SMART DESIGN & CONSTRUCTION

Utilizing Innovation and Technology to Maximize Public Investment in America’s Transportation Network
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Welcome to “Smart Design & Construction: Utilizing Innovation and Technology to Maximize Public Investment in America’s Transportation Network,” a special Transportation Builder insert.

As the association’s first chairman from a construction software company, the editorial content really hits home.

Written by thought leaders reflecting ARTBA’s diverse membership, this publication highlights how our industry is deploying 3D digital modeling tools, robots and artificial intelligence, apps, software and other cutting-edge technologies and equipment in the planning and construction of the world’s safest and most sophisticated transportation network. In the process, it also provides a glimpse of what to expect in the coming years as we build infrastructure more efficiently.

Of course, the beneficiary of this work is the American public, whose tax dollars help finance transportation improvements.

ARTBA’s commitment to innovation and technology is nothing new. This year marks the 10th anniversary of the Dr. J. Don Brock TransOvation Workshop, which will be held Nov. 16-17 in conjunction with ARTBA’s Central and Western Regional Meetings. Participants and speakers will discuss the evolution of transportation in the era of COVID-19 and explore the future of work, funding, and mobility. This commitment also extends to the recently-approved ARTBA strategic plan, which features creation of the “Innovation & Technology Forum” to serve as an “idea and best practice incubator” in these areas. See the related article on page 10 of this issue of Transportation Builder.

We will be sharing this insert with members of Congress. Special thanks to all of our public and private sector contributing writers. You are helping advance ARTBA’s advocacy mission of educating policymakers and the public about the many benefits of transportation investment.

STEVE MCGOUGH | President & CFO, HCSS
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When the Santa Clara Valley Transportation Authority (VTA) began considering a tunnel through downtown San Jose, California, in the early 2000s, twin-bore construction was the likely method.

Today, advancements in tunneling technology are allowing VTA to move forward with a $6.5 billion plan to construct a single-bore tunnel large enough to accommodate two trainways and station platforms. The relatively new method promises to minimize surface disruptions to downtown residents and businesses that will be virtually unaware of the massive construction project occurring below them.

Represents an Industry First
The VTA’s proposed project would be a first for the U.S. transit industry. There is only one other large-diameter, single-bore transit tunnel in the world, in Barcelona, Spain. Other large-diameter tunneling projects have been successfully completed around the world, leading to increased confidence in the construction method, which allows owners to pursue these minimally invasive concepts.

Conventional subway construction entails the use of cut-and-cover techniques that involve removing the street surface, relocating and protecting existing utilities, and excavating from the street level. For example, using cut-and-cover techniques in San Jose would require the station excavation to be approximately 1,500 feet long, 60 feet deep, and extend from curb to curb on one of the city’s busiest streets and downtown centers. Construction would be highly disruptive to daily activities and likely have devastating consequences for existing businesses and potential developments.

The large-diameter, single-bore tunneling method avoids most in-street impacts because the tunnel, trainways, and boarding platforms are constructed below ground within the tunnel. Modern tunnel boring machines (TBM) use “smart” technology that allow operators to precisely monitor and control ground behavior through pressurization, as demonstrated in the SR 99 tunnel construction in Seattle, to achieve nearly zero surface settlement and associated building/utility impacts.

Facilitates Economic Development
With the promise of the Bay Area Rapid Transit (BART) expansion service and minimal surface disruption during tunnel construction, development has begun to flourish in downtown San Jose. As it currently stands, many commercial, residential, and mixed-use developments have been planned around the future BART stations.

Simplifies Construction
The large-diameter, single-bore methodology minimizes surface disruptions, thus reducing environmental concerns and simplifying construction. With a single-bore tunnel’s off-street station entrances, the majority of station construction can occur independently from tunnel construction. Decoupling these activities allows the owner to issue separate tunneling and station construction contracts resulting in greater procurement and schedule flexibility.

Further, large-diameter, single-bore tunnels eliminate mined cross passages which accompany twin-bore tunnels—often one of the highest risk activities in an underground transit project. Excavation of cross passages sometimes cause severe surface settlements, sinkholes or inflows into the tunnel. A single-bore tunnel provides the ability to locate cross passages within the tunnel itself to connect adjacent trainways.

Some considerations on the single-bore concept include the limited number of contractors with large-diameter tunnel construction experience and higher capital costs for the TBM. However, depending on the project characteristics, a single-bore tunnel configuration can be cost competitive with a traditional twin-bore arrangement. With this developing
technology and increasing advances in TBM controls, it is critical to pay attention to contractor’s, designer’s, and machine manufacturer’s pre-qualification process as part of the tunnel contract procurements.

Positions the U.S. as a Leader
Single-bore tunnel construction can offer a number of environmental, community, and construction impact benefits and should be considered by any agency exploring an underground transit project. Demonstrating the single-bore tunnel’s viability in San Jose will serve as a model for other organizations exploring how to better construct infrastructure projects in cities.

Ronak Naik is a transportation engineer for the Santa Clara Valley Transportation Authority. Anthony Bauer, P.E., is West Region tunnel practice lead for HNTB Corp.
Transportation design, construction, and system operations, like many other industries, are being transformed by the COVID-19 pandemic and governmental responses to the crisis.

