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Looked Good on Paper — But Blockchain Technology Is Revolutionizing Data Management, Security

TEXAS TRANSPORTATION

VOL. 57 | NO. 4 | 2021

Researcher

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TEXAS TRANSPORTATION Researcher

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ON THE COVER: Using Big Data to optimize the global freight network — from improved trip planning to congestion mitigation to safety enhancement — can help create a more reliable supply chain that’s robust, resilient and responsive during the best (and worst) of times.



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Freight by the Numbers

EVERYTHING'S BIGGER IN TEXAS



3.3B
Total freight tons
transported*



\$3T
Total worth of
freight shipped*



313,000
Roadway
centerline miles*



600B
Truck trips
annually



~39.6B
Data points
sorted annually
via algorithm
to assess freight
fluidity and better
understand truck
parking



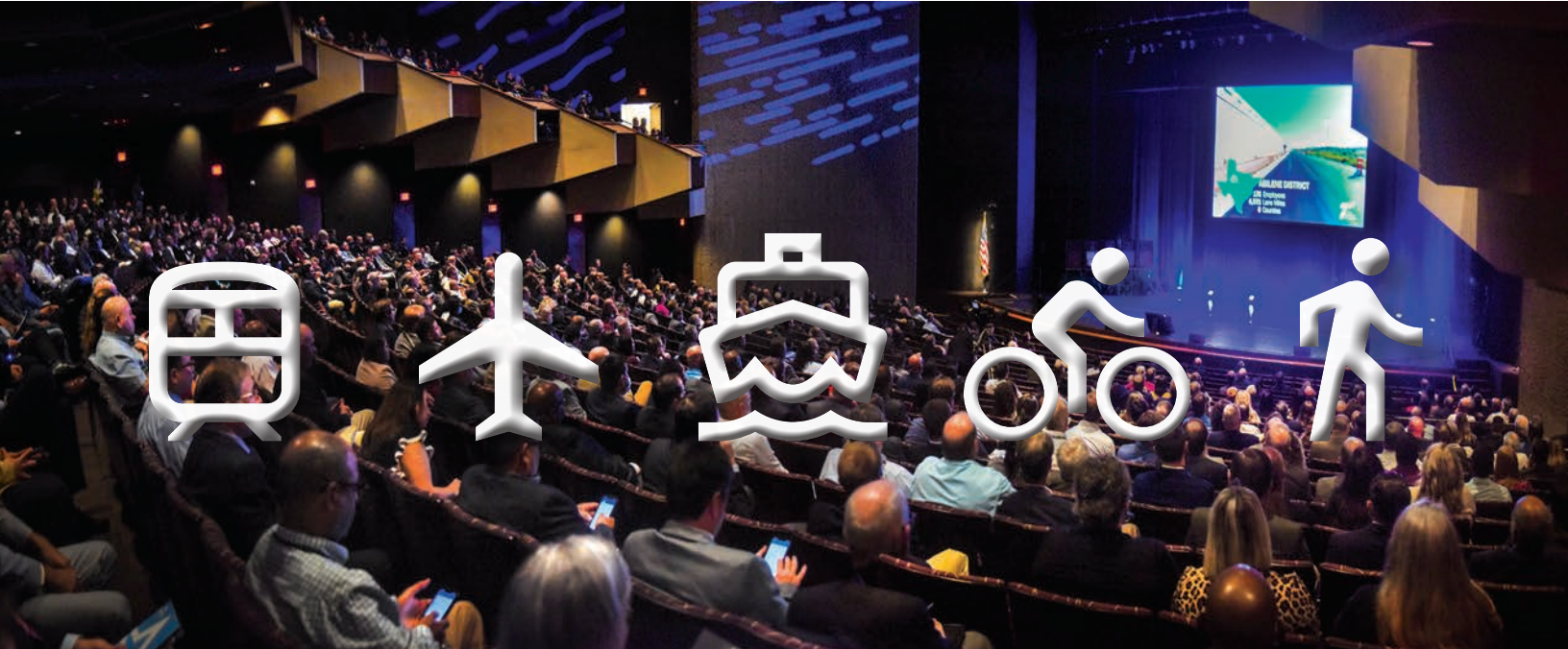
*The Economic Role of Freight in Texas – Executive Summary published by the Texas Department of Transportation (April 2021).



**TRANSPORTATION
SHORT COURSE**
NINETY FIFTH ANNUAL

Delivering Excellence

95th Annual Transportation Short Course Highlights Research Excellence, Need for Continued Diligence



Short Course attendees participated in the opening session and workshops during the three-day event.

“As we look at the many transportation challenges and opportunities before us, it’s clear that the need for innovation is as strong as ever. And we expect you to have high expectations of us in this endeavor. To everyone at TxDOT, we promise to continue our commitment to helping you achieve your mission to advance a safe, efficient and resilient transportation system for Texas and to share our collective expertise with the world.”

*Greg Winfree
TTI Agency Director*

The Texas A&M Transportation Institute (TTI) hosted the first-ever hybrid Transportation Short Course Oct. 11–13 both virtually and on the Texas A&M University campus. This year’s event marked 95 years of commitment by TTI and the Texas Department of Transportation (TxDOT) to present the latest research innovations from the department’s research program to practitioners around the Lone Star State and beyond, thanks to the online option. This year’s event hosted 1,538 in-person and 1,878 virtual attendees.

“It’s the state universities’ mission to help TxDOT implement the next generation of transportation innovations,” said TTI Agency Director Greg Winfree during the opening session. “Collectively, we’re TxDOT’s state transportation solutions providers ... [which] provided the impetus for the first Highway Short Course — as it was called back then — hosted at Texas A&M College in 1926.”

With that university mission toward enhancing workforce development as background, Winfree highlighted an upcoming online Master of Engineering degree in engineering for transportation professionals that Texas A&M’s College of Engineering, in partnership with TTI, will offer beginning in the fall 2022 semester. The two-year program is designed

November 7, 2000 was the last deathless day on Texas roadways.

