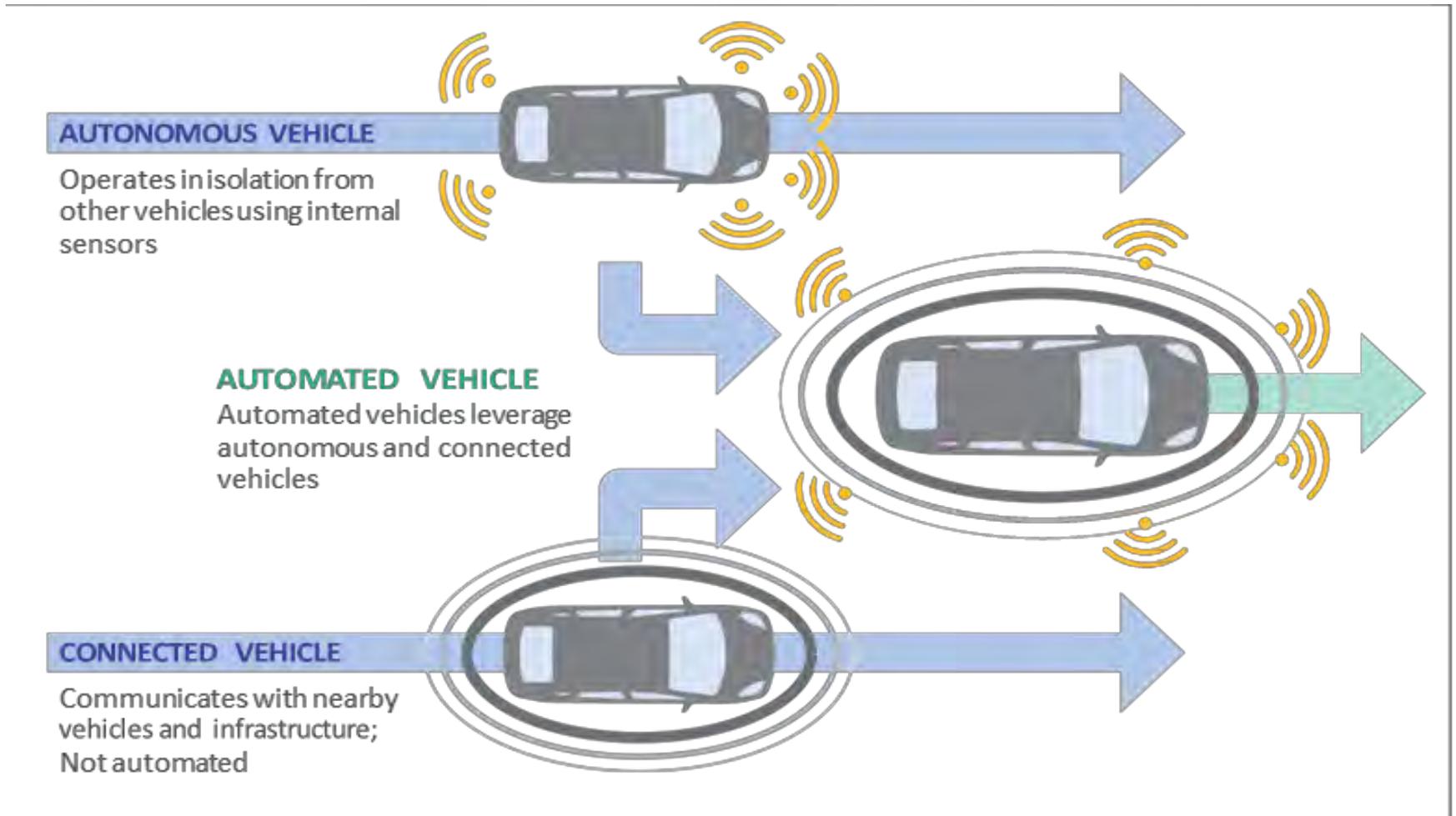# Automated Vehicle Testing Freight Council 3-3-17

Sandra Q. Larson, P.E.

