AMPO Research Efforts and MPO Emerging Technology Activities

BALTIMORE REGIONAL TRANSPORTATION BOARD

Tuesday, July 24th, 2018

9:00 – 11:00 A.M.

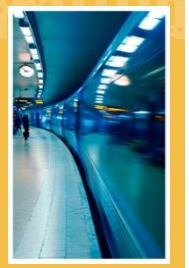
Bill Keyrouze

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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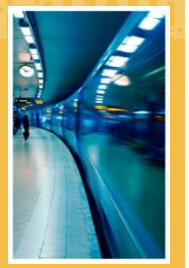

Board of Directors - Members

- R. Todd Ashby, Executive Director, Des Moines Area MPO (Des Moines, Iowa)
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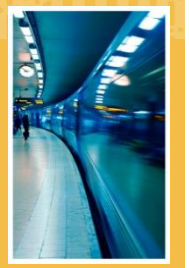
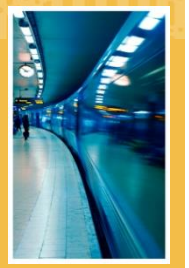
- Honorable Elaine Clegg, Councilmember, City of Boise, Idaho
- Greg Stuart, Executive Director, Broward Metropolitan Planning Organization (Ft. Lauderdale, Florida)
- David Wessel, Manager, Flagstaff MPO (Flagstaff, Arizona)



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 25th – 28th | San Antonio, TX

- **2018 Connected & Automated Vehicle Planning Workshop**

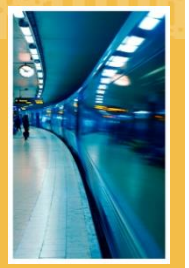
  November 14th – 15th | Denver, CO

- **2019 AMPO Planning Tools & Training Symposium**

  May 7th – 9th | Minneapolis, MN

- **2019 AMPO Annual Conference**

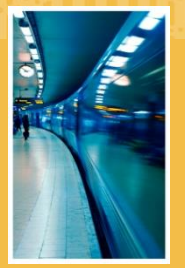
  October 22nd – 25th | Baltimore, MD



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.

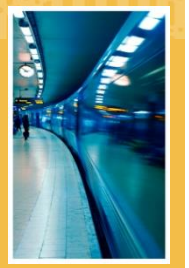
- Air Quality
- Connected & Automated Vehicle Planning
- Freight (*coming soon)*
- GIS (*coming soon*)
- Performance-based Planning & Programming
- Public Involvement & Environmental Justice
- Travel Modeling



Connected & Automated Vehicle Planning

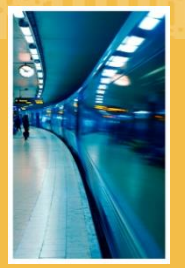
The working group serves as a mechanism to:

- 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



Working Group Participants

- 15-20 Core Members
- Diverse in MPO-size and Geography
- Variety of backgrounds
  - Policy
  - Operations
  - Modeling
  - ITS



Connected & Automated Vehicle Planning

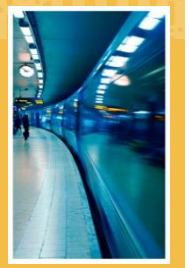
Working Group Activities:

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

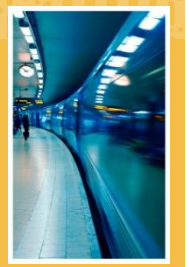
- November 2018



MTC/MAG – Understanding Uncertainties

Literature Review Ranges for Key Variables

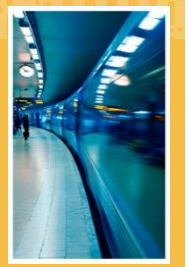
Timing	Safety	Capacity	Demand	Energy/ Emissions
• 3 to 13 years until fully driverless vehicles available for purchase.	• +40% to +90% increase in safety.	• 0% to +45% increase in roadway capacity.	• +5% to +40% increase in VMT.	• -50% to +100% change in GHG emissions.



