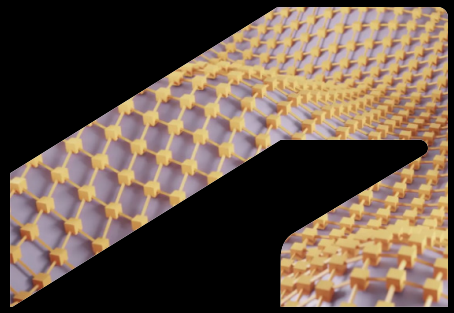
AUTODESK EBOOK

Understanding AI in construction

Contents



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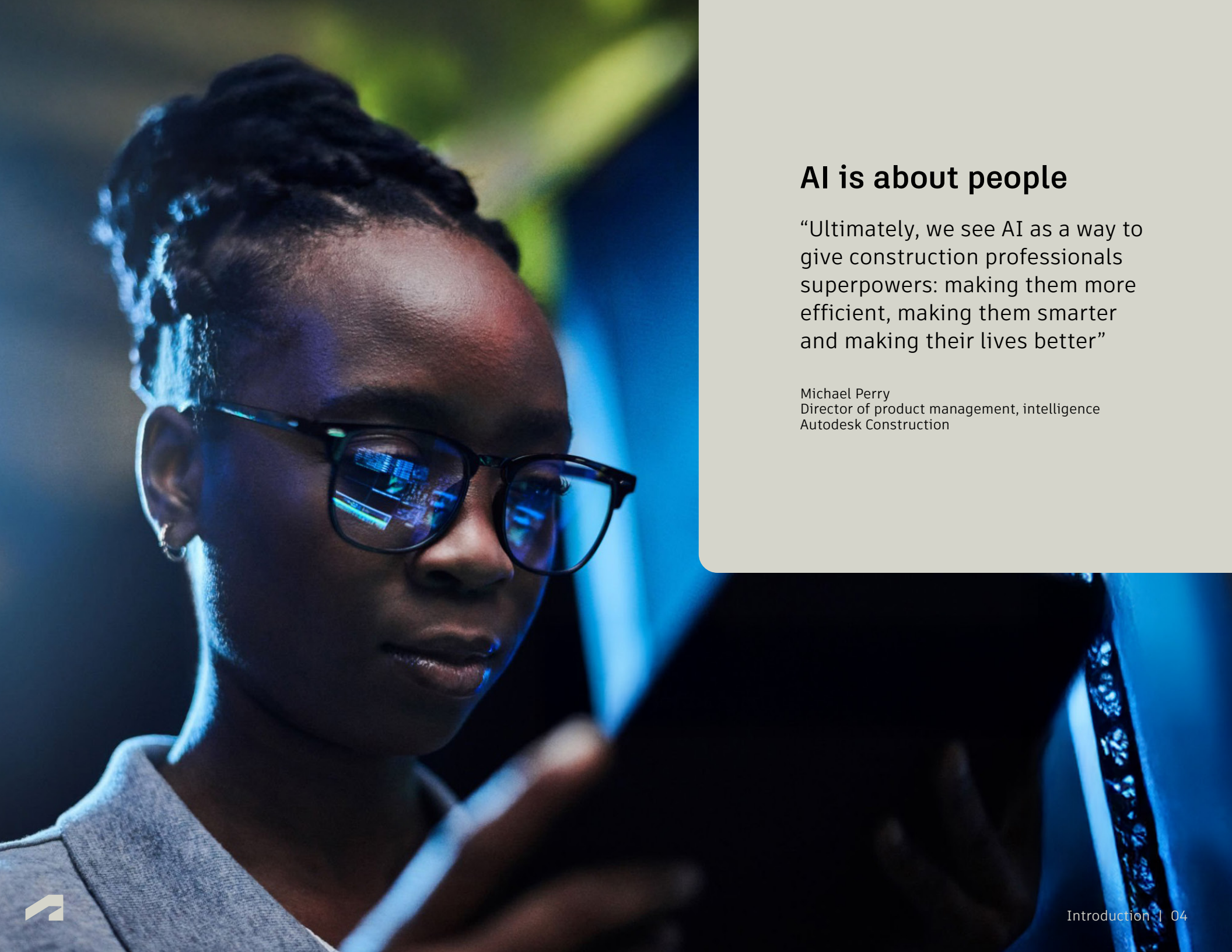
01

Introduction

Time for construction to embrace AI

While AI and neural networks have been around since the 1950s, the recent rise of generative AI – through tools such as ChatGPT – has made AI accessible, tangible and useful for countless organisations and people. It's been a tectonic shift for industry and society.

