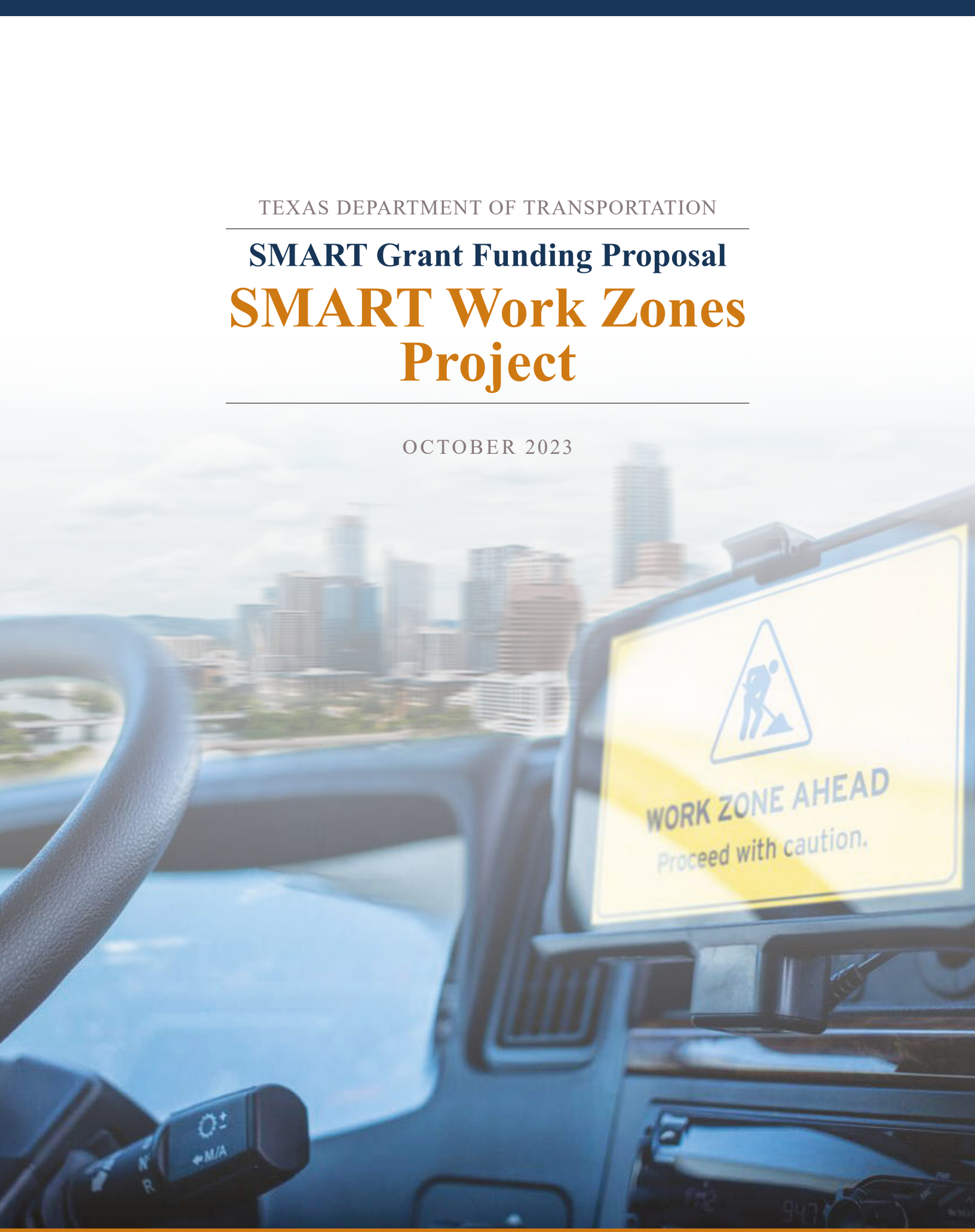
TEXAS DEPARTMENT OF TRANSPORTATION

SMART Grant Funding Proposal

SMART Work Zones Project

OCTOBER 2023



SMART Work Zones Project

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Project Description

Project Overview

The Texas Department of Transportation (TxDOT) requests $1,855,376 in Stage 1 USDOT SMART Grant funds to deploy **Systems Integrated, Intelligent Sensor Based Infrastructure**, in Austin, Texas. This infrastructure includes portable traffic monitoring devices that are configured for Temporary Traffic Control (TTC) equipment and wearables (e.g., traffic cones and work vests). Configured equipment will be placed in work zones to transmit real-time traffic information into Work Zone Data Exchange (WZDx) Device Feeds. These feeds will be integrated into TxDOT's current WZDx feed to validate work zones and dynamically track worker presence. The three main goals of this project are 1) validating actual versus planned work zone deployment activities; 2) identifying the presence of vulnerable road users (VRUs) (e.g., roadway workers), denoting an active work zone; and 3) collecting the data discrepancies between systems for analysis.

Stage 2 of this USDOT SMART Grant project will deploy a scalable solution in a significant percentage of known TxDOT-operated work zones, with hopes to fully integrate this technology within TxDOT's existing systems. Another major outcome of Stage 2 will be the development of a scalable framework for other state transportation agencies to adopt and implement.

This project aligns with SMART program goals by prioritizing safety for Vulnerable Road Users (VRUs), such as pedestrians, workers, and drivers. It deploys intelligent infrastructure and real-time data feeds to provide crucial safety information, reducing VRUs risks in work zones. Additionally, the project optimizes traffic flow, reducing emissions and work zone delays, which enhances economic competitiveness by ensuring timely goods delivery. This initiative fosters partnerships among public entities and improves integration within the existing WZDx network, collectively contributing to the program's objectives.