Source: Future Mobility Research Program, Metropolitan Transportation Commission, October 2017

Manufacturer Commitments

Manufacturer	2016	2017	2018	2019	2020-25	2025-30	2030-35	2035-40	2040+
Audi	2		3		3+	4/5			
BMW	2				4/5				
Ford				2	4/5				
Honda	2				3				3-4
Kia					3		4/5		
Mercedes-Benz	2								
Nissan	2		3		4/5				
Tesla	2		4/5						
Volvo / Uber	2	4/5							



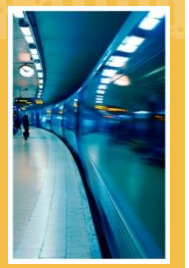
WSP: Planning for AVs, July 2017; Mashable June 2016

SAE Levels of Automation

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AUTOMATION LEVELS

Full Automation

0	1	2	3	4	5
No Automation	**Driver Assistance**	**Partial Automation**	**Conditional Automation**	**High Automation**	**Full Automation**
Zero autonomy; the driver performs all driving tasks.	Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.	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.	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.	The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.	The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.

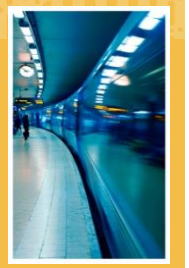


SEMCOG "Pulse of the Region" Survey

- **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

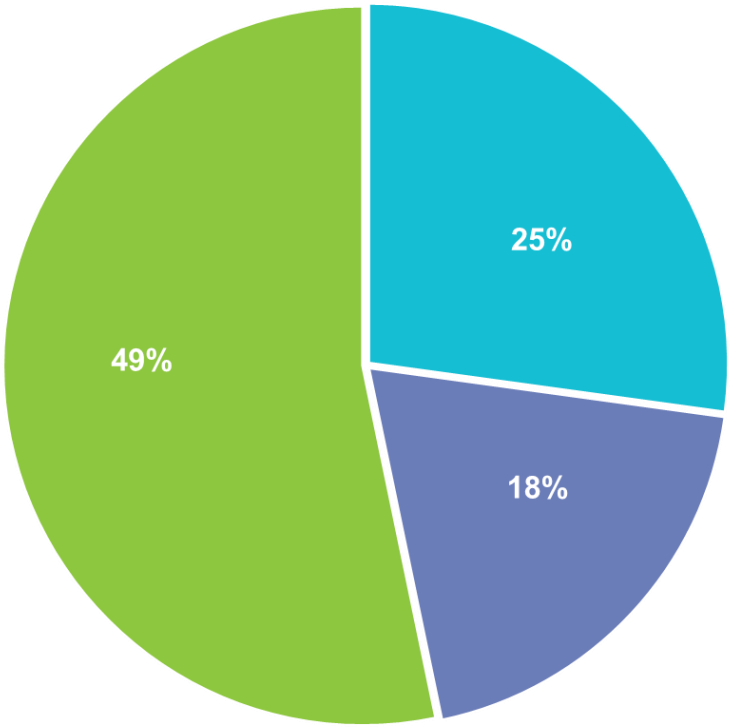


Source: SEMCOG and MAC "Pulse of the Region" Survey on Semi- and Fully-Autonomous Vehicles, 2017

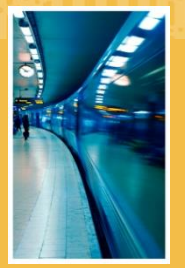
NCHRP Planning Snapshot #11

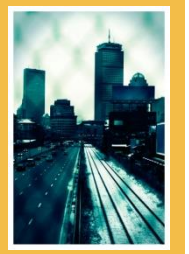
How have elected officials, decision makers, or agency executives responded to C/AV issues in your state or region?

- Supportive
- Too Early to Tell
- Uninformed but Curious



Source: http://www.planningsnapshots.camsys.com/

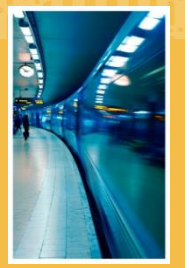




NCHRP Planning Snapshot #11

How would you best describe your agency's level of engagement with connected and autonomous vehicles?

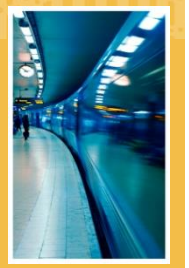
- Passively Engaged 37%
- Actively Engaged 33%
- Early Adopter 7%
- Leader 14%



