Breakout Session # 5 – Public Transport and Shared Mobility

Summary of Key Findings and Lessons Learned

- There is an acceleration of research in transit automation, Mobility on Demand, and Shared AVs (TRB / NCHRP, FTA Transit Automation Roadmap, FTA MOD Sandbox, UITP, UK, European examples)
- Shared AVs offer major benefits to society, but they probably won’t happen on their own (issues: ZOV, labor, equity, VMT, data availability, permitting, personal preferences)
- Pilots (Pinellas, AC Transit, Bestmile, Gomentum Station)
  - Set reasonable expectations / don’t be afraid to fail (even within a government paradigm)
  - Get technology in front of users and regulators will change perceptions and facilitate adoption
  - Get pilots started and learn as you go (iterative process)
  - Pilots have been initiated by both public and private entities
- No consensus on policy needs at early and interim stages of testing and deployment
- Need strong multi-party partnerships to make AV implementations work (pilots, test deployments, planned Automated Mobility Districts)
Recommended Action Items

• Many followups suggested in NCHRP 20-102(02) re: laws, regulations, and the future of AV Transit
• Follow FTA’s Transit Automation Roadmap and the MOD Sandbox projects
• Spend more time thinking about the messy, interim state that we are in now, to get to the utopian end-state
• Explore how cities and transit agencies can take on roles as mobility managers and brokers, working in partnership with mobility providers
• Investigate the role and mechanisms for new and evolving mobility services to address societal issues (access/equity, ADA, Title 6, environmental justice)
• Understand thresholds of acceptable risk for cities and transit agencies
• Continue to share lessons learned about Shared AV deployments
Key Results from the ITF - OECD Roundtable Cooperative Mobility Systems and Automated Driving

Dr. Tom Voege, Policy Analyst
International Transport Forum

Automated Vehicle Symposium AVS, July 2017, San Francisco
Breakout 5: Public Transport and Shared Mobility
The International Transport Forum of the OECD

Think Tank

Annual Summit

Intergovernmental Organisation

Moving Freight with Better Trucks

Research Report
Background

- R&D on vehicle automation in many OECD countries
- Covering many research areas, including e.g. human behaviour, vehicle design, and supporting infrastructure
- Overview in relation to regulation and policy timely
- Potential for car sharing to meet urban transport demand
- Shared economy facilitated by ICT over last 10 years
- Radical change in format of car use and ownership
- Extent car sharing is a tool for reducing car ownership
- Previous work carried out by the ITF’s CPB
Key Issues

• Automation concepts and scenarios being developed
• Infrastructure modifications or restrictions needed
• Future societal and economic factors and developments
• How should public authorities respond to them
• Maximum mobility benefits to end-users at minimum cost
• Vehicle automation regulations for safe operation
• How are liability and privacy being addressed
• Network effects on congestion and environmental impacts
• Personal security implications of sharing rides
• What types of cities likely to be more or less successful
Roundtable Overview

• Chair: Steven Shladover, UC Berkeley
• Location: Transport Canada Headquarter, Ottawa
• Date: 6-7 December 2016

• Discussion Papers:

1. Tom Cohen, University College London, “Possible consequences and Government challenges of automation”

2. Susan Shaheen, University of California at Berkeley, “Business models for shared mobility, car-sharing and ride-sharing”

3. Bryant Walker Smith, University of South Carolina Law School, “Overview of relevant legal and regulatory issues”

4. Natasha Merat, University of Leeds, “Human factors, user requirements, and user acceptance”
key results:

1. overview of the range of investigated service concepts
2. matching service concepts and operational environments
3. government actions determining how AV impact society
4. regulating the impacts of AV technology
1. Overview of the range of investigated service concepts

- Many existing systems since the 1990s already, accelerated development in the last years, focus on testing/demonstration.
- Operational Design Domain (ODD) constraints include e.g. geography, road type, speed, weather conditions, etc.
- ODD restrictions and dependency on infrastructure, including charging, communication, and other physical infrastructure.
- Vehicles are likely to have some common characteristics including electric propulsion, light weight, and tailor-made.
- Design of all internal/external user interfaces for service booking, accessing/using vehicles, and interactions in mixed traffic.
- In the short-term potential for offering last-mile services in connection with existing multi-modal public transport systems.
2. Matching service concepts and operational environments

