Connected Vehicle Pool Fund Study (CV-PFS)
Winter 2024
California Update

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California Department Of Transportation Facts

- State Highways **249**
- Lane-Miles **52,016**
- Centerline Miles **15,017**
- Statewide Districts **12**
- Freeways **28.9%**
- Non-Freeways **71.1%**
- Tunnels and Tubes **61**
- Large State-Owned Bridges **13**
- TMS Elements **>20,000**

DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION (DRISI)

The purpose of DRISI is to provide solutions and knowledge that improve California's transportation system.

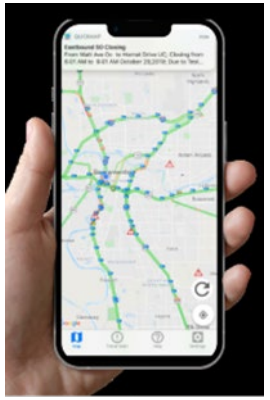
- DRISI Research Program supports the Caltrans programs with research that provides solutions for the most pressing challenges facing California's transportation system.
- Supports:
  - Field Tests, Crash Testing
  - System Information and GIS
  - Traveler Information, Reports (various)
  - Highway Performance Monitoring System (HPMS) Data
- Partners: FHWA, UTC, TRB, NCHRP, PATH, AHMCT at UC DAVIS

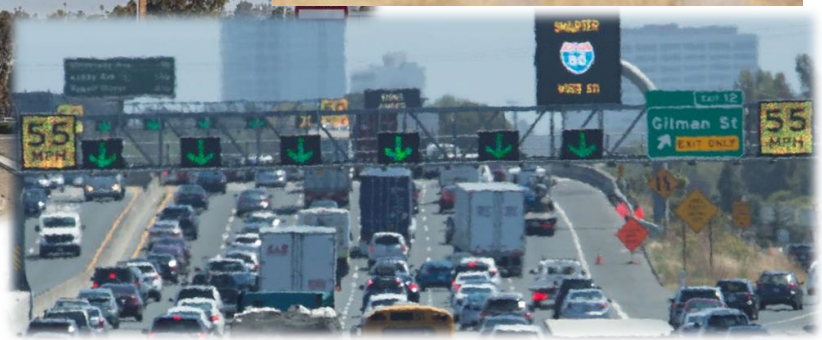
Current Areas of Focus

KEY INITIATIVES FOR ITS & OPERATIONS IN CALIFORNIA

- Workzone Safety
- Advanced Cameras & Smart Sensors
- Truck Parking
- Red Light Violations Warnings
- CV Application Deployments
- Smart Intersections & Safety Systems
- Big Data Integration
- Innovation Spaces
  - Caltrans "Sandbox"
- Cyber Security for ITS
- PeMS Modernization
- Traveler Information: QuickMaps
- Statewide ATMS
- Transit Signal Priority

- Mobility Hubs
- VRU Warning
- TSMO & Investment Strategy
- Next Gen ICMs & ATM
- 2028 Olympics





Areas of Interest

CALTRANS OPERATIONS & MAINTENANCE RELATED TECH

- Video Analytics & Machine Learning
- GenAI
- Edge Processing
- Sensor Fusion & Lidar
- Low Power IOT & Compute
- Data Lake & Warehouse
- Private 5G Networks & Satellite
- Credential Management
- Anonymization
- Virtualization
- Unmanned Aerial Systems (UAS)
- Alternate Power & Electrification
- Robotics
- BIM & Digital Twins