Considering the construction sector's ongoing challenges around delivering projects on time and on budget – as well as the many construction business insolvencies in recent years – it's time we embrace new AI solutions to long-standing issues.



AI is about people

"Ultimately, we see AI as a way to give construction professionals superpowers: making them more efficient, making them smarter and making their lives better"

Michael Perry
Director of product management, intelligence
Autodesk Construction

02

Defining AI and its benefits for construction

AI has already transformed business, with almost every industry embracing its potential.

Still, misconceptions and confusion around AI remain. So, what is AI and what can it offer construction?

Artificial intelligence

Artificial intelligence (AI) technology makes machines capable of performing tasks that typically require human intelligence – such as learning from experience, recognising patterns and understanding natural language.

Machine learning

AI powers machine learning (ML), where machines learn from data to predict outcomes on their own. For example, a machine could determine when it needs preventive maintenance based on its data analysis. ML also helps construction firms with cost estimation and safety monitoring.

Generative AI

Machine learning can power generative AI, which creates new content – from schedules to 3D designs.

Large language models

One kind of generative AI is a large language model (LLM), which specialises in processing and generating text. In construction, LLMs can give answers to technical queries, analyse contracts and generate reports.

Combined, these technologies offer benefits to the construction industry in three key areas.

Radical efficiency gains

Whether by offering rapid iterative design and analysis, streamlined quantity takeoffs or ease of access to all project data within a common data environment (CDE), AI frees up your teams' time to focus on the higher-value (and more rewarding) activities that need their specialised skills, creativity and judgement.

Early risk prevention

The best way to mitigate project risks is to prevent them. AI-powered intelligent tools can surface the right information sooner rather than later, preventing costly issues downstream.

Improved everyday decision-making

AI arms your teams with the data they need to make informed, timely decisions to minimise project risks or achieve desired project outcomes.

A wealth of use cases for AI tools

> AI will redefine construction operations:

AI-powered generative design tools will optimise architectural, structural and subsystems designs, reducing material waste and enhancing buildability.

Machine learning algorithms will predict project risks by analysing historical and real-time data, minimising delays and cost overruns in the near future.

Automation will expand beyond prefabrication to include autonomous equipment, such as drones for site surveys and robotics for repetitive tasks like bricklaying and welding.

AI-enhanced construction management platforms will streamline project coordination by integrating BIM with scheduling and procurement tools.

Safety will benefit significantly, with AI systems monitoring worker behaviour and site conditions to prevent accidents.

Predictive maintenance will ensure the longevity of equipment and structures, informed by sensor data processed through AI algorithms.

Sustainability efforts will also be enhanced, by AI analysing energy consumption and suggesting optimisations during the operational phase.

Eva Hernán García
Head of digital design and BIM strategy manager
CAF Turnkey & Engineering, Spain

03

Construction's AI future is here

Let’s deep-dive into the practical applications of AI on construction projects and share a few examples of AI-enabled capabilities already available to construction firms in Autodesk Construction Cloud.

Clearer paths to project success

“The beauty in AI-powered predictive insight is its ability to see what sometimes we as humans can easily miss, especially when working under the pressure of meeting deadlines.

Construction IQ is designed to grab your attention, enabling proactivity, analysis and action-taking. Knowing something might happen is important, but doing something before it does is what the ‘I’ in AI is all about – intelligence.”

