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10-37 4th Annual Smart Design & Construction

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- AECOM
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- Trimble

FEATURES

- 39 Q&A With South Carolina Department of Transportation Secretary Christy Hall
- 42 # Infrastructure Investment at Work: South Carolina and Utah Project Profiles



INSIGHTS

- Chair's Corner, p. 6
- Dave Bauer: The Arena, p. 8
- Regulatory Roundup, p. 45
- ARTBA On the Road, p. 47
- AEM Corner, p. 49
- TransOvation Tech, p. 50



ADVERTISER INDEX

Branch Group, p. 21

Flatiron Construction Corp., p. 52

GOMACO Corp., p. 22

HaulHub Technologies, p. 32

Hill & Smith Inc., p. 2

MAX USA CORP., p. 7

National Work Zone Safety Information Clearinghouse, p. 48

Reef Industries Inc., p. 5

Road Widener, LLC, p. 29

Roadway Construction Focus Four & Heat Hazards, p. 38

Stalker Radar / Street Dynamics, p. 41

Tensar, A Division of CMC, p. 19

TraFFix Devices Inc., p. 36

Valtir, LLC, p. 51

Wirtgen America Inc., p. 15

ARTBA:

Advertise With Us, p. 37

Follow Us On Social Media, p. 28

Interactive ARTBA Dashboards, p. 31

Membership, p. 46

National Convention, p. 9

Regional Meetings, p. 40

Safety Center, p. 25

Transportation Construction Market Intelligence Service, p. 44

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EDITOR'S NOTE

BETH MCGINN | Editorial Director

An Industry Adapting



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Last fall, I caught my teenagers asking their cell phones silly questions and giggling. I asked them who they were talking to. “ChatGPT,” they told me. A couple of months later I found myself using the same platform to help write an ARTBA video script. The script it spat out was far from perfect, but AI gave me some great ideas that enhanced the final product.

It is not a question of when AI (Artificial Intelligence) will “take over.” It is already taking root. My kids—as usual—were just ahead of me in terms of experimenting and adapting.

The technology is here, and as you will see in this issue, the industry is adapting too. We asked two experts how AI will transform their work. Their answers—along with ChatGPT’s—are found on page 26.

And it is not just AI transforming the industry. Our members are harnessing a wide variety of emerging technologies to make designing, building, and maintaining transportation infrastructure easier, safer, and more sustainable. Sensors in pavement predict damage and recommend maintenance before costly and dangerous harm occurs. Digitization of construction projects means seeing structures in 3D while also looking at costs and timelines. Drone acquired data helps crews out in the field anticipate design challenges before they happen.

After reading, researching, and editing this issue of the magazine—our 4th Annual Smart Design & Construction publication—I am convinced AI and other technologies will not replace humans. But humans who learn to use them to do their jobs better will be the ones who come out on top.



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CHAIR'S CORNER

PAULA HAMMOND | Senior Vice President, WSP USA

Showing What's Possible

In the early-morning hours of June 11, a tractor trailer carrying gasoline crashed and exploded at an underpass along I-95 in northeast Philadelphia. Tragically, the driver died. To watch video of the fire and the collapse of the roadway that followed—it is a miracle no one else was injured or killed.

What happened next was just as miraculous. While officials warned that closure of America's busiest east coast highway could last months—disrupting commerce and majorly impacting summer travel for millions—crews were able to repair and reopen the temporary fix to six lanes of interstate in just 12 days. This feat was made possible by a combination of good old fashioned hard work and the ability to innovate—two hallmarks of the transportation construction industry at large.

Construction and design teams, along with their state and federal agency partners, worked around the clock, using the materials they had available. This included ultra-lightweight glass foamed aggregates and highly advanced precast components. These materials saved time and allowed crews to work in all types of weather. When equipment was too short or too heavy to reach the jobsite, crews thought on their feet, adding and adjusting parts to find a workable solution.

As builders of great things, we are always trying to rethink and repurpose. If there is a way to do it faster, better, safer, we will find it. Technologies like Artificial Intelligence (AI) empowered tools, digital construction and sensing equipment are helping take this approach to the next level, as you will see in other stories featured in this issue of *Transportation Builder*. Today, we can anticipate structural issues before they happen. We can visualize and assess project timelines, costs and structures in real time across the project lifecycle.

ARTBA's Innovation & Technology Forum is working to accelerate adoption of these tools across the country. Like the men and women who repaired the I-95 bridge in Philadelphia—we need to work with the tools we have to get the job for the American public and deliver better infrastructure that is in the best interests of taxpayers. By embracing innovation and through good old fashioned hard work, our industry is showing everyone what's possible.

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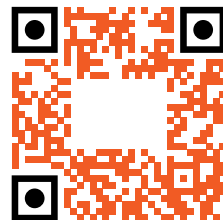
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THE ARENA

DAVE BAUER | President & CEO, ARTBA

Seeing is Believing

Step right up, you won't believe your eyes! This popular cry of carnival barkers is becoming a reality with the rise of Artificial Intelligence (AI), and its sentiment has not spared the transportation community, either.

Dissecting the U.S. transportation construction market—on a good day—can involve unravelling a collection of contradictions and anecdotes. That is why comments about the Infrastructure Investment and Jobs Act (IIJA), like those below, are hard to reconcile with other existing indicators.

“The law didn't make any difference in our state.”

“The funding increase isn't really that much.”

“Inflation ate up any gains from the bill.”

Really? A year-one increase of 38 percent and 73 percent in federal highway and public transit investment, respectively, compared to the previous year would be a pipe dream not too long ago—especially given the harsh polarization on Capitol Hill.

Amid these commentaries, I put AI to the test. What would a chatbot, seemingly immune to political and social pressures, say about the infrastructure law's benefits? A query to ChatGPT provided me a long and generic answer about increased productivity and competitiveness, but then it closed with this nugget:

“It is important to consult up-to-date economic studies and analyses to assess the specific benefits of infrastructure investments in a given context.”

Luckily at ARTBA, such analyses are at the heart of our advocacy activities. And believe it or not, the data reveals the law is working as intended with thousands of new projects underway compared to prior years.

ARTBA tracks contract awards, bid data, federal grants, and market activity across the country and makes the information widely available to the public and elected officials. Our analysis found that in 2022, the value of contract awards increased 26 percent—the highest ever since we launched our tracking service in 1997.

“But Dave, what about inflation?”

There is no denying the impacts of inflation, which have also been felt differently throughout the country. But the number of highway contract awards was up by 16 percent, too, compared with two percent in the prior five-year average. The IIJA's measurable impacts are not subjective and they're also not overnight. But contract awards are a key leading indicator of future market growth.

To help speed House passage of the IIJA, ARTBA commissioned a study from one of the world's top forecasting companies to analyze the economic benefits to the states resulting from a significant boost in highway investment. It found that most of growth and productivity gains would come in 2024, 2025 and 2026. We are just getting started.

State budgets are also expected to grow by 13 to 16 percent over the next two years, compared with five to six percent growth we have seen recently. There is no magic at play here—and the sustained benefit of long-term increased investment is a proven contributor to this market growth.

Empirical data will always be foundational to ARTBA's advocacy efforts and to touting IIJA successes. In 18 months, the push for a new reauthorization bill will begin in earnest. Demonstrating the economic benefits across America from the current authorization law will be integral to ensuring continued strong federal investment. The data is undeniable, and the improvements to roads, bridges and public transportation systems will be, too.

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Our 4th Annual “Smart Design & Construction” issue features articles from a variety of ARTBA member firms.

See on pages 12-37 how our members are leveraging digital construction and other technologies to deliver faster, safer, more resilient transportation improvements.

How a Heavy Civil Contractor Leverages Virtual Construction

BY ALICIA LOPEZ
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State departments of transportation and horizontal infrastructure clients increasingly require the use of building information modeling (BIM) and virtual design and construction (VDC) techniques. Project after project shows the reason: BIM and VDC take collaboration and organization to the next level of efficacy, efficiency, and safety throughout the infrastructure lifecycle.

With BIM, the leap from traditional 2D drawings to digital 3D models embeds more project information. Three hundred and sixty-degree visuals in an electronic format can be updated and shared with project stakeholders. The digital models are growing even more useful as they progress to 4D, which incorporates the dimension of time/schedule sequencing.

As part of the Virginia Department of Transportation (VDOT) \$3.9 billion contract for upgrading and expansion of the 3.5-mile bridge and tunnel connecting Norfolk and Hampton, Flatiron engineers build 4D visual simulations for each quarterly progress report. These animations show VDOT how construction work will take place during the upcoming three months. As part of the contract, Flatiron also submits an updated 4D model monthly to VDOT.

More cutting-edge models are moving to 5D, adding the dimension of cost. New York City's Battery Park City Authority, which is overseeing design and construction of a seawall to prevent flooding, will use 5D models to understand how budgets are affected based on schedule sequencing. Up next: 6D, which factors in sustainability efforts and impacts.

Benefits to All Stakeholders

In addition to the Hampton Roads and Battery Park City projects, Flatiron has successfully deployed BIM and VDC for a number of other clients, including Denver International Airport and Canada's Site C hydroelectric project. Digital technologies allow clients to keep closer track of massive, complex infrastructure efforts. They are especially well-suited for design-build, progressive design-build, construction manager at risk and construction manager/general contractor projects by providing a critical tool during the preconstruction process. They help the project team enhance design to reach budget, schedule goals, and improve overall stakeholder satisfaction.



The Site C - Generating Station and Spillways Civil Works Project near Fort St. John, British Columbia in Canada benefits heavily from VDC technology. Photo courtesy of Flatiron.

That's just the start. BIM and VDC deliver many important advantages not just before, but also during and after construction for clients and other project stakeholders from local agencies, designers, and engineers to builders, joint venture partners, and subcontractors. The big beneficiaries of infrastructure that is built safer, faster, at lower cost and with higher-quality outcomes are the users of these roads, bridges, airports, and other heavy civil projects.

Seven Key Use Cases

BIM and VDC techniques can significantly improve the heavy civil construction process from start to finish and beyond. Here are seven real-world applications:

- **Enhance design and constructability.** As part of the Site C Dam hydroelectric project, which has a goal of being built to last 100 years, Flatiron and its partners are relying on BIM for the Generating Station and Spillways (GSS) Civil Works. One key use involves determining the best way to construct temporary diversion tunnels for rerouting the river and then close and fill them in. Flatiron's BIM expert used the 3D model to create a video that shows the tunnel closure process, from modeling four kilometers of ventilation, to installing the fill layer-by-layer of soil,

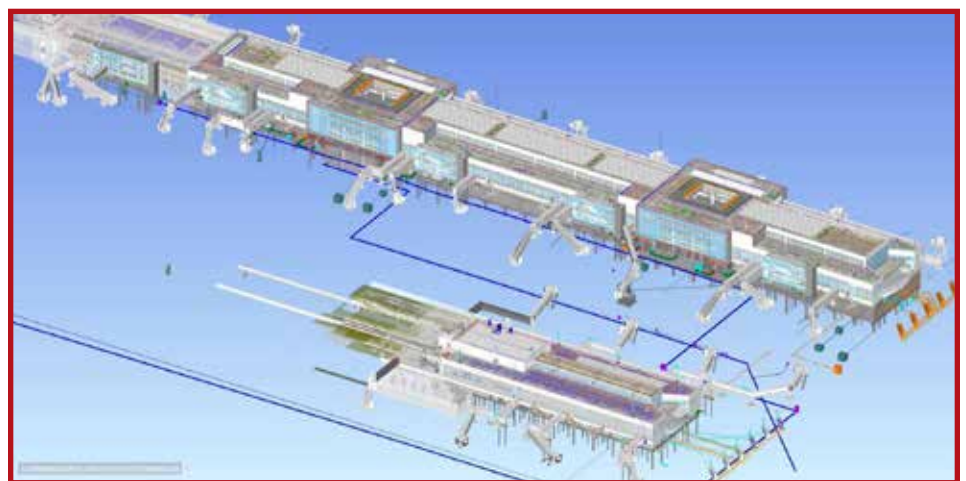
rocks, and liquid concrete. The team can view the model at any stage and make virtual changes, such as trying different sizes and placements for ventilation ducts. Using a VR helmet, the client and other team members also can virtually walk through the future design.

