

POWERED BY



ABC AI TECH REPORT



The Construction Technology and Innovation Committee supports the ABC strategic goal of delivering technology thought leadership and value to a diverse and committed membership. The committee is directed to understand member needs for technology solutions so that it can deploy the best technology solutions possible to support the innovative needs of ABC's members. The committee approves Tech Alliance membership, reviews Tech Marketplace requests and provides educational and informational resources for ABC members on technology.



The construction industry is constantly evolving as we strive to deliver successful projects that benefit our customers and fulfill the ambitions of all our industry professionals. Advancements in construction come in various forms, ranging from improvements in tools, materials and equipment to innovations in building techniques and technologies. Keeping pace with these developments can be challenging, but it is essential for personal growth, business enhancement and, ultimately, better project delivery.

To fully leverage these opportunities for improvement, we must remain engaged and surround ourselves with people and experiences that encourage learning and growth. By doing so, we can pass this knowledge forward, benefiting the industry as a whole.

This year's tech report provides an invaluable opportunity to explore how artificial intelligence is set to make a significant impact on construction. As our understanding of AI deepens and its applications become clearer, it will be crucial to learn the pros and cons, identify best practices and be aware of the risks involved to ensure AI becomes a tool that works for everyone.

In this tech report, we hear from experts with hands-on experience in AI for planning, development and execution within the construction sector. The ABC Tech and Innovation Committee hopes that this report enriches your understanding of AI technology, benefiting you, your company and those you serve. Thank you for reading the ABC AI Tech Report.

Patrick Irwin, Chief Operating Officer/Executive Vice President, Leonard S. Fiore Inc., and 2024 Chair of the ABC Construction Technology and Innovation Committee



The rapid advancement of artificial intelligence represents a new technological paradigm for the construction industry, with global leading solutions and companies in construction focused on helping the people who build our infrastructure.

The last three tech reports have focused on construction-specific technologies, along with the adoption and achievement of ROI with innovative solutions. This year, because of the mass interest and thirst to understand how AI will affect contractors of all sizes, we have created a report to explain how this technology is used by stakeholders in the construction industry. AI is going to have an enormous impact on how businesses attract and educate their top talent and win and deliver their work safely, ethically and profitably for the betterment of the communities in which they work. We hope that this report will sharpen that focus for ABC members.

Matt Abeles, ABC Vice President, Construction Technology and Innovation



ABC AI TECH REPORT

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EXECUTIVE SUMMARY

BRIANNE STEWART, GROUP PRODUCT MANAGER,
MILWAUKEE TOOL

It has been a privilege to serve on the ABC Construction Technology and Innovation Committee for the past three years. This has given me a front-row seat to watch the evolution of technology growth and maturity among ABC members and the entire construction industry.

The 2022 and 2023 Tech Reports provided a guide to the principles of adopting and evaluating technology. This year’s technology report is a blend of both. When I’ve canvassed members, I’ve seen a distinct shift in responses to my question, “What technologies and trends interest you?” Conversations center around how to use ChatGPT and which of the main artificial intelligence software creators are developing the best AI functions to streamline workflows in the office or on the jobsite.

The ABC AI Tech Report is the singular resource that a construction executive will need to make an informed decision about whether to adopt AI technologies. The next 19 pages offer a resource guide, a case study, insight papers and an essay to help you make the best decisions for your company.

The Hensel Phelps case study focuses on how it partnered with Track3D, an AI-powered platform, to enhance construction efficiency and innovation in complex projects. The insight essays provide an overview of how artificial intelligence can transform the construction industry by improving data maturity, project outcomes and safety. Dodge Construction Network discusses the concept of augmented intelligence, which is a form of artificial intelligence that supports human decision-making and productivity rather than replacing them.

The ABC AI Tech Report shows that AI holds much promise to transform our world while challenges remain in determining the best path to realize this opportunity for individual contractors. My recommendation is to approach AI by following the same principles introduced in the last tech report. AI is a technology, and it can be best understood through the lens of two critical questions: What problem are we solving by applying this technology? And how can we focus on our people to understand the stakeholders critical to adopting this transformational technology?

AI IN CONSTRUCTION: What Does It Mean for Our Contractors?

BY PATRICK SCARPATI, DIRECTOR, ABC CONSTRUCTION TECHNOLOGY AND INNOVATION

Artificial intelligence is revolutionizing the construction industry by enhancing efficiency, safety and decision-making throughout the project lifecycle. AI in construction involves the application of advanced technologies like machine learning, computer vision and data analytics to various construction processes. Through AI, machines can learn and imitate human cognitive functions.

The possibilities may sound endless, but as an industry traditionally looking from the outside in at technology, we must first step back to educate ourselves on the basics. This paper is meant to function as a starting point in your journey to understand AI and its potential impact on the construction industry. By reading through definitions, construction use cases and considerations, the reader should walk away with a base level of knowledge to ensure they can actively participate in future conversations on AI in construction.

Definitions

Artificial Intelligence: Per the National Artificial Intelligence Initiative Act of 2020: “A machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations or decisions influencing real or virtual environments.”

Machine Learning: Application of AI that allows a system to automatically learn and improve from experience. In other words, machine learning helps computers do tasks like recognizing colors, finding pictures of cats on the internet or even suggesting what to watch on TV. It’s like teaching the computer to be smart and make decisions by looking at several examples and learning from them. One common example of this is large language models.

Deep Learning: Per IBM: “Deep learning is a subset of machine learning, which is essentially a neural network with three or more layers. These neural networks attempt to simulate the behavior of the human brain—albeit far from matching its ability—allowing it to ‘learn’ from substantial amounts of data. While a

neural network with a single layer can still make approximate predictions, additional hidden layers can help to optimize and refine for accuracy.” Deep learning has achieved remarkable success in various applications, including self-driving cars, medical diagnosis, recommendation systems and more. Its power lies in its ability to automatically learn and adapt to new data, making it an innovative technology in the field of AI and data analysis.

Generative AI: A type of AI that can create new data or content, such as images, text, music or even videos, by learning patterns and structures from existing examples. It works by understanding and mimicking the patterns and styles it has seen in the data on which it was trained. The most publicly recognized tool in the last years is ChatGPT, built by the company OpenAI. ChatGPT is an artificial intelligence chatbot that can process natural human language and generate a response. It has revolutionized how we interact with computer systems and has influenced the evolution of AI. Other generative AI tools include Meta’s Llama 3.1, Microsoft’s Copilot, Google’s PaLM 2, Amazon’s Bedrock and Dall-E 3, also from OpenAI.

Predictive AI: A type of AI that uses data and machine learning algorithms to forecast future events or trends. It helps businesses and organizations make informed decisions by analyzing historical data, identifying patterns and making predictions based on those patterns.

Project Lifecycle Impacts

PRECONSTRUCTION

Predictive Analytics: Analyze historical project data and current conditions to optimize construction schedules, resource allocation and task sequencing.

Optimized Design Development: Allow project stakeholders to identify the best design for a building based on real-world data; rapidly create and explore a variety of unique design options.