Challenges

From 2012-2021, Texas had 20.7% of the work zone fatalities nationwide (1,580 out of 7,615). Texas Work Zone Crash Data from 2021 shows a 41% increase in work zone fatalities from the previous year[1]. Based on the USDOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, the cost as a function of a crash fatality in Texas work zones has resulted in nearly $21 billion in 2021 dollars. TxDOT WZDx feeds are manually updated and are prone to being out-of-date and inaccurately reporting when work zones are active. Additionally, TxDOT WZDx feeds do not include information on short duration work zones, which could include utility repairs or emergencies. At present, speed limit reductions are frequently enforced even in the absence of

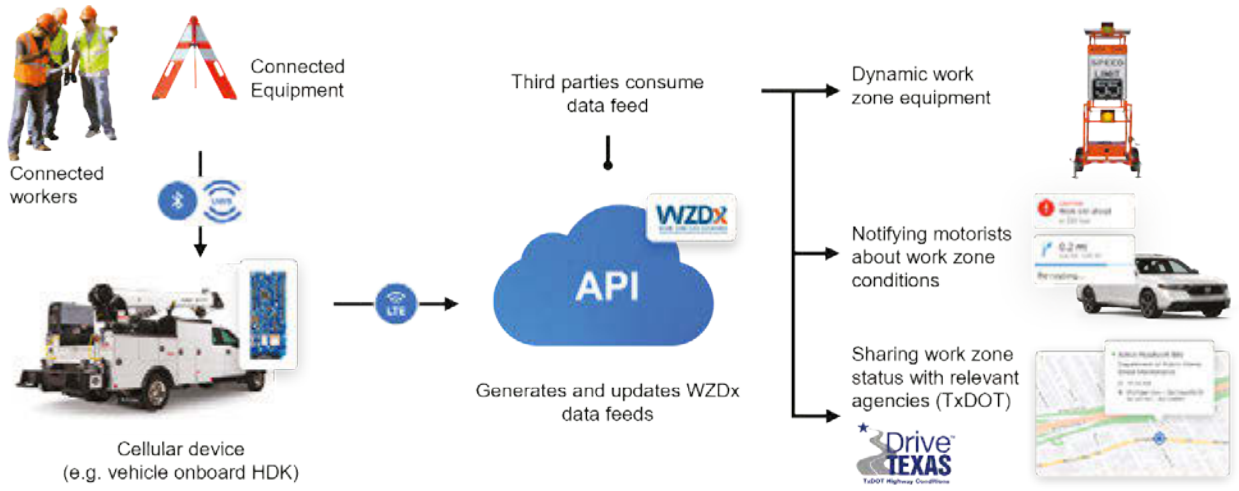
1 https://workzonesafety.org/work-zone-data/work-zone-fatal-crashes-and-fatalities/

active work crews, resulting in road users slowing down without apparent cause. This has led to a growing skepticism among drivers regarding the accuracy of these reductions as an indication of actual road worker presence. Consequently, drivers often maintain sustained speeds while entering work zones, thereby increasing the risk of work zone accidents.

Reducing work zone fatalities in work zones through groundbreaking worker safety solutions is one of the primary objectives of TxDOT's Traffic Safety Division.

Solution

This project improves upon the existing active work zone tracking infrastructure by more accurately identifying active work zones of *any duration*. This project proposes the addition of a federal standard WZDx feed that will be validated against existing Drive Texas System WZDx feeds.



First, validating existing reports of work zone deployment through a revolutionary connected work zone system, which is linked to a software interface that validates, confirms, and updates the status of a work zone as soon as it is placed. This connected work zone system is designed for exceptional stability, durability, and portability. The proposed deployment includes the ability to detect worker presence by supplying a wearable variation (e.g., vest) of the same connected technology, which identifies and updates the presence of workers in real-time.

Second, data from this system will be used to dynamically populate WZDx feeds via an application programming interface (API). These feeds can then be reliably consumed by dynamic work zone equipment, automotive OEMs, mapping providers, and other driver alerting systems to notify drivers of the upcoming hazards, thus enhancing traffic operations and Intelligent Transportation Systems (ITS). Data collected from these systems can also aid in detecting work zones that are incorrectly entered into the system or are out of date.

Project Location

The city of Austin is a large community with a 2021 population of over 1.8 million. Some of the largest employers in the city include Amazon, Apple, Dell, and IBM Corp. The University of Texas (UT) at Austin is headquartered in downtown. With nearly 52,000 students currently enrolled, UT is the largest public university in Texas. As a major north/south highway located near a university and tech conglomerates, I-35 is an ideal location to implement technological safety improvements. Specifically, the I-35 Capital Express South project is an 8-mile-long corridor from SH 71/Ben White Boulevard to SH 45 Southeast with planned construction during Stage 1 of this grant. The project is partially located in disadvantaged communities.

