



# Rebuilding the Future: Tech Solutions for Civil Infrastructure's Toughest Problems

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Explore how digital tools streamline design, compliance and delivery in public infrastructure projects

Whether it's annoying potholes on local highways, rusty steel on massive bridges or dilapidated rail networks, aging public infrastructure is easy to spot in small towns and big cities.

As funding for upgrades and improvements has traditionally fallen short, vital public infrastructure has been left to rapidly deteriorate. Meanwhile, climate change is the latest challenge for roads, bridges, water plants and more.

Increasingly, natural disasters are subjecting infrastructure to intensifying stress, strain and destruction.

But now, after decades of insufficient funding, money is available for public infrastructure projects. Post-COVID-19, lawmakers globally, especially in the United States, have approved a massive infusion of funding for public infrastructure, providing needed resources for agencies at all levels of government.

With funding, however, comes challenges as leaders grapple with long lists of needs, rising construction costs, labor shortages and more. For all these reasons, local, state and federal public agencies, along with the architects, engineers and contractors who work with them, must find ways to speed up the decision-making and design processes to ensure they can take full advantage of the funding.

Architecture, engineering and construction (AEC) companies are in a unique position to shape the future of public infrastructure by ensuring roads, bridges and water systems remain safe, functional and resilient. However, achieving this requires more than just ambition—it demands strategic planning, skilled teams and the right tools and technologies to navigate complex challenges and build sustainable, thriving communities.

# Not Making the Grade

**C-**

The grade US infrastructure gets, according to the latest [infrastructure report card](#) from the American Society of Civil Engineers.

**88%**

The percentage of EU municipalities that consider their infrastructure investments in the past three years as inadequate in at least one key area, according to the [European Investment Bank](#).

**\$1.7 trillion**

The annual investment in infrastructure required through 2030 to maintain the growth momentum, tackle poverty and respond to climate change in developing parts of Asia, according to the [Asian Development Bank](#).



# Shifting Landscape

Across the globe, funding is fueling a flood of opportunities for public agencies, along with AEC firms. Here's some of the money on the table.

## Infrastructure Funding in the United States

In recent years, US lawmakers have approved significant legislation aimed at addressing infrastructure needs and strengthening the economy.

**Infrastructure Investment and Jobs Act:** Passed in 2021, the bipartisan deal authorized \$1.2 trillion for transportation and infrastructure spending. Projects that focus on resilience to climate change are prioritized and encourage workforce development.

**Inflation Reduction Act:** The [2022 law](#) provides billions for new infrastructure investments in clean energy, transportation and the environment.

The act, the most consequential infrastructure investment in the US in recent history, provides:

**\$110 billion** for highways, roads and bridges

**\$39 billion** for transit

**\$55 billion** for water systems

**\$25 billion** for airports

**\$7.5 billion** for EV chargers

**CHIPS and Science Act:** The [bipartisan act](#), approved in 2022, provides about \$280 billion in new funding to increase the US-based construction of semiconductor plants and create regional high-tech hubs. Construction of new plants will trigger the need for a variety of public infrastructure projects including site preparation, utilities, roads and more.

## Infrastructure Funding Around the World

Lawmakers across the globe are also bolstering infrastructure planning and funding through a series of efforts.

- **European Union:** Connecting Europe Facility is an EU funding instrument that provides billions in euros for strategic investment in transportation, energy and digital infrastructure. And the [Recovery and Resilience Facility](#) is a centerpiece of the [Next GenerationEU plan](#). It provides billions in euros in a variety of areas, including energy renovations to public and private buildings to reduce energy consumption.
- **United Kingdom:** In October 2024, the UK government announced the creation of the [National Infrastructure and Service Transformation Authority](#) to “get a grip” on the underinvestment and instability that has waylaid the UK’s infrastructure systems and [has pledged to “turbocharge” infrastructure investment](#).

