National Developments in Cooperative Automated Transportation

Preparing for AV requires a CAT perspective

Roger Millar, Secretary
Washington State Department of Transportation

Washington State Transportation Commission Meeting
July 15, 2020
Presentation Overview

1. The CAT vs AV Perspective

2. CAT Policy Development in WA state

3. National CAT Initiatives
   - CAT Coalition (AASHTO, ITE and ITS America) with USDOT & FHWA
     - Organization/Structure
     - CAT Guiding Principles for Infrastructure Owners & Operators (IOOs)
   - ITS America
     - Fast Act Reauthorization Platform and Recommendation’s
     - MOD Alliance – Advancing Seamless Mobility in the United States
   - Mobility Data Specification

4. How Other States and Local Agencies are Preparing
Presentation Overview

5. How WSDOT is Preparing

- WSDOT and Increasing Telework
- WSDOT Mobility on Demand
- Public Records Act Study
- Automated Shuttles
- Active Transportation
- Broadband Accommodation
- Automated Enforcement
- Roadway Striping and Pavement Markings
- Connected Traffic Signals
- Automated Work Zone Safety and Data Partnerships
- Electric Vehicle Charging Infrastructure

6. Conclusion
How Does AV Relate to CAT?
What is a Connected Automated Vehicle?

**Connected Vehicle**
Communicates with nearby vehicles and infrastructure; Not automated

**Connected Automated Vehicle**
Leverages autonomous automated and connected vehicles

**Autonomous Vehicle**
Operates in isolation from other vehicles using internal sensors
What is Cooperative Automated Transportation (CAT)?

Cooperative: Deploying technology to encourage all modes of transportation to work in concert

Automated: Automating functions (traffic management systems, fare collection, trip planning and scheduling, etc.)
or access to various vehicle types (automobile, van, plane, truck, bus, rail, ferry, bicycle, scooter, etc.)

Transportation: The entire transportation system working together (vehicles, infrastructure, modes, services, etc.)
Preparing for AV requires a CAT Perspective
CAT Policy Development in Washington state
8 CAT Policy Goals Endorsed by the WSTC in October 2019

#1 Organize for Innovation: Enable organizational change that empowers officials to be flexible, accelerate decision-making, and adapt to changing technology.

#2 Shared Mobility: Encourage and incentivize shared mobility, including an emphasis on high occupancy and shared modes for moving people and goods.

#3 Economic Vitality and Livability: Create resilient and efficient regional networks and empower local agencies to create resilient, multimodal local networks.

#4 Infrastructure and Context Sensitive Street Design: Promote durable, physical and digital networks that accommodate the movement of people and goods in ways that are appropriate for the context.

#5 Land Use: Encourage land use development patterns that support multimodal connectivity to efficient local and regional networks.

#6 Equity: Work with marginalized communities to increase access to desirable mobility options.

#7 Safety: Increase the safety of transportation systems and infrastructure to support the safe movement of people and goods.

#8 Environment: Reduce the local and cumulative environmental impacts of mobility to improve air and water quality, energy conservation and mitigate climate change.
Using the 8 CAT Policy Goals as the Framework for Action

AV Work Group
Executive Committee

- Governor
- Four members from Senate
- Four members from House
- Insurance Commissioner
- DOL Director
- WSDOT Secretary
- WSP Chief
- Traffic Safety Commission Director
- State Chief Information Officer
- Transportation Commission Member

Government and Private Sector Representatives from:
- Data, Technology & AV Testing
- Shared, Electric, TNC & Transit
- Automakers
- Local Governments
- Consumers/Traveling Public
- Environment
- Academic
- Underrepresented Communities
- Freight
- Labor

Subcommittees

- Licensing
  - 2 Co-Chairs
  - DOL Support Lead
- Safety
  - 2 Co-Chairs
  - WTSC and WSP Support Lead
- Infrastructure & Systems
  - 2 Co-Chairs
  - WSDOT Support Lead
- System Tech & Data Security
  - 2 Co-Chairs
  - Insurance Comm. Support Lead
- Liability
  - 2 Co-Chairs
  - DOH Support Lead
- Health & Equity
  - 2 Co-Chairs
  - ESD and L&I Support Lead
- Workforce
  - 2 Co-Chairs
National CAT Initiatives
CAT Coalition
Joint Cooperative Effort between USDOT and AASHTO, ITE and ITS America

Formed to serve as a collaborative focal point for federal, state and local government officials, academia, industry and their related associations to address critical program and technical issues associated with the nationwide deployment of CVs and AVs.

