Enabling Deployment of Connected Work Zones

Connected Vehicle Pooled Fund Study (CV PFS) Project

Topics

- Project Recap
- Guidance Sources and Outreach
- Schedule for Remaining Tasks
- Next Steps

CV PFS Connected Work Zones Project

- 6 Tasks
- Supporting MCDOT and Caltrans Efforts
- Final Product will be Guidance Materials for IOO Deployment of Connected Work Zones – Network Cellular Approach

Task 1: Project Management

Task 2: Coordination with Relevant National Standards Efforts

Task 3: Arizona DOT Smart Work Zone Program

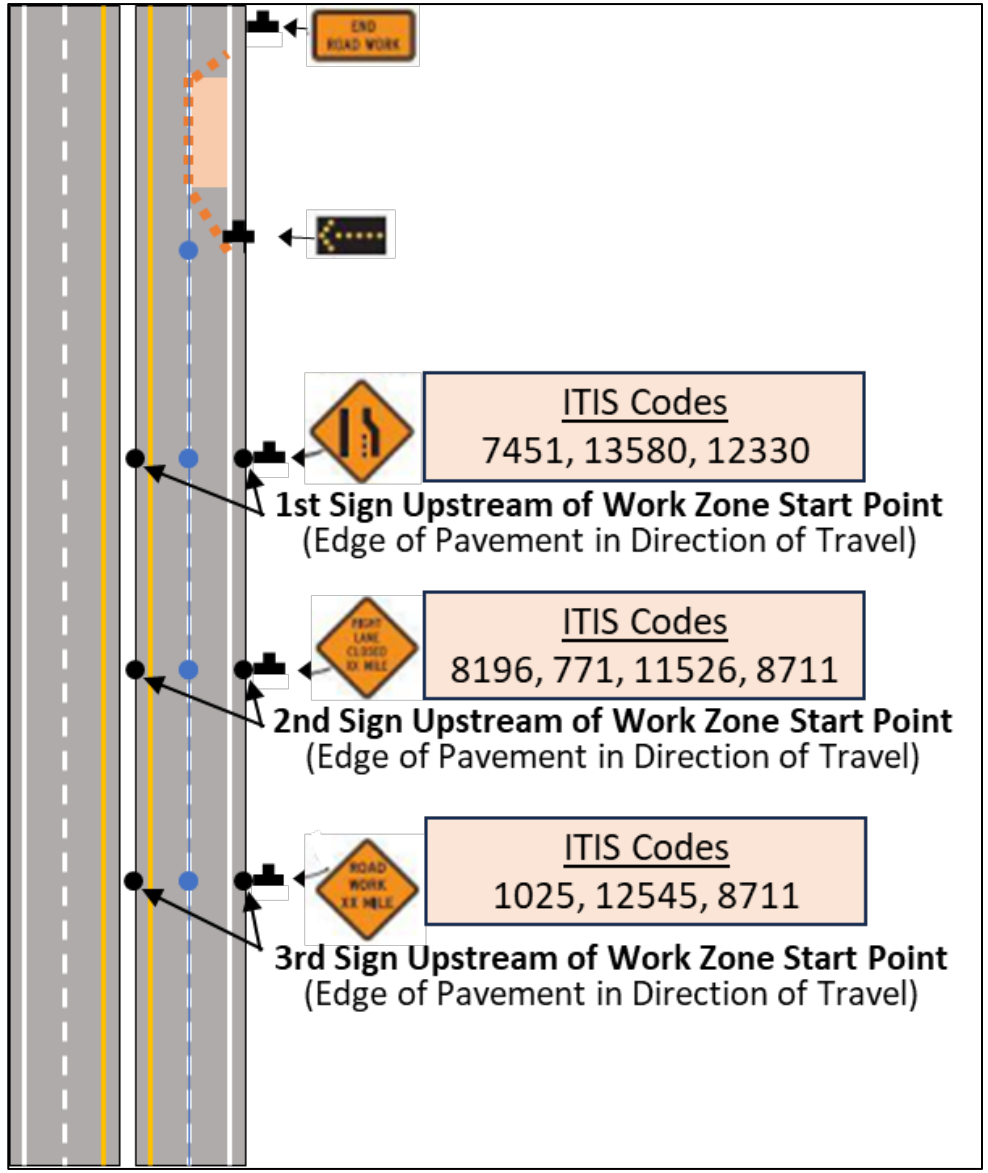
Task 4: Provide Technical Support for California Connected Work Zone Program

Task 5: Conduct Assessment of Interoperability of Arizona and California Deployments