Motor fuel taxes and toll collections have suddenly dropped to less than half of their budgeted levels. Transit farebox collections have decreased by 50 to 90 percent from anticipated levels. Sales tax revenues have declined over 30 percent, and even longer-term property tax revenue is anticipated to be affected with a softening real estate market.

Travel behavior is changing, too. There are potential long-term implications to telecommuting, the desirability of transit, shared rides, and demand for commercial space and mixed land uses.

We are facing a future that is both unknown and without contemporary precedent.

Some disruptions began before the pandemic. Since 1993, the last time the federal gas tax was increased, inflation has eroded 44 percent of buying power and the average fuel efficiency of a new car has increased 28 percent at the same time. The combination is making the motor fuel tax an unsustainable revenue source.

Technology is a disrupter, but also an asset during the pandemic. The ubiquitous webcam in laptops, once seen as an unnecessary feature or a security risk, today is as essential to many businesses as email and smartphones. It has enabled telecommuting to increase from single digit percentages shares to upwards of 90 percent of employees at large firms. Industry experts anticipate high rates of telecommuting will continue next year.

That impacts peak-hour travel. Technology has also streamlined toll and fare collections, with many operators converting to all cashless and touchless collections virtually overnight. Broad adoption of electronic toll and fare collection technologies opens the door to a more collaborative, seamless and customer-friendly approach to transportation payments.

For example, California and Minnesota are exploring the integration of road usage charges with shared mobility operators. The 15-state Road Usage Charge (RUC) West Consortium is advancing the state of the art for interoperability of these payments.

The Oregon Department of Transportation (ODOT) has pioneered the design for a mobility marketplace, which combines multimodal transactions into one customer account. ODOT’s open architecture accommodates road usage charges, future state tolling, urban congestion pricing and transit fare collection into an open system that preserves vendor options for not only the state but also the end customer.

Only with these advancements can highway and transit operators meet the growing demands for transportation in congested urban areas, coupled with the absolute necessity of providing for sustainable funding to address our aging systems’ asset management, rehabilitation and replacement.

Technology also has advanced our ability to manage traffic and transit operations. WSP has leveraged its global experience to bring the Australian Managed Motorways concept to the United States. This technology uses highly precise traffic sensors to provide for real-time flow management on freeways and predictive responses before the onset of congestion.

Now in development in Colorado, North Carolina, California and Georgia, this technology can provide the same capacity benefit as adding lanes to a freeway, but at a fraction of the cost and without community disturbance.

The road to post-pandemic recovery of transportation infrastructure is not clearly marked. We must be willing to take new turns, to find new sources of funds, and to use those funds better and more efficiently. The right road ahead includes applied technologies in revenue collection, RUC, mobility marketplaces, and advanced predictive traffic management.

WSP will continue to provide leadership in all these areas and help clear the path to recovery.

David Ungemah is national director for Transportation Operations Strategy at WSP USA.
In order to keep pace with aging infrastructure and growth, the transportation industry needs to continually bring innovative solutions to stakeholders and the general public. Advancement in digital innovations span across the spectrum of planning, design, and construction, as well as the operations and maintenance of infrastructure assets.

AECOM professionals have adopted an integrated approach to best leverage the most current digital technology tools. With many aspects of the nation’s infrastructure reaching the end of its as-designed life, and with the purchasing power of construction dollars continuing to be stretched, developing systematic processes for determining the most cost-effective infrastructure investment strategy is critical. At the same time, consideration of life-cycle asset management is key to successful owner stewardship of public dollars.

The use of Building Information Modeling (BIM) for infrastructure, or what AECOM calls Civil Infrastructure Information Modelling (CIIM), is a key focal point in our engineering services delivery. CIIM provides enhanced design, cost, and operational certainty through 3D data models of intelligent components. Lessons learned from the vertical construction industry can be applied to horizontal construction. Adopting this technology for civil infrastructure is essential to moving forward.

**Design Certainty**

3D technology and software have existed for decades. Introducing newer and more comprehensive technology provides enhanced design certainty (in particular for geometric aspects) on a project whether greenfield, brownfield, or existing conditions inventory and assessment. For example, BIM with LiDAR reality capture elevates the life-cycle management of the asset from the start. The next phases in this workflow—cost certainty and operational certainty—can be evaluated early and intelligently in the decision and analysis process. Geo-spatially referenced data capture of existing conditions and as-built geometry (via laser scanning and other methods) provides geometric accuracy and can provide component data for integration into the 3D data model, or what can be referred to as digital twin.

**Cost Certainty**

The workflow for design and construction needs to support all stages of the asset management process: condition assessment and data capture, data analysis, deficiency identification, cost estimating, capital investment planning and project prioritization, and OPEX budget modeling. In the past, complex tasks like organizational and operational planning, space optimization, and climate change resilience were time consuming, but with digital innovations, can be achieved much more quickly with more in-depth analysis.

Each of these variables can be connected to help inform capital project development and prioritization. Data mining schemes can provide outputs and relevant parameters can be selected to suit the needs of the owner. Providing the greatest level of interoperability between common data environment platforms for effective project collaboration and delivery is key.