Coalition membership includes representation from infrastructure owners and operators (IOOs), original equipment manufacturers (OEMs), technology and service providers, academic researchers, consultants, and internet of things (IOT) suppliers.
CAT Coalition – Organization

Co-Chairs
Roger Millar, WSDOT & Jennifer Cohan, Del DOT

Focus Area: Programmatic & Strategic Activities
Focus is on documenting needs and best practices for programmatic, strategic, and technical activities to encourage CAT deployment & operation through initiatives such as the SPaT Challenge & Connected Fleet Challenge.

Policy, Legislative and Regulatory Working Group
J. Toth
P. Ajegba

Strategic Initiatives Working Group
B. Leonard
J. Averkamp

Focus Area: Planning, Scenarios, & Resources
Supports the CAT industry in understanding Automated Transportation planning & scenario development, available resources, and documenting resource needs.

Technical Resources Working Group
F. Saleem
N. Katta

Planning / Scenarios Working Group
Sondra Rosenberg
J. Sydello

Focus Area: Infrastructure & Industry
Supports the CAT industry in defining the digital & physical CAT infrastructure, and establishing secure, verified connections between vehicles & this infrastructure.

100/OEM Forum
C. Castle
F. Saleem
M. Shulman

Infrastructure Industry Working Group
T. Larkin-Thomason
S. Gehring

Peer Exchange & Outreach Working Group (E. Seymour) – Supports all focus areas

Research Testing and Demonstration
(e.g. NCHRP 20-102, CV Pilot Sites, ATCMTD Sites, and other Federally & State led activities)
CAT Coalition: Phase 2 Year 2
Accomplishments Overview

Examples:

- Supported initiation of the National Strategy on Highway Automation
- Ongoing support of SPaT Challenge / Fleet Challenge
- Supported a dialogue regarding the wireless spectrum
- Helped members understand and benefit from USDOT activities and deliverables
- Expanded coalition membership (500+ members)
- MaaS/MOD Introduction (across all working groups)
- Clearinghouse of CAT policy frameworks
Cooperative Automated Transportation (CAT) Coalition

The Cooperative Automated Transportation Coalition (CAT) serves as a collaborative focal point for federal, state and local government officials, academia, industry and their related associations to address critical program and technical issues associated with the nationwide deployment of connected and automated vehicles on streets and highways. Coalition membership includes representation from infrastructure owners and operators (IIOs), original equipment manufacturers (OEMs), technology and service providers, and internet of things (IOT) suppliers.

The work of the CAT Coalition is accomplished through seven working groups, which were formerly a part of the Connected and Automated Vehicle Executive Leadership Team (CAV ELT) and the Vehicle-to-Infrastructure Deployment Coalition (V2I DC). The efforts of the working groups are coordinated and
Infrastructure Owner Operators’ Guiding Principles for Connected Infrastructure Supporting Cooperative Automated Transportation (AASHTO, ITE, ITS America)

**GP1—Automation:** Support increased vehicle automation to improve traveler safety, mobility, equity, and efficiency.

**GP2—Data:** Achieve a connected vehicle ecosystem that enables reliable, secure V2I data exchanges in order to support cooperative automated transportation to improve traveler safety, mobility, equity, and efficiency.

**GP3—Telecommunications:** Protect and utilize the 5.9 Gigahertz (GHz) spectrum designated for “operations related to the improvement of traffic flow, traffic safety, and other intelligent transportation service applications.” (FCC)

**GP4—Operations:** Develop CAT strategies that enhance existing transportation system operational capabilities to improve traveler safety, mobility, equity, and efficiency.