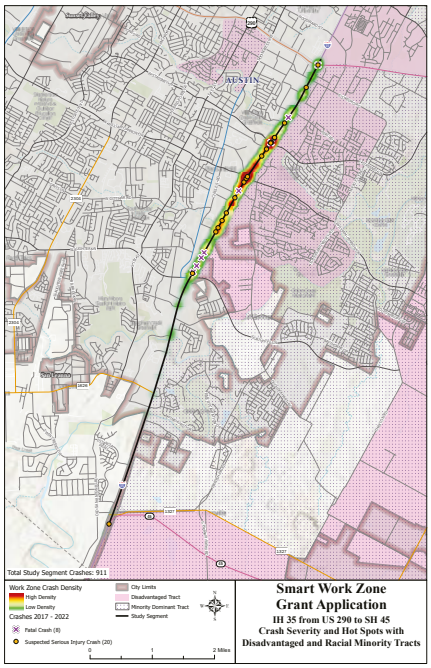


Exhibit 1: Project Area Census Tracts

Census Tract	24.02	24.03	24.07	24.11	24.19	24.21	24.22	24.25	24.27	24.28	24.29	24.34
Area of Persistent Poverty	No	Yes	No	Yes	Yes	No	No	No	No	No	Yes	No
Historically Disadvantaged Community	Yes	No	No	Yes	Yes	No	No	No	No	No	No	Yes

Community Impact

The project aims to enhance work zone safety and mobility, with a focus on vulnerable roadway users, including Hispanic/Latino workers and community members along I-35. Work zone advancements will facilitate safe travel for all, particularly workers and emergency responders. Privacy concerns will be addressed following Texas A&M University's Institutional Review Board guidelines.

While there are no major negative impacts anticipated, some adjustments may be required by highway crews, emergency vehicle operators, and connected vehicle users to adapt to new technology. Data quality controls will require data validity, reliability, precision, integrity, and timeliness, stored securely in accordance with the Data Management Plan. Access will be restricted to the deployment team, and Personally Identifiable Information (PII) will be safeguarded from public release. Texas A&M University's Institutional Review Board will oversee compliance with regulations, ethical standards, institutional policies, and participant protection throughout the project..

Technical Merit Overview

Identification and Understanding of the Problem to Be Solved

TxDOT's Move Over/Slow Down law requires drivers to move over a lane or reduce their speed to 20 mph below the posted speed limit when approaching emergency and work zone crews. While TxDOT continues to work on increased safety measures and public outreach efforts to educate motorists about driving in work zones, this project is a proactive step in innovating their current practices. In 2021, traffic crashes in Texas work zones claimed the lives of 244 people. **Speeding and driver inattention were among the leading causes of crashes in work zones**[2]. In 2021, out of the 444 contractors surveyed regarding work zone crashes across the country, more than 60% indicated they had experienced at least one crash, while 32% of them reported encountering five or more crashes in their work zones[3]. Short duration work zones are at an increased safety risk as TTC may be implemented with limited planning time and with fewer safety devices in use[4].

This project directly addresses the problem of notifying drivers of work zones ahead of time and limiting erratic driving in work zones. The WZDx feeds will more accurately detect active work zones that are consumed by mapping providers and other driver alerting systems. This includes the identification of short duration work zones which are not currently included in TxDOT's WZDx feed. The technology will proactively alert workers of nearby erratic driving, notifying them to move to a safer location within the work zone.

Appropriateness of Proposed Solution

The proposed set of solutions described in the Project Overview are appropriate to the challenges identified in the following ways:

Strong Research Foundation: The proposed solution builds upon foundational research validated by agencies like Caltrans and Iowa DOT. Notably, companies such as Haas, iCone, and PSS/Valtech have successfully implemented similar software and wearable devices. This extensive research supports the expectation of significant safety improvements along I-35, especially for VRUs within work zones.

Replicability and Scaling: This project extends existing research on the scalability and replicability of portable traffic monitoring devices and software. While these technologies have been deployed in specific locations both nationally and within Texas, the project aims to implement them across the entire state of Texas. Stage 1 will conclude with an Implementation Report demonstrating the potential for statewide scalability. Stage 2 aims to develop a versatile version suitable for rural and urban areas across Texas. The integration of this technology into TxDOT's *Smart Work Zone Guidelines*, governs the deployment of ITS in work zones, highlighting the commitment to modernizing work zone safety practices.

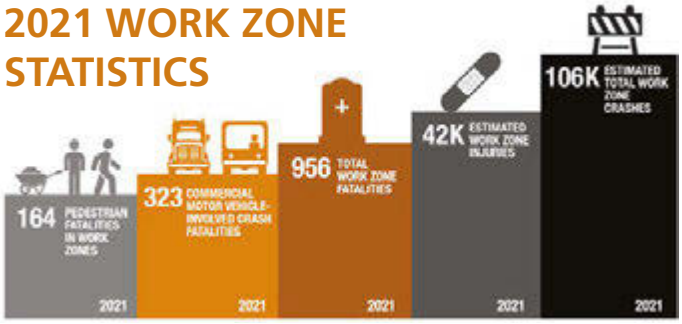
Improving the Status Quo: The proposed solution is an integration of intelligent, wearable, and device-mounted technologies within work zones, that would continuously supply real-time data into WZDx feeds and dynamically adjust the posted speed limits only when actual workers are confirmed to be present at the construction site. Texas House Bill 1885, enacted earlier this year, allows TxDOT to implement variable speed limits, including in work zones. This approach seeks to significantly enhance current data feeds and TTC practices.

2 https://www.txdot.gov/about/newsroom/statewide/traffic-deaths-spike-in-texas-work-zones.html
3 https://www.agc.org/sites/default/files/users/user21902/2022_Work_Zone_Survey_National_F.pdf
4 https://workzonesafety-media.s3.amazonaws.com/workzonesafety/files/documents/training/fhwa_wz_grant/wsu_STSDM_guide.pdf

Solution Appropriateness: The solution seamlessly aligns with the specific context of I-35, which hosts ongoing and future construction projects requiring work zones. The presence of multiple short-duration work zones in this location ensures the effective deployment of technology across various work zone scenarios.