Amit Puri
Senior manager of EMEA technical solutions
Autodesk Construction

Assessing and reducing risk

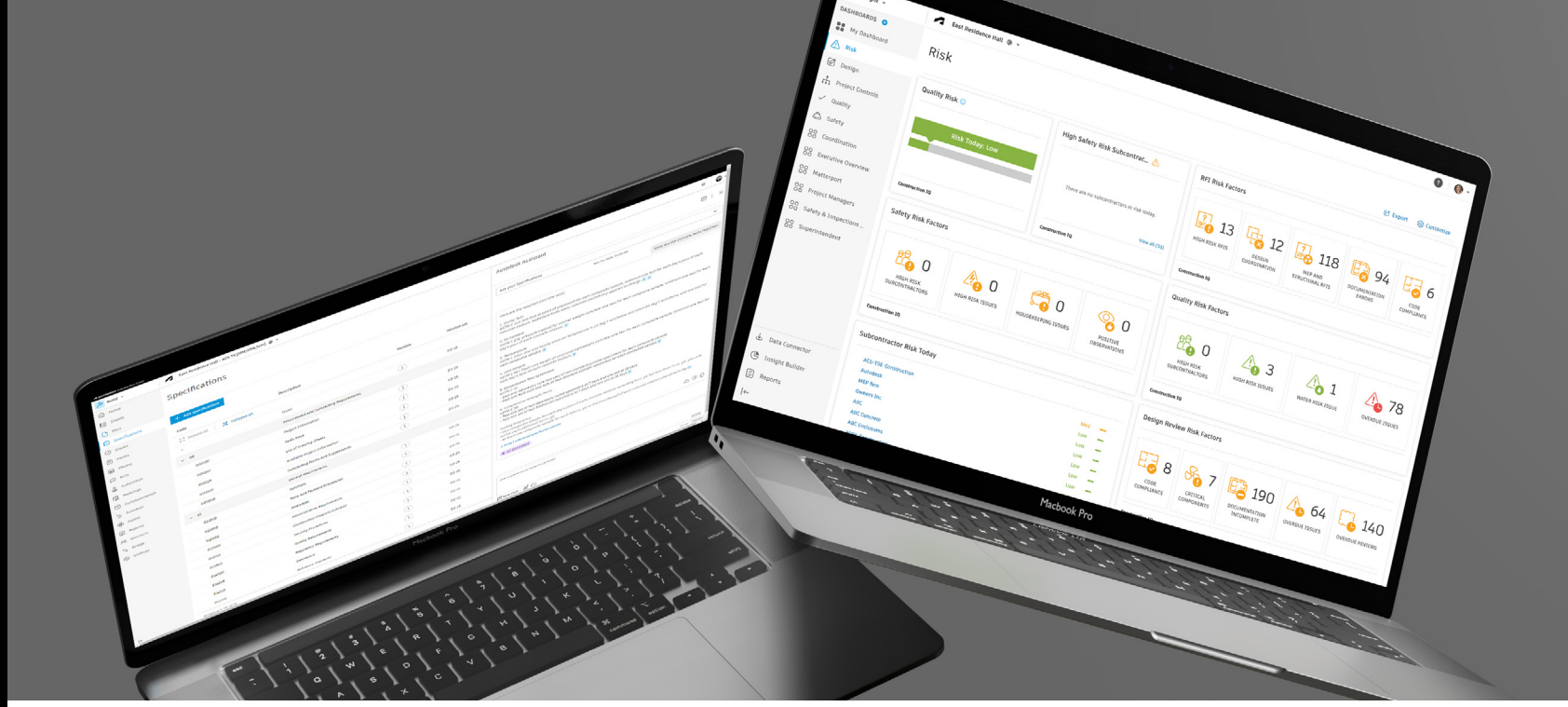
Inadequate risk identification and allocation increase the likelihood of project delays, cost overruns and financial losses – undermining the industry's ability to meet demand and deliver projects efficiently.

AI and machine learning can anticipate problems, measure their impact and use predictive analytics to help you reduce construction risks. This streamlines workflows as well as preventing issues.