- **Asia-Pacific:** In Singapore, the [Significant Infrastructure Government Loan Act](#), announced in 2021, provides for the issuance of \$90 billion in bonds for infrastructure projects over the next 15 years.

In Australia, the [Pacific Climate Infrastructure Financing Partnership](#) has set aside at least \$350 million in climate infrastructure funding for the region.



# Challenges and Solutions

But all that opportunity doesn't come without challenges. The funding fuels a much bigger workload for public agencies and the AEC industry. Eight main challenges present themselves.

## Aging Infrastructure

**Problem:** Repairing existing infrastructure, such as roads, pipes, bridges and treatment plants, can be more costly and complex. Original plans may not exist, and unexpected challenges often arise.

**Solutions:** Digital twins, such as dTwin, create virtual replicas of physical buildings, roads and other systems, even when original plan documents don't exist. With that digital version of the asset, project owners, designers and contractors can optimize design, forecast operational needs and track data about the asset once it's complete.



## Labor Shortages

**Problem:** The construction industry is struggling with a growing labor shortage, especially as more experienced workers retire and leave a wide skills gap. In 2025, the US construction industry will need to hire more than 450,000 workers on top of normal hiring to meet industry demand, according to [Associated Builders and Contractors](#).

**Solution:** Technology can streamline most workflows in the industry—from automating data collection and entry to the design and planning processes. Moving from paper-based practices to digital solutions will reduce the reliance on workers, allowing them to focus on more strategic tasks. What's more, as [McKinsey reports](#), deploying technology can help to lure more young professionals to the industry and boost retention.

## Next Generation

Bluebeam is working to close the skills gap and labor shortage in the construction industry and get young people excited about AEC professions.

Through its Bluebeam Academic Program, Bluebeam offers free software access to its platform to instructors at skilled trade centers and universities, students enrolled in related courses and competitions, and at school computer labs. So far, Bluebeam has reached more than 1,500 schools in more than 80 countries.

## Cost Overruns and Project Delays

**Problem:** Material costs have surged with experts predicting they will remain at least 15% higher than pre-pandemic levels, according to an [Oxford Economics report](#). While supply chain issues have eased, the rising costs for energy transition and ongoing labor shortages keep expenses elevated, the report found.

**Solution:** Technology is designed to improve collaboration at scale, tracking costs; evaluating design options based on budget, deadlines and available materials; and ensuring plans meet the client's specific needs.

Look to solutions like Bluebeam, BIM solutions provider ALLPLAN, structural analysis software SCIA and BIM quality assurance and quality control solution Solibri. All are tailored specifically to meet the needs of civil engineers, designers and others working on public infrastructure projects.



## Compliance

**Problem:** Funding is accelerating infrastructure planning and projects around the world. But with that cascade of new projects comes a torrent of rules and regulations that agencies and AEC companies must navigate. Anybody involved in public infrastructure must work diligently to stay on top of regulations and standards wherever they are. Failure to remain in compliance could end in costly delays and legal challenges.

**Solution:** Technology helps streamline compliance requirements, including for permitting and zoning needs. [Bluebeam](#), for example, provides centralized storage for large document sets, creating a complete audit trail and allowing review by stakeholders wherever they're located to ensure compliance. Similarly, [dRofus](#) provides templated design and helps to ensure model accuracy to support compliance.

**Streamline Design:** When consulting company Quadrante got to work on a massive new railway line project in Africa that spanned 400 km and included the design of 20 railway stations, five maintenance yards and workshops, 53 railway bridges, 86 road overpasses and seven road underpasses, it deployed ALLPLAN to streamline design.

The company's approach was guided by the principle that standardization would lead to efficiency, and that was the end result.