- Further research and development work is required on
  - Specific technology development (e.g. sensor, AI)
  - Relationship with existing multi-modal public transport
  - Effects on transport/ urban planning and policy
  - Communication and public image/ expectations
- Expert discourse on implementation of vehicle automation for shared urban mobility applications often over-simplifies the situation, advocating an “one-size-fits-all” solution
- Large difference globally but even within most highly developed countries where conceivably these solution will be taken up first, although leap-frogging might be possible here
- Variety of geographical, societal, and cultural factors
Geographical, societal, and cultural factors

• Social, societal, and demographic factors,
• Economic level and income distributions,
• Car ownership levels and car culture,
• Existing layout, size, and density of the urban form,
• Characteristics of the built environment,
• Specific requirements for mega-cities,
• New cities, green-field and brown-field developments,
• Current modal provision and share,
• Legal and regulatory frameworks in place,
• Cultural aspects relating to e.g.:
  ▪ IT and technology literacy,
  ▪ Perception of safety and trust,
  ▪ Driver behaviour,
  ▪ Environmental awareness,
  ▪ Views on privacy, etc.
3. Government actions determining how AV impact society

• Regulation will be necessary, as potential AV benefits are public goods that markets do not naturally protect
  ▪ Road safety improvements
  ▪ Accessibility improvements
  ▪ Reduced congestion levels

• Uncertainty around AV technology and impacts sees current AV regulation stretch existing frameworks

• Existing frameworks can only stretch so far, they will need to be updated shortly (SAE 4 due in 2021)

• Key issue to resolve in the short term: how safe must an AV be to obtain approval for operation (not just testing)?
4. Regulating the impacts of AV technology

- AVs are expected to reduce individual travel costs and in turn increase demand, in absence of regulation
  - AVs are unlikely to produce a shared mobility future
  - Increased congestion is more likely
- AV introductions does not change the regulatory actions available to address congestion, they are the same they have always been
- Internalising transport costs the most efficient approach
  - Reducing congestion
  - Making a shared mobility future more likely
Thank you for your attention!

www.itf-oecd.org/co-operative-mobility-systems-automated-driving-roundtable

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FTA’s Mobility On Demand (MOD) Sandbox Program

Automated Vehicles Symposium

July 2017

U.S. Department of Transportation
Federal Transit Administration
Trends: What’s Driving MOD?

**Societal Trends**
- Over the next 30 years, the U.S. population is expected to grow by 70 million
- By 2045 the number of Americans over the age of 65 will increase by 77%

**Technological Trends**
- The transportation sector is increasingly relying on data to drive decisions and to enable innovative travel options
- 72% of Americans own a smartphone, allowing them to access to traffic and transit information and to information travel choices
- Automated transportation offers transformation possibilities for safety, mobility, and accessibility

**Mobility and Environmental Trends**
- On average, Americans spend over 40 hours stuck in traffic each year, costing $121 billion
- There is growing popularity of shared mobility and shared modes, such as bikesharing, carsharing, and ridesourcing
What is Mobility on Demand?

An integrated and connected multi-modal network of safe, affordable, and reliable transportation options that are available to all.

- User-focused options to improve personal mobility and access to more destinations
- Promotes choice in personal mobility & optimizes the transportation system through Intelligent Transportation Systems
- Advances connected vehicles & automation applications
- Utilizes emerging technologies & data exchange to enable personal mobility
- Encourages multimodal connectivity & system interoperability
MOD Sandbox Program Overview

Demonstration Program to Explore MOD Models

- **Explores** innovative approaches to integrate MOD solutions with public transportation
- **Empowers** project teams to implement innovative business models to deliver high-quality, seamless and equitable mobility options
- **Informs** the MOD program on how to approach MOD and structure future MOD policies, and support grantees
MOD Sandbox Program Overview

Funding and Eligible Applicants

- $8 Million in FTA FY14 and FY16 research funds
- Local Share Minimum of 20% of the net project cost in cash, or in-kind
- Providers of public transportation (public transit agencies, state/local government DOTs, and federally recognized Indian tribes) with one or more strategic partners
- Projects solicited through Notice of Funding Opportunity (NOFO) published May 3, 2016, with proposals due July 5. The 11 awardees were announced on October 13, 2016
THANK YOU!

