2024 TECHNOLOGY REPORT

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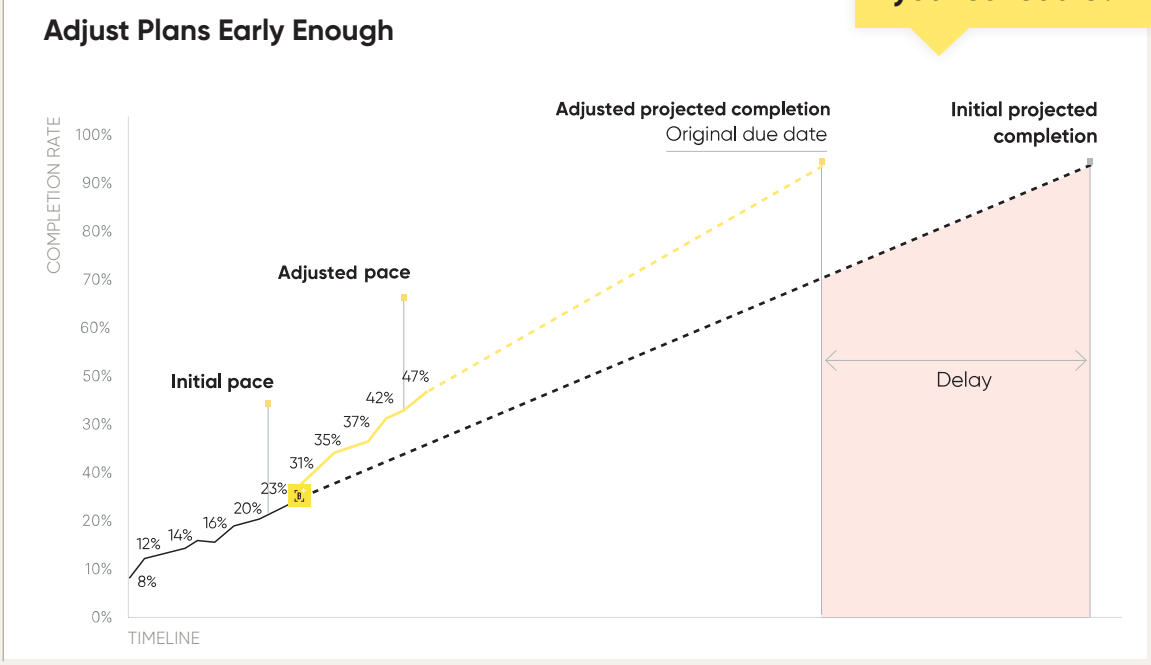

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OUR JOURNEY TOWARDS A PERFORMANCE-DRIVEN FUTURE IN CONSTRUCTION

As we navigate the fast-evolving landscape of modern construction, it's clear that embracing change isn't just a choice—it's a necessity. Our industry is defined by rapid changes, suffering labour shortages, new regulations, tight margins, and even tighter deadlines. This year's *On-Site* Construction Technology Report underscores a vital truth: To stay ahead, we must innovate and adapt. Yet, this evolution is more than just a shift in tactics; it's a transformation rooted in precision and driven by data.

At Buildots, our journey began in 2018 with a simple yet powerful vision: To equip construction professionals with the tools to make decisions grounded in solid, reliable data. Driven by our mission, we analyzed the equivalent of 82 years of ongoing construction activity and identified a crucial link between performance metrics and project delays. It highlighted the need for a paradigm shift in management methodologies—moving from lagging indicators like schedules and budgets to leading indicators focused on operational performance and process efficiency.

This is how, in collaboration with leading construction companies, we developed Performance-Driven Construction Management (PDCM)—a testament to our commitment to lead the way for better efficiency in construction.

Performance-Driven Construction Management resolves the entrenched blind spots in traditional project management, addressing hidden, systemic inefficiencies while elevating Planned Percentage Complete (PPC), boosting production pace, and sealing completion gaps. It isn't just a concept; it's a reality shaped by real-world pain points and tangible facts, honed in partnership with industry leaders.

