Transportation **Point**

The Resource for Transportation Professionals | Spring 2020



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Opening Perspective



Today's challenges with COVID-19 reinforce the important role we all play in ensuring the safety of our families, employees and communities. Transportation agencies are accustomed to evolving and modifying operations based upon unprecedented events. Identifying efficiencies, delivering programs and adapting to change is inherent in operations. Through it all providing safe, reliable transportation infrastructure remains the mission.

This issue of *Transportation Point* highlights how three agencies are accelerating construction while ensuring safety. Each of these agencies have unique approaches, but all face the similar challenges of managing data, improving construction techniques and ensuring the safety of employees and the traveling public.

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A dependable transportation network that efficiently moves people and goods is critical. There are great examples across the nation of how this is being done not only during today's challenges, but also in the way agencies are advancing innovations that will prepare the nation for the future.

I welcome your feedback on the approaches you are taking.

Hun A. Barton, P.E.

John Barton



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Can safety and acceleration live in the same workspace? In Texas, they do.

How TxDOT is reducing construction time while maintaining the safety of employees, contractors and the motoring public

In 2014 and 2015, Texas voters approved a total of nearly \$10.5 billion in additional transportation funding to improve congestion and connectivity and enhance safety. Getting these critical projects in the ground as quickly as possible has become a high priority for the Texas Department of Transportation, elected officials and our constituents. Shortening construction minimizes construction-zone impacts to the driving public and advances our mission of safety and mobility.

Ultimately, our goal is to reduce project delivery time by 20% to 50%. To speed construction, we may look at traffic control, traffic operations, incentives and disincentives, and contracting methods, such as design-build or A+ B contracting, where contractors' bids include the construction cost plus the number of construction days.

As we strive to accelerate project delivery, the welfare of our employees, contractors and the motoring public becomes a more significant issue. We have found a program that integrates the following five key elements as an effective way to ensure safety and accelerated construction can exist in the same workspace:

- 1. Industry partnerships that promote open communication
- 2. A safety reserve to fund unexpected expenses
- 3. Review teams to monitor safety throughout the project's life cycle
- 4. Technology that informs and measures progress
- 5. Work zones that create awareness

Industry partnerships promote communication

We Build Texas is a joint program we designed with the Associated General Contractors of Texas to foster open, receptive dialogue, useful partnering techniques and positive contract relationships. We Build Texas hosts workshops in each TxDOT district with contractors, the construction engineer and inspection teams. During the meetings, participants openly discuss ideas and share best practices for improving safety.

Because outside construction engineering and inspection contractors act as extensions of our staff, we invite them to participate in worksite tailgate meetings and local office safety meetings. These partners collaborate with our inspectors and construction engineers and listen as we discuss safety issues. Attending these meetings helps them to understand our concerns better and respond with solutions.

A safety reserve funds unexpected expenses

In the past, when roadway conditions could be improved, a contractor might ask us to modify the contract. To allow for TxDOT to make changes, a safety contingency was added to all contracts to fund concrete barriers; crash attenuators; portable, changeable message signs; or law enforcement.

A reserve account (2% to 3% of the total contract value) can be used to provide additional safety equipment when the contractor and DOT mutually agree upon the need. This particular provision ensures funds are available to protect workers and motorists.

Gina E. Gallegos, PE Director Construction Division > Texas Department of Transportation

Review teams monitor safety throughout the project's life cycle

Our design safety review team ensures plans not only include safety features but that contractors implement those features. The team typically is from the district where the project is being implemented. Their job is to review plans, traffic control, etc. Members include representatives from TxDOT's construction office, design office, planning office and a construction engineer. During their assessment, the team may propose changes or make recommendations to enhance what already exists.

Once the project has gone into construction, our on-site inspectors remain watchful. If they see a potential safety hazard, they will notify the area office, which forwards the issue to the design safety review team. Ultimately, it's their job to highlight the concern in project plans.

Our traffic control review team randomly selects construction projects to drive through. During their ride, team members may spot barricade problems or the need for an additional sign or message board to improve safety and traffic flow. The team may include a district construction engineer, the area engineer and a maintenance supervisor, but it is led by the division. After each trip, the team develops a safety report that is shared with the districts and the contracting community, so contractors can learn from it as well.

We also conduct interim and final evaluations of the contractor that include safety factors. Positive evaluations show we had excellent communication in the field, worked well together and successfully built the project we said we would build. Further, the results of each assessment provide reliable metrics on which to benchmark the safety of future projects.

Technology that informs and measures progress

We recently began designing projects with 3D models. One of the many benefits of using this advanced technology is that we can share it with our contractors, along with 2D plans, to help them more easily and precisely identify safety clashes before construction begins.

