

Saving Lives with Connectivity: Accelerating Vehicle to Everything (V2X) Deployment

Transforming Roads, Unleashing Smart Technologies (TRUST): Deployment Concept

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- You are welcome to ask questions via chat box at the Q&A Section.
- The webinar recording and the presentation material will be made available on ITSA's website.

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Agenda

1	Straight Talk On V2X
2	National Perspective
3	Why is V2X Important?
4	The TRUST Project
5	Our Use Cases
6	Our Status
7	Next Steps
8	What Success Looks Like
9	What Keeps Me Up At Night?
10	Q and A

What is Vehicle-to-Everything (V2X)?



V2X is communications technology that allows vehicles to communicate (beyond line of sight) with each other, infrastructure, and other road users.



It enhances **safety**, **mobility**, and **efficiency** by enabling real-time alerts and coordination.



Helps prevent crashes, reduce congestion, and improve traffic flow through smarter transportation systems.

Is V2X New?

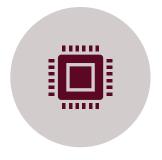
- V2X is not a new concept, but its deployment is just beginning.
- Research and testing have been ongoing for 20+ years, with pilots and early deployments across the U.S. and globally.
- Advancements in wireless technologies, AI, and automation are now making large-scale deployment more feasible and impactful.

How is v2x different than autonomous vehicles?

- AVs rely primarily on vehicle sensors and cameras
- V2X enables communication between vehicles and the environment
- V2X supports cooperative driving, while AVs focus on making decisions independently.
- V2X can enhance safety and awareness for human-driven vehicles, while AVs focus on self-driving capabilities.

Connected ≠ Self Driving

What's The Current Status of V2X?



Equipment – Sending information into the "air" is available.



Standards – Messaging standards exist and continue to evolve.



Vehicles – Few can receive (only a few very high-end models).



Prospective Users – No direct reception. A few cellphone apps.

Initiative Goals

Deploy, operate, and showcase integrated, advanced interoperable deployments.

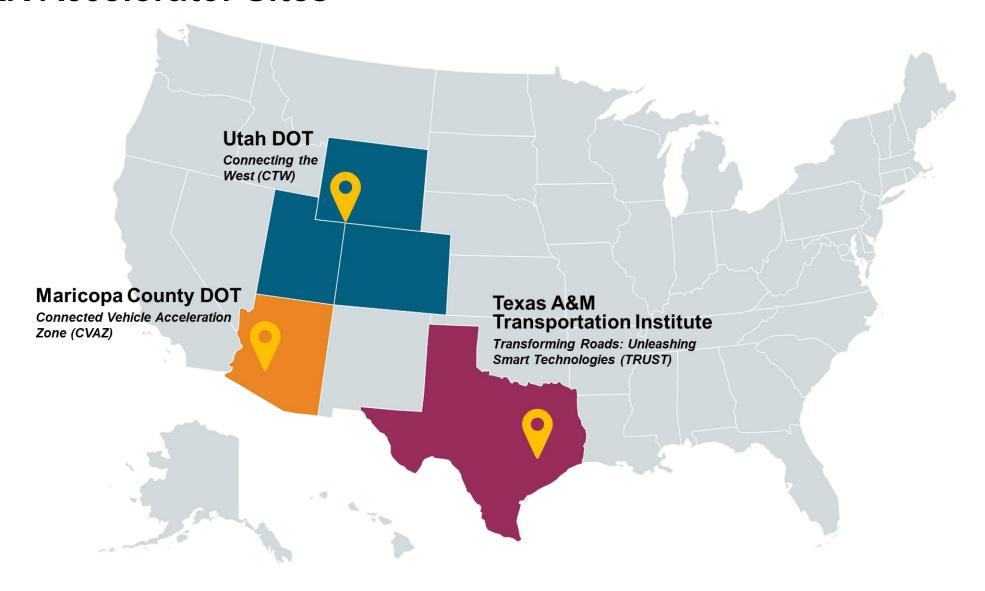
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Inform and educate the ITS community and the general public regarding these impacts.

03

Support the development, evaluation, and documentation of a suitable reference implementation.

V2X Accelerator Sites



Structure and Phasing



Why is V2X Important?

It's all about trusted traveler information!

"I'm not seeing an escape route and drivers are always on their phones. I hope they see me."