This unique approach is about ensuring outcomes, not hoping for them. We are eager to build a future where measurement, analysis, and optimization are the cornerstones of every successful project, a vision made possible by the trust and collaboration of our forward-thinking clients. This is our contribution: Forging a path towards a smarter, more productive, and more predictable world of construction, together.

Enjoy this year's Construction Technology Report as we explore how technologies like artificial intelligence are bringing value to Canada's construction industry.

Warm regards,

Jessica Herrala
Buildots
Regional Director - North America

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CONSTRUCTION HITS THE AI ERA

Webinar panel shares insights into how artificial intelligence is driving change in the construction sector.

BY ON-SITE STAFF

Much as such technologies as computers, email and smartphones have transformed business, Artificial Intelligence (AI) is quickly emerging as a generational game-changer, and a game-changer that is already in play in the construction industry.

AI is not new. In fact, the concept was considered by scientists and authors more than 70 years ago. In the ensuing decades, the pursuit of machines and programming that could mimic human-like decision making has made considerable headway, but the speed at which computers could analyze potential outcomes and apply decisions was always a limiting factor.

As computer technology has evolved, so too has AI, however, and the latest generation of the technology, which includes large language model-based programs like ChatGPT, is now making AI viable, and available to the masses.

While most agree that AI can be a game changer, it is not without its pitfalls, and many in Canada's construction industry are wrestling with the practical applications of AI, and what it can and cannot do for the world of construction.

To assess the impact that this technology is currently having on Canada's construction sector, as well as the potential it holds, this past January, *On-Site Magazine* hosted a webinar featuring experts from five of the nation's foremost contracting and engineering companies.

The panel discussion, which was sponsored by Buildots, whose technology uses artificial intelligence and computer vision to improve efficiency on construction projects, and American Global – Canada, one of North America's largest privately held insurance and surety brokerage firms specializing in all aspects of construction risk management, featured Hammad Chaudhry, vice-president of innovation and construction technology at EllisDon Corp., Charles Davis, director of data and analytics at Modern Niagara Group, Carolyne Filion, director of innovation, research and development at Pomerleau, Kevin MacLean, principal at Read Jones Christoffersen Ltd., and Chris Palmer, director, enterprise intelligence and security at PCL Business Technology.

AI IN THE FIELD

As he opened the discussion, *On-Site* editor Adam Freill asked the panel where AI is having an impact on the industry. They were quick to point out several current uses, as well as uses that are emerging and evolving as existing and start-up technology companies find industry pain points that they can address with various AI-based apps and technology platforms.

"If you look at BIM and VDC, you can use AI to help do things like automated clash detection that we couldn't do before without draining a lot of resources," said Chaudhry. "And then there's a predictive side of things."

As an example, he pointed at the ability of machine learning to analyze large amounts of data relatively quickly to do such things as assess risks on a project, explaining that risk mitigation is driving considerable interest in AI growth.

"The way we've been considering AI, as specialty trades contractors, is how can we use the tool set to eliminate or reduce the repetitive and mundane," added Davis. "We see there's some real value in that as a tool in the toolkit to help us become much more effective, and to free up time for people to really lean into their specific skills."

He also listed a variety of opportunities where AI can be harnessed, from the drawing stages to estimation, pointing to the

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jobsite issue of on-site logistics as a prime opportunity that will benefit his company.

"A lot of these sites where we're working, you've got multiple trades working there, you have limited set-down areas to keep things in, so having tools that can help with the logistics – with the coordination – could reduce the time and effort that really is a lot of manual chasing."

Filion, added that "safety, efficiency and the decision-making process" were core construction concepts where AI holds considerable promise.

EVOLVING QUICKLY

While some companies are already making use of AI through a variety of technologies on their sites, developments are moving quickly, which Davis said can make it difficult for many company owners and management staff to sort out the hype from the practical uses and applications.

"At this point, there's a lot of tire kicking going on, and trying to work your way through what is real and what is marketing," he explained, adding that costs associated with some of the customizable AI platforms can make access to their use prohibitive for smaller construction and contracting firms.

Today's iterations of AI are making it easier for those companies who have made the jump, however.