Powered by Autodesk AI, Construction IQ sifts through data collected in the Autodesk Construction Cloud platform, including:

- issues
- observations
- subcontractor assignments
- related metadata
- historical data.

Construction IQ analyses this data to identify and prioritise design, quality, safety and cost risk factors each day. This lets project teams resolve high-risk areas before they have a cost or schedule impact downstream.



Increasing productivity

The construction industry is one of the least digitised, according to Forbes – a factor that has contributed to productivity growth of just 1% over the last two decades.[1]

According to Euroconstruct, the sector's relatively low efficiency comes down to a productivity gap that persists throughout the supply chain, across architecture, engineering, construction and operations (AECO). [2]

AI automates everyday workflows such as updating schedules, entering costs and creating RFIs. This improves productivity – both by completing these tasks more quickly and freeing up teams to focus on more complicated work. And as the labour shortage in construction persists, getting more from the workers we have will be crucial to growth.

A few examples of AI-powered productivity gains already in use include:

Photo auto tags

Every construction project collects several thousand photos. This flow of valuable information is impossible to manage manually, making it difficult for project teams to find all the photos they need.

Using AI, all photos captured in Autodesk Build are automatically tagged with up to 50 critical elements and categories. Custom tags are still available, so project teams remain in control of all tags for faster search, retrieval, standardisation and risk identification.

Document production and optimisation

Large language models handle tasks such as writing up tenders, specifications and operational method statements, and makes these complicated documents easier to understand.

LLMs can also summarise documents, pull out data and derive insights. This keeps teams up to date on all relevant information, preventing oversights, delays and miscommunication.

Automatic symbol detection

For years, estimators and quantity surveyors have preferred to do paper-based estimation using 2D plans and spreadsheets. Early digital quantity takeoff tools, where users had to manually select and count symbols, didn't offer enough efficiency to make digital transition attractive to construction firms.

Now, Autodesk Takeoff can automatically identify and count all similar symbols. The estimator remains in control – it's like having an assistant do the groundwork the estimator can review and edit if needed. Automatic symbol detection enhances the speed, accuracy and efficiency of the quantity takeoff process.

Improving sustainability

The ability to make data-driven sustainability decisions at the conceptual design stage is vital. By the time construction begins, there's little you can do to improve embodied carbon.

AI-powered generative conceptual design can perform energy analysis and estimate embodied carbon from a project's outset.

The Autodesk Forma early-stage planning and design tool uses AI and automation to help designers, planners and developers create, evaluate and optimise building designs with real-world data.

For example, Autodesk Forma can evaluate your framing and concrete slabs, strategically distributing pillars and floors to ensure structural integrity according to the criteria set by the design team. This gives you accurate material estimates and, in turn, estimates for embodied carbon.

Transformed decision-making and efficiency

“AI will play a pivotal role in optimising construction processes in 2025. By making the most of big data from BIM models, IoT devices and historical projects, AI will enhance data-driven decision-making, predicting risks and improving cost-effectiveness.

Automated design tools, such as generative AI, will enable rapid design standardisation and validation, significantly reducing errors and project timelines. Additionally, AI models will be employed for predictive maintenance, monitoring infrastructure to prevent failures and extending asset lifespans.”

Josha van Reij
Data and AI product owner Arcadis
The Netherlands

04

Why a common data environment is vital

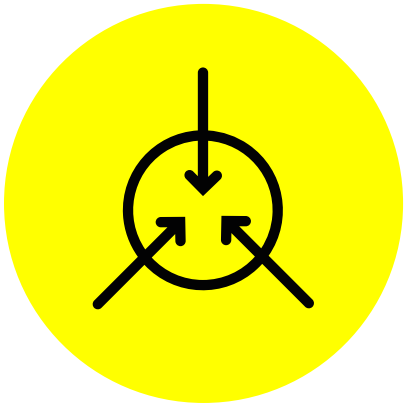
AI has the potential to revolutionise nearly all aspects of construction. AI systems, however, are only as strong as the data they're trained on. Reliable, high-quality data improves AI accuracy and creates more actionable insights that improve project outcomes.