Supply Chain: Throughout the procurement process for self-performing contractors, artificial intelligence will empower the purchasing team to quickly identify availability and best pricing within a certain region.

Contract Review: Empower legal teams to quickly identify critical risk factors in construction contracts.

CONSTRUCTION

Autonomous Equipment: Enables existing equipment to run at full utilization every day of the year, in any weather, without an operator and with 360-degree safety technology preventing any accidents.

Project Management: Ability to optimize resource allocation. AI can analyze various factors like workforce availability, equipment usage and materials supply, to ensure that resources are utilized efficiently.

Computer Vision/Intelligent Site

Monitoring: Through machine learning, video footage is trained to detect the number of workers entering or exiting the jobsite, workers in proximity of heavy construction machinery and even safety violations, such as the lack of face protection while saw-cutting concrete.

“The possibilities may sound endless, but as an industry traditionally looking from the outside in at technology, we must first step back to educate ourselves on the basics.”

Jobsite Mapping: Mapping applications use artificial intelligence to process images. Drones use machine learning to decode images and find patterns that are invisible to the human eye.

BUILDING MAINTENANCE

Energy Management: Analyze energy usage patterns and optimize HVAC systems to reduce energy consumption and overall costs.

Predictive Maintenance: Through the expanded use of building automation and control networks, AI can predict when building equipment is likely to fail, allowing for a proactive response.

HR OFFICE CONSIDERATIONS

Per insights from Littler Mendelson, ABC’s general counsel, consider the following when drafting interoffice AI policies. Please also note that “insights” do not constitute legal advice.

- Clearly define the purpose of the AI usage policy, which AI technologies are covered and how it applies to employees and/or outside stakeholders.
- The policy should include a purpose or mission statement, and an explanation on if AI is able to be used, how it can be used and who can use it.
- Designate point persons to oversee AI usage, troubleshoot problems and approve of AI use.
- Clarify a policy that instructs employees that programs like ChatGPT still make several mistakes and that these programs should be used to assist employees and not serve as a substitute.

- Consider an overall approach that monitors AI use and encourages innovation but ensures that AI is only used to augment internal work and with proper data.

AI has been in the background of some of our everyday technologies, but in the last few years has come closer to the surface thanks to strategic marketing and perhaps a more consumer-friendly approach. There are still a lot of unknowns on what the impact will be and what the technology could look like in the future.

The future of AI in construction is promising, with advancements that could revolutionize the industry. By staying informed about AI developments and adopting these technologies, construction workers can ensure they are well-prepared for the future and continue to thrive in a rapidly evolving industry.

This resource was originally published on abc.org. Parts of the guide have been reworked to be published in this report. To read the full AI Resource Guide, visit abc.org/ai or scan this QR code.



AI-POWERED ADVANCEMENTS: Hensel Phelps' Innovation and Collaboration Through Technology

MIHIR SOMALWAR, INNOVATION LEAD, DIVERGE, HENSEL PHELPS

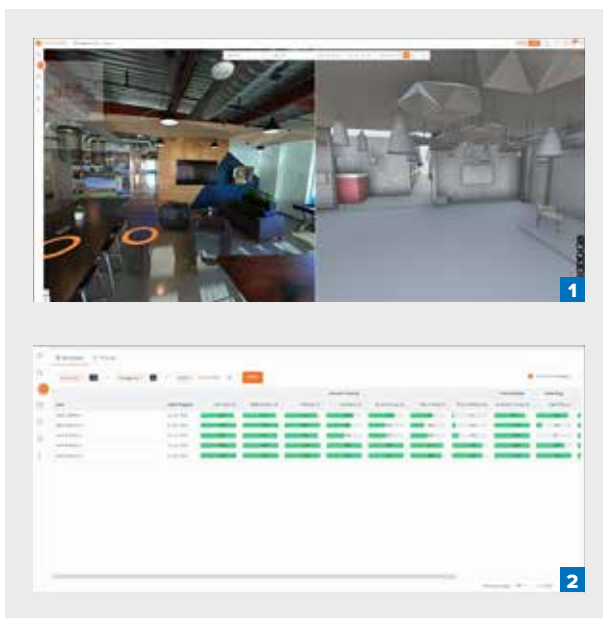
Hensel Phelps, a leading construction corporation and the largest aviation contractor in the United States, is utilizing Track3D to integrate its AI-powered platform into its operations. This platform offers advanced capabilities in photo documentation, progress tracking, deviation detection, safety and more, aiming to enhance construction efficiency and deliver complex projects on time.

Managing large-scale, complex projects with tight schedules requires meticulous progress-tracking across various trades such as electrical, mechanical, drywall and plumbing. This typically involves time-intensive site walks susceptible to errors and subjectivity. According to field engineers Zachary Clausing and Reginald Casseus at one of Hensel Phelps's large data center projects, "It consumes a significant amount of our time and effort to manually track every aspect of the project. Measuring each pipe, duct and piece of drywall across extensive jobsites and monitoring progress from one inspection to the next is impractical, necessitating estimations."

To enhance this process, Hensel Phelps decided to partner with Track3D to use its AI technology. This innovative platform utilizes jobsite photos from 360-degree cameras, lidars, drones and other sources. Track3D's AI precisely identifies installed elements like drywall and plumbing and calculates their installation progress over time, providing accurate progress reports for each trade. This automated analysis includes trend charts that indicate whether installations are on schedule, enabling proactive resource allocation and early anomaly detection. Consequently, project teams can preemptively address potential delays rather than reacting after issues arise. **1**

Nicholas Schnabel, project superintendent at a major data center project in Phoenix, attests to the impact: "Track3D provides an easy, repeatable and accurate way to validate installations in the field, ensuring transparency in progress tracking and saving critical hours for my team. This helps me to proactively allocate resources where they are most needed to optimize operations and incentivize timely performance from project teams." **2**