"In the past, AI was difficult to integrate, when data was unstructured," shared Filion. "Thanks to the evolution of AI, I'll say that today unstructured data is no longer as much of an issue as it once was. Of course, the more structured and organized data that you have, the easier the technology will be integrated in your practice."

MacLean said that for many in the engineering community, their first steps into the use of AI have been going after the low hanging fruit of debugging code and models.

AUGMENTING THE DETAILS

He explained that engineering and professional services firms appear to be focused on using AI technology to automate repeatable details, to add depth and additional data into the files they create.

"There is a lot of data that exists, but often, it's not in a form that you can use to draw conclusions," said MacLean. "So, we are looking towards automating the creation of databases using drawings and interpreting annotations and visual representations of our work because, ultimately, our product is an image that represents a three-dimensional building."

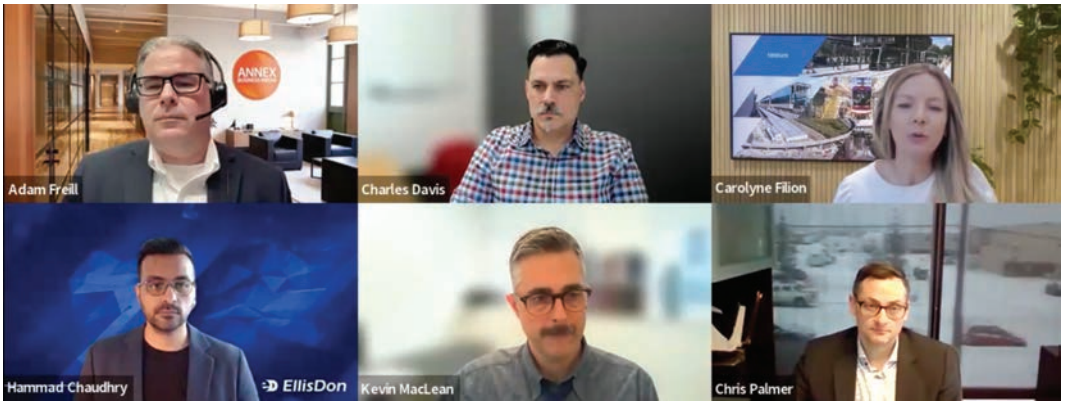
He used the example of rebar, since most models are not so detailed to include each piece in the drawings, however an AI platform has the potential to automatically add in each piece, which makes for a richer 3D rendering, with data that can be further used to add efficiency to the project.

"From a structural engineering perspective, the engineer doesn't draw every piece of rebar on the drawing, they don't detail every connection on the drawings, a lot of that's indicative, and there's an opportunity to translate that sort of common expectation about what those annotations mean, into something that's a bit more tangible," he explained.

DYNAMIC DECISION MAKING

Beyond fleshing out the model, Filion is excited about how fluid changes can be worked into the management of projects.

"Integrating AI with other technologies, such as IoT sensors or the BIM model, can enable a dynamic and responsive approach to construction project management, where decisions are based on current data rather than a static plan," she said, adding that



data gathered from current projects adds to the machine learning algorithms, which can help to optimize future projects. "This is really the strength to be exploited from AI; to learn about the past and improve the future," she explained.

"The Holy Grail is the true optimization of the building, and that's running through and having an algorithm make design decisions," said MacLean. "But I think that's a long way down the road."

"We're really at the beginning of this technology and what it's going to do," added Palmer. "The initial benefit that we're going to get is probably driving basic efficiencies. And then as we continue to develop the technology within our toolset and within our processes, we're going to see the real enhancements come down the road."

For now, Palmer says the technology can help site personnel juggle the numerous, and often repetitive, tasks that are a necessary process of managing a project.

"We have so many intelligent people that, through experience, understand the nuances of what goes into building a structure," he said. "How do we free up these knowledgeable people to focus on critical tasks and make them more effective? That's where I see AI being a tool they can use; to help automate more mundane tasks."

SECURITY AND CHATGPT

The panel was somewhat split on whether the use of ChatGPT was a positive or a negative for industry professionals. The risk of losing proprietary data into the cloud is a major concern, and a concern with merit – Chaudhry pointed to a recent issue experienced by Samsung, where its staff accidentally leaked some of the company's source code via an open AI platform.

