AMPO Research Efforts and MPO Emerging Technology Activities

BALTIMORE REGIONAL TRANSPORTATION BOARD
Tuesday, July 24th, 2018
9:00 – 11:00 A.M.

Bill Keyrouze
Technical Programs Director, AMPO
About AMPO

AMPO is a nonprofit, membership organization established in 1994 to serve the needs and interests of Metropolitan Planning Organizations (MPOs).

AMPO offers its member MPOs technical assistance and training, conferences and workshops, legislative and rulemaking updates, newsletters and communications, research, a forum for transportation policy development and coalition building, and a variety of other services.
Board of Directors - Leadership

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AMPO Standing Committees

• Policy Committee
  – 20 voting members; 10 alternate members

• Technical Committee
  – 20 voting members; 10 alternate members
  – Research Topics Subcommittee
  – Annual Conference Proposal Review

• Joint Committee Efforts
  – Freight
  – Ad-Hoc Reauthorization Priorities
  – MAP-21 Rulemaking Comments
Upcoming Conferences and Workshops

• 2018 AMPO Annual Conference
  September 25\textsuperscript{th} – 28\textsuperscript{th} | San Antonio, TX

• 2018 Connected & Automated Vehicle Planning Workshop
  November 14\textsuperscript{th} – 15\textsuperscript{th} | Denver, CO

• 2019 AMPO Planning Tools & Training Symposium
  May 7\textsuperscript{th} – 9\textsuperscript{th} | Minneapolis, MN

• 2019 AMPO Annual Conference
  October 22\textsuperscript{nd} – 25\textsuperscript{th} | Baltimore, MD
AMPO Technical Working Groups

AMPO facilitates several technical working groups focused on transportation planning topic areas that are required and/or of interest to MPOs.

- Air Quality
- Connected & Automated Vehicle Planning
- Freight (*coming soon*)
- GIS (*coming soon*)
- Performance-based Planning & Programming
- Public Involvement & Environmental Justice
- Travel Modeling
The working group serves as a mechanism to:

- Build technical, institutional, and policy capacity
- Identify and leverage C/AV benefits
- Address knowledge gaps
- Advance C/AV in planning
- Support USDOT, State DOT, MPO, and Stakeholder C/AV efforts
Connected & Automated Vehicle Planning

Working Group Participants

• 15-20 Core Members
• Diverse in MPO-size and Geography
• Variety of backgrounds
  – Policy
  – Operations
  – Modeling
  – ITS
Connected & Automated Vehicle Planning

Working Group Activities:

Four Working Group Meetings

- First Meeting: April 2017 (MPO focus)
- Second Meeting: July/August 2017 (State DOT/MPO focus)
- Third Meeting: November 2017 (Federal/State DOT/MPO focus)
- Fourth Meeting: March 2018 (Private sector focus)

National Framework and Workshop

- November 2018
# MTC/MAG – Understanding Uncertainties

## Literature Review Ranges for Key Variables

<table>
<thead>
<tr>
<th>Timing</th>
<th>Safety</th>
<th>Capacity</th>
<th>Demand</th>
<th>Energy/Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 13 years until fully driverless vehicles available for purchase.</td>
<td>+40% to +90% increase in safety.</td>
<td>0% to +45% increase in roadway capacity.</td>
<td>+5% to +40% increase in VMT.</td>
<td>-50% to +100% change in GHG emissions.</td>
</tr>
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Source: Future Mobility Research Program, Metropolitan Transportation Commission, October 2017
## Manufacturer Commitments

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<td>3+</td>
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<td><strong>BMW</strong></td>
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<td><strong>Honda</strong></td>
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<td><strong>Kia</strong></td>
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<td>4/5</td>
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<td><strong>Mercedes-Benz</strong></td>
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<td><strong>Nissan</strong></td>
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<td>4/5</td>
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<tr>
<td><strong>Tesla</strong></td>
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<tr>
<td><strong>Volvo</strong></td>
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<td><strong>Uber</strong></td>
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*WSP: Planning for AVs, July 2017; Mashable June 2016*
### SAE Levels of Automation