At Denver International Airport, where one main goal was preserving the architecture, Flatiron used BIM to explore and eliminate options to adjust above-ceiling utilities before demonstrating the need for architectural adjustments, such as lowering a ceiling.

- **Eliminate clashes and minimize rework.** In renovating and expanding the five-level Concourse A and four-level Concourse B at the Denver airport, Flatiron's VDC manager maintained a federated model that incorporated 3D models from many design team members and all major subcontractors. This model was used to identify and discuss more than 100,000 potential clashes throughout the project. The majority were resolved in the model during pre-installation, leading to a better final design. Flatiron also developed high-density spatial images using laser scanning to capture as-built conditions, then compared them to the federated model to identify, track and resolve more than 700 as-built issues.
- **Sequence workflow.** At the Hampton Roads Bridge and Tunnel Project, Flatiron's BIM coordinator meets weekly with schedulers for joint venture partners and trades to update the 4D model. Once he inputs the modifications and compares it to the 3D model, he flags any schedule conflicts or missing steps so schedulers can work with the construction engineers to resolve them. For example, the 3D model called for placing a sound barrier in the tunnel but the 4D model identified that this task was scheduled to occur before storm drainage was installed, which had to happen first.
- **Improve safety.** 3D models and simulations can identify potential hazards before they become a problem. Similarly, virtual, and augmented reality provide immersive and interactive training for workers to improve safety. For example, Flatiron uses the 4D model at Hampton Roads to ensure heavy equipment and materials are positioned so they can move through the tunnel but not impede or endanger workers building the pump station.

- **Streamline client approvals.** BIM helps in the client approval process. At the Denver airport, Flatiron's trade partners were required to produce and frequently update detailed 3D models of proposed work. The client used those models when reviewing shop drawings to confirm that the work in specific shop drawings was coordinated against its surroundings, decreasing their review time, and increasing their confidence in allowing the work to move forward.
- **Document quality along the way and of the final product.** The laser scanning combined with BIM at the Denver airport served as quality control and assurance for the client—showing that construction, such as a masonry wall reinforcement, met specifications. More clients, including the Denver airport and VDOT, also are specifying in contracts that they receive a final 3D model of the infrastructure to support ongoing operations and maintenance.
- **Develop more accurate cost and quantity estimates.** Project teams can extract detailed information from BIM and integrate this design data with materials databases. As a result, they can generate precise construction cost estimates, helping stakeholders make informed decisions and effectively manage budgets. The BIM model at Hampton Roads is used for quantity estimates.

See *Virtual*, 14



BIM allows for real-time visual models of progress at Denver International Airport's Concourse Expansion Projects. As a result, engineers can make modifications quicker if needed. Photo courtesy of Flatiron.

Virtual, from 13

VDC Gets Bigger...

From increasing productivity to expediting timelines, digital technologies have shown their value in helping manage increasingly complex infrastructure projects. Beginning in 2020, some European nations were expected to realize annual savings of five to 20 percent in civil construction spending due to BIM use, according to research by the Conference of European Directors of Roads.

Not surprisingly, more government clients in the U.S. and globally are throwing their weight behind BIM. In 2021, the U.S. Federal Highway Administration issued the report *Advancing BIM for Infrastructure: A National Strategic Roadmap*.

Even more ambitiously, Colombia developed a national strategy that requires 100 percent of public construction projects use BIM by 2026.

Industry groups are also working to spur BIM adoption. I am a member of the Design-Build Institute of America's Virtual Design and Construction Committee, and our mission is to educate the industry about its value while shaping how VDC can thrive in a collaborative "whole team approach" project delivery environment.

...And Better

VDC technologies are not standing still either. More clients are creating digital twins of their infrastructure, for example. Digital twins are virtual replicas that serve as a collaborative platform, allowing owners to engage stakeholders in the planning and management process.

Artificial Intelligence (AI) applications offer real promise as well. Flatiron is researching AI integrated with BIM to achieve advances such as predictive scheduling.

With a proven track record and greater potential in the future, VDC and BIM are becoming as indispensable on civil infrastructure projects as excavators and cranes.

Alicia Lopez is vice president of innovation and design management at Flatiron.

Innovative Solutions Protect the Weakest Part of Pavement

BY ZOE BUHL
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Have you ever heard the expression, "A chain is no stronger than its weakest link?" The adage can be applied to road construction. No matter how strong and durable your materials, if one component is breakable, the rest are compromised as well.

In roadways that link is often the longitudinal joints, which have a history of deteriorating much quicker than the road surface itself, creating potentially dangerous situations for drivers and reducing the lifespan of pavement.

Damage to joints occurs when a fresh batch of hot-mix asphalt (HMA) is laid adjacent to an existing lane. Most often, differences in temperature and mat plasticity cause improper bonding of the

fresh HMA with the older asphalt lane. As a result, the longitudinal joint is significantly less dense than the rest of the pavement. Over time, a crack occurs between the mats, allowing air and water to seep in.

An Ounce of Prevention

Innovative solutions have been developed to increase density at the longitudinal joint and help the industry build longer-lasting roads. Research shows that using a Void Reducing Asphalt Membrane (VRAM) and a Rapid Penetrating Emulsion (RPE) at the centerline can significantly extend pavement life.

See *Pavement*, 16

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Pavement, from 14

VRAM is a specially formulated polymer modified asphalt membrane applied at the time of construction. It migrates up, filling voids that can be penetrated by water and air. As voids and connected voids are filled, permeability decreases, which protects the pavement.

While VRAM fills voids from the bottom up, RPE is applied on the surface. Instead of sitting on top of a pavement like traditional fog seals, RPE is a specially formulated emulsion made to penetrate quickly down into the asphalt surface. The emulsion carries additional asphalt residue into the smaller interconnected voids of the pavement. This helps fill cracks and reduce permeability from above.

While VRAM and RPE have significant benefits on their own, they create even stronger roads when used together, and in turn have long-term economic, social, and environmental benefits.

Better Together

The longitudinal joint is not only the most vulnerable part of the pavement, but it is also the most expensive part of the road. The centerline of roadways often contains rumble strips, pavement striping and/or reflective pavement markers (RPMs) to keep drivers safe. When the center of the road deteriorates, these costly safety measures must be repaired or replaced. Agencies



Paving train placing pavement on top of VRAM application, highlighting an important step in the asphalt paving process to ensure pavement longevity. Photo courtesy of Asphalt Materials, Inc.

that invest in innovative joint-protecting technologies like VRAM and RPE see roads last up to five years longer and typically deliver a return on investment of three to five times its cost.

The use of both RPE and VRAM has been especially beneficial on roads featuring centerline rumble strips (CLRS). More and more transportation departments are investing in CLRS to warn drivers that they are straying from their lane. While CLRS are an investment to save lives, these textured grooves are milled into the pavement, increasing permeability. Applying VRAM at the time of construction, under the surface where centerline rumble strips are installed, reduces permeability in this critical area. Post-construction, it is recommended to use RPE as a preventative and remedial treatment for longitudinal joints. When these solutions work together, there is increased protection for roads and drivers.

Proper application of these innovative technologies will positively impact asphalt pavement service life. Long service life significantly increases pavement sustainability as well. Asphalt pavements that last longer reduce lifecycle costs, user delays, and environmental impacts compared to the standard 15-year pavement life. When longitudinal joints last longer, roads last longer, drivers have smoother, safer rides, and agency resources go further.

Zoe Buhl is Heritage Construction & Materials' brand manager.



Rumble strips along the centerline of a road enhance driver safety. Photo courtesy of Asphalt Materials, Inc.

Innovative Sensing Technologies for Roadway Maintenance

BY JOE CAVANAUGH AND JOHN WALLACE
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The City of Ft. Worth's Pavement Manager Omar Elbagalati has a challenging job: keeping over 8,000 miles of roads in good shape for millions of area residents, visitors and businesses while staying within budget. No easy task when you consider the extreme heat and unpredictable cold snaps in this part of Texas.

Not long ago, Elbagalati reached out to Tensar to discuss the use of Geogrids in roadway construction and rehab. Geogrids are net-like structures used primarily to stabilize or reinforce existing soil or aggregate materials. The grids help extend the life of roads.

During the conversation, Elbagalati was surprised to learn Tensar was developing a Geogrid that could potentially detect damage in roads long before it is visible, allowing state and local government agencies to be proactive in their maintenance and repair operations.

How it Works

The Geogrids contain sensors that use a unique technology to record the force applied as traffic moves above. The information is then sent via a wireless network to a monitoring platform which analyzes the data and provides insights using sensor fusion and Artificial Intelligence (AI) (Figure 1). These insights include information about the condition of the road structure that can then be used to make maintenance decisions.

The sensors also use a piezoelectric element that harvests energy from forces applied to the Geogrid, resulting in very low power requirements and extended sensor life (Figure 2). The energy levels are captured and converted to a strain via the

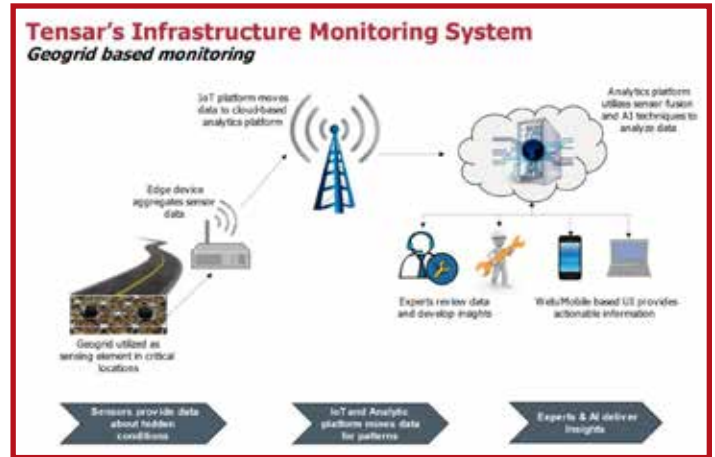


Figure 1- Infrastructure monitoring platform

analytics platform. A roadside gateway receives the data from the sensors and sends the information to the analytics platform.

Pilot Program

In early 2023, Ft. Worth launched a pilot program to test the technology. While rehabilitating one lane of FAA Boulevard near the Dallas/Ft. Worth Airport, several Tensar Geogrids with sensors were installed at the subgrade level (below the base) and on top of the base. Each unit contained a temperature sensor as well as the piezoelectric sensor (Figure 3).

The components were installed a few days before the concrete slab was poured. Data collected shows how temperature was

See *Geogrid*, 18

Geogrid Based Pavement Sensing System

- Utilizes Geogrids as base
- Unique technology provides insight into conditions "under the pavement"
 - Cumulative Strain & Temperature
- "No wires" system uses wireless communication and energy harvesting technology
- Wireless reader installed roadside to collect data and send to cloud based IoT platform
- System senses loading applied and records data
- Data analytics provides insights into structure condition

Images include: "Sensors mounted on geogrid" and "Installed under pavement to collect data". A "Wireless reader" is shown on a roadside.

Figure 2- Road sensors

City of Ft. Worth- Pilot Installation

- Tasked with Continuous Improvement of roadway construction and maintenance
- Challenged to find an innovative way to monitor condition of roads and optimize Maintenance
- Geogrid and sensing combination
- Pilot installation completed March 2023

Includes the City of Ft. Worth logo and "6,129 lane miles". Photos show "Roadside 'Reader'" and "Grid Sensors placed in wheel path".

