INFRASTRUCTURE READINESS FOR ADS

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A variety of national efforts are underway...

- Federal Highway Administration (FHWA) - Roadway ADS Integration Concept of Operations

- USDOT / Institute of Transportation Engineers - Connected Transportation Interoperability (CTI) efforts

- Connected Vehicle Pooled Fund Study (CV PFS) - Connected Intersections Program

- USDOT - Work Zone Data Exchange specification

Ongoing evolution and uncertainty...

- What comes first: infrastructure vs. vehicle technologies

- FCC reallocation of the 5.9 GHz Spectrum

- Political uncertainty and administration changes

- Uncertain quality of products or data

From demonstration to institutionalization...

- The AASHTO SPaT Challenge

- USDOT CV Pilots

- Work Zone Data Exchange Demonstration Grants

Looking to the future....

○ Roadway infrastructure and agency operations will be different in a future with automated driving systems (ADS) and fully automated vehicles

○ FHWA Roadway ADS Integration Concept of Operations identified capabilities needed to support ADS integration
  ○ Did not specify roles and responsibility – Federal agency, state and local DOTs, private sector automakers or third-parties, etc.
  ○ Capabilities addressed identified needs in four categories:
    ○ Planning and Policy (8)
    ○ Cyberphysical (10)
    ○ Operations and Services (13)
    ○ Cross-cutting functions for Institutional Capability and Workforce, and Awareness and Engagement (4)
  ○ Seven ADS integration scenarios to illustrate possible future state for various use cases

ADS Integration Scenario – ADS Vehicle Snowplow

- Scenario for a lead snowplow to be manually driven and two snowplows under ADS control following the lead vehicle on a multi-lane highway
  - Accommodated by adjusted ramp meters or signal timings, supported by next-generation TMS
  - Advance notice of snowplows to other ADS vehicles, and potentially all vehicles if DMS are present
  - Supporting policies and a trained workforce help to operate and maintain ADS fleet vehicles
  - Agency procedures govern how, when, and where to deploy ADS fleet vehicles for winter maintenance
  - DOT garages and facilities are able to accommodate ADS fleet vehicles
  - ADS fleet vehicles leverage sensors and available V2X communications to increase safety
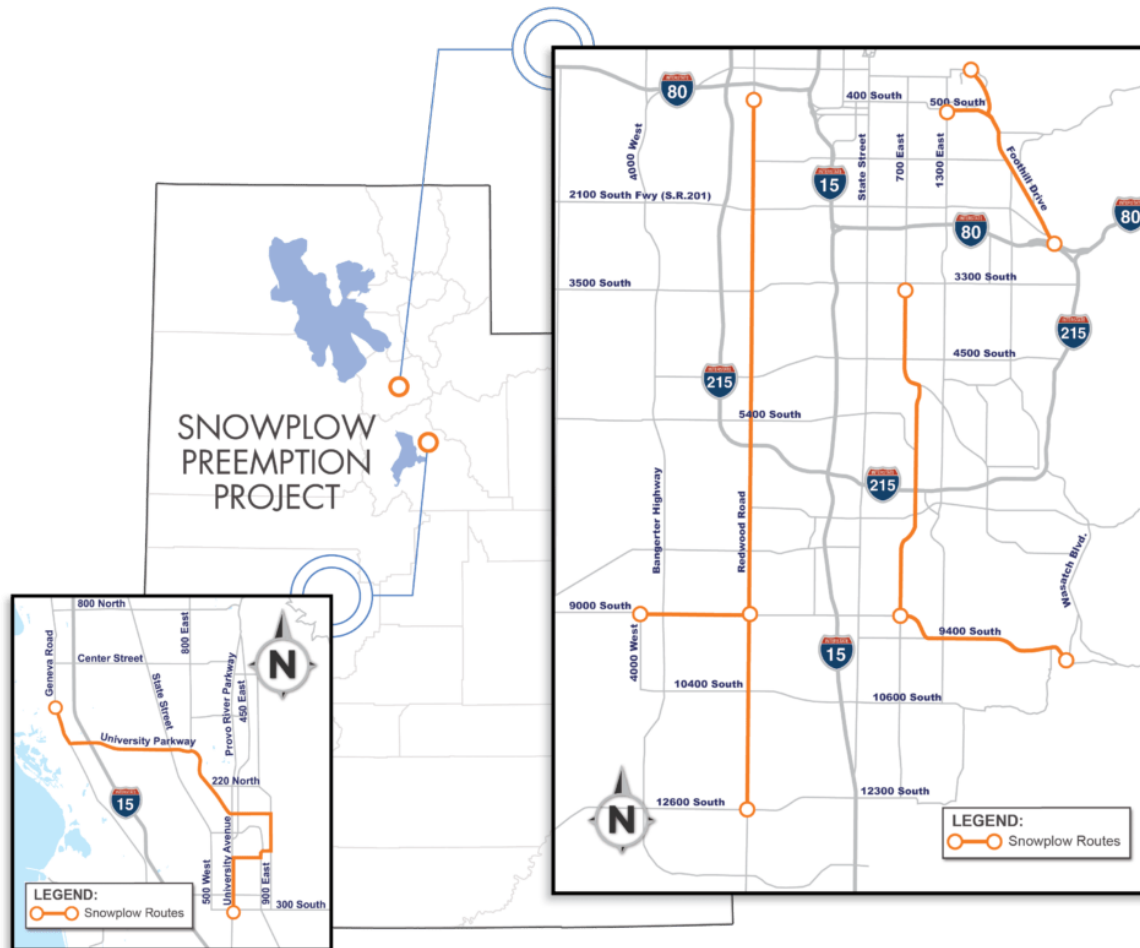
Capabilities to Support ADS