Expected Benefits

The outcomes of this project are in alignment with multiple critical goals of USDOT and SMART GRANT Program Priorities:



- This project aims to enhance **equity** in transportation by prioritizing the **safety** of VRUs. Through the deployment of intelligent infrastructure and reliable real-time data feeds, accurate information about work zone delays and speeds will provide VRUs and drivers with crucial safety information, reducing VRUs disproportionate risks in work zones.
- Work zone congestion is associated with the highest rates of carbon dioxide, carbon monoxide, and hydrocarbon emissions from excess fuel consumption[5]. Crashes disproportionately occur in work zones[6], leading to more idling and emissions output. This project seeks to enhance traffic flow, thereby minimizing vehicle idling times and **decreasing the emission of harmful pollutants** that contribute to air toxic respiratory risk. With lower fuel consumption, emissions of greenhouse gases are also lowered.
- Work zones contribute to delay as lanes and speeds are often reduced. Crashes within work zones lead to further congestion resulting in unreliability. **Approximately 10% of congestion nationally is estimated to be due to work zones resulting in $8.1 billion in user delay costs and 586.5 million hours of vehicle delay**[7]. This is especially detrimental to the regional economy, as system unreliability can cause goods delivery delays. This project **improves regional economic strength and competitiveness** by improving roadway reliability through decreasing delays and allowing roadway work to be undisturbed.
- This project will expand **partnerships** between multiple public entities such as TTI, Travis County, and the City of Austin. Partnerships would also include private entities such as Fluor, the contractor for the I-35 project segment, the providers of traveler information like Waze, Google Maps, Apple Maps, and OEMs that would use the API.
- At present, short duration work zones are not included in the current WZDx network. Additionally, work zones are manually uploaded and susceptible to error. This project improves the **integration** of work zones within the existing WZDx network by validating where work zones are and whether active workers are present by using portable traffic monitoring devices and wearables.

5 https://ops.fhwa.dot.gov/publications/fhwahop19062/fhwahop19062.pdf

6 https://workzonesafety.org/work-zone-data/work-zone-traffic-crash-trends-and-statistics/

7 Kartikeya, J., and L. Albert. Congestion Pie Chart for Different Sources of Congestion. Technical Memorandum submitted to the Support for Urban Mobility Analysis Federal Highway Administration Pooled Fund Study. Texas A&M Transportation Institute, College Station, Texas, August 2021.

Project Readiness Overview

Feasibility of Work Plan

Work Plan and Timeline

Stage 1 of this project will be implemented over the course of 18 months with six major tasks to be completed by the project team. Overseen by TxDOT's Traffic Safety Division and in collaboration with TxDOT's Cooperative and Automated Transportation Program, the majority of the work will be executed by TTI staff with research, transportation, data engineering, signalization, and ITS expertise (see **Appendix I** for staff resumes). See **Exhibit 2** for the proposed timeline. In Stage 2, there will be deployment of a scalable solution across a significant portion of TxDOT's work zones. Once deployed, the team will assess the feasibility of replicating this solution for other work zones, aiming to create a framework that can be adopted by state transportation agencies.

Exhibit 2: Project Timeline

Task		Month					
		1-3	3-6	6-9	9-12	12-15	15-18
1	Project Kickoff						
2	Develop Baseline and Protocols						
3	Consolidate TxDOT and Project WZDx Feeds						
4	Deploy and Evaluate Equipment						
5	Review Data and Enhancements						
6	Collect Data and Build Implementation Report						

Task 1: TxDOT commits to selecting an equipment supplier during the award notice phase to meet the timeline within three months of executing the grant agreement. This task will finalize work zone locations, partner agreements, data management plans, and a Project Advisory Committee.

Task 2: The chosen supplier will configure TTC equipment/wearables and set up troubleshooting and usage standards for road workers. The Plausibility Checker Tool will validate the Project's WZDx feed, eliminate data errors algorithmically, and establish work zone baselines for long-term, short-term, and active work zones.

Task 3: Both TxDOT's and the Project's WZDx feeds will be consumed using the Plausibility Checker. This will generate a Consolidated WZDx feed for planned and unplanned work zones.

Task 4: TTI and the supplier will conduct Consolidated WZDx feed verification studies with ground truth. Controlled tests will adjust feed data to changing conditions. Real work zone deployment will compare data with device/worker movement records, addressing discrepancies.

Task 5: System enhancements will be developed iteratively ensuring ongoing alignment.

Task 6: Live data will be collected and analyzed in the Implementation Report, assessing project costs, benefits, feasibility, methodology, and how the Project's WZDx feed integrates with TxDOT's WZDx feed.

Legal, Policy, and Regulatory Requirements

The installation and deployment of this technology does not require any special permitting or regulatory processes and is in line with current federal recommendations. The project will adhere to TxDOT's *Smart Work Zone Guidelines* where applicable. The system uses traffic monitoring data and vehicle speeds, no PII will be collected.

Performance Measurement

Key performance indicators (KPIs) are selected data categories used to identify changes from pre to post WZDx feed deployment. The results will indicate if the pilot met the three goals listed in the Project Overview section.

Potential KPIs:

- Number of actual versus planned work zones
- Number of work zone events confirmed by active device feeds and workers present.
- Number of unplanned work zone events detected by the system.
- Start/end time of actual versus planned work zone events.
- Location accuracy of actual versus planned work zone events.
- Type of work zone events (e.g., single vs multi-lane closures, etc.) compared to the planned work zone event information.
- Average speed of drivers.
- Number of crashes within the work zone.
- Crash type within work zones.