Quote: "With continuous monitoring, cities and municipalities can make information decisions for M&R activities, improve safety and prolong the service life of roadway infrastructure." Omar Elbagalati, Pavement Manager, City of Ft. Worth

Figure 3- Pilot test installation

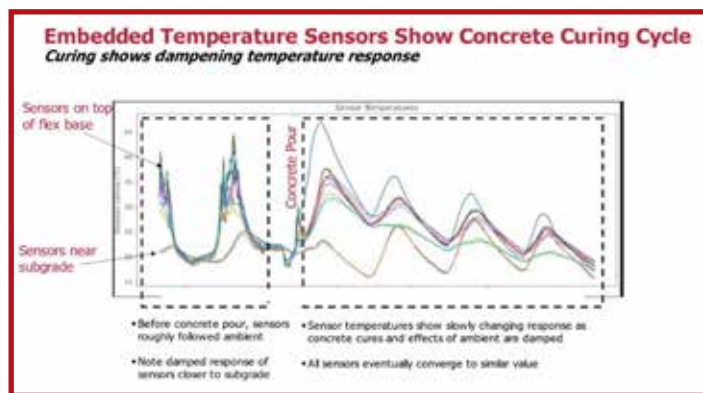


Figure 4- Temperature data

initially responding to the ambient conditions during day and night (Figure 4). The pattern abruptly changes as the concrete was poured and started the curing process.

The sensors also recorded strain levels during the initial installation (before the concrete was poured) and how the levels increased as the concrete was poured. The dynamic strain is captured in several “gates” based on the overall level of force being applied, with Level 1 being the smallest force and Level 7 being the largest (Figure 5). The sensors capture the data in a cumulative fashion, meaning that at any point in time the overall history of forces on the structure can be easily obtained.

Previous lab testing has shown that rapidly increasing values in the higher gates (Levels 6 & 7) indicate the onset of damage in the subgrade, or base, which can occur long before any damage is visible on the surface. By analyzing the data and reviewing trends over time, a predictive or condition-based maintenance strategy can be implemented.

Analyzing the Data

The pilot program collected several months of data (Figure 6). As traffic flowed, the lower level “gates” (G1, G2) show a generally increasing level, while the higher gates (G6, G7) are relatively static. This pattern would imply that there is little if any damage

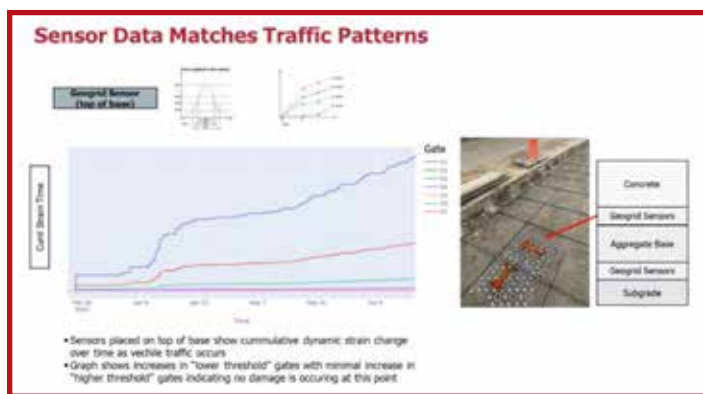


Figure 6- Sensor data with traffic

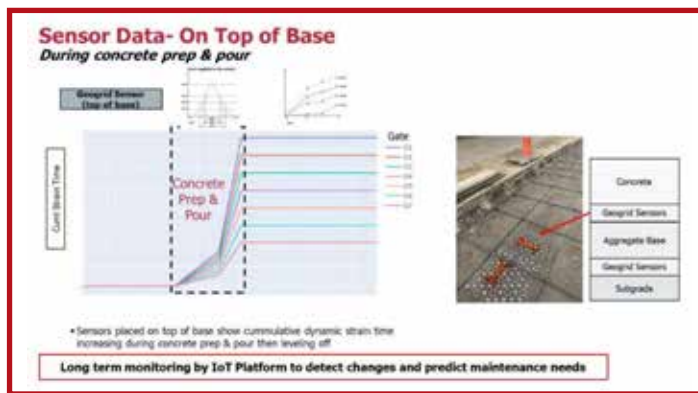


Figure 5- Sensor data

in the road at this point, an expected outcome given the road’s recent rehabilitation. If damage were starting to occur, the pattern would show an increasing value in the higher “gates” indicating the sensor is registering higher levels of dynamic strain due to deterioration of some part of the structure.

A traffic camera system was also recently installed onsite to enable traffic counts to be automatically collected and grouped by day (Figure 7). Traffic counts are reported daily but can be aggregated to obtain the total cumulative traffic the road has been exposed to. The data from the system will be used, along with the sensor data, to refine damage prediction algorithms.

The new sensor system could offer state and local transportation agencies a predictive system to optimize maintenance and repair operations. With continuous monitoring, cities and municipalities can make informed decisions to optimize their maintenance budgets. Helping managers like Elbagalati stay ahead of the curve means addressing costly damage before it happens, keeping unforeseen expenses from ballooning, and keeping people and goods moving.

Both authors are employed by Tensar. Joe Cavanaugh, P.E., is executive vice president, technology. John Wallace is director, intelligent systems.

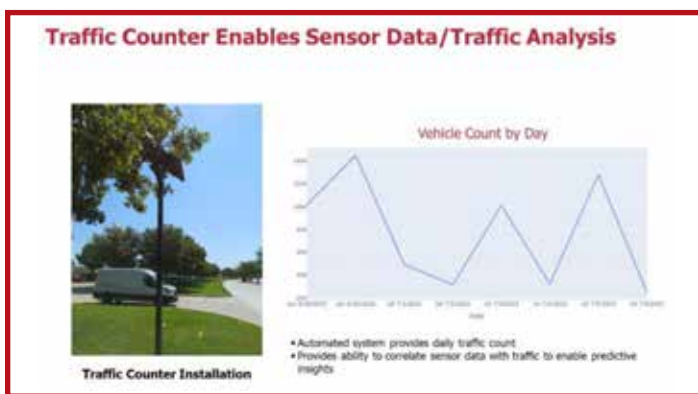
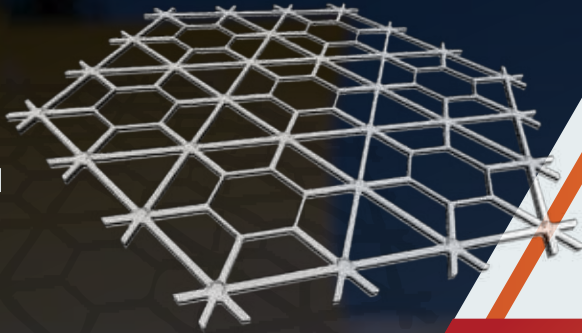


Figure 7- Traffic counter

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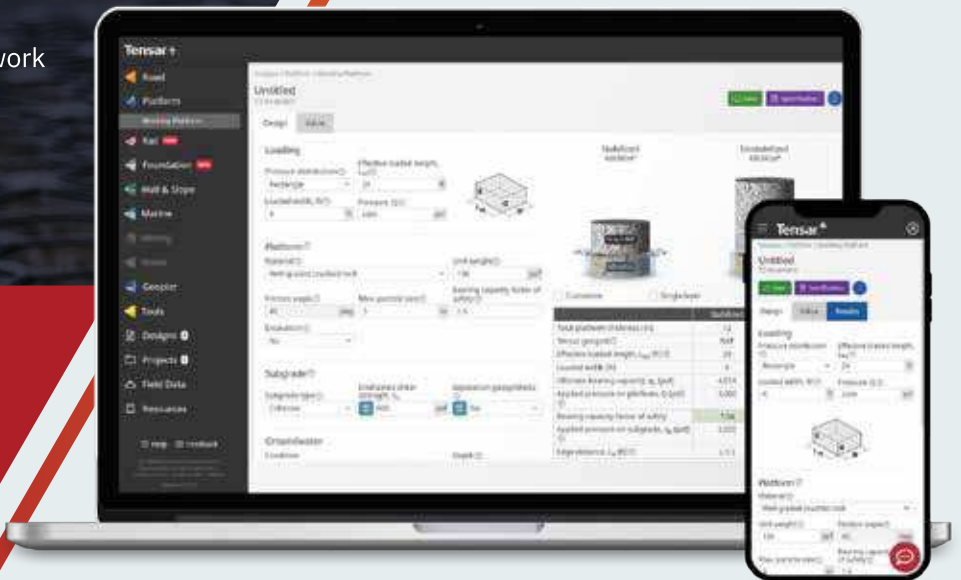
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Proof that Better Technology Wins

BY DANIEL LIEBERMAN
daniel.lieberman@branchgroup.com

Technology in construction has not always been synonymous with efficiency and cost-savings. While it's difficult to determine which technology or software is worth the investment in terms of time and money, it's imperative to look at successful projects and case studies to see how they are being used in real-world applications. What seemed like a great idea in a conference room at a corporate headquarters doesn't always translate to proper or positive utilization in the field. Before making an investment and disrupting project teams, creating a committee of end-users to vet, test, and train in new technology is critical.

Maximum Benefit

Branch has a two-pronged approach to improved project technology use and training. The first is the construction support services team, whose job it is to advance technical and administrative processes and frontline support to operations so they can be more efficient and effective. The connection of project teams with this support is streamlined through the Operations Awareness Rooms (OAR), which is

a satellite connection between the project site and regional offices. Recent advancements add formidable support to the OAR's success. With a modern telepresence system, project web cameras, iPlan Table, electronic whiteboard, and a future virtual reality station, the communication between office and field has never been more advanced. The OAR also becomes the focal point for regional office collaboration to connect employees in a strategic group setting in place of stand-alone desk monitors.

The second prong is a committee focused on technology and innovation, composed of a wide variety of end-users to ensure objectivity. This group is tasked with researching and testing solutions for enterprising engineering, updated or new technologies, testing, determining the best value-add, implementation and training, and focusing on new field-run software applications, which can often present hardware challenges. Getting the maximum benefit from a product before it becomes burdensome in the field is often a balance.

Real-World Application

When looking at a great example of straightforward, but advanced technology use, look no further than the Jamestown Parkway project in High Point, N.C. This relatively straightforward, 3.8-mile, four-lane connector between Greensboro and High Point encountered several unprecedented challenges during construction, but still came out on top due to the team's advanced technology use.

Two hurricanes (Florence and Matthew) hit the North Carolina Coast in late 2018, when the team was in the early stages of clearing, grubbing, and implementing erosion and river floodplain controls, along with stream diversions. Not long after the hurricanes hit, the area received an abnormal 12 inches of snow, followed by six inches of rain. The COVID-19 pandemic hit next, followed by a major change in scope, due to a flaw in the original design plan.

First, the team had to devise a way, and quickly, to redo most of the work damaged by the hurricanes and snow, rebuilding ruined stream diversions and get the project back on schedule while managing the multiple environmentally sensitive areas along the route. The company's internal GPS and modeling team performed modeling and quantity evaluations using drones and supporting software that



Two of the seven bridges built on the Jamestown Parkway Project in North Carolina. Photo courtesy of Branch.

quickly turned the drone imagery data into quantity analytics. Additional total station machine control for the most detailed 3D models expedited the relief and the execution of approximately 1.1 million cubic yards of earthwork, seven bridges, one railroad crossing, and 11 artery crossings. Branch's Construction Support Services division has since upgraded its drone fleet to Mavic with RTK and Aeropoints coupled with the latest Trimble Propellor software.

