PARSONS

CONNECTED VEHICLE DEPLOYMENTS ACROSS THE US

ITS NY

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Parsons

AGENDA

- CHICAGO
- DENVER
- SAN DIEGO
- DUBUQUE

CHICAGO

DIGITAL TRANSFORMATION ORIGIN

CHICAGO SMART MOBILITY (CSM) PROGRAM STARTED IN 2015

KEY COMPONENT IS THE ADVANCED TRAFFIC MANAGEMENT SYSTEM(ATMS) CENTRAL SYSTEM

MAIN GOAL WAS TO COLLECT AND PROCESS TRAFFIC DATA IN REAL-TIME AND BRING MULTIPLE CITY AGENCIES TOGETHER TO SHARE TRAFFIC DATA

CHICAGO SMART MOBILITY

Data Integrations

911/CAD Integration	DEO Dispatch and Work Order Integration	311 Integration	Speed Enforcement Cameras (Speed and Counts)	Speed Feedback Signs	Travel Midwest Integration
Crash data logs	Traffic signal database and asset management	Red light camera asset management	Camera feed	Dynamic Message Sign Integration	Roadway Permits
Arterial congestion estimates	Bus and Train locations	RWIS Weather Integration	Streets and Sanitation Work Order Integration	Google API use for travel time	Portable Changeable Message sign control and location
Stop sign inventory and asset management	Turning Movement Count Aggregation	Video Analytics Counts	Streets and Sanitation Integration	Miovision data interface	Trainfo Railway Gate Down Interface
Sensys Interface	Wejo Data Interface	Travel Time on IDOT signs	HERE probe data integration	National Weather Service Integration	

CDOT CV PROJECT GOALS

- Pilot Connected Vehicle technology & capabilities to be implemented at 7 intersections along Roosevelt Road
- OBU devices installed into 10 city fleet vehicles and 25 city buses to be used for evaluation and testing
- Pilot includes evaluating solutions for Pedestrian Detection (PSM) and Basic Safety Messages (BSM) to drivers for pedestrian awareness. Additionally, SPaT messages are to be transmitted to the driver indicating traffic signal timing countdown, in seconds.
- Become familiar, on a small scale, with C-V2X technologies and the considerations to be made when designing, implementing, and maintaining.

CONNECTED VEHICLE APPLICATIONS

V2I Safety

Red Light Violation Warning
Curve Speed Warning
Stop Sign Gap Assist
Spot Weather Impact Warning
Reduced Speed/Work Zone Warning
Pedestrian in Signalized Crosswalk Warning (Transit)

V2V Safety

Emergency Electronic Brake Lights (EEBL)
Forward Collision Warning (FCW)
Intersection Movement Assist (IMA)
Left Turn Assist (LTA)
Blind Spot/Lane Change Warning (BSW/LCW)
Do Not Pass Warning (DNPW)
Vehicle Turning Right in Front of Bus Warning (Transit)

Road Weather

Motorist Advisories and Warnings (MAW)
Enhanced MDSS
Vehicle Data Translator (VDT)
Weather Response Traffic Information (WxTINFO)

Environment

Eco-Approach and Departure at Signalized Intersections
Eco-Traffic Signal Timing
Eco-Traffic Signal Priority
Connected Eco-Driving
Wireless Inductive/Resonance Charging
Eco-Lanes Management
Eco-Speed Harmonization
Eco-Cooperative Adaptive Cruise Control
Eco-Traveler Information
Eco-Ramp Metering
Low Emissions Zone Management
AFV Charging / Fueling Information
Eco-Smart Parking
Dynamic Eco-Routing (light vehicle, transit, freight)
Eco-ICM Decision Support System

Agency Data

Probe-based Pavement Maintenance
Probe-enabled Traffic Monitoring
Vehicle Classification-based Traffic Studies
CV-enabled Turning Movement & Intersection Analysis
CV-enabled Origin-Destination Studies
Work Zone Traveler Information

Mobility

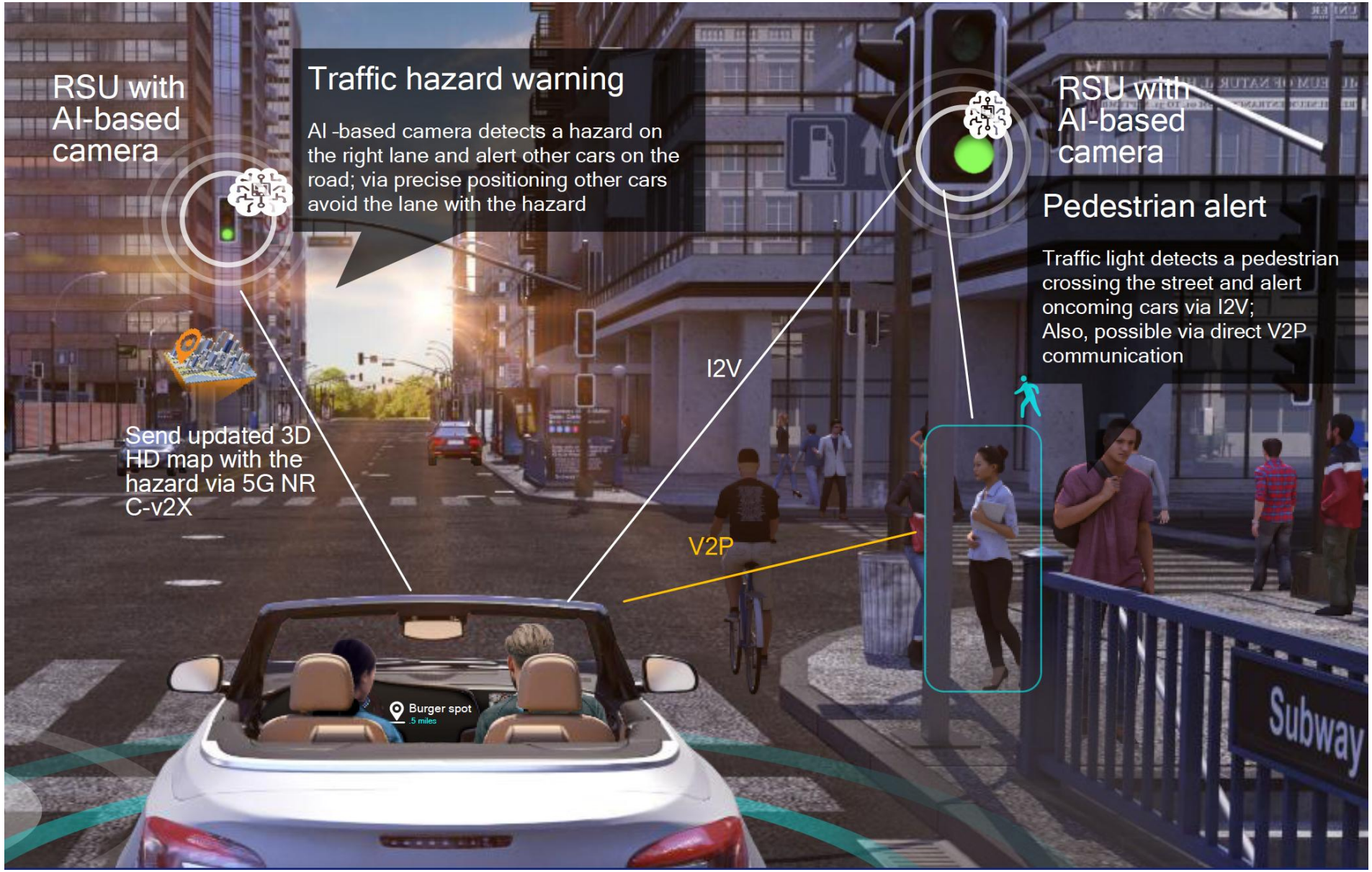
Advanced Traveler Information System
Intelligent Traffic Signal System (I-SIG)
Signal Priority (transit, freight)
Mobile Accessible Pedestrian Signal System (PED-SIG)
Emergency Vehicle Preemption (PREEMPT)
Dynamic Speed Harmonization (SPD-HARM)
Queue Warning (Q-WARN)
Cooperative Adaptive Cruise Control (CACC)
Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)
Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)
Emergency Communications and Evacuation (EVAC)
Connection Protection (T-CONNECT)
Dynamic Transit Operations (T-DISP)
Dynamic Ridesharing (D-RIDE)
Freight-Specific Dynamic Travel Planning and Performance
Drayage Optimization

