Transportation Planning Capacity Building

Preparing for Automated Vehicles and Other Emerging Technologies: What MPOs Can Do

A TPCB Peer Exchange Event

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Date: May 18-19, 2021

Host Agency: Association of Metropolitan Planning Organizations (AMPO)

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13. ABSTRACT (Maximum 200 words)

This report summarizes proceedings of a virtual peer exchange sponsored by the Federal Highway Administration (FHWA) and hosted by the Association of Metropolitan Planning Organizations (AMPO) on May 18-19, 2021. The purpose of the peer exchange was to discuss how metropolitan planning organizations (MPOs) can prepare for connected and automated vehicles (CAVs) and other emerging technologies. The event provided an opportunity for MPOs and other public agencies across the U.S. to share experiences, lessons learned, successes, and challenges related to the topic. Specifically, participants discussed current activities in the field, scenario planning, data collection and use, and capacity building. The topics of discussion stemmed from AMPO's National Framework for Regional Vehicle Connectivity and Automation Planning, published in 2019. The event was sponsored by FHWA through its Transportation Planning Capacity Building Program, led in partnership with the Federal Transit Administration.

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Peer Exchange Overview

This report highlights the presentations, discussions, and key takeaways from the "Preparing for Automated Vehicles and Other Emerging Technologies: What MPOs Can Do" virtual peer exchange, held over two half-days on May 18-19, 2021. The event was sponsored by the Federal Highway Administration (FHWA) through its Transportation Planning Capacity Building (TPCB) program, led jointly with the Federal Transit Administration. The event was held at the request of the Association of Metropolitan Planning Organizations (AMPO) to bring together peers from across the country to discuss ways to build metropolitan planning organization (MPO) capacity for automation and connectivity and identify gaps in current thinking as well as opportunities for further research and resources.

The peer exchange featured four main sessions focusing on topics pertaining to: connected and automated vehicle (CAV) technology; scenario planning and planning under uncertainty; new data sources and data-sharing arrangements from both technical and institutional perspectives; and professional capacity building for automation and connectivity. The first day included two peer presentation sessions, and the second day included a roundtable panel discussion and a breakout group session. Each session closed with a facilitated discussion. The FHWA and AMPO structured each session to tie back to the perspective of the MPO, noting specific challenges and opportunities they may experience or address.

Session Discussions

Opening Remarks

Representatives from the FHWA Office of Planning and AMPO provided opening remarks, recognizing that the purpose of the peer exchange is to explore the role of MPOs in CAV planning and deployment to identify gaps in knowledge and opportunities to better support MPOs in this work. The topics of discussion stemmed from AMPO's National Framework for Regional Vehicle Connectivity and Automation Planning, published in 2019.

The FHWA noted that the TPCB website hosts a variety of other valuable resources for the transportation planning community, including summary reports from TPCB peer exchanges, case studies, and past research.

After opening remarks, two poll questions were administered. The first question asked participants to note their level of awareness regarding automated vehicles (AVs) and other emerging technologies. Figure 1 shows that half of respondents reported that they have significant experience in the topic, 41 percent reported having a good understanding of the topic, and 9 percent reported that the topic is relatively new to them.