Data Driven Detour

The next challenge was the discovery of a road that was contracted to be closed for 270 days was no longer viable because of a nearby train depot blocking the detour route. Drone and modeling technology were used again to determine and exhibit earthwork flow for the complex change order needed to mitigate this issue. Many models and constructability reviews were created, pushing the 3D modeling technology to its fullest efficiency.

Branch suggested the addition of a proposed bridge site detour to maintain traffic in a tight right of way corridor. Working closely with the North Carolina Department of Transportation to generate various site model scenarios with quantities and stages of earthwork, which included a proposed temporary retaining wall, the team was able to mitigate eight months of the two-year original design delay by working on two different phases of the detour simultaneously. The modeling exercise resulted in a safe and efficient plan that worked flawlessly during the construction phase.

Efficient Equipment

The Jamestown Parkway project also utilized Branch's internal equipment Situation Awareness Room (SAR), located at the Branch headquarters in Roanoke, Va. Custom-built software provided real-time telematic data to facilitate the management of 350 pieces of heavy equipment, including constant GPS tracking, operator effectiveness, utilization, fault codes, scheduled maintenance, and downtime.

By enabling a pro-active, data-driven, and systematic approach to equipment maintenance, technicians maximized project efficiency, preventing lost time and keeping equipment in top shape, extending its life. Utilization rates and operator effectiveness are also analyzed to ensure equipment is being used on projects, and if not, to be transferred to another site for optimal efficiency. By ensuring little to no equipment downtime, the Jamestown project was able to execute all the earthwork ahead of schedule and had to wait on external utility relocation before resuming work.

See *Technology*, 23



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Technology, from 21

In the case of Jamestown Parkway, it's easy to see how much technology impacted the project and how the investment paid off. This was only possible through years of testing and improving products, creating procedures, hiring and training employees, and proving the benefits to the project teams. Deciding which technology to invest in is just as important as deciding what technology not to pursue. Research, testing, and training are key to investing in a company's technological future.

Daniel Lieberman has over 35 years of experience in the heavy civil and transportation industry serving in operational and executive roles for Branch, Flatiron, Archer Western and Tutor Perini. His expertise lies in project operations and controls with a passion for engineering and training. Now leading Branch's Construction Support Services division, Lieberman focuses on vetting and implementing technology to increase productivity and maximize resource utilization, to improve schedules, ensure safety, and improve owner satisfaction.

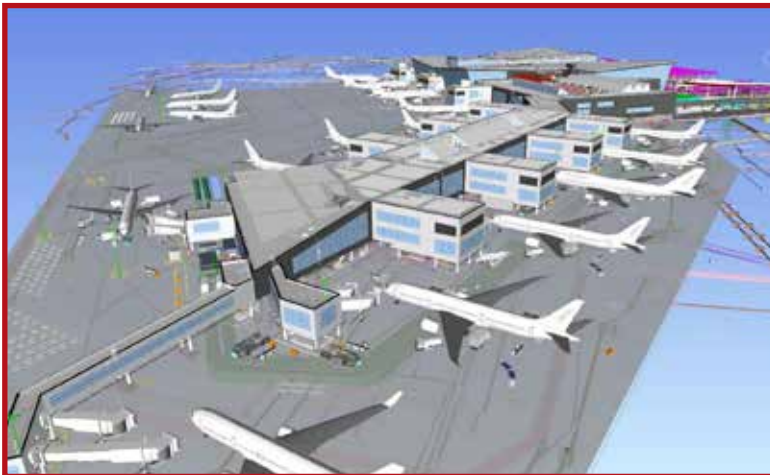


Excavator next to an active roadway after utility relocation. Photo courtesy of Branch.

Digital Delivery of the New Terminal One at JFK International Airport

BY NAVIN N. NITISH, P.E., AND CHARBEL MOUSALLEM
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As design engineer for the New Terminal One (NTO) at JFK International Airport (JFK), AECOM helped our client transform design and construction processes with digital solutions. The Port Authority of New York & New Jersey, in collaboration with JFKTerminalOneCo, LLC, is responsible for this airport redevelopment project. The NTO will replace the existing Terminal 1 and Terminal 2 while incorporating the former Terminal 3 site. The project involves phased demolition, coordinated construction with ongoing airport operations, and preservation of the existing Air Train. The NTO is the centerpiece of the largest terminal modernization project in the U.S., adding a new state-of-the-art, 23-gate, international-only facility to serve as a global gateway to the New York metropolitan area.



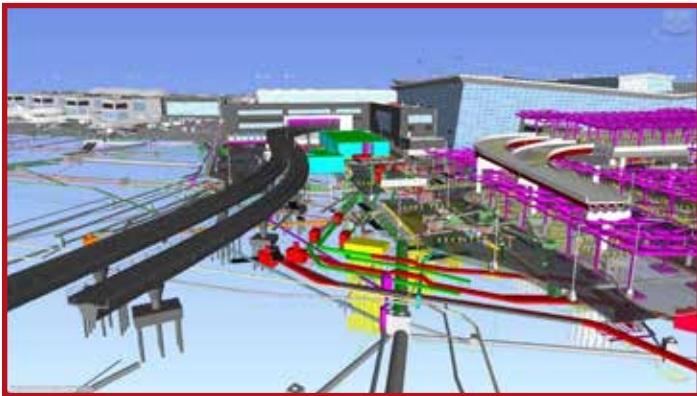
The federated multi-discipline coordination model was used throughout the apron planning and design process. Rendering courtesy of AECOM.

Tackling Early Design Challenges

AECOM managed the design for the entire airside and landside area for the NTO. Our work included all civil, site, and utility subsurface engineering for the apron as well as departure and arrival roadways. A key challenge of this project was planning, locating, and designing bridges, civil utility networks, and other new JFK NTO infrastructure to coexist with existing utilities and conditions. From the

See *JFK*, 24

JFK, from 23



Complex interfaces among the different disciplines of the project have been carefully and effectively managed through a federated project information model. Rendering courtesy of AECOM.

outset of the project, we needed to understand and be able to navigate the underground space between existing Terminals 1 and 4, which is a complex environment, densely populated with existing utilities and characterized by its unique soil type, drainage, vegetation, and topography.

The potential for unforeseen conflicts in this environment was compounded by a lack of reliable underground utility information. Our first assignment under the NTO was to develop enough drawing detail of the underground to enable contractors to solicit bids for utilities from utility subcontractors, within two weeks of notice to proceed.

Visualizing the Underground

Instead of preparing a set of 2D drawings, we created a computational tool to automatically convert 2D computer-aided design (CAD) drawings of the existing utilities survey into a 3D environment. Using this automated 3D modelling methodology, we were able to provide a detailed presentation of this complex problem so that our client and the design and construction team could visualize and understand the existing conditions.

AECOM's engineers created 3D models of the underground space to view and map each of the underground utilities, determine whether they matched the subsurface utility engineering as-built record data or on-site conditions, and then identify which utilities needed to be replaced or moved. Using our automated utility networks generation tool, we were able to automatically place structures such as manholes and catch basins as well as pipes in Revit based on 2D CAD files and highlight any pipes missing information for easy identification.

A dynamic link between source drawings and Revit enabled 3D networks was applied allowing for immediate updates.

Improving Bridge Design Processes With Digital Delivery

This early 3D modelling of existing utilities and site conditions kicked-off a broader computational and parametric design initiative for the NTO project. AECOM has successfully pioneered an advanced automated 3D modelling methodology as part of this initiative, seamlessly integrating AutoCAD data and 3D BIM models in Revit. On the new departure bridge project, potential conflicts with existing structures and utilities alongside operational, safety, and regulatory requirements posed many challenges. Our advanced 3D modelling methodology provided significant enhancements in efficiency and consistency in bridge design processes. Using a federated project information model, we carefully and effectively managed complex interfaces among the different disciplines of the project.

Key Features of Our Digital Delivery

1. **Develop an automated 3D modelling methodology:** We integrated AutoCAD and Revit to automate 3D modelling and streamlined tasks and processes through computational design techniques.
2. **Manage data:** We implemented a comprehensive data management strategy, ensured a smooth workflow, and informed users about file positions in the process.
3. **Automate tasks and projects:** We used visual programming software for automation and implemented automation at three data levels—overall process, operations, and parametric components.
4. **Collaborate and share knowledge:** We facilitated collaboration and knowledge sharing between teams and ensured transferability to other projects.
5. **Scale-up and deploy:** We explored scaling strategies for wider implementation and developed guidelines for future Port Authority project use.

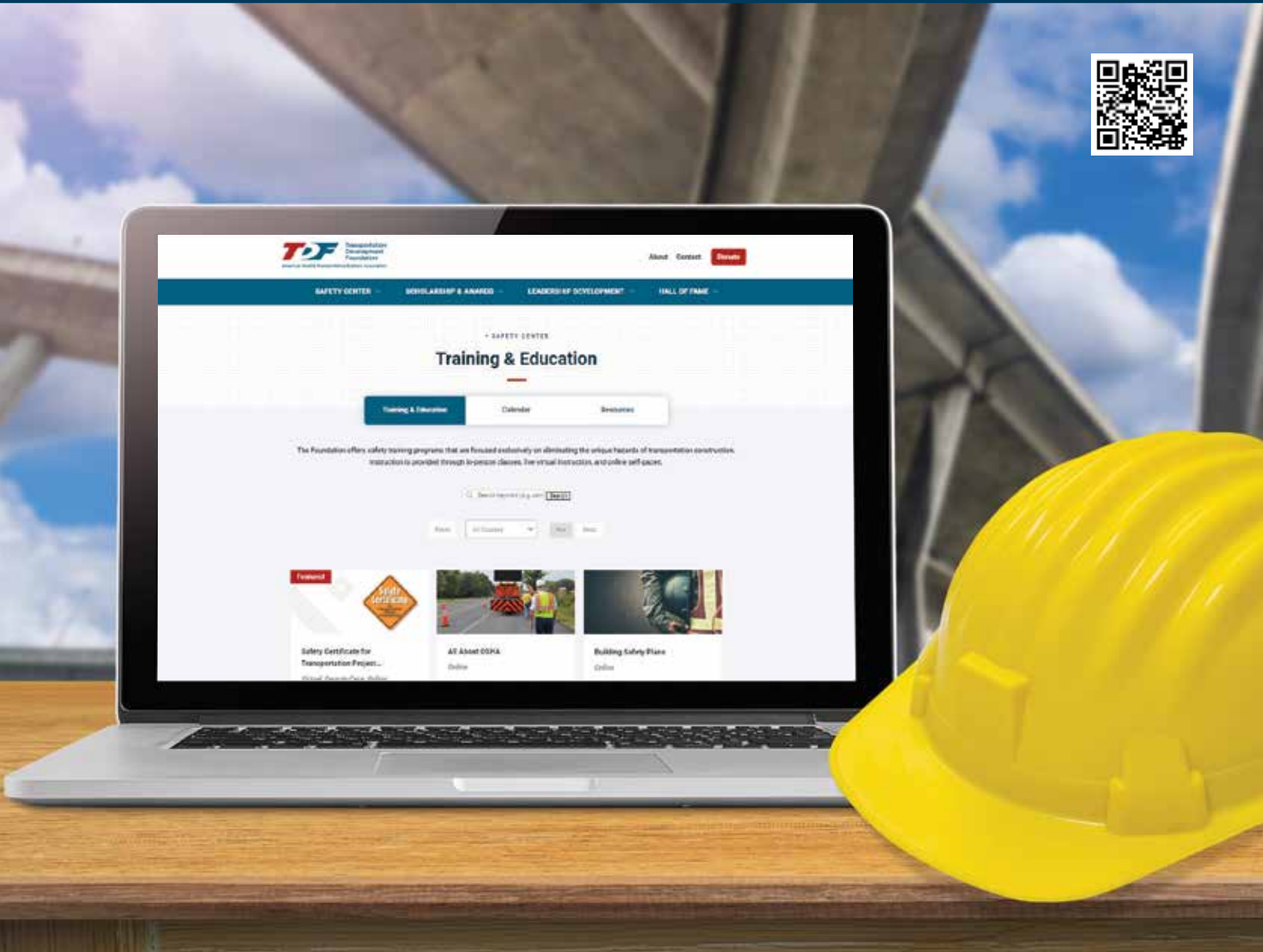
Transforming Design and Construction With Digital Solutions

Visualizing the existing site, utilities, and new infrastructure in 3D has been key to success on the JFK NTO project. Digital solutions enabled us to identify and resolve potential conflicts and aided the decision-making process for design, placement, and construction strategies. This streamlined our design and coordination process, mitigated potential challenges, and ensured a smoother transition from design to construction phase.