Smart Roadside

Wireless Inspection
Smart Truck Parking

U.S. Department of Transportation 13

PEDESTRIAN ALERT (PSM) APPLICATION



PEDESTRIAN IN SIGNALIZED CROSSWALK

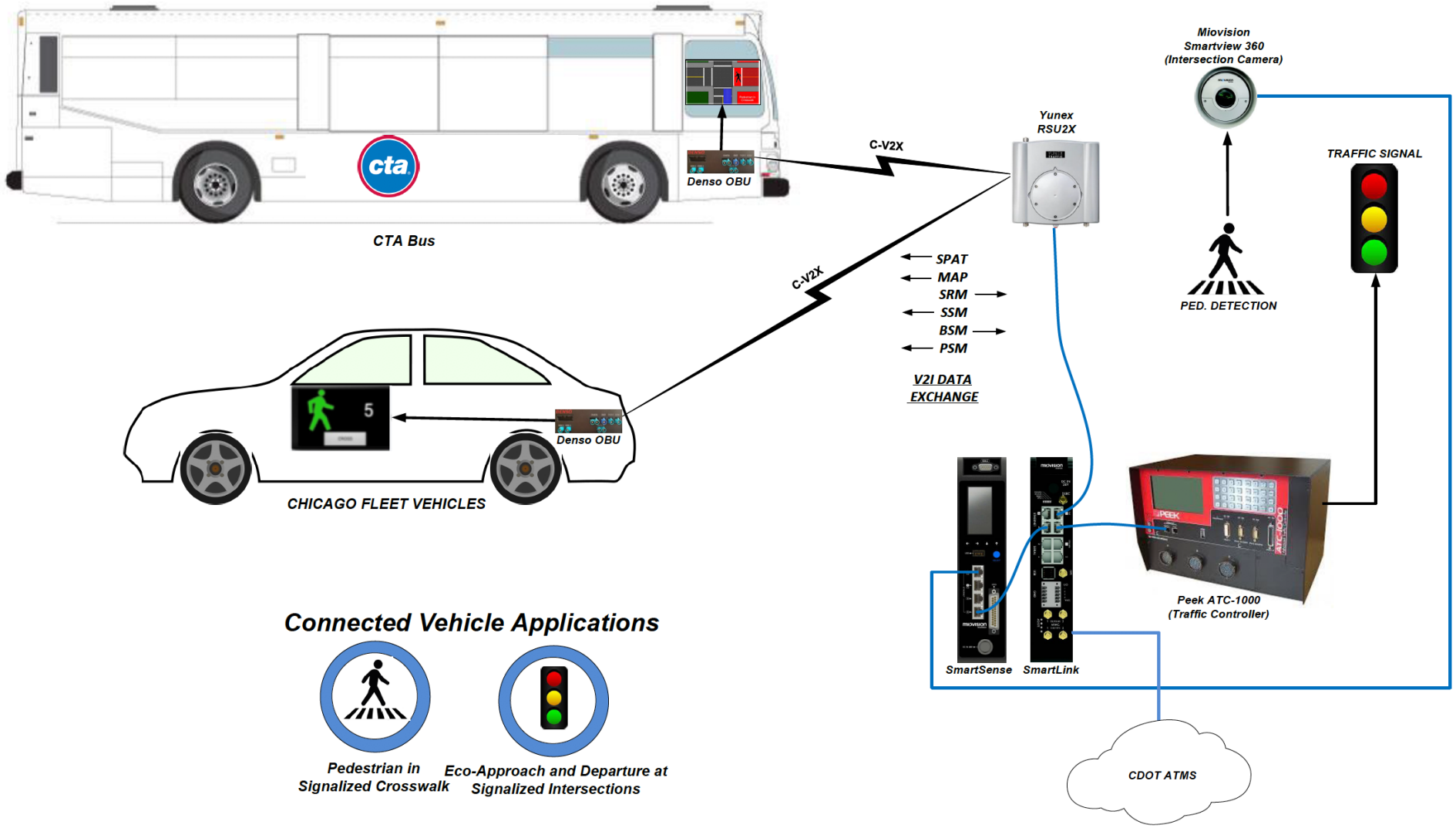
Pedestrian in Signalized Crosswalk Application alerts the driver when there is a danger of a collision with a a pedestrian. It is intended to reduce the chance of a collision.

How does it work?
Using GPS antenna on the vehicle as well as messages coming from the RSU and the cameras on the intersection, the OBU can determine that it is on a collision course with a crossing pedestrian.

Limitations
- Only works at at designated intersections
- If intersection equipment is down, app will not function
- Could display a warning even if pedestrian already crossed