Help us end the streak of daily deaths, Texas!

www.EndTheStreakTX.org

During his discussion of his five priority areas for the department, Williams cited an increase in traffic-related fatalities and injuries over the past year and reiterated TxDOT's #EndTheStreakTX campaign, which seeks to end traffic deaths in Texas by 2050. Getting there will rely not only on changing driver behavior but also on TxDOT employee dedication to doing the best job possible for Texans. Williams seemed to have no worry on the second score.

specifically for transportation professionals currently in management or who desire to achieve a management position and provides the background and skills to become better managers or launch their management careers.

Drilling down on the topic of leadership, Texas Transportation Commissioner Alvin New gave the keynote address and included details from his own life story as inspiration for TxDOT employees. Citing the modest means of his early childhood, New encouraged TxDOT employees to focus on serving those Texans who need them most and encouraged them to help others by being there for one another within and outside the department.

"The best thing you learn over time is interdependence. ... I finally started understanding — if I want to be effective at senior leadership, I need someone who can do that or this better than me, who I believe in and trust," New said. "You need this team of people to make things happen. And you can't jump to the end without going through the stages."

Marc Williams, TxDOT's new executive director, addressed attendees at the opening session. Williams praised TTI and TxDOT for winning a 2021 National Roadway Safety Award for the Safer by Design spreadsheet tool sponsored by the department and developed by TTI. The tool helps roadway designers assess the pros and cons of adding specific safety interventions to roadways to help them create the safest roadway possible before it's ever built. During his discussion of his five priority areas for the department, Williams cited an increase in traffic-related fatalities and injuries over the past year and reiterated TxDOT's #EndTheStreakTX campaign, which seeks to end traffic deaths in Texas by 2050. Getting there will rely not only on changing driver behavior but also on TxDOT employee dedication to doing the best job possible for Texans. Williams seemed to have no worry on the second score.

"During these [district] trips, I've enjoyed the opportunity to speak with — and, more importantly, listen to — the women and men serving in our districts," Williams said, referencing his commitment to visiting TxDOT districts since becoming



TxDOT Chief Engineer Bill Hale delivers remarks during the opening session.

executive director June 1. "The dedication and commitment of these employees at TxDOT are tremendous."

After the general session, attendees had their choice of breakout sessions to attend related to alternative delivery programs, bridges, construction, environment, maintenance and pavement management, materials, traffic operations, consultant management, design, hydraulics, planning, project management, and right of way. Learning from one another is a key part of Transportation Short Course.

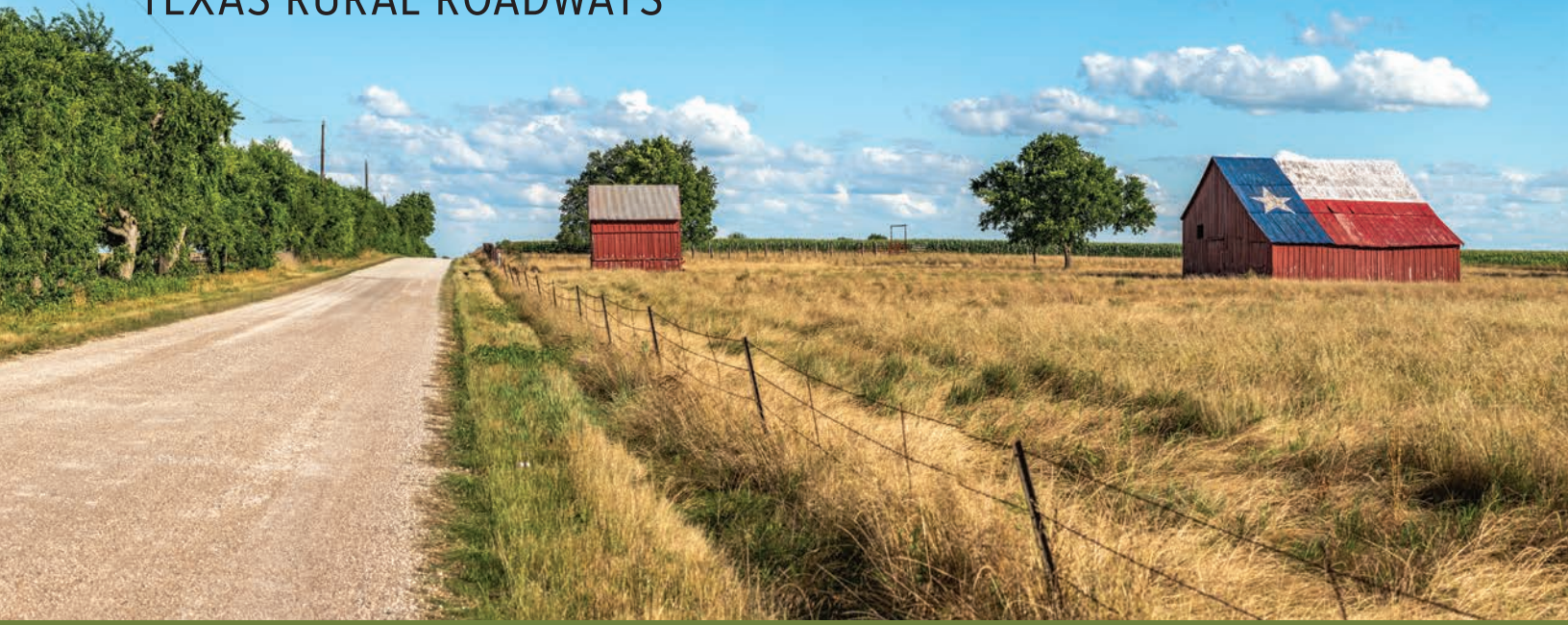
"As we look at the many transportation challenges and opportunities before us, it's clear that the need for innovation is as strong as ever. And we expect you to have high expectations of us in this endeavor," acknowledged Winfree. "To everyone at TxDOT, we promise to continue our commitment to helping you achieve your mission to advance a safe, efficient and resilient transportation system for Texas and to share our collective expertise with the world." ■



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TTI, TxDOT Win National Safety Award

“SAFER BY DESIGN” TOOL AIMS TO SAVE LIVES ON TEXAS RURAL ROADWAYS



The Roadway Safety Foundation honored the Texas A&M Transportation Institute (TTI) and the Texas Department of Transportation (TxDOT) with a 2021 National Roadway Safety Award Oct. 6. The foundation lauded the TxDOT-sponsored, TTI-developed “Safer by Design” tool for use by roadway designers to assess the safety characteristics of rural highway design.