**Operational Certainty**

The benefits of an innovative approach that includes digital and cost certainty from project inception will allow for more informed operational planning and life-cycle costing and budgeting. Advanced CIIM facilitates the study of multiple operations and maintenance options quickly using real-world simulated influences to find the optimum solution. Systems coordination can be accomplished utilizing CIIM and can provide the ability to produce quantity surveys, takeoffs, and cost estimates at any time during the asset’s lifecycle, helping an owner track, analyze and forecast quantities and costs more effectively.

BIM and CIIM centric approaches become the tie that bind. The digital collaboration of BIM and CIIM technology leaders, engineers, information technology specialists, systems and asset management analysts, constructors and operators, creates a holistic modelled system for reliable operational certainty of the infrastructure asset over the long term.

Innovative and advanced digital approaches for the inventory, planning, design, construction, and operations and maintenance of our infrastructure assets is essential. AECOM is proud to be a leader in the adoption and use of these technologies along with industry partners and infrastructure owners, with the best interests of the travelling public and users in mind throughout.

*Michael Warren is director of digital practice & technology at AECOM.*
Pittsburgh-based Advanced Construction Robotics (ACR) is bringing innovative robotics solutions to the transportation construction market and other building sectors. It’s the next step in the long-standing partnership of man and machine.

Last year, ACR introduced TyBot, a rebar tying robot initially designed to bulk tie the rebar for bridge decks. It was developed by Steve Muck, owner and CEO of Brayman Construction Corp. for over 25 years.

Using TyBot during horizontal bridge deck rebar installation can cut human worker hours in half. “TyBot is our first initiative to stop the decline of productivity on our job sites while addressing labor shortages at critical points during the annual construction cycles,” Muck says.

TyBot was used at the Koppel Bridge near Pittsburgh; the Central Susquehanna Valley Transportation project, about 80 miles north of Harrisburg, Pennsylvania; and in Tampa and Orlando, Florida. It will be used this summer at projects in Virginia and Michigan. There are currently seven TyBot robots.

In the third quarter, Muck and ACR co-founder Jeremy Searock will unveil a second autonomous solution for the heavy/highway
To learn more about TyBot visit: www.tybotllc.com

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Leading Bridge Builder Has Founded One Of The Most Innovative Technology Companies: Advanced Construction Robotics

Brayman Construction prides itself on it’s ability to provide creative and innovative solutions to our customers, from start to finish, utilizing the latest technology and industry advancements.
industry, called IronBot. It carries and places the rebar that TyBot secures on bridge decks using tie wire.

“Both robots are applicable to other horizontal reinforced concrete applications and plans are in the works to make modifications that will accelerate their use in ground slabs for the building market and the precast industry,” Searock says.

Shelby Erectors, Inc., of Davie, Florida, is among the specialty subcontractors that has used TyBot in its embrace of technology. “This doesn’t replace our workforce, it enhances it and supports us during the labor shortage,” company Vice President Jack Nix says.

Muck also has forged relationships with union leaders, including the International Association of Ironworkers (IAW). Its members tie rebar for the heavy construction industry, including bridge decks. The outreach has resulted not only in support for TyBot, but also financial investment in the technology by the Laborers’ District Council of Western Pennsylvania.

“We have partnered with the unions while performing many demonstrations for the contractor community at our frequent TyBot roadshows, including a stop at last year’s IAW’s annual training conference,” says TyBot Vice President Carson T. Carney. Most of his 25 years of construction experience has included working with IAW members on complex projects.

At the July 2019 IAW conference, General President Eric Dean said the union’s leadership wants to train its members to embrace the new technology. He explained if their members don’t embrace the technology, others will; the technology is a way to help labor shortages and gain market share by making their members more productive.

Searock notes that autonomous robots can work through extreme conditions, such as heat, rain, and cold, that put human workers at risk. And performing the same work with less man-hours through automating repetitive tasks statistically improves safety performance.

The productivity improvement of man and machine working together is substantial.

“The opportunity to perform twice the work in half the time will be hard to ignore,” he says. “We will continue to lead the way making new robots that will decrease the cost of infrastructure.”

Danielle Proctor is business development specialist at TyBot, LLC.
The way we move from point A to B continues to evolve. The global disruption caused by the COVID-19 pandemic has only accelerated that change. The immediate pandemic impacts on airline, transit, and roadway travel are clear as millions have sheltered in place. How quickly travel among these various modes will resume is less clear.

What does this mean for transportation technology and the adoption of this technology into our transportation systems? The current crisis may be seen in the future as a momentary pause, with technological progress picking up where it left following virus containment. Another scenario is market stagnation caused by abandoned plans as bruised governments and private industry try to avoid risk and focus on essentials rather than exploration and innovation. A more optimistic possibility is that we can seize this unprecedented opportunity to make progress by leaps and bounds and even discover innovative ideas that will change the world for the better.

Here’s what we might see in the coming months:

**A Surge of Electric Vehicles**
As traditional automotive manufacturers begin to recover from COVID-19, electric vehicles, with their simpler manufacturing processes, will accelerate. The trend towards electric vehicles will continue to be encouraged by new breakthroughs in battery technology and the experience of cleaner skies from reduced fossil-fuel burning vehicles. Expect increasing demand for new battery-charging infrastructure built near roads.

