AUTODESK
Construction Cloud

AI in Construction:
Steps to Success and Value Realisation

Table of Contents

Introduction

The meteoric rise of artificial intelligence (AI)in the past months has created a tectonic shift in various aspects of industry and society. While AI and neural networks have been around since the 1950's, the emergence of Generative AI with ChatGPT made AI accessible, tangible and useful for vast numbers of organisations and people.

Joint research by Deloitte and Autodesk found that 30% of surveyed construction businesses in key Asia Pacific markets are currently using AI and Machine Learning (ML), while 38% plan to do so in the future.

According to Accenture Research, applying AI could lead to profit increases by 71 percent for the construction industry by 2035.[2] AI and advanced data analytics technology could bring cost savings of 10% to 15% for construction projects.[3]

In light of the sector's ongoing challenges around the capacity to deliver projects, and deliver them on time and within budget, as well as the high number of construction business insolvencies in recent years, it is imperative for the industry to embrace solutions that can address long-standing issues.

In this eBook, we will explore the top use cases of AI in construction and how they benefit construction projects. We will explain why managing data in a Common Data Environment is the critical backbone for successful AI integration. The success stories and insights from Asia Pacific construction industry leaders will provide further guidance on the key opportunities in AI.

> "Over the next five to 10 years, AI and construction is going to be all about augmenting people, making people more efficient, making them smarter, and making their lives better."

Pat Keaney, Director of Product Management, Intelligence at Autodesk Construction R&D

Understanding AI, Machine Learning, and Deep Learning in Construction

The rapid growth of AI marks a transformative era in business, with almost every industry embracing its potential. Yet there remains a lot of misconceptions around AI – so what is it and what role can it play in construction?

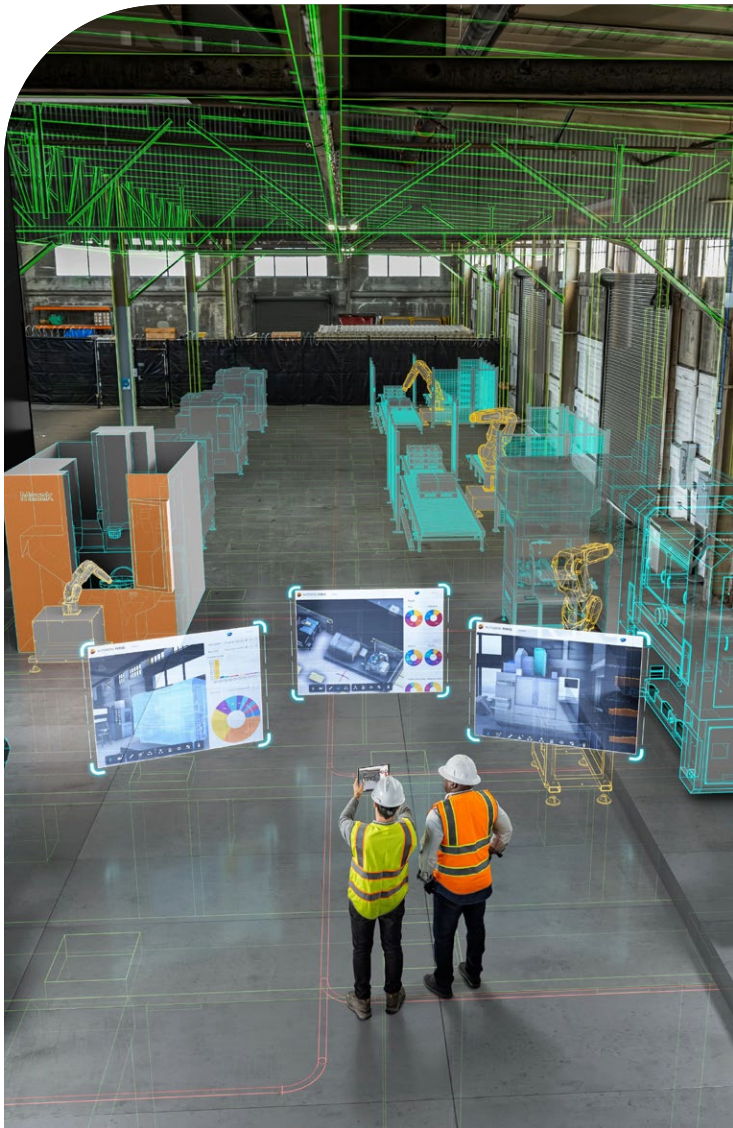
Before diving into the subject, let's ensure we cover the basics, especially if you're not yet familiar with AI, machine learning, and deep learning. These terms are often used interchangeably, but they have distinct meanings.