Vincent Valdes
Associate Administrator
Research, Demonstration and Innovation
Federal Transit Administration
Vincent.Valdes@dot.gov

For more information on MOD Program and MOD Sandbox, please search internet using “Mobility on Demand”, or “Mobility on Demand Sandbox”
TRB: Research – Convene – Advise

Why?
To facilitate fact-based research needed to deploy automated vehicles and shared mobility services in a manner and timeframe that informs policy to best meet long-term societal goals, including increasing safety, reducing congestion, enhancing accessibility, increasing sustainability, and encouraging economic development, and equity.

TRB Forum: Preparing for Automated Vehicles & Shared Mobility Systems
Impact of Mobility-on-Demand Services and Highly Automated Vehicles on the Transportation System
About TRB

• Part of the National Academies of Sciences, Engineering, and Medicine

• Private, non-profit institution

• Independent, non-partisan, objective

Research – Convene – Advise – Connect

The National Academies of Sciences • Engineering • Medicine
What is in TRID (trid.trb.org)?

The Transportation Research International Documentation (TRID) Database is the world’s largest, most comprehensive bibliographic resource on published and ongoing transportation research. TRID includes international research:

- the ITRD Database (Europe),
- the ATRI Database (Australia and New Zealand), and
- select records from the J-STAGE Database (Japan)

- Federal and state department of transportation reports
- Ongoing, recently completed, or soon-to-start transportation research projects
- TRB publications back to 1920
- University Transportation Centers reports
- Commercial and academic journal literature
- Monographs
Managing Research

- TRB administers over $58M annually in three cooperative research programs
  - All Modes, part. Highways & Streets (NCHRP)
  - Transit (TCRP)
  - Airports (ACRP)
- Also Freight, Rail, and Hazardous Materials CRPs
- Focused on practical research addressing issues faced by infrastructure owner/operators
Connected & Automated Vehicle Research

Since 2014, the National Cooperative Highway Research Program has invested $5M in CV and AV research.

Results are becoming available:
• Challenges to CV and AV Application in Truck Freight Operations (NCHRP Web-Only Document 231)
• Impacts of Regulations and Policies on CV and AV Technology Introduction in Transit Operations (Fall 2017)
• Road Markings for Machine Vision (Fall 2017)
• Impacts of CVs and AVs on State and Local Transportation Agencies
# Research Projects Roadmap

Figure 1 from NCHRP 20-24(98) Report


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**INSTITUTIONS AND POLICY ($3,000k)**

**INFRASTRUCTURE DESIGN AND OPERATIONS ($7,500k)**

**PLANNING ($4,000k)**

**MODAL APPLICATIONS ($800k)**
Impact of Mobility-on-Demand Services and Highly Automated Vehicles on the Transportation System

A framework for assessing MOD services and the emergence of HAVs must be crosscutting to encompass value for money, affordability, livability, mobility, access to jobs, infrastructure construction, maintenance and operation, economic development, safety, environment, and energy. The framework questions include:

• How should the impacts of MOD and HAVs on the transportation system be measured?
• How should social inclusion and the “digital and income divide” be addressed?
• What are the safety impacts of these technologies?
• How should the impact on public transit and the economy be assessed?
• How could the wide spectrum of shared mobility services and HAVs be incorporated into regional planning tools?
• What are the effects of MOD services on vehicle ownership and use?
• How do MOD services and HAVs impact parking, urban form, land use and city revenue sources?
Public transport offers the quickest development path to full autonomy because it can start operating in a limited area.

Car industry path
- Comfort features for private cars

Target: Full Autonomy

Full Autonomy on certain routes
- Business model for urban mobility service providers

Public transport path

1. No Autonomy
   - Driver has control

2. Vehicle gives driver warnings/info
   - Driver has informed control

3. Vehicle integrates detection/response
   - Driver ready to take control

4. Vehicle fully autonomous
   - Driver takes control in emergency

5. Vehicle fully autonomous
   - Occupants do not need ability to drive

Source: UITP / Transdev
Depuis hier, deux véhicules sans chauffeur circulent en libre-service sur une voie publique rochelaise à titre expérimental. Une première mondiale.

Un ballon qui roule, un cycliste qui double, un enfant qui traverse : la citycar voit tout, analyse tous les obstacles et choisit la réaction adaptée.
CV and AV Research Activities at the Transportation Research Board

Ray Derr (rderr@nas.edu) & Stephan Parker (saparker@nas.edu), Project Managers
National Cooperative Highway Research Program, Transportation Research Board
National Academies of Sciences, Engineering, and Medicine

Advancing Automated and Connected Vehicle Policy and Planning Actions for State and Local Transportation Agencies (Task 1) assesses strategies at the state, regional, and local levels that could positively affect societal goals. NCHRP Report 845 and the summary Briefing Document will be available in September 2017.