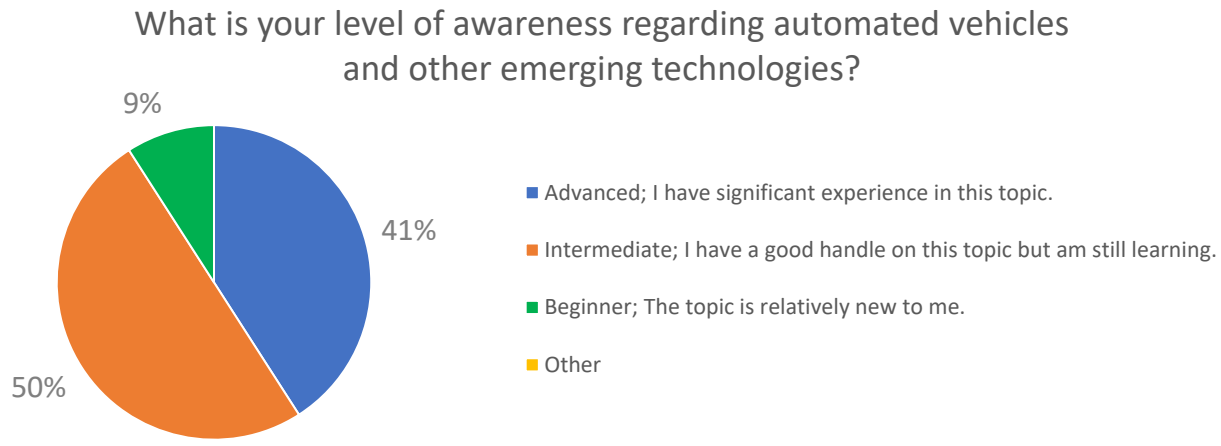

Figure 1: Poll Question 1: Participant's Level of Awareness Regarding AVs and Emerging Technologies

The second question asked participants to note how preparing for AVs and other emerging technologies currently fits among their agency's priorities, compared to a few years ago. Figure 2 shows that 42 percent of respondents reported that the topic is still important but shifting and that they are looking at different types of technologies. A third of respondents reported that the topic is more important than before, while 17 percent reported that the topic is less important than before. Finally, 8 percent of respondents reported that there has been no change in prioritization.

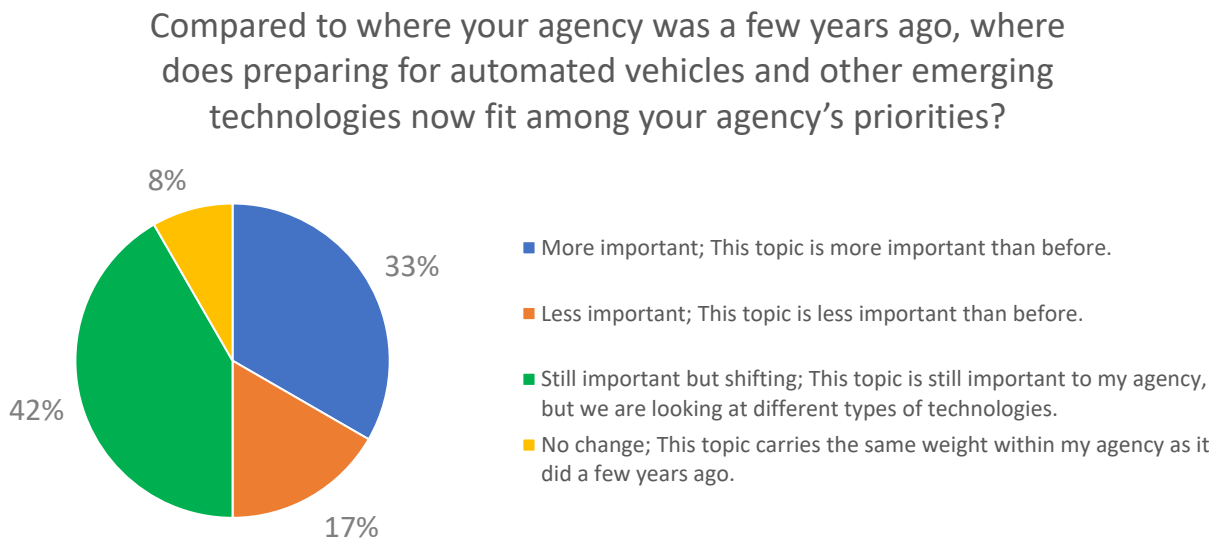

Figure 2: Poll Question 2: Agency Prioritization of Preparing for AVs and Other Emerging Technologies

Automated Vehicle Technologies: Current Status

This session included seven transportation practitioners to discuss how MPOs are approaching continually evolving CAV technologies and featured real-world examples of CAV vehicle activities/demonstrations in the panelists' regions of Arizona and Texas.

The session highlighted that "connected" and "automated" are two separate technologies; "connected" means low latency connectivity and "automated" means that at least one element of sustained vehicle control (e.g., steering, acceleration, brakes) occurs without direct driver input. There are a variety of automated vehicles, each with its own operational design domain like the kinds of roads on which it can travel and the type of traffic or weather conditions under which it can function. Connected applications (e.g., communication of traffic signal status to an approaching vehicle) may exist without automation, but the two technologies can work together, too. An example is truck platooning, which uses both vehicle-to-vehicle (V2V) communications and automation.