Firstly, **artificial intelligence (AI)** is a broad field in computer science focused on creating smart machines capable of performing tasks that typically require human intelligence. These tasks include learning from experience, recognizing patterns, and understanding natural language.

Machine learning is a subset of AI. Simply put, it involves machines learning and predicting outcomes on their own. Instead of being explicitly programmed, machines use algorithms to analyze data and make predictions. For instance, a machine can determine when it needs preventive maintenance based on its data analysis.

Deep learning, a subset of machine learning, involves teaching machines to learn and make decisions using artificial neural networks, specifically deep neural networks (DNN). Deep learning excels at handling large volumes of complex data.

So what can these technologies do for construction?



Practical Applications of AI and Their Benefits to Construction Projects

As the certified game changer in the construction industry, AI can significantly increase profitability and dramatically reduce project costs. The tangible benefits of AI primarily centre on the following areas:

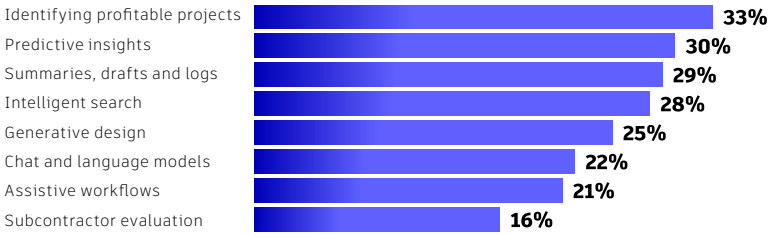
Radical efficiency gains. Whether it's rapid iterative design and analysis, automated takeoff, or getting access to all project data, AI frees up time from non-optimal work. Project teams can devote more energy to high-order activity that involve creative and human judgement.

Early prevention of construction risk. The best way to mitigate project risks and issues is to prevent them from happening in the first place. AI-powered intelligent tools can surface the right information sooner rather than later. By identifying and preventing problems during the early stages of the project, construction firms can avoid costly issues downstream.

Improve everyday decision-making. Teams are armed with the information they need to make informed, timely decisions to minimise project risks or achieve desired project outcomes.

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

Highest Priority Use Cases of AI in Construction in Key APAC Markets



Source: State of Digital Adoption in Construction Report 2024, Deloitte and Autodesk, April 2024.

Autodesk's Approach to Construction AI

At Autodesk, we see the use cases of AI focused on three categories.

Analyse
Surface actionable insights from vast amounts of complex, structured or unstructured data.

Automate
Reduce repetitive, manual work to catapult productivity.

Augment
Enhances creativity, improving quality, breadth of thinking and communication.

Assess and Reduce 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.

