



FY17-18 BIENNIAL REPORT

Center for International Intelligent
Transportation Research

El Paso, Texas



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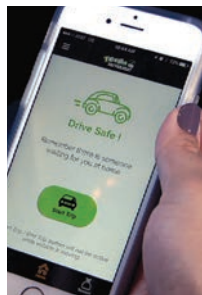
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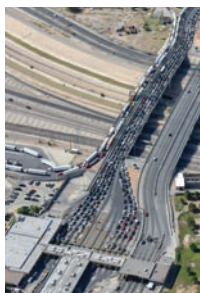
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A LETTER FROM THE DIRECTOR

Community Solutions, Home Grown

Research, by its nature, seeks solutions to finite problems. In 2017–2018, the Center for International Intelligent Transportation Research’s (CIITR’s) approach has sought to fit those “little picture solutions” into the bigger picture of the transportation system — whether local, state, national or international — because, at the end of the day, the world’s transportation system is interconnected.

Recently, center researchers developed the industry’s first border crossing-specific vehicle-counting technology that achieves high accuracy rates (nearing 99.5 percent). Using this technology, system stakeholders can optimize cross-border traffic so travelers and truckers spend less time waiting at land ports of entry, thereby reducing regional air pollution. Developing local solutions that can be applied in other, similar circumstances is always a strategic goal, and our expertise in cross-border traffic management was called upon to troubleshoot cross-border trade issues halfway across the world in Azerbaijan.

We also developed and deployed tools and processes to enable system stakeholders to better understand the interrelated nature of transportation, economics, and human behavior. For example, we supported the development of a smartphone app to incentivize smarter, safer driving behaviors among teenagers through our local Teens in the Driver Seat® program office. We also developed a dashboard for determining the economic impact of border-crossing operations. And we developed new visual tools to help local agencies secure increased funding from the Federal Highway Administration’s Highway Safety Improvement Program (HSIP) to reduce traffic fatalities and serious injuries on public roads.

Making the discrete cogs of the transportation system work more efficiently together is one way to make the larger transportation network operate more efficiently. In the case of local transit, El Paso’s city and county agencies have traditionally worked as separate entities, sometimes creating difficulty for residents who rely

on both to smoothly transition between the two systems. Several CIITR projects made recommendations for bridging this gap to not only improve access to needed services by transit riders, but also to encourage more folks to use transit, thereby reducing congestion.

CIITR’s mission:

- maintain and improve mobility in the face of growing traffic and shrinking resources,
- increase border-crossing efficiency while maintaining security, and
- improve air quality to advance public health.

As is evident in the transit example, how the discrete parts of our transportation system influence one another is becoming more and more important as the impacts on our local economies resonate across the international economy. An American mathematician, Edward Lorenz, is often misquoted when stating the central tenet of Chaos theory. The quote goes something like, “a butterfly flapping its wings in the Amazon can cause a hurricane halfway around the world.” What Lorenz actually said was, “If the flap of a butterfly’s wings can be instrumental in generating a tornado, it can equally well be instrumental in preventing a tornado.”

Since our founding by legislative appropriation in 2006, CIITR research has focused on finding specific solutions that have a larger impact — because solving even the smallest transportation problems can have a tremendous impact on the global network picture.

Rafael Aldrete, Ph.D.

Senior Research Scientist and
Director, Center for International
Intelligent Transportation Research



SUPPORT

El Paso Regional Support

CIITR is helping local stakeholders like the El Paso Metropolitan Planning Organization, the County of El Paso, the City of El Paso, and Sun Metro create a more reliable transportation system on both sides of the border as the economies of El Paso and its sister city in Mexico, Ciudad Juárez, grow more interdependent.

SAFETY AND MOBILITY

El Paso is growing, and with that growth comes a need for improved mobility and congestion mitigation. Construction alone isn't the answer. CIITR's regional research focuses on more efficiently using the system we have, combined with smarter planning for growth and building out the local transportation network in a way that prioritizes safety.

**Assisting El Paso with Its Mass Transit
Procurement Process**

**Incentivizing Safer Teen Driving Through
Smartphone Rewards**

**Ensuring Environmental Justice for Residents
When Building New Toll Roads**

**New Visual Tools Help Local Agencies Secure
Funding for Safety Projects**

Value Capture Expertise Applies Local Lessons Nationally

**Listening, Adapting to Local Governments'
TRZ Monitoring Needs**

Better Understanding Rural Residents' Transit Needs

Encouraging Rural Residents to Become Transit Riders

**Laying the Groundwork for a Mass Transit
Fare Equity Analysis**



Assisting El Paso with Its Mass Transit Procurement Process

TTI is helping the city of El Paso in its procurement process to select private companies to manage Sun Metro's fixed-route transit services (bus and streetcar) and to contract to operate Sun Metro's LIFT complementary paratransit services (meeting requirements of the Americans with Disabilities Act [ADA]). Sun Metro is El Paso's municipal transit department. Specifically, TTI has helped review different approaches to operating and managing transit services as well as provided technical assistance through the procurement process.

The Institute prepared a brief history of Sun Metro's management and operations and facilitated discussions with city officials regarding preferred approaches to provide transit. The city decided on different approaches for fixed-route transit and for LIFT paratransit and will seek proposals for key professional staff to manage bus and streetcar. The city will also ask for proposals to contract the operation of LIFT paratransit. Future

aspects of the project entail helping to define requirements for a new request for proposals (to be issued in Dec. 2018) and design pricing templates for 10-year agreements. In 2019, TTI will continue to provide technical support for the city's ongoing procurement process.

>> PI: Linda Cherrington

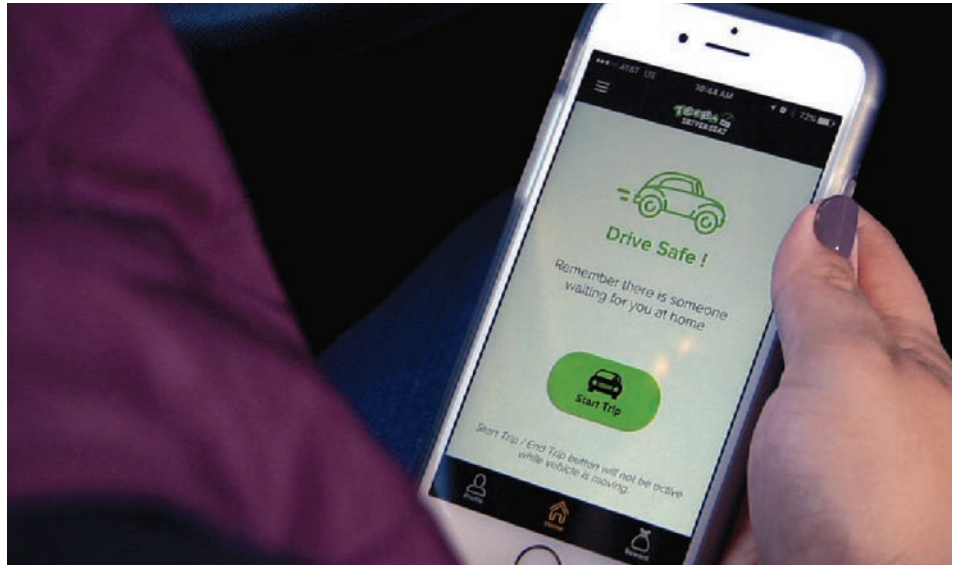
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Sponsor: *City of El Paso*

Incentivizing Safer Teen Driving Through Smartphone Rewards

The Teens in the Driver Seat® (TDS) program is a peer-to-peer safety program that educates teens about the top five dangers of teen driving – driving at night; speeding and street racing; distractions, such as cell phones and teen passengers; not wearing a seat belt; and alcohol/drug use. Thanks to funding from the Texas Department of Transportation and State Farm, program resources and technical support are available at no cost to schools in Texas. Schools in the El Paso area have been very involved historically with TDS, often winning top awards at the annual TDS Summit. U in the Driver Seat—a comparable program aimed at college students to reduce drinking and driving during spring break—enjoys similar support in the region through The University of Texas at El Paso and all five El Paso Community College campuses.

As part of its mission to promote safe driving among teens, TDS is developing an incentive-based teen driver smartphone app. The app uses a reward system that awards drivers points for miles driven without phone interaction. The points can be redeemed for rewards and used as a basis for competitions and achievement of safe driving levels. The TDS research team has proven that statistically significant reductions in distracted driving (at the 95 percent confidence level) occurred with incentives. TDS has given presentations on the app twice at both the Transportation Research Board and the annual Lifesavers National Conference on Highway Safety Priorities—the premier safety conference in the nation.