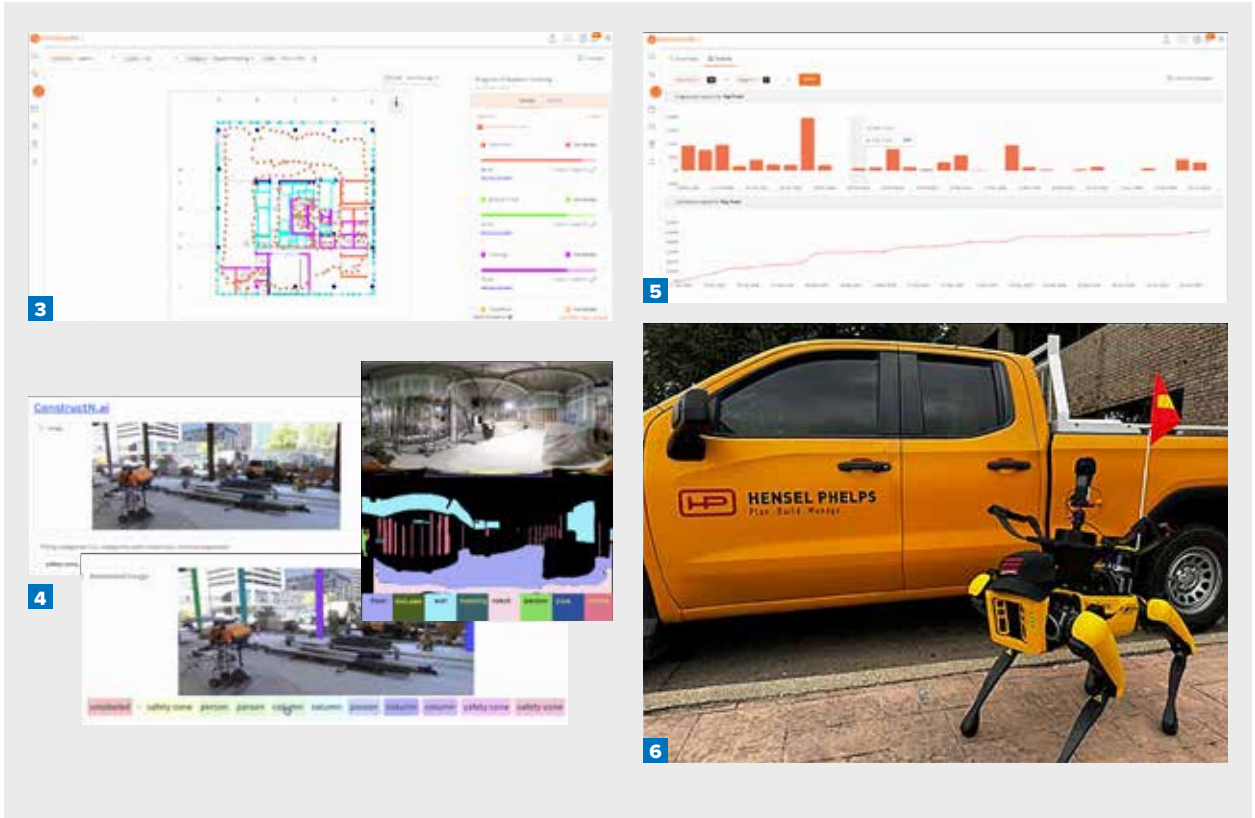
While several other competing solutions exist in the market, Hensel Phelps chose to streamline operations



by standardizing on one platform. This decision reduces tech stack complexity, eliminates data silos and optimizes expenditure across the enterprise.

Thai Nguyen, director of innovation at Diverge, Hensel Phelps' corporate venture capital and innovation arm, emphasizes the strategic partnership: "Our collaboration with Track3D represents a pivotal step toward revolutionizing construction practices. By integrating advanced AI and data analytics, we are not only enhancing project efficiency but also setting new standards for innovation in the industry. This partnership underscores our commitment to leveraging cutting-edge technologies that drive sustainable growth and deliver exceptional value to our clients."

Track3D's detailed production tracking and scheduling reports provide an additional verification layer for monitoring installation progress. This supports the efficiency of processing payments to



trade partners based on verified completion milestones. Precise data analytics help validate the progress of each trade faster, supporting timely compensation for workers and strengthening partnerships with trade partners.

In addition to progress monitoring, Track3D is advancing in deviation detection by comparing lidar scan data with BIM models to ensure precise installations within specified tolerances. This capability allows for early identification and rectification of anomalies, thereby reducing the risk of larger issues arising. **3**

Hensel Phelps is exploring ways to leverage Track3D's insights alongside other cutting-edge solutions to boost productivity. For example, integrating Internet of Things sensors embedded in hard hats from other innovative startups enables real-time and anonymized tracking of worker movements. By merging this data with Track3D's progress-tracking capabilities, we can monitor both installed elements and assess manpower efficiency. Additionally, combining this with IoT sensors on workers provides detailed insights into activities such as walking distances on site, helping identify issues like inconveniently located facilities such as portable restrooms. **4 5**

Worker safety remains a core value for Hensel Phelps. As the company expands its use of Track3D, it is looking at potentially utilizing it as one of several tools to proactively identify issues such as safety protocol breaches, adding an additional layer

of protection. This approach underscores Hensel Phelps' commitment to the safety of its people and trade partners. This initiative not only aims to potentially reduce accidents but also strives to improve overall project efficiency, ensuring that every individual returns home safely at the end of each day.

Hensel Phelps is actively piloting and testing advanced robotics for autonomous reality capture and analysis in construction projects, integrating these technologies with Track3D. Mihir Somalwar, innovation lead at Hensel Phelps, underscores the proactive approach: "We continuously evaluate advanced robotics solutions for reliable autonomous reality capture. By automating these mundane, repetitive and time-consuming tasks with a fleet of human-controlled robots, we can redirect our focus. This allows our teams to oversee robot operations and prioritize higher-value tasks, rather than spending time conducting site walks with a camera." **6**

Through innovation and strategic partnerships, Hensel Phelps sets a benchmark for efficient, safe and data-driven construction practices, leading the industry toward enhanced efficiency and safety. Its collaboration with Track3D and innovative startups harnesses AI, robotics and IoT to improve project management, prioritize worker safety and ensure sustainable growth. These efforts drive continuous improvement in construction practices, integrating cutting-edge technologies to deliver exceptional value and optimized operational performance to clients.

NAVIGATING CHANGE: The Transformative Power of AI in Construction

KRIS LENGIEZA, VICE PRESIDENT, GLOBAL TECHNOLOGY EVANGELIST, PROCORE

As an industry, construction is at a crossroads. Generational shifts in the labor market, changing risk profiles, dynamic build environments and increasing project complexity mean that companies are under immense pressure to get the best out of their most valuable asset—their people.

Technology is a key lever that construction executives can pull to drive growth and maximize their workforce's potential in today's evolving landscape. At the forefront of this tech revolution is artificial intelligence, a game-changing technology that has the potential to reshape the way construction projects are planned, executed and managed. With implications reaching every corner of the industry, from design and planning to project management and safety, AI is an ongoing reality for our industry to take advantage of.

Several types of AI are increasingly used in construction. First, there's machine learning, which is typically used to predict project outcomes, helping to foresee potential issues and optimize planning. Then, there is robotics, which generally involves augmenting field tasks that would otherwise take significantly more time and effort, enhancing efficiency and precision.

Computer vision is another key technology, with a lot of focus on progress tracking, providing real-time updates and insights on the project's status. Natural language processing is often used to extract contract details or summarize reports, making

it easier to handle large volumes of textual data. Lastly, generative AI, the newest addition, can generate monthly summaries from daily logs or create schedules from specifications, highlighting its potential to streamline various cumbersome tasks.

AI ROADMAP: A JOURNEY THAT NEEDS TO START WITH DATA

As organizations consider how to utilize AI effectively, the first question to ask is about the availability of clean, consistent and reliable data.

This process starts with how data is captured, collected and imported. A sufficient volume of data that's highly accurate will lead to higher-quality AI outputs like better cost estimates and improved risk assessments. On the other end of this spectrum is data utilization, which is how effectively the collected data is used. Data is plentiful in construction today but often isn't accessible, clean or fully utilized.