Source: http://www.planningsnapshots.camsys.com/

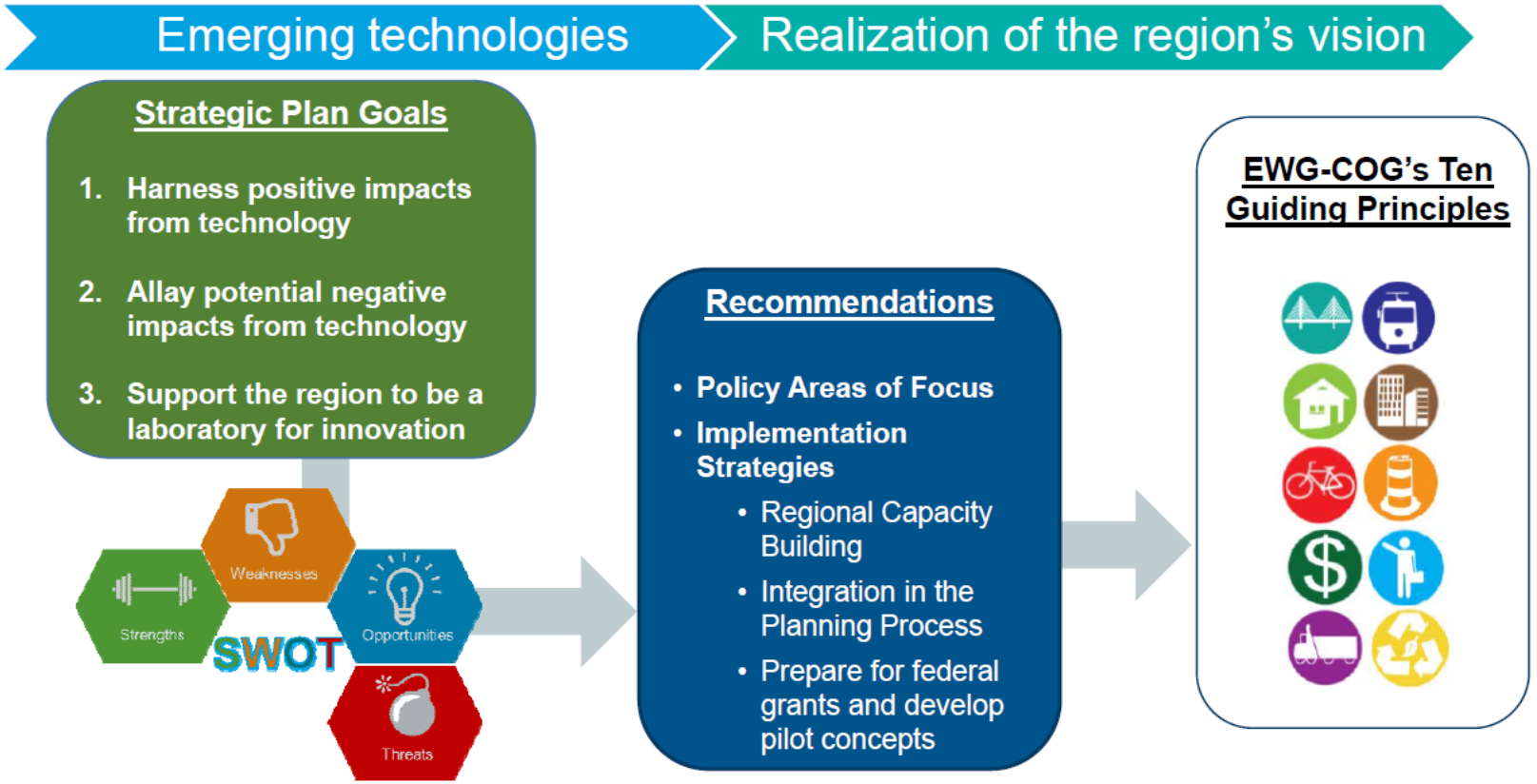
Emerging Transportation Technology Strategic Plan for the St. Louis Region

- 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.