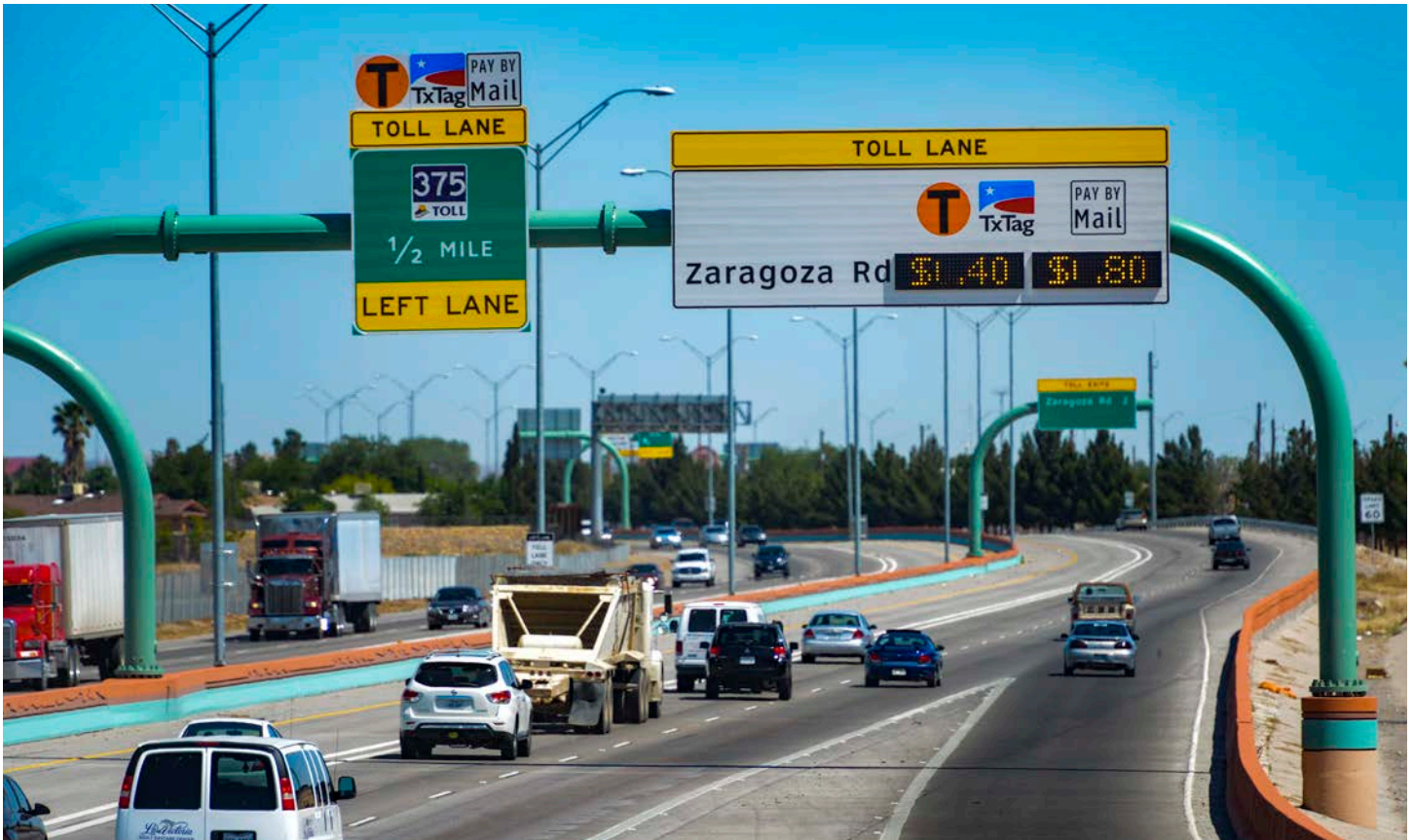
TOP FIVE DANGERS OF TEEN DRIVING

- 1 **driving at night**
- 2 **speeding and street racing**
- 3 **distractions, such as cell phones and teen passengers**
- 4 **alcohol/drug use**
- 5 **not wearing a seat belt**

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Sponsor: *Center for International
Intelligent Transportation Research*



Ensuring Environmental Justice for Residents When Building New Toll Roads

The City of El Paso and the surrounding towns need space for more toll roads to meet the transportation needs of the growing population. The El Paso Metropolitan Planning Organization runs a Title VI program—aimed at protecting populations who are sometimes discriminated against—specifically for transit programs and services within the county’s jurisdiction. Researchers analyzed potential environmental repercussions—such as an increase in noise or a decrease in air quality—of implementing transportation projects, especially building new toll roads, on economically challenged communities in the El Paso region. The goal was to address all concerns related to the transportation projects to ensure the best solution for everyone involved. Researchers used an innovative, multi-platform simulation modeling technique—turned multi-resolution modeling—to answer more difficult questions (e.g., how does congestive-responsive tolling influence driver behavior?) that cannot be answered with traditional modeling techniques.

The research team reviewed different aspects of environmental justice, including mobility, accessibility, community cohesion, economic cost, and environmental concerns. They considered

these factors in modeling scenarios for 2020 and 2040 traffic conditions related to new toll roads to determine optimal toll rates for the El Paso region. Most of the tolled roads had an optimal toll rate of \$0.12/mile. The research has value because it addresses several key issues related to equity such as the location of the proposed facility, disproportionality of projects based on capital recovery costs, distribution of funds to disadvantaged communities, options for alternative access (e.g., HOV 2+ free), public participation of impacted citizens, or the creation of toll accounts and the need for credit/debit cards.

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Sponsor: El Paso MPO



New Visual Tools Help Local Agencies Secure Funding for Safety Projects

Every year, the Federal Highway Administration's Highway Safety Improvement Program (HSIP) provides state agencies with funding for safety improvement projects aimed at reducing traffic fatalities and serious injuries on public roads. The funding level is based on a crash analysis of the district from the last three years. CIITR was asked by the Texas Department of Transportation's (TxDOT's) El Paso District for assistance in evaluating safety improvement projects that qualify for HSIP funding. The goal of the research was to test out graphic tools as an aid in selecting projects to propose to increase the funding rate for HSIP projects in the district.

The research team used Google Earth and QGIS software to visually analyze crash data by 1) type of crash and 2) HSIP project work code (i.e., types of safety improvement projects). The approach allowed them to clearly compare 2017 proposed projects with possible locations for future ones. TxDOT employed this methodology to submit 2018 HSIP funding project requests. The approach's success is evident in the increased number of HSIP projects submitted and, subsequently, the number

of projects securing HSIP funding. In 2018, CIITR recommended 166 projects for HSIP funding compared to 93 in 2017, a 56 percent increase in the number submitted. The HSIP funding for TxDOT's El Paso District was the most of any district in the state, increasing from \$8.1 million in 2017 to \$45.3 million in 2018, a more than 500 percent increase in funding.

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Sponsor: TxDOT El Paso District



Value Capture Expertise Applies Local Lessons Nationally

The Federal Highway Administration (FHWA) has implemented an initiative to increase the use of value capture (VC) techniques to help deliver highway projects. VC funds infrastructure improvements by recovering a portion of the increase in real property value generated by the improvements, mitigating transportation project funding challenges while providing benefits to property owners. Texas pioneered VC as a funding tool with the passing in 2007 of Senate Bill 1266 (SB 1266), which provided the legal framework for transportation reinvestment zones (TRZs), one example of the value capture funding mechanism.

In 2008, CIITR researchers helped El Paso implement one of the first TRZs in Texas to provide local matching funds for the city's \$1 billion 2008 Comprehensive Mobility Plan. CIITR researchers have subsequently assisted the Texas Department of Transportation (TxDOT) and local governments in implementing TRZs across

the state, as well as participated in broader VC research initiatives nationwide. Owing to this expertise, TTI Senior Research Scientist Rafael Aldrete was invited to participate in the FHWA's Every Day Counts 5 (EDC-5) innovation initiative. He served on the technical working group for the development of FHWA's Value Capture Implementation Manual, and was invited to deliver presentations covering TRZ success stories at two EDC-5 regional summits. More recently, Dr. Aldrete was engaged to provide support to the FHWA Value Capture Implementation Team, which provides technical assistance to state and local highway agencies nationally implementing VC funding mechanisms.

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Sponsor: USDOT Volpe Center (sub to DigitaliBiz)



Listening, Adapting to Local Governments' TRZ Monitoring Needs

Local governments monitor transportation reinvestment zones (TRZs) to keep track of trends and risks in each TRZ. The Texas Department of Transportation requested CIITR's assistance to develop the online TRZ Dashboard Toolkit to provide TRZ owners (e.g., municipal planning organizations, counties, and port authorities) with revenue estimation reports, updated property lists, and maps of the TRZ. Researchers created a TRZ Dashboard Toolkit Manual to train TRZ owners and central appraisal district (CAD) personnel on how to use the tools. The manual incorporates an El Paso TRZ as an example, explains how to set up the TRZ Dashboard Toolkit workspace, and provides step-by-step guidance on using each tool.

In February 2017, the research team conducted an online training course for staff members from El Paso, Horizon City, and Hidalgo County. After receiving feedback from the staff members, researchers learned that TRZ owners and CAD personnel lacked the expertise to upload data to the TRZ Dashboard Toolkit and could not afford the maintenance cost for doing so

going forward. The team developed a free offline toolkit that is more user-friendly. Using the offline tools, TRZ owners can monitor their TRZs using similar functions to the online TRZ Dashboard Toolkit. Listening to feedback from the TRZ stakeholders allowed the research team to tailor the project to fit the stakeholders' specific needs.