- Motorcyclist

"Every second counts. I wish we could get there faster."

- Emergency Responder

"I often feel unsafe crossing the street, especially when drivers make fast left turns while I'm in the crosswalk."

- Pedestrian

"Every second counts. I wish we could get there faster."

- Freight Operator

"I like taking my time while crossing the street but I'm worried if I don't hurry a driver might not notice me or wait long enough."

- Senior Adult

"People never slow down, even with all the signs. Someone could get hurt."

- Roadside Worker

USER **PERSPECTIVES**

SAVING LIVES WITH CONNECTIVITY: ACCELERATING VEHICLE TO EVERYTHING (V2X) DEPLOYMENT "I'm not seeing an escape route and drivers are always on their phones. I hope they see me."

"Do they ever clean construction zones? I almost lost traction on some gravel."

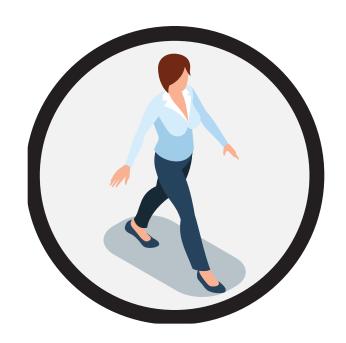


- Example applications:
 - Vulnerable Road User Alerts
 - Work Zone Warning
 - Left-Turn Conflict Warnings
 - Blind Spot Notifications
 - Adverse Weather Warnings
 - Etc.

"I often feel unsafe crossing the street, especially when drivers make fast left turns while I'm in the crosswalk."

"This is the quickest way to get to work, but there's no traffic signal here. What if a driver doesn't notice me crossing?"

- Example applications:
 - Vulnerable Road User Alerts
 - Left-Turn Conflict Warnings
 - Blind Spot Notifications
 - Increased Visibility of Vulnerable Road Users
 - Etc.



"Every second counts. I wish we could get there faster."

"Sometimes it feels like drivers don't even know we're coming. They don't react fast enough."



- Example applications:
 - Emergency Vehicle Notification
 - Real-Time Traffic Updates and Information
 - Signal Priority for Emergency/Transit/and Freight Vehicles
 - Incident Response Routing
 - Etc.

"People never slow down, even with all the signs. Someone could get hurt."

"I feel nervous turning my back to traffic. I hope drivers are paying attention."

- Example applications:
 - Work Zone Warning
 - Road Worker Alerts
 - Blind Spot Notifications
 - Wrong-Way Driver Alerts
 - Planned Construction and Special Event Routing
 - Etc.



"It's hard to keep schedule when I'm constantly surprised by road conditions."

"I worry most at night or in bad weather. It's hard to see people or stalled cars in time."



- Example applications:
 - Work Zone Warning
 - Adverse Weather Warning
 - Red Light Violation Warning
 - Real-Time Traffic Updates and Information
 - Signal Priority for Emergency/Transit/and Freight Vehicles
 - Weather-Related Evacuation and Support
 - Lane Closure Warnings
 - Real-Time Information for All Travel Modes
 - Etc.

"I like taking my time while crossing the street but I'm worried if I don't hurry a driver might not notice me or wait long enough."

"I still enjoy driving, but I don't want my family to worry. I know that I don't react as quickly as I used to."

- Example applications:
 - Vulnerable Road User Alerts
 - Left-Turn Conflict Warnings
 - Smart Intersections,
 - Increased Visibility for Vulnerable Road Users
 - Increased Situational Awareness and Roadway Knowledge
 - Etc.



TRUST Vision and Mission

Vision:

To create the nation's most advanced, connected, and resilient transportation system—where every trip is safer, smarter, and more efficient.

Mission:

Through large-scale, real-world V2X deployments, we will integrate cutting-edge technologies across diverse environments, deliver measurable safety and mobility benefits, and set the standard for how connected systems transform transportation.



Our Approach in One Phrase

Build foundational! Think aspirational!

Our Approach

- Deploy V2X technology on and within:
 - TxDOT Roadways,
 - City of Houston,
 - Missouri City,
 - Fort Bend County,
 - College Station,
 - Transit Fleets,
 - Emergency Vehicles, and,
 - Construction Vehicles.
- Enhance existing infrastructure.
- Install new roadside equipment as warranted.
- Enable the delivery of safety messages and V2X communications.