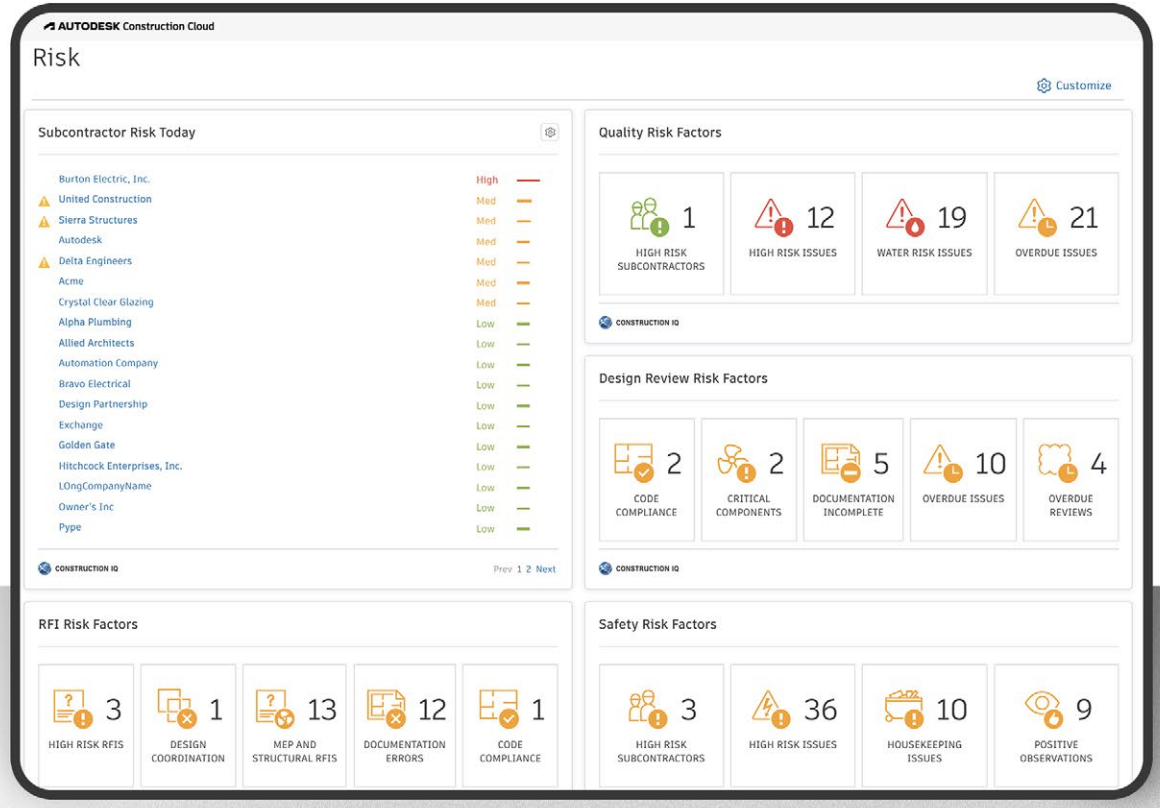
One of the truly amazing capabilities of AI in construction is it can identify risks before they happen. This helps humans increase awareness of potential pitfalls and figure out how to prevent problems from arising.

AI and machine learning can anticipate problems, measure their impact, and use predictive analytics to help you reduce construction risks.

Powered by Autodesk AI, Construction IQ sifts through data collected in the Autodesk Construction Cloud platform --including issues, observations, subcontractor assignments, related metadata, and historical data – to analyse, identify and prioritise risk factors each day. Using predictive insights from Construction IQ to mitigate risks in design, quality, safety or cost, project teams can resolve issues before they have a cost or schedule impact downstream. These AI-powered capabilities have the potential to help construction managers streamline their workflows and prevent problems.

> "We're also leveraging AI to automatically identify root causes of RFIs and to continuously identify high risk issues by tracking progress, predicting safety incidents, etc. This stuff is happening literally every single day in construction."

Pat Keaney, Director of Product Management, Intelligence at Autodesk Construction R&D



Increase Productivity

According to Infrastructure Australia's Market Capacity 2023 Report, productivity in the construction sector has stagnated for over 30 years.[4]

While many construction processes are highly manual, incorporating AI will automate everyday workflows such as updating schedules, entering costs, and creating RFIs. By removing these repetitive, menial tasks, AI can help improve productivity, freeing up workers to focus on more complicated tasks.