Workforce Development

Elevating work zone safety through technology advances workforce development by offering skill-building opportunities and exposure to innovative technologies, cultivating a safer workplace, and curbing injuries. This project attracts skilled talent, encourages career advancement, and champions data-driven decision-making, which greatly impacts racial minorities, given that Hispanics account for 46.7 percent of all construction laborers[8]. This mutually beneficial connection between safety and workforce development amplifies qualifications and overall productivity, with a pronounced impact on minority workers.

Community Engagement and Partnerships

Community-Centered Approach: This project will build on the findings of previous deployments of WZDx integration technology. There will be deliberate engagement with roadway workers and drivers to confirm that the solution is meeting their needs.

Public and Private Sector Partnerships: This Project Advisory Committee will feature public and private sector representatives from TxDOT, Fluor, TTI, and possibly roadway workers and drivers. The proposed staff will work closely with Fluor and the future supplier to configure the technology and troubleshoot any deployment issues.

Established Commitment: Letters of Commitment from Fluor and TTI are included in **Appendix III** and partner responsibilities are in the Personnel section of **Appendix II**.

Leadership and Qualifications

Rafael Riojas, P.E., with 31 years of expertise in traffic engineering, will oversee the project, leveraging his leadership in policy development at TxDOT. He'll be supported by Eduardo Villalon, P.E., TxDOT's Traffic Engineering Section Director. The TTI team, led by Melisa Finley, P.E., will handle WZDx feed deployment and data collection, with support from Dr. Kevin Balke, P.E., David Florence, P.E., and Hassan Charara. This TxDOT/TTI team is expected to lead Stage 2 if the proposal is funded. In addition to the relevant and technical expertise of the project team, TxDOT has relevant experience in managing similar multi-stakeholder projects. Last year, TxDOT was awarded a SMART Grant for their Smarter Intersections Pilot Project.

8 https://www.bls.gov/spotlight/2022/the-construction-industry-labor-force-2003-to-2020/home.htm

Appendix I: Resumes

Rafael Riojas, PE

Traffic Engineering Policy and Standards Branch Manager, Traffic Safety Division, TxDOT

Rafael serves as the Policy and Standards Branch Manager at the Texas Department of Transportation, Traffic Safety Division in Austin, TX, where he has led a team of eight Professional Engineers and Engineering Assistants since August 2021. Rafael is responsible for team development, publication of division manuals, and updates to guidelines, including the Work Zone Safety and Mobility Guidelines.

Rafael also directs Traffic Control Review Team (TCRT) activities, ensuring compliance with federal law and standards. He coordinates the assessment of new traffic control devices for compliance with the Manual for Assessing Safety Hardware and represents TxDOT as a subject matter expert. Rafael provides guidance for non-standard signs and memorial signing programs, actively coordinates within the division and with other units, and leverages his 30 years of experience in highway planning and design to advance division goals.

Before this role, Rafael served as Lead Engineer in the Traffic Safety Division, overseeing standards and representing TxDOT. Earlier in his career as a consultant, he managed projects, mentored staff, and led design efforts for various roadway projects.

Eduardo Villalon, PE

Traffic Engineering Section Director, Traffic Safety Division, TxDOT

Mr. Villalon, with over 12 years of diverse experience in transportation engineering in both public and private sectors, has honed his expertise at TxDOT. He tackled various roles within the San Antonio District, spanning Design, Maintenance, Laboratory, Construction, and Traffic Engineering, gaining valuable skills in planning, design, construction, and maintenance of transportation projects, alongside expertise in traffic analysis and safety assessments.

During his tenure in Design, he played a pivotal role in developing plans for the IH 410 and SH 151 Direct Connector Phase I project, leading engineering design aspects like traffic control plans, signalization, SPAT, and signage. In addition, Eduardo contributed to widening and rehabilitation projects, focusing on traffic control, safety, and engineering in the PS&E phase.

As the District Traffic Engineer, he managed $50M/year in projects and spearheaded the District's Highway Safety Improvement Program (HSIP), covering various projects from WZITS to bridge widenings. Currently, as the Traffic Engineering Section Director in TxDOT's Traffic Safety Division, he oversees work zone safety initiatives, HSIP, TMUTCD, traffic standards, speed zoning recommendations, and serves as the department's traffic engineering expert.

Melisa D. Finley, P.E.

Program Manager and Senior Research Engineer, Work Zone and Dynamic Signs Program, Texas A&M Transportation Institute

Melisa Finley is a Senior Research Engineer and the Program Manager of the Work Zone and Dynamic Signs Program in the Transportation Operations and Roadway Safety Division of the Texas A&M Transportation Institute (TTI). She has led over 40 studies relating to work zone safety and operations in her 24-year career. She has also conducted research concerning wrong-way driving, connected vehicles, traffic control measures and devices, and STEM K-12 educational outreach. Her experience includes numerous projects with the Texas Department of Transportation (TxDOT) and Federal Highway Administration (FHWA). She has also conducted research for the National Cooperative Highway Research Program (NCHRP), California DOT, Florida DOT, Ohio DOT, the North Texas Tollway Authority and various University Transportation Centers. She has extensive experience with developing experimental plans and conducting research to assess the safety and operational effectiveness of intelligent transportation systems and traffic control devices.

Ms. Finley is the Chair of the Transportation Research Board (TRB) Standing Committee on Traffic Control Devices (ACP55) and a technical member of the National Committee on Uniform Traffic Control Devices (NCUTCD) Temporary Traffic Control Technical Committee. She has published 30 peer-reviewed papers in the Transportation Research Record: Journal of the Transportation Research Board.