For successful AI adoption, your business needs to manage project data in a common data environment (CDE) such as the Autodesk Construction Cloud platform.

Working in a CDE delivers benefits along key themes

Data centralisation

Data is often dispersed and unstructured. A CDE, on the other hand, is a single source of truth for data collection, management and dissemination. It ensures all relevant information is stored in one reliable location, creating:



Efficiency

Centralising data makes it easier for AI systems to access the large datasets they need for effective training. This saves time and reduces the risk of missing important data.

Consistency

A CDE reduces data redundancy and inconsistencies, as all team members and systems pull from the same dataset. It also runs validation checks to prevent the entry of erroneous or duplicate data, for more reliable project outcomes.

Real-time accessibility

A cloud-based CDE is always available to all team members, from the office to the construction site. Real-time data is particularly beneficial for dynamic project environments, where quick decisions are needed.

Data standardisation

A CDE standardises how data is stored and formatted, establishing uniform protocols for data management. Standardisation is also crucial to AI success, providing:

Structure

AI systems require structured and consistent data to function optimally. Standardisation removes discrepancies and harmonises data formats.

Interoperability

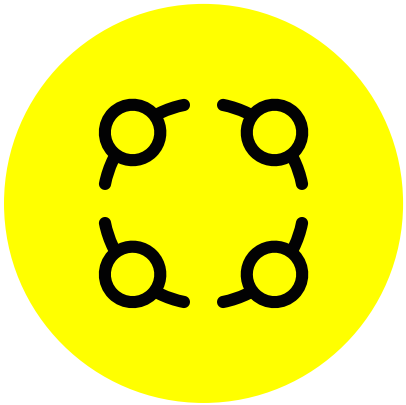
A CDE enables smoother integration with AI tools and platforms. This allows different software and systems to work together seamlessly and efficiently.

Quality

Standardised data entry protocols reduce errors and improve data reliability and accuracy. This is essential for AI to generate accurate insights and predictions.

Data collaboration

As a centralised platform, a CDE fosters better collaboration and data sharing, and streamlines how teams share information. In turn, better collaboration improves the quality and depth of the data available for AI training and analysis. Benefits of a CDE solution include:



Ease of use

A user-friendly interface is key for non-technical users to interact with AI tools. This ensures all team members, regardless of technical expertise, can use data effectively.

Security

Permissions management gives stakeholders access to the data they need to collaborate productively—while protecting data privacy and security.

Enrichment

Diverse data sources and inputs enrich data and enhance AI training. Rich data sets help AI systems learn more effectively and produce more nuanced insights.

Innovation

As teams share data and insights, they achieve better project outcomes. Access to a wide range of data and perspectives fosters creativity and problem-solving.

In short, a CDE is foundational for AI application across the lifecycle of a project or asset. It centralises, standardises and improves data quality while making it more accessible, all while fostering collaboration and sharing. This improves the effectiveness of AI systems, leading to better project outcomes and more efficient operations.

The transformative power of AI

"AI thrives on consistent data and streamlined workflows, becoming a catalyst for transitioning from reactive to proactive decision-making.

AI's transformative power lies in its ability to empower, not merely replace, human decision-making. However, organisations must make the conscious choice to create the connected systems AI needs to flourish. The question is not whether AI will revolutionise construction but whether companies will be ready when it does."