Data maturity is a concept used to measure an organization's capability to manage and utilize data. It's a journey from basic data collection to transforming data into a strategic asset. **1**

As organizations think about AI they need to first better understand where they lie on the data maturity scale and find ways to make progress. With a strong foundation of high-quality, well-managed data, organizations can be well positioned to experience the compounded benefits that AI can bring across the various phases of a construction project.

EXPEDITING PRECONSTRUCTION PROCESS

AI is revolutionizing the initial stages of construction. It enables the automatic generation and optimization of designs based on predefined criteria, helping reduce the time taken to create and finalize construction plans. AI also aids in project planning by predicting the likely outcomes of different strategies, allowing for better decision-making and risk mitigation. **2**

SUPPORTING DECISION-MAKING DURING THE COURSE OF CONSTRUCTION

In project management, AI shines in its ability to process vast amounts of data to generate actionable insights and speed decision-making. [In an industry survey](#) of over 1,000 professionals, on an average 18% of the total time on a project is spent looking for data or information. In the same survey, 43% of respondents felt they would make better decisions if they had greater access to real-time and historical information on project performance.

These are all areas where AI can have a big impact. It can expedite the speed of decision-making by putting critical information at the fingertips of decision makers. It can also analyze project timelines, resource allocation and performance data to provide recommendations for efficiency improvements. AI can even forecast potential project delays or cost overruns, enabling preventive measures to be taken. AI will play a huge role in reducing risk by helping stakeholders make data-driven decisions.

AI also holds significant promise in improving construction safety. AI-powered drones and robots can be used to monitor sites for safety hazards, while data from wearables can be analyzed to detect signs of worker fatigue or stress. AI can allow us to often see what can not be seen in real time by a human to help prevent accidents and improve overall site safety. ³

HELPING REDUCE FINANCIAL RISKS

AI is becoming an instrumental tool in financial management within the construction industry, particularly in helping to mitigate risk, minimize cost overruns and enhance forecasting accuracy. AI technologies can enable a more in-depth understanding of resource usage and project spending, which can lead to cost savings through informed decision-making and resource allocation.

In terms of risk management, AI assists in the identification, evaluation and mitigation of various project threats, helping to avoid costly delays and create safer construction environments. Furthermore, AI's predictive capabilities can help improve forecasting accuracy, allowing for better budgeting and cost control.

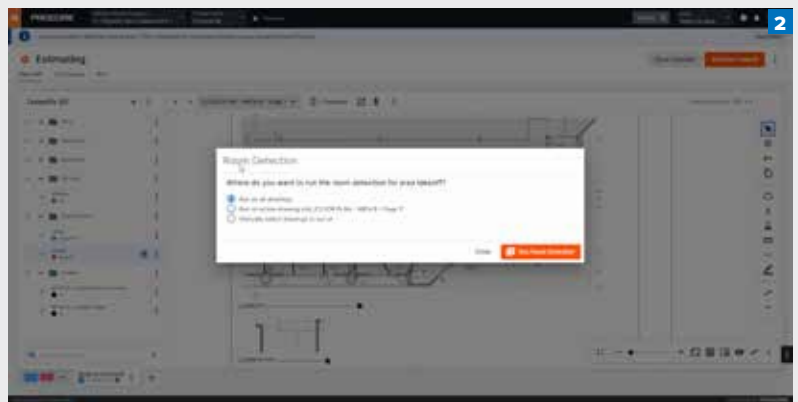
THE FUTURE OF AI IN CONSTRUCTION

The future of AI in construction is promising for both automation and improved decision-making. We can expect to see improved productivity due to the automation of complex tasks throughout the project lifecycle. And as various AI technologies become more sophisticated and are trained more specifically in our industry, their ability to analyze complex situations and provide insightful recommendations will only improve.

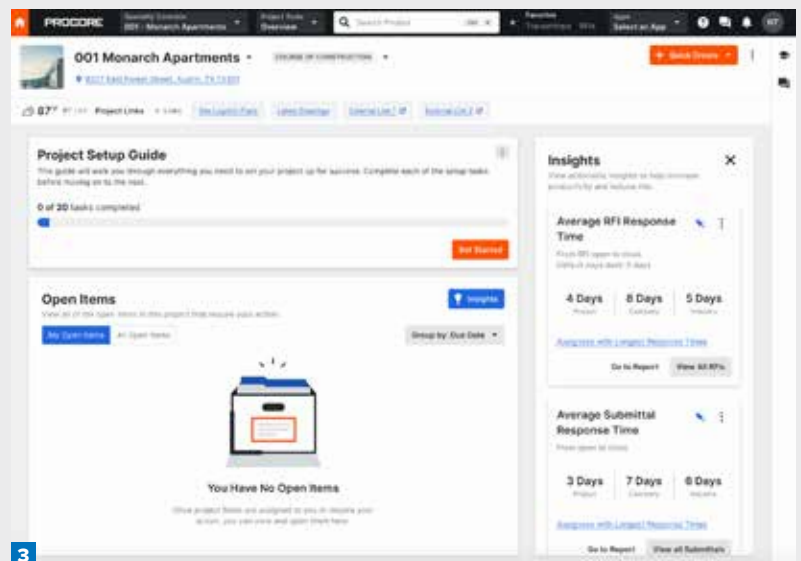
As companies start recognizing the value of investing in data maturity and the quality of inputs, these AI technologies will also improve. This will lead to AI becoming more and more ingrained in workflows and decision-making throughout the construction lifecycle. There is a good chance that companies that wait to understand or embrace this technology could be left behind in an increasingly competitive industry.



Source: [How We Build Now report by Procore](#).



Example of automated area takeoffs during estimating in Procore.



Example of AI-powered insights in Procore that can help with decision-making.

THE FUTURE OF AI IN CONSTRUCTION: Unlocking the Power of Data and Building Better Outcomes

JIM LYNCH, SENIOR VICE PRESIDENT AND GENERAL MANAGER, AUTODESK CONSTRUCTION

Artificial intelligence is gaining traction in construction. According to Autodesk's latest [State of Design and Make Report](#), 66% of leaders believe AI will become essential to their businesses within the next two to three years.

With the rapid advances that we're seeing, it's unsurprising that some people envision droid bricklayers or AI assistants producing thousands of perfect designs a day. However, it's crucial that the construction industry avoids automation for the sake of it. Advances in AI are helping tackle many of the industry's longstanding issues, from [low productivity to poor predictability](#), and the technology can create radical efficiency gains, from automated submittals to improving bulk data analysis.

AI tools can help construction teams reduce risk, spot potential errors much earlier in the process and improve everyday decision-making. And importantly, at a time when an estimated 40% of the construction workforce will [retire by 2030](#), AI can alleviate the burden on the remaining employees by reducing nonoptimal work.

With the help of this technology, the industry may start to see greater adoption of industrialized construction: the convergence of our industry with the principles of manufacturing, which can overhaul both what we build and how.