Nearly 4,000 people died on Texas roadways in 2020, more than in any year since 2003. Texas roadway crash fatalities rose 7.5 percent over 2019, despite a 9.8 percent decrease in miles traveled during the pandemic. Fatalities on rural non-interstate roadways occur at twice the rate of other road types in the Lone Star State.

“Last year’s jump in fatalities was alarming, but innovations like the Safer by Design tool will save lives by helping roadway designers better evaluate the safety outcomes of a wide range of design elements,” notes Greg Cohen, Roadway Safety Foundation executive director.

Transportation engineers traditionally design roadways using established standards that focus on elements such as how sharp a curve should be for a given speed. Data gathered over time help engineers determine the actual safety performance of the roadway and whether improvements are needed.

“That approach has resulted in improved levels of safety, but it’s inherently reactive,” says TTI Senior Research Engineer Robert

Wunderlich, director of the Institute’s Center for Transportation Safety. “This simple and straightforward spreadsheet tool incorporates sophisticated analysis techniques in a way that allows designers to model how changes in design affect safety. It’s a proactive approach designers can use at the planning stage to optimize roadway safety from the get-go.”

Using the Microsoft® Excel®-based tool, engineers can compare two design options at a time. The tool assigns a score between 1 and 100 for each safety option based on safety performance. The tool also compares alternative designs to one another, to the standard design for the proposed roadway, and to a conceptual optimal design for that roadway segment. Engineers can use this information to make better design decisions when prioritizing safety options before construction.

TxDOT sponsored development of the tool as part of its continuing efforts to improve roadway safety. [TxDOT’s #EndTheStreakTX campaign](#) aims to end the 20-year streak of daily traffic fatalities on Texas roadways, part of its larger



TTI's Robert Wunderlich, Raul Avelar, and Greg Winfree hold the 2021 National Roadway Safety Award during the virtual awards ceremony hosted by the Roadway Safety Foundation.

goal of achieving zero roadway deaths by 2050 and cutting those fatalities in half by 2035.

“Safety is top of mind for everything we do at TxDOT,” says TxDOT Executive Director Marc Williams. “I am proud of the work we have accomplished on this and the continued collaboration with TTI to develop tools and technologies that will help us combat the growing number of traffic fatalities that we have seen across both Texas and the nation.”

TxDOT now requires use of the tool for all non-interstate rural projects, ranging from routine maintenance to complete reconstruction projects. While initially focusing on rural roads, the department plans to incorporate similar Safer by Design practices for all Texas roadways.

“This tool is an excellent example of how TTI and TxDOT have worked together for more than 70 years to improve transportation safety for Texans,” says Greg Winfree, TTI agency director. “We recognize that rural traffic safety is an issue in all 50 states, with rural roads being a major contributor to vehicle fatalities. This tool can help save lives, not only in the Lone Star State but nationwide.”

Wunderlich and Winfree were joined for the award presentation by TTI Research Scientist Raul Avelar, the project’s principal investigator, and TTI Senior Research Engineer Karen Dixon, head of TTI’s Traffic Operations and Roadway Safety Division. TxDOT personnel were also present to represent the department.

“Safety is top of mind for everything we do at TxDOT. I am proud of the work we have accomplished on this and the continued collaboration with TTI to develop tools and technologies that will help us combat the growing number of traffic fatalities that we have seen across both Texas and the nation.”

Marc Williams
TxDOT Executive Director

“All of us know friends, family, acquaintances, loved ones lost in traffic crashes in the United States. ... But we know that it doesn’t have to be this way,” U.S. Secretary of Transportation Pete Buttigieg told recipients during the ceremony. “From cutting-edge video analytics in Bellevue, Washington ... to an innovative new safety scoring tool from [TxDOT and TTI] that’s making rural roads safer, these award recipients serve as models for other states and cities to emulate.” ■



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BIG DATA

Saves DOTs Time, Resources for Truck Parking Analysis



Helping truckers travel smarter can contribute to improved safety and faster, more reliable deliveries.

Truck drivers cover hundreds of miles a day carrying goods from distribution centers to store shelves. The Federal Motor Carrier Safety Administration requires truckers to take regular breaks and stop driving altogether once they pass a certain time behind the wheel. That means they must park their trucks and rest somewhere, and that can be a challenge for state departments of transportation (DOTs) charged with keeping the supply chain moving. Knowing what parking is available and where is key to meeting this challenge. So, how can Big Data help?

The Texas A&M Transportation Institute (TTI) used INRIX data to enhance truck parking analytics to support a project for the Texas Department of Transportation and the Federal Highway Administration to develop best practices in freight planning including truck parking. The research team studied six locations: Barbour's Cut (Houston, TX), Cedar Point (Houston, TX, area), Alliance (Dallas, TX), H-E-B Warehouse and Distribution (San Antonio, TX), Agribusiness Facility (Salisbury, MD) and Rural Crossroad

Industrial cluster (Hagerstown, MD). The goal was to understand how traffic data can facilitate a better understanding of truck parking demand and inform decisions for DOTs. Often with limited staffing and resources, DOTs have to identify and visualize problem areas and develop site-specific opportunities. Using Big Data in easy-to-use applications frees DOT employees to spend time on the larger picture.