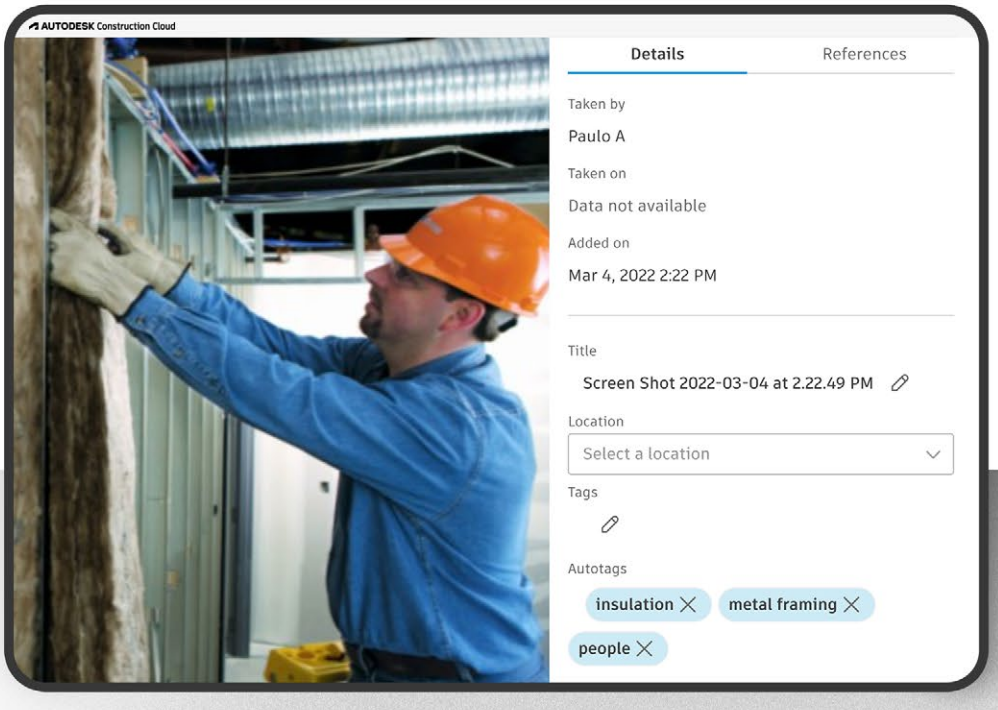
Photo Autotags. Every construction project collects several thousand photos. While the value of photos is understood, how do organisations keep up with managing photos so project teams can find relevant photos when needed? It is an impossible task to do manually because the photos keep streaming in.

Now, all photos captured in Autodesk Build are automatically tagged with up to 50 critical elements and categories. 86% of all photos in Autodesk Build have one or more tags. Custom tags are still available so project teams remain in control of all tags.

AI in the form of language models will have an impact on tasks like writing up tenders, specifications and operational method statements, helping make these complicated documents easier to understand with the added capability to summarise documents, pull out data and derive insights. This will ensure workers are aware of all relevant information to eliminate oversights, delays or miscommunication errors.

Automatic Symbol Detection. For years, estimators have preferred to do paper-based estimation using 2D plans and spreadsheets. Early digital takeoff tools did not make that process efficient enough for digital transition to be attractive.

Now, instead of a user having to manually select and count all symbols, Autodesk Takeoff can automatically find all similar symbols. The estimator remains in control - it is like having an assistant do the mundane work so they can review and edit if needed. Not only is the data captured, quantity takeoff is now faster and less error-prone.



Improve Sustainability

Generative Conceptual Design is being used today to do energy analysis and to estimate embodied carbon. Autodesk research showed us that as much as 70% of the decisions that impact sustainability of a project are decisions that are made during conceptual design. By the time you get to construction, there is very little you can do to improve the embodied carbon.

The Autodesk Forma conceptual design tool looks at framing and the concrete slabs and attempts to distribute pillars and floors in a structurally sound manner based on criteria defined by the Design teams.

This provides organisations accurate estimates of these materials and, in turn, estimates for embodied carbon.