**GP5—Collaboration:** Collaborate and communicate with OEMs and mobility service providers in the planning, testing, and demonstrations of CAT applications to support eventual interoperability and to achieve positive impacts.
New Supporting Technical Concepts Document

- **Overview of CAT** (Stakeholders and Their Objectives, Applicable Modes, Vehicle Automation, Roadway Automation, Technology and Communications, Applications)

- **IOO Guiding Principles (GP) for CAT Infrastructure**
  - The Need and Basis for GPs
  - Objective of the GPs
  - GPs and Concepts (Automation, Data, Telecommunications, Operations, Collaboration)

- **Applying the CAT Infrastructure GPs**
  - CAT and IOO Processes
  - Preparing for CAT Infrastructure
  - Future Efforts

https://systemoperations.transportation.org/ioo-guiding-principles-for-cat/
ITS America: FAST ACT Reauthorization Policy Platform
ITS America Board Members
Public, Private, Academic, Associations, Consultants across the Nation

AAA, AECOM, Arizona Department of Transportation, California State Transportation Agency, California PATH University of California Berkeley, Central Ohio Transit Authority, Cisco, Cubic, Delaware Department of Transportation, District of Columbia Department of Transportation, Econolite, Florida Department of Transportation, Ford Motor Company, General Motors, PrePass Safety Alliance, HNTB, Iteris, Los Angeles Department of Transportation, MCity, Michelin, Michael Baker International, Michigan Department of Transportation, New York City Department of Transportation, San Francisco Bay Area Metropolitan Transportation Commission, National Renewable Energy Lab, Panasonic North America, Qualcomm, San Francisco County Transportation Authority, State Farm Insurance, Toyota, Texas Department of Transportation, Texas Transportation Institute, Virginia Department of Transportation, Washington State Department of Transportation
FIXING AMERICA’S SURFACE TRANSPORTATION (FAST) ACT REAUTHORIZATION

PLATFORM AND RECOMMENDATIONS
Moving People, Data, and Freight: Safer, Greener, Smarter.

ITS America’s vision is “A better future transformed by intelligent mobility – one that is safer, greener, and smarter.” Our mission is to advance the research and deployment of intelligent transportation technologies and solutions to save lives, improve mobility, promote sustainability, and increase efficiency and productivity.
Moving People, Data, and Freight: Safer

1. Increase Investments in Research and Deployment of Intelligent Transportation Technologies

2. Safeguard Critical Transportation Infrastructure from Cybersecurity Threats

3. Prioritize the 5.9 GHz Spectrum for Vehicle-to-Everything (V2X) Public Safety Transportation Communications and Grow Investments in Vehicle-to-Infrastructure (V2I) and V2P Technologies

4. Expand Investments in Advanced Mobility Improvements

5. Plan for Transformative Transportation Technologies

6. Deploy Broadband to Support Intelligent Transportation Technologies
Moving People, Data, and Freight: Greener

7. Increase Buildout of Alternative Fuel Vehicle Infrastructure to Support Zero Emission Vehicles

8. Build Transformative and Adaptive Infrastructure for Deployment of Intelligent Transportation Technologies to Mitigate Climate Change
Moving People, Data, and Freight: Smarter

9. Establish A Mobility-on-Demand Program for the New World of Mobility
10. Invigorate the ITS Program Advisory Committee
11. Strengthen the University Transportation Centers Program
ITS America: Mobility on Demand (MOD) Alliance
ADVANCING SEAMLESS MOBILITY IN THE UNITED STATES
POLICY | Federal Reauthorization
- MOD definition and amendments in code - Transit, STBG, CMAQ
  - Shared mobility program such as bicycles, micromobility, microtransit, ridesourcing, shared automated services

PARTNERSHIPS | MOD/MaaS Alliance Partnership
- MOD/MaaS Markets – Bookend events discussing key MOD/MaaS issues
  - Insurance (September 2019/March 2020)
  - Infrastructure Services (TBD)

PROGRAMS | State of MOD Study
- Public and Practitioners annual national surveys to assess awareness of mobility on demand, customer understanding and adoption of MOD and its elements
MOD Supply & Demand

Treats transportation supply and demand as commodities

CONSUMER-DRIVEN
Focused on traveler and personal choice

MULTI-MODAL
Mode agnostic and focused on trip satisfaction

DATA-DRIVEN
Depends on connected data rather than on a particular technology

MANAGEMENT FRAMEWORK
Framework for aggregating and managing supply and demand
MOD Around the US
Building Blocks of MOD

Mobility Services

Transit | Micro Transit | Ride Sourcing | Bicycle | Scooter Personal & Shared Vehicle

84 MILLION SHARED MICROMOBILITY TRIPS IN 2018
Building Blocks of MOD

Mobility Services

Freight Delivery | Emerging Automated/Autonomous
Building Blocks of MOD

Infrastructure Services
Roadway | Mobility Hubs
Parking & Curb | ITS | Fiber
Tolling | CV/AV/Traffic | Data
Platforms | Electrification
Building Blocks of MOD

Data Services

High Quality | Dynamic Shared
Standardized | Portable
Incentivized

Today's cars have a lot to say ...