CAV Pilot Projects in California

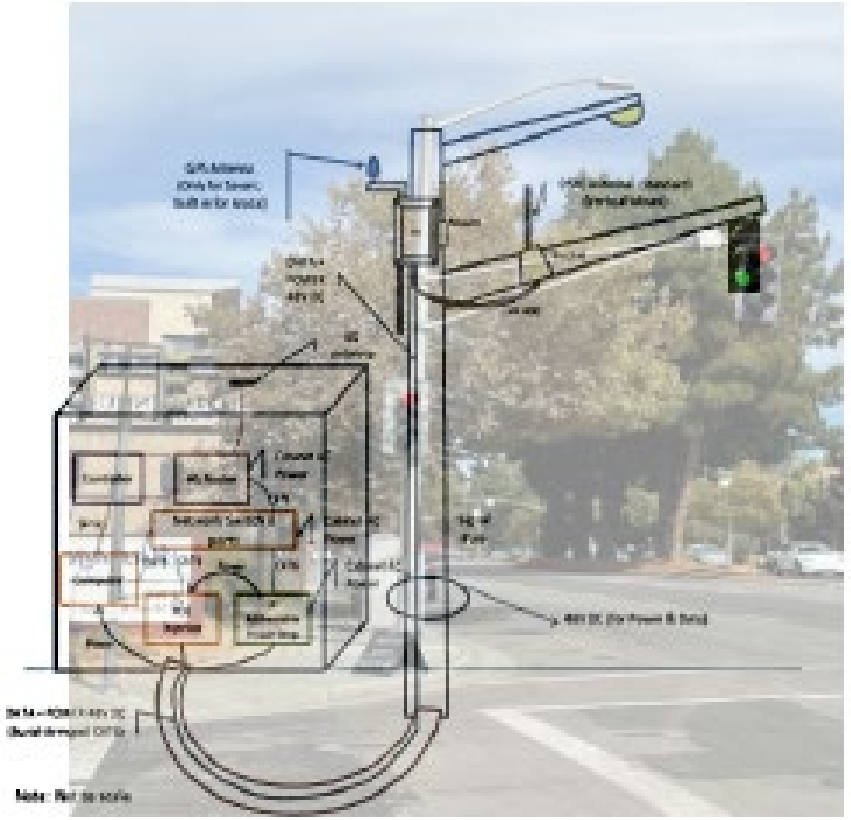
ACTIVE PROJECTS

District 4 ECR	• CAV Pilot Project in 7 Miles Stretch in El Camino Real with 31 intersections and 7 Ped/ Bike Crossing.
District 12 ICM-CAV Triangle	• Deployment of 184 RSUs along I-15 and I-8.
DRISI/D3 Virtual Roadside Unit (vRSU) Research Project	• Using Cellular Network instead of Physical Infrastructure to generate and send TIM messages.
District 11 SDRPG	• Evaluating the effectiveness of HAAS Alert using CAV technology • Bus on Shoulder project • Red Light Violation Warning
District 8 / CVAG	• Implementing 450 C-V2X RSUs, in 8 cities (county of Riverside)
City of Anaheim	• Deployment of CAV Pilot project using SMART fund in and around I-5

D4 El Camino Real Testbed

31 CONSECUTIVE INTERSECTIONS ALONG A SEVEN-MILE STRETCH OF STATE ROUTE 82 (EL CAMINO REAL)

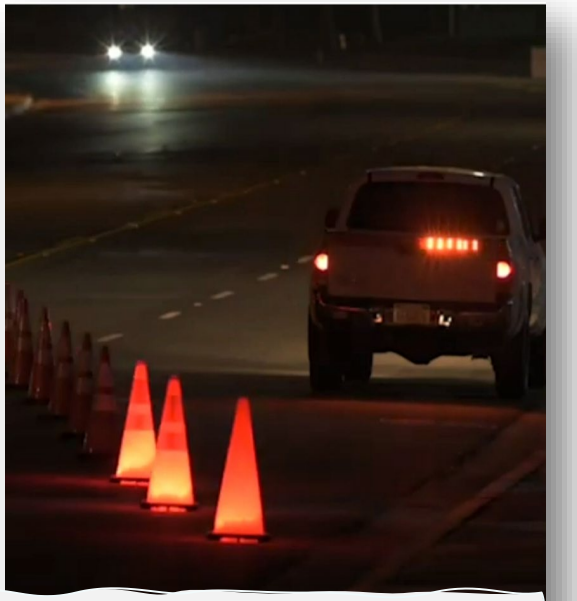
- V2X corridor: a sequence of consecutive blocks equipped with DSRC/C-V2X dual mode RSUs and supportive software.
- Interfacing with California Adaptive Traffic Signal Controllers (ATSC)and providing signal timing information and enabling signal priority apps.
- Dedicated Road-Side Processor (RSP) to augment edge computing capability.
- IPv6 connectivity to national as well as local servers via 4G backhaul.
- Use of multiple communication media: C-V2X PC5 and Uu, Wi-Fi, Bluetooth, Cellular.
- Integrated with TMC network to facilitate system management.