Systems Operations Bureau Director

Iowa Department of Transportation

Terminology

- **Automated Vehicle (AV)**
  - Connected Vehicle (CV) and Autonomous Vehicle
- **Autonomous Trucking (AT)**
  - **Newer concept to Public Agencies**

Automated Vehicle Definition

US DOT graphic

AUTONOMOUS VEHICLE

Operates in isolation from other vehicles using internal sensors

AUTOMATED VEHICLE

Automated vehicles leverage autonomous and connected vehicles

CONNECTED VEHICLE

Communicates with nearby vehicles and infrastructure; Not automated

IOWADOT

Questions to Answer in Presentation

1. **Why** should Public Agencies support Automated Vehicles (AV)/Autonomous Trucks(AT) testing?

2. **How** can we support AV/AT testing? **What** is underway?

3. How do we **collaborate** effectively?

4. What does the future hold?

Survey on Automated Vehicle Testing in Iowa and other states

- American Association of State Highway Transportation Officials (AASHTO)
- Transportation Research Board/National Cooperative Highway Research Program (TRB/NCHRP)
- State DOTs: Arizona(AZ), California(CA), Colorado(CO), Michigan(MI), Nevada(NV), Ohio(OH), Pennsylvania(PA), Texas(TX), Iowa(IA)
- University of Iowa (UI)
- Iowa State University (ISU)
- HERE of North America
- Iowa Motor Truck Association
- ❖ Disclaimer

IOWADOT

Passenger Vehicle Testing/Research

- Some of the AV Passenger Vehicle Testing and Research has applicability to Heavy Trucking, either directly or indirectly.

- Some of my comments will be applicable to both AV Passenger Vehicles and Heavy Trucking.

IOWA DOT

#1 - WHY? - Safety and Mobility

- This is THE reason why Public Agencies are interested in Automated Vehicles (AV) and Autonomous Trucking (AT) testing
- Improved **Safety** and **Mobility** result in **Economic** Benefits/Vitality/Opportunity

This is personal…….

Why? – The Timing is Right

- Traffic Fatalities Increasing
- Vehicle Miles Traveled (VMT)/Truck VMT is Increasing
- Economic Concerns/Driver Shortages Predicted to Increase
- Technology is developing rapidly
- Data is available and improving
- A "Perfect Storm" for AV/AT is brewing

Why? – This is Personal

- Traffic Fatalities

  ----- 35,092 - U.S. in 2015

  ----- National Safety Council estimates as many as 40,000 people died from crashes in 2016

IOWADOT

Why? – This is Personal

- Traffic Fatalities in Iowa

  ----- 322 in 2014

  ----- 320 in 2015

  ----- 403 in 2016; 27% increase between 2015 and 2016

IOWADOT

Why? - Opportunity

Unprecedented opportunity for safety impact -

The National Highway Traffic Safety Administration (NHTSA) has estimated

- **94 %** of crashes are due in some measure to human error/choice
- **80 %** of crashes could be mitigated or eliminated with AV

IOWADOT

Why? - Congestion

- Iowa total VMT* growth percentage
  - 2014 to 2034 = 47.1%
  - 2014 to 2044 = 79.4%
- Iowa **Truck** VMT* growth percentage
  - 2014 to 2034 = 47.9%
  - 2014 to 2044 = 80.7%

*Vehicle Miles Traveled

IOWADOT

Why would we only look at AV technologies for passenger cars?