Both authors are employed by AECOM. Navin N. Nitish, P.E., is vice president, global aviation, aviation sector lead – air cargo/design-build/digital. Charbel Mousallem is digital solution manager, transportation.

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Artificial Intelligence & Transportation Construction: What Does the Future Hold?

We asked two experts (and ChatGPT) about the possibilities and problems Artificial Intelligence (AI) presents for the industry.

Editor's note: ChatGPT was a little too "chatty" and its answers were edited for brevity.



James Minor
Chief Financial Officer,
Swank Construction Co.



Ross Smith
Worldwide Support Leader,
Microsoft 365 Supportability,
Microsoft

Q: There's been a lot of talk about AI and more recently, generative AI. How do you define these tools in a way that the average person can understand?

Ross: It's an exciting time in human history. We are living in the midst of a notable time of change, akin to the printing press or the steam engine. The world has focused a lot of attention on AI over the last seven months. This is because of advances in what's known as "generative AI" and specifically ChatGPT from OpenAI, that has made some incredible progress with their release last November. This technology is disrupting every industry, and really the way everyone works and lives. It's a real game-changing innovation.

To explain this simply, this technology uses training data from the whole internet (through 2021) to build algorithms (or equations) that use math to predict the next word in the sentence. So, if I were to ask you, what is the next word in this sentence? — "The quick brown fox jumped over the lazy _____" — you'd probably answer "dog." Or "once upon a _____ (time)". Now imagine you have a trillion websites, docs, videos, etc., to train the model to provide the answer.

To us as humans, it appears incredibly intelligent, in many cases, more intelligent than we are, but it's really just math leveraging lots and lots of data. In a sense, it is more intelligent because it has all our behaviors and data to help teach it.

Jimmy: As an average person myself, I think of AI as Chatbots. It can sometimes get you to the information you want faster, but cannot be trusted on its own.

ChatGPT: Sure! Let's break it down in simple terms: Artificial Intelligence (AI) is a field of computer science that aims to create machines that can perform tasks typically requiring human intelligence. In other words, AI is about making computers and

robots smart enough to do things that normally only humans can do, like recognizing objects in images, understanding and generating human language, playing games, making decisions, and much more.

Generative AI is a specific type of AI that focuses on creating things like images, music, or text that didn't exist before. It's like teaching a computer to be creative and produce new content on its own, based on patterns and examples it has learned from existing data.

In essence, AI is about making machines smart, and generative AI is a subset of AI that focuses on making machines creative. These technologies have the potential to revolutionize various industries and enhance our daily lives in exciting ways.

Q: Do you see AI making an impact on transportation construction projects today or is this something that is further out in the future?

Ross: There are some things where ChatGPT is great and really helpful, and other areas where it's not. I will say that the combination of human plus AI will be better than either one individually for a long time. So, it takes human oversight, but the AI can help us too. For example, I can ask (or prompt) it, "please give me an outline for a proposal on this new project for the Interstate—include sections covering budget and constraints." And 95 percent of it will be accurate and it will complete in 10 seconds vs. an hour for an engineer to put it together. But the engineer can spot the five percent that needs their help immediately.

The combination of AI plus human is greater and faster. In my opinion, and I will defer to Jimmy as the expert here, but where AI will make its first and most important immediate impact on construction projects will not be with robots driving graders but will be helping smart construction personnel become more efficient

and productive. It can help them by speeding up mundane tasks or generating creative ideas in new and exciting ways.

Jimmy: I don't envision AI impacting construction jobs anytime soon. Job performance is highly dependent on labor. Until there are meaningful developments in equipment automation, it is hard to see how AI will fit in. It may help do things like passively measure quantities, but that won't move the needle on productivity.

New technologies such as AI require people to grab hold and experiment. However, transportation construction is disincentivized to innovate. In low bid government contracting, we bid according to how jobs were completed in the past. We then perform the work according to how we bid. We would rather not win a job than rely on untested improvements or implementations of a new technology. The risks of experimentation and new ideas are much higher than the uncertain benefits.

ChatGPT: AI is already making an impact on transportation and construction projects today, and its influence is expected to grow even further in the future. Many aspects of these industries can benefit from AI technologies, leading to increased efficiency, safety, and cost-effectiveness. Here are some specific examples of how AI is being utilized: traffic management autonomous vehicles; construction planning and design; predictive maintenance; supply chain management; construction safety; and natural language processing.

Q: How will AI impact the future transportation construction workforce and how should public agencies or industry firms be preparing?

Ross: I think the most important thing that anyone, in any field or industry, can do is to pay attention, get curious and experiment. Don't dismiss the technology without becoming an expert first. Understand how and where this technology can help you. Ask it to review the email of your new idea that you were going to send your boss and ask to make it more inspirational. Or to review a public policy draft and ask to double check if your draft missed any constituents. Again, while it appears magical, it's just math—so your request will draw on the knowledge of millions of previous documents. Ask it to write a lullaby to sing to your daughter at bedtime. Ask it to write a thank you note to a partner for cutting costs.

Jimmy: AI will improve the quality and accuracy of machines in the field. I can envision a future where a machine operator reports to the office and remotely operates three machines simultaneously. The machines will run off rules set by the operator. For example, a milling machine operator might tell his or her machine to guide off the skip line at 80'/minute. The operator will intervene when the machine nears the end of a pass, gets to a bridge dam or approaches some uncertain situation. Our nation's youth spend thousands of hours playing video games, passively

preparing them for future jobs as machine operators. AI may also augment human performance by developing ways and means on the fly. For example, a savvy program may suggest the pattern of bracing to a carpenter foreman optimizing the most efficient placement of wood. In any event, it has the potential to augment human performance and drive productivity improvement.

ChatGPT: AI is likely to have a significant impact on the future transportation and construction workforce. While AI adoption can lead to increased efficiency and cost savings, it may also bring changes to the job landscape. Here are some potential impacts and considerations for public agencies and industry firms:

- Automation of repetitive tasks such as data analysis, documentation, and monitoring.
- Increased need for professionals with expertise in AI, data analysis, and machine learning to develop, maintain, and improve AI systems.
- Need to address ethical and social implications like data privacy, algorithmic bias, and transparency.
- Encouraging startups and research initiatives that can foster new ideas and technologies that benefit the industry.

Q: Will AI make building transportation projects more expensive or less expensive for taxpayers?

Ross: My feeling is that it will make projects notably less expensive, but again, not because we have robots behind the wheel replacing human workers, but because it will help humans be more efficient and productive. Things will get done faster because the AI will speed up the mundane work and free us up to be more creative. That will also unlock new methods and opportunities because we can draw on these large language models to suggest new ideas—that humans can oversee and validate/tweak/correct to open up new opportunities.

Jimmy: Less expensive. AI models give suggestions that are based/trained on past data. This isn't a whole lot different than what we do currently. We contemplate our approach to bidding and building a job utilizing rules of thumb developed over decades of doing the work. As AI improves and becomes more accessible, it will complement contractors' intuition as it will include millions/billions/trillions of data points, not just what is in our memory or on our excel spreadsheets. Better decisions result in better quality, lower costs, safer jobs and a better experience for all involved.

See **AI**, 28

ChatGPT: AI has the potential to make building transportation projects both more expensive and less expensive for taxpayers, depending on how it is implemented and utilized. Implementing AI technologies in transportation projects may require significant upfront investments. This includes the cost of acquiring AI-powered equipment, sensors, and software, as well as the expense of training the workforce to use and maintain these systems. AI can improve the efficiency and productivity of transportation projects. By automating tasks and providing real-time insights, AI can help streamline workflows and reduce delays, ultimately saving time and money.

Overall, the potential cost impact of AI on transportation projects for taxpayers will depend on how effectively the technology is implemented; the specific AI applications used; the scale of the projects; and the cost savings achieved through improved efficiency and resource management.

Q: When it comes to AI—what is your greatest fear and your biggest hope?

Ross: My greatest fear, right now, is that people are not spending the time to experiment, be curious, and learn and grow with the technology. The technology will get better and hopefully, we humans get better with it, but I worry that people aren't spending the time to understand how it can serve them and make them better in work and life.

My biggest hope is for a new Renaissance—that the combination of advances in generative AI with the unfortunate redistribution of tech talent over the last couple years along with what we've all learned from the pandemic—will lead to a rebirth of creativity, startup culture, and a new generation of exciting advances. Horse and buggy drivers worried about the automobile. Meat packers realized that trains and freezer cars would expand, not reduce their business. Students who could use a handheld calculator in the classroom in the 1970's are the ones building the big data and predictive analytics world we live in today. AI is our generation's printing press or steam engine that will, if we all stay curious and invest our time, bring a new Renaissance in creativity and innovation.

Jimmy: This is very much early days for AI in construction. My hope is that if we start thinking through how to organize our data then one day AI will give us helpful insights in managing our business. This will enable us to create a better work experience for our employees and deliver a higher quality product to the owner.

My fear for the advancement of AI is that too many people use it as a crutch and we lose our resourcefulness. Just as I mentioned, a carpenter foreman could use AI to suggest an optimal pattern for bracing. That foremen must use judgment, too. Bad things can happen if we blindly rely on technology.

ChatGPT: As an AI language model, I don't have personal feelings or emotions. However, I can provide insights into common concerns and aspirations related to AI: One of the greatest fears surrounding AI is its potential misuse or unintended consequences. Concerns also arise regarding AI's impact on employment and job displacement, as automation of tasks could lead to job losses in certain sectors, affecting the livelihoods of many people.

On the other hand, AI holds enormous potential to address some of humanity's most significant challenges. Ultimately, the biggest hope is that AI will be developed and deployed in a way that aligns with human values, ethics, and societal well-being.

The graphic features the ARTBA logo at the top left, with the text "American Road & Transportation Builders Association" to its right. Below this is a large red arrow pointing right, containing the text "Follow Us On Social Media". Underneath the arrow are five social media icons with their respective handles: LinkedIn (/company/artba), Twitter (@ARTBA), Instagram (@artbassociation), YouTube (/ARTBAMedia), and Facebook (/ARTBAssociation).

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It's Time for Connected Construction

BY CYNDEE HOAGLAND
cyndee_hoagland@trimble.com

The Bipartisan Infrastructure Law (BIL) creates a generational opportunity to improve our nation's infrastructure through the use of technology. The Federal Highway Administration is now accepting applications for \$34 million in grant funding targeting state DOTs to accelerate the use and deployment of Advanced Digital Construction Management Systems (ADCMS).

The goal of these authorized BIL dollars is to support infrastructure owners and their ecosystem of engineering firms and general contractors with technologies and processes that boost productivity and collaboration, reduce project delays and cost overruns, and enhance safety and quality. The result will be the acceleration of digital technologies throughout the infrastructure asset lifecycle—from planning and design through construction, operations and maintenance.

According to a recent study by Dodge Construction Network, *Connected Construction: The Owners' Perspective*, 60 percent of asset owners reported they use digital workflows for at least half of their project data between departments within their organization. However, only 28 percent report a similar level of digital data exchange with external companies—which means paper blueprints and related manual processes are hampering efficient collaboration with contractors and other stakeholders.