*"The main idea and the challenge of engineers was to define a series of model templates that could be applied to any bridge along the line and, secondly, compiling an instruction manual that would enable any engineer to pick up the template and apply it to any project structure later," said Alex Barbone, onboarding and professional services manager at ALLPLAN. "In total, 11 templates were created, one template for the rail bridges, six for the overpasses and four for the underpasses."*

## Sustainability Challenges

**Problem:** Not only do public agencies have a massive workload of infrastructure updates, but any new work must also withstand the impacts of climate change, including more extreme storms and rising sea levels.

According to the [World Bank, Organization for Economic Cooperation and Development and UN Environment analysis](#), an “annual investment of \$6.9 trillion in infrastructure is required by 2030 to ensure infrastructure investment is compatible with the Sustainable Development Goals and the Paris Agreement.”

At the same time, funding formulas reward sustainable projects, so diligent work to ensure projects meet the required standards pays off.

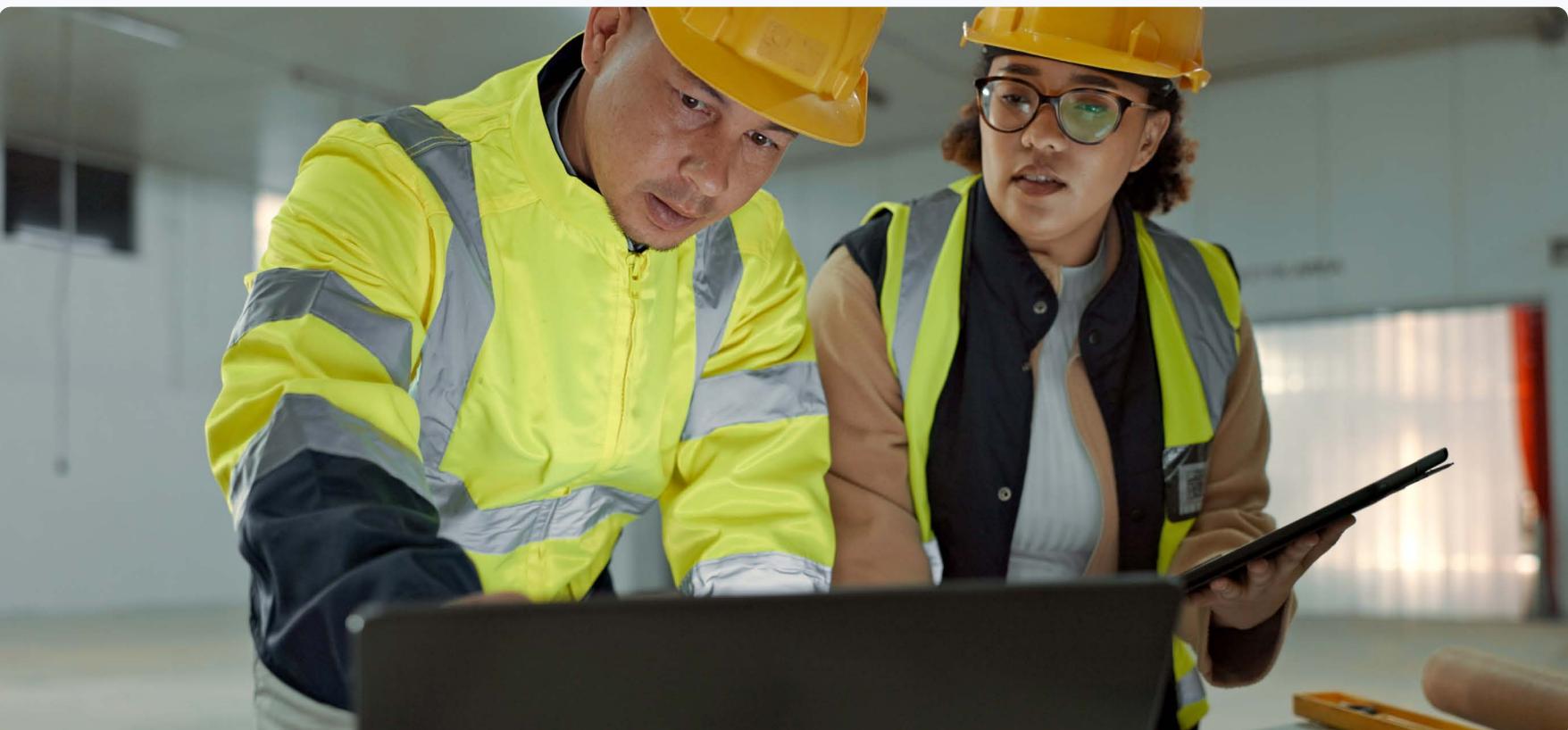
**Solution:** Modeling can help improve energy efficiency and predict the impact of different designs. Bluebeam can help achieve certain standards through data management and collaboration. BIM and CAD software providers Vectorworks, Graphisoft and ALLPLAN all can support more sustainable designs, such as [providing an easy way to document, calculate and report the materials used](#).