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
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<tbody>
<tr>
<td>0</td>
<td>No Automation&lt;br&gt;Zero autonomy; the driver performs all driving tasks.</td>
</tr>
<tr>
<td>1</td>
<td>Driver Assistance&lt;br&gt;Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.</td>
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<tr>
<td>2</td>
<td>Partial Automation&lt;br&gt;Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.</td>
</tr>
<tr>
<td>3</td>
<td>Conditional Automation&lt;br&gt;Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.</td>
</tr>
<tr>
<td>4</td>
<td>High Automation&lt;br&gt;The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.</td>
</tr>
<tr>
<td>5</td>
<td>Full Automation&lt;br&gt;The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.</td>
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</tbody>
</table>
Most respondents (43%) believe fully-autonomous self-driving cars will be available to the public in the next 6-10 years (20% within next 5 years).

43% described their level of comfort riding in a fully-autonomous, self-driving car as “Apprehensive, but would give it a try”.

54% of respondents are willing to wait for prices to lower before purchasing a vehicle with semi-autonomous features.

Source: SEMCOG and MAC “Pulse of the Region” Survey on Semi- and Fully-Autonomous Vehicles, 2017
How have elected officials, decision makers, or agency executives responded to C/AV issues in your state or region?

- Supportive
- Too Early to Tell
- Uninformed but Curious

Source: http://www.planningsnapshots.camsys.com/
How would you best describe your agency’s level of engagement with connected and autonomous vehicles?

- Passively Engaged 37%
- Actively Engaged 33%
- Early Adopter 7%
- Leader 14%

Source: http://www.planningsnapshots.camsys.com/
Emerging Transportation Technology Strategic Plan for the St. Louis Region

• New technologies may fundamentally alter the way people travel in the future, with potentially dramatic impacts on safety, mobility, and system performance over the next 20-30 years.

• The pace of technology adoption is quickening.

• The St. Louis Region needs to better prepare for the future in its regional transportation planning and investment decision-making.

Source: Emerging Transportation Technology Strategic Plan for the St. Louis Region, June 2017
Emerging Transportation Technology Strategic Plan for the St. Louis Region

Emerging technologies → Realization of the region's vision

**Strategic Plan Goals**

1. Harness positive impacts from technology
2. Allay potential negative impacts from technology
3. Support the region to be a laboratory for innovation

**SWOT**

- Strengths
- Weaknesses
- Opportunities
- Threats

**Recommendations**

- **Policy Areas of Focus**
- **Implementation Strategies**
  - Regional Capacity Building
  - Integration in the Planning Process
  - Prepare for federal grants and develop pilot concepts

Source: Emerging Transportation Technology Strategic Plan for the St. Louis Region, June 2017
Emerging Transportation Technology
Strategic Plan for the St. Louis Region

Data, Modeling, and Analytics
- Bolster staff data analytics capabilities
- Develop a robust data collection plan, leveraging new forms of data to support performance measures
- Enhance modeling to address emerging transportation technologies

Long-Range Planning
- Establish a Technology Advisory Committee
- Develop a shared vision for technology to recommend regional strategies
- Conduct scenario planning to better understand alternative futures and to support more informed analyses of investment priorities
- Include considerations related to emerging transportation technology as a factor when prioritizing projects for the regional transportation plan (RTP)
- Update the regional ITS Architecture and Deployment Plan
- Update the Congestion Management Process and ensure that other regional planning products integrate emerging transportation technology

Programming and Funding
Update the current Transportation Improvement Process (TIP) project selection process to encourage innovative technology applications

Pilot Program Development
- Build federal grant readiness by creating a compelling grant narrative
- Establish a grant tracking system
- Develop and fund a regional technology deployment pilot program

Education, Convening, and Supporting Partner Efforts
- Work with local universities to identify opportunities to collaborate
- Coordinate peer-to-peer workshops and facilitate regional discussions on topics including public-private partnerships, changes to procurement policies, and data collection and analytics
- Conduct assessments of local governments’ awareness and readiness regarding technology on a periodic basis

Source: Emerging Transportation Technology Strategic Plan for the St. Louis Region, June 2017
A total of 141 MPO long range transportation plans were downloaded and reviewed.