**Communications Technology for Vehicles Will Remain Uncertain**
For a decade, 75Mhz of the 5.9Ghz wireless spectrum has been reserved for Wi-Fi-based connected vehicle communications. Responding to an increased need for internet connectivity because of the pandemic, the Federal Communications Commission temporarily released 45Mhz of this spectrum for use as rural broadband access. If made permanent, this will accelerate the debate between cellular or Wi-Fi based protocols for connected vehicle communications, delaying widespread deployment of either technology. However, don’t expect resolution in protocols anytime soon as the debate will continue to persist for several years.

**A Lull in Automated Vehicles**
Expect things to go relatively “quiet” the rest of this year with respect to significant automated vehicle announcements. This is part of the natural lifecycle of technology adoption though it has been exacerbated by the COVID-19 pandemic and subsequent financial fallout. But look for the excitement to begin to rebuild in 2021 and 2022. Those planning, updating or constructing infrastructure should stick with the core tenets of future-proofing, such as preparing for significant data processing needs, incorporating dedicated power and communications, and including roadway navigation aids.

**Personal Mobility Expands**
Personal mobility devices will rebound and will continue to spread across the U.S. post-pandemic. However, expect companies to be more strategic and targeted in their rollouts. Beyond scooters, other types of personal mobility options will emerge such as “pod vehicles,” electric sitting scooters, electric mopeds, electric skateboards and more. Roadway designers will need to account for the mixed-use roadways needed in the next decade.

**Tolling Continues to Transform**
Tolling will continue its modern evolution. As a New York City central business district tolling launch looms, other cities will set the groundwork for their own cordon-based tolling programs. Discussions will also return to road user charging as an alternative funding mechanism. All-electronic tolling will continue gathering steam, accelerated by agencies seeking to reduce exposure risk of their employees and the public.

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Ben Pierce is transportation technology program leader at HDR.
As society and industry grapple with managing the impacts of the COVID-19 pandemic, construction technology offers a good example of how state transportation departments (DOTs), producers, and contractors can adopt new ways to leverage technology to ensure employees and customers remain safe.

Over the past decade, the Federal Highway Administration’s (FHWA) Every Day Counts initiative has deployed innovative digital solutions, or e-construction, to help solve industry problems. FHWA’s focus on e-construction has led to changes in the way stakeholders build projects and communicate key data across the lifecycle of a project.

Innovating in a Crisis with e-Ticketing

By Matthew Valle
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Trimble and Purdue University are partnering to develop a slowdown alert service that notifies commercial drivers to help reduce rear-end crashes, particularly in highway work zones. The service will interpret planned routes throughout the U.S. against real-time traffic incidents, such as roadwork and accidents, and slowdown patterns in order to understand congestion ahead.

It will deliver visual and audible in-cab slowdown alerts to drivers using the firm’s commercial navigation and driver trip planning apps, CoPilot Truck and MileOn by PC*MILER, or through telematics and electronic logging device (ELD) providers that integrate these apps. The service will also be available as a part of the Trip Management API in the Trimble MAPS Platform. Drivers can download premium subscriptions of CoPilot Truck or MileOn by PC*MILER in the Google Play or Apple App Store, which includes the slowdown alerts.

Smarter Technology
"We are big believers in the power of technology to empower drivers to make better, smarter, safer decisions on the road," said Dan Popkin, executive, Trimble MAPS Division. “We are enhancing our routing, scheduling, visualization and navigation platform to detect locations of work zone traffic queues throughout the U.S. to offer an advanced slowdown alert service to hundreds of thousands of professional drivers using our transportation-oriented solutions and in-cab truck navigation software."

In 2017, 18,000 total crashes in U.S. work zones involved trucks, according to the ARTBA-managed National Work Zone Safety Information Clearinghouse. Rear-end crashes are the most common type of work zone crash and the majority of fatalities occur on roads with speed limits greater than 50 mph. Such crashes have killed more than 4,400 people and injured 200,000 others in the past five years, according to government data.

"Our research has shown that there is sufficient penetration of connected vehicles operating on highways that we can provide advance warning of interstate queues," said Darcy Bullock, professor of Civil Engineering and director of the Joint Transportation Research Program, Purdue University, "If we can communicate that information in a timely and non-distracting manner to commercial vehicles, this will provide an opportunity to reduce rear end crashes involving trucks."

Trimble said the slowdown alert service is expected to be available in the third quarter.

Trimble and Purdue University Collaborate to Improve Highway Work Zone Safety

By Rishi Mehra
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As society and industry grapple with managing the impacts of the COVID-19 pandemic, construction technology offers a good example of how state transportation departments (DOTs), producers, and contractors can adopt new ways to leverage technology to ensure employees and customers remain safe.

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Rishi Mehra is an executive at Trimble MAPS.
Electronic ticketing, or e-ticketing, is one area that has an immediate impact on reducing face-to-face contact. It provides the digital transmission of construction material data from producer to consumer. Many states are exploring e-ticketing options. For example, the Pennsylvania Department of Transportation (PennDOT) has several e-ticketing pilot projects, including resurfacing work in Allegheny County.