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Sponsor: *TxDOT Project Finance, Debt and Strategic Contracts Division*

Better Understanding Rural Residents' Transit Needs

Sun Metro and El Paso County (EPC) transit systems differed in fare prices, quality of service, and infrastructure. EPC staff requested a fare optimization model for Route 50, a rural transit route in El Paso County. To receive funding from the state of Texas, Route 50 must meet the required level of riders set by the Congestion Mitigation Air Quality (CMAQ) program. An increase in the fare from \$0 to \$2.00 resulted in a notable decrease in ridership for the route. Researchers conducted a study to understand the impact of fare level on transit ridership for Route 50.

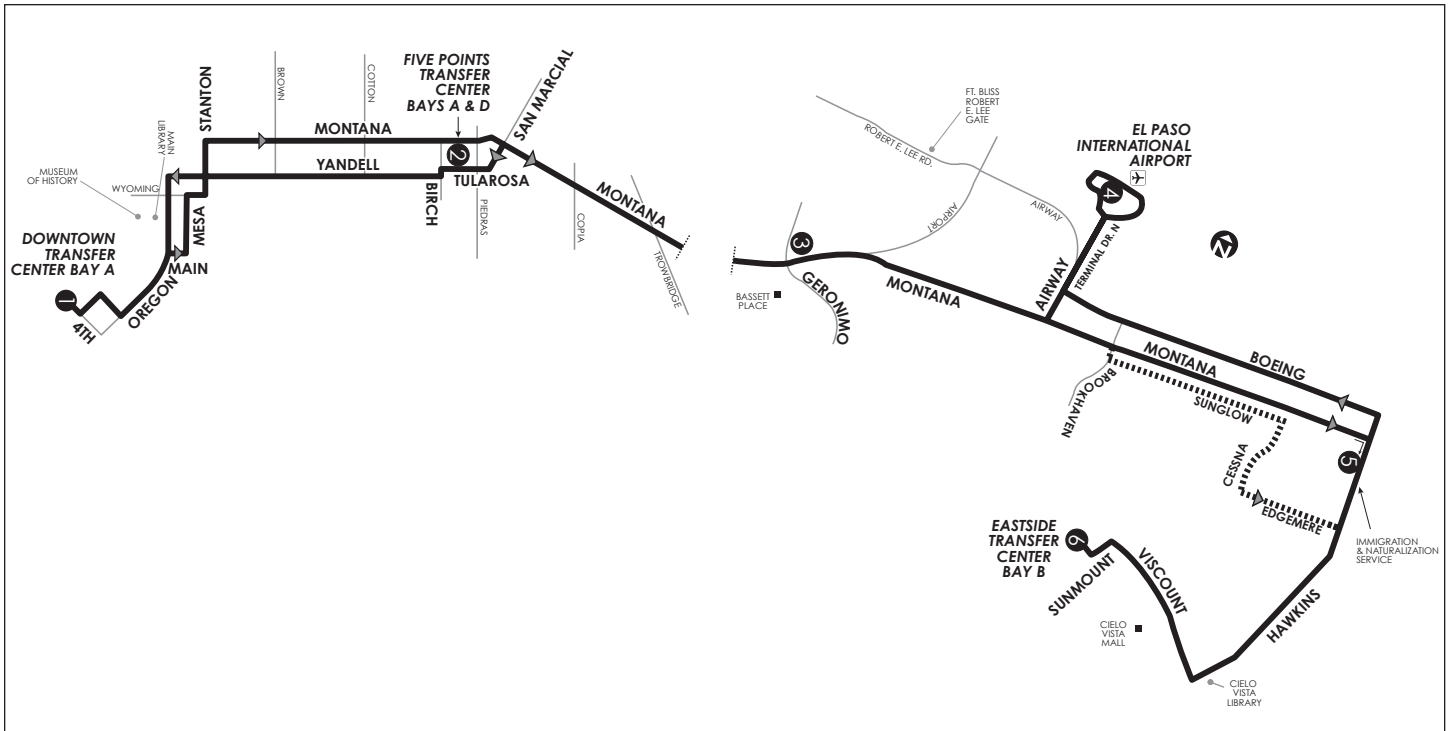
The research team completed a literature review to identify current fare optimization methodologies for transit routes. They then employed model testing and calibration strategies to develop a unique methodology tailored to Route 50's case. Researchers concluded that, based on the high poverty levels in the rural areas, many people may be unable to spend \$2.00 on a fixed-route transit service. The researchers recommended a fare of \$1.50 per trip. Reducing the fare could entice existing riders to decide to make more trips, or it could engage new riders who divert from other modes or who have not made the trip before. The methodology from this project could benefit other routes or services seeking CMAQ program funding.



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Sponsor: *El Paso County*



Encouraging Rural Residents to Become Transit Riders

Route 50 (Mission Trail) is a rural transit route in El Paso County (EPC). To help EPC staff create monthly emissions analysis reports for the Federal Highway Administration (FHWA), in 2016, CIITR developed an emissions measuring and reporting tool that estimates vehicle emissions produced by buses on the route. The tool's emissions rates must be updated every two years, per FHWA requirements. In this project, CIITR's objective was to complete an update of the tool for 2017–2018 and to conduct an emissions reduction analysis of Route 50 (Mission Trail).

The methodology included:

- Adding emissions processes to the tool;
- Generating new emissions rates;
- Updating the tool's user interface;
- Testing a draft of the tool;
- Refining a new version of the tool; and
- Conducting an emissions reduction analysis.

The emissions reduction analysis results display the estimated emissions reductions divided by type of pollutant—carbon monoxide (CO), oxides of nitrogen (NOx), volatile organic compounds (VOCs), PM-2.5 (fine particulate matter) and PM-10 (particulate matter 10 micrometers or less in diameter)—for 2017–2018. The findings allowed EPC planners to better understand the relationship between ridership and emissions “savings,” promote transit, and incentivize passenger vehicle drivers in the region to switch to EPC transit as their preferred mode of travel. They may appreciate the potential environmentally friendly benefits to leaving their car at home and, instead, opting for the bus.

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Sponsor: *El Paso County*



Laying the Groundwork for a Mass Transit Fare Equity Analysis

All transit agencies that receive Federal Transit Administration (FTA) funding must produce Title VI programs, updated every three years, to document the agency's policies and practices that ensure adherence to non-discrimination legislation from the Civil Rights Act of 1964. In 2017, when Sun Metro proposed changes to its fare policies, the transit agency also needed to conduct a fare equity analysis to identify and rectify any inequities. To assist with this task, researchers will analyze potential Title VI implications of Sun Metro's proposed fare changes that minority and low-income populations might experience. Anticipating future changes to Sun Metro's fare payment technologies, the research team will provide additional research on emerging fare technologies and the equity implications of each.

The research team gathered regional demographic and socio-economic data and supplemented it with survey data provided by Sun Metro staff. After the data collection phase, the researchers will:

- Evaluate the impact(s) of the proposed fare policy on Title VI protected populations;
- Present best practices to assist in mitigating any unavoidable impacts; and

- Provide a summary of the equity implications of emerging fare payment technologies.

The project will help Sun Metro adhere to federal requirements for transit agencies and ensure that its policies do not negatively affect minority and low-income populations at a rate greater than the effect on other populations. The project could lead to increased decision-maker Title VI awareness and suggest emerging fare technologies to support a more cost-effective and efficient collection system that enhances access to transit and facilitates regional fare structure.

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Sponsor: *City of El Paso*



TRANSPORTATION OPERATIONS

Advanced, intelligent transportation technologies hold the potential to vastly improve the efficiency and safety of our transportation network. Properly implementing those technologies in the coming decades will depend on accurately gathering and analyzing large amounts of traffic data from disparate sources. CIITR researchers are at the forefront of this research in the region.

**Helping Mitigate Congestion with El Paso's
TransVista Traffic Management System**

**TRANSNET Program Encourages
Smart Travel with Metropia App**

**Helping TxDOT Expand Bicycle
Commuting Efforts**

**Exploring a Single, Seamless Transit System
in El Paso County**



Helping Mitigate Congestion with El Paso's TransVista Traffic Management System

The Texas Department of Transportation's (TxDOT) El Paso District installed Bluetooth® sensors across the region to measure vehicle speeds and travel times as data for establishing performance measures. In 2016, CIITR researchers assisted TxDOT in developing mobility performance measures for the district's major corridors. This project sought to automate, where possible, the process for calculating and mapping the mobility performance measures in instrumented corridors.

Phase 1 developed the mobility performance measures. Phase 2 evaluated three approaches to automating the mapping process using: KML Python Script, ArcGIS Online and a customized TTI Map Visualization Tool. Researchers successfully tested the automation process using the 2015 data. Using the 2016 Bluetooth data, the team calculated the same performance measures using each of the three tools, then compared those outcomes to the 2015 results generated from the baseline data set. The TTI visualization tool proved the most reliable in replicating the measures such as identifying two corridors—nine sections along I-10 and one section along US 54—as having the highest Travel Time Index values. The study recommended future enhancements of the system including:

- reconfiguring two Transvista links to improve accuracy of localized congestion;

- installing more Bluetooth sensors in selected locations/corridors;
- creating new highway sections for newly added Transvista links;
- generating similar performance measures using 2017 data and semi-annual analysis to monitor the regional transportation network performance; and
- integrating local El Paso District Bluetooth data with TxDOT's Lonestar advanced traffic management system to centralize access by other applications.

