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Bentley®
Advancing Infrastructure

ENGINEERS
AUSTRALIA

Unlocking potential

Overcoming roadblocks for digital infrastructure delivery

Australia's infrastructure projects have never been larger or more complex than they are now. Efficiency, collaboration, sustainability and resilience are more vital than ever.

Digital technology is an indispensable tool, but its impact depends on how well it is used. Fragmented standards, software integration challenges, workforce skill gaps, and unclear outcomes can hinder the full benefits of technology.

At this critical juncture, these challenges require urgent solutions. The benefits of digital technology in infrastructure design, delivery, management and maintenance are clear, particularly in a connected data environment where advantages can scale widely.

Standardised practices, data governance, ongoing workforce education, and investment in scalable technology will drive better outcomes for all stakeholders – designers, engineers, owners and end users, throughout an asset's lifecycle.

In December 2024, Bentley Systems and Engineers Australia hosted roundtable discussions with thought leaders in Sydney, Melbourne and Brisbane to explore roadblocks to better digital project delivery, and how to overcome them.

This paper is a distillation of those discussions. It defines the current state of play in digital project delivery in the Australian infrastructure sector and recommends transparent, collaborative and actionable steps to improve project outcomes through smarter use of technology.

We invite you to work with us to drive meaningful change. By fostering collaboration, aligning standards, and embracing sustainable solutions, we can unlock efficiencies, reduce risk, and deliver infrastructure that is more sustainable, resilient and future-ready.

The challenge is to turn these insights into action.

We welcome your engagement as we build a digital project delivery environment that benefits engineers, asset owners, and communities alike.

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State of play

As engineering firms find themselves under increasing pressure to deliver on time and on budget, in an era of rising costs and supply uncertainty, previously unrealised efficiencies must be captured.

In late 2024, the UK's Institution of Civil Engineers (ICE) released a report called *5 ways Australia can improve how it delivers infrastructure*. Asserting that design and construction practices in Australia are inefficient, ICE found that rushed and rigid procurement processes, concentrating above all else on lowest cost, stifles innovation.

Investment decisions, the report said, focused too heavily on initial capital spend and not enough on total value over an asset's life. Contracts typically created adversarial relationships, disabling opportunities for collaborative problem solving.

Australia is not the only territory with such problems. The annual *CRUX Insight Report* in 2022 reported that more than a third of global project spend is burned up in disputes.

So, how do we unlock greater efficiencies?

One of the most powerful solutions is technology. Digital transformation in project delivery has long created new efficiencies. Infrastructure digital twins create real-time insights and helps avoid costly rework, data is used to identify trends and patterns, risk and reward, and designers can collaborate with operations teams thanks to the integration of various systems.

However, there is a sense that digital technology is only scratching the surface of what is possible. If we remove roadblocks – and some are significant – we enable that technology to be utilised to its full potential.

At Bentley Systems, having long been a developer and provider of infrastructure engineering software, we recognise our role and responsibility in helping to remove roadblocks to boost efficiency, safety, performance, innovation, engagement and more.

The first step to overcoming those roadblocks is to identify and understand them. The next is to develop solutions. Finally, it's essential to design actions to achieve those valuable goals.

Challenges in digital delivery

What are the major challenges to digital delivery of infrastructure?

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In 2024, Laurie Langford, AECOM Project and Program Management Technical Director, took a holiday with her family of four. Each of them took photos on their own phones. By the end of the holiday, they had collectively taken around 2000 photos.

“There are probably no more great photos than we would have had if we had a camera with a roll of film,” she said.

“I’m now paying to store those 2000 photos on my Google Drive. Am I ever going to look at them again? I’d love to create a photo book, but it’s too hard, because there are just too many photos to sort through.”

This illustrates a key challenges in the digital project management process. When you have the capability to gather so much data, how do you ensure it’s useful and relevant, that it serves a valuable purpose, and that it doesn’t effectively block further action?

Data serves different masters

There is a general perception in the infrastructure space that if you’re doing something digitally, it will be done faster, more efficiently and more accurately.

But organisations innovating around digital tools are also developing new ways of doing things, which takes time. They’re devising new processes and workflows, educating their people and informing supply chains. Often, they’re innovating in a smaller space before rolling the new technology out across the business.

As Langford discovered with her family’s holiday photos, it’s not always smooth sailing. Different organisations, government departments and business units also have their own, unique needs from data.

One Melbourne engineering lead made the point that handover and completion often involve two completely different sets of data.

“Completion is more about the developer and contractor side, data that is based on capex optimisation. Handover is from the side of the operator and maintainer, who want to optimise opex,” he said.

“These two data sets are not aligned, but we need to meet both outcomes.”