SharedStreets

The City of Detroit, SharedStreets, and NACTO to Pilot
New Data Standard for Dockless Mobility
Building Blocks of MOD

Operator Services
Dynamic System Planning
Operations Management | Fleet Management | Market Growth
Building Blocks of MOD

Pricing/Payment Services

Integrated Trip Payment
Parking & Curb Use
Electrification

Coord’s Curb Explorer map color codes curb access regulations in San Francisco.
Building Blocks of MOD

Pricing/Payment Services

Congestion Pricing  |  Road Usage Charge  |  Wi-Fi  |  Data Services

New York City drivers will soon have to pay for the privilege of sitting in traffic

Metro directors order congestion pricing study
Congestion pricing could alleviate traffic in the region—but some froze one skepticism.

Connected and automated vehicles: The role of toll road operators
Mobility Data Specification
Mobility Data Specification

THE FUTURE OF MOBILITY

Municipalities across the country have joined together to create a new global non-profit organization called the Open Mobility Foundation to support the development of open-sourced software that provides scalable mobility solutions for cities.

Governed by cities, the Open Mobility Foundation develops and promotes technology used in commercial products that either use the right-of-way or that help government entities manage the public right-of-way.
Mobility Data Specification

Establishes data standards that encourage data sharing, fare payment integration and competition.
How Other States and Local Agencies are Preparing
Survey on CAT / CAV Capacity & Funding Approaches in the states

Survey conducted by the CAT Coalition Working Group on Policy, Legislation, and Regulation during April 2019
# 25 State DOTs and 2 Local Agencies responded to the survey (27 total)

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<th>1. AKDOT&amp;PF Central Region</th>
<th>11. Maryland Department of Transportation</th>
<th>20. RI Dept. of Transportation</th>
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<td>2. Arizona Department of Transportation</td>
<td>12. Maryland DOT-SHA</td>
<td>21. Road Commission For Oakland County</td>
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<td>5. Delaware DOT</td>
<td>15. Nevada Department of Transportation</td>
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<td>8. Idaho Transportation Department</td>
<td>18. Oregon Department of Transportation</td>
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<td>10. Maine DOT</td>
<td>19. PennDOT</td>
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Future near-term CAT/CAV Deployment priorities

- Other (please specify)
- Open data/data sharing applications or projects
- Connecting traffic signal timing information to...
- Use of aerial drones for maintenance and asset...
- Signing and Striping: Roadway machine readable...
- Worker Safety: Autonomous roadway construction...
- Electrification: Expanding/building the electric...
- Transit: Automated bus braking and pedestrian...
- Transit: Low-speed AV shuttles
- Transit: First mile/last mile connections
- Truck Platooning: SAE Level 1 Driver Assisted, other
WSDOT and Increasing Telework
# Telework Initiatives

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<th>All Workers</th>
<th>State Workers</th>
<th>WSDOT</th>
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<td><strong>Statewide</strong></td>
<td>Telework (TDM Exec Board + Tech Committee)</td>
<td>State Workers Telework (OFM, TRPC, WSDOT)</td>
<td>Telework Transformation</td>
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<td>Data for Governor Inslee (OFM)</td>
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<td><strong>Local</strong></td>
<td>WorkSmart (King County Metro)</td>
<td>Telework Tuesdays (TRPC)</td>
<td>Goldsmith and WSF HQ</td>
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<td>Thurston TSMO (TRPC, WSDOT)</td>
<td>ORMAF (Olympic Region)</td>
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WSDOT telework survey

Understanding remote working trends during the COVID-19 pandemic

Prepared by the WSDOT Public Transportation Division
Key Takeaways

- The majority of WSDOT respondents (84 percent) never or rarely teleworked before the pandemic. WSDOT was able to convert over 93 percent of respondents’ positions to telework to keep our employees at home and reduce their exposure to COVID-19.

- Telework satisfaction was very high even in less than ideal conditions.

- Overall productivity stayed about the same despite significant challenges.

