Bracing for Change:
The Coming AI Revolution
in Construction

Imagine a world where data is seamlessly collected from years-old drawings and project reports to reveal best practices, alternative designs are quickly visualised in 3D renderings and virtual building replicas can predict future maintenance needs to improve energy efficiency.

Consider the time saved when the most mundane tasks – ensuring alignment in floor plans or fine-tuning the text in title blocks or RFPs – are automated to reduce errors and quicken decision-making.

Artificial intelligence (AI) has the potential to revolutionise those activities and every other aspect of the architecture, engineering, construction and operations (AECO) industry, from the initial design to management and maintenance when it's complete.

With these AI-powered efficiencies, AECO companies can tackle some of the industry's biggest challenges, including rising interest rates, widening labour gaps and growing sustainability requirements.

But despite headlines blaring about the latest advancements, it's still early days for AI's deployment. Navigating this transformative technology can be challenging, requiring a shift in mindset, upskilling of the workforce, robust data management strategies – and caution.
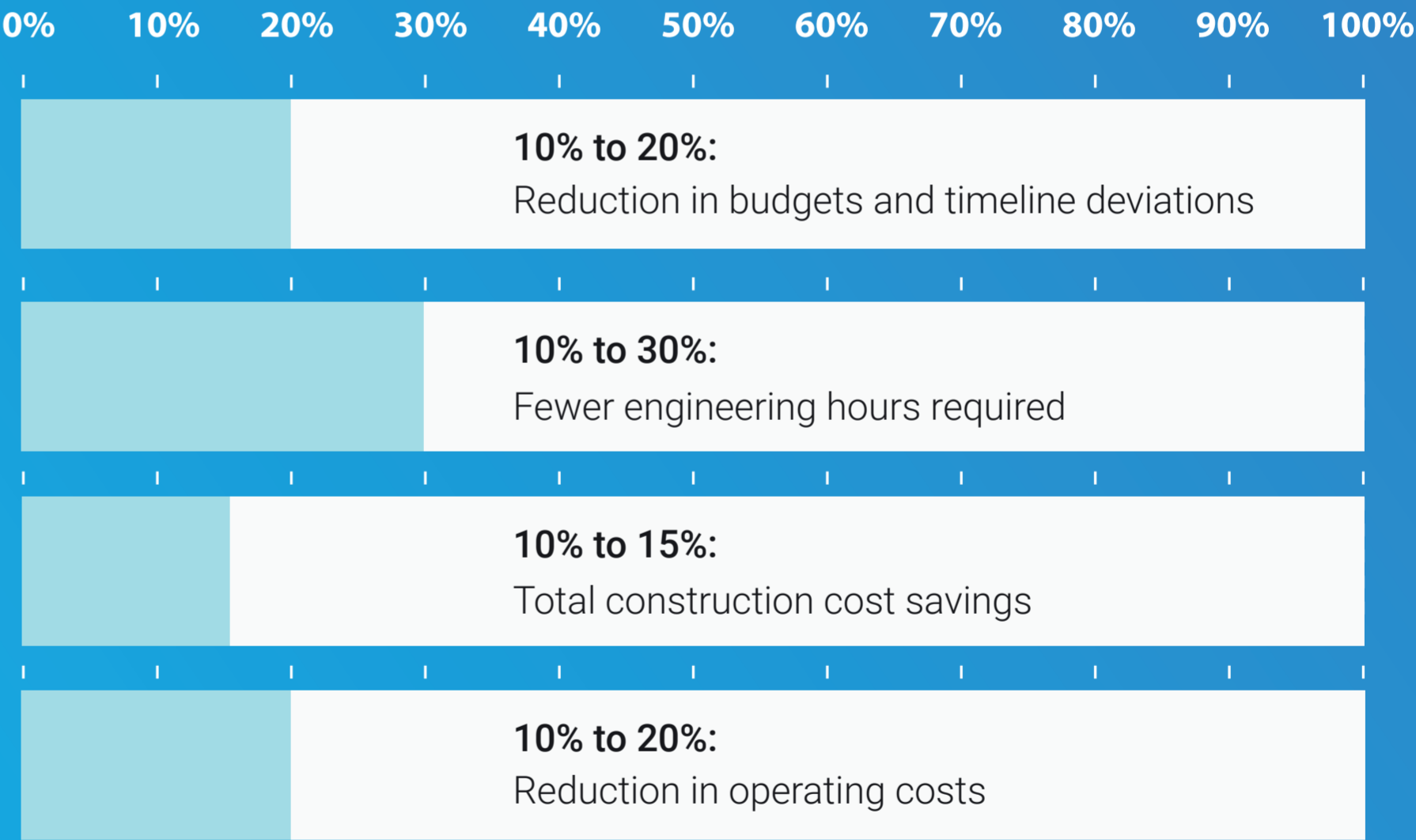
This eBook aims to cut through the noise about AI for the AECO industry. From understanding the potential applications of AI to implementing AI-driven solutions, this guide will help firms navigate the AI revolution and take advantage of the opportunities it presents.