Data can work wonders

At the Francis Crick Institute’s new building, Laing O’Rourke handed over a data model that enables advanced asset management capabilities, said Nicole Waterman, Technical Leader at Laing O’Rourke and President of Engineers Australia’s Sydney division.

The biomedical lab and research organisation, home to more than 1500 scientists, uses the digital model to carry out preventative maintenance on the building, dramatically reducing reactive maintenance requirements.

“We offered the fully functioning data model, and they accepted it,” she said. **“They can now click on a specific room and understand exactly what needs to be done, in advance, at any time.”**

Causes of digital roadblocks

Fragmented standards

Scattered approaches: Data and technology standards that are unique to a department, an organisation or a state, creating inefficiencies and restricting scalability opportunities.

Lack of a connected data environment: Disparate data storage and management standards, leading to lower-quality data, duplication, poor trust and difficult integration processes.

Unfocused implementation

Short-term outlook: A focus on near-term results as opposed to long-term lifecycle requirements, particularly around maintenance and management.

Poor definition of need: Failing to design the technological solution around a clearly understood and well defined, long-term need.

Misalignment: Technology vs need

Shiny toy syndrome: Focusing on delivering advanced technology as opposed to acquiring technology that serves a specific and well-defined need, creating misalignment and frustration among various stakeholder groups, and sometimes taking engineer focus away from core roles.

Integration failure: Tools that could serve a specific purpose not integrating into operational systems and platforms and instead standing alone. Their usefulness is limited and the effort and learning curve to recognise their full potential is made more challenging.

Cybersecurity: An ever-present threat

What lies ahead: Organisations are still unsure of what might be on the horizon in terms of cyber threats, with several firms having been hacked in the past 18 months

Skills gaps and training requirements

Technology in the supply chain: Assuming that the technology the tier-one firm is using will work with the systems and people within their supply chain. This can widen the trust gap between contractors and consultants.

Training the workforce: Not having a relevant level of investment or focus around upskilling or training, or removing the human trainer by outsourcing training to a technology platform.

Going too big and/or too early with artificial intelligence (AI)

Transparency issues: Setting up AI-driven platforms that utilise data of unclear origin to make decisions.

Removing the human factor: Enabling AI tools that remove human oversight. When inevitable errors are identified, trust is lost in AI technologies.

Proposed solutions and best practices

Digital infrastructure delivery: a solution for every challenge

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A well-designed digital twin can introduce benefits and efficiencies that were not considered possible just a few years earlier. Similarly, real-time data-sharing systems, building information modelling (BIM) functionality, purposeful and transparent AI systems and open data networks can decrease costs, reduce the need for rework, foster trust, engage talented engineers, improve efficiencies and more.

Successful technology adoption begins at the end. What is it that the client wants? What does a good outcome look like five, 10 and 15 years after handover? What are the low-value and/or costly management and maintenance tasks right now, and how would the workflow improve if they were removed?

Good technology makes this possible. A Queensland construction leader highlighted the case of an overseas railway business that revolutionised its operations through intelligent data use.

"The team got to the point where they had designed out 100% of their reactive maintenance – they no longer did any reactive maintenance at all," he said.

There were a few things that enabled this extraordinary achievement, he said. One was data, another was time – with a 20-year contract program. But it was also a trust-based partnership that had the operator and asset owner aligned on the right long-term outcomes.

"The contract model said you can do whatever you like to the network to increase your profitability, as long as it complies with the standards and you pay for it yourself."

Each of the thought leaders at the roundtables suggested ways in which digital technologies are being used to positive effect in a number of ways in design and construction. These include:

- Connected data environments improve stakeholder collaboration;
- AI and advanced analytics reduce maintenance effort and downtime by enabling more efficient and predictive maintenance schedules;
- Digital twins support operational efficiencies;
- Tools that enable standardised design create greater consistency and streamlined delivery;
- Virtual and augmented reality tools enable users to create and submit information and data as well as visualise it;

- Digital tools allow staff members, particularly new managers, to see into the past, providing a golden thread of information that is forever transparent and searchable;
- Automation frees engineers up from repetitive tasks to do higher-value and more engaging work, and;
- Projects that have taken the time to put in place comprehensive digital execution plans have experienced long-term success.

And yet, these best-practice examples are often happening in isolation, not necessarily connected with other parts of the project, with other projects, or across organisations and state lines.

Too many roadblocks still exist for too many organisations and projects. Remove these roadblocks, our thought leaders say, and the sector will realise an entirely new level of performance, efficiency and opportunity to innovate.

Preparing for what comes next

At each of the roundtables, there was strong appreciation of the current and potential value digital technologies bring to infrastructure delivery.

Simultaneously, there was frustration around its undelivered promises, organisational mismanagement of technological opportunity, and the scope of some of the current roadblocks.

Overwhelmingly, attendees agreed that the journey to technological mastery was one worth taking, providing the entire sector set ground rules and standards.