- 52 plans in the Less than 200,000 category.
- 43 plans in the 200,000 to 1,000,000 category.
- 46 plans in the Greater than 1,000,000 category.

Source: FTA, Shared Use Mobility, Transportation Technology and Intercity Transit Services, June 2018.
DVRPC – Setting Context

**FIGURE 19: THE FOUR INDUSTRIAL REVOLUTIONS**

<table>
<thead>
<tr>
<th>First (1770s)</th>
<th>Second (1870s)</th>
<th>Third (1960s)</th>
<th>Fourth (2010s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technology</strong></td>
<td><strong>Urban Form</strong></td>
<td><strong>Transportation</strong></td>
<td><strong>THE DIGITAL REVOLUTION</strong></td>
</tr>
<tr>
<td>Steam Power</td>
<td>Factories</td>
<td>Canals</td>
<td>Source: DVRPC, 2017. Adapted from World Economic Forum.</td>
</tr>
<tr>
<td>Mechanical Production</td>
<td>Town &amp; City Growth</td>
<td>Railroads</td>
<td></td>
</tr>
<tr>
<td>Interchangeable Parts</td>
<td>Zoning/Separation of Uses</td>
<td>Subways and Trolleys</td>
<td></td>
</tr>
<tr>
<td>Electricity &amp; Lighting</td>
<td>Skyscrapers &amp; Elevators</td>
<td>Cars, Buses, Trucks</td>
<td></td>
</tr>
<tr>
<td>Mass Production</td>
<td>Urban Growth/Streetcar Suburbs</td>
<td>Trucks, Airplanes</td>
<td></td>
</tr>
<tr>
<td>Electric Circuits</td>
<td>Auto-Oriented Suburbs</td>
<td>Intelligent Transportation Systems</td>
<td></td>
</tr>
<tr>
<td>Electronics &amp; Computers</td>
<td>Globalization/Deindustrialization</td>
<td>Real-Time Transport</td>
<td></td>
</tr>
<tr>
<td>Automated Production</td>
<td>Internet and e-Commerce</td>
<td>Space Travel</td>
<td></td>
</tr>
<tr>
<td>Integrated Circuits</td>
<td>Smart Cities &amp; Internet of Things</td>
<td>Connected &amp; Automated Vehicles</td>
<td></td>
</tr>
<tr>
<td>Robotics &amp; AI</td>
<td>Augmented Reality</td>
<td>unmanned Aerial Systems</td>
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<tr>
<td>3D Printing</td>
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</table>

Source: Delaware Valley Regional Planning Commission, Connections 2045, December 2017
<table>
<thead>
<tr>
<th>COULD DECREASE DUE TO</th>
<th>IMPLICATION</th>
<th>COULD INCREASE DUE TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle sharing, higher vehicle costs</td>
<td>Vehicle Ownership</td>
<td>Smaller, lighter-weight vehicles lower cost, new types of vehicles</td>
</tr>
<tr>
<td>Increased travel willingness / better use of in-vehicle time</td>
<td>Land Use Density</td>
<td>Network effects, shared &amp; transit vehicles, less parking</td>
</tr>
<tr>
<td>Vehicle sharing, denser development</td>
<td>VMT / Trips</td>
<td>Lower operating costs, zero-occupant trips, mode shift, expanded mobility for non-drivers, increased travel willingness</td>
</tr>
<tr>
<td>Follows all road rules / defensive driving</td>
<td>Road Capacity / Speed</td>
<td>Reduced headways, smoother traffic flow, shorter signal lag times, fewer crashes, and real-time route optimization</td>
</tr>
<tr>
<td>Machine precision</td>
<td>Crashes</td>
<td>Hacking, complex human-machine interactions</td>
</tr>
<tr>
<td>Low-emission vehicles, right-sized vehicles, eco-driving</td>
<td>Air and Noise Pollution</td>
<td>More travel, larger vehicles</td>
</tr>
<tr>
<td>Vehicles avoid deficiencies, smoother traffic flow</td>
<td>Pavement Distress</td>
<td>Platooning / closer vehicle spacing, increased VMT</td>
</tr>
<tr>
<td>AI (deep learning) displaces workers</td>
<td>Jobs</td>
<td>Technology creates more new high-skill jobs than the lower-skill ones it disrupts</td>
</tr>
</tbody>
</table>


