Docket Operations
U.S. Department of Transportation
1200 New Jersey Avenue, SE
West Building, Ground Floor
Room W12-140
Washington, DC 20590-0001

Re: DOT-OST-2019-0179

Dear Docket Clerk:

These comments and recommendations are submitted on behalf of the Metropolitan Transit Authority of Harris County (Houston METRO) on the Department of Transportation (DOT) Office of the Secretary (OST) Notice of Request for Comments: Ensuring American Leadership in Automated Vehicle Technologies: Automated Vehicles 4.0 (AV 4.0), published on February 6, 2020 at 85 FR 7011.

Houston METRO is the regional transportation provider of public transit service in the nation's 4 largest city and has been active in the planning, procurement and demonstration/piloting of AV technology. Today, it serves as an Autonomous Vehicle Proving Ground operating the University District AV Circulator Pilot/Demonstration with an EasyMile Autonomous Shuttle. Houston METRO was part of the Federal Automated Highway Program in the late 1990s. It partnered with Carnegie Mellon University to pilot vehicle platooning on its extensive 100 mile plus high occupancy roadway network. Through the learning process of these deployments, our attention to the critical safety matters facing AV in public transit, we offer the following comments.

Organizing Data Collection

A central repository would be extremely helpful for transit agencies. Research and development (R&D) are typically not a function of transit agencies, either due to human resource, financial constraints or political considerations. Leveraging existing demonstrations and pilots will allow transit agencies to cost effectively shorten the learning curve around implementation of AVs. Providing a central repository of all projects benefits agencies with practical real-world knowledge and helps them to discern the best application for their respective agency. Such data would also be compelling in asking stakeholders to support exploration of the technology considering the many competing needs and limited resources of transit agencies.

A data dashboard or information management tool with the ability to monitor real-time data, track KPI's, best practices and challenges and feedback from all involved regulators, such as the U.S. Department of Transportation, as well as the National Highway Traffic Safety Administration (NHTSA), of AV deployments would be essential and helpful before committing to a pilot demonstration

A data template could be created so at a minimum pilots/demonstration can collect data to form a baseline for agencies in addition to data specific to that project. This template could be created with collaborative input from transit agencies. This would ensure agencies have the information it needs to make an informed decision about use of AVs.

Specific policy goals to benefit public transportation

Public safety is the main priority in the transportation sector. To improve public safety on the roadways when integrating AV technology, specific policy goals that will benefit public transit include:

- Guidance on which existing rules, policies and regulations apply to AVs used for public transit
- Cyber and data security requirements
- Insurance liabilities
- Regulatory policies for AV integration in mixed traffic operations
- Guidance on operations at rail and/or light rail crossings

On the vehicle and technology side, goals are needed that focus on the protection of self-driving transit vehicles as they approach and traverse major roadway junctions – particularly when manually operated vehicles, pedestrians, bicyclists and scooter traffic is also passing through the intersection. We believe that intelligent infrastructure at these major signalized intersections will be an essential component of automated public transit. Such intelligent infrastructure must be able to perceive the multimodal traffic movements, determine when passage through the intersection is safe (or unsafe) for the AV transit vehicle, and then in coordination with the traffic light signal system provide command and control directives through dedicated, short-range communications systems to the transit vehicles.

Supporting public transit agencies through federal research & development (R&D) programs as they adopt automated systems

Limited funding poses a challenge to many public transportation agencies who would like to pilot AV technology to improve existing transportation services, improve infrastructure and to understand AV safety. R&D funding is crucial to the agency's learnings and adopting best practices. Federal funding plays a crucial role in advancing the technology thereby helping transit agencies quickly understand how AVs can be integrated into existing or new public transit services particularly for first and last mile and for underserved populations.

New demonstration and pilot programs are necessary to incorporate the development and refinement of intelligent intersections, with an integrated

deployment of radar, LiDAR, stereo camera and other such developing sensory technologies (as commonly used in ADS applications) within the roadway infrastructure. The 3-dimensional sensory system will require data fusion just like AV driving technologies, as well as AI processing to perceive and respond to potentially unsafe operating conditions across all modes that pass through the roadway intersections. Similarly, AV operations through other types of complex roadway junctions like high-speed merge locations where AV transit vehicles must safely enter dense vehicle streams and platooning lanes will also require intelligent infrastructure to manage the merge operations. These are just some of the reasons pilots and demonstrations are needed.

Lastly, pilots and demonstrations test how AVs can be fully integrated into public transit systems. Public transit operators would need to implement existing fare collection, passenger counter and scheduling systems, among other integrations. Many which are unique to public transit and will require demonstration and testing before full implementation. Federal support for these R&D studies and deployments will help ensure their safe and efficient implementation into public transportation systems.

A national policy framework as a safeguard against increased Vehicle Miles Traveled (VMT), emissions, traffic and sprawl

Based on what we know of the current electric vehicle market (the closest analogy), it's not clear if the free market would generate the benefits on the personal passenger side. However, environmental benefits could result under a high capacity transit model. A national policy framework that incentives public transit and disincentivizes single occupancy vehicle use could help generate the benefits outlined in AV 4.0. Without such a framework, and if AVs become as popular as forecasted, it is possible that VMTs may go up if the "ghost car" phenomena, where driverless privately owned or TNC type vehicles are dispatched for errand or discretionary type trips. Sprawl and congestion could be a consequence, hence undermining any environmental benefit.

Focus and funding at the federal level needs to foster the maturation of "microtransit" delivering First-Mile/Last-Mile (FM/LM) connections to high capacity transit lines. Automation of the transit circulation systems within urban districts and major activity centers which integrate with regional high capacity transit is the low hanging fruit which will move the mode choice to transit for many more people.