Graphic Displayed to the Driver

DESIGN CV INFRASTRUCTURE SOLUTION



Connected Vehicle Applications

Pedestrian in Signalized Crosswalk

Eco-Approach and Departure at Signalized Intersections

HARDWARE AT INTERSECTIONS

Yunex RSU2X – Roadside Unit

Peek ATC-1000 – ATC Controller

Miovision SmartView 360 – Pedestrian Detection

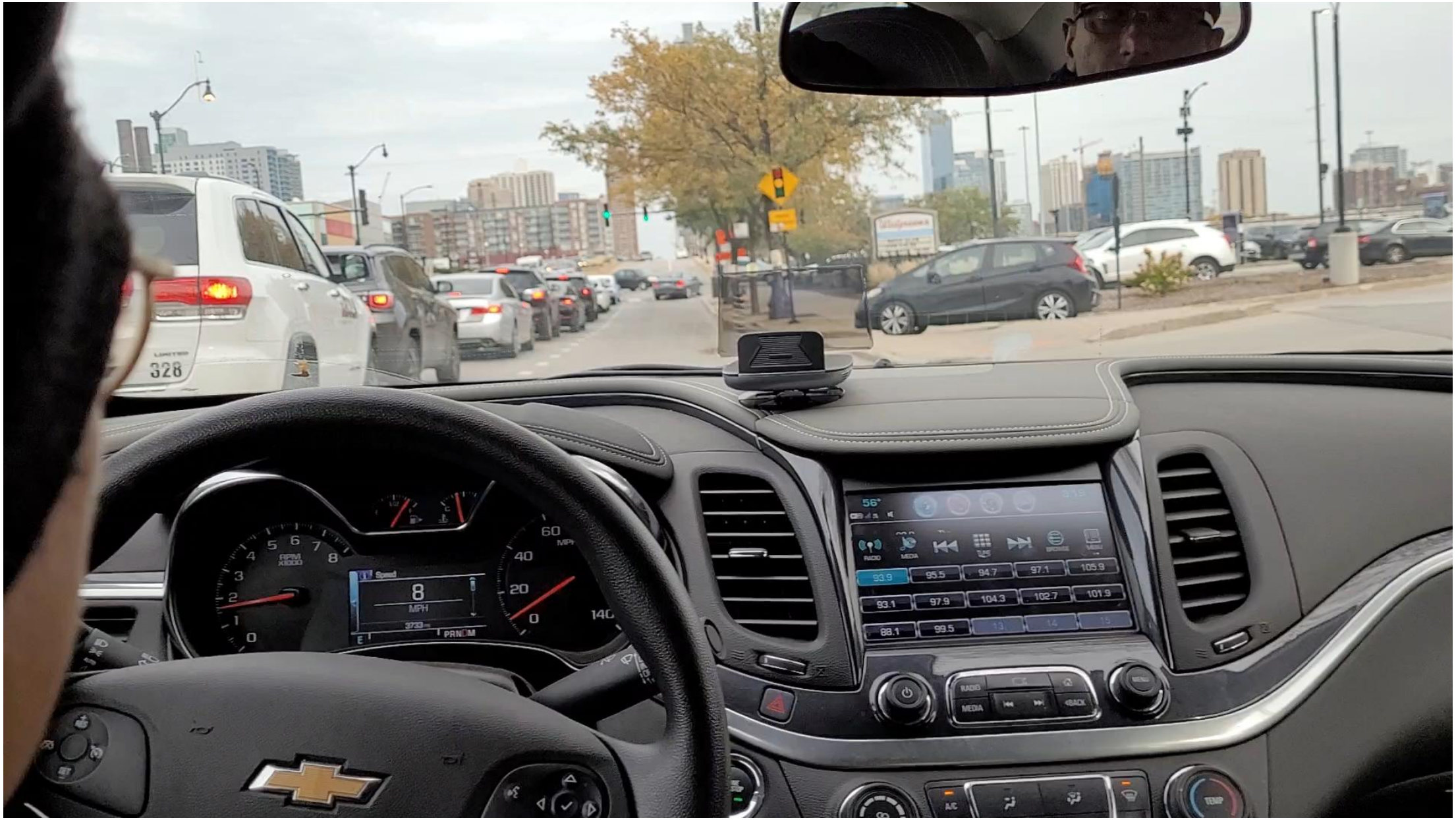
HARDWARE ON VEHICLES

DENSO On-Board Unit (OBU)

Heads Up Display (HUD)

CV2X Antenna

TEST CONFIRMS SPAT & PED. WARNING



Create a MAP for each intersection

Using the online ISD Builder Tool for SAE J2735 (UPER encoding), a MAP is created for each of the seven intersection locations.

- This tool allows a user to define the lanes and approaches of an intersection using a graphical interface. Once designed, the user can encode an ISD, MAP, or SPaT message as an ASN.1 UPER Hex string.
- Each MAP is uploaded into the installed RSU at each respective intersection location.
- SPaT and PSM messages require this MAP information to be transmitted out of the RSU simultaneously to be of use.
- The online tool library can be accessed at the USDOT weblink: https://webapp.connectedvcs.com

APPLY FOR FCC LICENSING FOR RSU DEVICES

FCC licensing is required to operate C-V2X transmitters which are built into the RSU device.

Currently, the FCC processes C-V2X license applications as an Experimental License which is likely to change in the future.

General Experimental License Application Requirements

All Experimental License forms		
1	Radio frequencies required for fixed and mobile units	5850-5925 MHz
2	Conducted Power	Leave blank
3	Antenna Gain	Leave Blank
4	(ERP)/(EIRP) of fixed (BTS) and mobile units	1.21 W ERP mean
5	Any antenna pattern information if not isotropic	
6	Fixed antenna locations (lat./long.)	United States (leave lat./long. blank)
7	Operational radius	Blank
8	Fixed antenna heights	Blank
9	Emission bandwidth	20 MHz
10	Emission designator	W7W
12	Dates experimental license is required	Either range or duration
13	Manufacturer of equipment	
14	Quantity of equipment to be used	
STA Specific Questions		
1	Explain why an STA is necessary	
2	Explain the purpose of operation	

LESSONS LEARNED

- Duplicate all integrated hardware within a lab environment to match final production environment.
- If possible, establish a live lab (i.e. parking lot area mimicking intersection) to be able to test real time applications and solutions using vehicles and pedestrians.
- Verify firmware updates for devices within the lab environment and allow to run for a good amount of time before deploying into production.
- Confirm the applications sought have been vetted and confirmed functional with all device vendors (RSU, OBU, ATC, Sensor devices (i.e. Camera, LIDAR, FLIR), Backhaul Cellular Router, etc…).
- For large scale production rollout, perform an RF analysis at all intersection locations to determine RF interference or GPS signal deficits needing mitigation. Adequate GPS signal is an absolute requirement for C-V2X to function.
- **Be aware, the backhaul network will likely need to support IPv6 for a successful large-scale rollout.**
- Security certificates and infrastructure support for SCMS will be needed for large-scale rollout. This was not addressed within the CDOT CV pilot and will require significantly more resources to implement.
- In advance of testing camera-based pedestrian detection, clean or clear camera lens/dome.

- TSSC, Mid-Year 2023

DENVER

Snowplow Signal Priority - CV2X

COLORADO
Department of Transportation
Region 1

FELSBURG HOLT & ULLEVIG

PARSONS

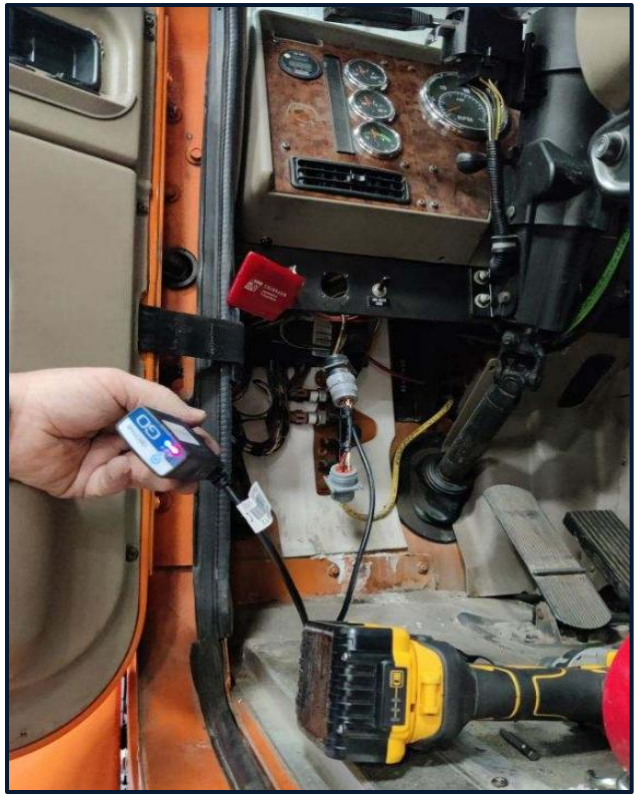
PROJECT GOALS

- Significantly accelerate the adoption of innovative technologies by the surface transportation community.
- Enhance safety.
- Reduce time to plow pavement.
- Improve traffic flow along the identified corridors during and after snow removal.
- Support the Nationwide CV2X agenda by sharing the experience and lessons learned.

