PLANNING FOR CONNECTED AND AUTOMATED VEHICLES

MAMA/PCLS Summer Conference
Mackinac Island, MI
24 June 2017
AGENDA

- CAV Technology and Innovative Mobility Services Definitions
- CAV-related Considerations for Municipalities
  - Transportation Systems
  - Infrastructure Investments
  - Land Use
  - Legal and Regulatory Framework
ADVANCED TRANSPORTATION TECHNOLOGIES

DEFINITIONS

Intelligent Transportation Systems (ITS)

- Electronics, communications, or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system (CFR 940.1)

Connected Vehicle Systems

- Any system enabling the exchange of digital information between a vehicle and the world (e.g., another vehicle, infrastructure)

Automated Vehicle Systems

- Any electronic system that influences the lateral or longitudinal operation (or both) of a vehicle
ADVANCED TRANSPORTATION TECHNOLOGIES

EXAMPLES

Connected ITS
- Automated Tolling
- Probe Vehicle Data for System Administration
- Emergency Vehicle Signal Preemption
- Transit Vehicle Signal Priority
- Automated Incident Reporting (Auto 911, eCall)
- DSRC V2V/V2X-enabled Warnings and Messages (USDOT Connected Vehicle Program)

Connected and Automated ITS
- Automated Shuttles
- Infrastructure-enabled Self-driving Cars

Automation Only
- Active Safety Systems (ABS, ESC, AEB)
- Automated Parking
- Adaptive Cruise Control
- Traffic Jam Assist
- Lane-keep Assist

ITS Only
- Remote Traffic Monitoring
- Roadside Weather Stations
- Adaptive Signal Control
- Incident Detection and Response
- Dynamic Message Signs
- Reconfigurable Lanes
- Demand-responsive Tolling

Connected Vehicle Systems
- GPS Navigation
- Cellular Connectivity
- Smartphone Linking (Bluetooth, Wi-Fi, etc.)
- Infotainment
- Telematics

Automated Vehicle Systems
- Cooperative Automation (Platooning) without Public Infrastructure
- Automated Driving Systems (ADS)

Intelligent Transportation Systems
- Automation-enabling Infrastructure (Standardized Signage, Lane Markings, Digital Maps, etc.)

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AUTOMATED VEHICLE SYSTEMS
SAE INTERNATIONAL TAXONOMY

Levels 0-2
Available Today

Levels 3-5
Automated Driving Systems (ADS)
Future

0: No Driving Automation
1: Driver Assistance
2: Partial Driving Automation
3: Conditional Driving Automation
4: High Driving Automation
5: Full Driving Automation

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AUTOMATED DRIVING SYSTEMS (ADS)
PROMISES TIMELINE

Waymo (Google)?
Tesla?
Toyota?

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Innovative mobility services are transportation solutions enabled by emerging technologies and wireless connectivity that allow for more convenient, efficient, and flexible travel.
TRAVEL DEMAND AND VEHICLE MILES TRAVELED (VMT)

- Lower car ownership
- Pay-per-use programs discourage unnecessary travel
- Increased vehicle occupancy
- First-and-last-mile solution with transit
- Overall lower number of vehicles
- Less travel related to searching for parking
- Denser land development (less parking)

- Increased travel demand
- Zero occupancy travel
- Reduced trip chaining
- Mode shift away from mass transit
- Greater urban sprawl
- Significant share of privately owned cars
- Increased mobility of non-drivers
- Increased automated freight and delivery
TRANSFORMATION OF PARKING

CAVs will enable more efficient use of existing parking supply.

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Considerations</th>
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<tbody>
<tr>
<td>Reduced need for new municipal parking</td>
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<tr>
<td>Smaller parking spots, less on-site and on-street parking</td>
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<td>Parking relocated on the back of lots or outside prime locations</td>
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<td>Possible decline of municipal revenues</td>
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<td>Reconversion in drop-off/pick-up areas</td>
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<td>Relocation of CAV parking impacts both VMT and congestion</td>
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TRANSFORMATION OF PARKING
CONNECTED AND AUTOMATED VEHICLES ONLY

CAVs only
One parking level for CAVs.
Ground floor converted to access area.
Top floors converted to other uses.