Using the TTI Map Visualization Tool and following the team's recommendations, TxDOT's El Paso District can leverage available travel-time data to provide monitor the local transportation network's health and performance over time.

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Sponsor: TxDOT El Paso District

TRANSNET Program Encourages Smart Travel with Metropia App

According to the annual TTI 2015 Urban Mobility Scorecard, American travel time increased in 2014 by 6.9 billion hours, increasing gas consumption by 3.1 billion gallons, resulting in a congestion cost of \$160 billion dollars. The *connected traveler* concept centers around an individual's ability and willingness to adjust travel patterns to increase overall transportation system efficiency (in terms of both energy and convenience). The National Renewal Energy Laboratory established the Connected Traveler project, funded by the Advanced Research Projects Agency-Energy's Traveler Response Architecture using Novel Signaling for Network Efficiency in Transportation (TRANSNET) program, to gauge potential transportation system energy savings by incentivizing efficient traveler behavior.

Metropia's mobile app offers updated traffic management information and rewards points to users traveling during off-peak times. Researchers used data, provided by Metropia, to populate a model to see what fuel savings would incur if the number of Metropia users increased (i.e., market penetration). The research team showed results of fuel consumption for different market penetrations. In alignment with sustainability trends, the project aims to connect travelers with fuel-saving technology that can seamlessly, yet effectively integrate into their lives.

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Sponsor: US Department of Energy
(sub to NREL)

AMERICAN TRAVEL TIME

increased in 2014 by



6.9 billion HOURS



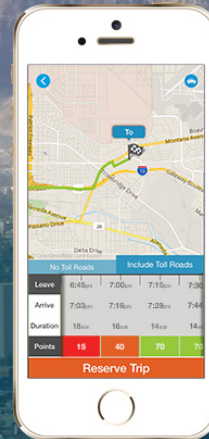
**GAS CONSUMPTION
by 3.1 billion gallons**



**resulting in a CONGESTION COST
of \$160 billion dollars**

 | Pioneer Program

<https://www.metropia.com/blog>

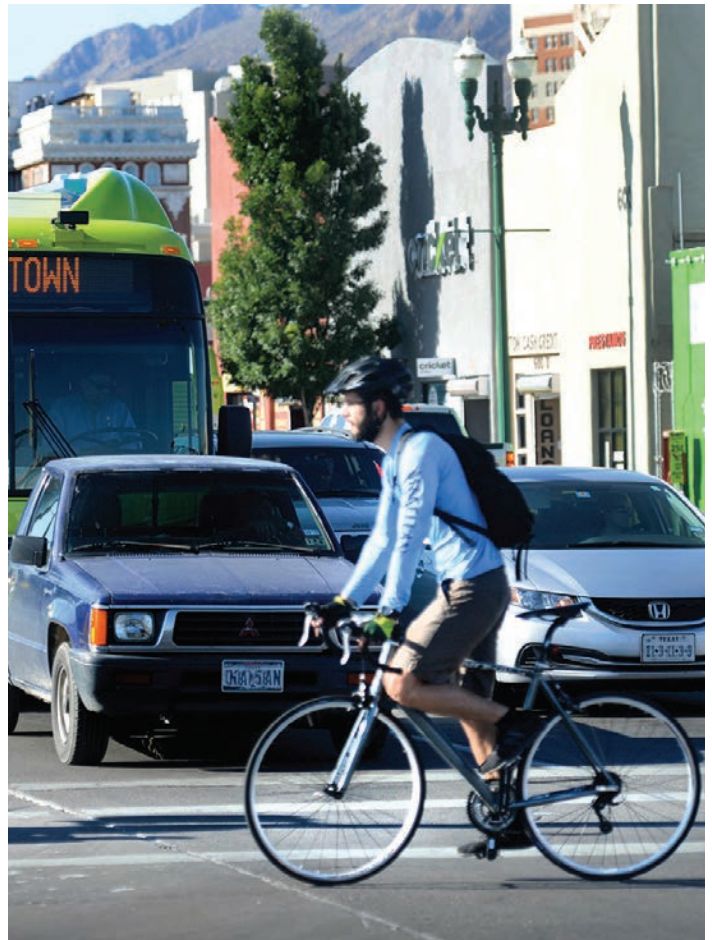


Plan Ahead | Avoid Traffic | Save Time | Earn Rewards

Helping TxDOT Expand Bicycle Commuting Efforts

The Texas Department of Transportation (TxDOT) and El Paso transportation agencies have increasingly supported bicycle commuting as an alternative travel mode that can aid in mitigating congestion and improving air quality. However, TxDOT, the City of El Paso, and the El Paso Metropolitan Planning Organization have created separate plans related to bicycle infrastructure improvements. TxDOT requested CIITR's assistance to provide pedestrian and bicycle technology testing and transfer and to coordinate with local agencies on unified planning efforts in the El Paso District.

Researches reviewed TxDOT's existing bicycle network and assessed current pedestrian and bicycle monitoring technology options. The research team tested the Eco-Counter and TRAFx technologies by installing the equipment in selected locations around El Paso. The results indicated that the Eco-Counter and TRAFx technologies make for a good starting point in regional pedestrian and bicycle monitoring, because the Eco-Counter technology allows users to directly track data (every 15 minutes, hourly, daily, and monthly) and the TRAFx technology works well for short duration pedestrian counts. Researchers produced a set of best practices for TxDOT on how to install the technologies, how to choose locations, and how to coordinate with local agencies. Sharing information between TxDOT and other local agencies can help in selecting future monitoring equipment and locations, identifying multimodal performance measures, and adding pedestrians to future travel demand models in the El Paso region. By setting the groundwork with a foundation of knowledge for best practices, this project will serve as a resource in future efforts to meet pedestrian and bicycle traffic demand in El Paso.



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Sponsor: *TxDOT El Paso District*



Exploring a Single, Seamless Transit System in El Paso County

The El Paso County transit system has limited connection to Sun Metro, El Paso's municipal transit department. The county is growing at a significant rate, and residents need a more efficient, effective transit system with linkages across agencies where possible. The El Paso County Regional Transit Institutional Options Feasibility Study explored the feasibility of a single, seamless transit system in El Paso County. CIITR provided technical assistance and planning support to El Paso County in conducting the study, which was funded by the Texas Department of Transportation.

Researchers examined possible service designs, governance models, and revenue streams for a countywide transit system. The study involved a stakeholder group, a transit rider survey, and two community outreach efforts. The research team produced six proposed service scenarios for countywide transit, including forecasted ridership, operating and capital expenses, and sources of revenue. El Paso County, in partnership with Sun Metro, is discussing implementation for one of the service scenarios. The proposed transit system could positively impact

the local economy via construction and operation of new transit vehicles and facilities. A countywide transit system would connect rural communities and urban areas outside the current Sun Metro service area to employment opportunities and other services.

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Sponsor: *El Paso County*

BORDER CROSSING EFFICIENCY

Trade, tourism, and international security—all depend on the efficient, safe, and thorough monitoring of cross-border traffic. CIITR researchers are evaluating advanced monitoring technologies—as well as facilitating communication among stakeholders from both countries—to ensure the secure, efficient movement of people and goods between the United States and Mexico.

Cross-Border Workshop to Facilitate Ambulance Mobility

Improving a Truck Classification System Can Help Stretch Maintenance Dollars

More Reliable Information Can Reduce Negative Impacts of Border Delays

Reducing Costs, Improving Travel Times for Commercial Vehicles

Optimizing Cross-Border Freight Movement via Shared Traffic Data

Facilitating Information Exchange Among Stakeholders for More Efficient Traffic Movement

Evaluating Technologies to Produce More Accurate Pedestrian Counts at LPOEs

Better Sensors, More Reliable Updates Related to Border Inspection Lane Status

Solving the Problem of Accurate Border Counts Via Innovative Technology Applications

Mapping Commodity Flow with Border Freight Traffic Trends

Forecasting Model Allows Agencies, Companies to Plan Ahead

Real-Time Information to Improve Travel-Time Reliability for Freight Companies

Managing Empty Trailers on the Road to Reducing Traffic Congestion



Cross-Border Workshop to Facilitate Ambulance Mobility

Leading a team of public agencies that includes Texas Tech University, CIITR researchers are working to expedite the cross-border transportation of patients needing emergency care in El Paso. In 2017, for example, the El Paso Fire Department (EPFD) received over 1,000 emergency calls from border crossings.

Mexican ambulances transport patients across the border via Bridge of the Americas and Ysleta-Zaragoza LPOEs. Following arrival at a LPOE, an ambulance waits in line with other passenger vehicles. Once U.S. Customs and Border Patrol (CBP) officers know an ambulance is approaching, they divert traffic so the Mexican ambulance can reach the inspection booth more quickly. Sometimes, these ambulances traveling northbound use southbound LPOE lanes to avoid delay, which can sometimes compromise traffic safety. At the border, CBP officers inspect patients' passports and request the dispatch of a U.S. ambulance operated by EPFD, which takes the patient to an El Paso hospital. The entire process can take up to three hours, and that delay can mean the difference between life and death for critical patients, many of whom are pregnant women.