Another technology advancement we are excited about is a measurement tool called "heat maps," which we developed and are piloting with the Texas A&M Transportation Institute. Just as a TV meteorologist's weather map uses color to indicate the amount of precipitation across a metro area, our heat maps use color to show where heavy amounts of traffic incidents occur on our highway system. We quickly can compare "before" heat maps of high-incident areas with "after" heat maps to determine whether accidents have decreased as the result of a project.

Like many other state DOTs, we also have adopted systems to help us inform motorists, including:

- Queue-warning detection alerts
- Traffic signal coordination
- Dynamic message signs

Work zones that create awareness

Year after year, the industry mourns the death of roadway construction workers caused by vehicles unknowingly or intentionally entering the work zone. To protect those who work on TxDOT projects, we are testing intrusion sensing and alert technologies.

Intrusion alarms use one or more sensors mounted on work-zone barriers. When an errant vehicle contacts a sensor, the alarm is activated, and a loud siren alerts construction crews that a vehicle has entered the protected area. The goal is to give workers enough reaction time to move out of harm's way.

Another best practice is expanding the work zone. Rather than restricting the contractor to the confines of a highway median, for example, we may create additional spaces, away from motorists, for workers and equipment. More space equals increased safety and productivity. Often, the contractor can reduce the number of longer closure times as a result.



"Our design safety review team ensures plans not only include safety features but that contractors implement those features."

Photo courtesy of Texas Department of Transportation

When additional workspace isn't possible, we deploy active-truck warning signs that encourage motorists to be aware of their surroundings and slow down. We also allow the contractor to extend road closure times or work at night under full closure. Although closures are an inconvenience to commuters, they may enable the contractor to complete more work in less time.

Often, the workforce on an accelerated construction project will work long shifts multiple days in a row. TxDOT is working to ensure longer work schedules do not impact safety. If we have an accelerated six-day bridge rehabilitation project, for example, where the contractor is working around the clock to reopen the facility, we will require the contractor and TxDOT construction inspectors to work no more than 10- or 12-hour shifts. Our employees are required to work only days or only nights, so they can rest between shifts. We expect the contractor to rotate his or her employees as well.

Remembering what's important

With every year that passes, our industry's backlog of critical infrastructure projects grows. When funding becomes available, it's natural to want to get those projects in the ground to improve safety and mobility and to show progress as soon as possible. But, as DOTs, we can't let a sense of urgency rule the day. We must adopt best practices that promote maximum safety and give contractors the flexibility to accelerate their schedules. Success, for us, is when the project gets built and everyone – our employees, the contractor's employees and motorists – can go home to their families at the end of the day.

ABOUT THE AUTHOR

Gina Gallegos is the director of the Texas Department of Transportation's construction division. She oversees contractor prequalification, statewide highway improvement contract letting, bid analysis, technical assistance, training and expertise in administering TxDOT's highway improvement program. She is a recipient of the 2016 Innovative Transportation Solutions Award and the 2017 Gibb Gilchrist Award. Contact her at (512) 416-2559 or at Gina.Gallegos@txdot.gov.

NJTA software paves road to smoother, safer rides

Interactive database helps manage and forecast pavement needs for smarter resource allocation

Providing New Jersey Turnpike and Garden State Parkway patrons with a safe, reliable and sustainable roadway is paramount to the New Jersey Turnpike Authority. To more effectively and efficiently manage the 4,400 lane miles and ramps of pavement, we actively pursue solutions that will improve the asset's overall quality and life expectancy. We have identified needed changes to the material quality and engaged the paving community in discussions about construction practices and mix composition.

Most recently, we converted to a web-based Pavement Management System. The tool has since become a best practice in helping us manage and forecast pavement needs. The combination of science, technology and our legacy data makes it a one-stop for all pavement data related to condition and performance.

Meaningful analysis and forecasting

Our original manual process of data collection and recording was paper-based and timeintensive. Staff spent hours populating spreadsheets. The new Pavement Management System is a dynamic and robust data management and storage tool that provides the meaningful pavement analysis and life-cycle forecasting our manual system lacked.

A repository for annual pavement inspections and repair history, the system combines the data of the current roadway pavement condition ratings with past pavement repairs and environmental factors to predict the remaining life span of the pavement. This aids the Authority in identifying areas requiring attention before they fall into disrepair. We can more easily forecast wearand-tear trends, identify "global" conditions or issues, and chart our progress against multiple performance metrics, including level of service, AASHTO pavement design standards and national pavement rankings. And because it is a digital tool versus a paper-based system hidden in a file drawer, the information is readily accessible to any enterprise geographic information system user on our team.