- Significant % of VMT is trucking
- Future scenario discussions for vehicle ownership and population shifts still include truck VMT % increases
- Significant Economic Benefits for Trucking from improved Safety, Mobility and Fuel Efficiency

Why?
Interstate Highways in **Iowa**

- Interstates make up ~8% of primary highways
- Carry over 60% of large truck traffic statewide
- Truck percentages approaching 40% in some interstate areas
- Opportunity to make major improvements to our **Interstate** Safety and Mobility with AT

IOWADOT

Why?
Congestion in Iowa

- 2016 – 2077 traffic incidents per month (state system only)

- Nationally - **2.8%** likelihood of a **secondary crash** per minute of lane blockage

- Average lane clearance time is 53 minutes

- So, 148% chance for secondary crash on the average incident lane closure

Pause Point

Testing AV/AT in Iowa and the Nation:

- It is just the beginning

- Expect incremental steps in testing and technology development over future years

- Glimpse into the future

IOWA DOT

#2 - How Support AV/AT testing, and what is underway?

- Share **Data** and information
- Facilitate and foster an environment for the **Safe Testing** of AV/AT
- Establish **partnerships** with industry, other agencies, universities to develop, examine, test, research AV safely
- **Research** Projects

Data

- AV/AT is enhanced with access to **high quality, continuously updated** road/traffic/weather/map **Data** to plan routes and make more **informed decisions**
- Public Agencies have data about:

    - lane closures, debris, work zones

    - ice and snow mitigation/ weather

    - traffic/speeds

Data Challenges for Public Agencies

- What data is valuable for AV/AT?
- How do we make sure the data can be actually used by AV/AT?
- How do we get the right data with the right level of detail?
- It takes testing and piloting.

IOWADOT

Iowa's AV Project

- Why do this? –increase safety, capacity, mobility, efficiency, economic vitality, access, and **Intermodal freight efficiency**

- Provide **data** to drivers and AV

- Project Purpose – partnership to develop strategies for research, development, testing, operation, and implementation of AV in Iowa.

What is Iowa's AV Project – First Steps?

- Initially focused on **traffic queues** and **work zones**. Data managed by DOT and hard challenges for AV.
- Project with HERE, UI, ISU to generate/test **data** for the driver/vehicle.
- Our goal is to define the **right data and common standards** and then share useful data with others.
- AV **pilot test** with traffic alerts and High Definition (HD) mapping for late fall 2017.

More Reasons for Iowa's AV Project

- Create an environment where AV driving and technologies can thrive in Iowa.
- Assist people to drive more effectively and **move freight more efficiently.**
- Enable automated vehicle driving as it becomes available.
- Make Iowa a leader in offering AV-Ready technologies.