Paulo Figueiredo
Associate director, digital innovation
WSP, UK

05

Case study

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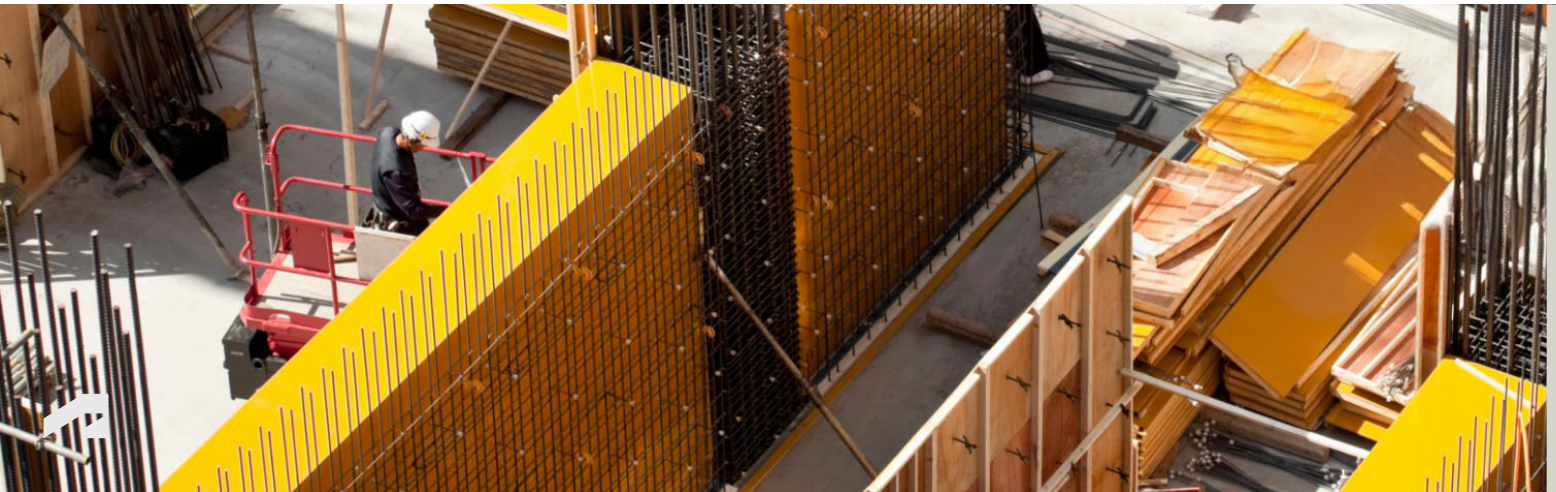
Converge cuts costs and carbon by pairing AI with Autodesk Platform Services

On most construction sites, a guessing game with concrete wastes both time and materials. Crews have long relied on cumbersome methods like wired sensors, or wasteful techniques like cube crushing, to determine when concrete has reached strength.

Converge's ConcreteDNA eliminates guesswork and waste, bringing together wireless sensors, AI and building information models (BIM) to create predictive digital twins built on Autodesk Platform Services.



ConcreteDNA's wireless sensors embed into concrete pours to provide real-time curing data. By feeding those sensor readings into cloud-based models powered by the Viewer and Model Derivative API, the solution transforms into a concrete digital twin.

Project managers can access sensor data in context of the build, easily checking precise sections of concrete.

An AI-based engine generates strength predictions, giving certainty about when to progress work at the earliest opportunity—typically 30% faster than with traditional methods.

With no need for cube crushing, material waste is reduced. And with advanced analytics, concrete mix performance data can inform more sustainable design mixes that hold less embodied carbon.

READ THE FULL STORY →

Turning data into insight

"Data on its own is useless. Using Autodesk Platform Services to organise and surface data in the context of a model is what highlights the insights we produce that can transform processes. This is key to how we achieve the holy grail of construction: less cost and less carbon."

Gideon Farrell
Co-founder and CTO
Converge, UK

06

Key success factors in adopting construction AI

The construction industry is on the verge of a significant transformation, driven by AI and data technologies.

Embracing AI isn't just about adopting new tools – it requires a strategic shift in how we manage data, collaborate and innovate.

AI integration, supported by a robust CDE, promises to unlock new levels of efficiency, safety and sustainability in construction. It's crucial to embrace this change proactively. Here's how to start.

Invest in the right technology partner

Choosing a technology partner is key to building a successful AI integration strategy. In an industry with as many variables as construction, it's important to have an AI solutions partner that understands your company's specific needs and challenges. This level of support is critical, to implement AI successfully and reap the rewards.

Autodesk is well positioned to help you build AI capabilities in your firm, thanks to our:

- **Industry-specific data:** General language models are trained on publicly available data. But as an industry-focused provider – with decades of global experience in design, construction and building – Autodesk can deliver industry-focused intelligence and insights. Our technology securely searches and queries your project data, using LLMs for natural language processing.