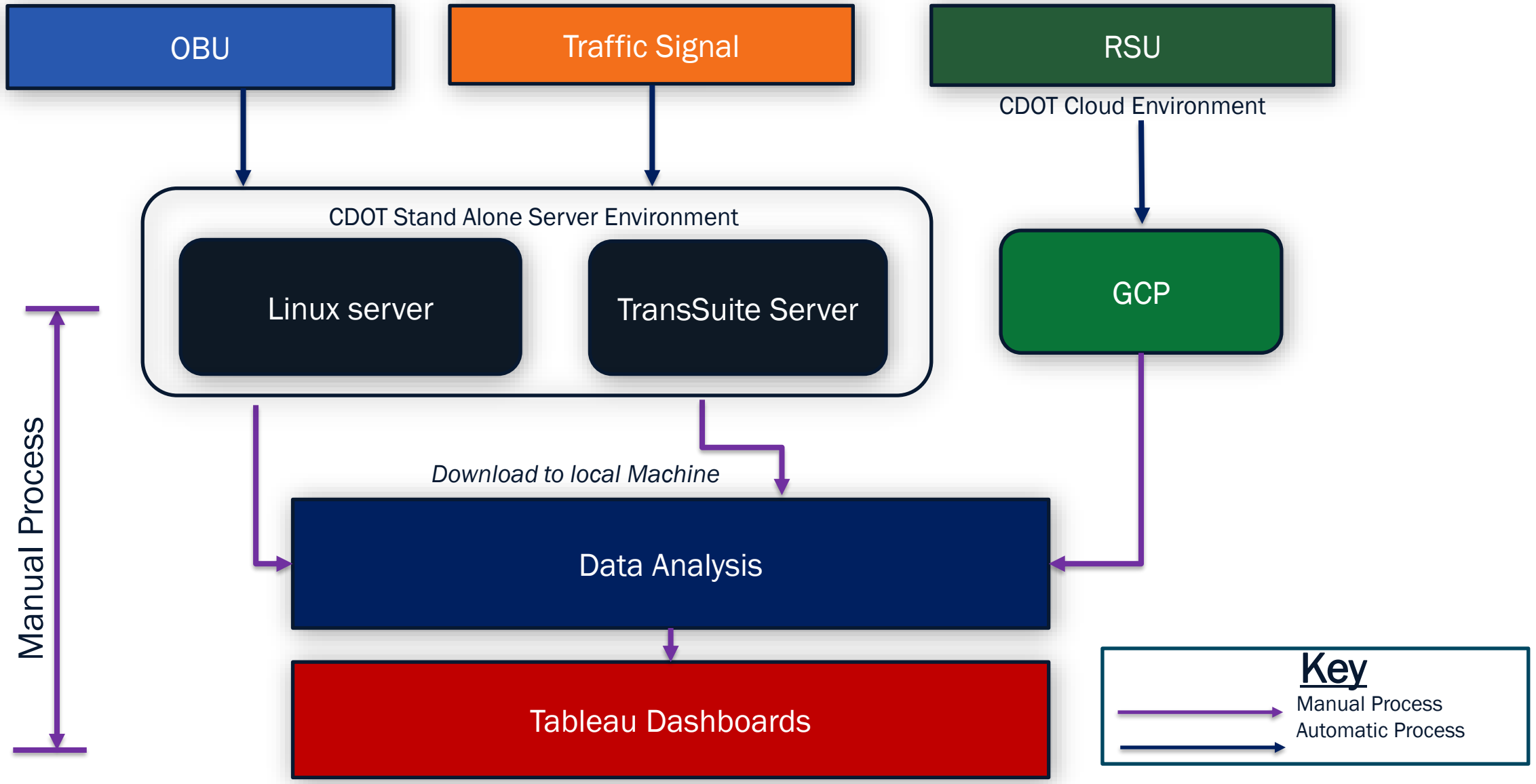
Project Success Story:

Great feedback received from the snowplow drivers feeling safer during a snowstorm. The drivers informed the project team that the number of their stops during a trip has reduced which has direct correlation with public safety and drivers' safety during a storm.