So, how is AI enhancing construction today and where will it create the most value in the future?

UNLOCKING THE POWER OF DATA

Currently, data remains a significantly underutilized resource in construction. Organizations may be generating a higher volume of data than ever before. However, according to analysis by Deloitte, 80% of global construction businesses today [have beginner or emerging data capabilities](#), meaning limited use of data, strategy and skills.

AI can play a key role in analyzing, augmenting and automating construction information to ensure that decision-makers can quickly act on key insights and implement long-term improvements.

Faster and more accurate data entry is an excellent application. For example, Autodesk Construction Cloud features [Specifications](#), a tool that automates the tedious manual process of preparing specifications by using machine learning to extract and section project requirements into relevant specification divisions within Autodesk Build and Autodesk Docs. This reduces time wasted sifting through data and empowers teams to quickly address discrepancies before they unravel into larger problems.

AI can also enable teams to gain more meaningful and timely insights from their data. [Construction IQ, powered by Autodesk AI](#), automatically analyzes data stored on a project to provide greater visibility into project health and

performance insights. By sifting through project data points, from issues to subcontractor assignments, the tool can highlight and prioritize risk factors daily.

With AI, project teams will have the insights to not only improve everyday decision-making but identify and mitigate risks far earlier in projects. AI can function as the support that teams need to gain insights from data regularly and effectively, saving time and improving outcomes with less effort.

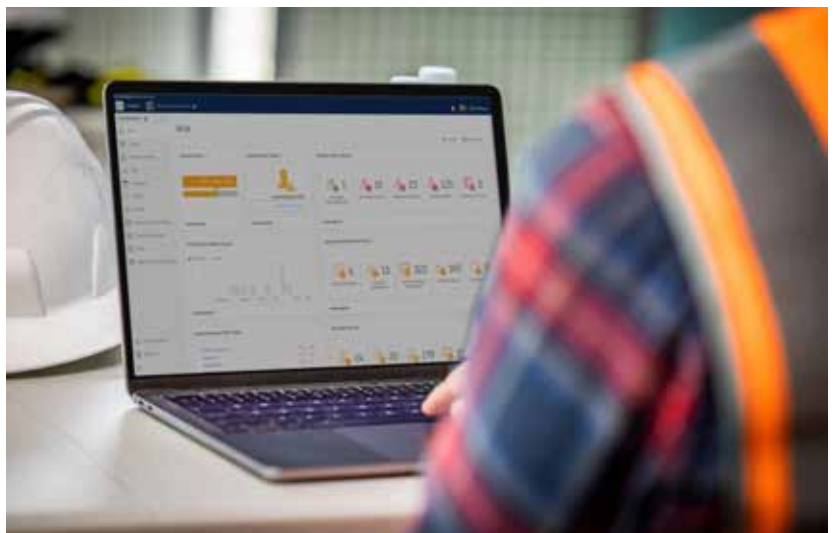
PURSuing BETTER OUTCOMES

The potential of AI technology is illustrated by [The Phoenix](#), a housing project working to develop 316 affordable and sustainable units in the San Francisco Bay Area. Using Autodesk AI tools, designers and builders worked together to rapidly explore a huge range of housing options that met complex project goals. Adding a floor to a building, nudging the structure's position north or south, shifting a playground or greenspace from the edge of the development to the center: Each move impacts the project's goals around cost, carbon and livability.

In the years ahead, AI tools for generative design will play a key role in enabling the architecture, engineering, construction and operations industry to meet increasingly complex construction requirements, like adapting to climate change or supporting population growth. New methods like industrialized construction allow buildings to become more like manufactured products rather than one-off projects.

The builders behind The Phoenix, Factory_OS, are harnessing Autodesk's cloud-based workflows to do exactly this. They use a rapid factory production process to build housing modules that can be trucked to project locations and assembled by crane.

With a focus on prefabrication, the innovative process removes the unpredictability of a traditional construction site, while the convergence of design, construction and manufacturing workflows dramatically accelerates the speed to completion. The Phoenix units will be erected in about two weeks whereas traditional processes typically take close to a year.



AI will enable continual improvements in industrialized construction, thanks to the higher volumes of data generated. The industry will have the insight to continually improve the process of construction and push the boundaries of what's achievable.

CONSTRUCTING WITH INTELLIGENCE

AI is already delivering benefits for forward-thinking firms, from reducing risk to improving day-to-day decision-making. A new Deloitte survey has found that data

leaders in construction are [seven times more likely to deploy AI and machine learning solutions](#)—and can in turn expect a 50% increase in average profit growth rate each year compared with beginners.

In the years ahead, the technology will benefit from—and drive—the rise of industrialized construction. We hope to see AI supporting consistent, predictable and exceptional construction projects, which deliver meaningful societal outcomes in a leaner, cleaner way. And that is much more exciting than droid bricklayers.

The Benefits of Incorporating AI Into the Construction Lifecycle

IAN WARNER, DIRECTOR OF INDUSTRY WORKFORCE DEVELOPMENT AND INNOVATION, TRIMBLE

Interest in artificial intelligence has been spreading like wildfire over the past few years. AI is not a new term for Trimble, which has been capturing and leveraging construction data for decades. From hardware to software, the field to the office or among stakeholders, harnessing and making meaning out of data is the crux of Trimble's business. Generative AI is simply a new set of tools that provide a richer narrative around data, making it more insightful and actionable.

As a company that helps connect stakeholders across the entire construction lifecycle—design, construction and operations/maintenance—AI has been woven in and leveraged across a number of Trimble solutions to help contractors do more with less, while also giving them greater decision-making power and the ability to focus on other key challenges.

While the use cases for AI are diverse and ever-changing, below are a few key areas where Trimble has doubled down on AI, with the goal of making contractors' jobs less cumbersome and repetitive, safer and more capable of being upskilled—efforts which will only continue to grow in the coming years.

AUTOMATING REPETITIVE, MUNDANE WORK

One of AI's top benefits in construction



is assisting with the automation of data entry, thereby removing (or at least reducing) the many manual, tedious tasks that occur across a project's lifecycle.

On the design side, generative AI is being used to help design teams automate modeling work—resulting in faster, less labor-intensive workflows. One recently released 3D-modeling tool—[Diffusion](#) from Trimble SketchUp—lets users create images from an active model through a simple text prompt. Diffusion can help inspire designers during the earliest stages of design, allowing them to explore ideas and

iterate on them rapidly, to later stages of design, helping them produce gorgeous renders in significantly less time.

SketchUp also recently released [Scan-to-Design](#), which captures and interprets scans of interior spaces or exterior building data and transforms it into clean, organized 3D geometry, creating an immediate starting point for conceptual design. AI is used to help convert the raw scan data into usable 3D models, providing architects with a starting point for creating beautiful conceptual designs that can easily be shared with clients for immediate feedback.



Many contractors are also using Trimble's [Automatic Invoicing](#) feature, which leverages AI within the company's two enterprise resource planning systems—[Vista](#) and [Spectrum](#)—allowing accounting teams to automatically turn paper and PDF invoices into validated, unapproved invoice entries for faster, more accurate workflows that save contractors valuable time, effort and money.