“At TTI, we focus on applied resources that help to simplify Big Data and tell

the stories DOT staff need to communicate to decision makers and the public,” says TTI Research Scientist Nicole Katsikides. “Truck parking is a multifaceted challenge. Using Big Data as we have in Maryland and Texas, we can quickly, efficiently and accurately capture demand and identify options for solutions.”

Visualization is key for multiple audiences to fully grasp DOT staff's stories. Converting data to a visual medium allows for a comparison of multiple data types, from parking and land-use data to safety and congestion data. Cross-comparing these different data types makes it easier to understand issues created by a lack of parking and highlights how valuable partnerships are between local governments and businesses investing in finding and implementing solutions.



Analyzing data points for where and when trucks park can help DOTs better manage their freight networks, ensuring supply chains remain intact.

TTI is currently working on a truck parking visualization tool for DOT employees to use to evaluate and monitor truck parking. For the current version of the analytics, the TTI team looked at 2019 INRIX trip data reflecting anonymized commercial vehicle trips with route details and waypoints. Using this type of Big Data, the researchers can:

- see where a truck trip originated, where the truck stops, and where it's headed to;
- determine how fast the truck traveled and how long the trip took; and
- identify what bottlenecks occurred along the way.

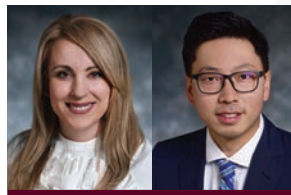
TTI is also addressing special parking factors, such as border-crossing parking demand and truck parking behavior during emergencies (e.g., hurricanes).

“Big Data offers a great deal of opportunity, but at first it can be daunting because of the

volume and complexity of the data itself,” notes Xiaoqiang “Jack” Kong, TTI graduate research assistant. “My colleagues and I have developed methods of using these data to help DOT staff, decision makers and stakeholders address transportation problems.”

In the context of truck parking, Kong and his colleagues take waypoints and non-moving truck trips and layer these data in with other data types to provide robust, user-friendly information. This process provides the opportunity for routine analysis of a truck parking problem. Employing this method that relies on Big Data instead of people performing manual counts can be more efficient, cost-effective and accurate — and safer.

Using INRIX data, TTI researchers built comprehensive analytics to help DOTs identify insights that can be invaluable to planning, policy and operations decision-making. Transportation agencies can use TTI’s methods to better understand where bottlenecks occur along freight corridors to, for example, redirect truck drivers to less-congested roadways, making their travel time more reliable and improving safety, not to mention boosting the bottom line. Based on this project, TTI has conducted several additional truck parking Big Data analytical projects in both Texas and Maryland, and interest in TTI’s work is now expanding into other states. In early 2022, Texas and Maryland will implement TTI’s methodology to routinely monitor truck parking and engage stakeholders in identifying much-needed solutions. ■



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“Big Data offers a great deal of opportunity, but at first it can be daunting because of the volume and complexity of the data itself. My colleagues and I have developed methods of using these data to help DOT staff, decision makers and stakeholders address transportation problems.”

*Xiaoqiang “Jack” Kong
TTI Graduate Research Assistant*

TTI Develops Guidebook for Implementing Freight Fluidity in Texas



The efficient movement of goods is vital to the Texas economy, whatever the mode of transportation

— via airports, highways, railways or waterways. Any disruption in the supply chain that prevents goods from moving efficiently can add not only to the costs of producing and shipping goods, but also to the variability and pricing of goods for consumers.

The Texas Department of Transportation recently sponsored the development of the guidebook *Implementing Freight Fluidity for Texas and Its Regions* by the Texas A&M Transportation Institute (TTI). The guidebook is structured to help transportation decision makers understand what freight fluidity is and provides methods for analysis that help illustrate the value of freight fluidity, including

- being aware of goods moving through a region,
- understanding current economic conditions and supply chain opportunities,
- using economic/supply chain intelligence to identify key trip routes for freight, and
- assessing freight mobility and bottlenecks along these trip routes.

“The guidebook provides a central source of information for transportation professionals eager to understand and apply

freight fluidity,” says TTI Senior Research Engineer Bill Eisele, one of the guidebook’s lead authors. “With insights from the guidebook, integrating freight fluidity into freight transportation planning processes can support investment and operational decisions.”

To help improve the reliability and efficiency of its supply chains, Transport Canada — the government agency responsible for Canada’s transportation policies and programs — turned to TTI over a decade ago to better understand the reliability and fluidity of its cross-country freight supply chain. The term *freight fluidity* describes a new way of measuring the various freight components of the overall transportation system. Simply put, freight fluidity measures trip performance to determine how efficiently goods are moving in a region. It involves answering questions like: What are the goods? How do they get from point A to point B? What’s the route?



The guidebook uses the concept of freight fluidity to provide users with resources and simple steps for integration into existing transportation efforts to ensure freight is more effectively considered in planning, policy, project development and operations. The authors provide a matrix to help determine how best to apply freight fluidity based on each user's role. The matrix can be followed by either finding the question you need to answer or identifying your role. For example, if you need to know where freight bottlenecks are, the matrix will point you to those sections of the guidebook. If you're not sure what questions you need answered related to freight but can identify your role within a transportation agency, you can find your role and then the relevant sections in the guidebook.

“TTI has had the unique opportunity to share in the early development of the freight fluidity concept and apply it across a number of geographies — corridor, state, regional, national and even international.”

Bill Eisele
TTI Senior Research Engineer

“When states consider freight fluidity, they can prioritize investments that best address and resolve bottlenecks that impact their economy,” says TTI Research Scientist Nicole Katsikides, a co-author on the guidebook. “Without the fluidity lens, states may be missing opportunities that would help sustain and grow businesses and jobs in their region.”