Task 6: Develop Guidance Materials for IOO Deployment of Connected Work Zones

ADOT Smart Work Zone Project

- Delivered messages to mobile applications at the time the messages should be displayed to drivers
- MUTCD used as a basis for generating the messages delivered to the mobile application
- Message information corresponds to the MUTCD-recommended static signing in advance of the work zone
- Messages provided at distances that correspond to MUTCD-recommended distances for static signing



ADOT Smart Work Zone Project

- Fixed Duration Prototype Deployment
  - DOT staff received alerts – pilot mobile devices
- ADOT created Roadside Alert (RSA) messages for each set of points
- RSAs sent to Verizon Virtual RSU (Intelligent Message Platform (IMP)) – utilizes MQTT server)
- Mobile applications subscribe to the Virtual RSU – Receive & Display RSAs
- Mobile applications sent partial BSM data through the IMP to reach ADOT (support queue warning and other applications)

CV PFS Connected Work Zones Project

- Reviewed and participated in Connected Work Zone Standards activities
- Engaged CV PFS members on their use and intentions with standards involving Connected Work Zones

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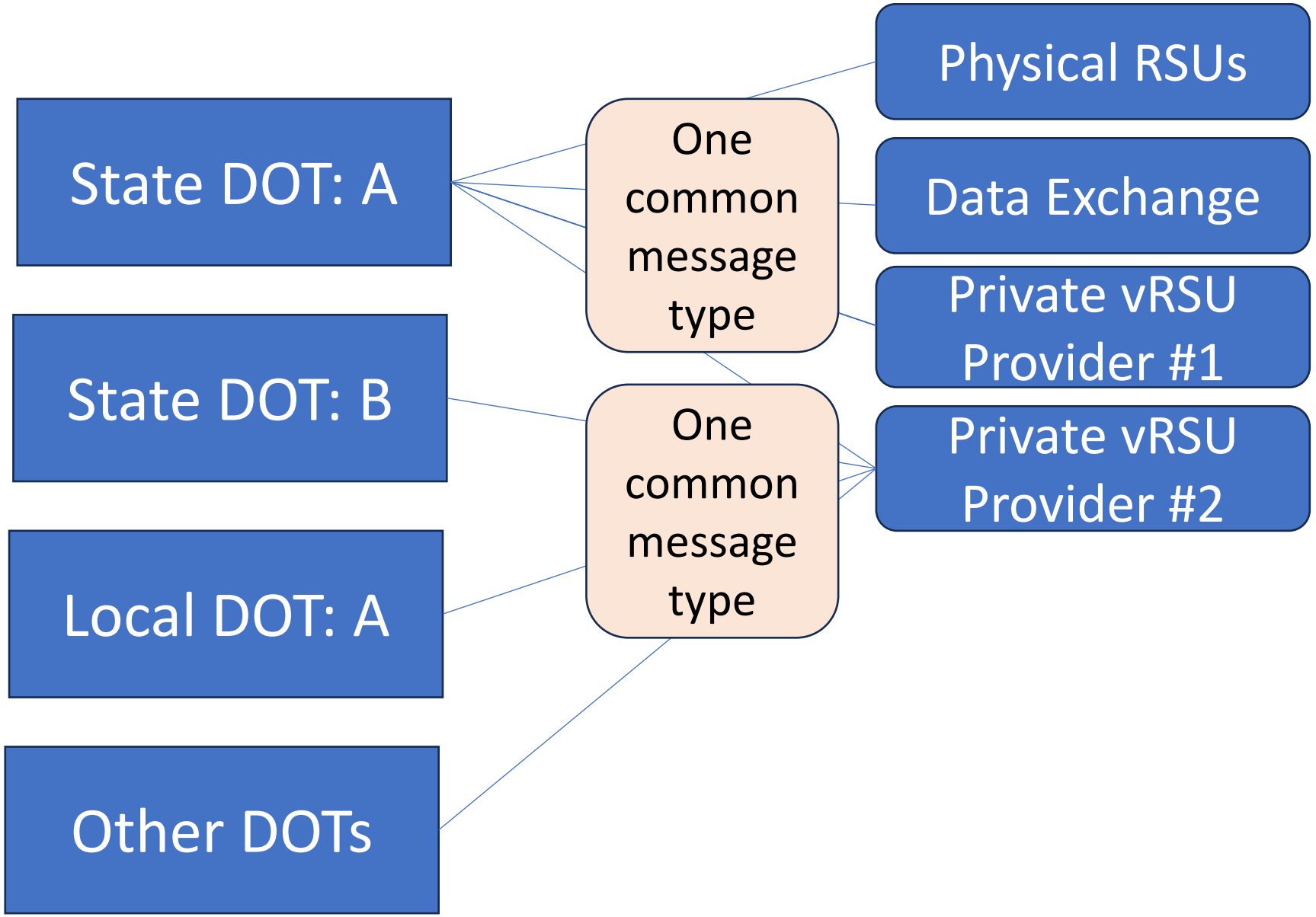
State DOT: A
State DOT: B
Local DOT: A
Other DOTs
One common message type
One common message type
Physical RSUs
Data Exchange
Private vRSU Provider #1
Private vRSU Provider #2