"In general, it's a yea to ChatGPT, but doing it in a safe manner," said Palmer. "There are guidelines that people should follow… They will bypass your technical controls and those sorts of things. You'd be in a far better position to educate."

"I think, personally, it's a phenomenal tool for practical applications and creative things," said Chaudhry. "From the scare side of a business, whether you're a small specialty contractor, large design firm, or anything in between, we all probably heard about the Samsung story… You need to educate, but I think blocking access, potentially, and providing a different tool, if you have the resources to… so you don't expose yourself to unnecessary risk."

"If you haven't already been having a discussion internally around creating guidance for your folks about 'How do I safely use generative AI tools or AI tools in general?', 'What are the telltale signs of where you can safely bring data versus when and where you can't?' and making sure people understand and have examples of what is an acceptable use and what is an unacceptable use, [you should initiate that discussion] because then you are arming them to use it safely and to use it without putting your organization, your data, or your clients at risk," explained Palmer.

"You've got to have good methods and tool sets around prioritizing your data security, access controls, secure authentication, and encryption. These are table stakes that you really have to put in there, particularly since the services are all cloud-based services," added Davis. "You need to do regular security audits, and compliance with data protection laws and data protection practices is essential. Depending on your client base, you may have data residency requirements that you have to consider."

Those details may not be part of the marketing pitch from a vendor offering to create an AI program that integrates into a construction company's procedures, so the panel advised digging deeper into such matters, rather than risking data loss, and to ensure that contractual requirements, which may include an integrity of data clause, are met.

LOOKING AHEAD

One thing that all panellists could agree upon is that the age of AI is upon us.

"Winston Churchill said, 'We shape our buildings; thereafter, they shape us.' I think it's apt to consider a modern twist, given AI in our digital age," said Chaudhry. "We create our data, and thereafter it shapes us. So, the linchpin to all these technologies, whether it's construction or anything else, is data. And that's what AI is unlocking."

"AI is becoming integral in Canadian construction, we see that there's an opportunity for the tool sets to enhance efficiency, enhance sustainability and the work that we're doing; to augment the workforce to help us free people for their highest and best use," said Davis. "The success lies in balancing the technology with human insight and continuous learning, and considering AI as a tool."

"AI has a really big role to play on the future of our industry," concluded Filion. "But you'll get more impact if you link AI also with other technologies, such as robotics, IoT sensor, and BIM models."

To watch the full webinar on *On-Site's* YouTube channel, scan the QR Code. ☐

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THE YEAR OF AI EXPLORATION

Emerging technology is gaining strong momentum throughout the build sector.

BY DANIEL HEWSON

Last year was a year of first steps in the investigation and use of Artificial Intelligence (AI) in construction. There have been many marketing releases and statements about AI, but it's very much in the early stages when it comes to construction companies incorporating AI into products or business practices.

What we did see in 2023 was many companies starting to announce their strategies, plans and beliefs about the use of AI. And we saw some early adopters using AI in their planning departments to evaluate historical data, including using the technology to explore what went wrong and how long certain initiatives took.

With AI still in the "new and evolving" stage for construction, it is difficult to predict the specifics of how software companies will provide AI for the industry, but the intent is certainly there. It's been somewhat of a boom for the rise of AI startups in the construction space, as well as related domains such as site capture, planning, tendering and contract review.

We also saw many small teams form companies to tackle these fields, and we have seen more and more people using ChatGPT for search and quick research but, in reality, we saw more marketing than traction. We'll need to see real-world data sets and use cases to move AI forward at a faster pace.

Big-name vendors are, of course, working on AI products, but seeing the number of AI startups formed to service the construction industry has been fascinating to watch. This growth has been catalyzed by the number of construction companies projected to use AI to improve their business practices. Most construction companies aren't developing AI products in-house, so they will look outside for AI vendors.

And the impact of language models, such as OpenAI's ChatGPT, Google Bard and Microsoft Bing should not be understated.

The move from closed providers and models, for example, ChatGPT and Google Bard, to Meta's pioneering of LLAMA/LLAMA2, has driven a lot of innovation in the space. With closed models, you don't know how it works or how it was trained. Further, there are limited ways to extend their abilities.