Trimble is also looking into using generative AI to help search and summarize documents, given that over 80% of construction data is unstructured and in the form of a document, such as a PDF. This can help streamline a tedious and time-consuming task, making it more manageable and efficient for contractors.

Throughout these tasks, AI is streamlining some of the more mundane yet important aspects of design and construction work, empowering construction professionals to focus on the more critical aspects of their jobs that require human judgment. In the process, it's helping to streamline project planning, offer alternative design possibilities and provide data-driven insights for better resource allocation.

However, it's important to note that

AI in construction has limitations. Its effectiveness depends on the quality and relevance of its training data. Human expertise remains crucial for interpreting AI outputs, ensuring regulatory compliance, and making final decisions that consider the full context of a project. The key is to leverage AI as a tool that enhances, rather than replaces, the invaluable experience and intuition of construction professionals.

IMPROVES SAFETY AND ACCELERATES SKILL ADOPTION

Another key area for AI lies in its ability to help train workers and get them up to speed, as well as help them make safer decisions.

Craft professionals are increasingly using [AI-powered augmented reality systems like Trimble Connect AR](#) to overlay design plans, specifications or instructional steps as a guide to tasks or to verify as-built conditions. There are also many examples of steel detailers using [AI to help overlay fabrication 2D details onto 3D models for use in the fabrication and installation process](#), as well as to evaluate each detailer's design history to document best practices and shorten the decision-making process.

The construction industry is also exploring the use of AI-enabled computer vision and sensors to automatically update schedules and budgets, as well as catch potential safety issues based on field data collection, which could help streamline processes, minimize rework and boost efficiency.

Other research and development efforts are looking into attaching cameras to construction equipment to leverage computer vision to detect if workers are wearing proper safety equipment like hard hats and alert supervisors of any noncompliance issues in real time, thereby reducing safety risks.

Leveraging AI and predictive modeling to not just track activities but recommend improvements is essential to getting the next generation worker up to speed quickly, while also making them safer in the process.

Construction has a lot to gain from incorporating AI into workflows, which can help with everything from reducing mundane tasks to maximizing productivity and efficiency, to enhancing skills adoption and improving safety. The future is here, and Trimble is committed to helping the industry embrace these solutions now and in the years to come.

BRIDGING THE EXPERTISE AND KNOWLEDGE GAP FROM A RETIRING GENERATION OF BUILDERS:

Smartapp's Vision for AI in the Built Environment

JAMES NORRIS, VICE PRESIDENT OF STRATEGY, SMARTAPP

The goal of AI in construction should be to manage risk better than ever before. This is how we keep our people safe and, frankly, it is how builders make money. Whoever manages risk best wins! Years ago, I heard from a head of construction operations that the goal of a construction company is to make more than 14% profit on the capital backing the construction company.

Basically, make more than you can in the stock market. If not, it makes no sense to be in business as a builder and you might as well go trade stocks or open a kombucha franchise for millennials. I am a millennial, so no offense taken.

The focus of AI needs to be based on value and the problems we as an architecture, engineering and construction industry know we are facing. Let's start by rehashing some well-known AEC industry problems to understand the real value AI can bring and is bringing to our industry:

KNOWN AEC INDUSTRY CHALLENGES

1. Good workers are hard to find!

In 2024, the industry was short by a half a million construction workers. **1**

2. Our building experts are retiring!

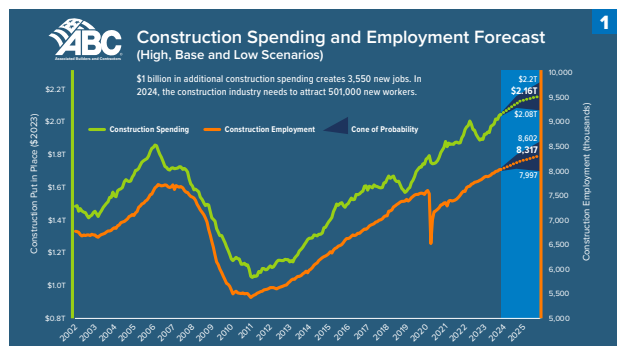
According to the U.S. Bureau of Labor Statistics, nearly 1 in 4 construction workers are older than 55, and retirements will continue to whittle away at the workforce. **2**

3. We're running our people ragged!

Workers in the construction industry are more vulnerable to burnout than in any other field. In 2017, the National Association of Home Builders found that only 3% of people aged 18 to 25 wanted to work in construction.

SO WHERE DO WE START WITH THIS AI INITIATIVE AS SOFTWARE COMPANIES OR BUILDERS?

First, building AI into a construction workflow requires expertise in the built world. Our industry is slow to adopt new software that doesn't instantly show value that is obvious to all parties. That's why 2D drawings on software mobile apps became multibillion-



dollar companies. Everyone wanted updated drawings at their fingertips because it was an obvious solution.

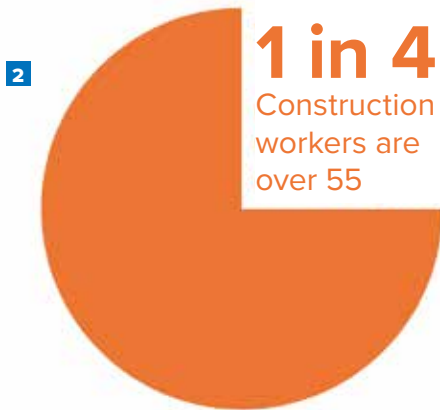
So, if you want AI to solve a construction problem that is truly obvious and can scale to help millions of people, hire people who deeply understand the nuances of the construction problem as well as AI engineers. Some questions to answer on your AI solution journey are:

- Is it simple?
- Is it reliable?
- Is it in real time or time-sensitive?
- Is it faster than what I am doing now?
- Does it predict risks well?
- Does it work with all the data I am capturing, such as schedule, safety, fieldwork and cost?

The more information you have, the better the solution you can implement. These are questions we ask at Smartapp before creating anything, whether it be automated, AI-driven or both.

3 WHAT IS SMARTAPP DOING WITH AI AND AUTOMATION?

Released in the fall of 2023, the benefits of the Brena.ai AI assistant have already helped on a \$100 million project.



PLANNING AND SCHEDULING AI AND AUTOMATION:

- AI-created lookahead schedules based on past performance, including assigning the trade, potential duration and crew size. Reference the current scheduled work or choose just one scheduled task, and Brena.ai will create a suggested lookahead.
- Automated and consolidated daily job reports for the trades, the general contractor and the owner.
- Automated schedule progress updates from the field back into your P6 or MS Pro schedule, removing double-entry of data.

SAVINGS:

- \$720,000 saved in manual labor entry per year.
- 260 hours saved by automating the construction schedule.
- 662 hours saved assigning work and verifying completed tasks.
- 5,800 hours saved on manual entry of daily job reports.

