to speed on how to maximize your investment.

Editor's Note: This is the third article in a series on connected construction. Other articles in the series include **How not being connected hurts your business** and **How to harness the power of connected construction**.

## Questions to Consider

Ask yourself these questions when looking at connected construction solutions:

**Is your team looking at the same data?** How can you ensure all machines and field workers have the correct data as soon as it's available? Are your operators immediately notified of updates?

**How do you monitor what's going on in the field?** Can you remotely monitor job site activity? Do you use this data to adjust your daily workflow?

**Are you making the most of the data coming off your machines?** Do you know whether your operators are meeting production goals? Are you using machine health telematics data to track hours, PMs, and repairs?

*Continued on next page*

"What are you trying to solve?," says Steve DiBenedetto, Trimble Civil Construction field solutions software product manager. "There are a lot of flexible solutions. Understand that you have a partner who understands how you do business, and they can offer a solution — tailor-made for you."

A technology provider will help you take these first steps:

- Identify your objectives. This includes knowing where your current systems are not productive. What's taking too much time? Do you still have paper processes? Are people having to rekey data? (See sidebar "Questions to consider.")
- Making sure all key company decision makers know the objectives. Besides budget approval, they convey enthusiasm for a process that will likely have its bumps.
- Capitalize on existing data. Examine what your company currently collects and explore ways it can yield more value. How could you better use the data-collecting tools you already have?

**"There are a lot of flexible solutions. Understand that you have a partner who understands how you do business, and they can offer a solution tailor-made for you."**

Britton Lawson, director of construction technology with civil contractor Veit, recommends contractors "start small, be intentional, get a committee of people, vet out two or three options and then pick a pilot." After that, document the process.

## Questions to Consider, Cont.

How do you know what design version each machine is using? How easy is it to see where your machines are and what they are doing?

**Are you meeting your financial goals?** How do you ensure you're accurately charging the right job with equipment and resource expenses? How do you measure your job productivity against cost projections and estimating? Could you get paid quicker by providing proof of actual work done?

**Are you focused on equipment uptime?** When a machine breaks down can you locate it and immediately schedule service? Can you quickly locate a replacement machine?

**What's important for you to transfer into any new system?** Some existing systems may be critical to your workflow. Look at ways to integrate these systems into a common data environment.

## Adopt a connected construction champion

“You need to have a champion, and they just have a yearn to learn,” Lawson says. “They have a curiosity.”

Charged with propelling your connected construction journey forward, this champion could come from anywhere in the company or be any age. They become the go-to person within your organization as you take steps to digitize your workflows. If they don’t know the answers, they find someone who does.


This person can also take advantage of generational differences in your company.

The younger members of your crew are likely digital natives, having grown up with touchscreens, phones, and the idea that everything is connected. Use that to get your other valued team members on board. With most job tasks, the older lead the younger. This time, younger teammates can take the lead, creating an opportunity

A champion could also use inventive ways to coax reluctant team members to embrace new processes. For example, instead of demanding an immediate switch to a new system, Lawson weaned a project manager off using a spreadsheet by allowing him to use the spreadsheet alongside the new system for 30 days.

“Within three days, he was off the spreadsheet,” Larson reports, “and he was like ‘my gosh, this is so easy.’”

Don’t take these steps in a vacuum. Get your employees involved. Along with you, they’ve experienced the painful disconnects that are prompting your switch to connected construction.

## Determining ROI

Once you go through your initial training/implementation phase, review what's happening with office/field data sharing. Is it meeting or exceeding your expectations? Are there still disconnects that need to be addressed?

For example, in reviewing the impact of its connected digital solutions during the course of a massive data center project, **Aldridge Electric** is seeing clear advantages in production, attitude, quality and safety.

**"With how fast everything has gone, there is no way we could have worked as fast and accurately without the technology as we have with it," says Devin White, BIM coordinator. "We probably would have had to quadruple the manpower to get the project done in the given timeline."**

White's co-worker, Jeff Buckley, PreFab/BIM program manager, agrees. "Technology allows us to deliver a product that is not just built 'as planned,' but is delivered 'as intended,' often allowing us to make recommendations and deliver a final outcome that exceeds original expectations," he says.

And you might be surprised by the outcomes of connected construction. For example, one Texas contractor used a paving grade control system to ensure a smoothness bonus on a high-spec road project.

After using the system, "they discovered that the jobsite became more predictable," says Kevin Garcia, general manager, civil specialty solutions, Trimble. "They knew exactly where they would start and end, the exact volume of material, their milling and paving rate, and where to set up base or total stations to guide the equipment."

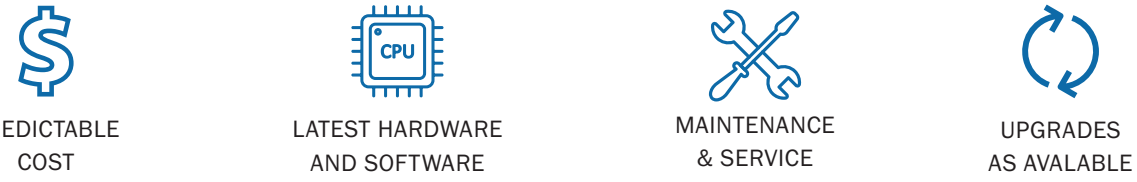
## Consider a subscription

You may have taken a first glance at technology's price tag and backed away. The price reflects the long-term commitment you're making. A complete grade control system, for example, can cost between $35,000 to $75,000 per machine.

This can prompt many questions: what if I decide on a technology and it becomes obsolete? How can I update my technology? How can I make sure it's always working?

A **technology subscription** offers a way for you to have a predictable cost of ownership, get the latest hardware and software across your entire fleet, have it maintained and serviced, and receive upgrades as they become available. Technology switches from a capital to an operational expenditure.

With the high ROI, technology can be offset through construction savings, freeing up your capex budget to buy a new machine, for example. And since all your machines are on the same system, there's no need to keep different kits and spare parts for different versions. Everyone uses the same rover, controller, and machine display. Cross training becomes so much simpler when there's no difference in controls from machine to machine.




## No more "wait and see."

The contractors featured in this report showcase what can be accomplished with connected construction. They also point out that the wait is over, and the opportunity to digitize your workflow is now.

What works for your company is not necessarily the same package that works for another company. Your solution will be your solution, one that fits the way you do business.

But none of the benefits outlined here can be realized without taking the first step. Outline the disconnects in your current systems. Come up with a list of wants and needs with your team and then reach out to a technology provider and start the process.

Lawson is succinct about the true opportunity in converting to a digital workflow:

"It's important to look at how much money it's going to make you, not how much money it's going to cost you."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Trimble

For more information, visit: ***civilconstruction.trimble.com***