> "AI will definitely take the construction industry in 2024. AI will be the assistant project manager that predicts problems, offers real-time insights, decision support, and keeps the budgets on track. Equipment powered by AI will be thing, like CCTV AI that predicts the risks in the construction site and maybe wearables that monitors and tracks the team in every move. With the help of generative AI, designs will come straight out with a simple click. And Digital Twins will be integrated with AI that provides automated predictive analysis and modelling and clash detection."

Mark Jason Villanueva,
Corporate BIM Manager, Newcon Builders Pte. Ltd.

Attract a Tech-Savvy Workforce

Infrastructure Australia has predicted a shortage of 229,000 full-time infrastructure workers in October 2023, with shortages expected in all occupational groups.[4]

The main reason for businesses delaying the adoption of digital technology is a lack of digital skills in the workforce, with 44 per cent of businesses reluctant to integrate new technology simply because workers did not know how to use the software or tool.[6]

With the advent of AI in construction comes the same trepidations about emerging technologies, but once mastered, workers will have the skills and confidence to utilise AI and other related digital technologies. Not to mention, there will be an emergence of new roles in the sector that are directly linked to the development and implementation of AI for construction purposes, unlocking more jobs for new workers and re-skilling opportunities for existing ones.

Why Data is the Foundation for AI in Construction

Disruptive technologies such as AI have the potential to revolutionise various facets of the construction industry, ranging from design and planning to project management. If AI adoption is to be successful, however, businesses first need to adopt a Common Data Environment.

Adopting a Common Data Environment (CDE) for Construction AI

A Common Data Environment (CDE) is indeed a crucial first step towards AI adoption, particularly in areas like construction, design, and project management where data is often dispersed and unstructured. Here's a detailed look at why a CDE is so important:

Data Centralization

A CDE serves as a single source of truth for the collection, management, and dissemination of data. It ensures that all relevant information is stored in one location, providing a unified and reliable data source.

- **Efficiency:** Centralising data ensures that all relevant information is stored in one location, making it easier for AI systems to access the large datasets they need for effective training. This central repository eliminates the need to search through multiple sources, saving time and reducing the risk of missing important data.
- **Eliminates Redundancy:** This approach reduces data redundancy and inconsistencies, as all team members and systems pull from the same dataset. By having a unified data source, duplication of effort and conflicting data are minimized, which leads to more reliable project outcomes.
- **Streamlined Access:** Facilitates quick and easy access to necessary data, enhancing decision-making and operational efficiency. Users can retrieve the information they need promptly, which is particularly useful in fast-paced project environments.

  A CDE that is cloud-based ensures that this single source of truth is available to all team members, from the boardroom to the work site, at all times. This constant availability supports dynamic and flexible workflows, essential for modern project management.

> "In 2024, the construction industry see new advancements in AI technology. In the short term, firms will leverage large language models (LLMs) to automate tasks like object recognition and document extraction. In the longer term, organizations will be looking to develop data schemas and governance to get more robust insights, trends, and predictions.
>
> AI is a highly valuable tool in construction, but its success is reliant on accurate and up-to-date datasets. 2024 will be the year that organizations focus on the fundamentals, prioritizing robust procedures and policies to maintain the protection, security, and privacy of these datasets. Ultimately, this focus will help enable socially responsible AI utilization."

Matt Hayward, Kaiwhakahaere Matihiko Whenua me te Wai Aotearoa, Aurecon (Digital Lead, Land and Water New Zealand, Aurecon)

Data Standardisation

CDEs standardize how data is stored and formatted, establishing uniform protocols for data management. This ensures consistency across the board, making it easier for teams to access and interpret data accurately and efficiently. By creating a standardised structure, CDEs eliminate discrepancies and streamline data integration processes, ultimately enhancing the reliability and usability of the information.

- **Consistency:** AI systems require structured and consistent data to function optimally. Standardisation removes discrepancies and harmonizes data formats, which is crucial for effective AI training and application.
- **Interoperability:** Makes it easier to integrate with various AI tools and platforms, which often rely on standardised data formats to function correctly. This interoperability allows different software and systems to work together seamlessly, enhancing overall project efficiency.
- **Quality Control:** Reduces errors and improves the reliability of data by enforcing standardised data entry protocols. Standardization helps in maintaining high data quality, which is essential for AI to generate accurate insights and predictions.

