DOT Wyoming Traveler Information Message (TIM) Interoperability Test

Why Interoperability Testing? Why TIMs?

- V2X Messages are often complicated with many optional data elements and potential ways of interpreting these elements
  - Different interpretations can lead to interoperability issues between devices
  - Some optional elements are considered mandatory for some deployments, which can lead to interoperability issues with other deployments
- Need to test these messages with operationally configured devices, using operational tools and production certificates
  - Standards conformance alone does not guarantee interoperability (e.g. – optional data elements)
  - Operational configurations of equipment can differ from default configurations

Interoperability Test Overview

- 3.5 days of testing at Archer Test Track in Cheyenne, WY
- **Tested 5 TIMs**
  - Weather Warning
  - Work Zone
  - Variable Speed Limit
  - Pedestrian Crosswalk
  - End of Ramp Warning
- **Edge case TIMs**
  - Conflicting TIMs
  - Different priority for different speeds
  - Circular region for weather TIM
  - Message count turnover (#127 to #0)

Archer Test Track (Cheyenne, WY)

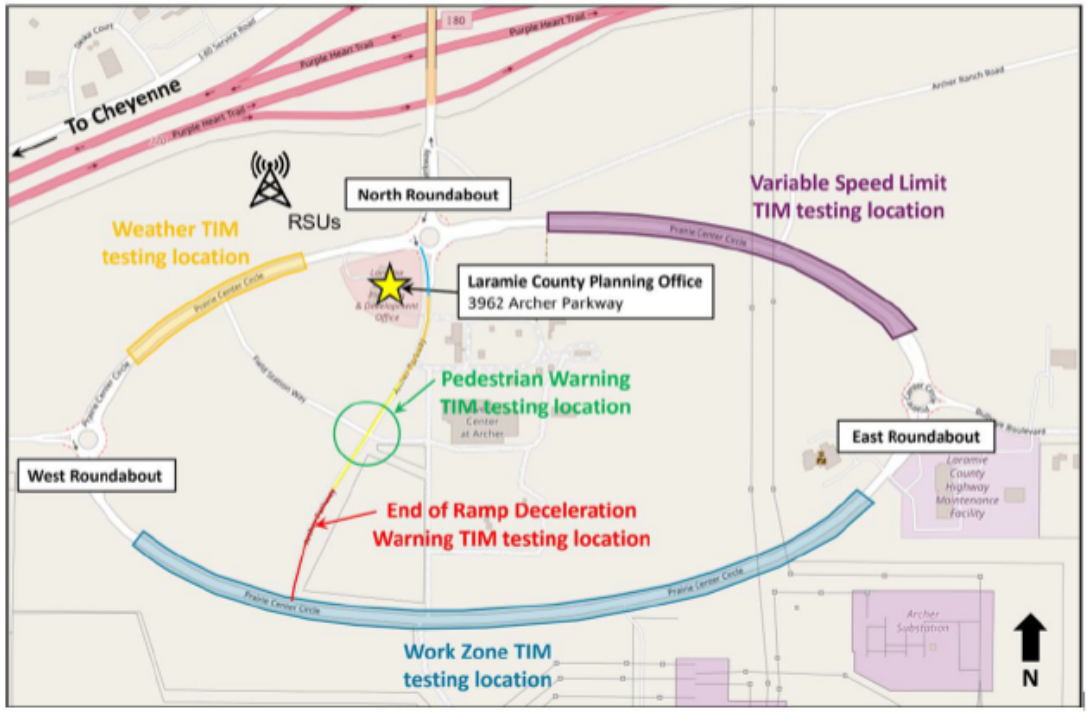


Fig. TIM locations around test track

Participants

Deployers:
- WYDOT
- CDOT
- UDOT
- GDOT
- THEA
- USDOT

Vendors:
- Yunex Traffic
- Commsignia
- DENSO
- Panasonic

Others:
- Neaera
- Trihydro
- Omni Air
- Narwhal Group
- Verizon
- Autocrypt

Support Contractors:
- Noblis
- Leidos

Equipment

OBUs (4 total)