IOWADOT

HERE's HD Live Map Cloud Communication
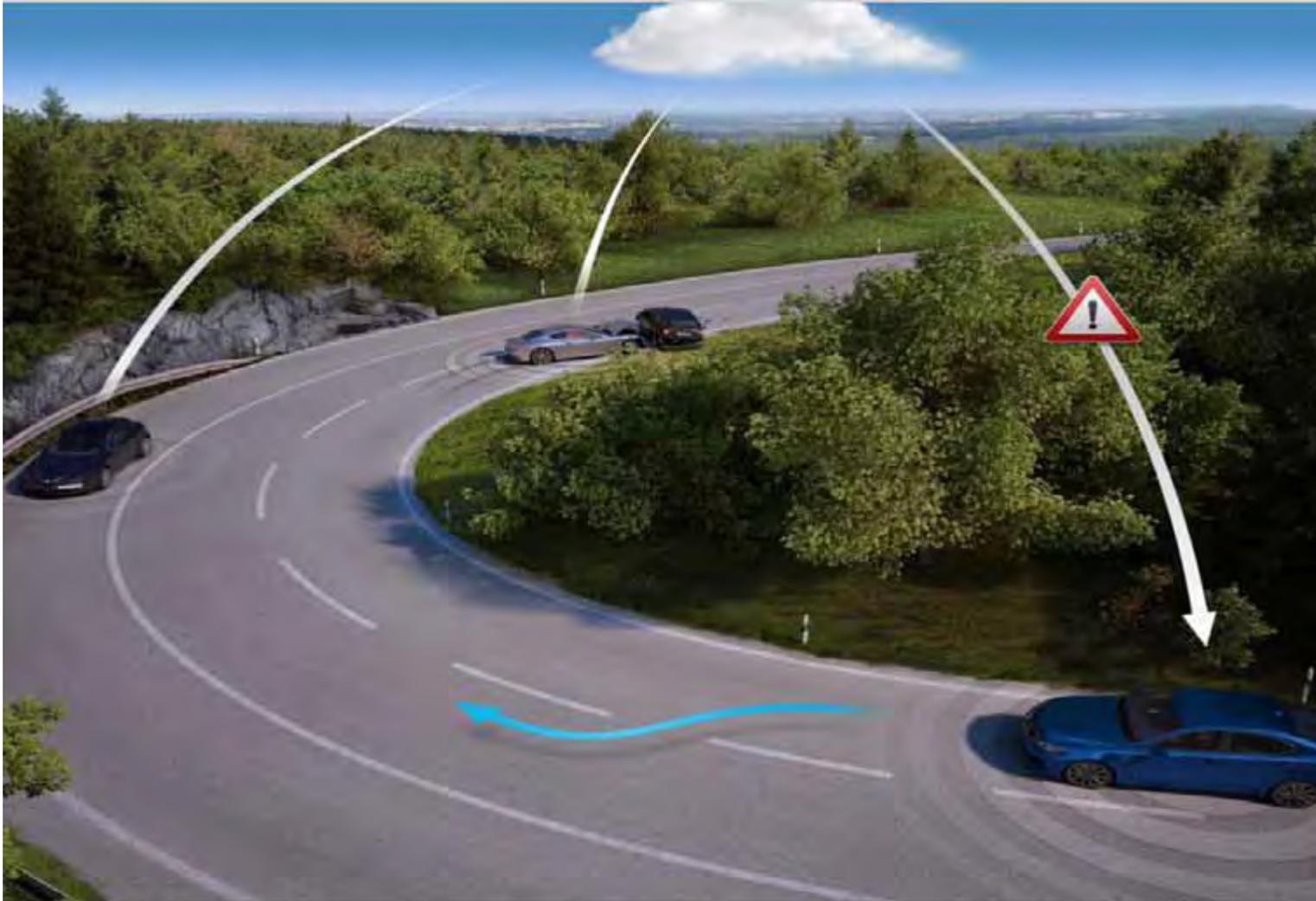
HERE HD Live Map
Cloud computing of HD Live mapping, Freight Efficiency, Live **integrated** AV Corridor
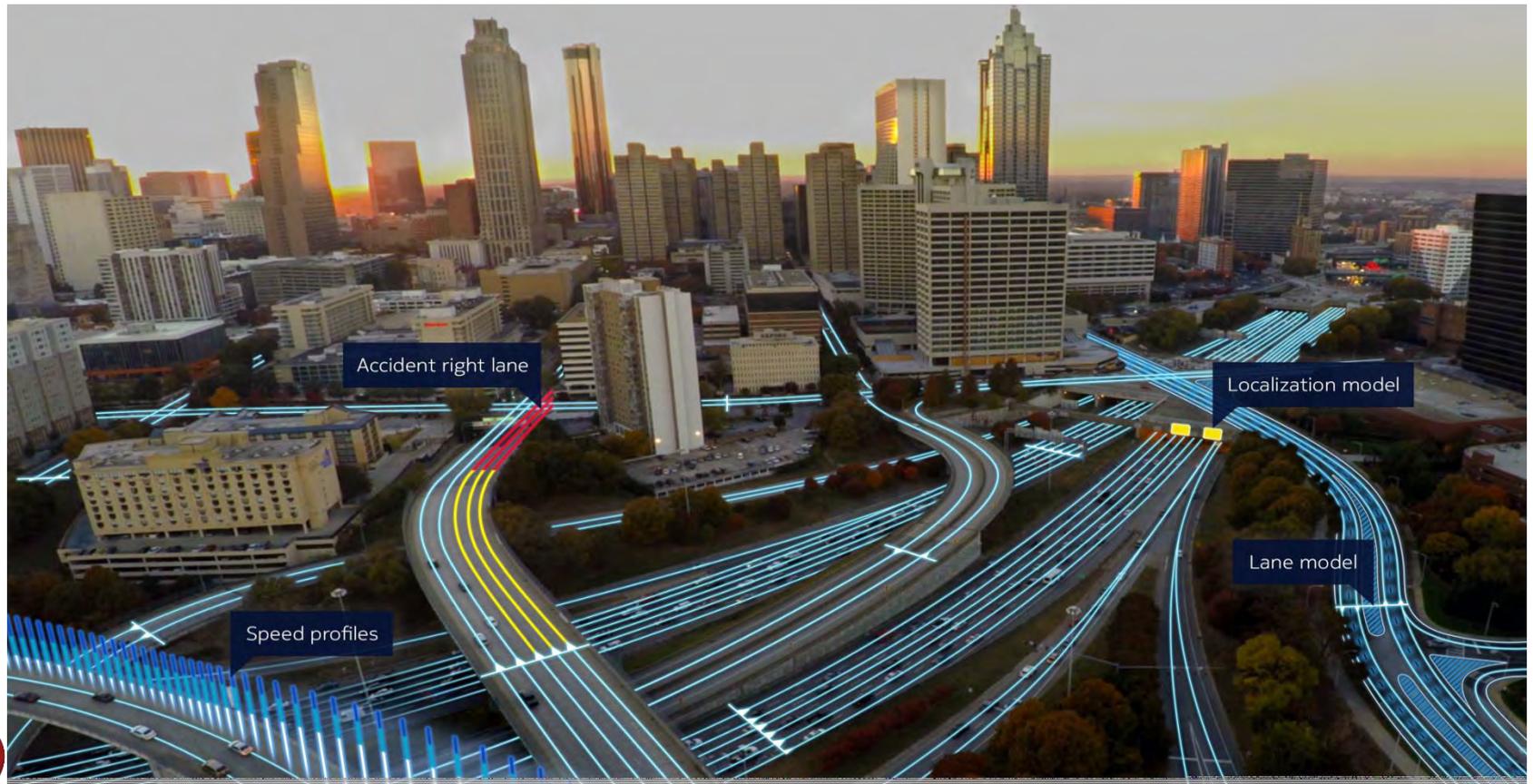
Mapping Precision for Project Interstates