D11 Testbed and Work Zone Safety

DISTRICT 11

- Work Zone Safety through Connected Corridors
- Vision Zero
  - D11 Connected Vehicles Infrastructure Architect
  - BSM forwarding from RSUs
  - BSM capture recording for analytics
- D11 TIM generation with ATMS-R and Corvus
  - ActiveITS integration with Corvus for TIM generation
  - TIM delivery through RSUs
  - TIM delivery through SDX – satellite
- TIMs for Work Zones Safety
- TIMs for Maintenance and Operations Safety

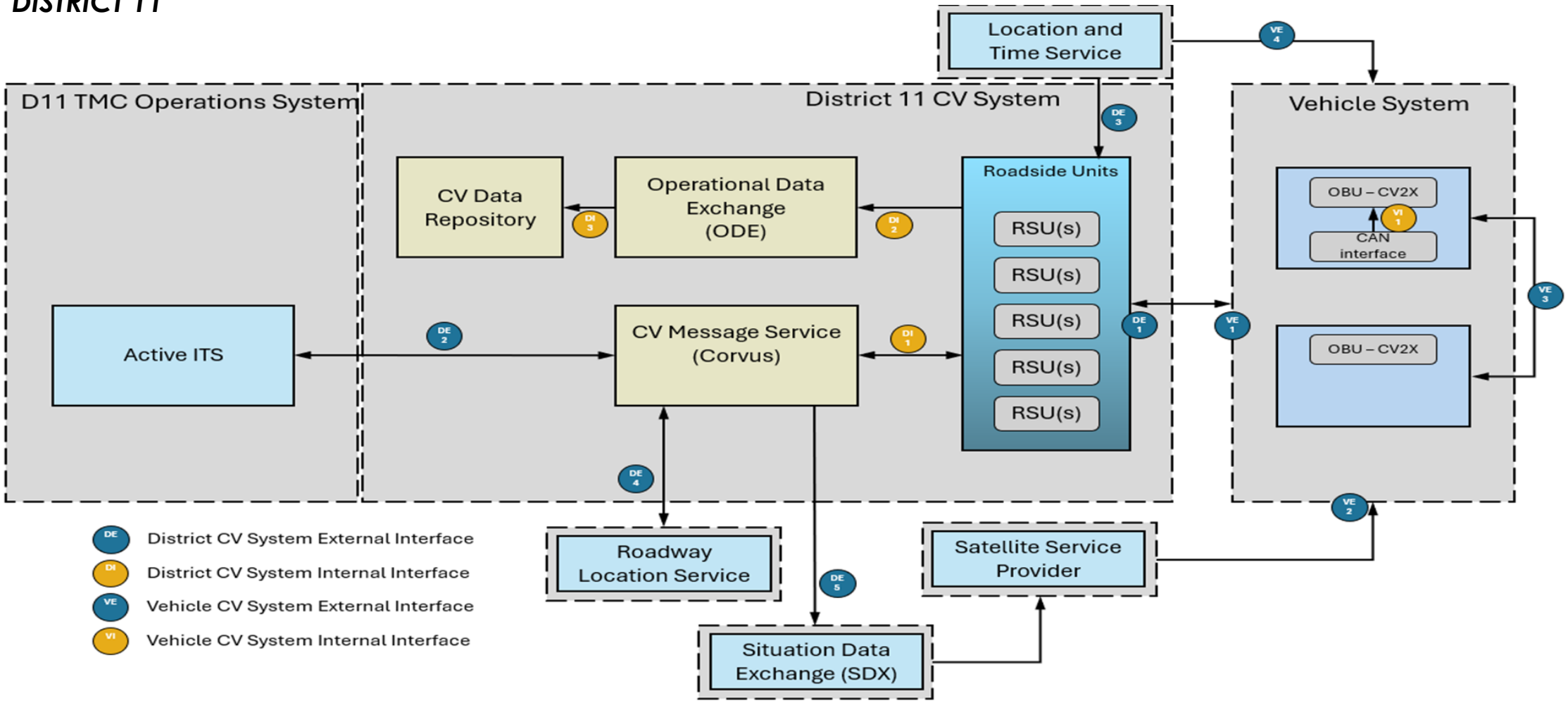


Pi-Lit™ Smart Sequential Cone-top Lamp & Led Flares

Intelligent Truck-Mounted Attenuator

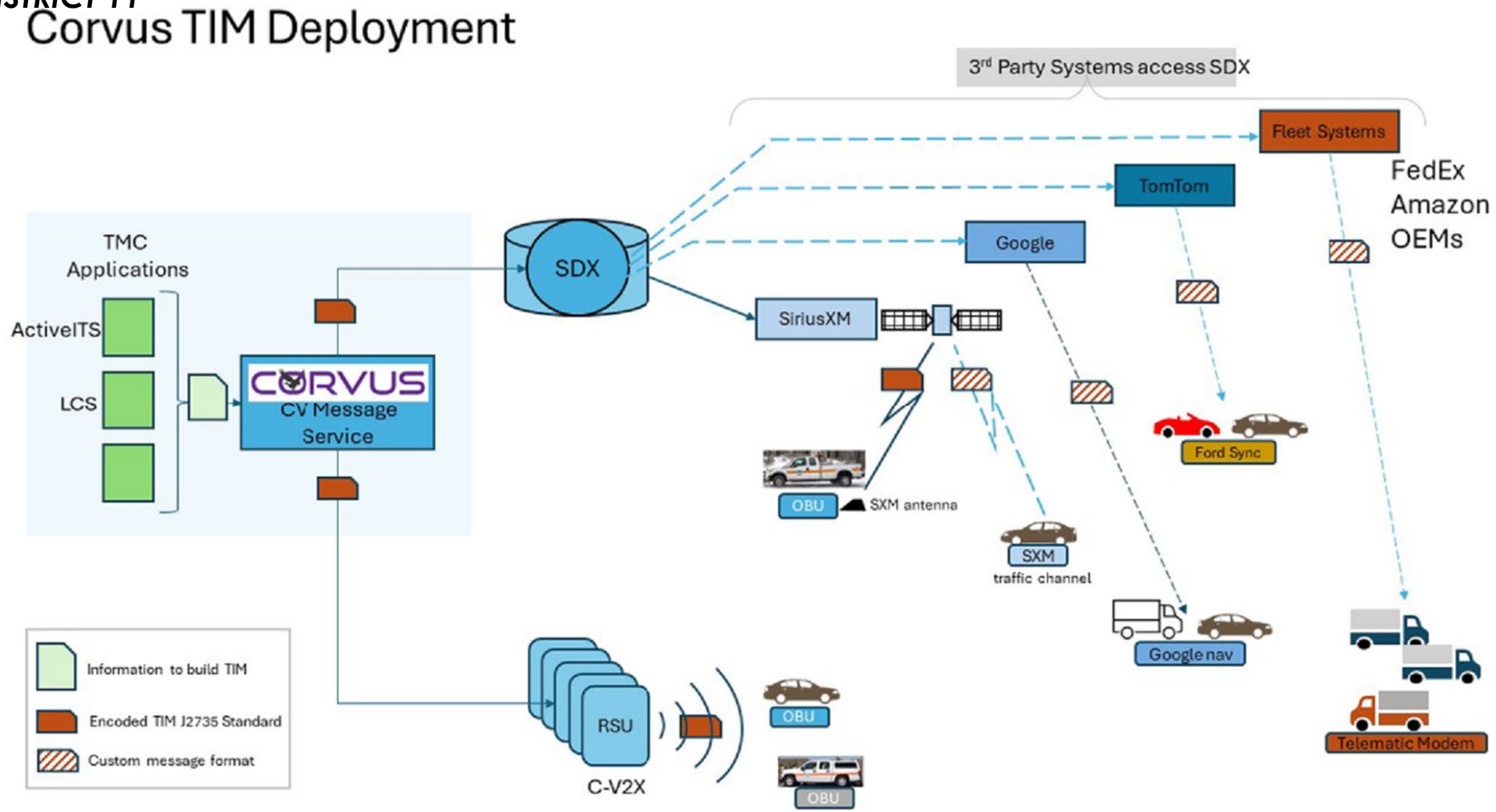
CV System Architect

DISTRICT 11



TIM Generation and Delivery Schematic

DISTRICT 11



D12 CAV - Triangle ICM Deployment

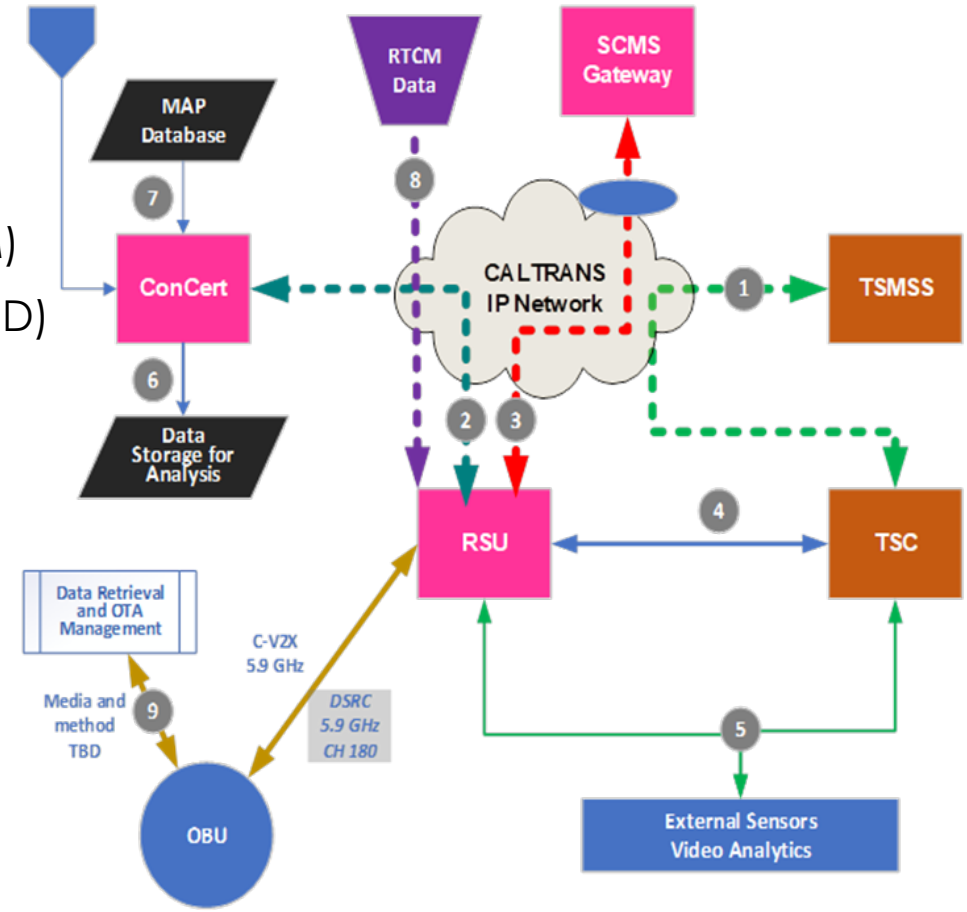
CALTRANS DISTRICT 12 TRIANGLE ICM PROJECT & CONNECTED VEHICLES DEPLOYMENT