Pictured: Cohda

Not pictured: Commsignia, Ficosa, MobiQ

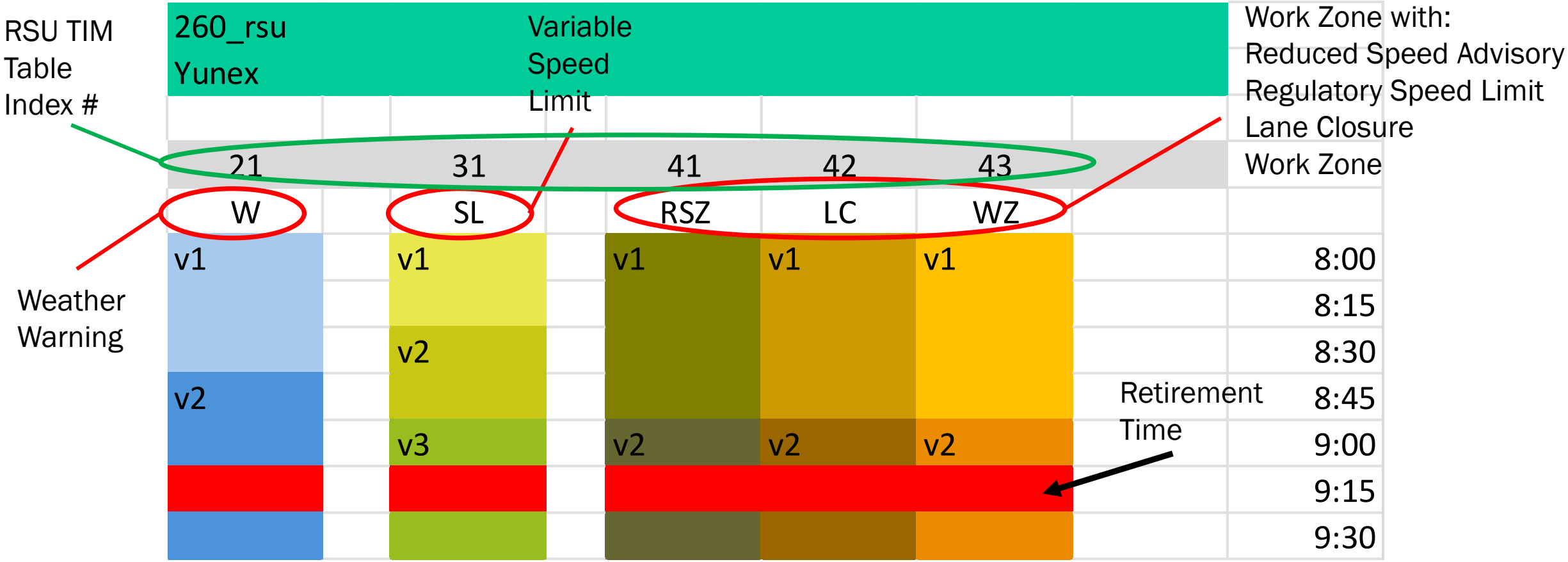
RSUs

From left: Iteris, Commsignia, Yunex, Danlaw

Not pictured: Kapsch (Panasonic), Kapsch (Narwhal)

RSU Installations

Interoperability Test Overview (continued)



Data Collection

- A data collection form has been distributed to participants to streamline the high-level information on the tests
  - The data from these forms will be incorporated into the test report
- An AWS S3 Bucket has been set up to collect data from the devices
  - This data will be uploaded to the ITS Data Hub

Initial Technical Findings from Interop Testing

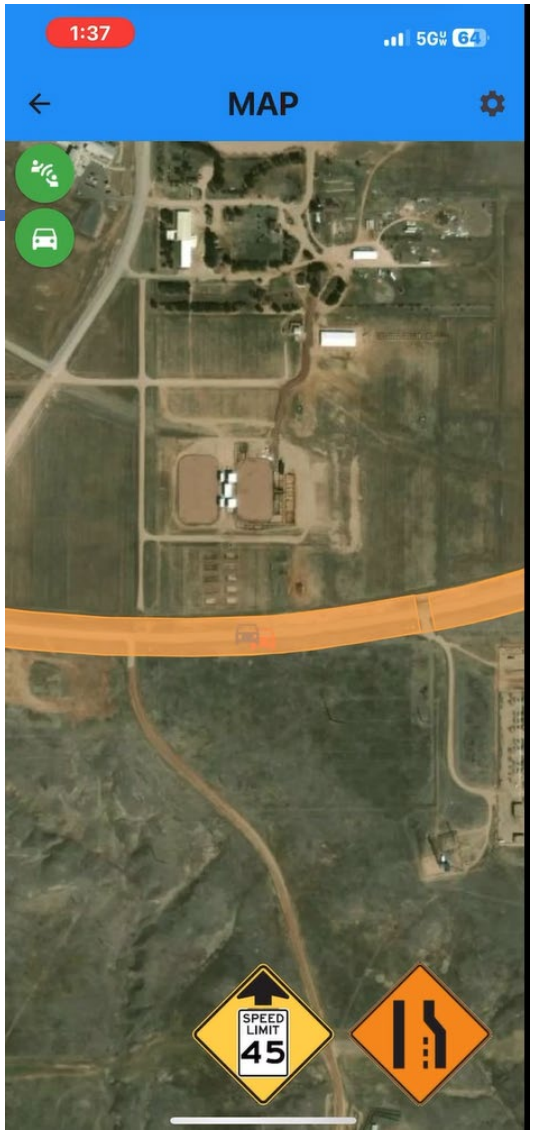
- Found some issues that broke interoperability between specific devices and some deployments TIM messages
  - Some devices don't like the FurtherInfold element in the TravelerDataFrame
- Directionality in messages can have issues
  - Path passed regionality has its' own directionality, in addition to the bitfield mask based directionality
  - Some devices applied the path directionality over the bitfield mask
- Devices generally did not like if an older TIM message and an updated TIM message were broadcast and received at the same time
  - Seemed to cycle continuously between the two

Initial Technical Findings from Interop Testing

- The message count turnover (msgCount going from 127 to 0 in a TIM update) has issues
  - Devices applied msgCount 127 over msgCount 0
- Using the SignPriority element in messages didn't really seem to an impact on the priority of signage displayed
- OBUs generally won't display Speed Limit warnings unless the vehicle is traveling faster than the speed limit
  - This is a good thing

Stretch Goal Successes

- Network V2X implementation worked really well!
  - Network V2X implementation ingested the same UPER encoded TIMs as the RSUs
  - Directionality and messaging worked just as an LTE-V2X RSU
  - Many thanks to Neaera Consulting for pulling this together!
- SCMS Interoperability between ISS and Autocrypt enrolled devices worked
  - This was not done with a production CTL, but hopefully will be in future tests



Next Steps

- As-Run Test Plan Update in work and will be published soon
- Test result packages and data are being collected
  - Test results will be summarized in the Test Report
  - Data will be posted to the ITS Data Hub
- Will start developing “Best Practices for TIM Deployment” Document
  - Will be developed in this working group and everyone will have an opportunity to provide comments and input on this document
- In November, we will start planning the next Interoperability Test Event
  - Will look for inputs from this working group
  - If you are interested in hosting the next event, please reach out to me (justin.anderson@dot.gov)

Questions?