## Tech Challenges

**Problem:** Many government agencies and AEC firms are slower to adopt technologies because of training and cost. Typical IT spend for AEC companies is 1% to 2% of revenue, much lower than the 3% to 5% average across industries, according to [Gartner](#). The Federal Risk and Authorization Management Program (FedRAMP), Paperwork Reduction Act and other tech standards add to the complexity.

**Solution:** Bluebeam is an easy way for tech-timid users to wade into digital solutions. It's file agnostic, which means any type of file can be added to the platform. And it provides quick benefits, speeding up workflows by building a single repository for construction documents and allowing for easy collaboration.



## Safety

**Problem:** Construction is dangerous, and many infrastructure projects carry even bigger risks as workers dangle above a waterway on a bridge project or are exposed to hazardous materials on a wastewater treatment plant expansion. Further, with any project, agencies and AEC firms must follow safety regulations and insurance requirements.

**Solution:** Within Bluebeam, safety documents are always centrally located and easily accessible. Solibri, safety management software SiteDocs and project management software GoCanvas also can champion this effort. SiteDocs, for example, reminds workers when safety certifications must be renewed and automatically schedules toolbox talks and other activities designed to keep workers safe.



## Public-Private Partnership

**Problem:** Collaboration becomes increasingly complex as project size grows, especially in large public-private partnerships (P3s). Teams working across multiple locations and juggling numerous projects face communication breakdowns that can cause costly delays.

**Solution:** Digital collaboration tools help teams stay connected by providing centralized access to project documents anytime, anywhere. This ensures all stakeholders have up-to-date information, streamlining communication and reducing downtime. By enabling real-time updates and data sharing, these tools keep even the largest infrastructure projects on track and within budget.

**Not Just Plan Review:** The Georgia Department of Transportation doesn't just use Bluebeam for plan review. More than 70% of its employees have access to Bluebeam and use it for document management and review.



## What to Do

To take advantage of the available funding by harnessing the benefits of construction technology, including creating more efficient workflows and easier collaboration among all stakeholders, government agencies and AEC companies should start now. Here are five things they can do.

**Skill up:** Now is the time to identify technology-related skills gaps in your workforce. Once you've identified the areas that need attention, you can upskill your people based on those needs and begin hiring new talent with tech expertise. Look to local community colleges and training schools where you can create tailored curricula that meet the evolving needs of the industry.

**Get your data right:** Artificial intelligence presents new and exciting opportunities for the AEC industry. But AI tools are only as good as the data they're built on. Even if you're not ready to deploy AI solutions right now, it's still a good time to invest in your data infrastructure and strengthen data management to ensure your data is accurate.

**Embrace AI and other technologies:** But don't go all in all at once. That can overwhelm employees and lead to disjointed deployments. Instead, identify your pain points and monitor and evaluate AI and technology use cases. Stay abreast of what your competitors and colleagues in other states are using to ensure you're deploying the best tools.