Our IOO Partner: Texas Department of Transportation



- Largest state highway system in the nation more than 80,000 miles.
- Largest highway network in the U.S. with 314,000 miles of public road.
- Average daily vehicle miles traveled on Texas roadways exceeds 750 million miles
- Annual vehicle miles exceeds 280 billion miles.
- Nearly 25 years since no daily fatalities (November 7, 2000).
- Challenges include congestion, adverse weather, safety, and substantial construction.
- Implements technologies such as ITS, AI, V2X and more.
- Home to numerous autonomous vehicle firms seeking to prove and scale their technologies on Texas roadways.

Our IOO Partner: City of Houston

- 4th largest city in the United States.
- Largest city in Texas.
- Larger metropolitan area nears 7 million residents.
- 3,500 centerline miles of roadway with daily vehicle miles travelled exceeding 100 million.
- Nearly 80,000 intersections including more than 2,000 of which are signal controlled across multiple entities.
- In 2024, fatalities in Houston increased 15 percent, to 345.



Our IOO Partner: City of College Station



- Growth is approximately 1.2 percent per year.
- 75 percent population increase over the next 25 years.
- Spans approximately 50 square miles.
- More than 200 miles of streets, 102 signalized intersections.
- Congestion has been increasing by more than 2% per year.
- Congestion on SH6 is rapidly increasing with several hours per day now being in a congestion condition.
- SH 6 will soon undergo a \$671 million expansion to widen it from four to six lanes as well as changing access paths and providing shared use pedestrian and bicycle paths.

Our IOO Partner: Missouri City



- Home to approximately 80,000 people.
- Faces typical Houston area traffic volume and congestion challenges, particularly during peak hours.
- The city's location near major employment centers Houston contributes to congestion on connecting roadways.
- ITS technologies have been employed to help monitor and manage traffic, reduce congestion, and enhance safety.
- V2X technologies have been installed at some locations with the information being broadcast via a network approach.

Our IOO Partner: Fort Bend County

- Home to nearly a million people.
- Encompasses nearly 900 square miles
- Has several recent roadway and tollway expansion efforts.
- Significant increases in traffic crashes and fatalities.
- Utilizes ITS technologies for traffic monitoring, signal operation, and emergency operations.
- Implementing advanced technologies such as V2X and Artificial Intelligence (AI) to monitor traffic flow, detect pedestrians and bicycles, measure delays, and identify incidents like stalled vehicles and red-light runners.



15 different use cases

TRUST Use Cases

- Diverse environments.
- Both DIRECT and NETWORK applications.
- Multiple OEMs as partners with test vehicles.
- Bridging NETWORK applications into a development version of Google Maps.
- Phase 2 plans for VRU OBU applications.
- Phase 2 plans for additional fleet vehicles.
- Phase 2 'virtual' RSUs.