Katsikides notes that by using fluidity in assessments of how freight moves through a region, states can improve business efficiency, making for a good economic climate and lower cost of living. “Having the trip lens of fluidity helps states to know the key corridors supporting industry in their state. They can address congestion as well as understand safety,

Freight Fluidity Beyond Texas

The use of freight fluidity has expanded nationally and internationally over the past decade. In addition to applying the concept for moving goods at the U.S.-Mexico border, TTI has played a pivotal role in demonstrating and implementing the freight fluidity framework in Maryland and Colorado, using key activity centers and corridors with high truck volumes. Researchers have also provided technical assistance for the development of the Federal Highway Administration's National Freight Fluidity Monitoring Program Implementation, and the Institute has developed a freight fluidity performance management framework for domestic ports for the U.S. Army Corps of Engineers with an application in Mobile, AL.

environmental and asset issues that can challenge efficient goods movement,” she says.

As the application of freight fluidity becomes more universal, analysis should continue to advance toward working with freight stakeholders (e.g., business, shippers and carriers) to obtain multimodal mobility data and enhance freight fluidity analysis. In this way, the use of Big Data underlying freight movement analysis can provide a more complete picture to better inform all stakeholders in the process.

“TTI has had the unique opportunity to share in the early development of the freight fluidity concept and apply it across a number of geographies — corridor, state, regional, national and even international,” Eisele says. “These experiences are captured in the guidebook with a vision of ubiquitous freight fluidity information across global supply chains.” ■



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Shipping Stranglehold

PANDEMIC HAMPERED BUSINESS OPERATIONS
AND SUPPLY CHAINS IN TEXAS



The COVID-19 pandemic rattled industries and crippled supply chains worldwide. The results were also evident in the Lone Star State, as research by the Texas A&M Transportation Institute (TTI) illustrates.

Institute experts conducted research studying the impacts of COVID-19 at the Texas–Mexico border and found that the effects of the viral outbreak were felt almost immediately.

“The public health emergency that was declared in March 2020 quickly became a supply chain emergency,” says TTI Research Scientist Juan Villa, who conducted the study with TTI colleagues Jolanda Prozzi, senior research scientist, and Chris Simek, associate research scientist. Other Institute personnel contributing to the study included Associate Transportation Researcher Jose Rivera,

“The public health emergency that was declared in March 2020 quickly became a supply chain emergency.”

Juan Villa
TTI Research Scientist

Research Engineering Associate Daniel Escoto and Research Specialist Carlos Silva.

“A variety of industry closures in Mexico caused major disruptions in the flow of commodities across the border into the United States,” Villa says. Automotive, defense/aerospace, electronics, personal care product and semiconductor industries were all heavily impacted, the researchers note.

After years of steady growth, imports by truck dropped to almost zero in spring 2020 at the El Paso, Hidalgo, and Laredo ports of entry before beginning to rebound in the summer. Owing significantly to the decreased density of cross-border traffic, wait times for trucks decreased substantially compared to 2019 before also rebounding in the summer. Wait times for privately owned vehicles dropped as well during quarantine, due largely to restrictions imposed on nonessential travel.



Researchers also studied the health emergency's effects by examining the personal experience of those who operate commercial businesses in the state. In August 2020, Prozzi and Simek surveyed more than 300 establishments representing 11 industry sectors to assess how freight transportation and supply chains were affected in the Dallas and Houston areas. Their findings show that slightly more than a third of the businesses reduced their operating capacity during the pandemic, and 8 percent of those businesses closed temporarily. Three-fourths of the respondents reported capacity reduction of at least 25 percent, and almost half reported reductions of 50 percent or more. Other findings showed that of the businesses polled in the survey:

- 65 percent that reduced capacity by 50 percent or more were in the manufacturing, wholesale trade, or health care and social assistance sectors.
- 62 percent reported decreased shipping, while 21 percent saw an increase; 29 percent had shipping schedule changes, while 16 percent experienced no such changes.
- 56 percent reported decreases in shipments received, while 11 percent saw increases; 28 percent reported changes in their receiving schedule, while schedules for 15 percent were unchanged.
- Most (53 percent) of the businesses that experienced reduced outgoing shipments by half or more were in the wholesale trade industry. Most (56 percent) of those that saw reduced incoming shipments were in the manufacturing and retail trade sector.

“The data showed that Texas establishments were not immune to the global pandemic’s effects since three of every four businesses reported impacts such as reduced capacity, staffing levels and/or temporary closures.”

Chris Simek
TTI Associate Research Scientist

“The data shows that Texas establishments were not immune to the global pandemic’s effects since three of every four businesses reported impacts such as reduced capacity, decreased staffing levels and/or temporary closures,” Simek says. “Consequences from the health crisis extended to the movement of goods as well.”

Ultimately, some two-thirds of the establishments saw reduced revenue in the first half of the year as a result of the pandemic.

“COVID-19 has impacted many areas along the border, and many things have changed,” Prozzi says. “Some of those — like enhanced sanitation measures and supply chain disruptions — are expected to remain in place for some time.” ■



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Commercial cargo ships in the Port of Veracruz in Mexico. Editorial credit: CassielMx/Shutterstock.com

Looked Good on Paper — But Blockchain Technology Is Revolutionizing Data Management, Security

As part of a classroom assignment at Harvard Business School in 1978, Dan Bricklin created the prototype for spreadsheet software. Not only did it make paper-based account ledgers with handwritten figures obsolete, but Steve Jobs credited Bricklin’s invention — dubbed VisiCalc (short for visible calculator) — with the success of the Apple II, the personal computer it shipped with. All because Bricklin excelled at homework. Now, some 40-odd years later, imagine trying to conduct business as efficiently without automated spreadsheets.

While money managers no longer use written ledgers, freight traveling the global supply chain still often requires paper documentation. Border agents, for example, demand truck drivers produce a printed manifest of their cargo.

“There’s a better way,” says TTI Research Scientist Juan Villa. “Digitizing data associated with products and processes can automate information exchange and minimize the need for human involvement. That increases efficiencies in the supply chain, and that helps everyone, from manufacturer to consumer.”