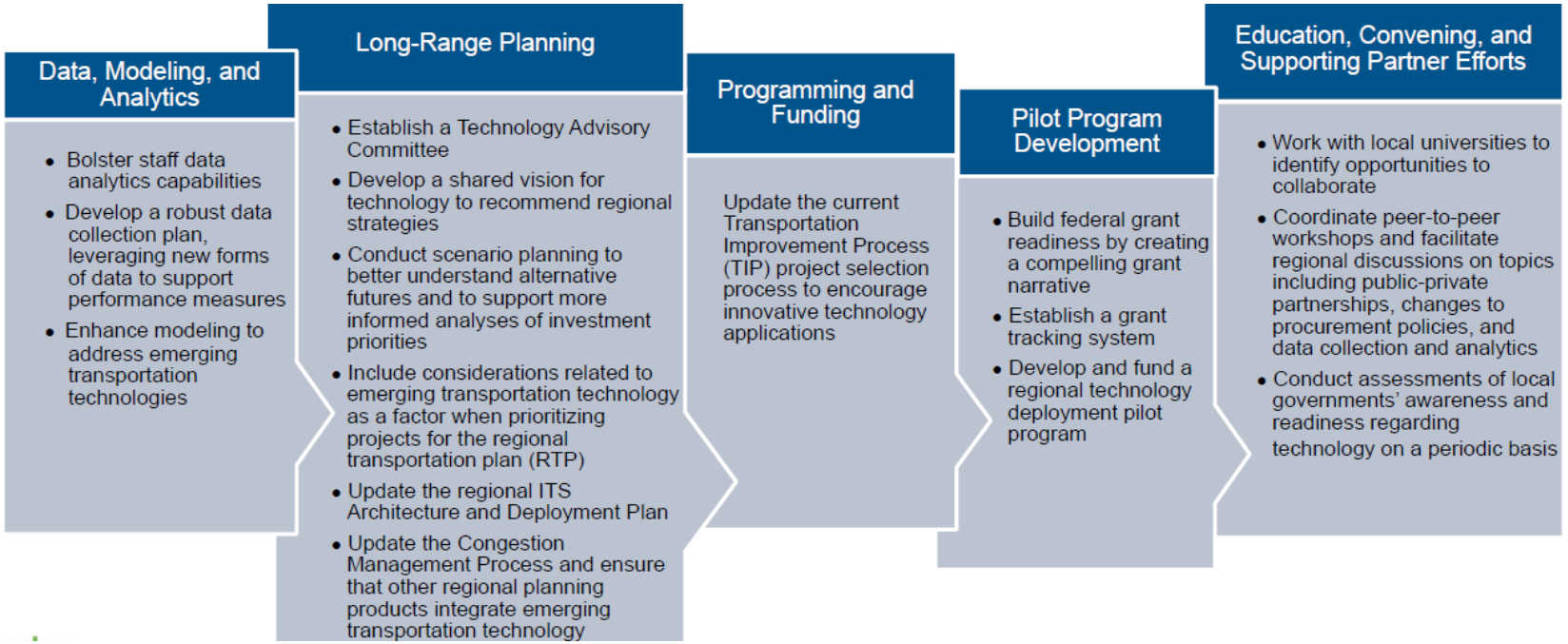
Source: Emerging Transportation Technology Strategic Plan for the St. Louis Region, June 2017

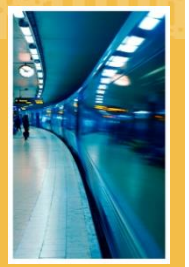
Emerging Transportation Technology Strategic Plan for the St. Louis Region



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

Emerging Transportation Technology Strategic Plan for the St. Louis Region

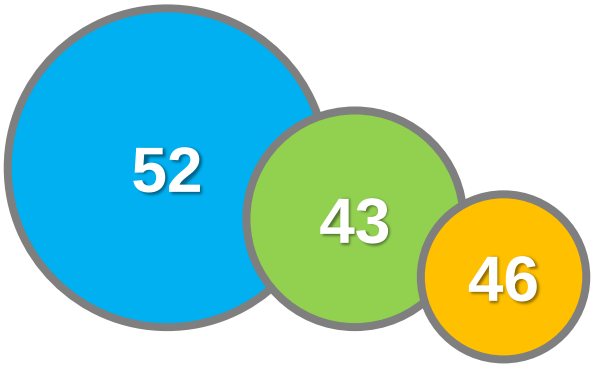




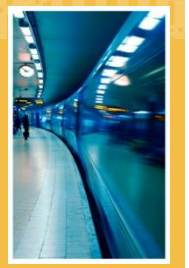
Source: Emerging Transportation Technology Strategic Plan for the St. Louis Region, June 2017

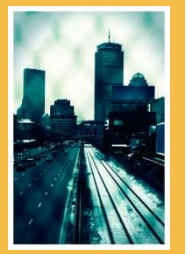
FTA/ARC – Shared Mobility and Technology Report