Data Quality

CDEs enhance the quality of data by providing a controlled environment for data entry and management.

- **Accuracy:** Ensures that data is accurate, complete, and up-to-date, which is essential for effective AI training and deployment. Accurate data is the foundation for building reliable AI models that can predict and analyze effectively.
- **Validation:** Implements validation checks to prevent the entry of erroneous or duplicate data. This validation process is vital for maintaining data integrity and trustworthiness.
- **Better Outcomes:** High-quality data leads to more accurate AI models and better predictive performance, as AI systems are only as good as the data they are trained on. Reliable data translates into actionable insights that can significantly improve project outcomes.

Data Accessibility

A CDE improves data accessibility, making it easier for AI systems to retrieve the data they need.

- **Ease of Use:** Provides a user-friendly interface for data access, which can be crucial for non-technical users to interact with AI tools. This accessibility ensures that all team members, regardless of technical expertise, can utilize the data effectively.
- **Real-Time Access:** Facilitates real-time data access, enabling AI systems to deliver timely insights and predictions. Real-time data is particularly beneficial for dynamic project environments where decisions need to be made quickly.
- **Permissions Management:** Ensures secure and controlled access to data, allowing only authorized personnel to access sensitive information. Proper permissions management protects data privacy and security, which is crucial for maintaining stakeholder trust.

Collaboration and Sharing

CDEs foster better collaboration and data sharing among project stakeholders by providing a centralized platform where all relevant data is stored and easily accessible. This promotes a collaborative environment where different teams can share data effortlessly, leading to more comprehensive datasets.

Enhanced collaboration improves the overall quality and depth of the data available for AI training and analysis, ensuring that AI systems are built on a robust foundation of diverse and rich data inputs.

- **Data Enrichment:** Diverse data sources and inputs improve the richness and diversity of the data, which can enhance AI training. Rich data sets enable AI systems to learn more effectively and produce more nuanced insights.
- **Innovation:** Facilitates innovative solutions by allowing different teams to leverage shared data and insights, driving better project outcomes. Access to a wide range of data and perspectives fosters creativity and innovation in problem-solving.

A Common Data Environment (CDE) is foundational for AI integration in construction, design, and project management. It centralizes, standardizes, improves the quality of, and makes data more accessible, all while fostering collaboration and sharing. These factors collectively enhance the effectiveness of AI systems, leading to better project outcomes and more efficient operations.

Enhancing Sunway Group's Search Capabilities with ChatGPT and Autodesk Construction Cloud

Sunway Group, builders of major Malaysian landmarks like Legoland Malaysia, needed a more efficient way to retrieve information from their extensive database. While Autodesk Construction Cloud provided a robust Common Data Environment (CDE), the challenge was that Sunway has a large database of knowledge articles.

William Wong, Senior Engineer at Sunway, saw the potential to enhance the search capabilities by integrating OpenAI's ChatGPT API with Autodesk Construction Cloud. This innovation leveraged the platform's strong data management and collaboration features while introducing semantic search capabilities. "The AI could understand the meaning and intent behind the user's question, providing more accurate results," said William.

The integration significantly improved the accuracy and relevance of search results. By combining Autodesk Construction Cloud's powerful CDE with ChatGPT's semantic understanding, Sunway enhanced its information retrieval processes. This solution ensured that users quickly found relevant information, supported by GPT-generated summaries, images, graphs, and direct document links.