HD Live Map Layer is the world's most precise mapping service, designed for positioning, localization and automated strategy planning - enabling greater safety and efficiency.

- Delivers attributes like slope and curvature of the interstate, lane marking types and roadside objects

- Provides a highly accurate lane model, assisting vehicle in spacing adjustments, drift corrections, speed management, safe lane changes, and overtaking

- Enables precise localization of vehicles - both lateral and longitudinal - to sub-lane level accuracy

IOWADOT

Data and Mapping

Live Roads Layer tracks dynamic events as they happen - providing near real-time information about the expanded road network, beyond the range of vehicle sensors.

- Provides insight into dynamic events such as <u>construction work zones</u>, traffic congestion (<u>queueing</u>), lane closures, crashes, weather-related hazards and more

- Sensed data is aggregated and processed in the cloud and affected tiles within layers are updated

- Enables proactive strategy planning for drivers and ultimately **vehicles**

IOWADOT

What Testing/Projects are Underway? (not an exhaustive list)

- AV Testing/demos in AZ, CA, CO, MI, NV, OH, PA, TX,

    *Recent OTTO AT demo in CO, OH

- Laws Specifically on AV
    - CA, MI, NV

- No Laws Specifically on AV
    - AZ, CO, IA, OH, PA, TX

- Governor Executive Order – AZ, MA

What is Underway?
(not an exhaustive list)