DEPLOYMENT



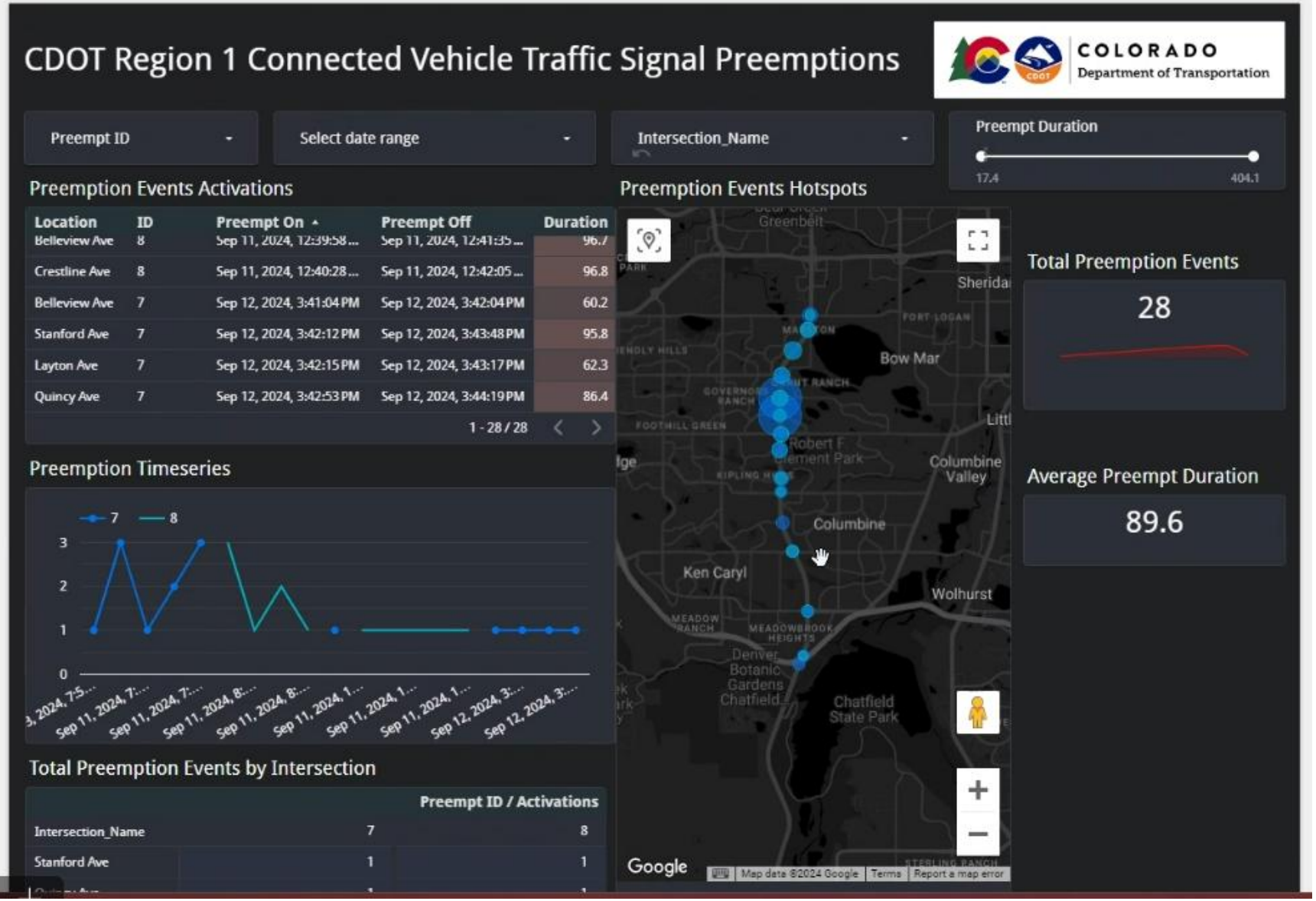
CURRENT METHODOLOGY



CV Preemption Data Review

Reset

Sha



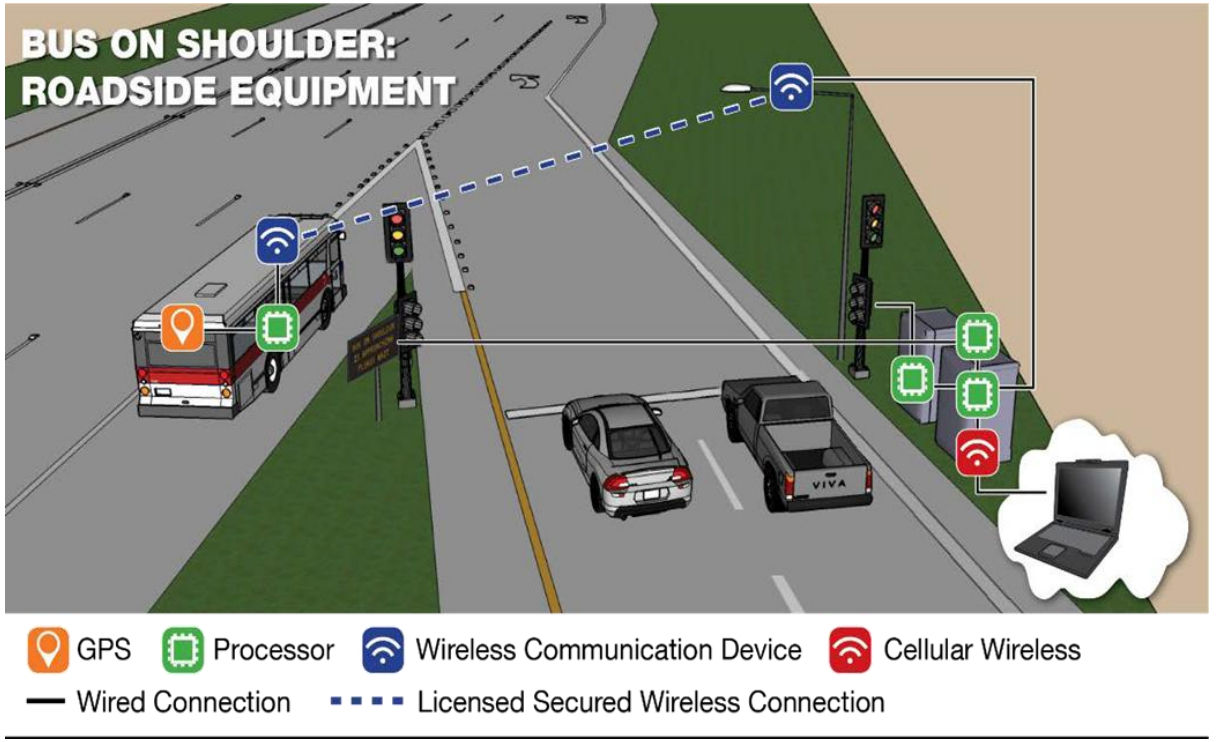
SAN DIEGO

PROJECT OVERVIEW

- Pilot demonstration of Bus-on-Shoulder operations on a limited access freeway using state-of-the-art technology for driver assist. Integrated with South Bay BRT.
- Objectives
- - Bus performance (travel time and peak hour travel reliability) will be improved by allowing buses to drive on the freeway shoulder during periods of traffic congestion with minimal changes to the roadway
- - Driver assistance technology will enhance safety and operations along the corridor
- Transit Signal Priority Locations
- - Four Entry Ramps on I-805 N
- - Interchange I-805 N @ SR94 W
- Project Phases
- - Development / Deployment
  - Pilot Operation - 3 Year

TYPICAL RAMP LOCATION

Existing RM: I-805 NB at 47th (Source: Google Street View; Image Capture: Nov 2015)