A total of 141 MPO long range transportation plans were downloaded and reviewed



Less than 200,000
200,000 to 1,000,000
Greater than 1,000,000

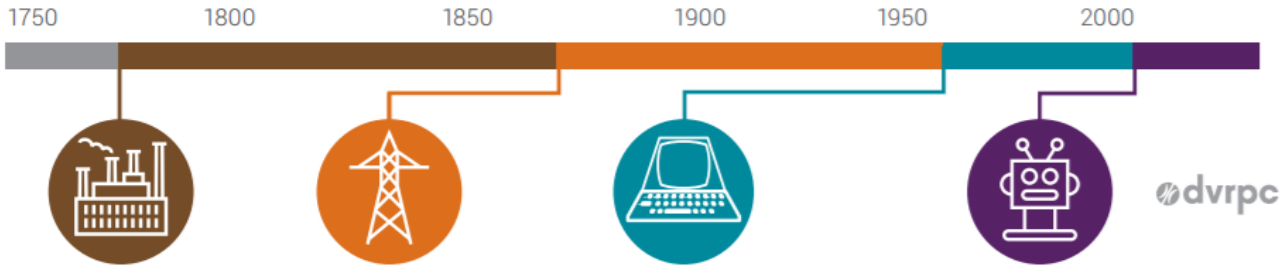




Source: FTA, Shared Use Mobility, Transportation Technology and Intercity Transit Services, June 2018

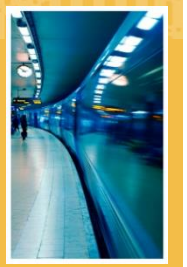
DVRPC – Setting Context

FIGURE 19: THE FOUR INDUSTRIAL REVOLUTIONS



	FIRST (1770s)	SECOND (1870s)	THIRD (1960s)	FOURTH (2010s)
TECHNOLOGY	Steam Power Mechanical Production Interchangeable Parts	Electricity & Lighting Mass Production Electric Circuits	Electronics & Computers Automated Production Integrated Circuits	Robotics & AI 3D Printing ???
URBAN FORM	Factories Town & City Growth	Skyscrapers & Elevators Zoning/Separation of Uses Urban Growth/Streetcar Suburbs	Auto-Oriented Suburbs Globalization/Deindustrialization Internet and e-Commerce	Smart Cities & Internet of Things Augmented Reality ???
TRANSPORTATION	Canals Railroads	Subways and Trolleys Cars, Buses, Trucks Airplanes	Intelligent Transportation Systems Real-Time Transport Space Travel	Connected & Automated Vehicles Unmanned Aerial Systems ???
			THE DIGITAL REVOLUTION	

Source: DVRPC, 2017. Adapted from World Economic Forum.



Source: Delaware Valley Regional Planning Commission, Connections 2045, December 2017

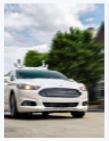
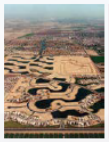
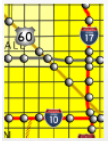
DVRPC Connections 2045 – Potential Impacts

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

Source: DVRPC, 2017. Adapted from Bryant Walker Smith, How Governments Can Promote Automated Driving, New Mexico Law Review, forthcoming, March 17, 2016, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2749375; and Johanna Zmud, Ginger Goodin, Maarit Moran, Nidhi Kalra, and Eric Thorn, Advancing Automated and Connected Vehicles: Policy and Planning Strategies for State and Local Transportation Agencies, National Cooperative Highway Research Program; Transportation Research Board, National Academies of Sciences, Engineering, and Medicine, 2017, http://nap.edu/24872.

Source: Delaware Valley Regional Planning Commission, Connections 2045, December 2017

MTC/MAG – Potential Benefits/Risks

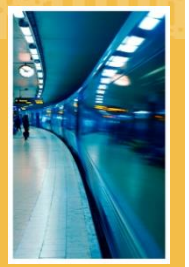
A Unique Opportunity . . .	...but not without risks.
 New Travel Choices Ridesharing Reduced Car Ownership	 Increased VMT Empty Vehicle Circulation Fight for the Market
 Repurposed Parking Space for Housing Public Space	 Urban Sprawl Higher Congestion Longer Travel Times
 Safer Streets Improved User Experience Efficient Network Management	 Cyber Attacks Privacy Concerns
 Higher Efficiency Transit Lower Operating Costs	 Declined in Transit Use Inequity

Source: Future Mobility Research Program, Metropolitan Transportation Commission, October 2017

RTC Southern Nevada – Planning Process

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

Source: Regional Transportation Commission of Southern Nevada, Access 2040, February 2017