A large part of each discussion centred around value. This included the immense value-add when the digital offering is done well, and the constant growth of value after handover, as the digital product removes time and effort from the maintenance and management program.

It was also recognised that there was a significant erosion of value when clients did not share the same appreciation of the advantages offered by digital delivery.

“We’re building these assets for the client that they can use to maintain the project in the future, but sometimes they don’t see the value,” GHD Digital Engineering Lead Adam Favaloro said.

"We're excited about the effort we're putting in because we know the immense value it brings and how it will benefit everyone in the long run. If the asset owner maintains this product, its value will be immeasurable”.

Roundtable outcomes and recommendations

Lessons from the roundtable

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Roundtable insights: What those in the industry can do

Numerous roadblocks to digital technology success were identified in the roundtable discussions, along with several solutions.

Proposed pathways to success include prioritising scalable solutions, investing in targeted training programs, and building trust between systems and stakeholders.

It was clear that fully leveraging digital technology to unlock better project delivery required concerted efforts not just from the industry, but also from government, educational bodies and other stakeholders.

01 Start with a strategic understanding of the end users' needs

The "why" of digital solutions must be defined before procurement or implementation. Understanding end-user needs will guide decisions around data relevance and scalability, ensuring equal access for all stakeholders.

02 Build trust at all levels

Trust is critical in Australian infrastructure engineering. Adversarial contract models, integration issues, and unclear data validity erode confidence. There is a strong push for trust-based relationships with aligned strategies and goals to ensure technology adoption benefits asset managers, clients, contractors, users and engineers.

03 Adopt best-in-class data practices

Standardisation requires a single source of truth for project and other related data. This builds trust, enhances transparency, and identifies and fills data gaps to meet operational needs.

04 Constantly upskill and develop people

The best technology is only as good as its users. Comprehensive training across the entire supply chain can broaden the talent pool, reduce the duplication of effort, and deliver benefits over the long term.

05 Deploy AI as an assistant to human decision making

AI should support human expertise, particularly in the areas of analytics and predictive maintenance. Data transparency, AI explainability, and ethical safeguards are all vital inclusions in the design of such solutions.

06 Understand that this is a long-term project

Digital transformation is not a quick fix. While benefits appear quickly, maximizing a data-driven system takes time.

07 Earn executive buy-in

Without visible support, engagement and advocacy at the highest levels, including constant promotion of the value and strategic importance of technology, cultural change to embrace that technology becomes more difficult. Leadership should actively champion digital transformation projects and at a national level, including government, to unify standards and drive innovation.

08 Share successes and failures

Along the same lines as regulatory and policy alignment, developers and organisations must, as much as possible, share their work in an open-source environment. This will enable proven solutions to scale quickly across new projects, and value will also be found in lessons learned from unsuccessful experiments.

Roundtable insights: What else the industry needs

There were common themes from the roundtable attendees on what is needed from government, regulators and other authorities to clear the way for industry to make the most of the digital possibilities.

01 Standardise for an environment of interoperability

Leadership at the national level is required. Without clear, enforceable national standards, seamless data sharing remains difficult. At best, this adds time and effort. At worst, it blocks collaboration, learning and innovation.

Government and other policymakers must lead by revisiting regulations to encourage the standardisation of digital and asset requirements across all states and territories, to incentivise sustainable, consistent and innovative practices.

02 Educators must come to the party

Training and upskilling isn't just a challenge for industry. Universities and other educational bodies must bring digital engineering courses into the mainstream, as well as develop micro-credential programs. Mentorship programs and defined career pathways in the digital engineering space will also help to attract and retain talent.

03 Collaboration and cooperation is the future

Alliance and integrated project delivery models that reward collaboration and encourage innovation and risk-sharing are the way forward. If stakeholders can exist in an environment in which project design is aligned with long-term asset management goals, digital engineering will naturally flourish.

04 Cybersecurity frameworks

More effort must be put into robust cybersecurity frameworks for the platforms adopted by infrastructure engineers and managers. As with digital engineering solutions, cybersecurity frameworks must be reliable, scalable and updated regularly.

Final considerations

Digital engineering solutions are already providing tangible and repeatable benefits on projects around the globe. From cost saving to materials innovation, process enhancement, project sustainability and maintenance efficiency, the advantages already introduced are as varied as they are valuable.

Engineers naturally seek to always do better. In a time of talent shortages, project complexity and tough competition, leaders of engineering firms understand that technology, when leveraged effectively, creates enormous advantages.

For digital engineering to scale, accelerate and fulfill its potential, the entire sector must take a step forward in unison. The outcome will be better engineering, more positive outcomes for all stakeholders, and a thriving infrastructure sector.

Bentley Systems thanks the many thought leaders who contributed their insights on advancing technology in infrastructure.