Villa is talking about blockchain technology. *Blockchain* refers to housing data in secure blocks and making it accessible through a chain of secured databases for eyes-only viewing by those who need to see it. Manufacturers, shippers, warehouse managers, customs agents, store managers and even consumers need information about where, when and how a product will make it to store shelves. Not *all* of them, however, need access to *all* the data. A shipper, for example, might want their costing structure kept private, away from the competition. Strong security measures also fence off data from potential bad actors, who could target dangerous cargo (e.g., hazardous materials) for use in acts of terrorism.



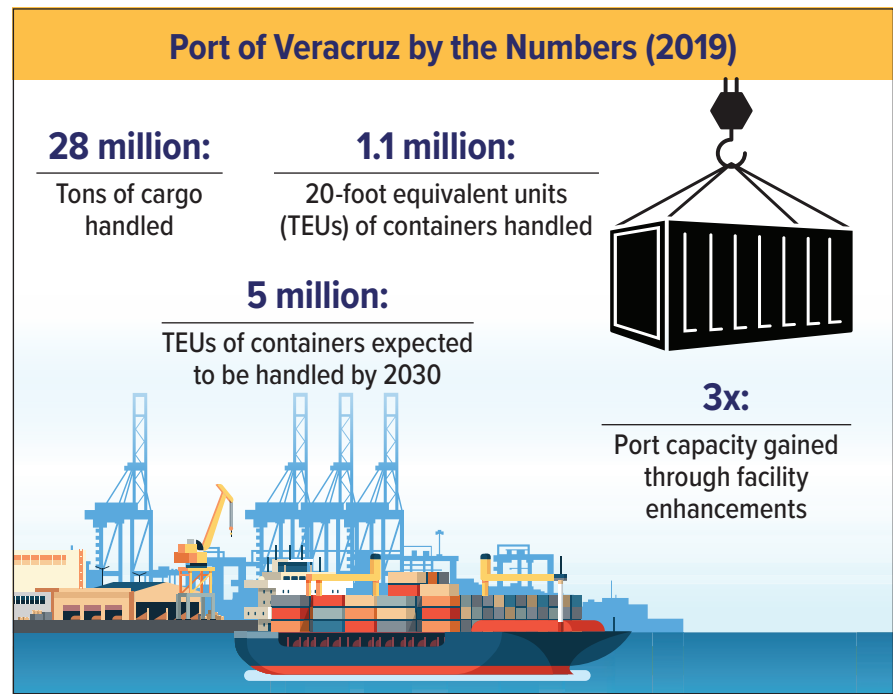
“That’s the security part,” Villa says, “but blockchain is also about automation. Currently, passing a shipping container through inspection at a port can be onerous.”

As part of its ongoing research into freight logistics and supply-chain optimization, TTI recently completed a project with the Port of Veracruz, the third busiest port in Mexico. By 2030, port authorities expect to more than quadruple the volume of freight passing through. To meet that demand, operate efficiently and attract shippers to use the port, Port of Veracruz stakeholders engaged TTI to help them develop a port community system (PCS) using blockchain technology. Phase I of the project focused on modeling and optimizing container exports.

Traditionally, when a container is flagged for inspection, the customs agency notifies a customs broker of the requirement. The broker calls the terminal operator, who moves the flagged container to a specific location. Assuming the container passes inspection, the customs agent notes the approval on paper, releasing the container for shipping. Depending on how long the process takes, the ship the container was destined for might, quite literally, have sailed already. The container then sits, maybe for weeks, until another vessel comes along headed to its destination.

With blockchain, the customs agent uses a smartphone app tied into the PCS, and many of the in-person, physical-movement stages of the process are automated. When the inspection notice is first entered into the PCS, the system sends the request to all parties involved in the process, expediting the procedure without compromising efficacy. Once passed, the container is craned aboard ship and off to its next port of call with minimal delay.

With the inspection process, algorithms use digitized data to trigger the next steps in the freight management process to optimize information exchange. In another example of how blockchain can



“The search for productivity, efficiency and social benefits is a collaborative undertaking in the freight sector. The blockchain project in Veracruz is the demonstration of how multiple parties — such as the port authority, the port community and research centers like TTI — can collaborate to promote the technological, economic and social development of a community.”

*Jorge Lecona Murillo
Head of Innovation for Hutchison Ports Mexico*

expedite processes, smart contracts can replace human-based paper inventories and invoices, and be submitted via data entry to automate payments for truckers once cargo arrives safely at its destination.

“The search for productivity, efficiency and social benefits is a collaborative undertaking in the freight sector,” says Jorge Lecona Murillo, head of innovation for Hutchison Ports Mexico. “The blockchain project in Veracruz is the demonstration of how multiple parties — such as the port authority, the port community and research centers like TTI — can collaborate to promote the technological, economic and social development of a community.”

Reduced costs, minimal delays, optimized efficiency, expedited freight flow — all are readily achievable thanks

to blockchain technology. However, implementation of blockchain is just the beginning, Villa says. As with spreadsheet technology, its widespread implementation can transform the way data are managed to track freight worldwide.

“There is an imperative behind embracing blockchain sooner rather than later,” Villa says. “To remain competitive against economic powerhouses like China and India, the United States must use every tool in its toolbox. And blockchain is one of the most powerful tools we have to lower production and distribution costs for industry and commodity costs for consumers.” ■



For more information, contact **Juan Villa** at (979) 317-2471 or j-villa@tti.tamu.edu.

TTI Hosts First In-Person Advisory Council Meeting Since 2019



The TTI Advisory Council posed for a group picture in Westlake, Texas, at The Barn at Circle T Ranch.

For the first time since 2019, the Texas A&M Transportation Institute (TTI) Advisory Council held its annual meeting in person Nov. 1–2 at the Barn at Circle T Ranch in Westlake, Texas.

TTI Agency Director Greg Winfree and council chair and former Texas State Sen. David Cain welcomed the approximately 50 individuals attending, including council members, friends of the council, and TTI staff. Following introduction of the newest members, guest speaker Marc Williams, executive director of the Texas Department of Transportation (TxDOT), praised the value of the TTI-TxDOT partnership, which has lasted for more than 70 years.