**Get comfortable modeling:** New modeling tools allow project owners and managers to gauge the pros and cons of different designs quickly and efficiently. Now, civil engineers and others working on public infrastructure projects can move far beyond traditional paper plans or 2D digital versions to detailed 3D models that pull together the various elements of a project—from the architecture to its operating systems. Other solutions automate standard designs for a roadway or bridge, speeding up the design process.

**Embrace green building:** New funding sources and growing regulations are increasingly requiring sustainable building practices. Project owners are more often requiring them, too. In the past, data and insights into the environmental impacts of a project and its operations were hard to come by. But technology is making that work easier, tracking the benefits of a particular design and ensuring that a project is optimized for sustainability.

## Cutting Operations Costs

For nearly every built asset, the biggest expense isn't its design and construction, but its operation and maintenance. And thanks to building information modeling (BIM) solutions, project owners and stakeholders can more easily vet various designs to optimize plans and ensure the asset can run efficiently for decades to come. That might require spending more money and investing in the right BIM tools, but that expense can pay off.

*"It's a stupidly small percentage of the overall cost of that built asset, and it drives down the operations and maintenance costs over the lifetime of that structure," said Alex Barbone, onboarding and professional services manager at ALLPLAN. "But if you don't have that initial investment, that's not really a thing that you can do."*





## The Benefits of Digitization: From 17 Steps to 1

Plan. Design. Build. Construct. Public infrastructure projects require a multitude of steps and teams of professionals to get projects from plan to reality. But outdated paper-based processes have long waylaid those major projects. A single issue or course correction can quickly gum up the process and throw a project into chaos.

But with billions of dollars in infrastructure funding on the line, state and local governments can't afford delays, said Parth Tikiwala, Bluebeam's director of government affairs. Embracing digital collaboration is key to removing roadblocks and streamlining processes, so agencies can take full advantage of the opportunities.

That's where platforms like Bluebeam, with its digital collaboration capabilities, come in. Bluebeam enables all stakeholders—from government agencies to contractors—to access project plans, designs and documents in one centralized, digital hub wherever they're located and on desktop and mobile devices. That fast access eliminates the time-consuming back-and-forth of physical paperwork, allowing teams to make real-time updates and approvals.

Beyond streamlining workflows, Bluebeam's digital tools also enhance data management and compliance. By digitizing records, agencies can more easily fulfill reporting requirements under regulations like the Paperwork Reduction Act.

*"Something that once took 17 steps can be done in one, saving valuable time and resources," Tikiwala said. "It's fundamentally, exponentially faster."*

## Case Study: Taming Complexity at LaGuardia Airport

**Project Challenge:** The LaGuardia Airport renovation in Queens, New York, involved dozens of contractors and consultants working on a complex design-build project. Without a clear system for managing communication, coordinating design updates and reviewing project plans, the team risked major delays due to disjointed workflows and reliance on paper-based processes.

**The Tech Solution:** To streamline operations, the Port Authority required all teams to use a centralized digital collaboration platform. This allowed contractors to review plans, make adjustments and log every communication in real time. The file-agnostic system ensured all stakeholders had instant access to the latest project information, regardless of location or device.

**The Result:** *“Everything was being updated within the Sessions, so everyone had the latest information,” said Jalpesh Patel, now Bluebeam’s industry development manager who worked on the renovation as a civil engineer. “Accessibility was key—you didn’t need special software, and the information was always available.”*

By centralizing communication and enabling real-time updates, the team avoided logistical bottlenecks, keeping the massive infrastructure project on track even as project timelines accelerated.



## A Q&A with ALLPLAN

ALLPLAN has been around since the 1980s, but its ALLPLAN Civil, designed specifically for public infrastructure projects such as roads, bridges, railway lines and more, recently launched to better serve civil engineers and others working on infrastructure projects.