In August 2018, CIITR researcher led a workshop of various stakeholders, including EPFD, the University Medical Center of El Paso, and Ambulancias UMAM (a Mexican ambulance service) among others. The workshop examined current policies and practices regarding, as well as possible strategies for facilitating, cross-border movement of patients. This project will continue to encourage dialogue among affected agencies and seek practical solutions that benefit all parties, especially the affected patients.

>> **PI: David Salgado**


















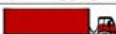




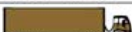











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Sponsor: *Center for International Intelligent Transportation Research*

Improving a Truck Classification System Can Help Stretch Maintenance Dollars

Every five years, the U.S. Department of Transportation's Bureau of Transportation Statistics conducts the Commodity Flow Survey (CFS), the primary source of national- and state-level data regarding domestic freight shipments. The CFS is limited to those companies that choose to participate and the results are not appropriate for modeling freight movement or vehicle emissions. CIITR researchers looked at two main methodologies for identifying truck body classifications: weigh-in-motion and inductive signature data and video-based vehicle detection. Researchers found that a method employing a combination of both methodologies is the most reliable for accurately identifying truck body types. Future research could involve employing infrared sensors for the same purpose.

Better understanding the types of trucks crossing the border at various ports of entry could help improve policies related to shipping. The Federal Highway Administration classification structure defines 13 axle-based classes. Since different truck types can have very different impacts on transportation infrastructure (e.g., a six-axle single trailer [Class 10] truck will put considerably more wear and tear on a two-lane country road than a four-tire, single-unit [Class 3] truck would), more readily identifying truck types can help local agencies responsible for infrastructure maintenance stretch limited dollars further. Additionally, freight and emission forecasting models would be more accurate with more comprehensive information, potentially benefiting company shipping schedules, mitigating border-crossing congestion, and helping border communities improve local air quality.

Class 1 Motorcycles		Class 7 Four or more axle, single unit	
Class 2 Passenger cars	   		 
Class 3 Four tire, single unit	  	Class 8 Four or less axle, single trailer	  
Class 4 Buses	  	Class 9 5-Axle tractor semitrailer	 
Class 5 Two axle, six tire, single unit	  	Class 10 Six or more axle, single trailer	 
Class 6 Three axle, single unit	  	Class 11 Five or less axle, multi trailer	
		Class 12 Six axle, multi-trailer	 
		Class 13 Seven or more axle, multi-trailer	   

Source: <https://www.fhwa.dot.gov>

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More Reliable Information Can Reduce Negative Impacts of Border Delays

Required security inspections and increased truck traffic at U.S.–Mexico border crossings create costly, disruptive delays to manufacturers, shippers and, ultimately, consumers. With up-to-date, real-time traffic information and accurate border wait times, shippers and carriers can reduce costs associated with those delays. Since 2009, CIITR researchers have examined the reasons for and realities of congestion-related delays at border crossings. Acknowledging the center’s expertise, the Texas Legislature twice requested that center researchers testify on the topic. Likewise, the White House Council of Economic Advisors requested similar information in 2018.

CIITR conducted this study to update the earlier research. Increased availability of real-time data provides more detailed information regarding traffic trends. Using that data, this study proposes creation of a connected economic impact estimation dashboard accessible to the public, businesses, and transportation system agencies. Using the more granular, contemporary data, researchers created a proof of concept for the dashboard and beta-tested the estimation of delay costs. They also gener-

ated a six-step implementation plan to develop and launch the web-based dashboard for stakeholder use.

With the dashboard’s accurate, reliable information, shippers and carriers can optimize shipping times, choose the LPOE with the lowest wait time, and/or take other steps to mitigate delay costs. The positive economic impact will not only reduce the shippers’ bottom line but could also benefit consumers through lower prices on store shelves. Even traffic safety and air quality near LPOE communities could be improved through reduced congestion at border crossings during peak times of travel.

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Reducing Costs, Improving Travel Times for Commercial Vehicles

Transportation performance measures are critical for stakeholder decision-making. Public agencies need measures to know how best to allocate limited resources to maintain the transportation system, and private companies can use them to make goods transfer to market more efficient, potentially passing along reduced shipping costs to consumers through lower prices.

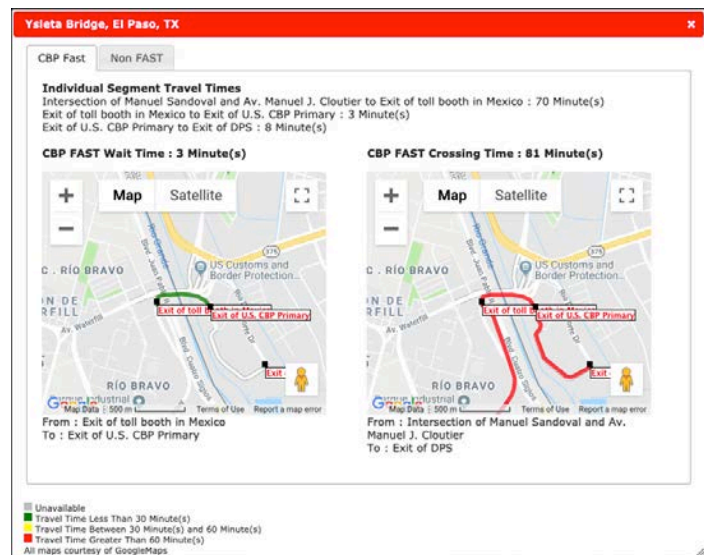
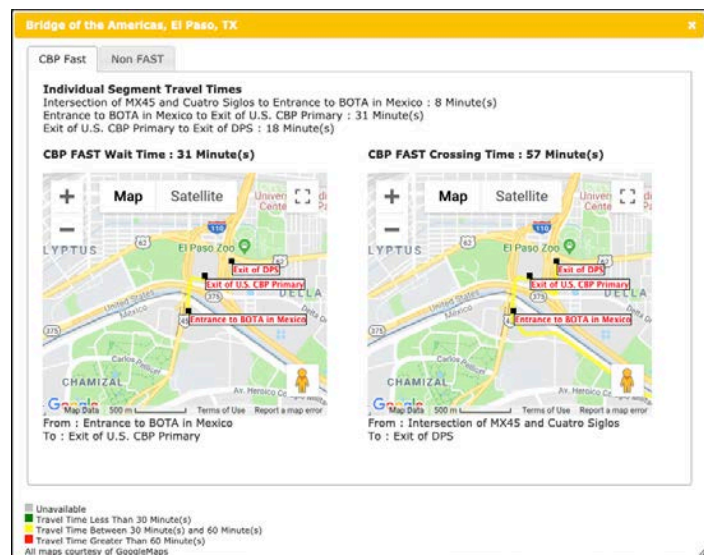
Crossing times for U.S.-bound commercial vehicles are now available through the Border Crossing Information System (BCIS). Data alone, however, don't show the kinds of historic and future trends necessary for short- and long-term decision-making. CIITR researchers leveraged the findings from previous research projects to provide stakeholders on both sides of the U.S.-Mexico border with reliable wait-time estimations. They developed a short-term wait-time estimation algorithm, created a methodology to identify outlier data points, and cleaned the volume and travel-time datasets (e.g., removing outliers) from BCIS. They then performed data-driven and time-based trend analysis, and developed a consistent score using multiple performance measures for comparison.

Although this project made much progress in developing border crossing performance measures, scores and trends, researchers recommend developing a single product, perhaps similar to the BCIS website, to provide stakeholders access to this information. Stakeholders can then make better-informed, mobility-related decisions to mitigate the negative impacts of disasters, short-term traffic disruptions or otherwise congested conditions at LPOEs; and shippers will be better able to schedule and plan their freight movement.

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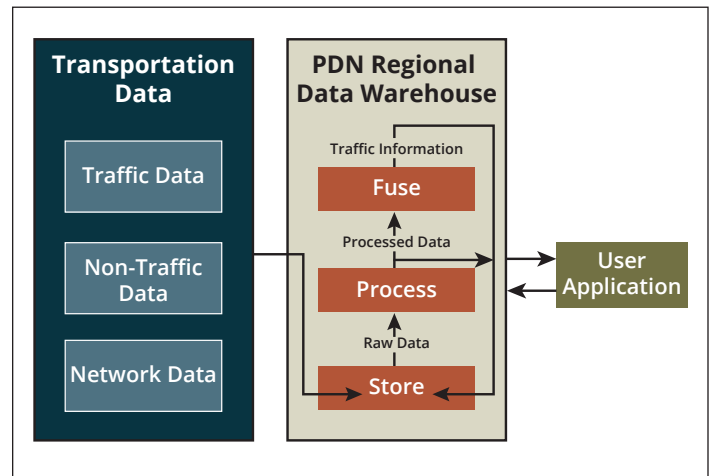
Optimizing Cross-Border Freight Movement Via Shared Traffic Data



The Paso del Norte (PDN) region comprises the City of El Paso, City of Las Cruces and Ciudad Juárez. The PDN is a multi-jurisdictional, binational traffic environment maintained and regulated by national, state, and local agencies from both countries. Because multiple agencies capture and manage the region's transportation data, the data is heterogeneous and not easily shared without a central repository that "translates" the disparate data into useful information.