- WSDOT is working to remove technology barriers to productivity; many of the other barriers people identified will be mitigated once we reach the “new normal.”
Satisfaction with telework was extremely high

- more than 70 percent of employees reported being at least somewhat satisfied with their telework experience, whereas only 8 percent responded they were at least somewhat dissatisfied
Changes to productivity

Productivity stayed roughly the same but was distributed differently

- 30 percent of employees were at least somewhat more productive, while 29 percent were at least somewhat less productive
Productivity boosters

What, if anything, is helping your productivity?

- fewer workday interruptions: 54%
- comfortable environment: 46%
- less socializing: 35%
- eliminated stressful commute: 33%
- supervisor support: 29%
- targeted meetings: 28%
- eliminated long commute: 28%
- coworker support: 21%
- clearer priorities: 13%

**Note:** this question allowed respondents to select **all** options that were applicable; only options identified as affecting 10 percent or higher of employees are shown.
### Productivity Barriers

What, if anything, is a barrier to your productivity?

- Work station is not as functional: 34%
- Lack of access to work systems: 30%
- Lack of social connection: 29%
- Connectivity issues: 29%
- Lack of collaboration: 28%
- Change in duties due to Covid: 19%
- Demands from family: 16%
- Slow/no personal internet: 15%
- Hard to get signatures: 14%
- Job duties not suited to TW: 12%
- Changed duties draining: 12%
- Distractions: 11%

**Note:** This question allowed respondents to select **all** options that were applicable; only options identified as affecting 10 percent or higher of employees are shown.
Next Steps

- As part of the telework transformation initiative, we will recommend that the core team conduct a follow-up survey, with three main purposes:
  - Check on employees’ telework experiences now that they have been teleworking longer and the IT infrastructure has been improved
  - Explore employees’ ideal number of telework days in the future
  - Determine if employees’ feelings about telework are shifting

- We are also working on determining realistic (post-COVID) telework targets and measurement techniques to help convert WSDOT to a telework-first agency* and reinforce our status as an employer of choice.

* For non-front line positions: of WSDOT’s 7,000 statewide positions, approximately 3,000 work predominantly in the field and 4,000 work mostly in office settings
WSDOT Mobility on Demand (MOD)
Policy Development: Mobility on Demand core principles and emphasis areas

- Connectivity
- Environment
- Data
- User experience
- Safety

EQUITY
Mobility on Demand key issues

- Reduce emissions
- Vulnerable populations
- One app to rule them all
- Funding needs
- Active transportation
- Physical infrastructure and right-of-way management
- Workforce development
Regulate, support and pay for GTFS-Flex adoption

Flexible transit service in Washington State

- 8 urban
  - 11 small urban
  - 13 rural
- 31 have flexible service

WSDOT is partnering with UW, Oregon State University, and King County Metro to advance the adoption of this standard in Washington state.
Next steps

- Conduct a Public Records Act research study
- Establish data standards that encourage data sharing, fare payment integration and competition
- Regulate, support and pay for GTFS (General Transit Feed Specification) - Flex adoption
- Test and pilot first and last mile program
Public Records Act Study
Considering a public-private partnership to support a research project that examines how the Public Records Act may be updated to:

- Protect trade secrets for private mobility providers
- Protect personally identifiable information for users
- Allow for data sharing between public and private entities that advances mobility, safety, equity and other public interest outcomes.
Connecting people to transit

- Automated Shuttles (SAE Level 3 / 4)
- First Mile/Last Mile connections to transit through partnerships with rideshare companies
- 40% of the trips we make every day are 1 mile or less (60% of these trips are taken in a car)
Grant Applications: Applied for, but did not receive, a FTA Grant for Low Speed Shuttle in Washington State

- Aimed at providing safe, regular, and on-time delivery of its riders.
- Help increase public confidence and acceptance of AV technology.
- Supported by Pierce Transit and WSDOT.
- ADA compliance will be provided by Virginia Tech Transportation Institute.
Supporting local partners as they explore low speed shuttles

- At least 5 groups in Washington are exploring the use of low speed shuttles to meet transportation needs.
- These groups included, transit agencies, cities, and private businesses.
- Funding for new pilot projects is challenging in this environment.
- Shuttle pilot projects range in cost between $250k - $2.5 million.
Active Transportation
Active Transportation: Automated bus braking and pedestrian detection

Pierce County, Wash., Transit Deploys System to Help Buses Avoid Collisions with Pedestrians, Bicyclists

Researchers at the University of Washington are compiling data on the system to help determine whether it is “as effective as claimed.”