Road Markings for Machine Vision (Task 6) is developing information on the performance characteristics of longitudinal pavement markings (i.e., centerline, lane lines, edge lines, and dotted lines across freeway ramps) that affect the ability of machine vision systems to recognize them. This information is expected to be useful to the AASHTO/SAE Working Group as they develop guidelines and criteria. The final report is expected in Fall 2017.

Dedicating Lanes for Priority or Exclusive Use by CVs and AVs (Task 8) will identify conditions amenable to dedicated CV/AV lanes and identify obstacles to building them. Ways to measure benefits to CV/AV users and operating agencies, as well as possible dis-benefits to non-assen will be described. This work will be coordinated with work underway by the Crash Avoidance Metrics Partnership (CAMP) on cooperative adaptive cruise control. The final report is expected in Spring 2018.

Cybersecurity of Traffic Management Systems (Task 10, NCHRP 03-127) will develop guidance for state and local transportation agencies on mitigating the risk from cyber-attacks on the field side of traffic management systems and on informing the agency’s response to an attack. The contract is under negotiation.

Planning Data Needs and Collection Techniques for CV/AV Applications (Task 13) and Data Management Strategies for CV/AV Applications for Operations (Task 14) will be exploring how transportation agencies can handle the data aspects of these technologies. The oversight panels for these tasks are being formed.

The NCHRP 20-102 suite of projects includes:
- Evaluation Guidance for Automated Vehicle Pilot and Demonstration Projects (Task 4)
- Strategic Communications Plan for NCHRP Project 20-102 (Task 5)
- Impact of Mobility-on-Demand Services and Highly Automated Vehicles on the Transportation System (Task 11)
- Understanding the Impacts of the Physical Highway Infrastructure Caused by the Increased Prevalence of Advanced Vehicle Technologies (Task 15)

Impact of Connected Vehicles and Automated Vehicles on State and Local Transportation Agencies (NCHRP Project 20-102) began in December 2014 to CV and AV issues. Additional tasks will be programmed on Friday, July 21 drawing primarily from the CV/AV Research Roadmap for AASHTO, input from AASHTO and TRB committees, and needs identified at the 2017 AVS. The new tasks will be announced in the TRB listserv in August and oversight panel member nominations solicited. Contractors for each task will be selected from teams led by Booz-Allen Hamilton, Kimley-Horn & Associates, Texas A&M Transportation Institute, and Virginia Tech Transportation Institute.

Challenges to CV and AV Application in Truck Freight Operations (Task 3) describes freight regulatory, planning, policy, and operational environments and challenges for connected and autonomous truck technologies and proposed next steps for addressing the challenges. NCHRP Web-OH Document 231 is available on the TRB website.

Impacts of Regulations and Policies on CV and AV Technology Introduction in Transit Operations (Task 2) describes current transit system regulations and policies that could impact the introduction of CV and AV technologies; (2) describes regulatory and policy changes that could address obstacles; and (3) discusses the administrative implications of CV/AV technologies to transit stakeholders. The final report has been received and will be published in Fall 2017.

Implications of Automation for Motor Vehicle Codes (Task 7) will provide state departments of transportation and motor vehicle departments with guidance and resources to assist with the legal changes that will result from the roll out of connected and automated vehicles. The project is being coordinated with related efforts by the American Association of Motor Vehicle Administrators. The final report is expected in Spring 2018.

Providing Support to the Introduction of CV/AV Impacts into Regional Transportation Planning and Modeling Tools (Task 9) will provide a conceptual framework and applicable guidelines to support state DOTs and regional MPOs as they begin to incorporate CVs and AVs into their planning, modeling, and forecasting tools. The final report is expected in early 2018.

Business Models to Facilitate Deployment of CV Infrastructure to Support AV Operations (Task 12) will (1) describe scenarios characterizing how CV infrastructure technology may be developed and deployed and (2) assess the business case for DOTs to make investments in CV infrastructure—alone and in partnership with private enterprise—to realize the greatest public benefits of AV technology. The contract is under negotiation.