> 'We're at the beginning of the Renaissance. It's one of those great, amazing times in our human evolution where you have this transformative technology. … These are tools that will enable us to operate better, exist better. And how we apply those, that's where the real trick will come into play.'
>
> **Don Jacob, co-founder and chief innovation officer, Bluebeam**

Accelerating Savings with AI

When the construction and infrastructure industry deploys AI and advanced analytics, consulting firm Deloitte estimates the industry could enjoy:

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

10% to 20%:
Reduction in budgets and timeline deviations

10% to 30%:
Fewer engineering hours required

10% to 15%:
Total construction cost savings

10% to 20%:
Reduction in operating costs

Source: Deloitte

What Is AI?

AI is a computer system that's built to learn. Humans feed the technology information and AI is designed to analyse and solve problems or make decisions with it like a human.

There isn't just one type of AI. Branches include:

Machine Learning: Humans learn from gaining new information and experiences; machine learning works in a similar way, combining data and algorithms to make decisions on its own.

Natural Language Processing: Natural language processing (NLP) allows computers to understand and generate human language. Amazon's Alexa uses NLP. So do customer service chatbots.

Generative AI: Generative AI (GenAI) uses machine learning to generate text, graphics, images, software code and audio from a simple prompt. OpenAI's ChatGPT is a form of GenAI that produces text and code. Midjourney and DALL-E use it to create images.

Predictive Analytics: Predictive analytics rely on machine learning, along with data and algorithms, to predict what might happen in the future. Before AI existed, companies had long used predictive analytics to assess risk, staffing, cash flow, profits and other things.

AI Robotics: When paired with AI, robots can operate more independently, adapting to new conditions or information. In the AECO industry, AI robots are already guiding vehicles, plastering walls and monitoring jobsite progress.

> *'Today we talk about AI software and non-AI software. In a year or, at the latest, two years, this differentiation will not be made anymore because every software will be an AI software.'*
>
> **Stefan Kaufmann, product manager of BIM strategy and new technologies, ALLPLAN**

State of AI Today in AECO Industry

Some AECO companies are already wading into AI, harnessing the tools to limit mundane tasks and streamline work.
Potential AI uses include:

Analysing Data: AI can analyse swathes of data to identify patterns and uncover insights that were previously stored away in scattered drawings, files, invoices and safety reports. AECO companies use this information to improve design accuracy, streamline project management, bolster safety, optimise energy consumption and calculate sustainability metrics.
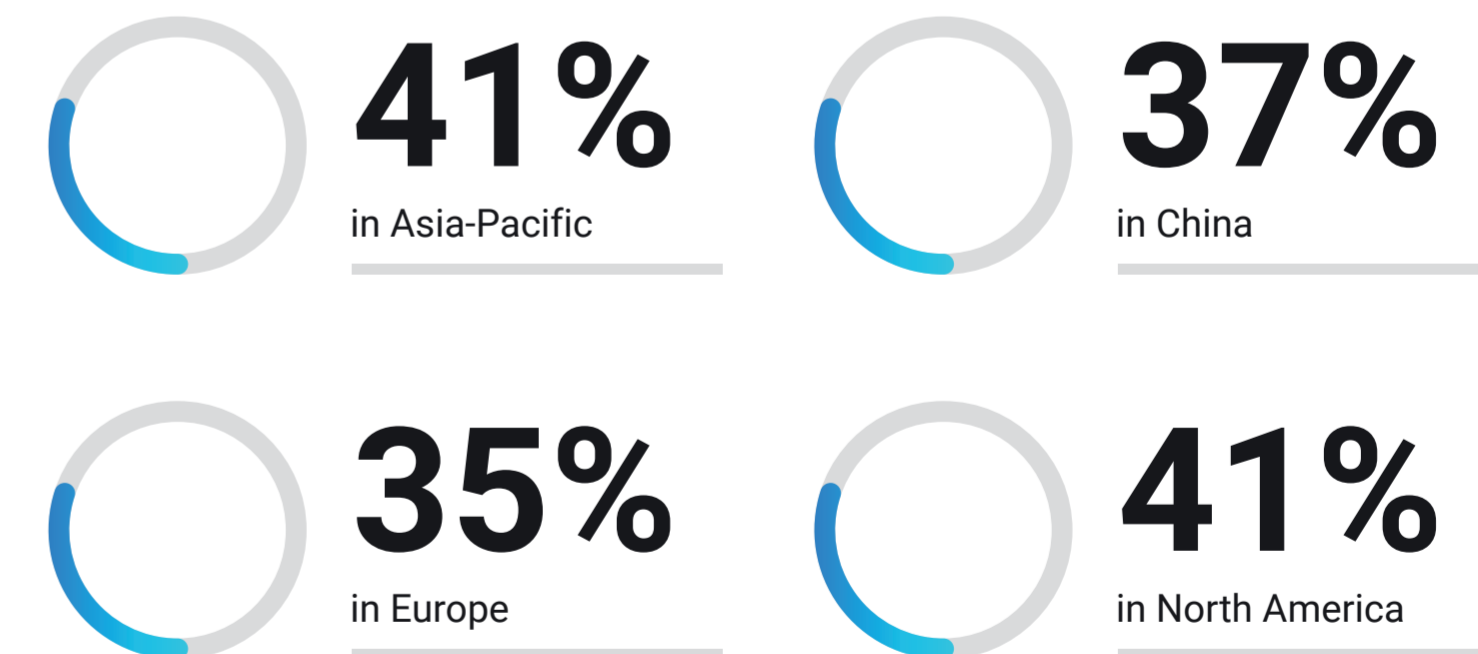
Iterating on Designs: With AI-powered software, AECO companies can quickly update and iterate on designs, testing out the appearance and performance of different features and allowing for easier collaboration with owners and other stakeholders.

Optimising Facilities Management: Using data from sensors and smart meters, AI can adjust heating, cooling and other energy use based on real-time occupancy data and climate information. The technology allows building owners to reduce energy consumption, operating costs and environmental impact.

Creating Content: AECO companies are using AI to fine-tune proposals and client emails, and organise and annotate meeting notes and transcripts.

GenAI Popularity

The percentage of individuals who use generative AI tools regularly personally or professionally, or both.

41%
in Asia-Pacific

37%
in China

35%
in Europe

41%
in North America

Source: McKinsey & Co.'s State of AI in 2023

![ALLPLAN — A NEMETSCHEK COMPANY]

A Conversation with ALLPLAN

Designers and contractors typically have access to years of data, drawings and other documents, which could inform and streamline their current work. But much of it is scattered across siloed files, plan archives, data management systems and project rooms. Today, it's impossible to efficiently search for information managed in that way.