PennDOT facilitated this change by starting with a simple initiative, and adding small continuous improvements until it achieved the desired result. Such innovations have saved the agency more than $60 million since it began the initiative in 2013.

PennDOT’s leadership and innovation in e-ticketing highlight several benefits to state DOTs, producers, and contractors. These include:

- enhanced project documentation;
- tracked material yields;
- streamlined payment process with digital reconciliation; and
- integrated accounting systems.

Advances in cloud storage and computing are also helping the operators of asphalt plants, quarries, and ready-mix facilities integrate e-ticketing with their IT systems.

As all 50 state DOTs determine the most efficient path forward in safely transferring critical project data, cloud computing offers the opportunity to help unify and standardize how this information passes between public agencies, producers, and contractors.

The challenges of the COVID-19 pandemic provide an opportunity to reshape our thinking on how we transfer construction materials information from the plant to the field. This is likely to prompt even more innovation.

Matthew Valle is vice president of services at HaulHub Technologies.

HaulHub Technologies is leading the digital construction revolution with integrated SaaS tools that allow materials producers, contractors and fleets to digitize their supply chain and enhance operational performance. HaulHub’s deep industry experience and passionate team are focused on leveraging the latest technological developments to help drive the industry forward.

HaulHub’s Field App provides crews with real-time visibility into fleet performance and offers in-app analytics to provide insight into overall job performance, with visibility down to the individual truck level.

HaulHub’s Web Portal enables office personnel to efficiently dispatch, monitor, and pay their truckers. Dispatchers can rapidly communicate job changes to their entire fleet of trucks in a single click. Whether paying by the ton or by the hour, the flexibility of the platform allows efficient payment and cost coding.

HaulHub’s robust timesheet solution system easily integrates into leading ERPs and provides daily fleet job costs to improve business operations. The HaulHub Carrier App provides fleets and drivers with the tools needed to accept jobs, monitor performance, and get paid.

HaulHub is revolutionizing the industry with its e-ticketing solutions: DOTslip and JOBslip, which provide digital materials tickets to asphalt, aggregate, and ready-mix consumers. These apps were built collaboratively with DOTs and leading materials producers throughout the US. DOT inspectors, and field crews now have a tool that allows them to safely and quickly accept delivery of materials, make project notes, and easily reconcile quantities through the DOTslip and JOBslip web portals, all without ever having to touch a paper ticket.

By combining their own deep industry experience with the expertise and feedback of leading producers and contractors, the team at HaulHub is solving some of the industry’s most complex problems and looks forward to building the integrated technology solutions that will push our industry forward.

Learn more at haulhub.com.
With most construction tradeshows and conferences cancelled due to COVID-19, software itself has become a leading venue for exploring software options. A growing number of contractors are connecting online with suppliers to evaluate the ROI value of new technology. Faster, more accurate estimating, operational efficiency and mobile capabilities are at the top of their lists.

Look for these four priorities:

**Workflow Connectivity and Real-Time Data**
Efficiency increases when applications for estimating and operations talk to each other. Estimating logic is visible to leaders in the field. Performance data can be used to adjust operations immediately. Repair requests, equipment moves, resource needs, inspection results and dozens of other critical pieces of intelligence can be communicated and seen instantly across workflows.

**Enterprise-Class Performance**
The architecture of the software should accommodate multiple users and run fast and reliably, without bugs. How aggressively a supplier keeps pace with technology and delivers updates are things to look for. Requirements also change, so contractors should make sure software can scale to meet future needs.

**Construction Logic**
Some applications are intuitive for accountants or IT pros, but contractors often complain the apps don’t match how they work in the field. Look for software that aligns with existing processes. A user interface that’s easy to learn and use is also essential, so users buying it can stay focused on construction, rather than getting software to work.

**Support and Fit**
Get a feel for the personality of the supplier, the expertise of its employees and how well they could work together with your team. Look for proven implementation and training processes and ask questions about support resources, such as how long it takes to respond to calls or resolve issues. References on support capabilities from existing users should be readily available.

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Greg Norris is marketing communications director at B2W Software.

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Idaho is one of the fastest-growing states in the nation, with higher demand than ever on its transportation system of more than 12,000 lane miles of roads and highways, 1,830 bridges, and 31 backcountry airstrips. Like too many other states, however, funding hasn’t kept pace.

To help bridge the funding gap and encourage employee-driven solutions, the Idaho Transportation Department (ITD) in 2014 developed the Innovate ITD program, which helps the agency operate more like a business. It has turned 1,630 employee ideas into $11 million in savings. The innovations have benefited Idaho citizens and other users of the state’s transportation network. It also has improved trust, credibility, and confidence in the agency.

Employees are the driving force behind Innovate ITD. They create ideas and implement solutions. Workers at every level are encouraged and empowered to submit ideas to save time and money.

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See Innovate, A-16
"When you trust your employees to be innovative and make decisions about how to do their jobs, they will do the right thing," says ITD Director Brian Ness. “To be the best and deliver on our mission, ITD harnesses the innovative spirit of our employees. Innovation allows us to change and get better.”