CIITR researchers designed a PDN Regional Data Warehouse system, as well as created a business plan to provide for the long-term maintenance of warehouse upkeep and data management. Every 10 minutes, the warehouse extracts discrete information from local data sources on both sides of the border and stores the following data types:

- **Traffic data:** travel time, wait time, crossing time, and closed-circuit television (CCTV) screenshots.
- **Non-traffic data:** traffic incidents, road closures, weather, and special events.
- **Network data:** detector location, CCTV location, speed limit, and roadway number of lanes.



Researchers programmed the system to fuse the raw, aggregated data with Highway Performance Indices to make it useful and meaningful to end-users through the PDN Data Warehouse dashboard. Designed by CIITR researchers to be completely customizable to the user's needs, the interface enables discrete searches delimited by such parameters as desired date and time (e.g., for searching archival information to, for example, determine traffic trends). A business plan, presented by CIITR, will help provide for ongoing system sustainability over time as new data is integrated.

Better understanding and sharing traffic data across the border can provide for more efficient, reliable, and cost-effective international freight movement, benefiting national economies, private company bottom lines, and consumer prices.

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Facilitating Information Exchange Among Stakeholders for More Efficient Traffic Movement

Both private- and public-sector stakeholders are interested in border crossing performance measures at El Paso, Texas, land ports of entry (LPOEs). While data availability and access to performance measures at the El Paso LPOEs have significantly increased, rarely have these stakeholders been interviewed or brought together to learn their expectations regarding border crossing performance measures. CIITR researchers brought stakeholders together in an interactive workshop to educate them about new data sources, discover information gaps, and identify challenges to establishing more effective performance measures.

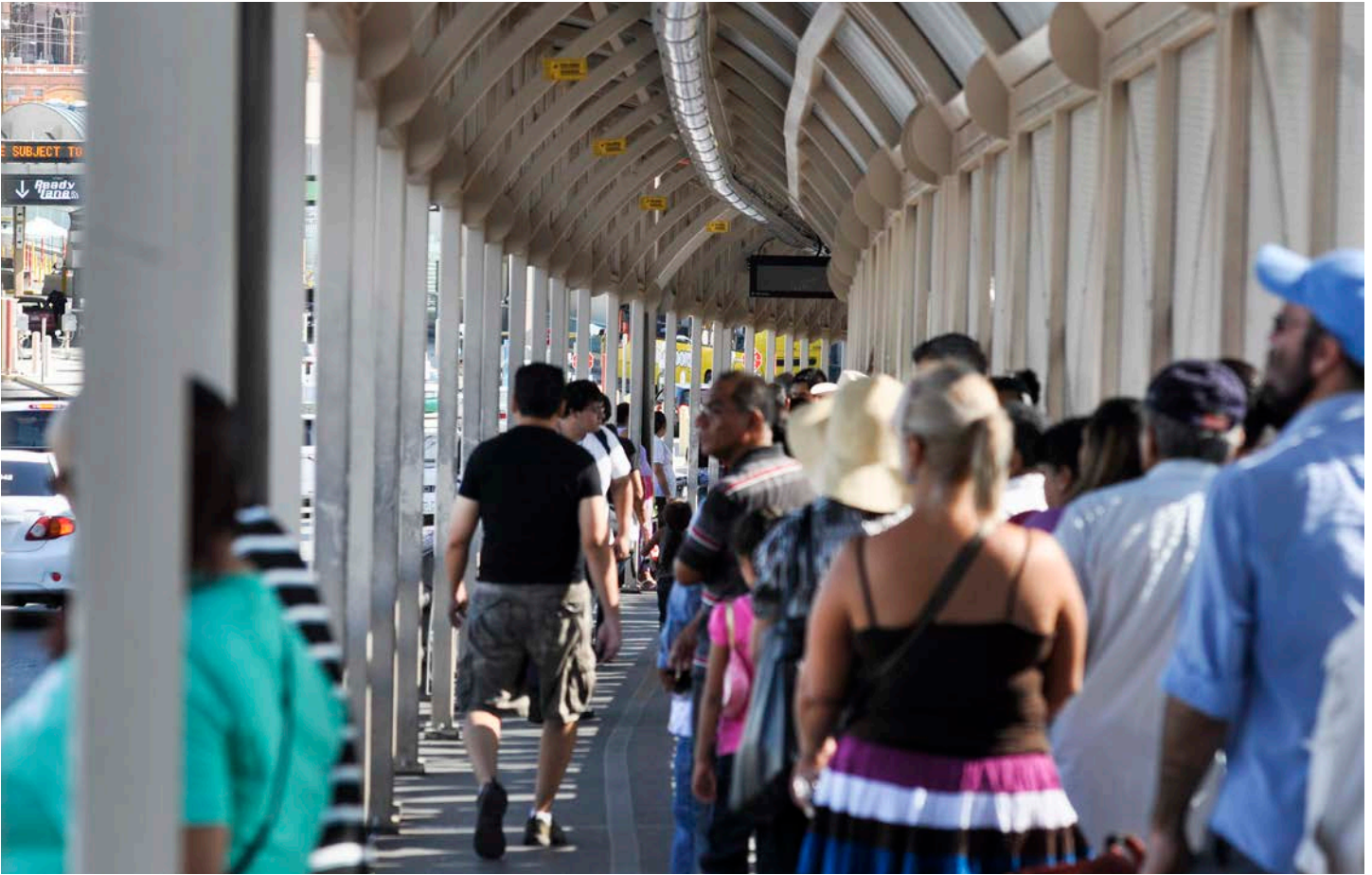
Researchers conducted individual interviews and a follow-up workshop that included all interviewed stakeholders. The resulting conversations revealed a need for a web-based information platform accessible by all stakeholders that is regularly updated and provides available data and sources. The workshop

also found potential synergy between various stakeholders; for instance, wait times captured by CIITR can supplement U.S. Customs and Border Patrol's (CBP's) processing-time data to yield a more accurate picture of how traffic passes through LPOEs. Other major results of the workshop included CBP's interest in CIITR's traffic volume data collected specifically at the Bridge of the Americas and CBP's desire to know more about the center's method for using LED sensors to capture traffic data. Also identified was the need for more workshops held annually to facilitate communication among stakeholders. The web-based platform for sharing traffic data noted by stakeholders is currently being developed in an effort led by CIITR researchers.

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Evaluating Technologies to Produce More Accurate Pedestrian Counts at LPOEs

The pedestrian traffic crossing into the United States is monitored at the land ports of entry (LPOEs) between El Paso, Texas, and Ciudad, Juárez, Chihuahua. The semi-automatic collection of data is prone to pedestrian-flow and revenue errors. Discrepancies also exist between the different collection methods used by U.S. and Mexican authorities. Stakeholders are interested in improving the reliability of their pedestrian monitoring systems. In this project, researchers aimed to:

- Build a comprehensive literature review;
- Explore emerging technologies in pedestrian monitoring systems;
- Identify viable solutions for the LPOEs;
- Set up and test counting equipment; and
- Provide project recommendations to local authorities.

The research team tested different technologies for counting pedestrians at border crossings. The results indicated that the thermal camera sensor was most useful when a high level of pedestrian traffic exists. The sensor required a limited amount of operation (e.g., adjusting it to the correct area of pedestrian traffic). The Mexican authorities used fare boxes to track daily pedestrian traffic data. The next step in the research is to compare the thermal camera sensor's counts with those of the fare boxes. Facilitating communication between U.S. and Mexican authorities would improve pedestrian monitoring on both sides of the bridge, increasing accuracy, reducing inconsistencies, and providing reliable data.

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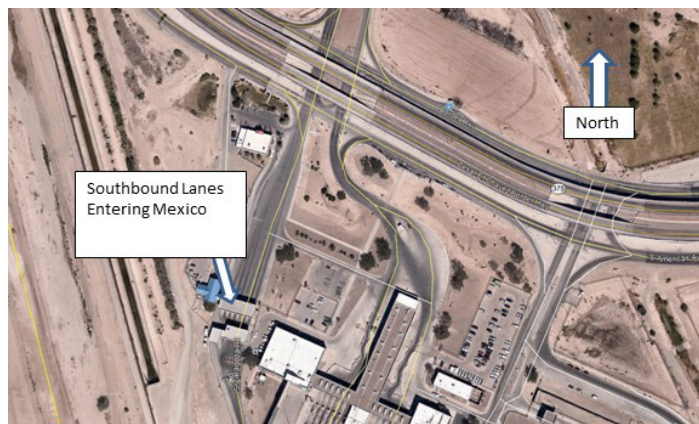
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Better Sensors, More Reliable Updates Related to Border Inspection Lane Status

The website for the U.S. Customs and Border Protection reports the number of open lanes at the land ports of entry (LPOEs). Usually the information is updated hourly. In some cases, the updates don't happen for several hours, or in other cases, the website displays unreliable numbers. CIITR identified and tested sensors to improve the accuracy of counting vehicles. Another project goal was to find a sensor or methodology that could be placed to the side of the lanes, while still enabling accurate lane counts. Researchers evaluated the LeddarTech IS16 LED scanner and the Wavetronix SmartSensor Matrix system.