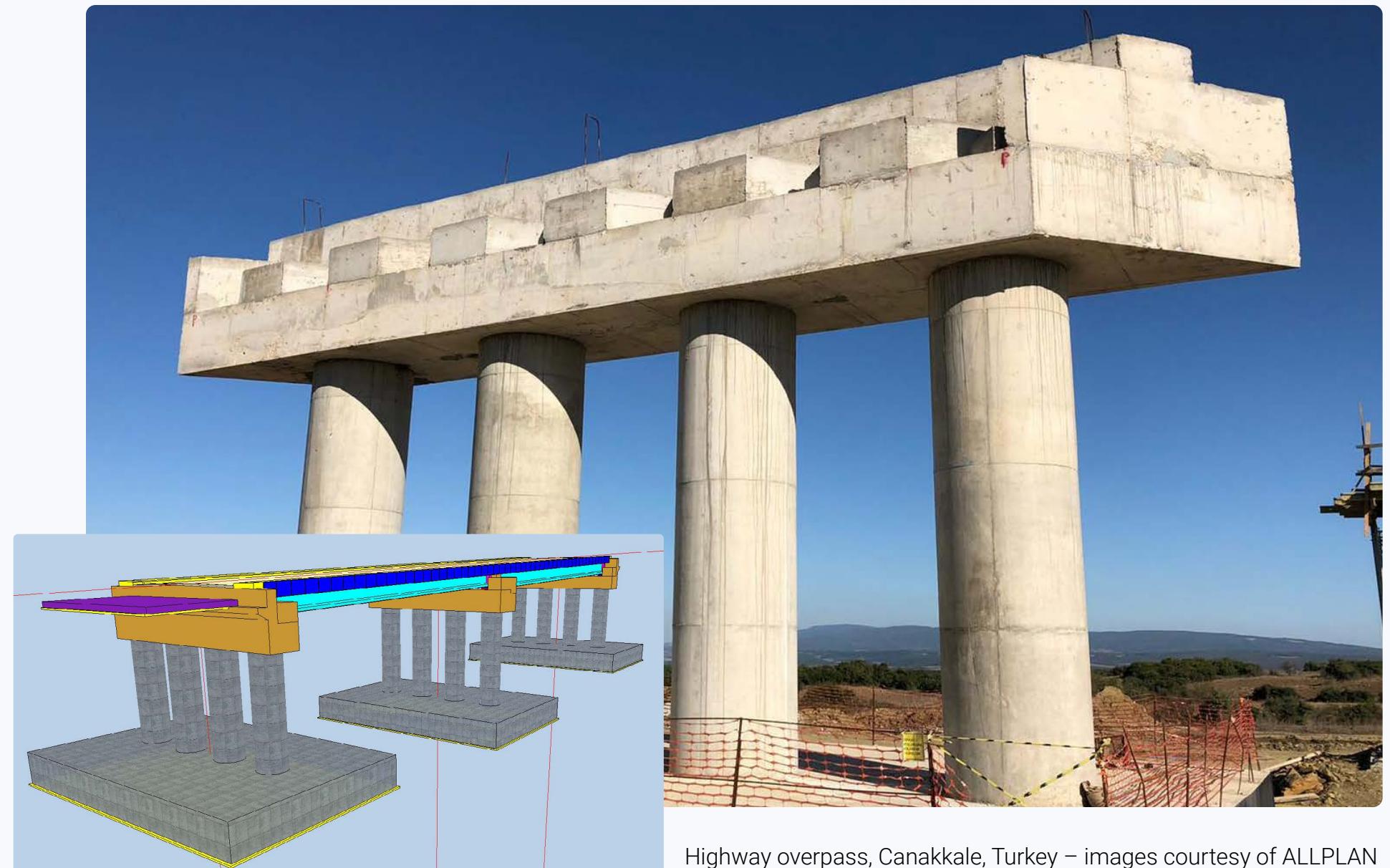
Bluebeam checked in with ALLPLAN's Alex Barbone, onboarding and professional services manager, to learn more about challenges in the industry and its new offering.