Three ideas have been recognized with American Association of State Highway & Transportation Officials (AASHTO) President’s Awards:

- Combining 17 bridge repairs into one contract, saving $4.7 million in design and construction costs and shaving an estimated 17 years off the work schedule.
- Building nesting platforms for protected osprey to allow for bridge inspections.
- Deploying geocells to combat swelling and heaving in clay soils beneath the roadbed, the first U.S. use of this technique.

"ITD creates a culture where employees look for ways to innovate. This translates into better service for our customers," Ness adds.

In addition to better service, the innovative effort by ITD helped the department earn the respect of elected officials. The Idaho legislature provided ITD with two transportation-funding increases in the last five years worth about $87 million after no investment boosts the previous two decades. ITD’s annual operating budget is about $750 million.

Another accomplishment has been seeing that a public agency can compete with the private sector. In 2016, ITD was one of three finalists for Idaho Innovative Company of the Year, sponsored by the Idaho Technology Council, a business advocacy group. It was the first time a public agency was named as a finalist, a feat that ITD repeated in 2019.

“Innovate ITD shows that a government agency can be just as innovative as the private sector and move at the speed of business,” says Ness. “By finding better ways to do our jobs, we put the focus on the customer and serve the citizens, not ourselves.”

Innovative solutions generated by employees help ITD better serve the citizens of Idaho with savings and efficiencies and deliver critical customer-service improvements. Visit the “Innovation” section of itd.idaho.gov for more details and videos.

Reed Hollinshead is public information officer at the Idaho Transportation Department.

WHY PAPER COSTS $10,000 PER FOREMAN, THREATENS SAFETY & HAMSTRINGS GROWTH

By Mike Rydin
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Eliminating paper on the job site not only saves time and reduces costs, but also lowers risk and provides real-time insight about expenses and productivity. When time cards, diaries, plans, forms, safety meetings, inspections, and truck tickets are digital, they become searchable and provide critical up-to-date decision-making information for your project management team.

The savings from reduced entry time and processing are significant. HCSS estimates that companies still using paper can save nearly $10,000 a year per foreman from reduced field entry time, document handling, redundant office entry, and reduced error processing procedures and makeup checks.

Having the right information at your fingertips also allows companies to catch errors early and make corrections quickly. Such adjustments reduce or eliminate unproductive time and keep problems from moving from the field into the office.

See Paper, A-18
THE INDUSTRY’S CHOICE FOR ELECTRONIC TICKETING

We power digital ticketing for producers, contractors, and DOTs nationwide.

WWW.HAULHUB.COM
"I was out on a job a couple of months ago and noticed a superintendent and foreman working through problems that the project manager didn't even know yet because they were seeing the data first," said Jake Anderson, project controls manager at Austin Bridge & Road. "They are solving problems for us before it even gets to our financials. That is a transformational change for us."

In the age of COVID-19, eliminating paper improves safety, too. Reducing the person-to-person contact of paper-based systems minimize the chance of spreading any virus. And safety advantages go beyond the current health crisis. For example, having someone standing among trucks on a busy site is dangerous. Recording truck tickets from a distance or without human intervention virtually eliminates that danger and decreases the time spent reconciling truck ticket invoices.

So why doesn’t every company go paperless? It’s a big change, to be sure, one that can seem daunting in the middle of coping with all the usual challenges faced by construction firms.

To help them manage, HCSS has developed a “Go Paperless in 30 Days” process. The goal is to eliminate paper with the least amount of distraction or disruption to the firm’s regular work. HCSS offers a 12-month money-back guarantee on new software if customers are not happy with the results.

We believe the cost is secondary, but we also know that conserving cash is critical at this time. Companies need a fast payoff on their investment. Having analyzed our customers with between 10 to 20 foremen, it typically costs between $3,500 and $5,500 per foreman for the first year and around $3,000 per foreman in subsequent years. This is the entire cost of the software divided by the number of foremen, not just the cost of the foremen. We would expect payback for the expense to occur within six months. Even better, the company is positioned for efficient growth.

HCSS has customers of all sizes. Our “Go Paperless in 30 Days” process is geared to companies with 30 foremen or less. Larger companies, especially those with multiple offices, will take longer.

Mike Rydin is CEO at HCSS.
The construction industry is entering the digital age. Technological innovation has transformed many industries—retail, auto manufacturing, media—but the construction and infrastructure segments of the economy have been slow to adapt, operating much the way they have for the past 20 years.

That is changing. Today’s work sites include laptops and iPads, cell phones with GPS connections, augmented reality headsets making the workers look more like video gamers, and even a drone or two flying overhead. And for a variety of reasons, mostly health and safety related, the COVID-19 pandemic is speeding the adoption of many of these new technologies.

Digital construction technology offers the promise of building roads, buildings, and bridges faster and more efficiently than ever before with significant cost savings to contractors, owners, and, in the case of publicly-owned infrastructure, taxpayers.

“Today you can take a 3D constructible model of a bridge, incorporate it into an augmented reality platform like HoloLens glasses,” Cyndee Hoagland, senior vice president of Trimble, told the California Transportation Commission in an August 2019 presentation. “Your field workers and your stakeholders can all be viewing that bridge, in a reality type environment to collectively identify where the problems are in real-time and make better, more informed decisions. This reduces rework and saves time and money.”