- What actions may agencies consider now to prepare for this future that are reasonable
  - Low-risk
  - No/low cost
  - Provide benefits today

- Policy: Develop policies to support equity, encourage safe use, as needed

- Operations: Develop practices for sharing operational strategies

- Cyber-physical: Support for Alternative Fuel Infrastructure that is likely the backbone for several ADS uses

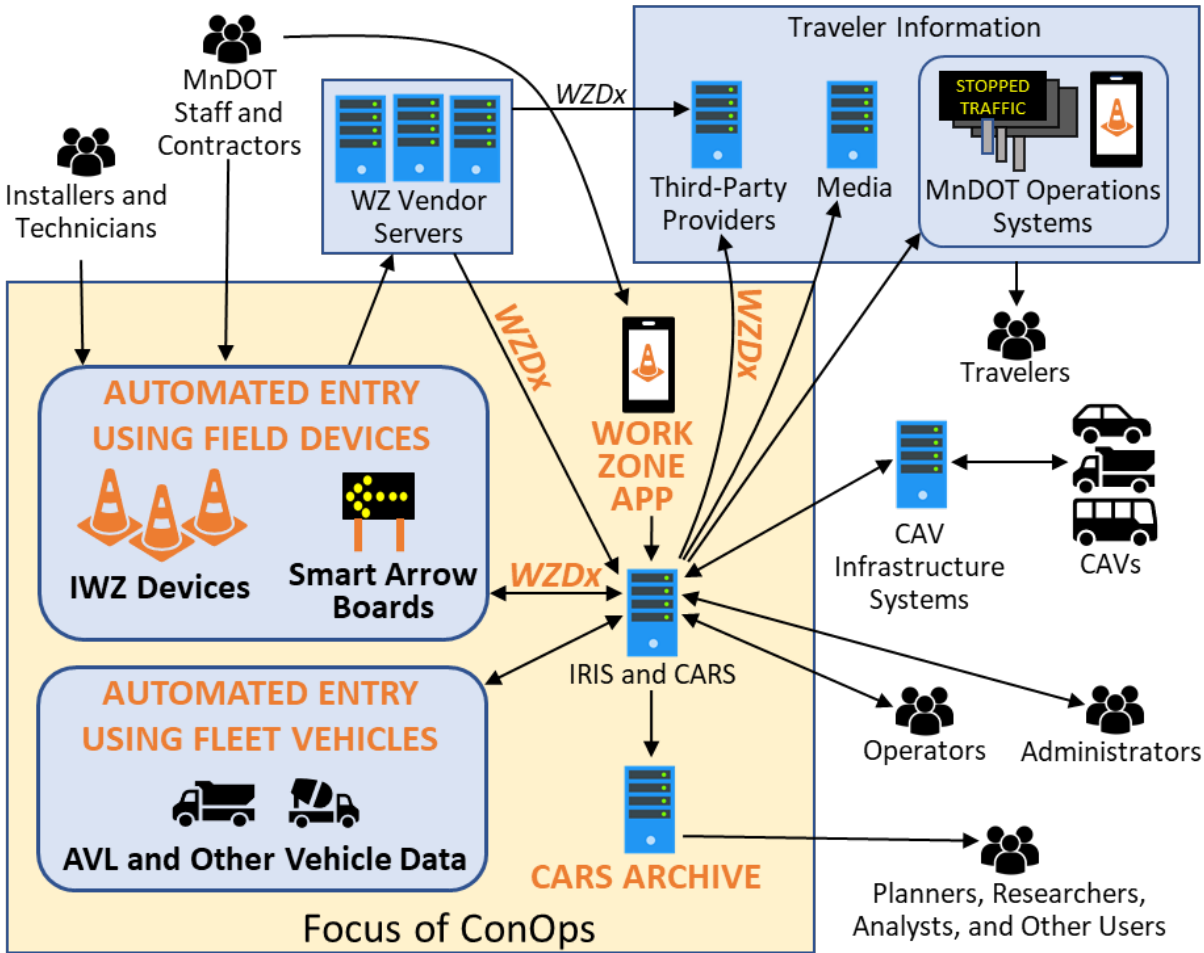- Workforce: Develop agency workforce expertise