The research team initially mounted and tested the LeddarTech IS16 LED scanner and the Wavetronix SmartSensor Matrix system at The Texas A&M University System's RELLIS Campus. After successful testing at RELLIS, they installed the technology at the Ysleta-Zaragoza bridge. Both detectors were able to evaluate lane status (either open or closed) for the three or four lanes nearest the location of the detectors. Both sensor systems provide viable solutions for monitoring lane status, but additional development work would be needed for the LeddarTech scanner to make it a stand-alone solution. Knowing lane status, passenger vehicles and freight carriers can make informed decisions about departure times and bridge selection. Also, LPOEs can build more reliable models and improve their mobility analysis.



Source: Google Earth.

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Solving the Problem of Accurate Border Counts via Innovative Technology Applications

Border counts are particularly challenging for most traditional vehicle counting sensors that depend on vehicles maintaining a constant speed. Since 2015, CIITR has been helping to improve the accuracy of border counts at the U.S.-Mexico land ports of entry (LPOEs). Previously, the research team recommended the overhead-mounted LeddarTech IS16, a low-cost scanner that uses LED technology. The objective of this phase was to install LeddarTech IS16 sensors at the Bridge of the Americas (BOTA) LPOE and replace field computers at the Ysleta-Zaragoza LPOE.

Researchers received permission from the General Services Administration, in cooperation with U.S. Customs and Border Protection, to install vehicle count equipment at the BOTA LPOE. Since most of the work was on the Mexican side of the border, CIITR provided the equipment and supervised a contractor in Mexico. The sensors exhibited a few overcounts and a few undercounts, but combining the counts produced an error rate of less than one percent. The research team concluded that, based on these results, the sensor is viable for counting vehicles at international borders. The LeddarTech IS16 sensor could be deployed at additional LPOEs used by commercial and passenger vehicles to increase accurate vehicle counts and improve operational efficiencies for border agencies.



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Forecasting Model Allows Agencies, Companies to Plan Ahead

Every year, CIITR publishes an updated issue of the *U.S.-Mexico Border Freight Traffic Trends* report. The publication is mainly focused on reporting historical freight activities—such as types of commodities transported—at land ports of entry on the U.S.-Mexico border over the past decade. In this project, researchers sought to develop a prediction model capable of forecasting future commodity trading between the United States and Mexico based on historical commodity data.

The research team built a prototype prediction model, which was then added to the latest version of the report. Future reports will include trends forecasted with the model developed by CIITR researchers. The forecasts could help transportation and trade agencies, as well as companies in the private sector, achieve a better understanding of future trends in border trade dynamics. For example, public agencies focusing on cross-border transportation operations could use the forecasts to

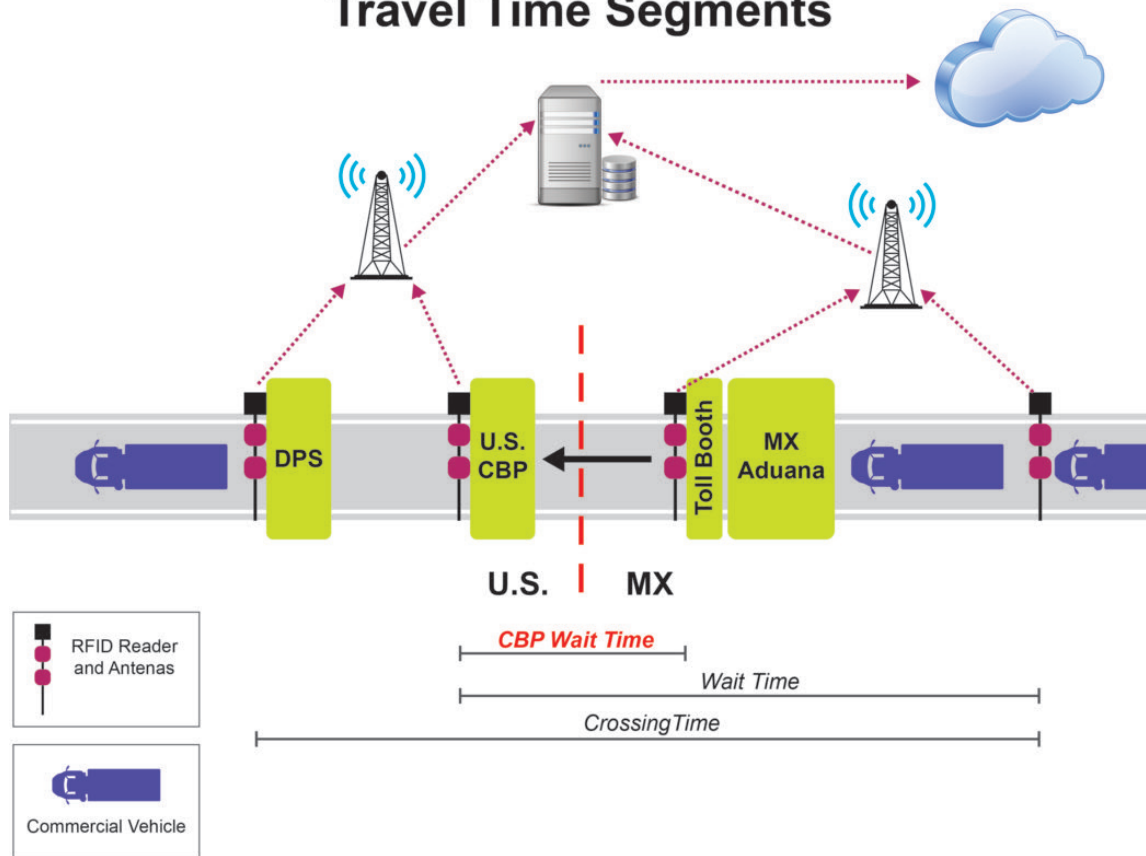
identify which commodities they should allocate time, money, and freights to. Private-sector companies involved in trade and manufacturing could consult the predictor model to plan out projected budgets and manage the resources needed to meet increased (or decreased) trade of certain commodities.

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Travel Time Segments



Real-Time Information to Improve Travel-Time Reliability for Freight Companies

A travel-time reliability monitoring system (TTRMS) tracks the impact of factors—such as incidents, work zones, special events, and weather—on a transportation network. A TTRMS collects travel-time data from various sources to monitor travel-time reliability in real time. Such a system allows transportation agencies to quantify travel-time reliability of their transportation networks and evaluate the impact of transportation network improvements on reliability. No TTRMS has been installed at the land ports of entry (LPOEs) along the U.S.-Mexico border. Under the second Strategic Highway Research Program, the Texas Department of Transportation (TxDOT) received a grant to set up a TTRMS at the Ysleta LPOE in the El Paso-Ciudad Juárez region.

To assist TxDOT, researchers examined data, gathered stakeholder input, and developed a concept of operations. They also produced an implementation plan for installation of the TTRMS. The project's final report includes a schedule for the installa-

tion and estimated costs for setting up the TTRMS. The next step will be to locate a source of funding and a public agency as the sponsor. Establishing a TTRMS in El Paso could enable freight companies to make real-time decisions to decrease travel delays, reducing shipping costs and benefiting bottom lines. Freight companies could also study travel-time trends to improve the efficiency of freight schedules.

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Managing Empty Trailers on the Road to Reducing Traffic Congestion

Trucks crossing from El Paso, Texas, to Ciudad Juárez, Chihuahua (or vice versa), drop off their cargo on one side of the border and return, empty, to the other side. Better managing these empty trailers might reduce traffic congestion and facilitate faster inspections at Texas land ports of entry (LPOEs). In this project, researchers investigated the following questions:

- Can more accurate data help improve the efficiency of the border inspection process?
- What are the current state and impacts associated with empty trailers at Texas LPOEs?
- What opportunities and partnerships with the private sector exist to better manage these empty trailers using best practices?

Researchers conducted a literature review, analyzed border crossing data, and interviewed El Paso officials. The literature verified the negative impacts of border wait time delays, like unreliable travel times and increased air pollution. El Paso officials noted the continued challenges presented by empty

trailers crossing the border. CIITR suggests creating a process to manage the empty trailers to leverage past data and current trends, management strategies, and performance monitoring. Public and private policies that reduce the number of empty trailers in U.S.-Mexico border crossing queues could reduce wait times for commercial vehicles with cargo, and that could yield improved just-in-time deliveries, enhanced travel-time reliability, and reduced traffic-related air pollution in the region.