- States contacted have active discussions on **next steps** to test AV, and some with AT testing
- Some states interested in **truck platooning** demos
- States have a **wide variety of state laws** for AV testing and have a **common focus on safe** AV testing
- Some **concern** expressed about possible **restrictions** to AV progress if AV legislation were added/expanded

IOWA DOT

What is Underway?
(not an exhaustive list)

- Several states mentioned efforts to have good road paint lines for AV.
- **Truck parking information** projects developing, some in real time (CO, IA, MI)
- Two states looking at AV/AT benefits from **RTK/GPS** state systems (OH, IA)
- Improved communications, data, technologies causing AV **momentum** to build rapidly

IOWADOT

What Didn't Surprise Me in Discussions?

- Strong Purpose to Improve Safety and Mobility/Congestion

- Strong Interest in Economic Opportunities

- Variety of AV Testing Underway under various specific state regs/laws or no specific laws

- All states stressed their focus on safe testing of AV and/or AT

- All states looking to a safer future from AV/AT technologies

IOWA DOT

What Didn't Surprise Me in Discussions?

- Importance of Public engagement, transparency, trust, understanding, acceptance
- Commitment to NOT overselling the ease of transition – moving to AV will not be quick or simple – expect incremental steps
- States are making remarkable progress
- Multiplicity of state approaches with AV

IOWADOT

What Surprised Me?

- Breadth of AV or AT demos/testing underway
- **Very** strong interest in Economic Opportunities from AV and/or AT
- Public Feedback, mostly positive
- Strong Support for National Policies and Leadership for AV Testing, including facilitating testing across state borders, if flexibility is included

Future Testing Efforts?

- More and expanded testing

- Data sharing and standard development/discussion

- Weather challenges for AV/AT

IOWADOT

AV Research Projects

- National Cooperative Highway Research Program (NCHRP)

- State Research Programs

- US DOT Research Program

- Industry Research

NCHRP AV Research

- NCHRP 20-24(98)

  Connected Automated Vehicle (CAV)

  Research Roadmap for AASHTO

NCHRP AV Research

- NCHRP series 20-102(03) – draft form

  "Challenges to CV and AV Applications in Truck Freight Operations"

  ❖ Very good future resource as we consider what is needed for future widespread adoption of these tech

- Recommend reviewing the other NCHRP series 20-102 on AV/CV

#3- How Can We Collaborate?

- Several states mentioned interest in learning more about other states' and national AV/AT activities. Develop more opportunities for dialogue, including an information clearinghouse for states/industry.
- Attend TRB Annual Meeting!
- Follow national and state research results.
- Attend other meetings/conferences on AV/AT.
- Get involved with pertinent organizations.

AASHTO Activities

- Vehicle to Infrastructure Deployment Coalition (V2I DC)

- Connected and Automated Vehicle Executive Leadership Team (CAV ELT)

- Regional Autonomous Vehicle Policy Workshops

- NCHRP project to establish CAV Road Map

IOWA DOT

AASHTO – CAV-ELT

- 7 High Priority Policy Issues
  - National Guidelines*
  - Early Stage Risks*
  - Interoperability*
  - Industry-Government Information Exchange**
  - Data Access Provisions**
  - Public Outreach and Education**
  - Planning Scenarios**

*defined, ** starting to define

IOWADOT

Questions to Answer in Presentation

1. **Why** should Public Agencies support Automated Vehicles (AV)/Autonomous Trucks(AT) testing?

2. **How** can we support AV/AT testing? **What** is underway?

3. How do we **collaborate** effectively?

4. What does the future hold?

IOWADOT

What does the future hold?

- **Opportunity**
  - Safety
  - Mobility
  - Economic
- AV **Momentum** is building
- Every organization I spoke to expressed strong **enthusiasm** for AV and the future of AV testing – I believe this translates to AT also.

Why?   This is personal…..