But many state agencies are accelerating their use of digital construction technologies to maximize productivity and collaboration across internal and external teams—and they are already seeing great results.

The California Department of Transportation (Caltrans) is a proven leader in technology innovation. The recent Cosumnes River Bridge Replacement project on State Route 99 in Sacramento County, for example, used leading-edge technology to achieve an estimated \$12.4 million in savings. Using a connected data environment for the design model, both Caltrans and the contracted construction team could collaboratively review project and asset-related information and optimize the design prior to construction. These digital construction tools also helped coordinate multiple teams throughout construction, improved worker safety and minimized the impact on the public and the environment.

In Minnesota, the state DOT's first, fully digitally designed-delivered construction project produced immediate and ongoing cost savings. The Elk River redesign and reconstruction project connected three miles of Highway



169 to a new freeway system in Sherburne County. Planning phase savings totaled \$12 million, as workers were able to use digital technologies to help relocate 59 miles of utilities one year ahead of schedule and begin construction 12 months earlier than planned. In addition, digital workflows used during the construction phase further reduced overall costs, trimming an estimated \$34 million from the originally budgeted \$158 million project.

Digital solutions also deliver operation and maintenance savings for state agencies. The Idaho Transportation Department's automated maintenance and reporting system has improved winter snow plow operations. With an advanced maintenance management system in place, the state agency has achieved material savings of 10 percent, which translates to approximately \$600,000 annually. Automated processes also helped reduce operator input time by about 7,500 labor hours per year.

These are but a few examples of proven advanced digital construction and related technologies at work to make quality infrastructure more affordable. As new grant money hits the marketplace, more and more success stories will undoubtedly follow. It's time for widespread adoption of ADCMS solutions and accelerated digital transformation of America's transportation infrastructure.

Cyndee Hoagland is senior vice president, owner & public sector, at Trimble. She also serves as co-chair of the ARTBA Innovation & Technology Forum.

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The image shows two construction workers in high-visibility vests and hard hats. One worker is holding a smartphone displaying the HaulHub app interface, which includes a 'Delivered' status, 'Inspector review' section, and a table of contract items. The other worker is holding a tablet displaying a dashboard with 'Ticket Performance Overview' showing 9 flagged and 12 rejected tickets, and a 'Contract Items Breakdown for Pay Period 2' table.

ITEM NO	DESCRIPTION	EST. QTY	WORK COMPLETED	
			Prev Period	This Period
0001.282	WET HAUL (H.)	10,000...	0.00	68,191.03
0001.98E	WET HAUL (R.)	10,000...	0.00	664.18
2100.042	SELECTED BA.	300.00	0.00	2,554.86
2100.031	EXCAVATION	100.00	79.00	886.86

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Driving Innovation: How Digitization is Transforming Safety, Sustainability, and Project Delivery in Highway Construction

BY MATTHEW VALLE
matthew@haulhub.com

The transportation construction sector is embarking on a transformative journey prompted by an era of digital revolution and innovation. Propelled by the sustained drive towards digitization, the rate of change is accelerating at an unprecedented pace. The recently announced funding opportunity known as Advanced Digital Construction Management Systems (ADCMS) enabled by the 2021 Bipartisan Infrastructure Law (BIL) is set to ignite a unique confluence of events: an industry-wide readiness to innovate, a workforce gap that will need supporting technology to implement future work, and unprecedented investment in our nation's infrastructure. This critical juncture serves as the perfect moment to reimagine the future of horizontal transportation infrastructure construction, leveraging the tools of today to build the roads of tomorrow.

Foundation for Change

Nationwide, departments of transportation (DOTs) are in the midst of scaling out the revolutionary potential of digitization. Historically supported by the Federal Highway Administration's (FHWA) Every Day Counts (EDC) program, great progress has been made in laying the foundation for what comes next on the construction side.

EDC has focused on 3D/4D and 5D models, e-Construction, e-Ticketing and Digital As-Builts, setting the stage for a wider implementation of Building Information Modeling (BIM) for infrastructure to provide a robust framework for better communication and coordination throughout the lifecycle of a project across planning, design, construction, and asset management.

The e-Ticketing initiative supported by the sixth round of EDC was one of the most widely adopted innovations across DOTs because it was simple, scalable, and added immediate value for contractors, materials producers, and transportation agencies. Now that this



network of construction stakeholders is established, additional benefits across the sector will start to emerge. With construction materials as the foundation and e-Ticketing as the mechanism of change, projects can become safer, more environmentally responsible, and automated. Over the next year, forward thinking DOTs, contractors, and producers are embarking on a journey to pilot what's next in e-Construction. The ADCMS Grants stand ready to catalyze additional transformation and investment across the sector and bring about much needed change and innovation.

Real Time Data Delivers Real-World Safety Benefits

Work zone safety continues to be a critical concern within the highway construction sector as the number of crashes and fatalities climbs. The tragic work zone intrusion in Maryland earlier this year that killed six workers is a wakeup call to the entire industry to accelerate the work towards finding solutions that keep our teams safe out in the field. To that end, many states are now working towards leveraging connected devices that accurately warn motorists of active construction projects ahead.

The ability to get this data to the traveling public is largely made possible by FHWA's Work Zone Data Exchange (WZDx)—an open standard that allows approved data feeds to seamlessly flow into apps like Google, Apple Maps, and Waze. The milling

Over the next year, forward thinking DOTs, contractors, and producers are embarking on a journey to pilot what's next in e-Construction.

See *Digitization*, 34

Digitization, from 33

machines and pavers rebuilding our nation's infrastructure are not only capable of transmitting machine data to enable a connected worksite and improve project performance—but improve safety as well.

The Delaware DOT is taking the lead on working with materials producers and contractors across the state to connect field equipment to their e-Construction portal. This critical data connection will, in turn, provide the WZDx with real time insights into which projects are active and immediately alert the traveling public to the hazards ahead through in-vehicle navigation apps.

Tracking and Reducing Environmental Impacts

In addition to improving work zone safety, environmental responsibility and sustainability is an important task that will require the attention of stakeholders across the sector. The latest round of EDC provides funding for DOTs, producers, and contractors to explore ways to quantify the greenhouse gas emissions (GHG) associated with construction materials and the highway construction process using environmental product declarations (EPDs), which are basically “nutrition labels” for construction materials.

Over the remainder of the 2023 construction season, DOTs and their construction partners will be working together to streamline the process for reporting EPD information into their e-Construction portals, removing manual reporting and tying into the emerging ecosystem of digital EPDs. The tie between e-Ticketing and EPDs allows for owners, producers, and contractors to have a real time view into the GHG emissions associated with projects and provide insights into ways to reduce their environmental impact.

Major construction materials associations like the National Asphalt Pavement Association and the National Stone Sand and Gravel Association are working quickly to educate their members on navigating the journey to net-zero and how EPDs play a critical role in monitoring, measuring, and driving towards this goal.

Easing Workforce Worries

As plants and construction equipment become more connected and integrated, benefits beyond safety and environmental

stewardship—such as increased productivity and better workflow—become clear. According to management consulting firm McKinsey, over 41 percent of the construction workforce is set to retire over the next decade. Couple this sobering reality with the challenges of attracting new talent into the industry and the deployment of technology at scale, along with the automation and integration of construction sites, will play a critical role in how the projects of the future are built.

Many DOTs use a suite of tools known as AASHTOWare to manage their projects. This tracks data on everything from Disadvantaged Business Enterprise reporting and materials testing to daily work reports for field inspectors. The data that flows into this toolset provides DOT teams with a holistic view of the project portfolio. States are working hard to migrate these systems to the Cloud and are establishing open access points where additional innovation and enhancements will benefit the project delivery process. Once inspectors in the field can approve delivered materials, this information can flow directly into back-end systems to facilitate speedier payments, adding critical and necessary transparency across the supply chain, so producers and general contractors can have near-realtime pay requisitions being built as the project progresses.

Additionally, as the equipment at the jobsite becomes connected and data flows into e-Construction portals, the reporting for equipment types and usage hours becomes automated and starts to relieve the reporting requirement burden on the foreperson or inspector out in the field. Eventually, coupling the digitally connected machine with the material flows coming from the plants provides crews and inspectors with a mechanism to control the flow of production to optimize material placement and enhance the quality of the project.

Shaping the Future

This is an exciting time of innovation and exploration as DOTs, materials producers, and general contractors begin to harness the power of scalable and open frameworks to accelerate e-Construction enabled by the shift towards BIM. As this shift accelerates, input from industry stakeholders is needed to develop integrated solutions that work across the lifecycle of a project. If you haven't done so already, I encourage you to become involved in ARTBA's Innovation and Technology Forum and help develop policies that will shape the future of transportation construction in the digital age.

Matthew Valle is vice president, industry relations & government affairs at HaulHub, Inc.



TECHNOLOGY TRANSFER

Remote Machine Access Unexpectedly Paves the Way for International Training

BY RON ARREDONDO
rona@bergkampinc.com

In April 2022, when a leading road construction and pavement maintenance contractor in the Toronto, Ontario-region took delivery of a new M1E4 slurry and micro surfacing paver from Salina, Kan.-based Bergkamp Inc., COVID-19 travel restrictions between the U.S. and Canada threw a wrench into onsite training Bergkamp traditionally offers. In spite of the 1,100-mile distance between manufacturer and customer, it was technology that paved the way for Bergkamp to train the new unit's operator in less than a day.

According to Matt Harkness, lead technical representative for Bergkamp's contractor business unit, the company typically provides three days of onsite training at the customer's facility with all new machine deliveries. "But in this case, because COVID travel restrictions were still in place, we couldn't do that, and the situation presented a real challenge," he says.

Harkness explains, "The operator for the new paver, Mark, was very experienced with mechanical calibration, but the M1E4 uses technology called EMCADS, which handles calibration calculations and mix design for the machine. Mark had no experience with this type of technology, and we weren't able to physically get to their site to train him. So we knew we had to find a different route to train their operator on the unit. That's when we decided we could use the remote capabilities offered by our M1E4's EMCADS Pro technology to help train Mark in Ontario from our facility in Kansas."

Technology Enters the Mix

EMCADS Pro is an evolution of Bergkamp's original EMCADS (Electronic Mix Calibration And Design System) technology. First introduced in 2008, EMCADS assists operators on certain Bergkamp paver models in performing calibration calculations and setting the correct mix design, as it reduces the number of required steps and eliminates manual calculations.

The calibration process with EMCADS includes entering the weight per calibration run of each material into a terminal display. Emulsion and cement ratios are set by entering the desired ratio on the display. After calibrating and entering in the material ratios, the operator presses a single on/off switch to start the mix. All feeds are independently hydraulically driven and controlled by the system controller, enabling changes in production rate without affecting material ratios. The controller processes feedback signals from material feeds and displays them on the



With no ability to train the operator onsite, Bergkamp technicians utilized the cellular capabilities of EMCADS Pro to remotely provide training from the Kansas factory. Within four hours, the operator was successfully using the system to calibrate the paver in Ontario. Photo courtesy of Bergkamp Inc.

terminal display. EMCADS also provides onboard diagnostics that constantly monitor paver components, and it displays error messages when a problem arises. This ability simplifies troubleshooting, as most problems can be diagnosed by reading the message on the display.

The progression from EMCADS to EMCADS Pro adds a remote aspect to the system through the use of cellular and GPS technology. Today, EMCADS Pro not only handles the calibration and mix calculations for operators, but it also allows the customer's management team to view operations in real time online—including paver data and location. The system monitors and reports on daily production rates. Using onboard radar, it provides distance paved and uses operator paving width inputs to calculate actual application rate and area covered.