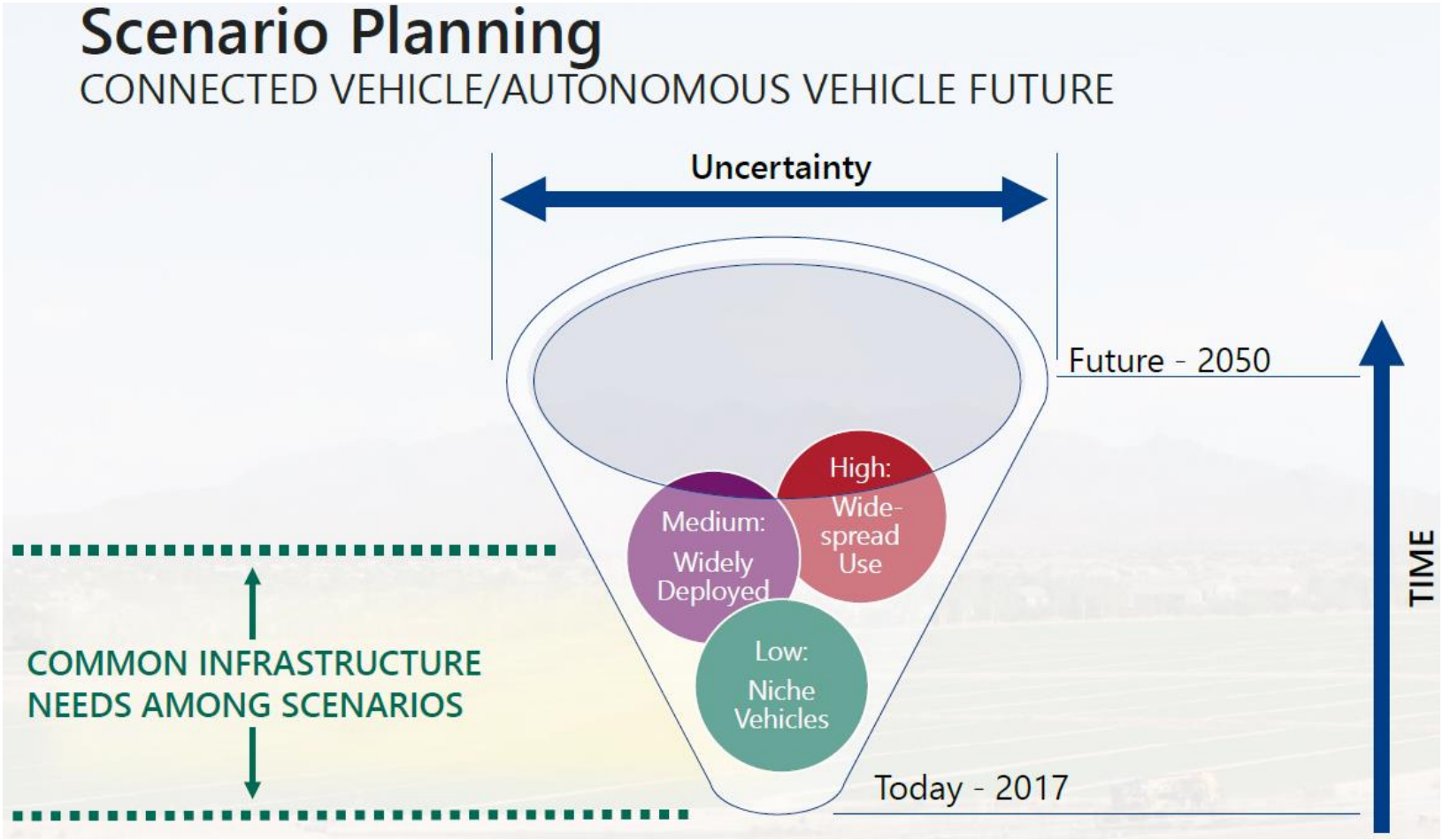


How will automated vehicles arrive?

Fully Autonomous	Personal Automation 	Shared Automated/ Platooning 
Semi-Autonomous	 Business as Usual	 Shared Mobility
Driver		