Notable Takeaways

- Maricopa Association of Governments (MAG) – Phoenix, AZ
    - MAG tracks technology deployment and stays aware of the local efforts of other regional entities to remain abreast of emerging technologies.
    - MAG transitioned from a four-step (trip-based) travel demand model to an activity-based model (ABM), which provides a more accurate representation of daily activities, with their resulting trips, by households and travelers.
    - MAG used its ABM to consider a spectrum of 'what if' scenarios based on user-defined assumptions regarding automation. Under these assumptions, it appears that AV technologies have the potential to drastically improve accessibility in rural regions and increase the mobility of pre-driving children.
- Maricopa County Department of Transportation (MCDOT) – Phoenix, AZ
    - MCDOT has strong partnerships with agencies in the Phoenix metropolitan area, including MAG, 15 cities and towns, State DOT, and 3 State universities. Through these partnerships, MCDOT works to promote the deployment and advancement of CAV technologies. There is a strong effort to share data among the various partners; MCDOT supports data-sharing through its Regional Archive Data System (RADS) and by co-leading the AZTech Regional Information System (ARIS) with the Arizona Department of Transportation (ADOT).
    - MCDOT focuses on connected vehicle (CV) technology to progress traffic management and operations. MCDOT currently uses dedicated short-range communication (DSRC) rather than 5G to communicate with CVs but noted that it is "equipment agnostic." The applications MCDOT is developing are flexible enough to convert to 5G when the time is appropriate to do so.
    - MCDOT is focusing on four CV applications: Intelligent Traffic Signal System; Signal Priority (for transit and freight); Mobile Accessible Pedestrian Signal; and Emergency Vehicle Preemption. The ultimate goal is for third-party vendors to adopt and advance these applications.
- City of Arlington, TX
    - The City of Arlington has performed three AV pilots named Milo, Drive.ai, and Arlington RAPID. Through these, the City learned that the deployment environment is critical to success. AVs need wide, clear paths free of obstacles and regular vertical objects to trigger safety sensors.
    - The City of Arlington reported that the majority of riders using Arlington RAPID felt safe and support the technology and that wheelchair-accessible vehicles improved accessibility for those with disabilities.

    - The City noted that a more streamlined approach to paperwork related to procurement and insurance would help to move innovation forward.
- North Central Texas Council of Governments (NCTCOG) – Arlington, TX
    - In four years, NCTCOG's AV deployment has advanced from a public demonstration of a single vehicle, to a pilot with multiple vehicles and a fixed-route service, to an area-wide service. While advancement has not been as fast as some predicted, there is still a lot of innovation and development happening in the area.
    - NCTCOG has two dedicated staff members to focus full-time on AV technologies and associated developments, which helps to move efforts forward.
    - NCTCOG stressed the importance of engaging with industry partners, public sector partners, and academic partners. NCTCOG has invested substantial resources into the AV sector by subsidizing local innovators as a way to develop effective partnerships and support AV deployments. Rather than simply proving the funding, NCTCOG stays involved in the projects.

Main Challenges

- AVs are covered by existing Federal regulations.
    - AV testing is happening in many locations across the county (42 States and DC), but only a patchwork of State regulations exist. Twenty-nine States have enacted legislation related to AVs, while 11 others have executive orders related to AVs.
- MPOs do not own the infrastructure on which to perform pilot programs.
    - MPOs typically do not own nor operate the transportation systems they serve. Instead, MPOs serve an overall coordination and consensus-building role in the CAV space, working with partners to perform CAV technology pilot testing.
- MPOs may not have staff dedicated to the advancement of CAV technologies.
    - Smaller MPOs must prioritize their efforts and may not have the capacity to focus on advancing emerging technologies.
    - Cities, towns, and the public may be looking to MPOs for guidance regarding the impacts and benefits of CAVs.
- Federal and State procurement regulations can be cumbersome.
    - Accessing funding for pilots is challenging; a more streamlined approach to paperwork related to procurement and insurance would help to move CAV innovation forward.
- Changes in technology are occurring more quickly than the typical timeframe for goal-setting in a long-range transportation plan.
    - It can be difficult for MPOs to incorporate emerging technologies in long-term planning efforts since CAV advancements have a fast pace of change.

Opportunities

- Foster partnerships with industry, public sector, and academic partners to pool resources and encourage AV deployment.
- Perform public outreach and education to build trust and consensus among communities.
- Incorporate flexibilities into long-range planning documents to help align efforts with quickly evolving CAV technologies.