The introduction of digital construction technology in the highway and bridge sector began in earnest more than 10 years ago. That’s when the Federal Highway Administration (FHWA) began to encourage the adoption of innovative construction techniques through its Every Day Counts partnership with the states.

The Utah Department of Transportation became an early adopter of 3D modeling throughout the bid, design and construction process. Florida’s DOT also began taking advantage of 3D data models and the benefits of automated machine guidance resulting in better quality roads, improved safety during the construction process and reduction in rework costs. Both state DOTs continue to lead in the pursuit of broader and more integrated application of digital construction technology, which can produce cost savings of up to 25 percent in major projects, according to The Boston Consulting Group.

The COVID-19 pandemic has introduced new challenges for the construction industry. In order to fully re-open our economy in a sustainable manner, industries will need to meet certain criteria and adhere to social distancing and other guidelines or risk shutdown and delays. Fortunately, the same digital construction technology already employed for remote worksite monitoring can be adapted to include features that address COVID-19 and any future outbreak. These technology-based solutions—including access control systems for worksite security, tracking worker time and attendance, safety compliance, and even drug screens and background checks—can improve transparency and keep projects operational while ensuring that proper health and safety measures are in place.

Congress has directed the FHWA to develop an incentive program to help accelerate the adoption of digital construction technology by public agencies at the state and county levels, technologies that have been extensively validated by DOTs through research as well as collaboration through the Every Day Counts partnership. With technology becoming less expensive and more user-friendly, now is the time for the construction industry and the owners of public infrastructure to take advantage of these advances and adopt these strategies as standard operating procedures.

Gregory Nadeau is founder and chairman of Infrastructure Ventures, a policy based market development business. He was the FHWA administrator during the Obama administration.
U.S. Department of Transportation Secretary Elaine Chao answered these questions from ARTBA.

Q: The surface transportation system continues to undergo transformation, in terms of both the technology on our roads and the way the traveling public uses the roadways. How has U.S.DOT prioritized innovation to ensure we are prepared for the future needs of our transportation system while providing for the traveling public’s safety?

CHAO: There is so much innovation going on in the transportation field today. Our mantra has always been: The Department needs to engage with emerging new technologies to address legitimate public concerns about safety, security, and innovation without hampering progress.

The Department is technology neutral—not top-down, command and control. That means the government is not in the business of picking technology winners and losers. Our goal is to enable the safe testing and deployment of a wide variety of new technologies, so communities and individuals can choose what fits their needs best. This employs a flexible, performance-based approach that protects safety while giving entrepreneurs the room they need to innovate and grow.

One example of how we are advancing innovation and improving safety and infrastructure is through our new pilot program designed to help avoid traffic accidents and save the lives of first responders by utilizing the 5.9 GHz Safety Band. Recently, the Department has announced its intention to invest up to $38 million in the First Responder Safety Technology Pilot Program, which will help equip emergency response vehicles and key infrastructure with vehicle-to-everything (V2X) communication technology.

Many of the new technologies are cross-modal, so in March 2019 the Department established the Non-Traditional and Emerging Transportation Technology (NETT) Council, which is a one-stop shop to make it easier for innovators and stakeholders to work with the Department. In July, the NETT Council released its “Pathways to the Future of Transportation” guidance document that lays out a process for innovators and stakeholders to approach the Department with their plans and proposals for emerging technologies.

The Department is also engaged in ground-breaking rulemakings that will create a path forward for some of the most advanced emerging transportation technologies.

Q: How is the Department preparing for the future of Automated Vehicle (AV) technology?

CHAO: On Jan. 8, I announced the release of “Ensuring American Leadership in Automated Vehicle Technologies: Automated Vehicles 4.0.” This document unifies AV efforts across 38 Federal departments, independent agencies, commissions, and Executive Offices of the President. It signifies that the federal government is all in for safer, better, and more inclusive transportation, aided by automated driving systems. It recognizes the value of private sector leadership in AV research, development, and integration.

Bringing to fruition the vast potential of AVs will require collaboration and information-sharing among industry partners, state and local governments, academia, non-profits, standards development organizations, and the federal government.

An example of such an effort by the Department can be seen through FHWA’s CARMA program. The CARMA program is a multi-modal research initiative focused on improving the transportation system by leveraging emerging automated driving technology and V2X technology to enhance safety, efficiency, and operational performance in moving people and goods.

Automated vehicles have the potential to save thousands of lives annually and restore mobility to millions of people who face transportation challenges, such as older Americans and people with disabilities.

And FHWA is pursuing an update of the Manual on Uniform Traffic Control Devices (MUTCD), the first major update in a decade. The updated version will reflect advances in technologies that are not currently represented in the MUTCD today.
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Unionport Bridge is a critical section of the Bruckner Expressway Service Road in the Bronx, New York. The roadway carries an average 55,000 cars and buses daily, and the bascule drawbridge allows commercial and recreational marine traffic on Westchester Creek.

Because of its critical transportation function, the 67-year-old bridge has been forced to remain in continuous service and never received major repairs. Now, it is being replaced by Schiavone Construction Co. LLC of Secaucus, New Jersey, and The Lane Construction Corp. of Cheshire, Connecticut, teamed as Unionport Constructors Joint Venture (JV), on behalf of the New York City Department of Transportation.