Utah DOT Snowplow Signal Pre-emption

- Leverages V2X technologies at connected intersections

- Snowplow preemption anticipates snowplow arrival and changes a red light to green to keep the plow moving at efficient speeds
  - Occurs when the salt or sand spreader is active.

- 132 equipped signalized intersections and 44 equipped snowplows from 6 maintenance garages by end of 2021
  - Plans to equip an additional 139 signalized intersections and 17 snowplows from 2 additional maintenance garages in 2022.

Image source: Utah DOT
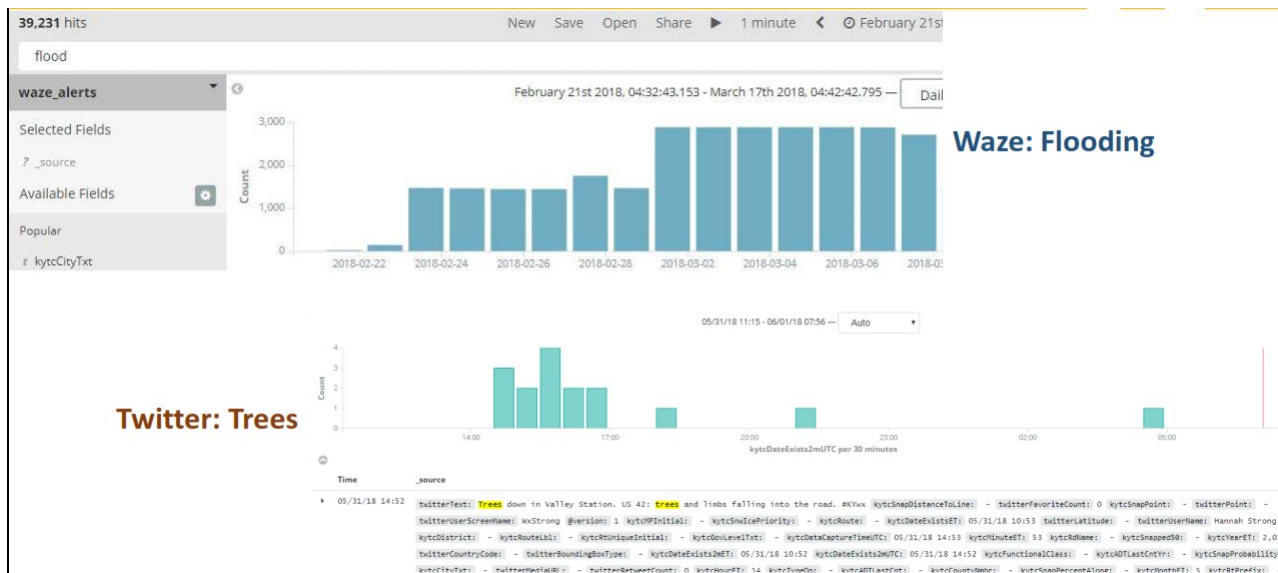
Minnesota DOT Work Zone Data Initiative

- Developed a Vision and Concept of Operations for Work Zone Data Initiative

- Work Zone App developed and WZDx feed implemented as part of WZDx Demonstration Grant

- Image source: MnDOT

Kentucky Transportation Cabinet and Big Data

Source	Records per Year
HERE	2.5 billion
Waze Jams	128 million
Waze Incidents	180 million
AVL (Snow Plows)	175 million
All Others	123 million
Total :	3.1 billion unique records

- Ingest and maintain a total of 55 TB of probe data with 26B stored records

- Leverage for a variety of planning and operations use cases
  - Road weather, work zone, congestion, performance management

- Image source: KTC

Waze: Flooding

Twitter: Trees

Conclusion

◦ Every agency will deploy and respond to new technologies at a different pace

◦ Agencies are institutionalizing new practices today that already provide benefits, and are laying a foundation for a transformed future, whatever that may be