Texas TRUST Deployment Region



Applications in College Station

SPaT-Enabled Intersections for VRU Identification and Protection

Traffic Signal Preemption and Priority

Transit Fleet Integration

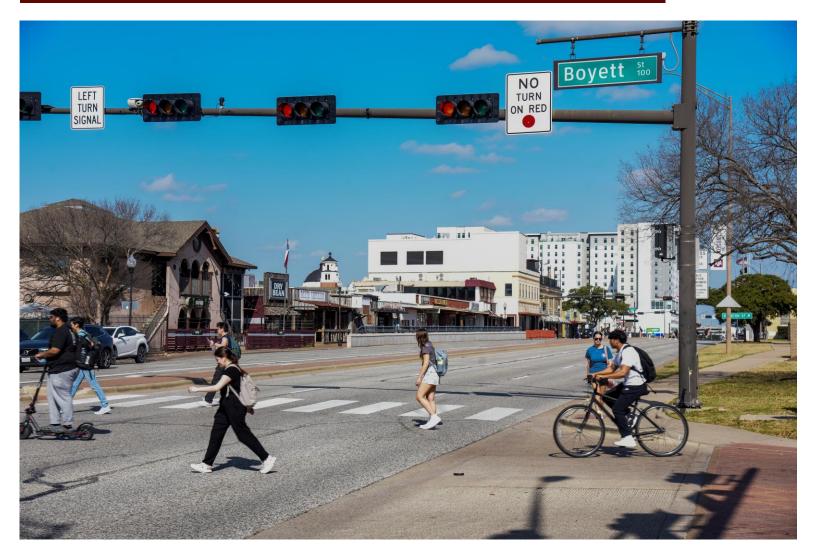
Every Day a Gameday

Enhanced Highway Construction Worker Safety





Use Case 1: SPaT-Enabled Intersections for VRU Identification and Protection







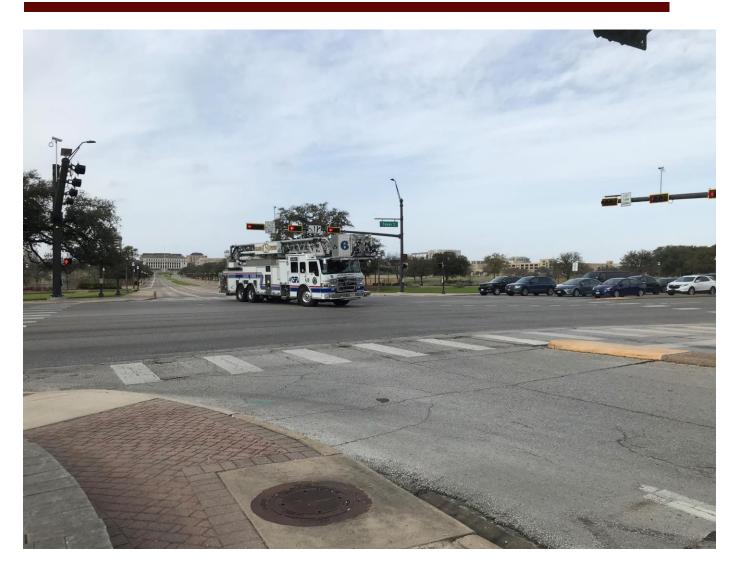
Use Case 1: SPaT-Enabled Intersections for VRU Identification and Protection



Goal:	Identify and Protect VRUs at SPaT Enabled Intersections in College Station (CS)
Scope:	 Equip 35 traffic signals across three major corridors in College Station. Use SPaT, MAP, SDMS, TIM, and RSA messaging for real-time communication. Provide support for emergency responders and transit vehicles through signal priority mechanisms. Future aspiration - May leverage personal devices and aftermarket V2X units to communicate alerts to VRUs.
Mode:	DIRECT



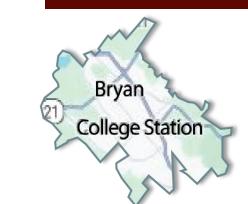
Use Case 2: Traffic Signal Preemption and Priority







Use Case 2: Traffic Signal Preemption and Priority



Goal:	Improve Emergency Response through Traffic Signal Preemption (TSP) and Priority in College Station
Scope:	 Support emergency vehicle preemption (EVP), rail preemption, and transit signal priority (TSP) using V2X OBUs, RSUs, and standardized messaging. Emergency vehicles transmit SRM messages; intersections respond with SSM messages to grant preemption. Interface with signal controllers via NTCIP 1202 and 1211 protocols.
Mode:	DIRECT



Use Case 3: Transit Fleet Integration







Use Case 3: Transit Fleet Integration



Goal:	Improve Transit Bus Mobility in College Station
Scope:	 Equip the 100 Busses in TAMU fleet for transit priority. Support transit vehicle preemption and transit signal priority (TSP) using V2X OBUs, RSUs, and standardized messaging. Transit vehicles transmit SRM messages; intersections respond with SSM messages to grant priority as warranted. Interface with signal controllers via NTCIP 1202 and 1211 protocols.
Mode:	DIRECT



Use Case 4: Every Day a Gameday







Use Case 4: Every Day a Gameday



Goal:	Improve Mobility in College Station
Scope:	Utilize history of stakeholder collaboration and operational data
	Compile and fuse available data from multiple systems.
	Construct TIM Messages based on situational awareness.
	Dissemination to a development version of Google Maps.
Mode:	NETWORK



Use Case 5: Enhanced Highway Construction Worker Safety







Use Case 5: Enhanced Highway Construction Worker Safety



Goal:	Enhance Highway Construction Worker Safety in College Station
Scope:	 Equip work zone vehicles with portable RSUs. Demonstrate broadcast to OBU equipped vehicles. (Future aspiration) - Workers may carry personal V2X devices to generate PSMs.
Mode:	DIRECT