SAFETY AI AND AUTOMATION:

- AI PPE recognition of jobsite staff.
- AI multilingual support.
- AI enterprisewide repeat offender detection.
- Automated worker onboarding, I-9 process and certification tracking.

SAVINGS:

- \$1.29 million saved in hours and injury avoidance per 1,000 workers.

- Approximately 10,000 labor hours saved per 1,000 workers onboarded.
- 25% reduction in injuries onsite.

CONSTRUCTION DOCUMENTATION AI AND AUTOMATION:

- AI spec extraction to help with means and methods guidance during work installation.
- AI submittal creation from specs.
- AI machine vision for locating items in construction progress photos.
- AI for Livelink, Smartapp's version of live video or text conference calls with multiparty markup, automatically creating follow-up items and a summary with multilanguage transcripts on the fly.

SAVINGS:

- 250 hours saved from finding and entering submittal data.
- Machine vision of photos allows for instant lookup of items.
- Livelink reduces manual data entry and RFIs by 13.2%.

FINANCE AND PROJECT CONTROLS AI AND AUTOMATION:

- AI-suggested budget and cost breakdown structure based on past performance.
- Automated bid award to contract creation process.
- Automated pay applications and earned value tracking.

SAVINGS:

- \$448,000 in time savings per large project
- 8 times faster forecasting and pay application processes.
- 1,050 hours saved per 30 contracts created.

FUTURE DIRECTION

The future of AI is going to be multifaceted and will require guidance and effort from builders and software companies around the globe.

AI initiatives will combine both hardware and software. We live in a physical world using physical tools, especially in construction. So, we think you will see much more fusion and harmony between hardware and software, tracking things like progress and people, identifying safety risks and aiding in the installation of work. We are already seeing this now.

Project schedule durations will be known with approximately 97% accuracy before the project begins, improving risk management.

Predictive analytics will become so good that the best superintendent knowledge at a company will be spread to all superintendents and field workers to make them at least B to A players since they will be informed of issues even before they ever happen.

Cameras and depth sensors guided by AI algorithms will lead to a new era of surveying and reality capture solution offerings.

We could go on forever on the possibilities of how AI will benefit the construction process—some of them are known today while many benefits will reveal themselves in the coming years.

AI for Construction HR: The Next Frontier of Transformation

Kevin Berens, Chief Product Officer, Arcoro

Arcoro discusses how AI can transform the HR and workforce management for the construction industry by enhancing the user interface and providing data-driven insights. Learn how conversational AI can enable workers to interact with HR apps through voice, natural language and personalized responses, making it easier and faster to complete tasks like clocking in, requesting time off or reporting incidents. AI can analyze substantial amounts of HR data to generate business intelligence that can help companies optimize their workforce, reduce costs, improve safety and benchmark their performance. The paper concludes that AI is not only a supportive tool, but also a transformative one that can change the HR game for construction in the near future.



The Impact of AI on the Construction Industry: Driving Efficiency and Productivity

Zulq Malik, Chief Happiness Officer, SMARTBUILD

SMARTBUILD describes how AI is transforming the construction industry, enhancing efficiency, productivity and safety. Learn how AI affects various aspects of construction, such as planning and design, project management, robotics and automation, quality control and safety and skills and training. Understand the role of construction management software, like SMARTBUILD, in integrating AI into the industry, providing data-driven insights, streamlined collaboration and proactive issue resolution. SMARTBUILD emphasizes the need for upskilling the workforce and embracing innovative technologies to leverage the full potential of AI and drive the future of construction.



Read these articles on AI at abc.org/techreport.

Document Crunch: Our Vision for the Future of AI in Construction

Josh Levy, Founder and CEO, and Trent Miskelly, COO, Document Crunch

Document Crunch uses AI to help the construction industry with contract compliance, which is the alignment of daily decisions with contractual commitments. Learn about CrunchAI, a proprietary AI engine that speaks the language of construction and leverages state-of-the-art language models to analyze complex contract documents and provide practical tools for legal and risk managers, operations leaders and project teams. Document Crunch's tools can generate contract summaries, create project team playbooks and automate compliance tasks during construction, as well as provide guidance on the next best action based on industry best practices and company data.



BuildOps: Pioneering AI in the Construction Industry

Michael Chou, Chief Product Officer, BuildOps

BuildOps develops field service management solutions for the construction sector. Learn about the challenges and opportunities of AI in construction, including the labor shortage, the need for vertical AI and the benefits of AI for the workforce, business insights, data management, skill development and sales and operations. BuildOps is committed to building a more efficient, innovative and resilient construction industry for the future, with AI as the cornerstone of success.



Egnyte: Revolutionizing Construction With Cloud Technology and AI

Kevin Soohoo, Senior Director of Architecture, Engineering, and Construction, Egnyte

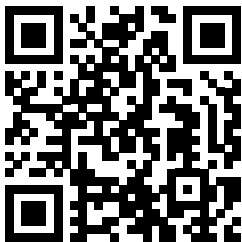
Soohoo argues that centralizing data in the cloud enables AI to analyze comprehensive datasets and provide accurate insights for better decision-making. He also introduces Egnyte Copilot, an AI-driven assistant that allows users to have AI-powered conversations with their private and trusted data. Egnyte Copilot can help project managers, estimators and operations teams with various aspects of construction projects, such as object identification, cost estimation and safety compliance. See how you can harness the power of the cloud and AI to build smarter, more connected and more successful projects.



FCA: How AI Helps Overcome Construction Challenges

Reid Rubinstein, CEO, Field Control Analytics

Field Control Analytics believes AI can transform the construction industry by predicting cost overruns, mitigating worker risks and optimizing workforce management. FCA envisions AI algorithms that can analyze data from worksite sensors, video and wearable devices, and provide real-time insights and recommendations to project managers, supervisors and workers. FCA is committed to developing effective AI tools in collaboration with contractors and integrating client feedback into its innovations.



Read these articles on AI
at [abc.org/techreport](https://www.abc.org/techreport).

Kojo Intelligence: AI for Construction Procurement

Micah Rodman, Co-Founder and Chief Operating Officer, Kojo Technologies

Kojo Intelligence uses AI to help trade contractors manage their procurement processes for construction materials. The product leverages advances in large language models and machine learning to extract and structure data from unstructured sources, such as spreadsheets, emails and PDFs, and to provide insights and recommendations for optimal procurement strategies. The product is built for industry-specific workflows and supports various trades, such as electrical, plumbing and HVAC. Kojo Intelligence is part of a larger vision to transform the construction industry with AI-powered solutions that make it cheaper, easier and more sustainable to build the physical world by reducing overhead, enabling bulk discounts and minimizing availability risk.

KOJO

Sage's Vision for Responsible and Effective AI

Dustin Stephens, Vice President, Construction and Real Estate, Sage

Sage believes that AI can augment human capabilities by automating repetitive tasks, providing real-time insights and ensuring data quality and integrity. Sage also emphasizes the importance of using AI responsibly, following data principles that prioritize customer safety and trust and involve customers in the development of AI tools. Learn how Sage's AI solutions can transform construction accounting, enabling continuous accounting, assurance and insights, and providing outlier detection for general ledgers. AI can also enhance other aspects of construction management, such as takeoff, project management and communication, by offering speed, accuracy, optimization and automation. AI is not a replacement for human expertise and judgement, but rather a powerful tool that can elevate the work of construction professionals and help them build a sustainable future.