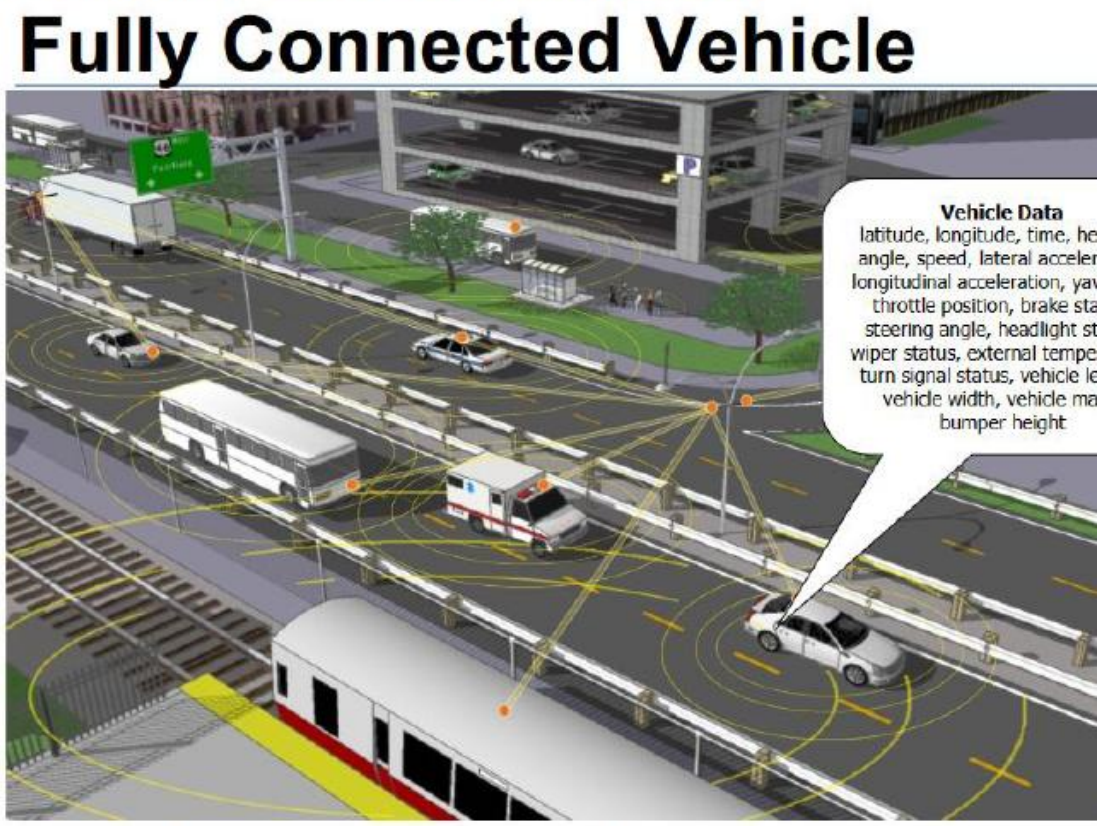


FOUNDATIONAL COMPONENTS

Connected Vehicle Technology

- Dedicated Short Range Communications (DSRC) to Cellular V2X
- Security protocols: Trust & Confidentiality using SCMS
- Exchange of a series of SAE Messages
- SAE J2735 & J2945
- Basic Safety Message (BSM)
- MAP Message (MAP)
- Signal Status Message (SSM)
- Signal Request Message (SRM)
- Probe Data Management (PDM)
- Transit Signal Priority(TSP) - Caltrans Ramp Controller

US DOT Model – Future of Transportation



Vehicle Based Data and Availability, B. Cronin, US DOT ITS JPO, 2012
https://www.its.dot.gov/itspac/october2012/PDF/data_availability.pdf

ROBUST SENSOR SYSTEM WITH DRIVER ASSIST

Front Side and Rear Side Sensor & Camera (both sides)

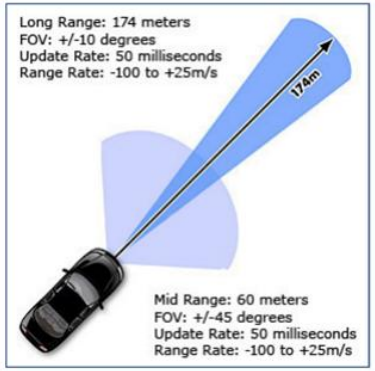
- Pedestrian Warning
- Lane Departure Warning
- Forward Collision Warning

By Rosco / Mobileye

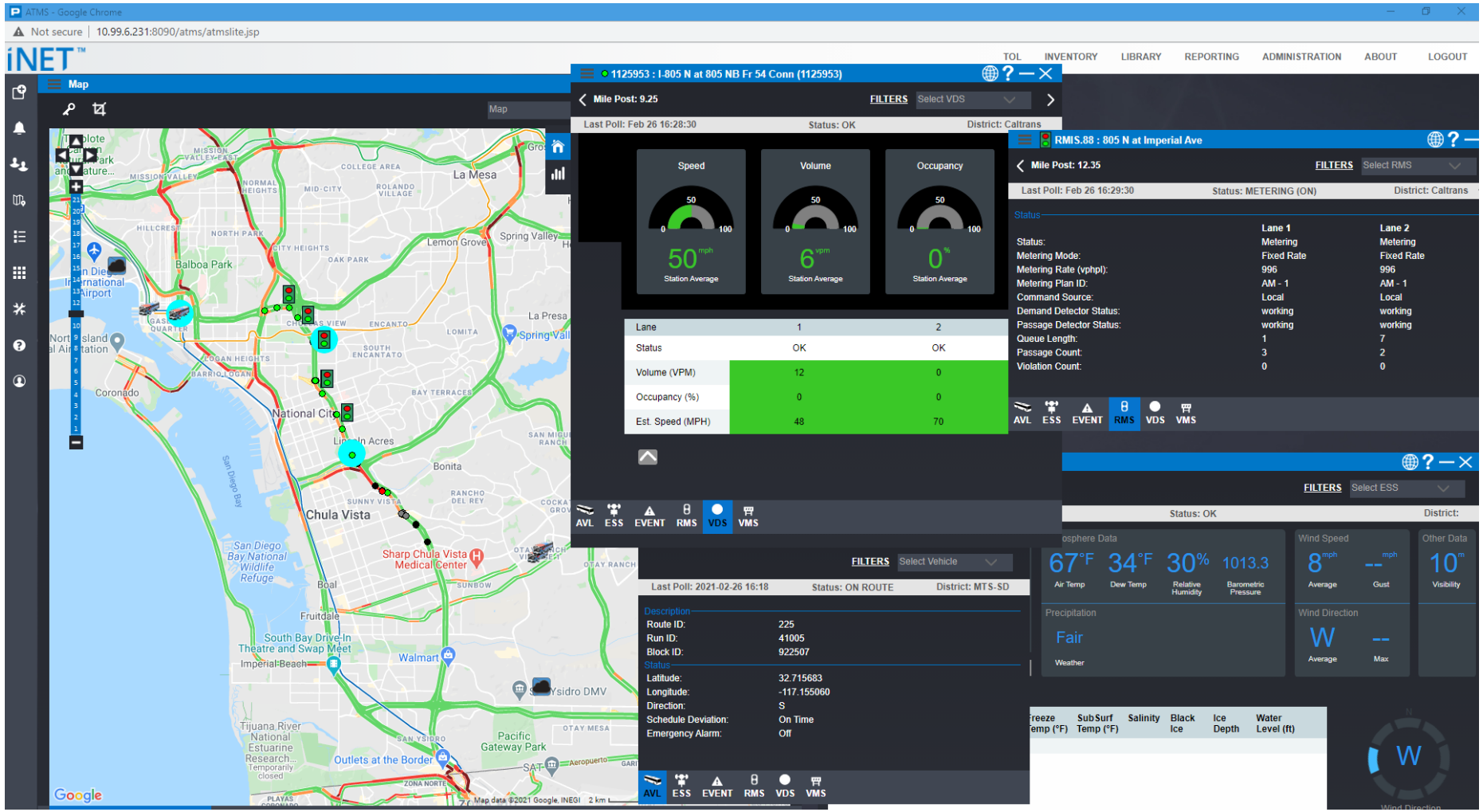
- Blindspot Warning

By AutonomouStuff (Hexagon)