ALLPLAN, a global provider of **BIM solutions**, recently partnered with elevait, a startup that provides AI-powered enterprise software, to bring that so-called dark data into the light. As part of its solutions portfolio, elevait provides an intelligent search engine for proprietary documents and, through AI-based process management, can reduce repetitive tasks and increase efficiency and quality.

The partnership will bring order to thousands of once-scattered drawings and documents. 'There's a lot of data and a lot of information, but it's not easy to access this data and to find the right information very quickly in 100,000 drawings,' said Stefan Kaufmann, **ALLPLAN's** product manager of **BIM strategy** and new technologies.

But this is just the beginning of **ALLPLAN's** AI future. It's also researching the viability of chatbots to support users and even make real-time suggestions to optimise the design, detect errors or make plans more sustainable. Also on the table: creating **3D models** from point clouds made of **2D images** or photos, which could accelerate renovations of older buildings.

> 'We believe AI is a copilot function at least for the very foreseeable future. We want to help engineers and architects do their jobs better. We don't talk about removing functions … we talk about AI to help architects and engineers do their jobs better.'
>
> **Eduardo Lazzarotto, ALLPLAN's senior vice president of product and strategy**

SOLIBRI
A NEMETSCHEK COMPANY

A Conversation with Solibri

With solutions that analyse and validate the quality of BIM-based designs, Solibri is the market leader in model checking software aimed at making the design process more productive, fluid and efficient. Its quality assurance tools uncover errors and issues between models of different domains – for example, whether a building's architectural model matches its structural and HVAC models – to ensure there are no overlaps or clearance issues.

Internally, Solibri is already using AI to support its developers as they write and test new code. 'It's a helper,' said Toni Gyllenberg, Solibri's head of research and development.

As Solibri considers how AI might help its customers, leaders have been working diligently to determine the best use cases by analysing how the industry already uses the tool.

Solibri's customers are diving into the complex world of IFC data schema, and using the tool requires expertise. As Solibri looks at how it might incorporate AI, 'It really all boils down to making the user experience easier,' Gyllenberg said.

Solibri is currently researching the potential of a chatbot within the product, which could direct customers to information and learning resources as they use the tool. 'We think that would be able to help and make quality checking easier and faster for all of our users regardless of if they are beginners or if they are more advanced users,' Gyllenberg said.

Solibri is also analysing data from past projects to potentially use AI to flag common issues at certain points during planning, construction and maintenance to streamline the work and proactively avoid repeated missteps.

But it's all still a work in progress, and Gyllenberg is mindful about the skilled expertise of their customers and philosophical questions around how much AI should be used to support their work.

A Conversation with Graphisoft

Graphisoft's Archicad revolutionised architectural design in the 1980s when it launched for the new Apple Macintosh. Today, as the industry's leading BIM software tool for architecture and design, it continues in that spirit of innovation with new AI-powered capabilities.

In 2023, it launched AI Visualizer for Archicad. By inputting a prompt based on the kind of building planned – for instance, a modern office building in Palo Alto, California, with a palette of Corten steel and rustic stone – the tool creates detailed 3D renderings.

AI Visualizer provides a kind of digital playdough for architects and designers to test how their ideas might look on a particular site and give clients a better picture of their ideas at the earliest stages. It's been a huge success with users, according to Miles Smith, Graphisoft's solutions manager.

'Within a matter of minutes, you bridge the gap from the very first inklings of architectural authorship all the way to the back end,' Smith said.

But Smith believes this is just the beginning of AI-powered solutions within Graphisoft. The next stage will focus on lifting building designers out of the mundanity of their day-to-day work. That might include AI-powered documentation, code compliance checking and HVAC and duct sizing.