Source: Delaware Valley Regional Planning Commission, Connections 2045, December 2017
### MTC/MAG – Potential Benefits/Risks

#### A Unique Opportunity . . .
- New Travel Choices
- Ridesharing
- Reduced Car Ownership
- Repurposed Parking
- Space for Housing
- Public Space
- Safer Streets
- Improved User Experience
- Efficient Network Management
- Higher Efficiency Transit
- Lower Operating Costs

#### ...but not without risks.
- Increased VMT
- Empty Vehicle Circulation
- Fight for the Market
- Urban Sprawl
- Higher Congestion
- Longer Travel Times
- Cyber Attacks
- Privacy Concerns
- Declined in Transit Use
- Inequity

Source: Future Mobility Research Program, Metropolitan Transportation Commission, October 2017
## RTC Southern Nevada – Planning Process

<table>
<thead>
<tr>
<th>Technology-Related Planning Needs</th>
<th>RTC Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorporate emerging technologies into goals</td>
<td>Included in Access 2040</td>
</tr>
<tr>
<td>Establish policies &amp; plans with consideration for the future</td>
<td>Initiated in Access 2040</td>
</tr>
<tr>
<td>Develop scenario model with Emerging Technologies capabilities</td>
<td>Model development underway (2017)</td>
</tr>
<tr>
<td>Assess high-capacity transit impacts and requirements</td>
<td>High Capacity Transit Plan (2017-2018)</td>
</tr>
<tr>
<td>Evaluate road capacity needs</td>
<td>Emerging Technologies Planning Study (2017)</td>
</tr>
<tr>
<td>Forecast financial implications</td>
<td>Emerging Technologies Planning Study (2017)</td>
</tr>
<tr>
<td>Identify trigger points for longer-term actions</td>
<td>Emerging Technologies Planning Study (2017)</td>
</tr>
<tr>
<td>Evaluate and test use of AV paratransit vehicles</td>
<td>1-5 years</td>
</tr>
<tr>
<td>Update roadway policies and infrastructure to leverage the VMT impact</td>
<td>1-5 years</td>
</tr>
<tr>
<td>Develop new predictive models for pavement maintenance</td>
<td>1-5 years</td>
</tr>
<tr>
<td>Assess impacts on low-ridership transit routes</td>
<td>1-5 years</td>
</tr>
<tr>
<td>Provide analysis of transportation and land use impacts to support stakeholders</td>
<td>1-5 years</td>
</tr>
</tbody>
</table>

Source: Regional Transportation Commission of Southern Nevada, Access 2040, February 2017
How will automated vehicles arrive?