Applications on NHS

Incident Management

Adverse Weather Events / Flooding

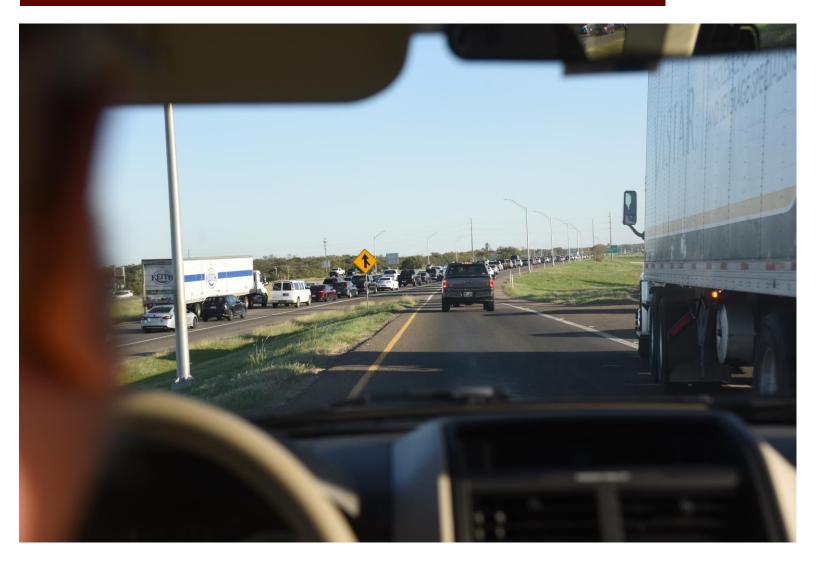
Construction events

Curve speed warning





Use Case 6: Incident Management







Use Case 6: Incident Management



Goal:	Improve Incident Management on identified locations on the National Highway System
Scope:	 Deploy RSUs or use existing ones to broadcast TIMs and RSAs for planned activities. Provide lane closure, detour, and parking information in advance of traveler arrival. Support integration with city event schedules and TxDOT work zone data. Future aspiration – blanket the system with virtual RSUs.
Mode:	NETWORK



Use Case 7: Adverse Weather Events / Flooding







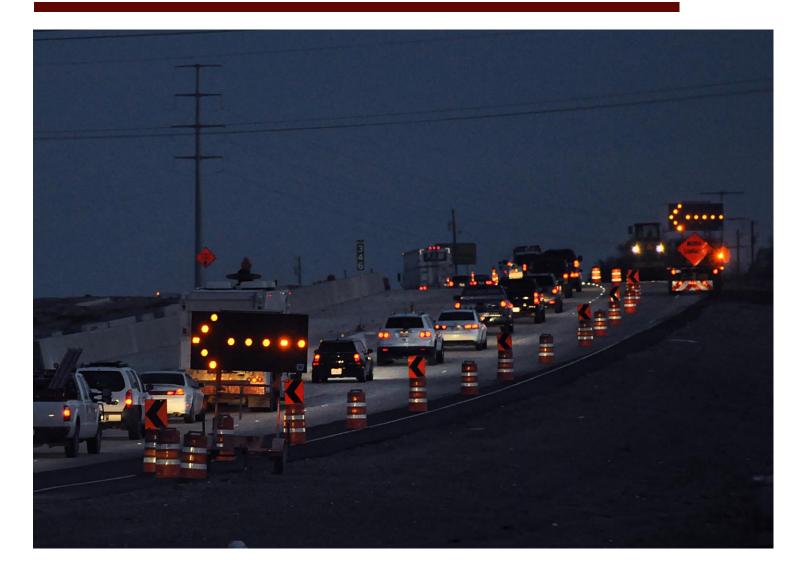
Use Case 7: Adverse Weather Events / Flooding



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Goal:	Address Weather Effects and Flooding on identified locations on the National Highway System
Scope:	Ingest flood sensor data and alerts.
	Broadcast TIMs, RSAs, and weather-related alerts from roadside and backend systems.
	Dissemination to a development version of Google Maps.
Mode:	NETWORK