*"When it comes to building information modeling, what's difficult about the building is the scale of it. It's a lot of simple components, but it is an incredibly large number of them—all those doors, windows, beams and bolts," Barbone said. "For transportation projects, the complexity is not the scale, it's the geometry. The geometry is much more complicated. It involves a lot of curves, a lot of subtle changes, and your modeler needs to be able to handle that. And if it wasn't designed from the start to handle that, it probably won't handle it very well."*

**What are some important trends you've seen in this sector as a whole?**

**Barbone:** Probably the biggest two trends are a shortage of design professionals and the push toward digital delivery. It's no secret that there's a lot of work to be done on the country's infrastructure. But we regularly hear about difficulties in hiring and retaining skilled designers from both government agencies and design firms.

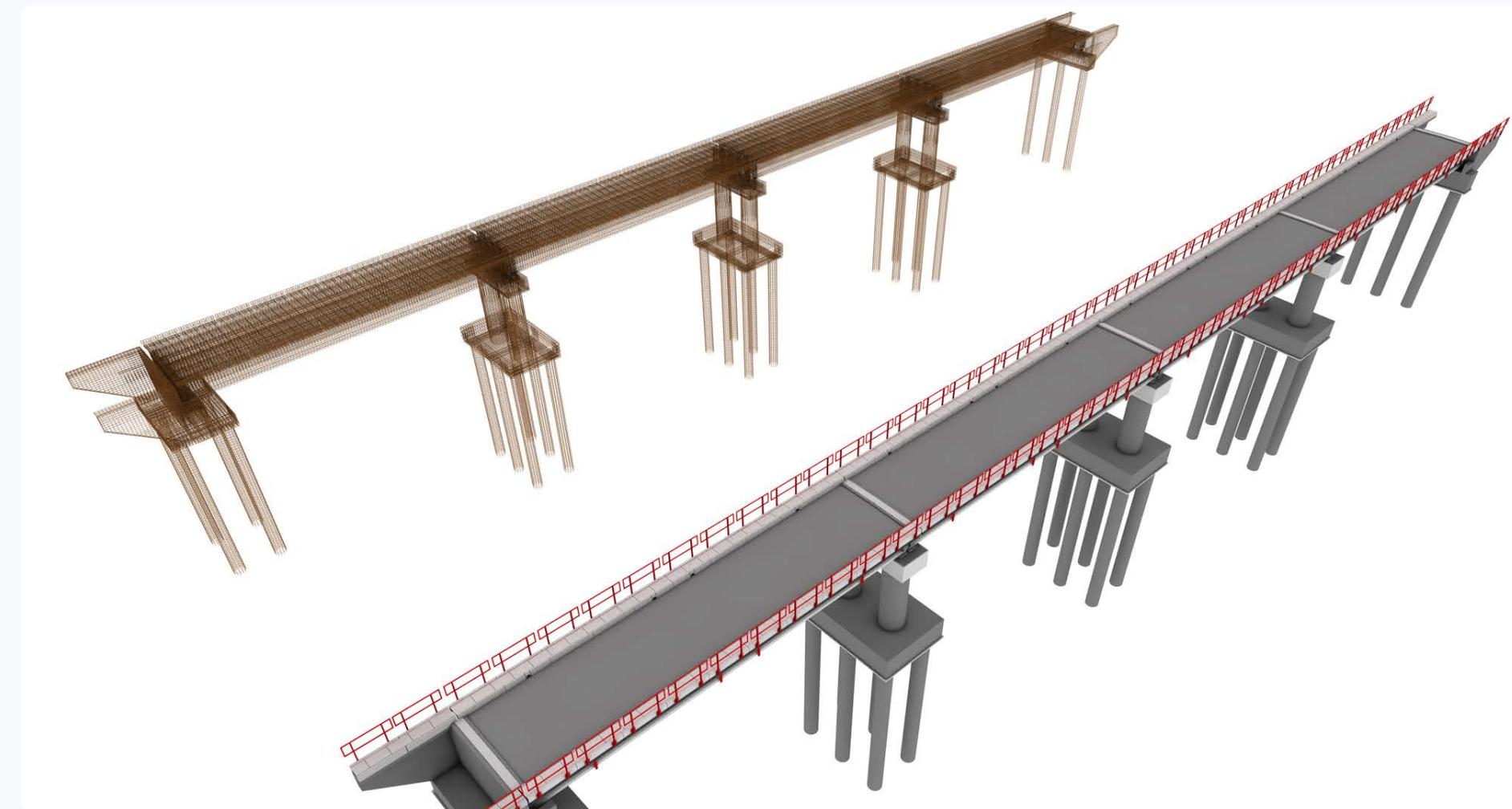
At the same time, there's a lot of interest in modernizing design deliverables. Digital delivery is intended to improve the quality of infrastructure projects by turning over to construction contractors a digital representation of the project design instead of just drawings. It's quite the departure from a sector that has historically been slower to adopt BIM project delivery. Both trends are driving many governmental agencies and design firms to reevaluate what technology they use.