These are essential tasks that are the cornerstone of the industry's responsibility to the public, but, according to Smith, not the work that gets most architects and designers excited about their profession. 'All of these things are actively being investigated right now, and the value proposition is being built around them,' he said. 'I think they're all within the realm of possibility.'

dTwin™
A NEMETSCHEK SOLUTION

Digital Twinning

Using AI, Internet of Things (IoT) sensors and other technology, digital twins are virtual replicas of existing buildings and can enhance real-time visibility into the building's operations and enable data-driven decision-making. Arup, the British professional services firm, estimates that digital twins can lead to a 15% to 20% reduction in variable operating costs for office buildings and a 10% to 15% improvement in tenant retention for office and industrial assets.

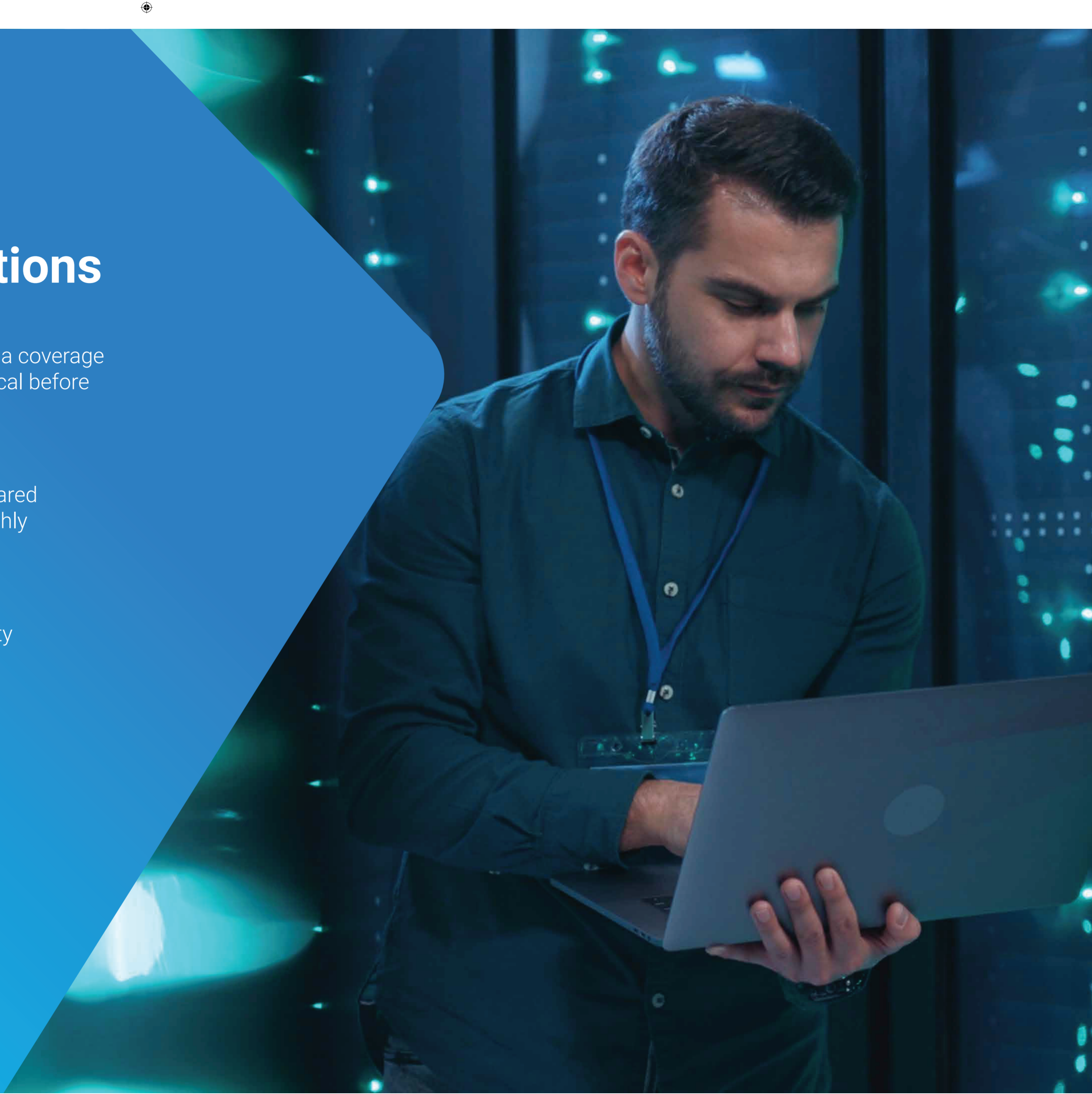**With digital twin solutions such as dTwin, users can:**

> Link data from disparate systems and sources, including IoT sensors.