Fully Autonomous

Personal Automation

Shared Automated/Platooning

Semi-Autonomous

Business as Usual

Driver

Shared Mobility

Source: Maricopa Association of Government, November, 2017
MAG – Cone of Uncertainty

Scenario Planning
CONNECTED VEHICLE/AUTONOMOUS VEHICLE FUTURE

Uncertainty

Future - 2050

Common Infrastructure Needs among Scenarios

Today - 2017

Source: Maricopa Association of Government, November, 2017
FHWA 2035 CV/AV Scenarios

Enhanced Driving Experience
- Managed Automated Lanes
  AV lane networks
  AV travel is consolidated to a large-scale lane network with significant consumer adoption
- Ultimate Traveler Assist
  Ultra-Connectivity
  AV adoption stalls, CV becomes ubiquitous

Slow Roll
- Slow Roll
  Minimal Plausible Change
  Accounts for advances in safety technology, TSMO and mobility services

Driver Becomes Mobility Consumer
- Niche Service Growth
  High AV/CV in certain cases
  Niche applications for CV/AV dominate the landscape
- Competing Fleets
  Automated TNC fleets compete
  Level-4 AV is safe for most trips, travel is dominated by competing fleets
- Automated Integrated Mobility
  Automated mobility-as-a-service
  Strong public-private partnership for system optimization

Trajectories towards CV/AV Advancements
TODAY (circa 2017)

Source: Scenario Planning for Connected and Automated Vehicles, FHWA Office of Policy, February, 2018
Identified Strategies:

• Maintain an environment that fosters innovation

• Establish a desired vision of the future transportation system with C/AVs

• Based on the vision, identify actions (i.e., policies and investment decisions) within the metropolitan planning process and products to support the desired future
Connected & Automated Vehicle Planning

• Through scenario planning and exploratory modeling, understand plausible deployment scenarios and their range of implications and risks to the transportation system, specific modes, and the behavior of transportation

• Educate and inform MPO policy boards, other relevant decisions makers, and MPO stakeholders on C/AV status and critical issues

• Help ensure equity, safety, and traffic operations are maintained
Connected & Automated Vehicle Planning

• Do not prematurely select a preferred technology (e.g., 5G vs. DSRC)

• Expand MPO staff skills to include expertise in planning for and managing emerging technologies

• Make investment decisions the support both the current and future transportation system
To help address uncertainty, explore the future in incremental transitions (e.g. 5, 10, 15, and 20 horizon years)

- This could be visualized as a cone of uncertainty with the narrowest part of the cone representing the present and the greatest overlap of scenarios. The height and width would represent time and uncertainty respectively.
Connected & Automated Vehicle Planning

- Scenario planning may help narrow the cone.

- Potential investment decisions could be identified as projects common to all or most of the cone or projects at the narrow end of the cone that support both the current and future transportation system.

- Needs at the widest end of the cone could be thought of more generally by program type or corridor need (e.g., capacity improvements along a corridor within certain mileposts).
Connected & Automated Vehicle Planning

National Framework
• A framework to inform the transportation planning process and products
• Collection of resources and templates

Workshop
• The workshop will be used as an opportunity to gather feedback on the framework
• Breakout sessions will include:
  – Scenario testing and Modeling
  – Messaging
  – MPO Planning Process and Products
Connected & Automated Vehicle Planning

• The MPO role is critical to the nation as 80.7% of the United States population is urban and overall the nation’s transportation network moves 54 million tons of freight valued at more than $48 billion each day.

• MPOs are stewards of the transportation system within urban areas. With their partner agencies, they serve as transportation system planners, managers, operators, and developers who shape the transportation system, maintain safety and equity, and move people and goods regardless of mode choice.
Connected & Automated Vehicle Planning

Urbanized Areas and Urban Clusters: 2010

Source: United States Census Bureau Urbanized Areas and Urban Clusters 2010
Connected & Automated Vehicle Planning

• MPOs are leaders for their regions and must keep pace with, leverage, and support emerging technologies, like C/AV, and their potential to improve the transportation system while helping to ensure the safe deployment of these technologies with minimal disruptions or negative impacts to the transportation system and its users.
Connected & Automated Vehicle Planning

All of the whitepapers and meeting materials can be found on the AMPO website at www.ampo.org

Framework and related materials coming December 2018

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Thank you!