- Guidance on Roles and Responsibilities in the Operation of Automated Vehicles

The National Cooperative Highway Research Program (NCHRP) addresses issues faced by transportation professionals at all levels of government and the private sector. The NCHRP is administered by the Transportation Research Board (TRB), part of the National Academies of Sciences, Engineering, and Medicine, and sponsored by the members of the American Association of State Highway and Transportation Officials (AASHTO).
Thank You

• For more information on TRB, visit: www.TRB.org
• For more information on TRB Transformational Technologies activities, visit: www.TRB.org/TransTech.aspx
• To get involved, go to www.MyTRB.org
• Questions? saparker@nas.edu or rderr@nas.edu
Laws, regulations, and the future of AV transit

TRB/AUVSI 2017

Kimley-Horn
Expect More. Experience Better.
PTASP: Role of the State

- Each State would be required to draft and certify a Public Transportation Agency Safety Plan on behalf of any recipient/sub-recipient under 49 U.S.C. 5310 and 5311, and any “small public transportation provider” located in that State.
  - A “small public transportation provider” would include a recipient/sub-recipient of funds under FTA’s Urbanized Area Formula Program at 49 U.S.C. 5307 that has 100 or fewer vehicles in revenue service and does not operate a rail fixed-guideway system.
- Any of these transit agencies may opt to draft and certify their own plans.
- If State drafts and certifies a plan on behalf of a transit agency, then that transit agency would be required to carry out and implement the plan.
- A State Safety Oversight Agency would be required to review and approve each plan of a rail fixed guideway system under its jurisdiction.
Section 13c
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<th>Activity</th>
<th>Budget</th>
<th>Schedule (months)</th>
<th>Timeframe</th>
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<td>Assessment of restrictions on transit platooning strategies</td>
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<td>Research identifying possible changes to transit facilities and stations</td>
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<td>Transit operational design domain definitions</td>
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<td>Definition of AV transit employee roles and responsibilities</td>
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<td>Union Contracting Guidelines</td>
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<td>Automation of employee actions in compliance with ADA</td>
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<td>Long range planning AV transit benefit/cost analysis guidelines</td>
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Shared Automated Vehicles: Developments and Policy Overview

Susan Shaheen, PhD
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LinkedIn: Susan Shaheen
Overview

- Introduction

- Shared Automated Vehicle (SAV) Developments
  - Low-Speed Automated Shuttles
  - Conventional Vehicle SAVs
  - Planned SAV Pilots

- Automated Vehicle (AV) Policy Overview
  - Federal AV Policy
  - State AV Policy
  - Local AV Policy

- Potential Future SAV Policy Developments
Introduction

- Over 30 companies worldwide developing AV technology
- Shared Mobility + Automated Vehicle (SAV) trends are beginning to converge
- SAV partnerships and announcements happening every week
SAV Developments

• Mostly small-scale pilots, at present, serving select groups of riders and specific trip purposes

• Two categories of SAV pilots emerging:
  1) Low-Speed Automated Shuttlles
  2) Conventional Vehicle SAVs
SAV Developments – Low-Speed SAV Shuttles

Many low-speed SAV developments have taken place on private roads, university campuses, and local streets

EasyMile EZ10
Example Pilot: Bishop Ranch Office Park

Navya ARMA
Example Pilot: Mcity, University of Michigan

Auro
Example Pilot: Santa Clara University
SAV Developments – Low-Speed SAV Shuttles

EasyMile EZ10, Bishop Ranch Office Park, San Ramon, CA

• Two EZ10 12-seater shuttles began initial testing in Bishop Ranch Office Park in March 2017
• Later this year, the EZ10s will connect tenants to multiple transit options including bus, bike, and carsharing services
• Will run a fixed route and stop at designated stops within the office park
SAV Developments – Low-Speed SAV Shuttles

Navya ARMA, Mcity, University of Michigan, MI

• The 15-passenger ARMA began testing at Mcity, the University of Michigan’s 32-acre test facility in December 2016

• Starting in Fall 2017, ARMA will transport students, faculty, and staff between the engineering campus and the university's North Campus Research Complex
SAV Developments – Low-Speed SAV Shuttles

Auro Robotics, Santa Clara University, CA

- Auro Robotics operates a public pilot of their low-speed SAV at Santa Clara University
- Vehicle is a retrofitted Polaris GEM electric four-seater golf cart
- Operates a fixed route on campus for eight hours most days of the week; pilot became fully operational on November 14, 2016
SAV Developments – Conventional Vehicle SAVs

All SAV pilots with conventional vehicles to date have a steering wheel in the vehicle and an engineer in the driver’s seat for safety.