- **Knowledgeable partnership:** Our customers are experts, with experience across a range of projects and regions. Autodesk sees opportunities for AI to automate, deliver insights and provide design alternatives, always with an expert in control. AI serves as a digital assistant, but the construction professional provides guidance and governance, controlling the final outcomes.

- **Responsible approach:** These advantages are underpinned by Autodesk's promise to bring AI solutions to market in a responsible way, with privacy and security as the top priority.

Autodesk's approach to AI

Construction-specific data

We built our AI model specifically for construction by learning from your projects to provide real project data.

Strong AEC foundation

By applying LLM technology to our decades of global AEC industry experience, we deliver a more focused AI.

Contextualised assistance

Powered by AI, Autodesk Assistant in Autodesk Construction Cloud optimises construction workflows, while giving you full review and control.

Privacy and security

You can trust us to bring AI solutions to market in a responsible way, that meets our pillars of transparency, caring, reliability and capability.

VISIT OUR TRUST CENTRE →

Develop a digitally skilled workforce

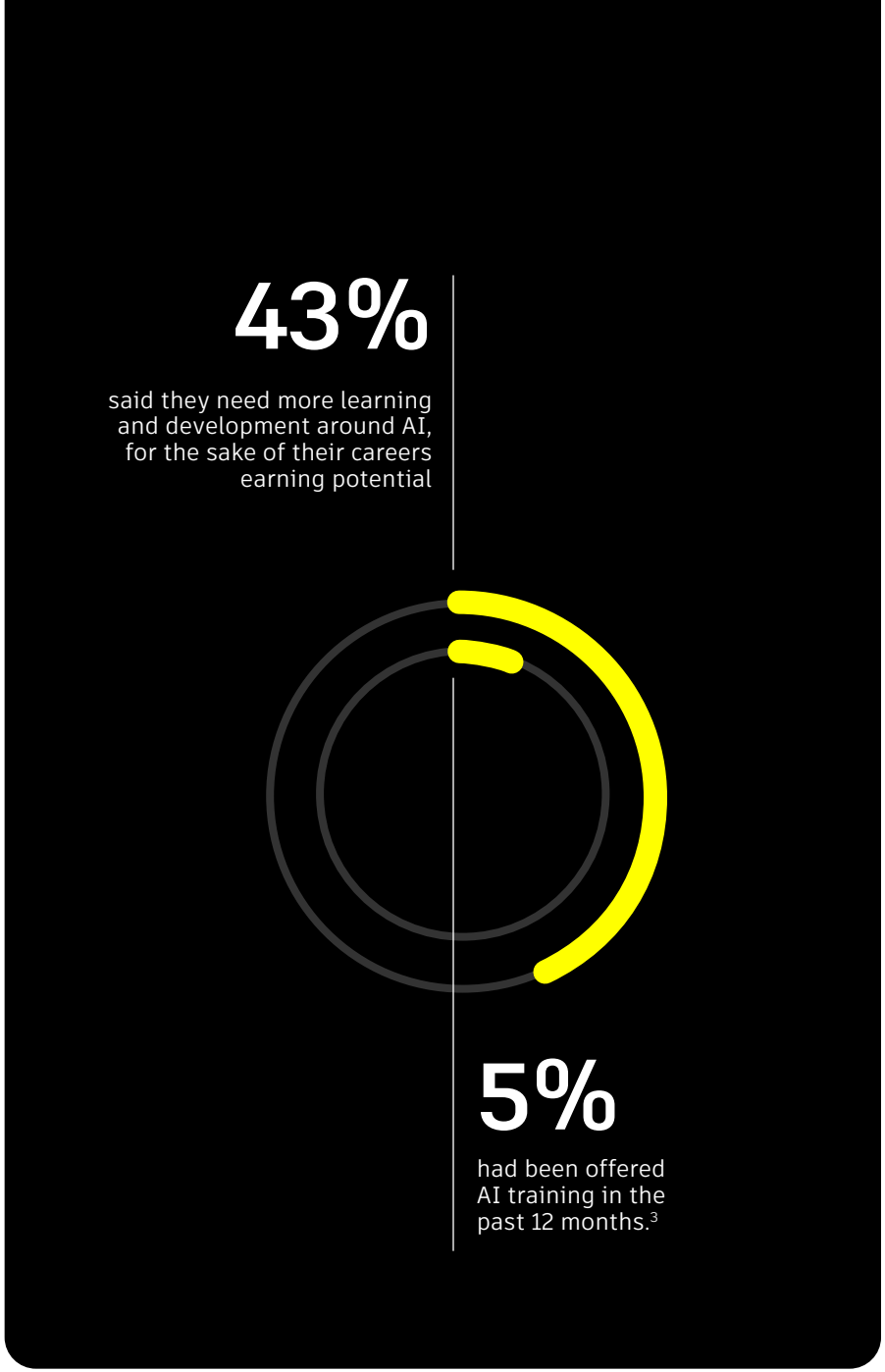
Construction is a human endeavour and will remain so. It is important, however, for stakeholders to learn to work side-by-side with AI.