LANGUAGE MODELS AND DATA QUALITY

As the technology has advanced, we saw that RAG, or resource augmented generation, was essential for enhancing language models such as ChatGPT with document data. If you want to ask a question about financials, you can use a language model to quickly pull out the answer with a semantic search to your question instead of scouring through multiple records.

Data quality is vital to corporate success, as researchers have found that language models can be significantly more accurate and cost-effective when the training data is curated correctly. We've heard a lot about having big data, which is good, but ultimately it comes down to building proper data pipelines to have robust data quality with minimal errors.

And cross training may improve the ability of AI, as the use of different data sources allows models to become multi-modal to be able to "read" and "see."

Currently within the construction sector, AI mainly lives in the IT departments of contracting companies. They are the custodians of the data infrastructure and, therefore, the best place to try to find applications of AI that will correlation with the data they have. This is good and bad as it provides oversight and control but also limits user capability – at least for now.

The construction site has seen limited adoption, mainly for information capture and with field devices to drive productivity information. We also saw some progressive companies use a bit of AI for planning and analyzing historical data to help with accounting, procurement, reporting, fraud detection, and transactions, however this is in the early stages.

There are some promising developments on the horizon though, which may open the

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AI NEEDS PEOPLE

If you are someone who is worried about machines taking over for humans, don't expect to see AI causing layoffs in construction any time soon. The data is too messy for people to lose their jobs, and humans are needed. It's definitely going to be a scenario of AI augmenting what people do, not replacing them.

door to more advanced use in this sector.

To start, combining RAG with language models and tools with semantic search and external data sources will make it much faster to conduct document reviews, contract reviews, tendering, etc.

TALK TO MY AGENT

Agents, which are a computer program, system, app or bot that can interpret the environment to take an intended action, have a conversational interface so that you can feed in text to predict subsequent text. With agents, we can augment language models with tools, such as a calculator, to answer questions and enable users and non-users of programs to ask questions in natural language to get answers. We won't see this in full force this year, but we should see the start of this trend.

Also expect to see the democratization of machine learning to advance this year. We should see programs such as Excel and Power BI incorporating AI to enable users to take historical data, tools, and BI apps to perform forecasts for future projects. This will allow them to use large amounts of well-structured data to improve business decisions.

TRENDS WITH BENEFITS

There are two primary reasons why construction professionals might want to pay attention to these trends.

The first is to improve productivity. Construction has tight resource limitations with very thin margins and people in construction are often overworked. This can include spending hours looking for crucial information in existing data and documentation. RAG and agents will allow people to be more productive and save time when seeking information within documentation.

The second is that democratization will move AI from IT departments to users. This is critical as IT is experienced in managing the data infrastructure but not in using and interpreting the data.

Democratization gives the data and AI to the actual users and true subject-matter experts, empowering them and enhancing data-driven decision-making during daily tasks. We should also expect to see planners, site supervisors, and various other players in the industry begin to use new tools in conjunction with AI to augment their AI experience.

This will all require guardrails to ensure that confidential data is protected, stays within the boundaries of corporate governance, and meets government regulations and guidelines. There will be friction and learning along the way, as well as training and upskilling of people.

As AI matures, we will see planners using AI-driven tools to analyze historical data and rich, current data. We should also see some site supervisors and workers adding more field devices like cameras and sensors to help capture more of that loop for AI usage and improvements in safety and progress tracking.

This past year, we saw the groundwork for AI being laid throughout construction and entering the industry's consciousness. AI in the building world will take off in both usage and further development, but with that, let us remember that we are seeing quite a bit of "AI hype" right now when we need to see less fanfare and more problem solving.

Complicating matters is that some AI vendors tend to keep their development projects under wraps, so it can all be a bit confusing as the AI market is being developed and sorted out. Many startups that focus on AI in construction are in the works, and we should see many of these new ideas stick in the office and on job sites.

Many construction companies have included AI as part of their business strategy, and we'll see the transition occur from a strategic level goal to trials and experimentation, or what I call "AI Exploration." ☐

Daniel Hewson is the data capability manager at Elecosoft, a company that helps its customers implement technical innovations. He oversees development of overall data and AI strategy to focus on how AI can be leveraged to improve project planning and to identify inherent project risk.