> Collaborate across teams in real time to quickly address issues, such as a broken lift.

> Adjust energy use in real time to reflect building occupancy and needs.

AI's Challenges and Considerations

A full embrace of AI in construction will take time. That's OK. While media coverage may suggest most are rushing towards AI, careful deliberations are critical before its deployment.

Already, AI is helping bad actors, forcing organisations to strengthen cybersecurity measures. In 2023, Europol, a European police agency, shared that bad actors could "impersonate an organisation or individual in a highly realistic manner even with only a basic grasp of the English language," thanks to ChatGPT.

Indeed, AI experts are calling for caution. In 2023, the Center for AI Safety released a short, 22-word statement signed by hundreds of notable AI scientists and experts calling for 'mitigating the risk of extinction from AI' to become a global priority.

Before rushing into any AI tool:

Educate yourself: Follow the latest advancements and learn from industry leaders about how AI works and its potential uses.

Be transparent: Let colleagues, clients and other stakeholders know why and how you're using AI.

Stay in compliance: Across the United States as well as in Europe and China, lawmakers and regulators are debating and passing new laws aimed at limiting AI's use, reducing its potential to discriminate and protecting data privacy.

The Future Is AI

As the AECO industry seeks to lure young talent, AI may be part of the answer.

65%
of GenAI users are millennials and Gen Z.

52%
of Gen Z trust AI to help them make informed decisions.

Source: Salesforce's Generative AI Snapshot Research: The AI Divide

Getting Started with AI

Even if you're not ready to fully invest in AI tools, it's time to get ready for them. The tools are poised to allow the industry to deliver better value at reduced costs, accelerate collaboration, boost the sector's flagging productivity levels and address other challenges.

Here's how you can prepare for AI:

1 **Identify pain points:** What problems could AI solve for your business?

2 **Invest in data infrastructure:** Even if you don't plan to deploy AI now, ensure you have the right data infrastructure in place as you upgrade your technology.

3 **Strengthen data management:** Good data is required for effective AI algorithms, so ensure you're storing good data now – even before you deploy AI.

4 **Monitor and evaluate:** Stay abreast of the latest developments and AI use cases. Know what your competitors are doing.

5 **Upskill the workforce:** Find, nurture and train tech talent who have the skills to deploy AI now and into the future.

6 **Start small:** Wade into AI with a small pilot project. Consider partnering with an AI expert to guide your way.