## What types of civil and infrastructure projects are best suited for ALLPLAN?

**Barbone:** If there's one thing we learned over the past few years, it's that we underestimated our own parametric modeling tool. We had developed a product specifically for modeling bridges, but our customers were quick to realize they could use it to model retaining walls and tunnels. It's one of the reasons we changed the name of the product from "ALLPLAN Bridge" to "ALLPLAN Civil." Turns out it's useful for more than just bridges and basically all linear infrastructure projects.

I used it myself to model the walls and steel framing for building, and even successfully experimented with modeling overhead contact system structures for a rail corridor. I know somebody else at ALLPLAN who modeled their carport in ALLPLAN Civil; he even used a built-in analysis engine to check the member sizes. I think the next thing that I want to try to model in ALLPLAN Civil is a roller coaster, just to see if we can.



## How does ALLPLAN specifically benefit infrastructure projects like roads or railways?

**Barbone:** Many building information modeling software products were initially developed for vertical built assets and later modified to better accommodate infrastructure projects. Our ALLPLAN Civil product was built from scratch to give civil engineers in the transportation sector a parametric modeling tool specific for the types of structures they design.

Having been a structural engineer with a background in vertical structures and then later become familiar with bridge design, I can tell you that it would have been very difficult to use some tools made for buildings to design even a simple bridge. Having a separate modeling platform for these types of structures makes the process feel more natural.

## The Road Ahead: Future-Proofing Civil Infrastructure with Technology

The intersection of groundbreaking technology, increased infrastructure funding and the urgent need for modernized public works has set the stage for a transformative era in the AEC industry.

As infrastructure projects grow in scale and complexity, open data standards and seamless interoperability between tools are becoming essential for success.

Bluebeam's commitment to open data standards through initiatives like the Nemetschek Group's interoperability agreement with Autodesk exemplify how industry leaders are enabling smarter, more connected project ecosystems.

By breaking down data silos and avoiding proprietary formats, these advancements ensure critical project data remains accessible, accurate and secure throughout a project's lifecycle.

The potential goes far beyond current capabilities. Emerging technologies like AI-powered design automation, real-time digital twins and predictive maintenance models are set to redefine how infrastructure is planned, built and maintained. Combined with record-breaking funding initiatives worldwide, the AEC industry is primed for innovation that could reshape public infrastructure on an unprecedented scale.

As the infrastructure boom accelerates, the integration of advanced technologies and collaborative platforms will be critical for turning today's challenges into tomorrow's solutions—building smarter, safer and more sustainable communities for future generations.

**Ready to Experience Bluebeam for Yourself?**

Turn project complexity into streamlined success.

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