But one of the biggest benefits of online paver connection through EMCADS Pro is the ability to further reduce troubleshooting time and repairs. If the crew receives warning of a paver malfunction they cannot fix, the operator can call a Bergkamp factory technician, who will access the paver remotely to diagnose the issue and help resolve it.

The EMCADS Pro system, which does require a data plan from Bergkamp, became standard on specific pavers in 2020.

See Transfer, 37



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Transfer, from 35

Training From Afar

Early in the morning on May 25, 2022, Harkness began Mark's training session by remotely accessing the customer's M1E4 EMCADS Pro system from the Salina factory and placing a call to the customer. With Mark on the phone, Harkness was able to watch and instruct the operator as he calibrated the paver and set the mix design.

"I could see what he was doing by viewing the display and the controller's inputs and outputs on my computer. As he was performing the calibrations, I was able to observe the process and provide him with instructions and guidance," he says. Harkness adds that with EMCADS Pro, factory technicians can view, but, for safety reasons, cannot ever actually take control of a paver from a remote location. "Mark caught on remarkably quickly. It helped immensely that he had read the manual prior to our call, so he was somewhat familiar with the controls—and he is an experienced paver operator. By lunch, he had pretty well picked it up. We helped him a little after lunch, but really, he had it down in three to four hours."

Following that first day of remote training, Harkness says he has received a couple of texts and calls from Mark, but the operator has experienced no real issues calibrating and running the paver over the past year-plus.

The Takeaway

Harkness says that with the introduction of EMCADS Pro, the customer care team at Bergkamp was fully aware there would be the occasional need to remotely connect with customers' pavers



New M1E4 pavers from Bergkamp come standard with a proprietary system called EMCADS Pro that handles calibration calculations and mix design for the machine. Photo courtesy of Bergkamp Inc.

to provide assistance, but he did not foresee the ability to use the system for startup training.

"I think the remote viewing, diagnostics, and troubleshooting capabilities are the 'why,' as far as Bergkamp developing EMCADS Pro, but we really didn't think about using it for training when we're not able to visit onsite. In this first case, it was kind of a last-minute shuffle, but it worked really well," he notes. "It's now another tool we have to improve customer care moving forward."

Ron Arredondo is marketing manager at Bergkamp Inc.

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Q & A With South Carolina Department of Transportation Secretary



CHRISTY HALL

Ahead of the Game

Secretary of Transportation Christy Hall leads the South Carolina Department of Transportation (SCDOT), which involves overseeing operational efforts for the nation's fourth largest state-owned highway system.

Secretary Hall is a South Carolina native, a graduate of Clemson University, and a registered Professional Engineer. She has received several awards, including an Emmy nomination for her work with SCETV, and the state's highest civilian honor, The Order of the Palmetto.

She recently spoke with ARTBA Vice President of Public Affairs John Schneidawind about her strategy for using Infrastructure Investment and Jobs Act (IIJA) funding in the ongoing revitalization of the state's transportation network.

Q: What does South Carolina's transportation environment look like in 2023?

A: In South Carolina, we are well into our 10-year plan, which is a very aggressive maintenance and construction program that we entered into in July 2017 that was precipitated by a pretty large infusion of state funding. As with any large infrastructure program, it takes a little while to get things off the ground and take a project from concept into actual construction. We're approaching the seventh year of that program, and we're seeing a great deal of construction work happening on the ground in the state, particularly along our Interstate routes, lots of bridge projects underway, some widening projects, but most of our widening right now is focused on our Interstate network.

Q: How big is the program?

A: The program we talked about beginning in July 2017 through what I guess is the present has enabled us to take our construction program from a \$1 billion annual construction program to approaching \$5 billion today, and I expect it'll be \$6 billion by the end of this calendar year.

Q: So now that you're in year-two of the IIJA, how have these historic levels of federal investment helped shape your state program?

A: How they complement each other, I think, is the right way to describe it. That fairly aggressive 2017 program was our 10-year program and within that program we outlined specific goals that we wanted to achieve.

Our approach has been—whether it's additional state funding, one-time federal funds, or in this case a 30 percent increase in federal funding—driving it all to fit into the existing priorities. We plug those dollars into very specific areas already defined within our plan. We don't really take the approach of expanding a new program or doing something that we weren't already focused on. The federal funding has enabled us to look at either plugging some budget holes that we may have with the inflationary pricing that everybody's experiencing or helped us in combination with state funding increase some of our goals on our program.

For example, we originally had a plan of improving 465 bridges over 10 years, and we've increased that to 500 bridges within that same timeframe. It's not just due to the IIJA, but to some additional state funding that our legislature has allocated to us. For us here in South Carolina, that 10-year plan has placed us in a position to already have projects moving through the pipeline. We already knew what our priorities were. We've been able to position South Carolina to be in a great place to really maximize and optimize the use of those federal funds.

Q: Sounds like the IIJA was just the icing on the cake. How are you balancing demands for new capacity with the need to maintain and improve existing facilities within your system?

A: Just like all the other states, we're having to try to accomplish both maintenance and capacity building at the same time. I'm not aware of anybody that's able to do one and not the other. As the owner and operator of the fourth largest state highway system in the nation that had experienced 30 years of deferred

See **Q&A**, 40

maintenance prior to summer of 2017, we had a huge backlog of paving, bridge, safety, and widening projects that needed to be done. When we launched our 10-year program, we were very careful to ensure that we targeted a significant amount of state funding specifically for maintenance type projects (paving projects and those types).

A significant amount of environmental review occurs on those disruptive projects and those requirements go along with the work on the Interstate system. I did not want any of that going on with our “bread and butter” paving projects. We had been using federal funds for paving projects. I’m of the opinion it was costing us probably 30 percent more and a good amount of time to pull it through the federal processes. We turned and said we’re going to focus our state funding on paving projects and maintenance type projects and keep our federal funds focused on any kind of capacity projects.

Q: How did you react when it became clear that the U.S. DOT was pushing states to spend IIJA money on maintenance first, capacity-building later?

A: When the U.S. DOT and Federal Highway Administration initially came forward and said “we don’t want you focusing on capacity projects, we want you focusing on maintenance projects,” that was completely opposite of the approach that we had here in South Carolina. As you can imagine, we were very concerned about it. We submitted letters to the Federal Highway Administration and we made sure we were very vocal.

Q: Onto workforce challenges. What trends are you seeing? What are you doing to attract and retain talent?

A: I think in a state like South Carolina, where the economy is booming, the approach of “business as usual” is no longer the way to go. At SCDOT, we recognize that our pay policies were out of date. We just had to recognize that we needed to invest in things to support the workforce, meaning better equipment and taking care of our employees, you know, reenergizing that aspect of things.

One of the things that we actually just completed—and is in the process literally of being finally phased in over the next 30 days—is that we implemented a reform to our pay plan, where no one in the agency would be paid less than \$18 an hour minimum, and that includes the person on the front line, our maintenance employees out on the field, and out on the road.

We were tracking well north of 50 to 55 percent vacancy rate, and some of our areas where we had a lot of booming economic development, jobs were plentiful and the candidates to fill them were not and so we did that market analysis and determined to be competitive and the rate we needed to set. I see a lot of new hire paperwork coming through. We were roughly 1,000 people down from where I really wanted our manpower strength to be. We’re normally about a 4,400-person workforce.

Q: What are some of the ways that you stay in touch and work with the industry in your state? For example, do you have regular formal meetings or is it more of an ongoing dialogue?

A: It’s both. I’m very familiar with the governmental affairs directors for the Carolinas, the engineering companies, material suppliers, manufacturers, and alliances. At least quarterly I meet with the executives’ groups for the Carolinas, and we have

2023 ARTBA REGIONAL MEETINGS



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Nov. 1-3
Fort Lauderdale, Fla.



Western & Central
Nov. 8-10
Irving, Texas

a partnering meeting with people at the director- and below-level. I do the same thing with the professional services side. I meet every six months or so with the minority contractors of the state and then we have very regular discussions with our material suppliers.

When we launched the 10-year program, we had a fairly in depth discussion about growth rates and how much we would be able to deliver increases year over year, meaning like increased production, or how much more can we grow our paving program year over year, and what would it take for the contractors to expand their footprint in the state in terms of number of crews and plants.

With that very detailed discussion with our industry partners, we were able to lay out a planned growth rate by market sector across our program. Now that we're seven years into it, we've achieved that full growth.

Q: When you started out in your career, did you envision yourself running a state DOT someday or did you take an unexpected path to your current position?

A: I never expected to be director. It's just that the SCDOT has been a very good place to grow and develop as a professional. I was recruited to the agency straight out of college into an engineering position and ever since that day I've made it a point to look at every opportunity that presented itself. It's just that I've been able to move around the agency and geographically all across the state, with job functions in all facets of engineering. I even had the opportunity to run our finance division for a while when we had some financial issues.

Along with a great team of folks, we were able to get the ship righted then. And I think that experience led our legislature to

begin to have more faith in SCDOT that we could run and manage a large organization.

When the opportunity presented itself, I agreed to accept the job on an interim basis and was appointed permanent by Governor Nikki Haley. So I've been here since and just really enjoy working with a great team of very skilled and agile individuals.

Q: I guess that's what your major accomplishment was, getting the legislature to trust the agency to do what you could do?

A: That's right. I use the term sometimes that we went from zeros to heroes. We were not thought very well of and there were calls to reform the agency before investment was made. That was always the mantra of the legislature as to why they wouldn't pay for additional road money. We had the lowest gas tax in the nation, was that way for a while, and we were this agency was trying to operate on the equivalent of a nickel in state funds. That math does not work. Because of that, we had that 30-year hole of deferred maintenance. Only 20 percent of our roads were in good shape; 80 percent needed either major or moderate repairs to them and our widening projects were practically non-existent.

Really a turning point for us looking back on it now was that we made it a point to be much more transparent. We made it a point to be much more open about what we were doing and what our cash balances were, what projects we were working on.

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Solution: With help from the federal infrastructure investment law, the old roads are getting a facelift. The I-80/I-215 Renewed project will remove damaged concrete pavement, add and widen lanes, and replace several bridges. Two have already been replaced using the Accelerated Bridge Construction (ABC) method—a technique where the old bridge is demolished while a new one is built adjacent. When it's time—the new bridge simply slides into place. These improvements will reduce congestion and give Utah drivers a smoother, safer ride for many years to come.

What They're Saying: "It becomes a safety concern when you are out there traveling freeway speeds and you hit a pothole going at that speed." - Utah Department of Transportation spokesperson John Gleason (KSLTV 5, 05/31/23)

"Once completed, this project will improve both traffic flow and safety for motorists traveling throughout the region." - Joe Cutillo, CEO of Sterling Construction Co. (Ralph L. Wadsworth Construction Co.'s parent)

- **Estimated Cost:**
- \$180.5 million
-
- **Federal Funds:**
- \$176.3 million
-
- **Program Management:**
- Horrocks and HNTB
-
- **Designer:**
- Michael Baker International
-
- **Contractor:**
- Ralph L. Wadsworth
- Construction
-
- **Start Date:**
- 2021
-
- **Scheduled End Date:**
- 2023
-

If you have an IJA project that should be featured, please contact ARTBA's Beth McGinn at bmcginn@artba.org.

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Regulatory Roundup

The Road to ARTBA

BY PRIANKA SHARMA
psharma@artba.org

I am using my inaugural column to share a little about me. Full disclosure: I don't come from a construction background. I am a regulatory and environmental law attorney. But as you'll see, roads are what led me here.

In 2017, I embarked on a 35-state, three-year regulatory roadshow on behalf of the U.S. Small Business Administration's (SBA) Office of Advocacy. The purpose? Listen to small business regulatory concerns. The goal? Communicate those concerns to federal agencies, work to reduce regulatory burdens, and enact sound policies.