READ THE FULL STORY HERE >

> "The hard part will be convincing people to use it. We have to show how AI is going to change people's lives and show them that AI is not actually replacing our jobs. AI is definitely the future, so let's embrace it."
>
> **– William Wong, Senior Engineer, Sunway Group**

Key Success Factors in Construction AI Adoption

The construction industry is on the cusp of a significant transformation, driven by AI and data technologies. Embracing AI is not just about adopting new tools; it requires a strategic shift in how we manage data, collaborate, and innovate. The integration of AI, supported by a robust CDE, promises to unlock new levels of efficiency, safety, and sustainability in construction. It is crucial to embrace this change proactively. Here are actionable steps to take:

Invest in the Right Technology Partner: Choosing an AI technology partner that has construction industry expertise, solutions and support is critical to implementing AI successfully and reaping rewards from innovation.

Autodesk is in the best position to work with you on building these AI capabilities in your firm for a number of reasons.

Firstly, general language models are trained on vast amounts of public available data. Autodesk is an industry focused provider with decades of global experience in the design, construction, and building operations. This deep industry domain and data expertise ensures that Autodesk can deliver more industry focused intelligence and insights. Our technology will securely search and query your project data, while leveraging larger language models for natural language processing.

Virtually all Autodesk AI is expert assistance. Our customers are industry experts and this industry has a lot of variability across projects and regions. For the foreseeable future, Autodesk sees opportunities for AI to automate, provide insights, and provide design alternatives, but always with the expert in control. AI will serve as a digital assistant, but the professional will still provide guidance and governance, controlling the final outcomes.

These advantages are underpinned by Autodesk's promise to bring these AI solutions to market in a responsible manner with privacy and security as the utmost priority.

Construction Specific

AI model built specifically for construction by learning from your project data to provide the most accurate insights

Strong AEC Foundation

Combining the technology of LLM's with our decades of global AEC industry experience to deliver more focused AI

Contextualized Assistance

AI-generated assistance in the context of construction workflows while maintaining full review and control

Privacy & Security

Trust us to bring AI solutions to market in a responsible manner that meets our pillars of transparency, caring, reliability, and capability.

Visit our Trust Center

Develop a Skilled Workforce: Construction is fundamentally a human endeavour, and it will remain so. Our workforce's skills, expertise, and innovation are essential to our future success Therefore, it is crucial to provide training and development opportunities to build AI and data analytics skills within your team. In fact, a study by McKinsey found that companies in APAC that invest in training programs are 60% more likely to successfully implement AI.[5]

Foster a Culture of Innovation: This involves creating an environment that encourages experimentation and collaboration across teams. By encouraging a forward-thinking, collaborative mindset, organizations can adapt to industry trends and maintain a competitive edge.

> "I don't think AI will replace the man on the ground to pour cement or lay bricks in 2024 just yet. But I think AI (in the form of large language models) will have a profound impact in the office when it comes to writing up tenders, specifications, operational method statements and anything else that requires writing. Construction as an industry is notorious for having many long documents that sit in repositories and to find information is difficult. AI will simplify that process and save time through generative search to find and summarize information for the end user."

John Lim Ji Xiong
Chief Digital Officer, Gamuda Bhd

References

[1] State of Digital Adoption in the Construction Industry 2024
Deloitte Access Economics, 2024

[2] Accenture Report: Artificial Intelligence Has Potential to Increase Corporate Profitability in 16 Industries by an Average of 38 Percent by 2035
Accenture, 2017