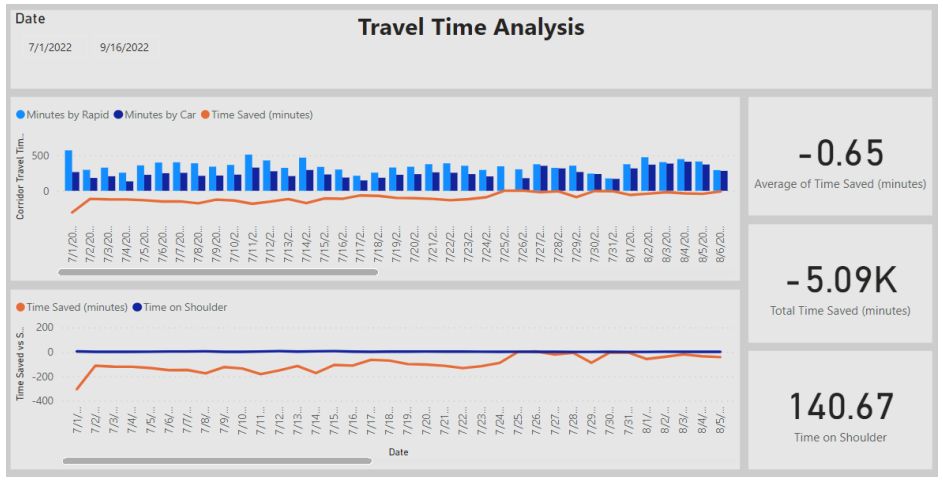
Delphi SRR2 – Electronically Scanning Radar (quantity 4)

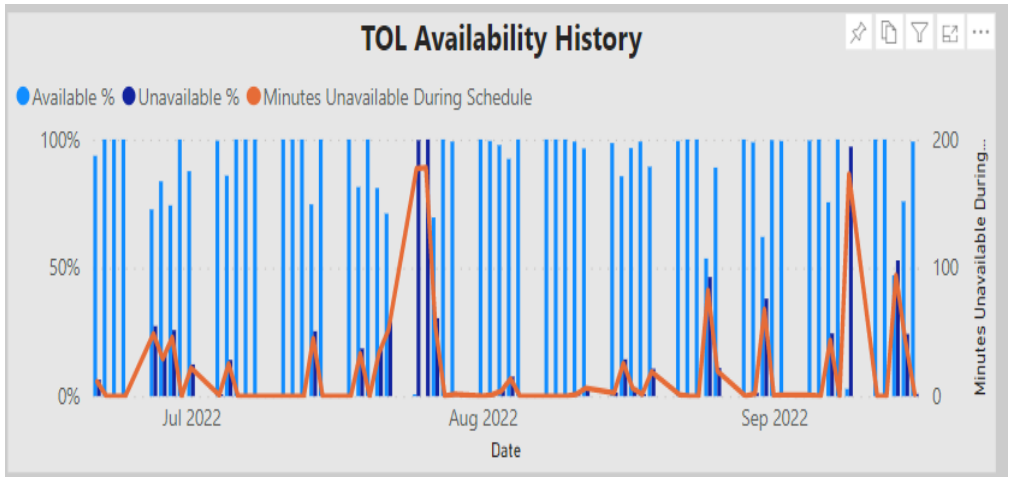


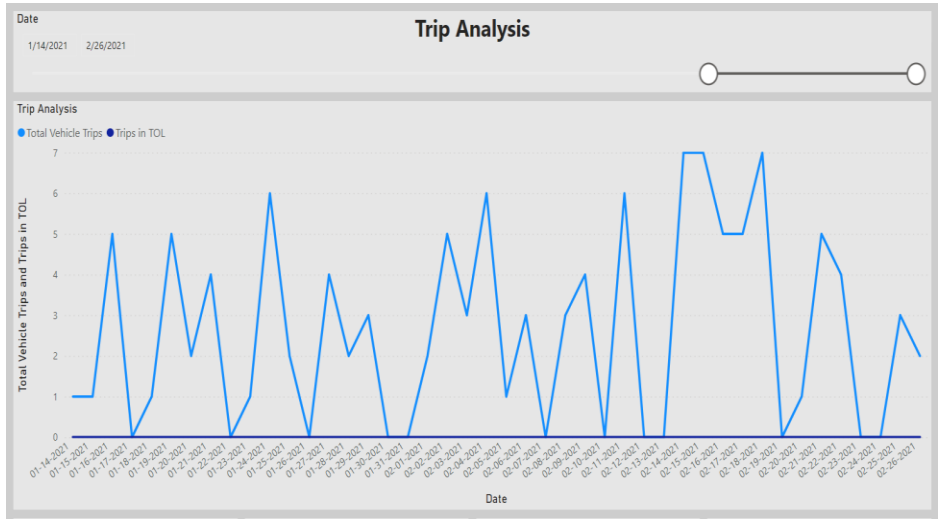
iNET® Monitoring and Analysis

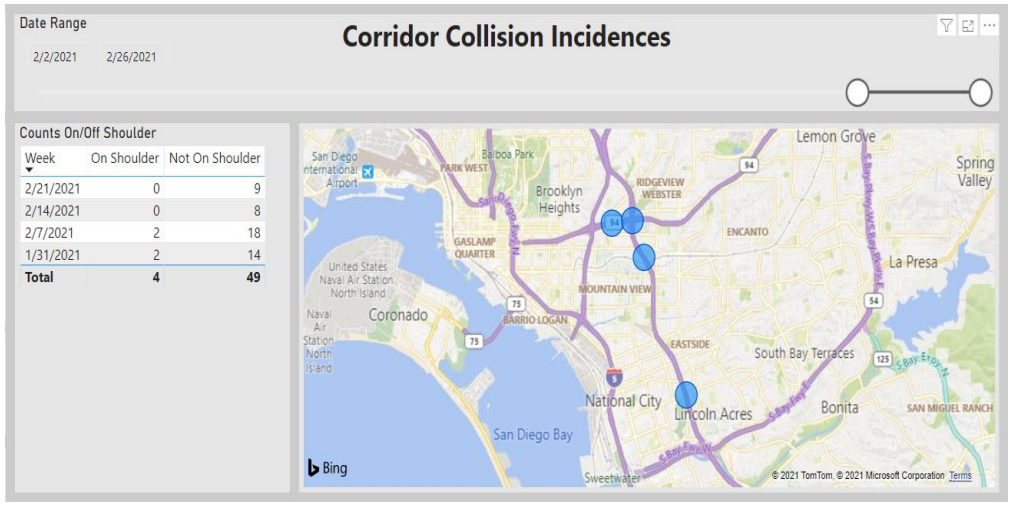


Reporting


Date
7/1/2022
9/16/2022
Travel Time Analysis
Minutes by Rapid
Minutes by Car
Time Saved (minutes)
Corridor Travel Tim...
-0.65
Average of Time Saved (minutes)
-5.09K
Total Time Saved (minutes)
Time Saved (minutes)
Time on Shoulder
Time Saved vs S...
Date
140.67
Time on Shoulder


TOL Availability History
Available %
Unavailable %
Minutes Unavailable During Schedule
100%
50%
0%
200
100
0
Minutes Unavailable During...
Jul 2022
Aug 2022
Sep 2022
Date


Date
1/14/2021
2/26/2021
Trip Analysis
Trip Analysis
Total Vehicle Trips
Trips in TOL
Total Vehicle Trips and Trips in TOL
Date