Use Case 8: Planned Construction and Special Events







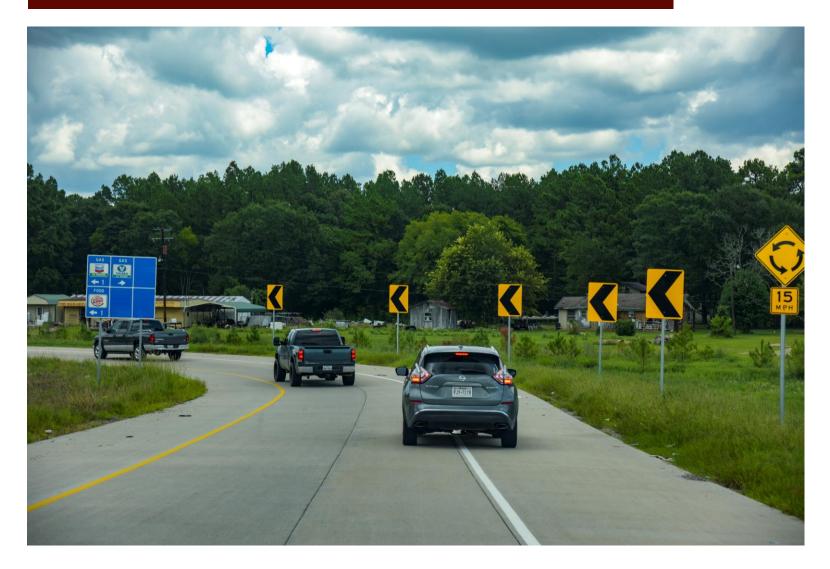
Use Case 8: Planned Construction and Special Events



Goal:	Improve Mobility During Planned Construction and Planned Special Events (PSEs) on identified locations on the National Highway System
Scope:	Disseminate closure alerts, travel time, and queue information depending on conditions.
	Dissemination to a development version of Google Maps.
	• Future aspiration – blanket the system with virtual RSUs.
Mode:	NETWORK



Use Case 9: Curve Speed Warning







Use Case 9: Curve Speed Warning



Goal:	Improve Safety at Sharp Curves on identified locations on the National Highway System
Scope:	 Curve speed warning based on weather and geometry. Dissemination to a development version of Google Maps. Future aspiration – blanket the system with virtual RSUs.
Mode:	NETWORK