[3] The Age with...AI in Construction and Infrastructure
Deloitte, 2020

[4] Market Capacity Report 2023
Infrastructure Australia, 2023

[5] The state of AI in 2021
McKinsey Analytics, 2021

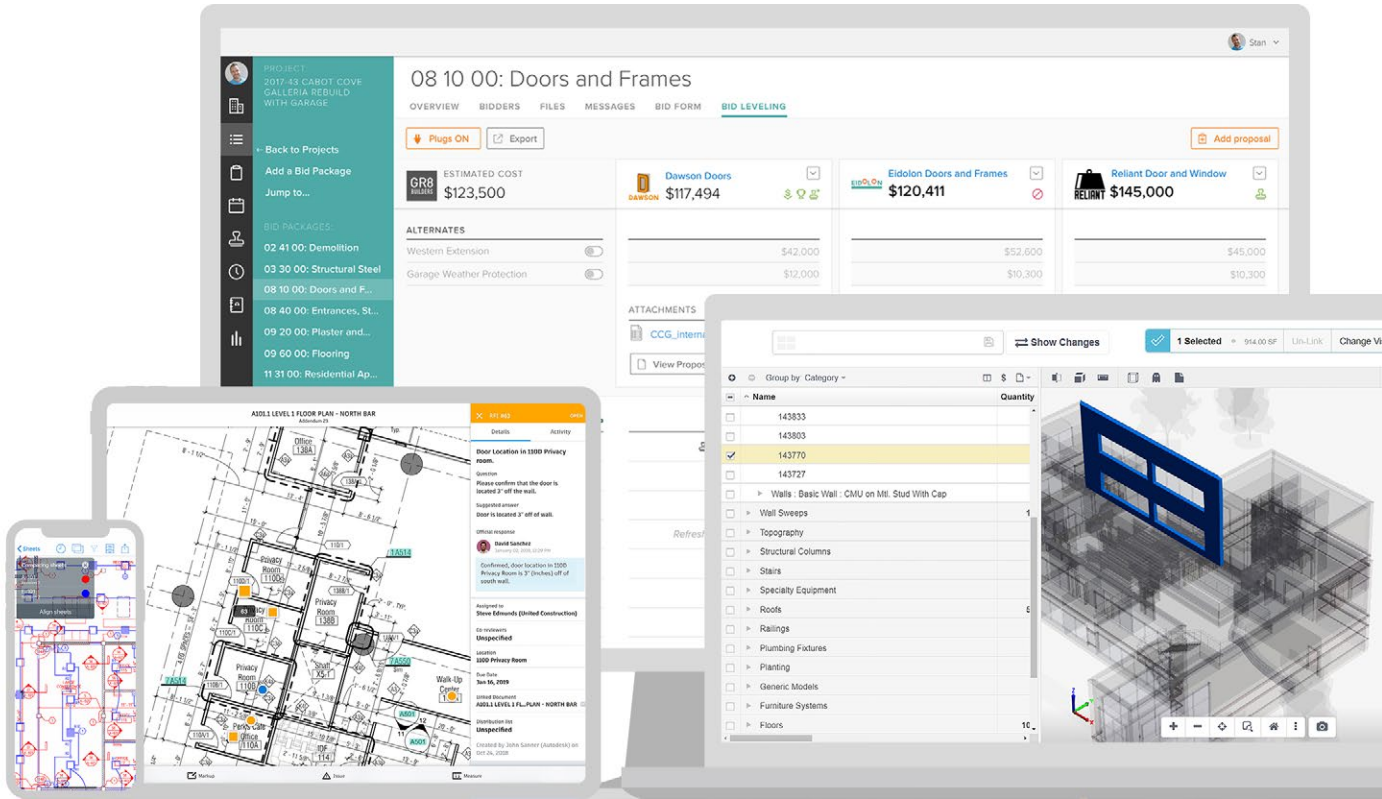
See the Future of Connected Construction

construction.autodesk.com

Our industry requires solutions that connect their information, teams, and technology —breaking down data silos and disconnected processes that hinder true transformation. As we navigate the ever-present push to do more with less, we need to uncover new ways of working, enhance connected digital workflows, and incorporate advanced analytics. To support us on this journey of transformation, we 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. And we've remained steadfast in our promise to deliver the industry's most compelling solutions, connecting data, teams and workflows from the field. This is our commitment to connected construction.



AUTODESK

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 mesmerizing blockbusters, Autodesk software helps our customers to design and make a better world for all. For more information visit **autodesk.com/construction.**

Connect with ACS

United States
+1 (866) 475-3802
construction.autodesk.com

Australia & APAC
AUS +61 1800 314 435
acs.apac@autodesk.com
construction.autodesk.com.au

UK & EMEA
+44 808 1892 253
acs.emea@autodesk.com
construction.autodesk.co.uk