TxDOT Executive Director Marc Williams provided an update on TxDOT's strategic partnership with TTI.

"It's very exciting to see the integration of the research TTI does with TxDOT throughout the entire state of Texas," Williams said. "From work on our ports and waterways system to collaborating on energy projects in the Permian Basin, the reach of TxDOT's partnership with TTI is tremendously vital and far-reaching."

Winfree opened day two with an update on the agency and its recent research initiatives, including the highly anticipated *2021 Urban Mobility Report*. "TTI's biannual *Urban Mobility Report* is considered by many to be the most definitive study of traffic congestion in the country, documenting congestion costs, trends and mitigation measures in almost 500 urban areas," Winfree noted.

Winfree also reported that research expenditures were up slightly for the Institute, topping \$67.7 million for fiscal year 2021. He closed with an update on TTI's strategic partnerships, including the agency's newest initiative with the Texas A&M Engineering Experiment Station to assess and test vehicle electrification and its impact on the grid; the development of a two-year online master's degree program in engineering with the Texas A&M College of Engineering; and TTI's being named the official research partner in the AllianceTexas Mobility Innovation Zone.

TTI Assistant Director Joe Zietsman led a panel discussion comprised of external industry experts, and several interactive panel discussions followed on current transportation-related topics. Timely topics included the recent



Rice University's Ed Emmett (far left) led a panel discussion on supply chain disruptions and the role of the transportation system. Panelists included (left to right) Tiffany Melvin, North American Strategy for Competitiveness; Roger Guenther, Port Houston; and Russell Laughlin, Hillwood/AllianceTexas.

supply chain disruptions and the role of the transportation system, and electrified transportation and the Texas power grid. TTI Deputy Director Bill Stockton and Senior Research Engineer Ginger Goodin also led a collaborative exercise prompting discussions on potential future research opportunities, transportation issues facing the state, and how TTI can contribute to improving our transportation system. The meeting concluded with TTI Executive Associate Director Katie Turnbull leading a thought panel discussion on the future of transportation in Texas and across the nation. ■



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Kirk Watson Inducted into Texas Transportation Hall of Honor

Kirk P. Watson, a champion of transportation investment for Austin and the state of Texas for more than two decades, was inducted into the Texas Transportation Hall of Honor Nov. 4.

Texas A&M University System Chancellor John Sharp welcomed some 100 guests including numerous VIPs from the public and private sectors to the event. Throughout his decades-long career in public service as Texas senator, mayor of Austin, and chair of the Capital Area Metropolitan Planning Organization Policy Board, Watson championed numerous projects to improve transportation mobility, funding, air quality and safety to improve the state's economy and Texans' quality of life.

As mayor of Austin, Watson passed multiple transportation bonds, served as an advocate for public transportation, developed a new international airport, and encouraged environmental stewardship and transportation planning. His relationship-building skills as mayor were lauded, especially in convening representatives of Austin's minority communities to hear their perspectives on how best to build an equitable multimodal transportation system during an important city bond election to expand bus and rail lines. And Watson's work with the Central Texas Regional Mobility Authority was credited with creating more than 480 additional lane miles of roadway and 70 miles of bike lanes and pedestrian paths.



Speakers at the event included (left to right): Ray Wilkerson, former chair of the Central Texas Regional Mobility Authority; Ashton Cumberbatch Jr., special counsel at McGinnis Lochridge and former employee with the city of Austin; Deirdre Delisi, former chair of the Texas Transportation Commission; Watson; A&M System Chancellor John Sharp; and TTI Agency Director Greg Winfree.

“Even with these numerous and significant accomplishments, Kirk’s real strength lies in his dogged determination and special ability to engage stakeholders, define the issues, and arrive at consensus to deliver transportation solutions for the public,” said TTI Agency Director Greg Winfree.

Watson was deeply honored and very thankful for the recognition, pointing out his many years of working with TTI and emphasizing the Institute’s value. “As we face the transportation challenges of the future, we need organizations like TTI to guide us and assure we are innovating,” he said.

Watson is the 47th member of the Hall of Honor, established in 2000 by TTI to recognize select individuals who played pivotal roles in the advancement of transportation in Texas and the nation. The Hall of Honor is located at TTI’s Headquarters in Bryan, Texas. ■

TTI, Texas A&M Offer Online Master of Engineering Program for Transportation Professionals

Beginning fall 2022, Texas A&M University’s College of Engineering, in partnership with TTI, now offer an online Master of Engineering in engineering for transportation professionals. Designed specifically for transportation professionals currently in management or who desire to achieve a management position, the degree provides students with the background and skills to become better managers or launch their management careers.

Degree candidates are taught by faculty from Texas A&M’s Department of Multidisciplinary Engineering specifically selected from TTI’s subject matter experts in the curriculum topics. Courses in nontechnical topics relevant to managers and/or policy or decision makers in the transportation community form the core of the curriculum. The program also satisfies professional development requirements for registered professional engineers. The

program’s first-year courses include topics on leadership, organizational management, the economy and communication. Second-year core courses examine topics on selection and adoption of technology, sustainable transportation, policy, regulatory and legal issues, and innovative approaches to transportation finance. Two capstone courses in year two cover selecting and completing a transportation-related project.

“We’re offering a unique opportunity to current and future industry leaders to help them round out the technical side of their education so they can better grapple with today’s complex transportation world,” explains Kevin Womack, TTI senior research scientist and program manager. “I can’t think of anything else that opens more doors in the industry than a first-rate A&M engineering degree.” ■

TTI's Beverly Kuhn Co-leads STEM Workshop at 2021 AISES National Conference

With support from the Institute of Transportation Engineers (ITE) Arizona Section and Mountain District, TTI Senior Research Engineer Beverly Kuhn co-lead an activity during the Boeing Company's Sept. 22 STEM Day event as part of the 2021 American Indian Science and Engineering Society (AISES) National Conference at the Phoenix Convention Center.