Kevin Balke Ph.D., P.E.

Senior Research Engineer, Connected Infrastructure Program, Texas A&M Transportation Institute

Dr. Balke boasts a remarkable 39-year career in transportation operations, specializing in Intelligent Transportation Systems (ITS), Freeway Operations, Traffic Signal Systems, Weather-Responsive Traffic Management, Traveler Information Systems, Incident Management, and Work Zones. He's played a pivotal role in nationally significant evaluations for the Federal Highway Administration, including the Connected Vehicle Pilot Deployment Independent Evaluation and various demonstration projects.

His expertise extends to prototype connected vehicle applications, such as Traffic Optimization for Signalized Corridors, Wrong Way Driving in a Connected Vehicle Environment, and Level 2 Automated Truck Platooning. Dr. Balke has authored key publications like the Traffic Signal Program Handbook and contributed to the Signal Timing Manual update.

Furthermore, he's conducted research on various topics, including weather-responsive traffic signal operations, incident management, and capability modeling for traffic system management. Dr. Balke has also led research projects for the Texas Department of Transportation and is an experienced instructor and course developer for the National Highway Institute.

David Florence, P.E.

Assistance Research Engineer, Connected Infrastructure Program, Texas A&M Transportation Institute

Mr. Florence is a professional engineer with nine years of experience working at TTI. His expertise includes traffic signal systems and control, microsimulation, Intelligent Traffic Systems (ITS), freeway design, wrong way driving detection, and traveler information systems. Mr. Florence is skilled in traffic signal systems and deployment of detection technology. Mr. Florence is a skilled programmer who has scripted applications to generate real time traveler information and applications to facilitate data collection. He has experience with field deployments and testing of systems in the field including deploying ITS devices in the field including 14 intersection deployments of devices to support partially autonomous vehicles along FM 1960 in Houston, TX. Mr. Florence uses his data analysis expertise and traffic operations evaluation skills to evaluate both simulation and field operations across various research projects.

Hassan Charara

Software Engineer V, Connected Infrastructure Program, Texas A&M Transportation Institute

Mr. Charara, a Software Engineer at the Texas A&M Transportation Institute's Connected Infrastructure Program, boasts 30+ years of expertise in software design, development, field implementation, and evaluating technologies, including Connected Vehicle applications, Traffic Signal Monitoring and Analysis, ITS systems, and Traffic Sensor Technology. Since joining TTI in 1993, he has actively contributed to pivotal projects. One such project aimed to showcase technologies for providing information to freight carriers in connected work zones. Collaborating with Drivewyze, Inc., Mr. Charara introduced in-cab alerts for truck drivers approaching work zones, necessitating the installation of Electronic Logging Devices (ELD) and the Drivewyze application on mobile devices.

Another critical contribution involved evaluating Wrong-Way Driving Detection Technologies, rigorously testing ten systems at the Texas A&M University RELLIS campus. He also played a key role in the Traffic Optimization for Signalized Corridors (TOSCo) project, overseeing the generation and broadcast of SAE J2735 standard messages to connected vehicles in Houston's FM-1960 corridor. This required deploying 14 Dedicated Short-Range Communications (DSRC) Road-Side-Units (RSUs) at intersections for message broadcasting to automated and connected vehicles.

Mr. Charara's expertise further extends to evaluating and testing traffic sensor detector technology for intersections and freeways. He successfully developed and deployed prototype systems across Texas, including the Advanced Warning of End of Green System (AWEGS), Innovative Methods to Reduce Stops to Trucks at Signalized Intersections, Fully Adaptive Detection-Control System (D-CS) for Isolated Intersections, Real-Time Multi-Modal Traffic Adaptive Interchange Control (Smart Diamond), and the Platoon Identification and Accommodation System for Isolated Traffic Signals on Arterials.

Appendix II: Budget Narrative

The total budget for the project is dedicated to the Texas A&M Transportation Institute (TTI) and a Future Potential Supplier at $1,855,376. As per the SF424A instructions, as a sub-recipient to the Texas Department of Transportation, all TTI and future supplier expenses are included in the "Contractual" category. TxDOT is seeking $200,000 to fund their existing consultant's support in integrating WZDx into the Drive Texas feed. All other TxDOT staff time will not be charged to the project. **This budget breakdown and accompanying narrative is for informational purposes only**.

	TxDOT Drive Texas Consultant	TTI	Potential Supplier Estimate*
Personnel	-	$ 298,983	$ 920,000
Fringe Benefits	-	$ 84,518	-
Travel	-	$ 57,267	$ 15,000
Equipment	-	$ 10,000	$ 25,000
Supplies	-	$ 5,000	-
Contractual	$200,000	-	-
Construction	-	-	-
Other	-	$ 5,580	-
Total Direct	**-**	**$ 461,348**	-
Indirect	-	$ 234,028	-
Total	**$200,000**	**$ 695,376**	**$ 960,000**
Grand Total	**$1,855,376**		

** Totals based on high-level cost estimate provided by a potential supplier (Valtech). A supplier will be selected ahead of the final grant agreement.*

TTI Personnel

Melisa D. Finley, P.E., Senior Research Engineer and Program Manager, Work Zone and Dynamic Signs Program: (25% FTE). Ms. Finley will oversee the TTI team, coordinate the development and execution of the validation and evaluation plans, and assist with the study documentation and development of the Phase II implementation plan. She will attend meetings, as needed, and provide all required information to support project documentation.