High-quality pavement

- Eliminates rutting
- Improves drainage runoff
- Offers superior rideability
- Allows better vehicle handling
- Minimizes cracking, raveling and the potential for potholes
- Reduces vehicle damage, breakdowns and guick avoidance maneuvers that could compromise safety
- Facilitates faster snow and ice removal



John M. Keller, PE, PMP Executive Director > New Jersey Turnpike Authority



Photo courtesy of New Jersey Turnpike Authority

Safer data capture in the field

We have two methods for system data collection, and both have improved the safety of our engineers in the field. The first is a uniquely equipped truck utilized by our consultants. The truck travels along the New Jersey Turnpike and Garden State Parkway, collecting and feeding data surface conditions into the system. The engineers also conduct visual inspections and record their observed ratings using handheld devices with drop-down menus. The portable, intuitive software allows our engineers to record their findings quickly with less exposure to traffic.

Customizable, geospatial maps

The Pavement Management System's geospatial capabilities are uniquely customized to manage the New Jersey Turnpike and the Garden State Parkway roadways and pavement condition ratings system. The system is supported by GIS software and a web-based application called a Pavement Condition Viewer. GIS mapping of the pavement conditions allows users to view the pavement conditions along the roadway alignment, which assists in identifying patterns, relationships and situations, helping us make more informed decisions.

For example, we can create a report indicating pavement ratings and rideability scores for any one of 38 prespecified roadway sections along our mainlines and ramps. And, our engineers can interact with the Pavement Management System to anticipate levels of service per roadway section, view the projected pavement performance and target funding needs. In addition to customized geospatial maps, we can generate reports, perform comparisons and develop cost estimates and life-cycle analyses.

Historical data preservation

When we began considering migrating to the electronic Pavement Management System, one of our biggest concerns was preserving the many years of pavement inspection data and practices recorded on paper. Future analyses and reports couldn't be based solely on new data collected and entered in one year. It wouldn't accurately reflect pavement repairs or trends in pavement conditions.

Staff manually entered historic data into the new digital system, which has tremendous storage capability. Having access to historical data sets allows us to forecast the needs of our network from a well-informed, comprehensive perspective. The new system also uses AASHTOWare ME Design software to perform the pavement life-cycle analyses based on current standards and procedures used by numerous roadway agencies.

"... we converted to a web-based Pavement Management System. The tool has since become a best practice in helping us manage and forecast pavement needs."



Strategic resource and funding allocation

We completed our first inspection and systemwide pavement performance analysis using the Pavement Management System in 2017. In 2018, we produced reports from the 2017 inspections and analyses to determine resurfacing priorities and future funding needs.

The system has been instrumental in helping us identify future funding levels necessary to support the Authority's desired level of service and to help direct resources to address targeted needs on our system. It also enables more efficient use of funding by flagging pavement sections just as they approach end-of-life-cycle metrics, which aligns with our asset management process.

Since initial implementation, we have refined and further customized the Pavement Management System by assigning weighted values, based on lane miles, to each of the 38 predefined roadway segments. We also improved the graphics, added pop-up data, report templates and costestimating tools to better align the system with our long-range plan for pavement investments.

A valuable tool

The Pavement Management System makes reliable data readily available to assist the Authority in critical asset management and fiscal decision-making, helping us improve the quality of our pavement significantly while saving time, money and resources.

However, it cannot replace the expertise of a talented team. We attribute the ultimate success of our pavement program to our dedicated engineering and maintenance departments that work with our general consulting engineer and New Jersey's contracting and consulting communities to pave the way to greater safety for our patrons.

ABOUT THE AUTHOR

John M. Keller is responsible for managing both the New Jersey Turnpike and Garden State Parkway roadways and the NJTA's 2,000 employees. The two iconic roadways, combined, convey 2 million vehicles a day in the most densely populated state in the nation. Contact him at keller@njta.com.

Accelerated construction methods increase work zone safety in Georgia

Shorter construction phases leave less chance for accidents

To relieve growing congestion on some of Georgia's most congested roadways, the Georgia Department of Transportation's Public-Private Partnership Division, which includes the Office of Innovative Delivery, is implementing a series of major transportation projects, all of which will be open to traffic between 2020 and 2032. The goal of the Major Mobility Investment Program, as it is known, is to advance mobility and allow the traveling public to navigate more efficiently through Atlanta and the state.

To relieve congestion, we must work in congested areas, which can be dangerous for our employees, construction crews and motorists. It is easy to become desensitized to live traffic environments when working in them every day. To protect our employees, the traveling public and construction crews, we take extra precautions, including public outreach through print media, social media and radio to notify commuters of scheduled work and the impact to existing conditions. In addition, the Department utilizes advanced signage; portable, changeable message signs; off-duty police officers and various other traffic-control devices to assist in successfully delivering the work.