We looked at RSAs, TIMs & RSMs

Document the intent to migrate to RSM

RoadSide Alert (RSA)

- Message in SAE J2735
- "Message is to send alerts for nearby hazards to travelers"
- Does not include location references "this message likely applies to the receiver by the very fact that it is received"
- Examples: "Bridge icing ahead" "Train coming"
- Typically transmitted as V2X

Traveler Information Message (TIM)

- Message in SAE J2735 Support a Variety of Events
- Define the Valid Area of the Message & Viewing Angle
- Similar to "In-vehicle Signing"

Road Safety Message (RSM)

- Defined in SAE J2945/4
- Three levels of Areas:
- Low Level Fidelity:
  - Areas (e.g., evacuation area)
- Medium Level Fidelity:
  - Road Segment (Valid Area)
- High Level Fidelity:
  - Lane Level Details
- Can support OBU specific "warnings"

CV PFS Connected Work Zones Project

- Supported the scoping of efforts to be performed by Caltrans (or supporting system integrators)
- Contracts are still being processed

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CV PFS Connected Work Zones Project

Details to be Discussed:

- Bring Mobile Applications from Arizona to California and test their functionality
- Bring Mobile Applications from California to Arizona and test their functionality
- Tests on different cellular services

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Questions Regarding Connected Work zones using network cellular

1. Will there be one “router of TIMs/RSMs”? Or multiple? Who will decide?
2. If there are multiple, will state DOTs send their TIMs/RSMs to all of them?
3. Who will pay for the MQTT servers (or other routers) beyond the pilots?
4. How will payment occur?

The presence and role of a “router” adds complexities that 5.9 GHz communications do not have, and the CV PFS members are expecting more pilots will be needed to answer these and other questions

CV PFS Connected Work Zones Project

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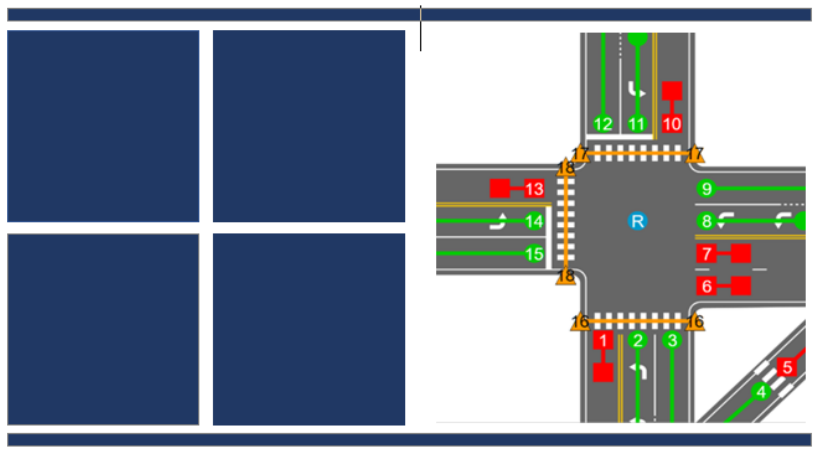
CV PFS Guidance Documents



Guidance Document for MAP Message Preparation

FINAL – Revision #3
March 2024

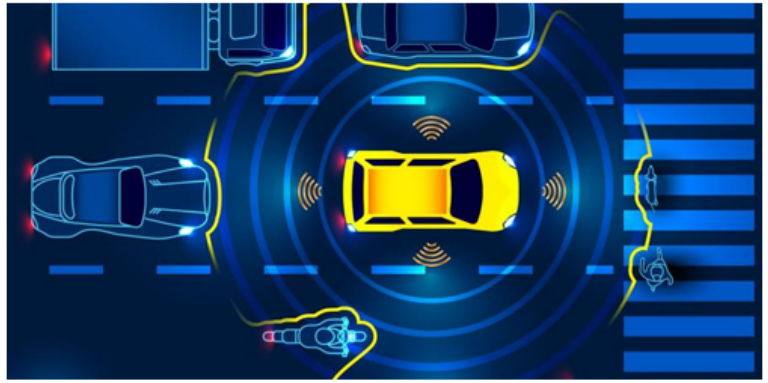
Prepared for:
The Connected Vehicle Pooled Fund Study
(University of Virginia Center for Transportation Studies)