Scenario Planning for Automation and Connectivity

This session included five transportation practitioners to discuss how MPOs and other stakeholders can use scenario planning to inform future decision-making. Panelists shared available tools and resources and appropriate research and lessons learned in the application of scenario planning approaches to emerging technology.

Notable Takeaways

- Delaware Valley Regional Planning Commission (DVRPC) – Philadelphia, PA
    - DVRPC has embedded scenario planning in its long-range planning to connect with and better understand key external forces reshaping the Greater Philadelphia region.
    - DVRPC meets with its Futures Working Group, comprised of transdisciplinary subject matter experts and interested stakeholders, on a quarterly basis to discuss emerging trends and how they are shaping the region. Since scenario planning is an ongoing process, this continuous dialogue helps DVRPC and its partners "learn their way to the future."
    - Scenario planning allows DVRPC to integrate uncertainties into its planning processes, but uncertainty and changing relationships are two inputs that models are not well-suited to anticipate. The future does not only depend on a handful of variables like population, employment, and availability of transportation infrastructure; politics and ideology play a role too. Stakeholder dialogues and systems thinking research complement scenario planning models well.
    - Shared resources: Scenario Planning Reports developed with Futures Working Group.
- Atlanta Regional Commission (ARC) – Atlanta, GA
    - Scenario planning models need inputs to produce outputs. These models typically work well with traditional inputs like demand (population and employment) and supply, but it is difficult to determine inputs for scenarios that include emerging technologies like CAVs because the effects of CAVs are uncertain.
    - The world today is more complex, interconnected, interdependent, and has more variables at play than any other time in history. Trying to model that using the traditional model structure is extremely complex.
    - Planning for uncertainties will require a different structure that considers spatial, temporal, and scale issues.
- Metropolitan Area Planning Council (MAPC) – Boston, MA
    - MAPC used scenario planning to explore how land use and pricing policies contribute to the underlying supply and demand balance for travel in the region. Further analysis allowed MAPC to identify certain key levers that influence or drive trends.
    - MAPC uses UrbanSim to create alternative land use scenarios for the Greater Boston region, each representing a different distribution of future growth across the region. Then, the resulting outputs are fed into a VisionEval Regional Strategic Planning Model (VERSPM), which estimates travel demand and VMT for each land use scenario based on specified assumptions about the cost of gas and driving.
    - Using a two-tiered analysis approach, MAPC uses models to illustrate the effects of different collections of policies, which can help decisionmakers prioritize focus areas.
- Boston Region MPO – Boston, MA

    - The Boston Region MPO uses exploratory scenario planning to help develop its Metropolitan Transportation Plan. The MPO used a series of focus group workshops to gather input about the factors that might influence the Boston region and is using that information to redesign its regional model.
    - The Boston Region MPO uses causal loop diagrams to capture qualitative data and create metrics that it then applies to its models. This approach incorporates system dynamics and also allows for quantitative analysis.
    - The Boston MPO uses FHWA's Exploratory Modeling and Analysis Tool (EMAT) to produce meta models that validate the model response. Doing so helps the MPO determine which scenarios should be explored further.

Main Challenges

- It is difficult to predict the implications that CAV technologies will have using current travel demand models.
    - Scenario planning models help to predict some risks and opportunities, but they are not sophisticated enough to consider changing relationships, system dynamics, or agent-based decision-making. These models are often not flexible enough to add the variables required and would be very complex to modify and run.
- As uncertainties increase, there is often a reaction to focus more on short-term decisions.
    - Justifying a project, or an air quality conformity determination, might call for a point prediction, which becomes difficult in a highly uncertain environment.

Opportunities

- Provide opportunities for ongoing dialogue about external factors and trends that could have an impact on the future.
- In addition to models, use a second level of analysis to capture qualitative data.
- Consider scenario planning as a "tool in the toolbox" to explore policies that could be helpful in reaching setting goals for the future and supporting decisionmaking.

Collecting and Using Data

This session included four transportation practitioners from Florida to discuss the capabilities that CAVs have to generate and collect data for a host of purposes, ranging from basic navigation to other complex functionalities like traffic management. Panelists explored the role MPOs can play with CAV data—from data warehousing and modeling to data-driven policymaking—and highlighted the value that MPOs bring to the work in this space.