As an example, implementing accelerated construction methods, when applicable, do as much to enhance work zone safety as they do to speed construction. Because roadwork is performed in a fraction of the time, traffic disruptions to motorists are significantly reduced, and long-term work zones are avoided. Reducing work zone exposure improves safety for the traveling public and construction workers alike. Safety and efficiency also can increase as traffic control installation and removal happen less frequently. When traffic disruptions cannot be avoided, work is scheduled during nonpeak times, such as nights or weekends, to reduce work zone safety concerns.

Two years ago, the Department used accelerated bridge construction to replace a structurally deficient bridge on State Route 299 over I-24 near the Georgia/Tennessee state line. (Although the bridge is located in a highly congested area, it was not part of the MMIP.) The Department chose slide-in bridge construction, a cost-effective technique for deploying prefabricated bridge elements and systems. The new bridge, with two 12-foot travel lanes and two 8-foot shoulders, was built on temporary supports parallel to the existing structure.

Plans included demolishing the existing bridge, sliding the new bridge into place, tying it into the approaches and paving it during a three-day weekend. Complications during the project required an extension of the tight schedule by one day. Nevertheless, construction was a fraction of the conservatively estimated six months to a year that would have been required by traditional bridge replacement techniques.

It's impossible to capture all the impacts avoided utilizing the accelerated construction technique; however, we do know that the traveling public's schedules were impacted by one weekend as compared to a one-year or two-year schedule for traditional bridge replacement projects. We know that there were no accidents on the roadway or in the work zone that weekend.

For another project, the contractor used bridge caps that were precast in lieu of cast-in-place to accelerate delivery. The caps were placed on the bridge columns, as compared to forming the cap and pouring in place. The caps were placed during nighttime double-lane closures. This particular



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"Reducing work zone exposure improves safety for the traveling public and construction workers alike." construction method was a win for the project, the traveling public and the construction crews, as the method minimized the lane closures required to complete the work.

As DOTs incorporate many ways, both traditional and highly innovative, to make work zones safer, construction methods should be considered among them. Techniques, such as accelerated bridge construction, can help everyone get home safely at the end of the day or at the end of their shift.

ABOUT THE AUTHOR

Stephen Lively is the P3 Construction Program Manager for the Georgia Department of Transportation's Public-Private Partnership Division and the Office of Innovative Delivery. In addition to delivering the Major Mobility Investment Program, the office is responsible for delivering the \$834 million Northwest Corridor Express Lanes, the No. 1 project on the 2018 *Roads & Bridges* Top 10 Roads list and the largest single investment in Georgia's transportation infrastructure. Contact him at (404) 631-1828 or slively@dot.ga.gov

Promoting safety in a dynamic traffic environment



Dynamic message boards are one of the best ways to improve safety in an active and continually changing work zone. Slowdowns or accidents in a work zone create lengthy backups that can surprise motorists and cause accidents miles upstream from the actual construction area. To alert the traveling public to traffic queues, GDOT may place traditional orange and black "construction zone" signs and changeable message signs miles from major work zones to give motorists ample warning.

During the four-year construction phase of the Northwest Corridor Express Lanes, the work constructed express lanes to the west of the existing lanes along I-75 between I-285 and I-575. From that interchange, we added two express lanes along I-75 north to Hickory Grove Road and one express lane along I-575 to Sixes Road. As required by the Department, the developer utilized changeable message signs to provide advance notice of traffic impacts. In addition, variable message boards, operated by the Department's Traffic Management Center, notified motorists of construction ahead.

On-site project personnel communicated traffic situations to the TMC, which in turn updated the message boards with the latest information about traffic conditions. The advanced notification allowed the traveler to take alternate routes as necessary to avoid the work zone or to successfully navigate it.

Resource Center

Other helpful websites:

Federal Highway Administration

fhwa.dot.gov

The FHWA provides stewardship over the construction, maintenance and preservation of the nation's highways, bridges and tunnels. FHWA also conducts research and provides technical assistance to state and local agencies to improve safety, mobility and livability and to encourage innovation.

U.S. Department of Transportation

transportation.gov

The U.S. DOT serves the nation by ensuring a fast, safe, efficient, accessible and convenient transportation system that meets vital national interests and enhances quality of life.

International Bridge, Tunnel and Turnpike Association

ibtta.org

IBTTA is the worldwide association for the owners and operators of toll facilities and the businesses that serve them.

American Association of State Highway and Transportation Officials

transportation.org

AASHTO advocates for transportation-related policies and provides technical services to support states in their efforts to efficiently and safely move people and goods.

American Road and Transportation Builders

artba.org

ARTBA grows and protects transportation infrastructure investment to meet the public and business demand for safe and efficient travel.

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