BY ADAM LYNN, THE NEWS TRIBUNE (TACOMA, WASH.) / OCTOBER 18, 2016

Pierce Transit has been piloting: Automated pedestrian detection which has reduced pedestrian-related crashes

Photo credit: Seattle Medium

Photo credit: Pierce Transit

Photo credit: SounderBruce
Active Transportation: Lessons from COVID-19

I’m going for a walk: the importance of complete neighborhoods

- Stay Home, Stay Healthy – many see their neighborhoods in the daytime
- Mixed use neighborhoods provide food security, access to services
- Sidewalks and bikeways often don’t exist, or too narrow for social distancing
- Need to do catch up on accessibility – for a person in a wheelchair, no curb cut means they aren’t going anywhere
- People staying closer to home likely to influence/increase local active transportation investments
- Complete the state’s active transportation system to complement/leverage affordable housing, transportation and telecommunity initiatives
Broadband Accommodation
Broadband and transportation

Far-reaching and high functioning broadband networks will:

- Enable and enhance transportation choices
- Improve livability, access to jobs and education in rural and urban communities while decreasing travel demand
- Improve transportation system management and operations.
- Facilitate the deployment of connected automated transportation systems
• The legislation established aggressive goals:

2024 • All residences and businesses will have 25/3 Mpbs service

2026 • All anchor institutions will be served with a 1 Gbps connection

2028 • All residences and businesses will have symmetrical service at 150/150 Mpbs
Broadband infrastructure accommodation current policies

**Utility Accommodation**
- RCW 47.44
- Permits and Franchises

**Wireless Leasing**
- RCW 47.04
- Special Wireless Facility Leases and Access Permits

**General Leasing Authority**
- RCW 47.12
- Highway Land or Airspace Lease
WSDOT’s current efforts

Revising WSDOT policies
- Collaboration with the Department of Commerce Broadband Office to align state broadband policy goals

Exploring opportunities with public agency broadband providers
- Ports
- Public Utility Districts
- Tribes

Focused on partnerships and collaboration rather than traditional permitting or leasing.

Examples
- Installing conduit for fiber as part of roadway and bridge projects
- Access to services in lieu of Fair Market Rent
- Road Weather Information Systems
- Access to Public Rights of Way for 4G / 5G Small cells
Example: Providing access to public rights of way for 4G / 5G small cells

Next New Small Cell
1,000 ft. separation

New Small Cell

4G Antenna
5G Antennas
Equipment Cabinet

Power & Fiber fed underground and internally through the pole

Photo simulation along I-5
Automated Enforcement
Automated Enforcement

Speed

Other Opportunities
- HOV Lane Enforcement
- Tolling
- Red Light Running at Traffic Signals
- Congestion Management
- Road User Charging
Automated Speed Enforcement:
Potential concept of operations for Washington State

“Aircraft like” enforcement on the ground process.

- Set a highway segment with license plate readers and cameras at the beginning and end of the segments.
- Vehicles exceeding a speed threshold (like 95% of all vehicles) have the rear of the car and license plate photographed and transmitted to a nearby trooper.
- Troopers stage at an area off the shoulder, providing the troopers a margin of safety from moving traffic and has less impacts on traffic flow.
- The trooper searches for the vehicle, once the vehicle is spotted the trooper follows the vehicle until a safe stop can be made.
- Gives troopers some discretion in who to pull over
- The trooper can write an infraction, issue a warning or do other police investigations.
Next steps toward automated speed enforcement:

- Validate concept of operations by identifying viable technology, equipment needs and potential cost to establish and operate the system. This will also include the identifying the number and location of potential enforcement zones.

- Reached concurrence on concept of operation with WSP, WTSC and WSDOT Leadership, Winter 2020

- Refining proposed legislation with needed funding identified Spring-Summer 2020

- Contacting stakeholders and seeking Governor approval Summer 2020
Roadway Striping and Pavement Markings
Roadway striping and pavement markings

Striping and marking investments are the least cost / highest return investments for keeping driven and automated vehicles safely on the road.