Prepared by:
Athey Creek Consultants, LLC and Synesis Partners, LLC

CONNECTED INTERSECTIONS PROGRAM:
PROGRAM MANAGEMENT AND TECHNICAL SUPPORT

Connected Intersection Guidance Document – Revision 2

April 2025



Prepared by

wsp

Athey Creek CONSULTANTS

Guidance Document

Guidance for how the next round of IOOs could create pilots

Guidance will include steps to:

- Develop software and systems to generate the needed TIM messages for work zones (together with GeoHash or other routing)
- Procure services of a MQTT Service Provider to deliver messages to applications (as is done by Verizon), or services of another data router
- Develop in-house or procure services for IOO software and systems to interface with the procured services,
- Develop in-house or procure mobile applications to display messages and send the BSM data.

Proposed Guidance Document Structure

- Two key parts with five steps currently defined for each:

Initial, one-time process

1. Initiate Connected Work Zones Environment with Network Communications:
   - Data sources, CWZ scale, agency policies, software development, vendor procurement
   - Determine the overall approach to sharing WZ TIMs (e.g., network cellular, RSUs, both)

Cyclical, ongoing process

2. Ongoing Operations for Each Work Zone:
   - Work zones to include as a CWZ
   - Initiate CWZ by creating and sharing a TIM to Cellular RSU (cRSU) and other mechanisms
   - Data management
   - Wrap-up / Removal of the CWZ TIM

Sources for Guidance Content

Drive Arizona Project

Caltrans vRSU Project

Others

FHWA Interoperability Testing

Others?

Guidance Steps: Initiating CWZs

Step 1: Identify and define data sources

Initial, one-time process

DRIVE Arizona Questions:

1. Work zone data sources used?
2. Were there multiple sources of work zone reports (e.g., ADOT, MCDOT, etc.)
3. Any assessments on the work zone data completeness, especially in relation to creating TIMs?
4. Are you creating multiple TIMs for each work zone (e.g., “right lane closed ahead”, “right lane closed”, “Reduced speed”)
5. Are the TIMs generated automatically or through manual intervention?
6. How are updates to work zones handled? (updated TIMs? Any manual role?)

Step 1: Identify & Define Data Sources

Step 2: Determine Scale of Deployment

Step 3: Define CWZ Plan

Step 4: System Development & Procurement

Step 5: CWZ System Testing

Guidance Steps: Initiating CWZs

Step 2: Determine scale of CWZ deployment

Initial, one-time process

DRIVE Arizona Questions:

1. Did you consider expanding the mobile application users beyond public employees? Would this be a possible next step or Stage 2 to the SMART Grant?
2. Are there any plans for broadcasting the TIMs through RSUs deployed in AZ? Possibly through V2X Accelerator grant RSUs?
3. Given your experiences, would you envision that as future cities in Maricopa County initiated systems would there continue to be one Drive AZ feed to Verizon or would entity have their own (e.g., ADOT, MCDOT, City of Phoenix, City of Tempe, etc.)?

Step 1: Identify & Define Data Sources

Step 2: Determine Scale of Deployment

Step 3: Define CWZ Plan

Step 4: System Development & Procurement

Step 5: CWZ System Testing

Guidance Steps: Initiating CWZs

Step 3: Define CWZ Plan

Initial, one-time process

DRIVE Arizona Questions:

1. Did you identify any definitions of what work zones would be included and excluded (e.g., by duration of work zone, by impact of work zone, etc.)?
2. Did you have (or need) any data policies such as: validating work zone data before broadcast, archiving the messages broadcast to support future data requests?
3. Did you consider creating TIM policies (possibly based on the webinar to define TIMs) that could be adopted within the state and support future projects that create and disseminate TIMs?

Step 1: Identify & Define Data Sources

Step 2: Determine Scale of Deployment

Step 3: Define CWZ Plan

Step 4: System Development & Procurement

Step 5: CWZ System Testing

Guidance Steps: Initiating CWZs

Step 4: CWZ System Development and Procurement

Initial, one-time process

DRIVE Arizona Questions:

1. Any experiences you can share with selecting the Mobile App developer?
2. Any experiences you can share with contracting with Verizon for the IMP?
3. Do you have any vision for what this might look like in 5 years? Would there be multiple providers in similar roles as Verizon? Would your system send to all of them?