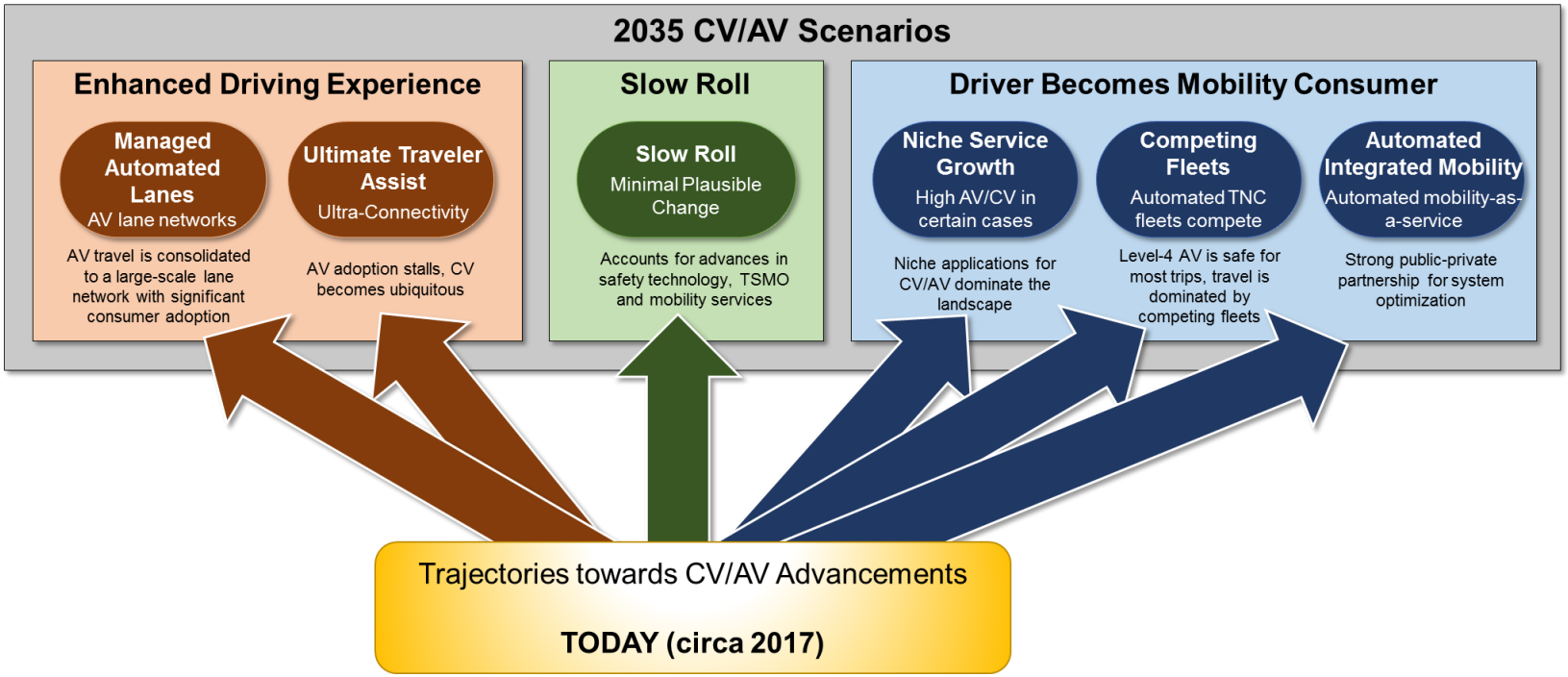
Source: Maricopa Association of Government, November, 2017

MAG – Cone of Uncertainty



Source: Maricopa Association of Government, November, 2017

FHWA 2035 CV/AV Scenarios

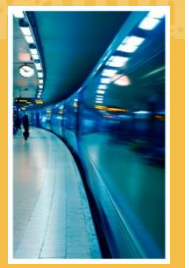


Source: Scenario Planning for Connected and Automated Vehicles, FHWA Office of Policy, February, 2018

Connected & Automated Vehicle Planning

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

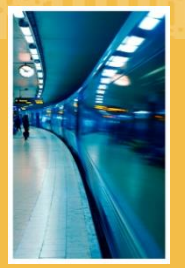


Connected & Automated Vehicle Planning

- 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

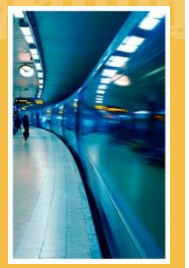
- Educate and inform MPO policy boards, other relevant decisions makers, and MPO stakeholders on C/AV status and critical issues

- Help ensure equity, safety, and traffic operations are maintained



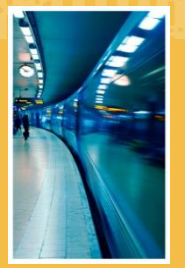
Connected & Automated Vehicle Planning

- 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



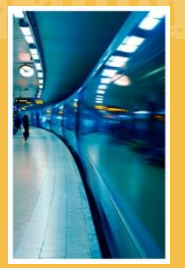
Connected & Automated Vehicle Planning

- 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)



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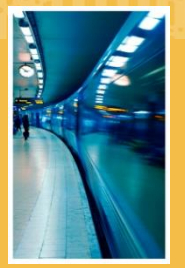
National Framework

- 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



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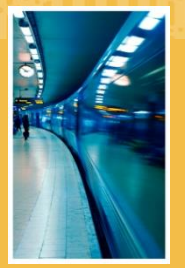
- The MPO role is critical to the nation as 80.7% of the United States population is urban and overall the nation's transportation network moves 54 million tons of freight valued at more than $48 billion each day.
- MPOs are stewards of the transportation system within urban areas. With their partner 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.