A policy framework that continues to promote the benefit of public transit must continue as the current message points of "leave the driving to us" may not be as effective in the future if a rider can acquire their own driverless vehicle. Hence, a national policy framework that supports and emphasizes public transit (shared rides) would be needed to facilitate the hoped-for environmental benefits and to manage congestion and sprawl.

AV 4.0 identifies safety, economic and societal benefits, efficiency and convenience, and mobility as four benefits that could emerge from vehicle automation However, there are others that would be important from the perspective of public transportation operations.

Objective: Equity and universal accessibility are focus areas that should be addressed in public transportation operations to serve diverse and underserved populations.

Objective: Other areas of focus should include workforce and training. What happens to existing transit operators? What new roles are created? What is the knowledge, skills and abilities (KSAs) of an AV attendant or ambassador?

Objective: Isolation of the V2I communications systems and safety functions that protect transit vehicles operating through major roadway junctions need to be addressed through communications technology that is dedicated and isolated from the cyber security risks of V2X communications and internet-based data transmission systems (similar to a fire-wall concept). The concept of isolated equipment and communications to locally protect each intersection through V2I safety protocols is like the way fixed guideway automated transit systems protect track junctions with local, failsafe "interlocking" systems.

APTA recently commented on the FCC NPRM that would permit unlicensed devices to operate under spectrum currently devoted to transportation operations, pointing out the reasons why spectrum will be essential as transportation operations increasing become automated. Can you provide examples that will support APTA as we reiterate this point?

Houston METRO is currently operating an Autonomous Vehicle Shuttle pilot project. We opted to use lidar mapping rather than rely exclusively on cellular communications to manage V2I or V2V due to the following concerns:

1. Slower speeds during heavy times of usage
2. Dead Zones (where the signal cannot reach the vehicle)
3. Outages if the towers are affected by external events (weather, accidents)
4. Cybersecurity hacks
5. Subject to reliability of provider and/or equipment
6. Latency

It is not clear that cellular communication has addressed these issues to ensure safe operation of AVs. The provision of sufficient frequency spectrum is essential for supporting digital, short range communications technology (traditionally called DSRC) by which the roadway infrastructure communicate safety critical information and directives to AV

transit and fleet operated vehicles at roadway junctions. The proliferation of AV technology applications and the host of roadway junctions that must be protected in the near term by dedicated infrastructure utilizing the protected frequency spectrum provide ample support for concerns about the release of the frequencies for unlicensed use. The safety function of the protected spectrum must be retained for transportation safety use.

Vehicle automation should be a gradual process

This state of full "autonomy" by which a vehicle is as fully capable and functional as a human being to drive anywhere at any time (i.e., SAE Level 5 Automation with no geofenced boundaries) remains a topic of debate in terms of timing. However, we can focus on facilitating and advancing Level 4 automation in public transit, and fleet operations within geofenced areas. These objectives can be achieved first in lower speed applications like circulators and FM/LM connectors serving urban districts, town centers, local communities and major activity centers. Then higher speed public transit applications and fleet operations of shared-ride services within dedicated corridors, BRT systems and HOV lanes can be the second tier of "full" Level 4 automation.

Focusing on level 5 leaves out other key considerations. The technology around a level 5 vehicle must include automation to accommodate ADA passengers such as automated fare collection, automatic doors, automatic wheelchair securement. Even with these enhancements some form of human interaction is needed either on board or remotely to respond to ADA and non-ADA needs.

Also, simply having a Level 5 vehicle without the accompanying infrastructure (V2I and V2V communications, traffic signal configuration, road conditions and striping) won't help agencies realize the full potential of AV technology.

Incremental steps are a key to developing AV technology as we have seen with the growth of driver assist technologies. Focusing on refining and developing the foundational components and operations like drive by wire and related technology are essential to get to safe Level 4 and Level 5 vehicles. A focus should also be on achieving full automation under SAE Level 4 definition, in which the vehicles can operate "unmanned" without the physical presence of an operator or even an attendant. But for the near to medium term, these AV transit and fleet vehicles must remain under the attention and oversight of fleet operations staff – including personnel in dedicated operations control centers, in local operations field offices at the district level, and with roving operations personnel who provide a quick response when failures, incidents or operations problems require human intervention.

The incremental approach to achieving full automation with Level 4 functionality (as addressed above) may allow the current staffing of public

transit agencies to be retained. Conceptually, those transit agency employees who are currently driving large transit vehicles will begin to transition to a new role of monitoring and overseeing the field operations of many smaller and fully automated transit vehicles. For these new AV field operations staff, the training requirements can be achieved progressively as the early deployment of AV technology starts to occur. In this approach, the size of the workforce could remain as it is today, while delivering a much greater level of passenger service, more customized to the passenger needs and convenience. This in turn will result in the workforce becoming much more productive as a larger total ridership is attracted to the transit mode as Level 4 automation becomes a reality.

Support is needed to prepare the public transit workforce for vehicle automation because there will be new skill sets that come with the technology. There needs to be a consideration of labor force-displacement, training, and educational partnerships. Partnerships with educational institutions will create a pipeline to avoid workforce gaps as higher skills are needed as automation advances.

FTA Automated Vehicle Grants

- Current FTA grants request a data management plan. It would be helpful if federal agencies collaborated to create a template of data they need or have a particular focus. This would particularly help if a central repository was created. It would create uniformity and a streamlining of data for both federal agencies and users of the repository.

We commend and thank you for your leadership and support of AV research, development, pilots and deployments. Houston METRO appreciates the opportunity to provide comments on this important and evolving topic. Please do not hesitate to contact us if we may be of further assistance.

Sincerely,

Kimberly Williams
Chief Innovation Officer
Metropolitan Transit Authority
713-739-4992
Kimberly.Williams@ridemetro.org