Date Range
2/2/2021
2/26/2021
Corridor Collision Incidences
Counts On/Off Shoulder
Week | On Shoulder | Not On Shoulder
2/21/2021 | 0 | 9
2/14/2021 | 0 | 8
2/7/2021 | 2 | 18
1/31/2021 | 2 | 14
Total | 4 | 49
Lemon Grove
Spring Valley
Balboa Park
Brooklyn Heights
RIDGEVIEW WEBSTER
ENCANTO
La Presa
GASLAMP QUARTER
MOUNTAIN VIEW
Coronado
BARRIO LOGAN
EASTSIDE
South Bay Terraces
National City
Lincoln Acres
Bonita
San Diego Bay
Bing
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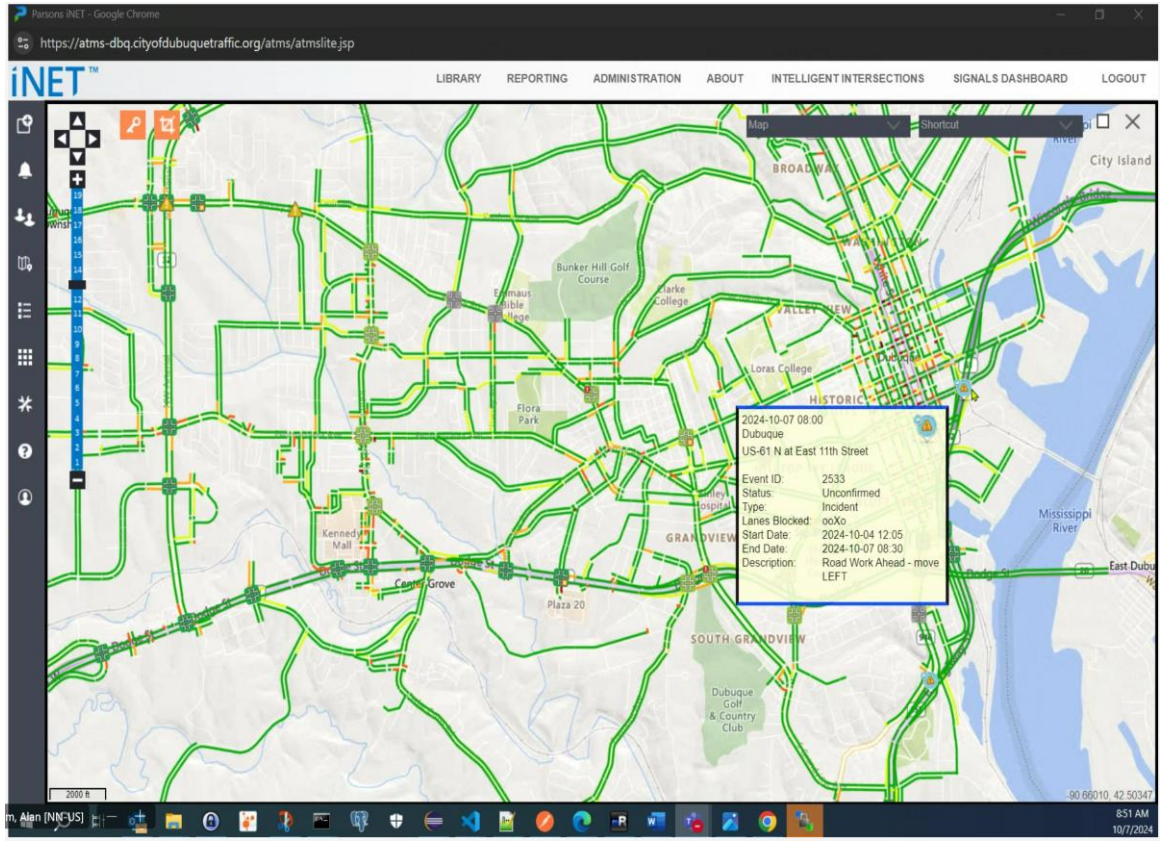
DUBUQUE

Dubuque Streets Project
&
Metro Dubuque Traffic Data Aggregation for Connected Vehicles SMART Grant Project

October
2024

STREETS INTEGRATED MODELING

- **The STREETS solution uses Parsons iNET® ATMS integrated with Aimsun Next.**
  - Live model predicts near future traffic (i.e., 15, 30, 45, 60 minutes)
    - Integrates travel demand modeling, static and dynamic
    - Constantly compares the forecasted results to the future observed
  - Unusual traffic conditions detected by the real time model and/or events manually entered into the system.
  - Potential responses are modeled in the system in near real time and scored.
    - The system will allow for an operator to approve the response or automatically implement it.



INFOTAINMENT DISPLAY

Traffic Light Information

Red Light Assist

Time to Green

GLOSA

Traffic Light Information

Road Alerts (V2N2I)

Roadworks Warning

Queue Jam Ahead

Accident / Obj on Road

Slippery Road

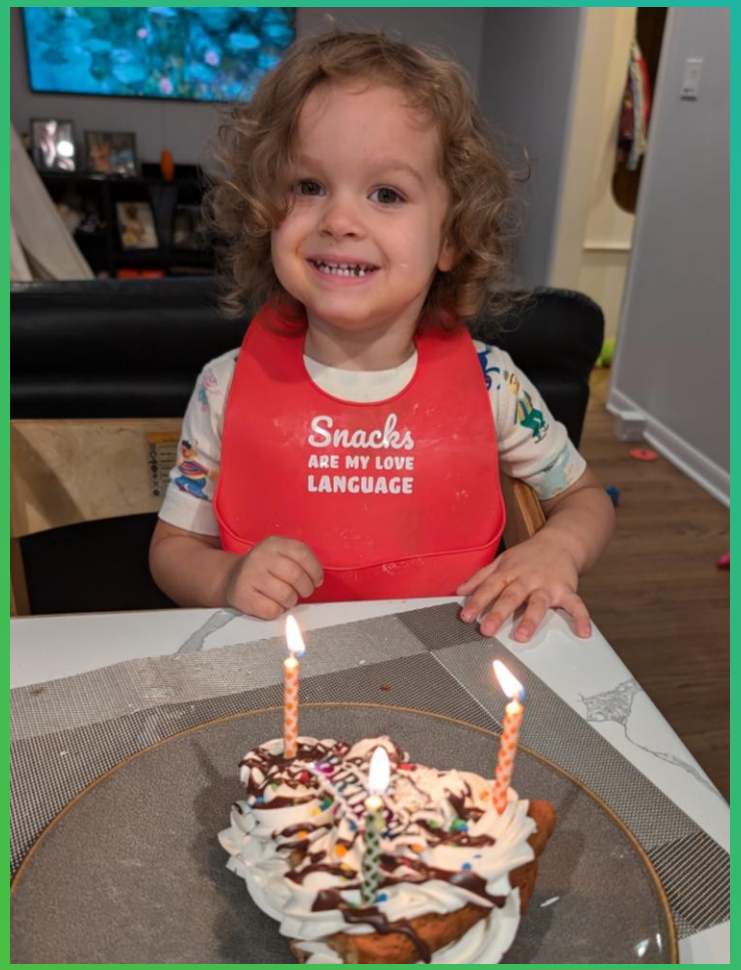
Spot Weather

Emergency Brakes

Wrong Way Driver

Disabled Vehicle

Road Alerts (V2N2V)



QUESTIONS?

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