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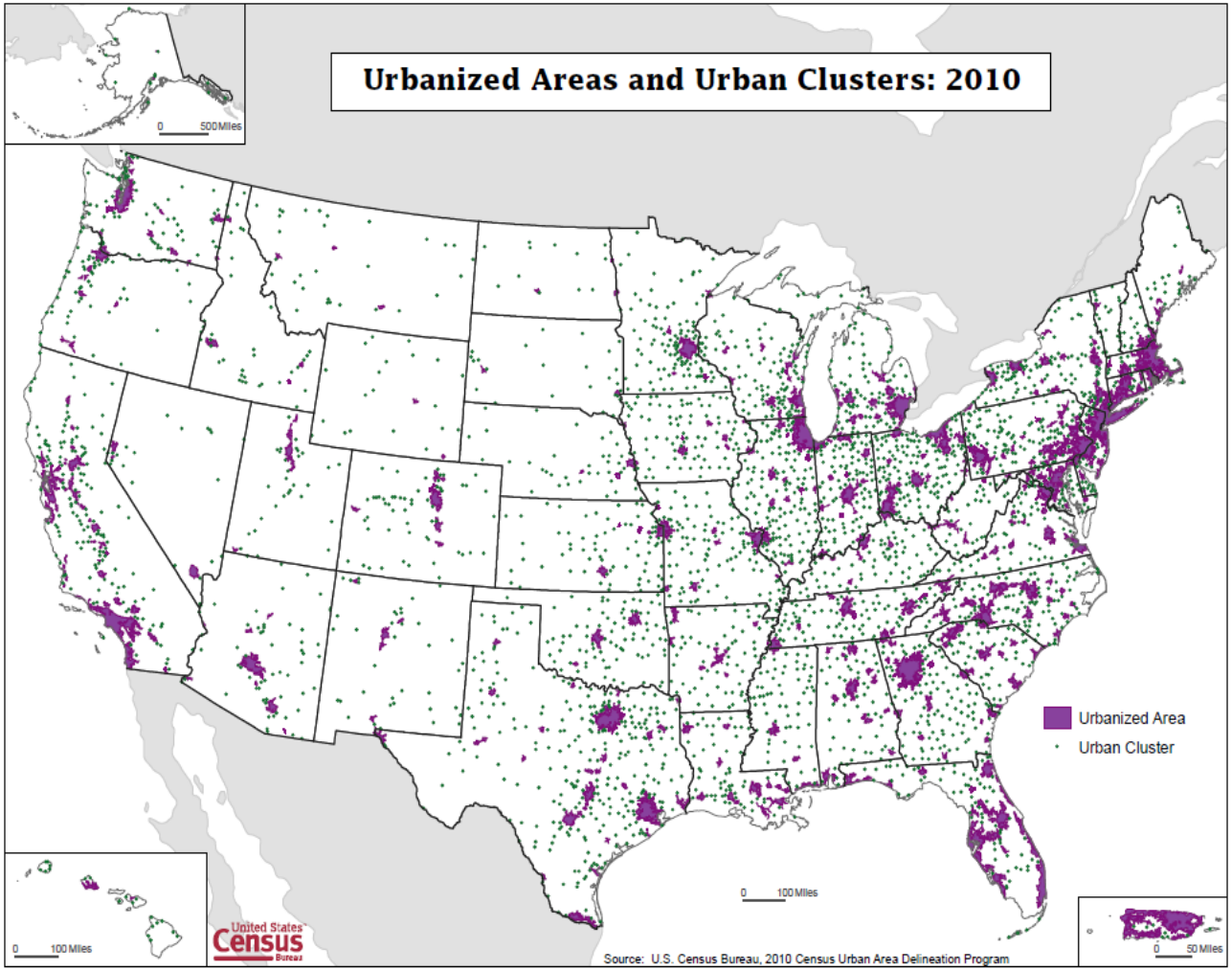

Source: United States Census Bureau Urbanized Areas and Urban Clusters 2010

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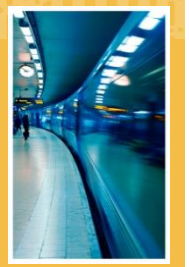
- MPOs are leaders for their regions and must keep pace with, leverage, and support emerging technologies, like C/AV, and their potential to improve the transportation system while helping to ensure the safe deployment of these technologies with minimal disruptions or negative impacts to the transportation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



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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!