The main construction challenge of the $232 million project is keeping the busy waterway navigable and arterial route open while replacing the bridge. To accomplish this task required constructing two temporary bridges to maintain vehicle traffic, erecting the final bascule span in an open position, and finishing all work in the navigation channel within strict time limits.

The two vertical lift bridges are the first temporary hydraulically driven bridges in the United States. They were designed by Acrow Corporation of America of Parsippany, New Jersey.

The north bridge carrying westbound Bruckner traffic is 24 feet wide and has a 66-foot lift span supported by four lift towers housing the concrete counterweights and the hydraulic ram system. The lift towers are founded on a temporary support platform designed by UrbanTech Consulting Engineering, P.C. of New York, which is supported by the existing piers of an earlier bridge.

The south bridge carrying eastbound traffic is 30 feet wide with an 85-foot lift span and a 5-foot cantilevered walkway along the south edge of the bridge. The lift span is supported by four lift towers founded on a temporary steel cap beam system with eight, 54-inch shafts drilled into bedrock designed by GEI Consultants, Inc., P.C. of Washington, D.C.

The vertical lift bridges operate utilizing a hydraulic ram system connected to precast counterweights within each lift tower to raise and lower the span. It was designed to function in a “heavy span” condition under all operating conditions. The concrete counterweights are connected to the lift span via four cables in each corner of the bridge that are run through the lift towers and around a set of sheave cassettes that direct the wire down to the bridge corners for connection.

When the lift bridges are in the closed position, the hydraulic ram system is extended with the concrete counterweight to the top of the lift towers. During a bridge opening, the hydraulic ram is retracted to pull the concrete counterweight down within the lift tower to overcome the span heavy condition of the lift bridge, thus raising the bridge. In order to close, the hydraulic ram is extended under hydraulic control to raise the counterweight, thus lowering the span onto the bearings. A variety of limit switches, inclinometers, and tilt sensors assist the hydraulic controls system for the raising and lowering operations.

The lift bridges are operated from a control panel that operates the bridges in individual or dual span operations for any bridge openings. The hydraulic system, along with the bridge operations controls was designed, manufactured, and commissioned by Electro Hydraulic Machinery Co. of Hallandale Beach, Florida. The sequencing and installation of the system on site required several days of testing and configuration for each lift bridge to ensure the bridge opening operations ran in a smooth fashion.

The temporary lift bridges have been in service since December 2019 and are expected to remain operational until the third quarter of 2021.

Graham Neville is an engineer at Schiavone Construction Co. LLC. Kevin Clark is project director at The Lane Construction Corporation. They both are working on this project through Unionport Constructors JV.
Helping motorists see and stay in their lanes has been a challenge for road planners since the start of the automobile age. Solutions have evolved from simple painted white lines in the early 1900s to the range of retroreflective pavement markings on today’s roads. These critical pieces of transportation infrastructure are engineered for visibility by providing contrast with the road and reflecting light to drivers, whether that’s sunlight during the day or light from headlights at night.

However, research has revealed that pavement markings, even those made of retroreflective materials, are almost impossible to see in rainy nighttime conditions. Rain increases the risk of crashes by as much as 57 percent, according to a 2018 study. Most people who have driven on a rainy night recognize the difficulties—surrounding objects are harder to see, headlights create glare, and standard pavement markings become virtually invisible. The primary cause of this is because mediums such as air and water bend light. This is measured using the refractive index, or RI.

The RI of air is just over 1, meaning that air bends light very little. In dry conditions, retroreflective pavement markings optimize the amount of light reflected back to the driver using spherical glass beads attached to the road using a colored binder. Water decreases reflectivity because its RI is 1.333, which means it bends and disperses light. When a standard retroreflective pavement marking gets wet, it reflects light from a vehicle’s headlights in a much broader, weaker cone. Less light is returned to the driver and the pavement marking becomes more difficult to see.

**Wet Retroreflective Pavement Markings**

In rainy nighttime conditions, pavement markings need to counteract the effects of water so drivers can see their lane lines. Manufacturers, engineers, and safety experts have developed wet retroreflective technology that helps make pavement markings more visible in all conditions—day or night, rain or shine.

Wet retroreflective pavement markings contain ultra-high RI optics specifically engineered to reflect more light in a narrower cone, optimizing visibility even when the markings are wet.

The Georgia Department of Transportation (GDOT) in 2012 started installing 3M all-weather pavement marking tape to reduce accidents on their roads—specifically in rainy conditions. “The department made the decision to use 3M’s tape because it checked all the boxes—from a retroreflectivity perspective, from a longevity perspective, and from a lifecycle cost perspective—so that we felt confident that we were being strong stewards of taxpayer dollars,” said GDOT Traffic Engineer Andrew Heath.

Pavement marking visibility is also important to driver assistance technologies such as lane guidance systems, which use images from cameras. The effectiveness of these systems is jeopardized if markings are not visible to the camera in challenging weather conditions such as a rainy night. As more and more connected and automated vehicles find their way onto the road networks, wet reflective technology can help improve marking visibility.

*Chris Edwards is global business manager, pavement markings, at 3M.*