Applications in Houston

Roadway Flood Warning

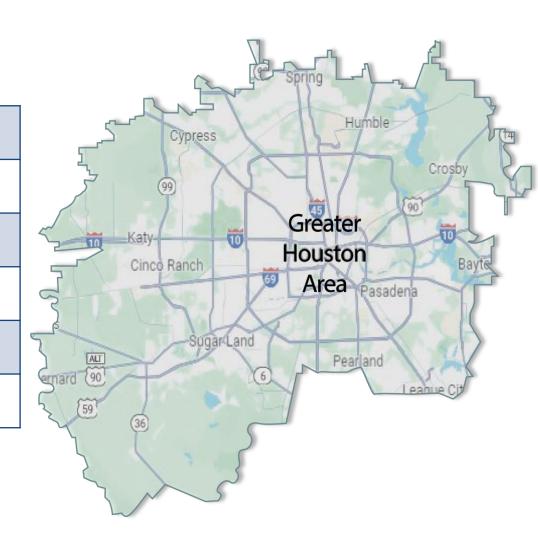
Houston SPaT-Enabled Intersections

Right Turns on Red Warning

Red Light Violation Warning

Wrong Way Driving

Emergency Vehicle Response Time and Safety





Use Case 10: Roadway Flood Warning







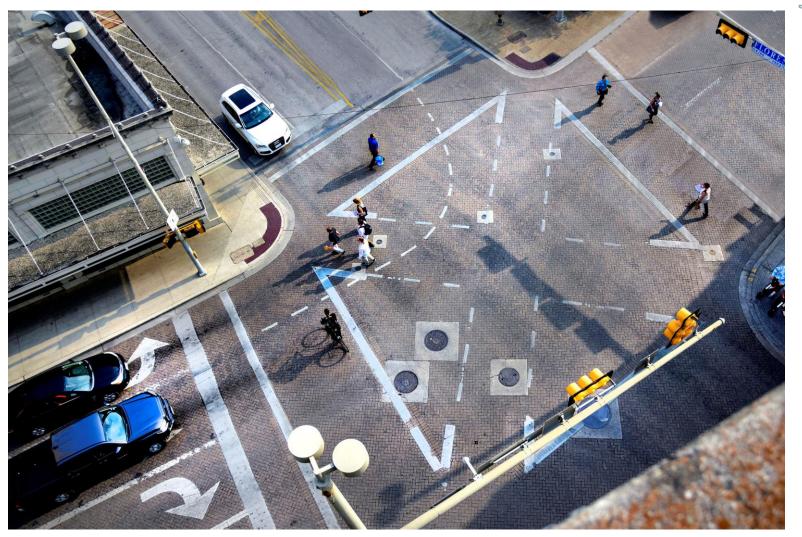
Use Case 10: Roadway Flood Warning



Goal:	Improve Mobility and Road Safety in Houston during Flooding
Scope:	 Integrate flood detection sensors with RSUs at high-risk locations. Create RSAs and TIMs for warnings.
	Dissemination to a development version of Google Maps.
Mode:	NETWORK



Use Case 11: Houston SPaT-Enabled Intersections







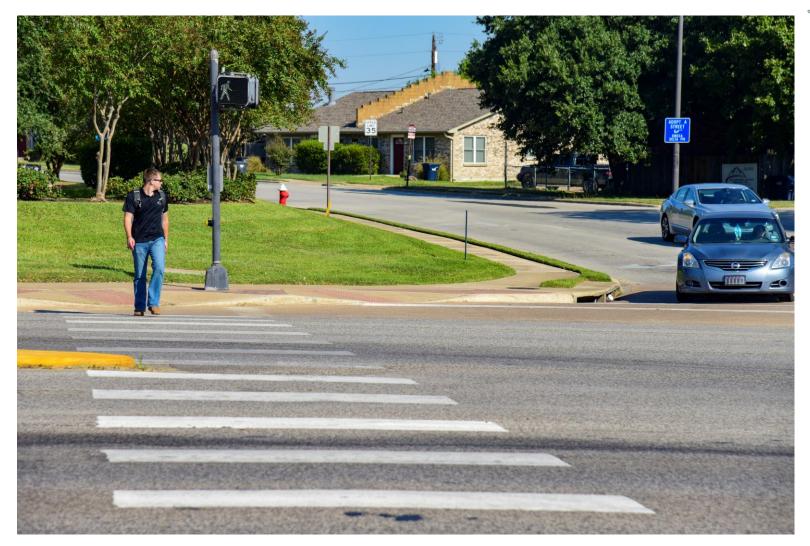
Use Case 11: Houston SPaT-Enabled Intersections



Goal:	Improve Safety and Mobility in Houston via SPaT Enabled Intersections
Scope:	 Deploy RSUs at targeted intersections. Broadcast SPaT, MAP, and related messages to approaching vehicles.
	Support applications like red-light violation warnings and signal phase countdowns.
Mode:	DIRECT



Use Case 12: Right Turn on Red VRU Protection







Use Case 12: Right Turn on Red VRU Protection



Goal:	Enhance VRU Safety in Houston through Right Turn on Red Warning at Intersections
Scope:	 Use detection systems to identify VRUs in the path of right-turning vehicles. Broadcast SDMS or RSAs to equipped vehicles to warn drivers.
Mode:	DIRECT



Use Case 13: Red Light Violation Warning







Use Case 13: Red Light Violation Warning



Goal:	Improve Safety in Houston through Red Light Violation Warning at Intersections
Scope:	 Use vehicle speed, distance, and SPaT data to determine violation potential. Broadcast warnings to the violating vehicle and potentially impacted cross traffic.
Mode:	DIRECT