Step 1: Identify & Define Data Sources

Step 2: Determine Scale of Deployment

Step 3: Define CWZ Plan

Step 4: System Development & Procurement

Step 5: CWZ System Testing

Guidance Steps: Initiating CWZs

Step 5: CWZ System Testing

Initial, one-time process

DRIVE Arizona Questions:

1. Do you have a Test Plan that we could reference or cite examples from?
2. Any lessons learned about creating the test plan (e.g., was the focus on latency of data delivery? Was it on reliability of communications? Was it on interoperability across devices?
3. We've discussed the potential for interoperability testing with California, is this still a possibility?

Step 1: Identify & Define Data Sources

Step 2: Determine Scale of Deployment

Step 3: Define CWZ Plan

Step 4: System Development & Procurement

Step 5: CWZ System Testing

Guidance Steps: Ongoing Operations

Cyclical, ongoing process

DRIVE Arizona Questions:

1. TBD

Step 6: Business Process for CWZ Inputs

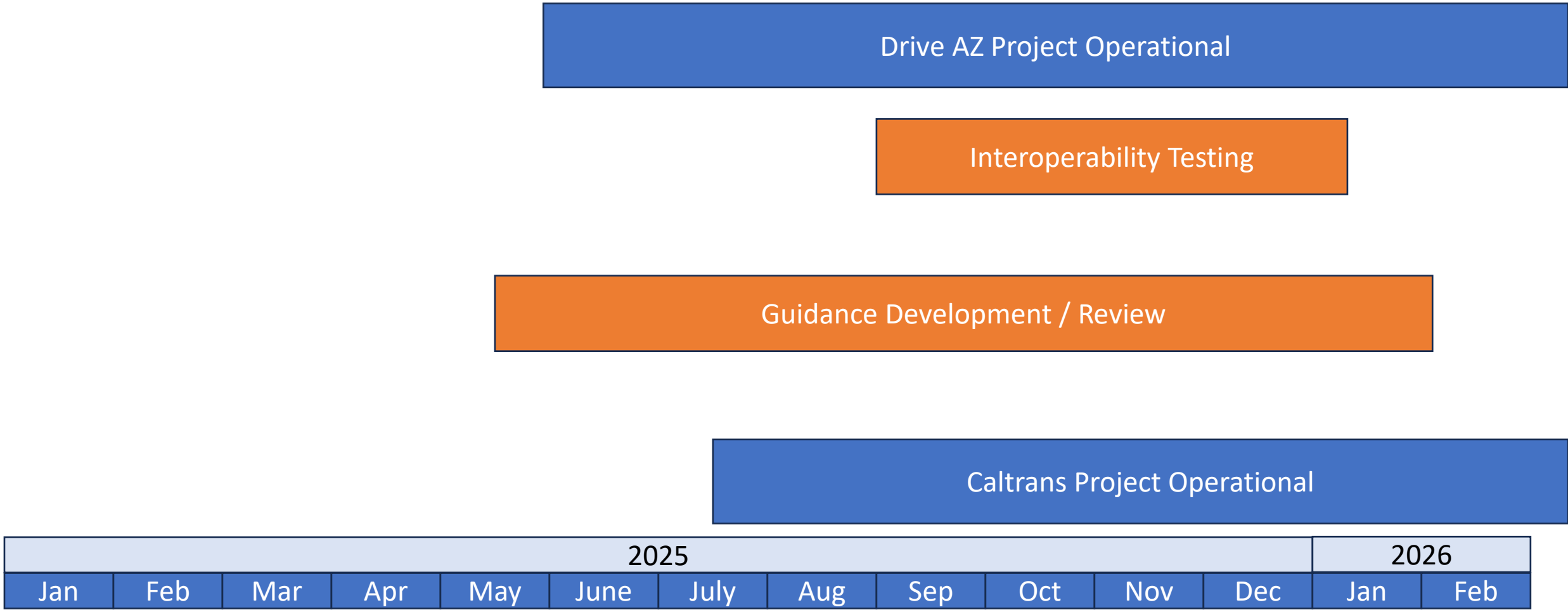
Step 7: Initiate Work Zone TIM Generation

Step 8: Data Management

Step 9: Remove Work Zone TIM

Step 10: Data Analysis and Evaluation

Rough Dates for Interoperability Testing Between Projects –



Next Steps

- Continue Guidance Development
  - Interviews with Arizona Teams
  - Interviews with Caltrans Team (as they advance through development)
- Plan and Conduct Interoperability Testing
  - Summer/Fall 2025 – As the California Project is Ready
- Develop Guidance Document
- Project Completion: June 2026

Questions?