CV Applications

- End of Queue Warning, Work Zone Warning
- Transit Priority (Future, Emergency Vehicles Preemption
- VRU (Peds and Bikes) Warning, Incident Information (TIM)
- ICM Response Plans (TIM), Mobility Data (Travel Time, (OD)
- Red Light Violation Warning, Curve Speed Warning, Wrong Way Entry Warning

CV Components

- 188 RSU with BT & WIFI Readers, 10 OBUs
- Yunex Concert CV Management
- CV Data Storage and Exchange
- NTCIP Firmware Upgrade, SCMS
- Video Image Vehicle Detection Systems (VIVDS)
- Video Analytics Application, Edge Processor
- RTCM Location & Time Services



CALTRANS D12 Physical Architecture and Connections to Support the Pedestrian Warning Application

Active and Future Testing Facilities

CRASH TESTING, APPLICATION TESTING

- ECR Testbed
- California Highway Patrol Testing site, West Sacramento, CA
- GOMENTUM STATION Testbed 2.0, Concord, CA
- TRC CA Testbed, Atwater, CA

GOMENTUM Station 2.0

ECR Testbed

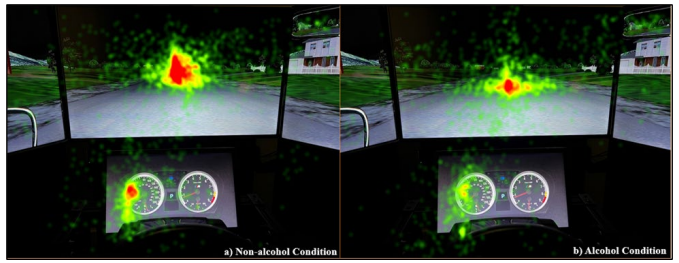
Other Relevant Research Projects

WRONG WAY DRIVING RESEARCH

Standard countermeasures do not work for impaired drivers. The research seeks to understand cognitive ability of severely impaired drivers and developing countermeasures.

•Prevent wrong way entries onto state highways.

Figure: Driver's Fixation Distribution Roadmap under a) Non-alcohol b) Alcohol



CIRCLES Project

A roadmap for flow smoothing via CAVs.

The research discusses aims to leverage automation advancements for traffic management. Numerical simulations of the I-210 Connected Corridors model indicate a potential 10% reduction in energy consumption with a 5% penetration rate of level-1-enabled CAVs on that freeway.

YouTube Video

Questions?

Thank you!