Use Case 14: Wrong Way Driving







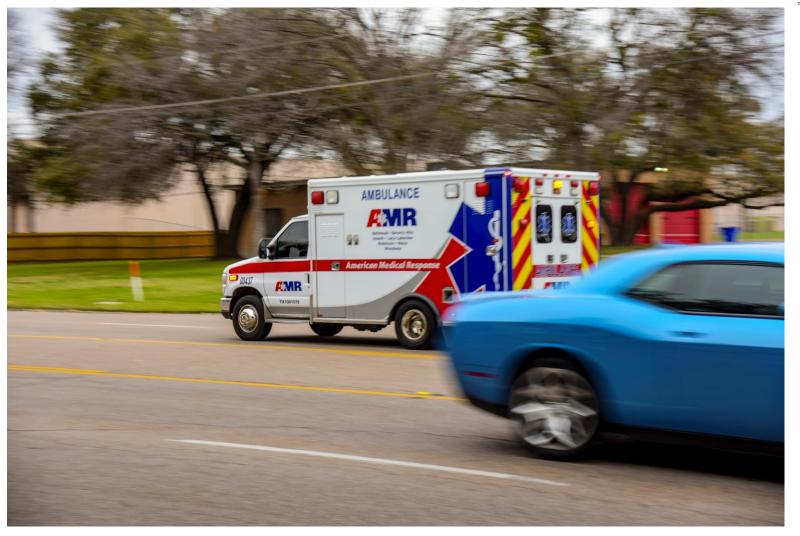
Use Case 14: Wrong Way Driving



Goal:	Improve Safety at Offramps in Houston through Wrong-Way Driving Detection
Scope:	 Utilize information feeds from existing WWD systems Dissemination to a development version of Google Maps. Future aspiration – blanket the system with virtual RSUs.
Mode:	NETWORK



Use Case 15: Emergency Vehicle Response Time and Safety







Use Case 15: Emergency Vehicle Response Time and Safety



Goal:	Improve Emergency Response and Safety in Houston
Scope:	 An approaching EV with active flashing lights is broadcasting BSM and EVA via its OBU. EV MAP and SPaT messages and starts sending a request for service through an SRM. The RSU generates an SSM and broadcasts it back to the EV. The RSU can also broadcast TIM to inform other users about the presence of the EVs
Mode:	DIRECT

Operational Concepts

Concept 1) Connected Intersections

- Use connected signals to improve intersection safety for all road users.
 - UC 1: SPaT-Enabled Intersections for VRU Protection
 - UC 11: Houston SPaT-Enabled Intersections
 - UC 12: Right Turn on Red Warning
 - UC 13: Red Light Violation Warning

Concept 2) Preemption and Priority

- Give emergency and transit vehicles the ability to request signal timing adjustments.
 - UC 2: Traffic Signal Preemption and Priority
 - UC 3: Transit Fleet Integration
 - UC 15: Emergency Vehicle Response Time and Safety



Operational Concepts

- Concept 3) Enhanced Safety
- Provide location-specific safety alerts to help drivers react quickly to changing roadway conditions.
 - UC 9: Curve Speed Warning
 - UC 5: Enhanced Highway Construction Worker Safety
 - UC 8: Planned Construction and Special Events

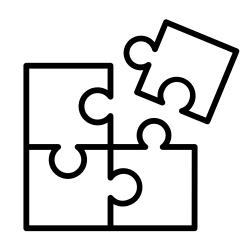
Concept 4) Enhanced Traveler Information

- Deliver timely updates on planned or unexpected roadway impacts.
 - UC 4: Every Day a Gameday
 - UC 6: Incident Management
 - UC 7: Adverse Weather Events
 - UC 10: Roadway Flood Warning
 - UC 14: Wrong-Way Driver Detection



Our Status

- Evolving system documentation
- 90% of equipment in house
- 35% installed (100% buses, 35 intersections)
- Developing MAP messages
- First set of intersections up and running (College Station)
- Multiple operational tours to TxDOT over last 3 days
- OEM vehicles in progress.
- Google Maps (development) in progress.
- Fully equipped test intersection in closed course setting



What Are The Next Steps?

- Continue documentation efforts
- Continue OEM collaboration and UIX development
- Complete equipment installation
- Test test test and then test again!
- Operational demo development
- Operational readiness testing
- Interoperability testing
- 'Before' data collection
- And more





- Implement 15 use cases successfully.
- Test 15 use cases successfully.
- Pass Phase 1 test gate.
- Show quantitative benefits.
- Demonstrate other aspects, such as latency
- Happy IOO partners.
- Be fiscally responsible.
- Achieve / exceed match requirements.
- Long-term partnerships for operations.
- Think aspirational deploy foundational

What Keeps Me Up At Night?

- Honestly, everything, but especially...
 - Providing the right vision
 - Finishing documentation
 - Getting things installed
 - Testing
 - Phase 1 gate check
 - Money
 - Long-term operations and maintenance clause



Stakeholder Q&A

Stakeholder Q&A

Please keep your phone muted.

Please use chatbox to ask questions.

 Questions will be answered in the order in which they were received.

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