During these travels, I got my boots dirty. I visited construction sites, lumber yards, and mining operations. I listened and learned. Ultimately, I used these experiences to advocate on behalf these stakeholders back in D.C. I met with federal agencies (Environmental Protection Agency, Army Corps, Department of Energy, Department of the Interior, Department of Agriculture, and more), read thousands of pages of regulatory text, and wrote comment letters. The objective was to give regulated industries a voice. I never detracted from the SBA's Office of Advocacy goal: safety, environment, or benefitting the greater good. But I did attempt to make regulations feasible and cost-effective. These efforts amounted to regulatory cost savings.

After seven years as assistant chief counsel for agriculture, energy and natural resource policy, I decided it was time to try something new. I remembered the miles of highways, bridges, and tunnels that got me to all my meetings. Indeed, our nation's infrastructure enabled me to do my job and do it well. So, when given the opportunity to join ARTBA, I figured who better to advocate for in the regulatory arena than the very same people who got me where I needed to go.

My goal is to be your voice in rulemaking. While I've been entrenched in federal rulemaking and environmental policy, I know there's a lot for me to learn about transportation development. That's where you come in. I cannot do this job well without your insights. Please feel free to share them with me. In turn, ARTBA will communicate to federal agencies the real-world impacts of their proposals on our industry. Together, the outcome we all seek is a balanced regulatory environment that supports efficient and effective transportation project delivery.

Prianka Sharma is ARTBA vice president and counsel for regulatory affairs.



WSP USA Senior Executive Paula Hammond joined ARTBA because of its singular focus.



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ARTBA On the Road

At the Aug. 3 Board meeting of the Florida Transportation Builders' Association (FTBA), ARTBA Chair **Paula Hammond** (WSP USA) met with (left to right): FTBA President **Ananth Prasad**, FTBA Chairman **Keith Waugh** (Leware Construction), and ARTBA First Vice Chair **Jeff Nelson** (David Nelson Construction). The meeting took place during FTBA's annual convention in Boca Raton.



ARTBA Senior Vice President of Safety and Education **Brad Sant** (left) June 20 visited the 3M Transportation Safety operations in St. Paul, Minn. He is pictured with 3M Global Business Development Director, Ethics & Compliance Partner, **Steven Poss**.



ARTBA staff Aug. 1 met with ARTBA Senior Vice Chair **Tim Duit** (right), president, Duit Construction, at a jobsite in Wynnewood, Okla.



Over 60 people attended ARTBA's annual Engineering Issues Luncheon July 10 at the Northeast Association of State Transportation Officials (NASTO) meeting in Wilmington, Del. ARTBA Planning & Design Division President **Chris Fronheiser** (right) from TYLin, moderated the panel discussion with seven state DOT leaders.



ARTBA Western Region Vice Chair **Lisa Robert** (RS&H) met Aug. 7 with ARTBA COO **Matt Jeanneret** at the company's Denver offices. Robert co-chaired the Strategic Planning Committee, which put together the association's new five-year business plan.



Sant June 19 made a stop at the RoadSafe Traffic Systems operations in Chicago. He is pictured with RoadSafe President **Joe Scarano**.

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DEFINING THE INNOVATION PROCESS WITHIN YOUR ORGANIZATION

By: Jaime Vos, AEM Senior Director of Cultural Innovation

I have always prided myself as an idea person. When I worked in a corporate creative department years before, I would brainstorm all day long. But when it came to vetting those ideas for value and potential, I usually handed them off to someone else. The marketing team would do the research, the designers would take care of the concepts, and the project managers would juggle the logistics. My work was finished. I had done the fun part. I was fine letting others fill in all the details.

However, I'm now responsible for the entire process of moving ideas forward within the organization. Following several weeks of meeting with coworkers, my notebook was filled. I began feeling a little overwhelmed about what to do next.

While it's important to generate as many new ideas as possible, you can easily get backlogged if you don't have a structured method to move them forward. Despite feeling overwhelmed, you can help yourself and your team by implementing the following phases for building momentum behind your innovation process.

GENERATOR PHASE

When generating new ideas, they need to not only be discussed but documented as well. It's not enough to simply have a casual conversation over lunch with a coworker about random thoughts that might create new revenue. You need to organize sessions to foster those conversations. Have a dedicated space and time to detail the thinking behind the ideas. Get a whiteboard and a large number of paper pads to take notes. Document everything in a project brief, no matter how silly or outrageous it sounds. Allow yourself enough freedom to discuss random ideas, while at the same time, capture them in some way to gain perspective and categorize them into actionable items.

FACILITATOR PHASE

This phase facilitates the research and vetting of chosen ideas based on your predetermined criteria. Some of those might include: What kind of investment will need to be made? Who needs to be involved? How will the idea be tested? What is the projected ROI?

Consider if other stakeholders need to be included in this phase. Be sure your team is not only diversified, but knowledgeable in their respective disciplines to provide insight. Empowering your culture to innovate strengthens the entire organization.

This is an opportunity to inspire your team to take charge. Challenge them to provide constructive criticism and "poke holes" in the idea to reveal hidden problems.



ACCELERATOR PHASE

After a significant amount of research has been done and ideas have been vetted, they will need to quickly gain momentum toward launch. This phase is more granular, focusing on specifics needed for the idea to speed to market. For an idea to fully be realized, the following actions need to be initiated:

Develop a business plan – outline a budget, describe how the idea will be implemented. Identify resources – production costs, marketing strategies, distribution channels, etc. Beta testing, consumer research, quantitative and qualitative testing may be needed. Create metrics to measure the idea once it's launched. Clarify which department will oversee it/manage it/measure its success. Determine a yearly budget for all operating costs.

LAUNCHPAD PHASE

Just like the name implies, launching your idea requires it first go through all the qualification phases to ensure a successful liftoff. The criteria that you use that confirms your idea is ready to take to market will greatly depend on how your specific business is structured and how your stakeholders participate. Obviously, budgets and operating costs should always be signed off by senior staff or someone who has the authority to give approval.

The other important part of this phase is making sure you know how the idea will be measured, supported, maintained and improved to strengthen its chances for success. Just like launching a rocket, every detail should be examined from every angle, lists should be double-checked and all systems should be confirmed GO to make sure the idea is ready for the marketplace. Once launched, it will need to be monitored, supported and measured to avoid any unforeseen problems and ensure continual growth.

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Using Glass to Fix a Shattered Highway

BY JOHN SCHNEIDAWIND
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On June 11, just after seven in the morning, the calls started coming into Archie Filshill's cell phone in rapid-fire fashion.

Driving north on Interstate 95 near Philadelphia and stuck in traffic, Filshill first heard from a friend that a bridge had collapsed on the highway. Then came an urgent call at 8:30 a.m. from an engineer at the collapse-site location.

"And about a half-hour after that call," Filshill recalls, "I have a call from PennDOT saying 'Hey, we have an issue. How much material do you have in inventory?'"

Earlier that morning, a tanker truck carrying 87-octane gasoline overturned in the Cottman Avenue underpass under I-95, melting the steel frame bridge and creating an impassable cavity in one of the most indispensable highways on America's east coast. About 160,000 vehicles cross this stretch of highway daily, with more than \$100 billion of freight crossing Philadelphia highways in trucks each year—much of it on I-95.

The material so urgently needed is the primary product sold by Aero Aggregates of North America, where Filshill serves as CEO. His company is the only North American manufacturer of foamed glass aggregate—a lightweight fill made of recycled beer bottles and mayonnaise jars.

And in the case of this bridge collapse, the word "lightweight" took on urgent meaning. An 86-inch sewer main and a 36-inch watermain ran under Cottman Avenue below the collapsed overpass. If crews piled gravel on top of the road, they risked breaking the utilities under its weight, making a bad situation much worse.

"If they were to build up 20-foot of traditional fill, that would be too much weight and put stress on the utilities and potentially collapse them," Filshill said. "Foamed glass aggregate is 85 percent lighter than traditional aggregate."

Its lighter weight helped in other ways. While it costs as much as 50 percent more than conventional fill, the glass aggregate can also be shipped quicker in fewer truckloads. "Every truck we delivered to the site was the equivalent of seven dump trucks" of conventional aggregate, Filshill said.

The material is also impervious to weather; it doesn't gain weight when wet. Serendipitously, Aero's factory was just 25 miles from the bridge collapse. Through a torrential rain, the



Photo courtesy of Aero Aggregates of North America.

aggregate was poured into the cavity. "We did not skip a beat," Filshill said.

With several contractors working non-stop day and night, the highway re-opened June 23—12 days after the accident. The project used more than 8,000 cubic yards of foamed glass aggregate to rebuild the collapsed corridor. This project alone diverted approximately 6.5 million, 12-ounce glass bottles from landfill.

Contrary to initial perceptions, using Aero Aggregates aggregate to repair I-95 was not an off-the-cuff idea. "The long story is that foam glass—what we call dry process foamed glass—has been used in Europe for over 30 years in highway applications," Filshill said. "But Aero Aggregates is the first to do it in North America."

"Our materials have a demonstrated history of safety and success in a range of essential infrastructure projects, both in the Philadelphia area and across the country, including other sections of I-95," he added. "Where we get used are for lightweight fills, where you have soft compressible soils, or where you're building over existing utilities, or where you're going to put fill up against the foundation wall like a bridge abutment or a structure, and you don't want that lateral load against that structure."

Founded in 2017, the company is now working with state departments of transportation across the country. Its material has been used at Boston and Philadelphia airports. And the stuff can be re-used. Once the steel beams arrive for the permanent I-95 bridge repair, Aero Aggregates will haul it out to another scheduled Philadelphia project.

"For a job that had to be turned around really quickly, the foamed glass aggregate really checked a lot of boxes," Filshill said.

John Schneidawind is ARTBA's vice president of public affairs.

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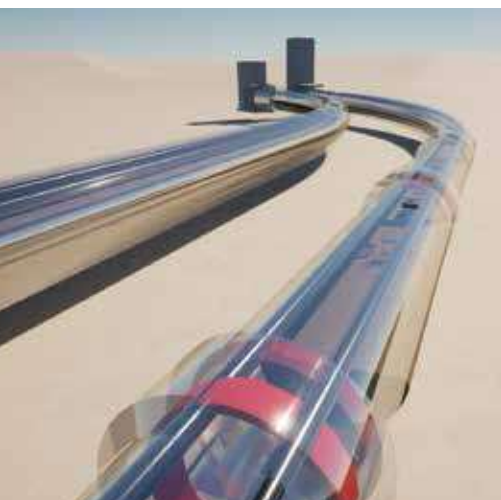
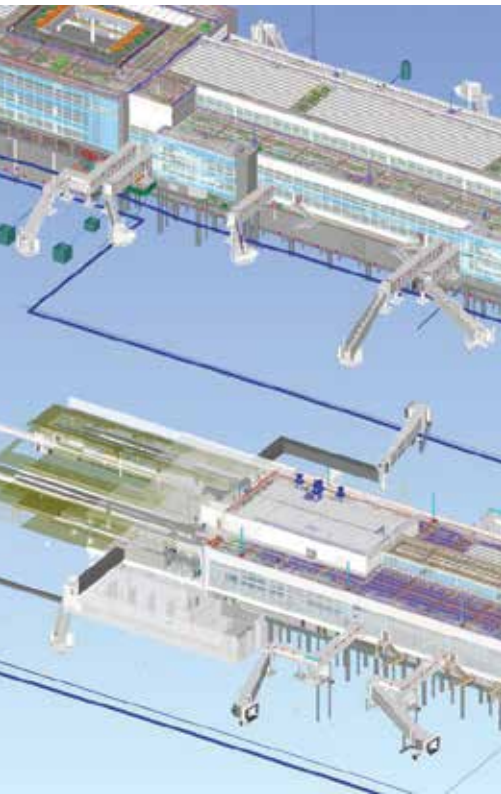
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