With aging drivers and automated systems, higher quality striping is now an operational need rather than a simple maintenance or preservation task.
Roadway striping and pavement markings

- SAE Level 1&2 vehicles, adaptive cruise control and/or lane keeping assist
- Dotted extension lines (edge)
- Without the dotted extension lines
- Vehicles can drift toward gore areas and/or follow the off ramp
NCUTCD: Markings Committee Update

MUTCD Recommendations Section 3A.06:

A. Normal line — 4 to 6 inches wide for Interstate, freeway, expressway and corresponding ramp interchange markings and for edge lines on all other roadways with posted or statutory speeds of 55 mph or more and an ADT of 6,000 vehicles per day or greater; otherwise, a normal line shall be 4 to 6 inches wide.

B. Wide line — 8 inches or more in width when used with 4 inch normal lines and 10 inches or more in width when used with 6 inch normal lines at least twice the width of a normal line. [Approved 06-28-2014, 14B-MRK-02]

Note 1: Proposed additions to the MUTCD are shown in blue underline

Note 2: Changes previously approved by NCUTCD Council (but not yet adopted by FHWA) are shown in green double underline for additions and green double strike-through for deletions.
Connected Traffic Signals
Traffic signal operations deployments and testing

Communicating with the transportation infrastructure – Dedicated Short-range Communications (DSRC) allows infrastructure and vehicles to share data

Partnering with universities – UW researchers are developing a mobile application to allow for pedestrians to request walk signal and additional sharing of Signal Timing and Phasing (SPaT) data
Centralized platforms and Connected Vehicle (CV) readiness

Cloud-based connectivity – Signal Timing and Phasing (SPaT) data can be sent via cloud to be consumed by 3rd party

CV-readiness and standards – Agency standards are being updated to include advanced transportation controllers and cabinets in all new signal and ramp meter installations

Dashboard signal timing information (Audi)

3rd party data integrators /centralized system
Automated Work Zone Safety/ Data Sharing Partnerships
Autonomous Truck Mounted Attenuator (ATMA)

Work Zone Safety

Low-speed striping operations
WSDOT’s Work Zone database

Planning level data input:

What is the work?
When is it scheduled?
Who is responsible?
  - Construction
  - Maintenance
  - Utilities
  - Special Events, etc.
How can we contact them?
  - Avoid conflicts
  - Combine multiple
  - Work zone activities?

Deployment underway
  - 4 of 6 regions to date
National Work Zone Data Initiative (WZDI) engagement

Future Intent:
- Both Planned Work Activities and Incident messaging sent to National WZDx

Expected Benefits:
- Potential Reduction of Secondary Crashes

FHWA National Work Zone Data Exchange (WZDx) Specifications Concept
Current WSDOT pilot: Transmit work zone data through roadside devices to WAZE

WSDOT Credited Work Zone in WAZE

Connected Arrow Board Kit:
Two Each for Olympic and Southwest Region Dedicated Work Zone Crews

“iPin”
Marks End of Work Zone

Courtesy: iCone Products/Waze App
Electric Vehicle Charging Infrastructure
Response to challenges: Electrification & alternative fuels

Alternative energy

- **EV charging stations**
- **Ferry conversion, new vessels**
- **Fleet conversion**
- **Clean transit** – 386 electric buses in Washington (as of December 2018)
  - WSDOT working with local partners to obtain federal grants to replace diesel with alternative fuel vehicles
- **E-bikes, E-scooters**
Electric vehicle charging infrastructure

- Uses a portion of the annual electric vehicle registration fee to provide matching grants
- $1 million in state funding used to encourage private sector investment for 15 new locations totaling $2.5 million
- $100M would complete the gap map with charging stations every 70 miles
Additional Efforts Underway

- Coordination with other states (OR, CA) and province (BC) on the West Coast Electric Highway

- FHWA Designation of EV corridors: I-5 and sections of I-82, I-90, US 101

- Coordination with other organizations on EV charging investments
  - Joint OR/WA Pacific Northwest ZEV Investment proposals to Electrify America
  - Ecology VW Settlement Investments in EV charging
  - Commerce Electrification of Transportation Systems Program - Clean Energy Fund (CEF)

- Research with UW to prioritize investments in highway corridor charging
  - Built an Electric Vehicle Infrastructure – Decision Support System (EVI-DSS)
Conclusion
Preparing for AV requires a CAT perspective
Questions?