Waymo

Example Pilot:
Early Rider Program, Phoenix, AZ

Uber

Example Pilot:
Pittsburgh, PA

NuTonomy

Example Pilot:
One North, Singapore
SAV Developments – Conventional Vehicle SAVs

Waymo Early Rider Program, Phoenix, AZ

• Alphabet’s Waymo launched its Early Rider program in April 2017, inviting residents of certain areas of Phoenix, Arizona to ride in their autonomous vehicles.

• After a trial period in Phoenix, Waymo plans to expand its fleet from 100 to 600 autonomous Fiat-Chrysler Pacifica Hybrid minivans.
In September 2016, Uber began a pilot in Pittsburgh, PA serving around 1,000 select Uber customers with four autonomous Ford Fusions.

There is a backup driver and engineer present in the front seats.
In August 2016, NuTonomy launched a public trial of their autonomous vehicles in a 1.5 square-mile section of Singapore, called One North. NuTonomy partnered with Grab, the Southeast Asia-based ridesourcing company, and vehicles can be hailed via smartphone through Grab’s platform.
SAV Developments – Planned SAV Pilots

Low-Speed SAV Shuttle Pilots

EasyMile, Treasure Island, San Francisco Bay Area, CA

Local Motors Olli, Miami Dade County, FL and Las Vegas, NV

• EasyMile and the San Francisco County Transportation Authority are planning a pilot to serve first and last mile public transit trips on Treasure Island by 2020

• Local Motors’ Olli has been tested in National Harbor, MD and has expansion plans to serve passengers in Miami and Las Vegas
SAV Developments – Planned SAV Pilots

Conventional Vehicle SAV Pilots

**NuTonomy and Lyft, Boston, MA**

- NuTonomy has been testing its AVs in the Seaport and Fort Point areas of Boston since April 2017

- In June 2017, Lyft and NuTonomy formed a partnership with plans to deploy a SAV pilot serving passengers sometime in the coming months

**Delphi and Transdev, Normandy and Paris, France**

- In June 2017, Delphi and Transdev announced that they will test AVs in Normandy and outside Paris in advance of building a commercial service starting in 2019, which could be deployed in other markets, including North America
AV Policy Developments

• Not much activity on SAV-specific policies or regulations, at present

• Most legislation, to date, relates to road safety, liability and insurance, vehicle design requirements, and operational area

• AV legislation and regulatory roles in the U.S. differ across levels of governance:
  1) Federal
  2) State
  3) Local
AV Policy Developments - Federal

• Federal AV policy will likely regulate vehicle design standards (FMVSS), vehicle and consumer safety, and exemptions

• Federal Automated Vehicles Policy (September 2016) provides guidelines but no enacted regulations yet

• At present, House Energy and Commerce Committee considering a number of AV-related bills
AV Policy Developments - State

- State AV policy will likely regulate liability and insurance, licensing, traffic laws, and infrastructure
- 18 states have enacted AV laws, 70 state bills have been considered in 2017 alone
- Different states taking different approaches to regulating AVs
  - California has been closely regulating AV testing
  - Florida and Michigan passed less stringent AV regulations
  - Some states have no enacted AV-specific legislation, allowing AV operations in some circumstances

Liability, insurance, licensing, traffic laws + infrastructure
AV Policy Developments - Local

• Local AV policy will likely regulate AV/SAV operations, rights-of-way access, and local taxation

• A number of the CityMobil2 pilots in Europe allowed low-speed SAVs on public roads employing a local ordinance

Important in regulating SAV ops, traffic mitigation + equity implications
Potential Future SAV Policy Developments

• SAV-specific policy is sparse, at present

• Potential adverse impacts of AVs/SAVs will have to be considered when crafting SAV regulations

• Both Massachusetts and Tennessee have proposed bills that consider imposing a mileage-based operating fee on AVs

• A number of USDOT Smart City Challenge proposals included access to rights-of-way regulations for AVs and SAVs
Summary

• SAV developments are mostly small-scale pilots, at present

• Federal, state, and local regulations have mostly focused on the *safe testing* and *deployment of AVs*, and SAV-specific regulations are sparse at this time

• Moving forward, collaboration among public and private sector players will be important to encourage safe, sustainable, and equitable SAV deployment
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