Notable Takeaways

- MetroPlan Orlando – Orlando, FL
    - AVs are equivalent to supercomputers driving down highways and generating and transmitting an enormous volume of data—up to four terabytes per day per car. AVs can collect data related to pavement conditions and aggravated vehicle speed information to determine roadway conditions and inform decisionmaking. It is critical to ensure all communities are represented in these decisions.
    - Information sharing across agencies is key. It promotes a collective of lessons learned and allows for the discovery of new applicability of data, vendors, and research.

    - Partnering with technology companies in the private sector that are developing these technologies will help to guide implementation.
- City of Tampa, FL
    - The City of Tampa uses a "learn by doing" approach. They developed a pilot connecting a suburb to downtown and outfitted traffic signals with cameras to see how pedestrian safety and transit priority could be affected by CVs. They learned that, sometimes, there is friction between products that should work together (e.g., equipment and application software).
    - CAV data brings time and space together; it improves validation and allows for a better understanding of vehicle journeys. The City of Tampa is looking across modes, form factors, and communication types to understand these systems. They hope their research provides value for other mid-sized cities.
    - There is a role for the private sector to aggregate different types of data, some public and some non-public. Potentially, private and public data could be paired to produce products of value to both the planning community and the general public.
- Florida Department of Transportation (FDOT)
    - FDOT coordinates with MPOs in the State to ensure that there is a common political and technical understanding of the potential of CAV data.
    - FDOT ensures it has consistent data flows that can be used by other agencies. This often means that traditional datasets used to meet Federal requirements must be augmented. FDOT complements AV data with data collected from cameras to address concerns in communities where AVs might not be present.
    - FDOT is investing in a code base (data warehouse and operating set of software) and intends to make it available publicly so that smaller agencies can implement the system without being burdened by the cost.
- Hillsborough MPO – Tampa, FL
    - Hillsborough MPO is still in the learning stages when it comes to CAV data collection and use. The MPO has more experience with shared and electric vehicles and manages a shared data platform for its eight-county region that analyzes factors like crash data reliability incidents.
    - Hillsborough MPO stressed the need to assess the public's understanding and opinions of these innovative technologies and data collection methods. It is important to know if they are hopeful for the benefits of the technology or if there are concerns about issues like policing, privacy, and confidentiality.
    - Hillsborough MPO, like many other MPOs, uses static data that may not be current. The MPO hopes that the specificity and magnitude of CAV data will allow them to produce more accurate predictions of future travel behaviors.

Main Challenges

- Unequal distribution of AV-supported infrastructure and AV use can lead to imbalanced decisions and outcomes.
    - If AVs require certain infrastructure that is not available in underserved communities or if the turnover from traditional vehicles to AVs lags in certain communities, then decisions informed by AV data will be imbalanced. Communities lacking AV resources would then not be represented in critical transportation planning decisions.
- CAV equipment and software are sometimes incompatible.

    - Depending on the level of CAV deployment (service-based or personal ownership), hardware and software compatibilities may create obstacles related to data collection and analysis.
- Some MPOs have limited capacity.
    - Incorporating CAV data into programs requires financial investments and technical knowledge that some MPOs do not have the capacity to support.

Opportunities

- Use CAV data to help inform decisionmaking, prioritize project selection, and justify the implementation of tools like roadway pricing.
- Use CAV data to improve road safety and environmental conditions like pavement condition.
- Supplement AV data with data collected from infrastructure (cameras) to ensure that all communities are represented in data analysis that influences decisionmaking.
- Engage the public to learn about privacy concerns or other issues related to CAV data.
- Pair private data with publicly available data for more robust datasets.

Professional Capacity Building for Automation and Connectivity

This session opened with three breakout groups that discussed the ways MPOs can create institutional capacity for research and projects related to CAVs. The session continued with four transportation practitioners, who shared best practices for investing in new skills and resources for emerging research topics like CAVs, supporting collaboration within an agency and with outside partners, and how to create sustainable programming focused on connectivity and automation.

Notable Takeaways (Breakout Groups)

Other than money/funding, what are the biggest barrier(s) for your agency?