AI at Bluebeam

Bluebeam has been focused on finding new ways to use technology to streamline processes for the AECO industry. Their goal is discovering creative solutions to the industry's toughest challenges, making life and work easier for the architects, engineers and contractors behind our built worlds.
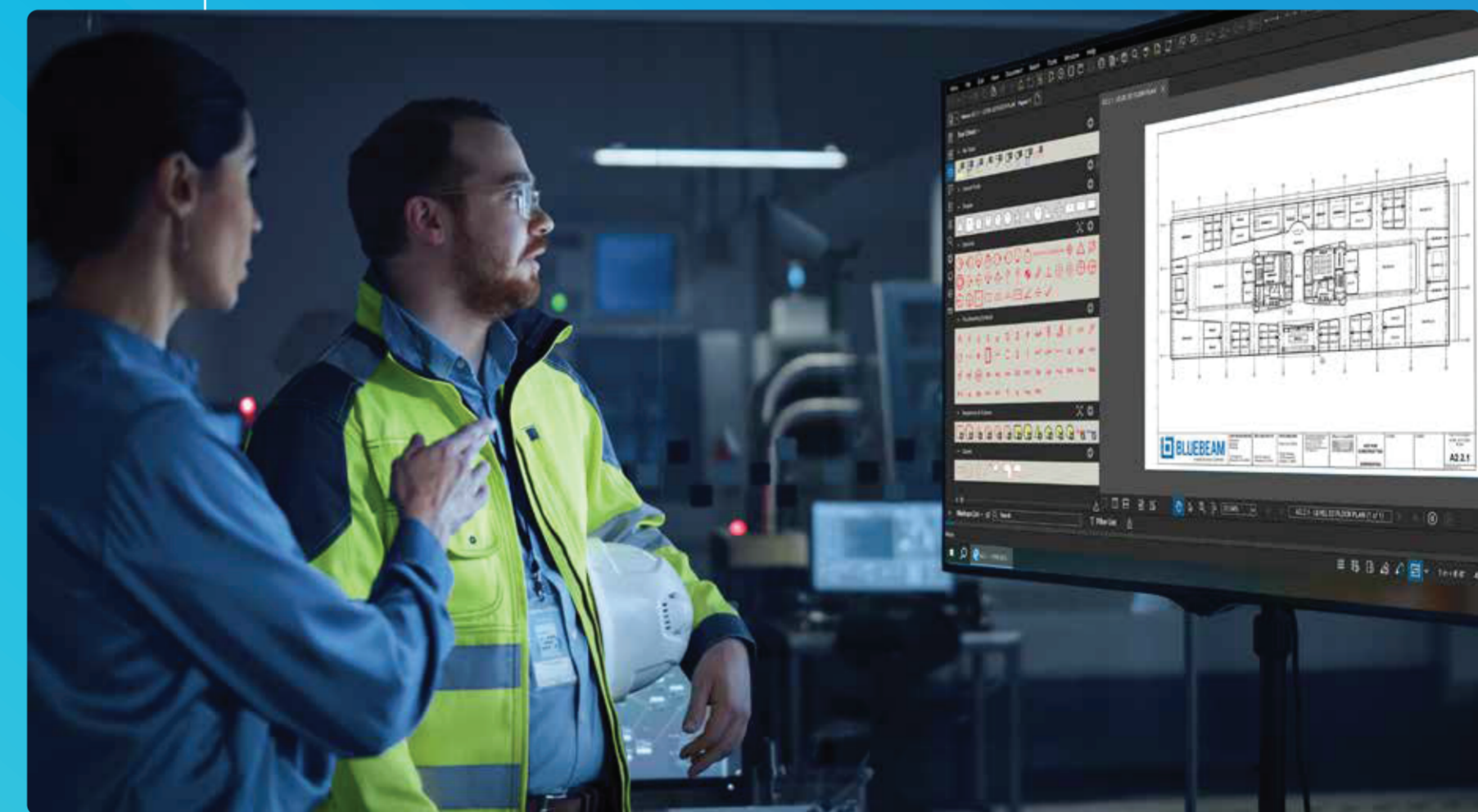
'We want to bring the industry forward,' said Don Jacob, Bluebeam's chief innovation officer and co-founder.
'We want to build a bridge.'

AI is behind some of their newest innovations, starting with three AI-powered tools that aim to save the industry time by removing mundane and repetitive tasks.

> Auto Align simplifies the tedious and error-prone process of aligning points on drawings.

> Automatic Title Block Recognition extracts key information from drawings to automate the creation of title blocks.

> 3D Drawings uses AI to position flat drawings into a 3D space, giving users a new way to visualise their projects.

And as they consider more innovations – using AI and other technologies – they've launched Bluebeam Labs, an innovation sandbox. There, they invite Bluebeam Cloud users to work together to shape the future of their solutions before they are shared with the world.

'With this emergent technology and the rate of change, there is a huge opportunity to solve this together with the industry,' Jacob said. 'We want to walk shoulder to shoulder with our customers and users to identify the best way to shape these tools.'