Ranstad UK's 2024 Employer Brand Research explored how construction industry professionals feel about AI. Of the people surveyed, 43% said they need more learning and development around AI, for the sake of their careers earning potential. By contrast, only 5% had been offered AI training in the past 12 months.[3]

The workforce's skills, expertise and ability to innovate are essential to future success. So it's crucial to provide training and development opportunities to improve your team's AI and data analytics skills.

Foster a culture of innovation

Create an environment that encourages experimentation and collaboration across teams. By encouraging a forward-thinking, collaborative mindset, organisations can adapt to industry trends and maintain a competitive edge.



Future trends in AI

“We have all heard the expression ‘data is the new gold’, and no doubt AI will feature heavily in 2025 as organisations seek to maximise the profitability and benefits from this valuable commodity.

The use of AI will likely be focused first on the quick wins, for example, the collation and formatting of data and initial design renderings, as the available tools for wider uses develop into viable products.

I expect the fear and hesitancy of using AI will disappear as it becomes as common as using Google to search for the answer to a query. Client requests or acceptance of the use of AI tools and platforms will likely become a more regular occurrence in bids and proposals in many key regions, with the resulting necessity to develop standardised internal processes and documentation to implement them.”

May Winfield
Global director of commercial, legal and digital risks
Buro Happold, UK

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See the future of connected construction

construction.autodesk.eu

The construction industry requires solutions that connect their information, teams and technology – breaking down data silos and disconnected processes that hinder true transformation.

As we're pushed to do more with less, we need to uncover new ways of working, enhance connected digital workflows and incorporate advanced analytics. This transformation must lean into tools that connect construction – from design to plan, build, handover and operations.

Built on a unified platform and common data environment, Autodesk Construction Cloud is a powerful and complete portfolio of construction management products that empowers general contractors, specialty trades, designers and owners to drive better business outcomes.

Autodesk Construction Cloud combines advanced technology, a unique builders' network and predictive insights to connect teams, workflows and data across the entire building lifecycle.

While the industry experiences unprecedented transformation, our mission remains the same: to help construction teams meet the world's rapidly expanding building and infrastructure needs – while making construction more predictable, safe and sustainable.

We've remained steadfast in our promise to deliver the industry's most compelling solutions for connecting data, teams and workflows from the construction site. This is our commitment to connected construction.

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References

1. Generative AI in the construction sector: taking building technology to new heights, Forbes, 2023

2. Productivity in construction, something is changing: The path through a digital construction sector, Euroconstruct, 2023

3. AI in the construction industry, Randstad UK, 2024

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Autodesk is changing how the world is designed and made. Our technology spans architecture, engineering, construction, product design, manufacturing, media, and entertainment, empowering innovators everywhere to solve challenges big and small.

From greener buildings to smarter products to more mesmerising blockbusters, Autodesk software helps our customers to design and make a better world for all.

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