- Lack of capacity
    - Smaller MPOs with limited staff do not have the time or technical knowledge to support the advancement of CAV technologies.
    - It requires a significant amount of effort to oversee contracts and paperwork related to pilot projects.
- Decision-making under uncertainty
    - It is difficult to make investment decisions about uncertainties; there is hesitancy to invest in something that could become obsolete in the long term.
- Garnering buy-in and political support
    - Communicating the benefits of emerging technology investments to MPO boards, political leaders, and the general public can be difficult. Public education will help to advance the state of the practice.
    - Developing a shared vision of the future within the MPO and across the region is critical. MPOs do not own or operate roads, so strong partnerships are required to implement pilot projects.
    - Addressing privacy concerns related to data is key.
    - Competing priorities affect support, especially politically.
- Meeting Federal requirements

    - Federal requirements are not tailored to pilot projects, which can limit MPOs' ability to experiment with innovative projects and programs.
    - There is a need for more Federal guidance and encouragement to implement pilot projects.

If there were no obstacles (e.g., staff/money no object), how would you go about creating a more formalized capacity building effort within your organization?

- Focus on talent acquisition and workforce development.
    - Hire more technical positions with certain levels of expertise, especially related to data management, data science, data visualization, and geographic information systems (GIS).
    - Offer mid-career trainings.
    - Invest in more innovative analysis and technologies.
- Build and strengthen academic partnerships.
    - Leverage academic resources and research capabilities for technical assistance and potential contracting opportunities.
- Increase community engagement and develop ways to better communicate long-term visions and goals.
    - MPOs are often responsible for "connecting the dots" and telling a story. Developing communication tools and creating more opportunities for participatory planning would help to keep the public informed and engaged.

Notable Takeaways

- FHWA Office of Operations – Washington, DC
    - Emerging technologies like CAVs will yield a transformative and disruptive pace of change that will have both technological and institutional implications. It is important for Federal, State, and local-level governments to adapt; the historical role of the public sector will likely change.
- Waco MPO – Waco, TX
    - The pace of change in the public sector is slower than that of technological advancements, which makes it difficult for MPOs and others to be innovative.
- Mid-America Regional Council (MARC) – Kansas City, MO
    - MARC raised several challenges during the peer exchange regarding coordination across funding opportunities. For example, partner agencies' project funding cycles may not always align with Federal funding cycles, and some partner agencies perceive the Federal application process as too cumbersome. To support and advance CAV technology, funding sources will potentially need to be more flexible and accessible. Planning for emerging technologies 2-3 years in the future is not necessarily plausible.
    - MARC encourages upskilling its existing workforce to meet data management needs, especially since those employees already have institutional knowledge. Beyond the technical aspects, MARC noted that engaging partners that can provide psychological and human behavior expertise will help to develop more robust programs.
- U.S. DOT Intelligent Transportation Systems Joint Program Office (ITS JPO) – Washington, DC
    - ITS JPO offers a variety of professional capacity building resources including webinars and other trainings. They have also developed a robust academic program, which works

with community colleges and universities to discuss future workforce needs. All of the resources can be accessed on the ITS JPO website.

Conclusion and Key Takeaways

This peer exchange, led by FHWA and AMPO, convened representatives from Federal, State, regional, and local agencies across the U.S. to discuss how MPOs can incorporate CAV and other emerging technologies into their planning efforts. Participants shared their experiences, lessons learned, and key challenges during several group discussions and identified opportunities for engagement. Peers shared resources with notable practices and training opportunities to help advance capabilities.

Key takeaways from discussions:

- Planning for CAVs and other emerging technologies requires technical staff and flexible funding.
    - CAVs produce valuable data that can be used to prioritize projects and improve safety and environmental conditions. Applying CAV data requires a certain level of technical knowledge, so MPOs often need staff proficient in data management, data science, and data visualization. Offering upskill opportunities or internal trainings to current MPO staff is one way to meet these needs.
    - New technologies bring new potential investment opportunities. To take advantage of these opportunities, public agencies often need flexibility. Identifying opportunities for these flexibilities, whether as part of the transportation planning process or otherwise, could help MPOs and other public agencies better leverage their resources.
- Partnerships and collaboration are key to delivering pilot projects and building MPO capacity.
    - Even when MPOs have the capacity to advance CAV technologies, they do not typically own or operate the transportation systems they serve. Partnerships with a shared vision of the future are necessary to implement pilot projects or conduct field research. Academic partnerships can provide research or technical assistance, and lateral MPO partnerships can help to share knowledge and incorporate lessons learned into projects. Resources and materials produced by FHWA and AMPO that represent how mid-size and smaller cities have implemented CAV technologies could further help MPOs envision future programs.

Appendices

Appendix A: Key Contacts

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