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Mapping Commodity Flow with Border Freight Traffic Trends

Trade gateways between the United States and Mexico include 25 land ports of entry (LPOEs) along the 1,969-mile U.S.-Mexico border. Since 2009, CIITR has monitored freight activities at the U.S.-Mexico LPOEs in Texas, California, Arizona, and New Mexico. On a national scale, freight movement across the U.S.-Mexico border is an important indicator of the status of the U.S. economy. The ongoing project explores the movement of goods, the popularity of each LPOE with shippers, and the most frequent transportation modes. Each year, the research team publishes a *U.S.-Mexico Border Freight Traffic Trends* report with border freight traffic statistics and trends. Regarding CIITR's 2018 research brief, the Border Trade Advisory Committee suggested that researchers focus on a more detailed commodity-specific freight analysis.

With that feedback, the research team identified new data sources and provided updated statistics and trends in the brief. For example, manufactured goods represented the commodity shipped most often across the border (both as an export and an import). Also, freight activities at Texas LPOEs were significantly

higher than in the other three states (California, Arizona, and New Mexico). The trends discovered in the research can inform estimates of future freight activities and assist in resource allocation planning for border crossings, potentially providing for the more efficient movement of goods between the two countries.

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INITIATIVES

International Research Initiatives

In a world economy, national borders must facilitate commerce while protecting the sovereignty of participating nations. Partnering with agencies in both the United States and Mexico, CIITR researchers look for innovative solutions that leverage the latest in monitoring technologies to ensure security, reduce wait times at checkpoints, and improve travel-time reliability for shippers and travelers alike.

IN THIS SECTION

**Prioritizing Road Safety as a Learning
Opportunity in Saudi Arabia**

**Strategies for Streamlining Freight Traffic
Through Urban Areas**

**Advising Azerbaijan on Strategies to Attract
International Freight Trade**



Prioritizing Road Safety as a Learning Opportunity in Saudi Arabia

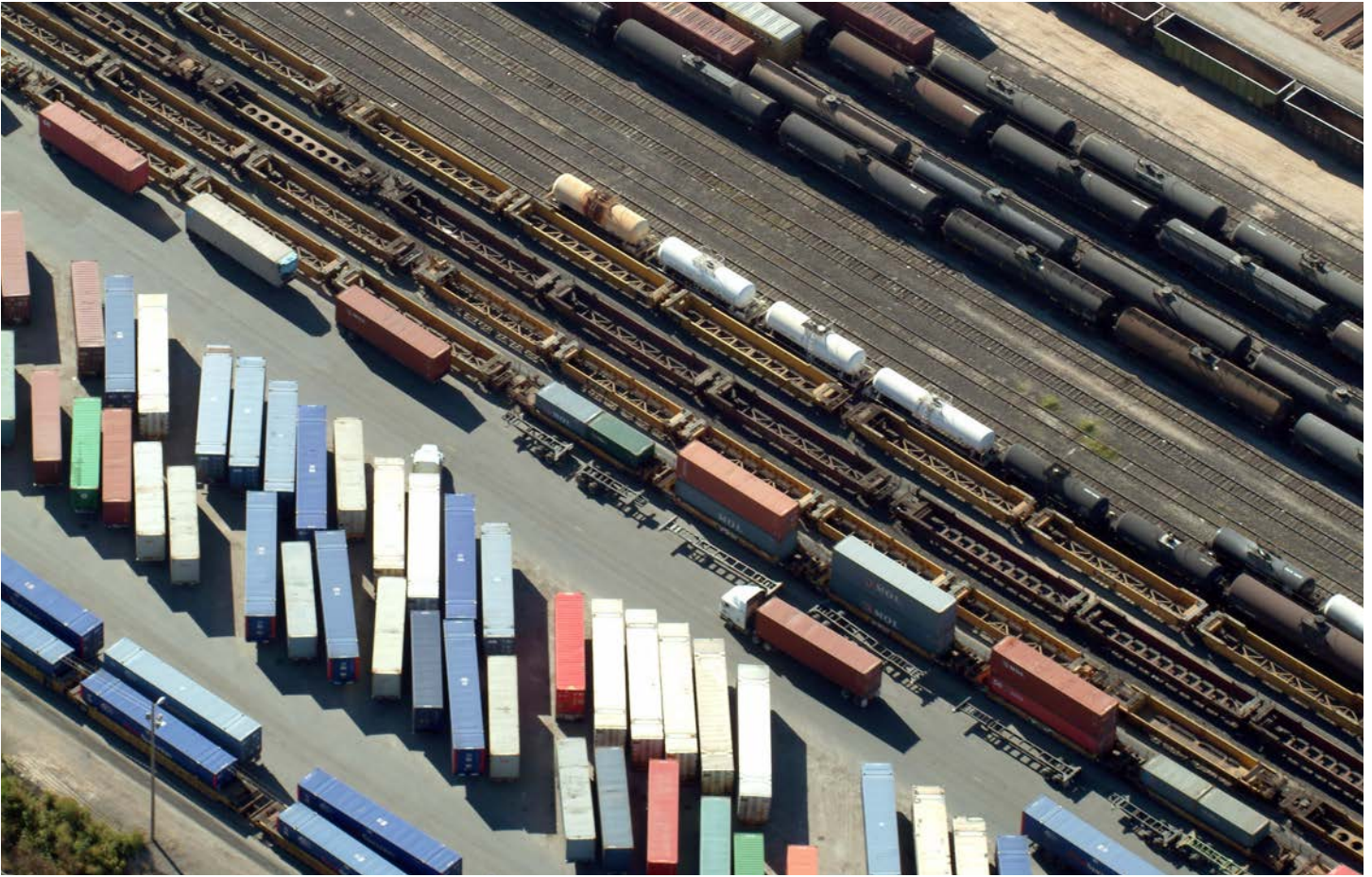
CIITR provides road safety audit (RSA) training to local and international road agency professionals. A RSA is a formal safety evaluation that emphasizes the critical relationships between roadside conditions, driver behavior, and safety. The audit team performs a thorough field review, identifying low-cost transportation improvements that reduce the severity and frequency of collisions and helping professionals better appreciate multiple aspects of road safety. Training local road agencies to conduct RSAs can ensure that safety is included in road management decisions.

Researchers led a RSA workshop (May 22–25, 2017) at the Imam Abdulrahman bin Faisal University in Dammam, Saudi Arabia. The workshop, funded by Saudi Aramco, outlined the RSA audit process and each team's roles. The workshop mainly focused on audits for existing roads, and participants divided into groups to work through case studies, including two case studies on RSAs in El Paso, Texas, as examples. Each group discussed safety issues and possible solutions.

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Sponsor: ??



Strategies for Streamlining Freight Traffic Through Urban Areas

Texas is rapidly becoming more urbanized. However, the increase in urban traffic often hinders the passage of freight through urban areas, as well as to and from production sites within cities. Assisting the Texas Department of Transportation (TxDOT) and the Federal Highway Administration, researchers examined several potential strategies for managing freight movement in Texas' largest urban areas. The research team analyzed urban freight characteristics and modeled freight management strategies on selected corridors in Austin, Houston, Dallas-Fort Worth, and El Paso (and at the U.S.-Mexico border). The most applicable strategies for the El Paso locations include:

- **For the El Paso region**—dedicated/exclusive truck lanes; and incident management using an advanced traveler information system (ATIS).
- **For the U.S.-Mexico border region (El Paso, Texas, and Ciudad Juárez, Chihuahua)**—truck route diversion; geometric design and operational improvements; and designated truck routes.

Researchers presented an extensive report to TxDOT that offered guidance on implementing specific freight flow management techniques in these large, populated areas. For example, they modeled a scenario—detouring trucks when an incident occurs during peak congestion hours—based on the strategy of incident management using an ATIS. Diverting truck traffic from El Paso's I-10 highway, the city's most congested freight corridor, led to decreased travel-time and fuel costs for trucks while also clearing roadway space and improving safety, which benefited other travelers.

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Sponsor: TxDOT RTI

Advising Azerbaijan on Strategies to Attract International Freight Trade

The Coordinating Council of the Republic of Azerbaijan on Transit Freight is responsible for ensuring that Azerbaijan's freight transport corridors facilitate international transit freight. In alignment with the U.S. Agency International Development's (USAID's) Regional Economic Growth Project, the USAID mission in Azerbaijan assisted the council in its mandate to support a competitive, sustainable economy for the country. Sponsored by USAID, CIITR worked with Segura Consulting to provide technical assistance to improve international transit cargo flows through Azerbaijan. Researchers focused on developing tools and information to help the council monitor the performance of Azerbaijan's international freight corridors to further the country's attractiveness as a logistics and international transit hub.

The research team developed a transit freight information system to display key freight performance metrics, and reviewed current transit freight demand, logistics infrastructure, and operations practices along Azerbaijan's corridors. Additionally, researchers assessed current transportation and logistics infrastructure and operations on the corridors, as well as the factors that freight shippers consider in selecting transit routes. This project allows Azerbaijan to identify industries that could benefit from the country's trade corridors and to develop strategies to attract the industries to set up operations in the country. For example, the oil terminals are one way for Azerbaijan to attract oil companies to set up operations. Furthermore, an influx of operations centers in the country creates more jobs and spurs economic development.



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Sponsor: USAID (Sub to Segura Consulting)

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