Kevin Balke, Ph.D., P.E., Senior Research Engineer, Connected Infrastructure Program: (22% FTE). Dr. Balke's primary responsibility will be planning and organizing the validation and evaluation studies for the deployment. He will be responsible for developing the evaluation and data management plan. His responsibilities also include planning, organizing, and executing the field data collection and developing the test plans for conducting the validation studies. He will also document the study methodologies and results and assist with the development of the Phase II implementation plan.

David Florence, P.E., Assistance Research Engineer, Connected Infrastructure Program: (27% FTE). Mr. Florence will assist Dr. Balke in the planning and organizing field validation and evaluation studies. Mr. Florence will assist in the collection and analysis of the collected data and with documenting the results.

Hassan Charara, Software Engineer V, Connected Infrastructure Program: (10% FTE). Mr. Charara will be responsible for developing programs and tools to assist with managing the data collected by the project team. Mr. Charara will also be responsible for creating and managing data management processes.

The TTI team *may* include other full-time technical staff, deliverable support staff, graduate student support, and administrative support staff.

Supplier Personnel

Non-Recurring Engineering: The allocation of $860,000 towards non-recurring engineering (NRE) costs is pivotal for the research, design, development, and testing of a new product or enhancement. These one-time expenses, though substantial, are essential to ensure product's long-term success.

In-Field Testing: The allocation of $60,000 for in-field testing, include installation, deployment, and on-going support for the project.

Funds Requested for Personnel: $1,218,983

Fringe Benefits

The fringe benefits at TTI include Social Security, Medicare, workers' compensation, unemployment compensation, retirement, and leave termination and are calculated at 19.7% of salary for full-time faculty and staff. Group medical insurance is calculated as $1,033.00 per month for full-time faculty and staff.

Funds Requested for Fringe Benefits: $84,518

Travel

The travel costs include mileage, meals, and lodging for TTI key personnel to attend project meetings in Washington, DC with USDOT. Additional travel costs will support local travel to project meetings and field visits for both TTI and the supplier.

Funds Requested for Travel: $72,267

Equipment

Procured equipment will be determined once a supplier is selected. Funds requested are based on initial cost estimates from a potential supplier (Valtech) for connected TTC and wearables.

Funds Requested for Equipment: $25,000

Supplies

Supplies includes equipment rentals for conducting field studies.

Funds Requested for Supplies: $5,000

Contractual

Contractual costs include payment to TxDOT's current Drive Texas consultant for the integration of this Project's WZDx feed into TxDOT's current WZDx feed. All other work performed by TxDOT will be funded by the state.

Funds Requested for Contractual: $200,000

Other Direct Costs

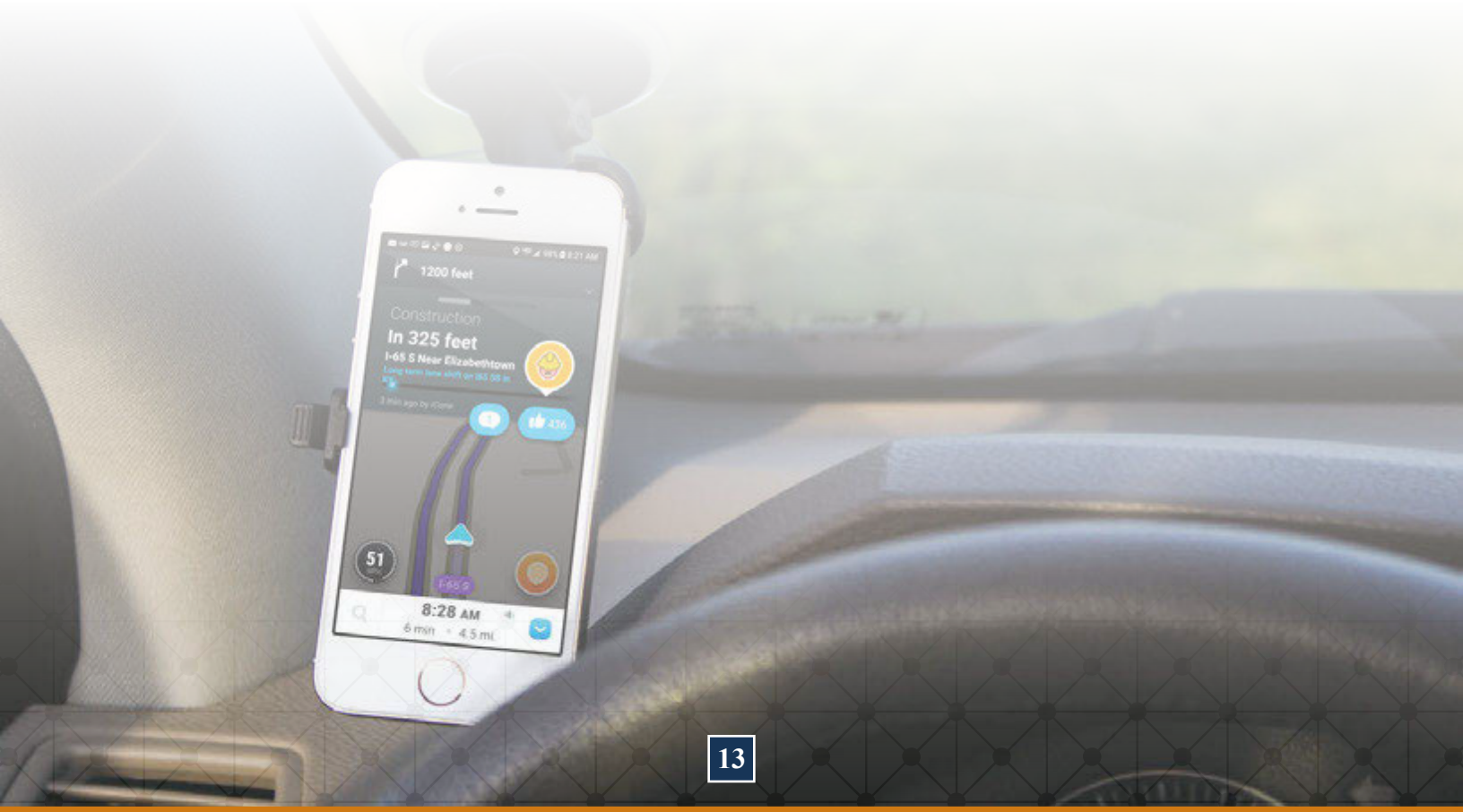
The other direct costs include computer costs to be billed based on usage of computer time based on employee percentage of month worked and shall not exceed $225 per staff-month as shown above.