Sage

AI AS AUGMENTED INTELLIGENCE: Enhancing Human Capabilities

BY STEVE JONES, SENIOR DIRECTOR, INDUSTRY INSIGHTS RESEARCH,
DODGE CONSTRUCTION NETWORK

In recent years, artificial intelligence has evolved from a concept in science fiction to an increasingly transformative tool across numerous sectors of the global economy. Popular media often portrays AI as a fearsome force that will replace human labor, thinking and judgment. However, a more nuanced and beneficial perspective is emerging: AI as augmented intelligence, enhancing human capabilities rather than replacing them. It points to a collaborative future where machines and humans work in harmony to achieve more than either could alone.

DEFINING AUGMENTED INTELLIGENCE

Unlike AI, which aims to replicate or surpass human intelligence, augmented intelligence is designed to support human decision-making and improve productivity. It can process and analyze vast amounts of data swiftly and accurately, providing insights and recommendations that humans can then adapt to the situation at hand according to their experience and judgment. Put simply, augmented intelligence helps people make more informed decisions. It does not make decisions for (or instead of) people.

APPLICATIONS OF AUGMENTED INTELLIGENCE IN CONSTRUCTION

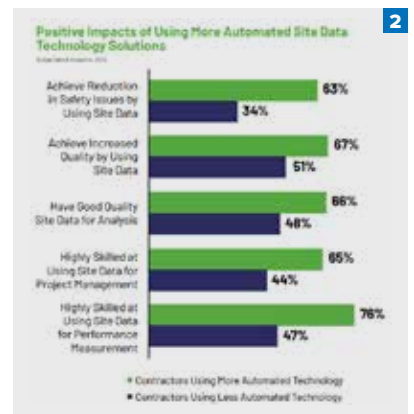
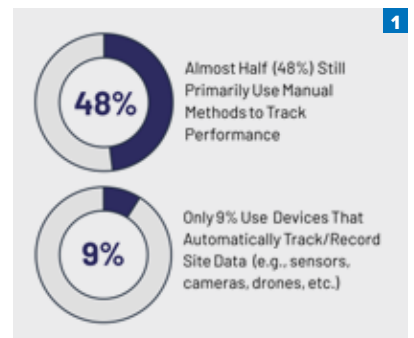
Already used in health care, manufacturing, finance and customer service, augmented intelligence has been slower to find footing in construction. Recent research reports published by Dodge Construction Network highlight three examples where augmented intelligence is providing tangible value for contractors, although none are widely adopted yet.

1. Augmented Intelligence for Construction Jobsite Productivity

Commercially available solutions (e.g., Versatile) apply augmented intelligence to contractors' jobsite performance data to identify patterns, predict problems and suggest improvements. But, to be most effective, it requires accurate, complete and consistent data across projects.

Dodge's [Measuring What Matters: Unleashing the Power of Site Data to Enhance Construction Performance](#) report, which studies how contractors currently collect and analyze seven critical types of jobsite data, reveals that between one-third and two-thirds have frequent quality issues with data accuracy, completeness and consistency.

The report identifies two likely root causes of data quality issues:



- Frequent use of manual methods that can be prone to errors, omissions and inconsistencies.
- Extremely infrequent use of automated methods (including AI-enabled tools) that can dramatically improve data quality. **1**

Importantly, using automated methods correlates to more benefits and greater competency at effectively leveraging site data to improve processes, findings that should drive more adoption. **2**

2. Augmented Intelligence for Construction Jobsite Safety

Dodge's [Safety Management in the Construction Industry](#) report examines U.S. contractors' use of 11 technologies specifically for jobsite safety.

- Currently, only 5% of contractors report using visual monitoring with AI (e.g., Newmetrix and other jobsite camera-based safety solutions), ranking it 10th out of the 11 solutions studied.
- But importantly, it ranks third for usage frequency, a strong indicator that it provides value.
- Also, another 9% express interest in adopting it in the next 12 months.

Dodge categorizes visual monitoring with AI as "poised for growth" among these 11 safety technologies because those few users are indicating high value, which usually encourages wider adoption.

3. Augmented Intelligence for Construction Fleet Safety

Most contractors have multiple vehicles working on jobsites and public roadways. AI technology (e.g., Motive) can now analyze dashcam and perimeter camera data to improve vehicle safety.

Dodge's [AI-Based Camera Systems and the Future of Construction Fleet Management](#) report reveals that:

- Operator errors are the leading cause of construction vehicle accidents and near-misses.
- However, only 17% of contractors use any kind of technology to monitor operator behavior and identify risks around the vehicle, including just 1% using AI-based solutions.

Still, that 17% of contractors report powerful benefits. **3**

In addition, across other vehicle-intensive industries (e.g., trucking), companies using AI-powered cameras to support operator coaching efforts report

50% fewer accidents. So again, usage in construction should increase markedly as the value becomes more widely recognized. **4**

HOW TO ENGAGE WITH AI

AI is the Taylor Swift of construction technology these days. It is the hot buzzword on every vendor's lips, and they can't say enough great things about it. However, as with any innovative technology trend, each vendor is somewhere on their journey toward genuinely embedding useful AI capabilities into its offerings.

So, how does a construction company get productively engaged with AI and not just distracted by shiny objects?

1. Use Commercially Available Construction Technology Solutions That Incorporate AI

First, identify processes that could be improved by carefully analyzing performance data that most companies simply don't have the time and resources to do internally. These include schedule compliance, budget compliance, safety performance, construction quality, jobsite logistical efficiency and labor productivity.

Then, ask vendors about AI capabilities that address those specific issues. Consider piloting promising solutions and determine in advance how to measure their success. This approach focuses AI on a company's identified needs rather than force-fitting a vendor's AI value proposition of the moment onto its processes.

2. Applying AI to a Company's Existing Internal Data

A company can experience AI's strengths (and weaknesses) by focusing one of the general purpose AI applications (e.g., RapidMiner, Orange, IBM Watson) on data the company already has and seeing what value it provides. Suggestions include:

- **Requests for proposals and proposals.** After ingesting past examples, staff resumes and company history, AI can produce a first draft of a new proposal. With additional data on current

Benefits of Using Technology **3**



workload, it can be taught to advise on the suitability of a potential project for the company's capabilities and available capacity.

- **Requests for information from past projects.** This exercise can identify the conditions that tend to generate RFIs (e.g., project type, element, trade, timing). A project manager can then reduce or avoid RFIs by ensuring those aspects are clarified earlier in the project.

THE FUTURE OF AI IN CONSTRUCTION

Ultimately, AI capability will be baked into everything, and its benefits will be taken for granted. But for now, the best course of action is for each company to test, pilot and evaluate specific use cases that are meaningful to its performance and can drive measurable improvements.

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