By Jacob Stoller

AI and the next generation of BIM

Newly released AI features from major BIM platforms are targeted at streamlining the work of architects and engineers.

Last fall, the investment advisory firm Wall Street Zen released a study showing that the mere mention of Artificial Intelligence (AI) in a company's quarterly report resulted in a measurable bump in the company's share prices. AI, it appears, is the magic bullet that you can't go wrong with. For contractors, however, techno-optimism meets a sobering reality: the challenge of applying digital information to a real-life physical job site.

"AI doesn't hammer nails," says Thomas Strong, principal at construction tech firm wired.construction and CEO of Building Transformations, a not-for-profit serving the digital needs of the construction industry. "AI can help manage all the pre-construction processes like creating schedules and better coordinated designs or buying materials. But at the end of the day, until you actually affect what's happening on the job site, you're not actually creating any real efficiencies in construction."

Pre-construction, consequently, is where the action is for contractors, at least for now. "Our thoughts with AI-based 3D models are to create another layer that will empower the production process," says Hammad Chaudhry, vice-president, Innovation & Construction Technology at EllisDon.

SWAPP and Augmenta are examples of upcoming start-ups betting on this change and aiming to bridge that gap. "We generally don't build models, but there are tools in the market right now that help us get that AutoCAD or Revit model ready for production," says Chaudhry. "So, you don't need somebody to do the drafting or modelling – AI will do that, allowing those who were focused on modelling or drafting to focus on coordination."

For many contractors, their AI journey began with ChatGPT, using it for such time-consuming work as looking up information from building codes.

"I think ChatGPT set the tone for all of these AI products," says Strong. "There are so many construction-specific tools emerging, focused especially on the pre-construction phase of work, which is a lot of navigating red tape, reading documentation, and producing a plan that ultimately needs to be taken to the job site."

Software vendor Zapier, for example, provides a tool for creating workflows with ChatGPT and Procore. Many of the new tools are bridging the gap between sophisticated digital models and contractors' in-house skill levels. These tools not only help extract data from models, but from within the company's own data assets.

"The data already exists, but it's a lot harder to extract everything and look at all of it. You need someone who's very, very experienced," says Rajitha Chaparala, vice-president of product, data and AI at Procore. "So, what we can do is build models that actually extract meaning and present it so users can see everything together and make the decisions."

The Procore BIM product takes models from major platforms and makes it accessible for contractors and facilities managers. "Procore BIM takes created models and builds a production model that can be used through pre-construction, construction, and building maintenance," says Chaparala.

LOOKING AHEAD

The biggest opportunities for AI may lie in enabling the adoption of new business models.

"A lot of the value of AI is going to be on the architect's side," says Chaudhry, "but in a future world where we're working on an RFP for a design-build project, we'd be working with a design team to come up with a lot of different drawings and models for something that might not even move forward. So, AI could make a huge impact there."

According to Chaparala, contractors can expect new products that will bring new capabilities to contractors, such as better clash detection, determining and tracking the carbon footprint of building materials, and detecting bias in a model.

AI can also support better collaboration between designers, contractors, and owners. "Hypothetically what we've been seeing is precon coming in earlier," says Chaudhry, "and this is the perfect time to emphasize the value of precon becoming more important. With the architects and designers having the ability to get their models and drawings to production level a little bit sooner, precon can actually do what we've all been trying to do with models – identify the issues and flush them out before construction."

His company's in-house Insight and Analytics team, led by Eze Machabanksi, is working on what he calls "some exciting things" that they hope to showcase soon.

AI could also help contractors improve their products the way manufacturers do. "Manufacturers retain their IP and iterate to make their products better, but we don't do that in construction. We start with a clean slate every time," says Strong. "The Province of Ontario has built many hospitals, and each one is unique. The government paid for that unique solution every time, and there's a huge cost to that. If we want to create efficiency, we need to do the same thing more than once so we can iterate and improve." ☐

Jacob Stoller is principal of StollerStrategies. Send comments to editor@on-sitemag.com.

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