Funds Requested for Other Direct Costs: $5,580

Indirect Costs

The Federally approved indirect rate for the Texas A&M Transportation Institute is 52.5% of the Modified Total Direct Cost (MTDC = $445,768).

Funds Requested for Indirect Costs: $234,028



Appendix III: Letters of Commitment

Letters of Commitment from the following project partners are provided:

- Texas A&M Transportation Institute
- Fluor

Texas A&M Transportation Institute
3135 TAMU
College Station, TX 77843-3135

979-317-2000
Fax: (979) 888-9477
http://tti.tamu.edu

September 27, 2023

The Honorable Pete Buttigieg
Secretary
United States Department of Transportation
1200 New Jersey Avenue SE
Washington, DC 20590

Dear Secretary Buttigieg:

The Texas A&M Transportation Institute (TTI) commits to participating in the SMART Grants Program, **Augmenting Ground-Truth by Validating Work Zones and Identifying Worker Presence Stage I Project** proposal submitted by the Texas Department of Transportation (TxDOT). TTI has the staff resources, technical expertise, and facilities to complete the proposed project on time and on budget. TTI has strong ongoing partnerships with TxDOT, the City of Austin, and Fluor.

The proposed project will connect WZDx validated work zone and active work zone feeds, based on worker presence, to the DriveTexas System for a specified region. This project will also identify discrepancies between planned event data and actual event data, and document lessons learned about how information from connected devices can be processed and vetted to provide validated information about active work zones. Such real-time information can be consumed by third-party entities to further enhance the safety of workers.

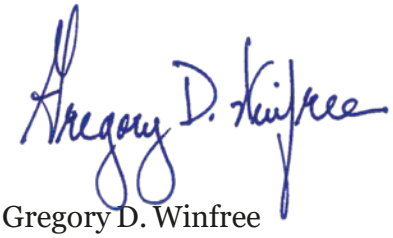
TTI commits to conducting the following activities:

- TTI will establish a process for evaluating the functionality of the connected equipment and the data received, processed, and shared, including key performance indicators.
- TTI will create a database for collecting and storing information to be used in the evaluation.
- TTI will validate the system versus ground truth for six months and make recommendations regarding system enhancements.

- TTI will evaluate the system from deployment to the end of Stage I, approximately eight months.
- TTI will document the evaluation results in a report and PowerPoint presentation.
- TTI will conduct other activities as appropriate.

TTI is confident that this project will provide numerous benefits supporting federal, state, and local goals associated with safety, mobility, technology, and innovation. The long-standing strong working relationship among TTI, TxDOT, the Austin, and Fluor ensures the success of this project.

Very truly yours,



Gregory D. Winfree
Agency Director

September 26, 2023

The Honorable Pete Buttigieg
Secretary
United States Department of Transportation
1200 New Jersey Avenue SE
Washington, DC 20590

Dear Secretary Buttigieg:

Fluor commits to participating in the SMART Grants Program, **SMART Work Zones Stage I Project** proposal submitted by the Texas Department of Transportation (TxDOT). Fluor has the staff resources, technical expertise, and facilities to complete the proposed project on time and on budget. Fluor has strong ongoing partnerships with TxDOT, the City of Austin, and Texas A&M University (TTI).

The proposed project will connect WZDx validated work zone and active work zone feeds, based on worker presence, to the DriveTexas System for a specified region. This project will also identify discrepancies between planned event data and actual event data, and document lessons learned about how information from connected devices can be processed and vetted to provide validated information about active work zones. Such real-time information can be consumed by third-party entities to further enhance the safety of workers.

Fluor commits to conducting the following activities:

- **Implementation of WZDx-Enabled Devices**: Commit to installing and maintaining WZDx-enabled devices in designated work zones.
- **Discrepancy Identification:** Actively identify and report any discrepancies between planned event data and actual event data in a timely manner.
- **Lessons Learned Documentation:** Commit to documenting and sharing insights and lessons learned from the processing and vetting of data from connected devices. This documentation should include recommendations for improving data quality and usability.
- **Data Security and Privacy:** Adhere to all data security and privacy regulations and standards, ensuring that sensitive information related to workers and work zone operations is protected and not compromised.
- **Training and Education:** Assist TxDOT and TTI in training relevant personnel within Fluor on the proper use and maintenance of WZDx-enabled devices, data handling procedures, and the importance of data accuracy and security.

Fluor is confident that this project will provide numerous benefits supporting federal, state, and local goals associated with safety, mobility, technology, and innovation. The long-standing strong working relationship among Fluor, TxDOT, TTI, and the City of Austin ensures the success of this project.

Sincerely,

Matthew Krein
Project Director – I-35 Capital Express South