Upper levels evolve into residential, office, recreation and entertainment spaces.

Users call cars via personal mobile devices and pick up vehicles in retrieval zones.

Concept: Arrowstreet Architecture

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## INTERACTION WITH NON-MOTORIZED TRAFFIC

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<td>- Increased safety for pedestrians and cyclists</td>
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<td>- Free up space for pedestrian areas and bike lanes (via road diets)</td>
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<tr>
<td>- Need to learn the implicit and explicit cues of pedestrians and cyclists</td>
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<tr>
<td>- Planning and design will need to consider non-motorized modes and CAVs equally</td>
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## IMPLICATIONS FOR MASS TRANSIT

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<th>Opportunities</th>
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<tr>
<td>Offer better first- and last-mile solutions</td>
<td>Reduce public transit demand</td>
</tr>
<tr>
<td>Be more affordable</td>
<td>Could negate the congestion benefits</td>
</tr>
<tr>
<td>Improve service in low-density areas</td>
<td>Exacerbate equity and digital divide issues</td>
</tr>
<tr>
<td>Act as feeder service to rail or BRT</td>
<td>Lead to job loss among public transit employees</td>
</tr>
<tr>
<td>Decrease wait times</td>
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</tbody>
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Private or shared AVs

Automated transit

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IMPLICATIONS FOR MASS TRANSIT
AUTOMATED SHUTTLES

Pilot projects for automated transit already exist, mostly in Europe.
Level 4 Automation, available today: low speed, fixed route, limited conflicts

Navya Arma
Easymile EZ10
Local Motors Olli
2getthere
Auro
INFRASTRUCTURE INVESTMENTS

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NEW INFRASTRUCTURE FOR V2I

Example of roadside equipment:

- **Roadside units (RSUs)**
- **Traffic signal controller**
- **Traffic Management Center**
- **Communication links**
- **Support functions**

Cost of deploying one RSU: $51,650

- Eligible for federal aid highway funding
- Expected to drop over time
MODIFICATIONS TO EXISTING INFRASTRUCTURE

SIGNALS AND ROAD MARKINGS

- Traffic signal updates are necessary to enable V2I
- V2I communication may replace some functions of signs and signals
  - Pedestrians, cyclists, or non-connected vehicles still need them
- Clear lane markings are beneficial, but not necessary

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MODIFICATIONS TO EXISTING INFRASTRUCTURE
LANE WIDTH AND ROAD CAPACITY

Congestion relief effect could be cancelled out if VMT increases

Source: FDOT, 2016
Potential Public Sector Roles

- Creation, maintenance, and distribution of maps for automated driving:
  - Create open-sourced maps
  - Develop open standards
  - Collect and publish pertinent data

- Data exchange partnerships: Waze, HERE, INRIX

Source: Waze
LAND FORM
SPRAWL

- Urban-core space could be freed up for redevelopment, thanks to lower parking demand
- Denser, more walkable developments could be created

- Willingness to travel longer distances to and from work could increase
- Household and businesses might locate farther from urban cores

Source: Alloybuild

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ZONING

Potential changes to zoning ordinances:

- Eliminate or reduce minimum parking requirements
- Develop specifications for parking design for CAVs
- Develop specifications for the design of drop-off/pick-up areas
REGIONAL AND LOCAL PLANNING

Near term

Develop policies for data collection and sharing

Incorporate CAVs in city goals for safety, GHG emissions, congestion

Start considering policies to manage the VMT and sprawl impact

Medium to long term

Update travel demand and roadway design manuals

Reevaluate road capacity needs and road expansion projects

Reevaluate transit fleet management plans and service delivery plans

Plan infrastructure investments

Take impact of CAVs into account in long range transportation plans
LEGAL AND REGULATORY CONSIDERATIONS
LEGAL FRAMEWORKS

- Federal (International)
- State
- Local

Intelligent Transportation Systems
Connected Vehicle Systems
Automated Vehicle Systems

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THINGS THAT COULD CHANGE LEGAL LANDSCAPE

- Automated vehicle deployment
- Connected vehicle mandate
- Federal legislation, regulation, and policy
- State legislation, regulation, and policy
- Local statute and policy
THANK YOU!
QUESTIONS?

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