The workshop topic was Circle Versus Square: Which Is Better? Roundabouts Versus All-Way Stop-Controlled Intersections. Kuhn's co-leader for the workshop was Kohinoor Kar, an Arizona State University faculty member and a transportation engineer manager at the Arizona Department of Transportation. Dozens of high school students from different parts of the country attended this workshop, many from Native American nations. The objective was to educate them on the difference between two types of intersections that road users often come across.

A dummy intersection was mocked up with edge lines, centerlines and crosswalks; stop, yield and directional arrow signs were placed as appropriate. Students were asked to evaluate the intersection in



High school students participate in an interactive activity where they walk through a dummy intersection marked out on the floor.

two different settings for safety and other factors after navigating them.

Acknowledgment: A version of this story originally appeared in the fall 2021 issue of *The Summit: ITE Mountain District Quarterly Magazine*. Used by permission of the author. ■

Fitzpatrick Co-authors NCHRP User Guide on Setting Posted Speed Limits



Fitzpatrick

TTI Senior Research Engineer Kay Fitzpatrick led the team of experts who wrote the recently published

NCHRP Research Report 966: Posted Speed Limit Setting Procedure and Tool: User Guide for the National Cooperative Highway Research Program (NCHRP). Several engineering factors are considered when determining a posted speed limit, including the 85th percentile speed, which is based on the driving behavior of most drivers. This percentile speed is believed to represent a speed that would minimize crashes. The report

provides the Speed Limit Setting Procedure (SLS-Procedure), which considers factors beyond the 85th percentile speed, including driver speed choice and safety associated with the roadway, to help engineers make informed decisions about the setting of speed limits. The report also provides instructions for using an automated version of the SLS-Procedure via the spreadsheet-based Speed Limit Setting Tool (SLS-Tool), where users input data for a roadway segment and obtain the suggested speed limit.

"The SLS-Procedure and accompanying SLS-Tool reflect current knowledge of relationships among roadway conditions, traffic, safety and operating speeds," says

Fitzpatrick. "The tool provides an easy-to-use, intuitive spreadsheet that produces a suggested speed limit reflecting existing conditions. The tool can also document the conditions for a speed-zone study."

The user guide is accompanied by *NCHRP Web-Only Document 291: Development of a Posted Speed Limit Setting Procedure and Tool*, which documents the research efforts of NCHRP Project 17-76. ■

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THE LAST STOP

with Greg Winfree, Agency Director

More Reliable, More Resilient

A SUPPLY CHAIN IS ONLY AS STRONG AS ITS WEAKEST (DATA) LINK



A backlog of container ships waits beyond the breakwater at sea to unload at the Port of Los Angeles and Long Beach.

We're in the middle of a global supply chain crisis. A shortage of supplies and workers, especially truck drivers, has combined with a post-pandemic surge in demand to create bottlenecks. Add to that the impact of COVID-19 mitigation strategies (some of which are still in force) on goods movement, particularly across national borders.

According to the Texas Department of Transportation (TxDOT), some 3.3 billion tons of freight representing \$3 trillion were transported in Texas in 2021. Moving those goods generated approximately 40 billion crowd-sourced data points along the way. What, where, when, how and how much are questions with answers found somewhere in the “data log” of every product moving along the global supply chain. This ocean of information — called Big Data — can help us better understand what happens to those products between points A and B and show us how those trips can be made more reliable and efficient.

Ever start your car in the morning and your smartphone shows you how long it'll take to get to work? An algorithm somewhere is analyzing current traffic patterns and calculating your

commute. That's Big Data at work. Applying that same kind of proactive analysis to freight — looking at how efficiently goods are moving in a region — is called *freight fluidity*.

While TTI didn't coin the term, we've done quite a bit of frontline work with the concept. In 2021, we produced a guidebook for TxDOT on how to implement the concept in Texas (see the article on page 10). We've also worked with other states, Transport Canada, the Federal Highway Administration and the U.S. Army Corps of Engineers to apply it. Now, I'd argue, it's time to implement freight fluidity on a global scale.

Leveraging Big Data through freight fluidity can boost efficiency, reduce shipping costs, improve trip reliability and lower consumer prices. But its

Leveraging Big Data through freight fluidity can boost efficiency, reduce shipping costs, improve trip reliability and lower consumer prices.

value is about more than economics. Extreme weather events occur more frequently these days, and times of crisis are when we most rely on the supply chain to distribute vital materials like water, food and medicine. Doing so requires a resilient transportation system — the reliability of which doesn't stop at the border — and there's currently no international effort to improve cross-border freight fluidity. We need that meeting of the minds to help ensure supply chains are as efficient, reliable and responsive as possible as demonstrated by our present supply-chain crisis. Progress begins by asking the simplest of questions, like “How can we do this better?” TTI, as always, stands ready to assist in finding the answers. ■

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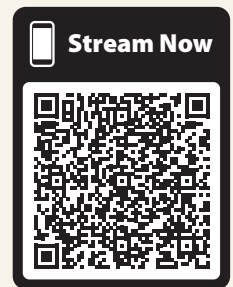
Prozzi



Villa

Strong as Their Weakest Link: What the pandemic taught us about supply chains.

Supply chains everywhere were strained to their limits long before the COVID-19 outbreak. The pandemic simply exposed weaknesses that were already there. TTI's Senior Research Scientist Jolanda Prozzi and Research Scientist Juan Villa share new understanding about the complexity and fragility of the systems we depend on to get our goods where they need to go.



Innovation U: In a transportation research rivalry, everyone is a winner.

Greg Winfree and Zac Doerzaph, leaders of America's two most prominent transportation research agencies, share their insights on the nation's mobility priorities, and what university-based research can do to support those priorities. (They talk a little about motorcycles and teleportation, too.)



Doerzaph



Winfree