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

Re: FTA-2022-0012

Dear Docket Clerk:

On behalf of the 1,500 public- and private-sector members organizations of the American Public Transportation Association (APTA), I am pleased to submit these comments on the Federal Transit Administration (FTA) Request for Information on Transit Bus Automation Research and Demonstrations, published June 2, 2022, at 87 FR 33574.

General Comments

APTA commends the DOT for reaching out to the transit community to seek guidance for how to continue and expand research, deployments, and recommendations concerning Advanced Driver Assistance Systems (ADAS) and Automated Driving Systems (ADS). The transit industry is witnessing dramatic changes in vehicle capabilities, Microtransit solutions, and automated vehicle (AV) shuttles to serve first/last mile trips. The Strategic Transit Automation Research (STAR) Plan 1.0 provided a multitude of analysis and deployment guidance, but the research to date is just scratching the surface. By continuing and expanding research deployments within the STAR Plan 2.0, APTA is hopeful that transit agencies will receive a better understanding of the benefits, challenges, deployment considerations (from additional live demonstrations) and ideal use cases when deciding whether to invest in automated solutions.

Additionally, the significant investment to transition fleets to zero-emission bus (ZEBs) through the Bipartisan Infrastructure Law accelerates the opportunities and use cases for ADAS and ADS technologies. APTA's comments are structured around the key areas of the FTA STAR Plan 2.0 (1) Priority Areas, (2) Enabling Research, (3) Integrated Demonstrations, (4) Strategic Partnerships, (5) Stakeholder Engagement and Knowledge Transfer, and (6) Workforce.

PRESIDENT AND CEO

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Priority Areas

Regarding what *research* topics the FTA STAR Plan 2.0 may include, APTA encourages the FTA to consider the following:

- **ADAS/ADS impacts to insurance premiums** – What effect will varied levels of ADAS/ADS deployment have on property loss and other claims? What resulting reduction in insurance premiums would be expected for if equipped with ADAS/ADS solution and if so, what is the scale? What incentives are insurance companies offering now to employ ADAS features such as collision avoidance, precision docking and valet parking?
- **Sensor reliability and asset management implications** – To effectively manage inventory and warranties, transit agencies require a better understanding of the useful life of sensor suites and onboard computers. This will help guide warranty requirements, maintenance inspections, and workforce needs.
- **Adoption of automation and electrification** – Exploring the potential to reduce the amount of charging infrastructure required by deploying battery electric buses (BEBs) equipped with ADS Level 4 capabilities. Depending on state of charge (SOC) and next service block assignment, BEBs equipped with ADS capabilities may be able to autonomously park, charge, and then drive to a designed location increasing the yard operations and decreasing the number of charging dispensers that may be required. Furthermore, STAR Plan 2.0 should include an assessment of hydrogen fuel cell buses as a part of the impacts from zero-emission buses.
- **Cybersecurity** – Understanding and preparing for cyber threats with both ADS and ADAS solutions and recommendations for transit agencies to mitigate these risks. These technologies require advanced forms of communication protocols thus increasing the likelihood of malicious cyber threats. Additionally, further guidance and research is needed into the cybersecurity implications of remote operations of ADS-equipped vehicles.
- **Workforce** – Deeper understanding of the future needs to safely maintain and operate ADAS/ADS equipment. Additionally, what type of training certification programs will be required to safely operate and maintain ADAS/ADS-equipped vehicles? APTA encourages FTA to continue to conduct in-depth research to ensure the transit workforce is not negatively impacted by ADAS/ADS technology at all levels of automation. What standards need to be developed to promote interoperability of equipment and software applications by transit agencies, manufacturers, consultants, and suppliers? It is also recommended to provide guidance to transit agencies on how to staff properly and how to establish the minimum required cybersecurity awareness training.
- **Accessibility** – providing additional guidance, research, and design recommendations to ensure ADA compliance, integrating accessibility and “universal design” concepts into vehicle designs is important and ADAS/ADS pilot deployments. Thorough documentation related to accessibility requirements must be at the forefront to continue to advance technical capabilities to ensure solutions address all passenger needs.
- **Increased understanding of liability** – A long-standing and unresolved challenge in the AV market is who is liable in the event of an incident? Whether it is the vehicle manufacturer, the automation software, sensors, or driver, these instances must continue to be researched and shared to better prepare transit agencies for in-service AV deployments.
- **Equity** – Similar to zero-emission bus (ZEB) fleet rollouts, transit agencies are looking for guidance to ensure they are following equity best practices when it comes to vehicle automation.

This may mean prioritizing deployments in disadvantaged communities which may require increased infrastructure (sidewalks, smooth paved roads), community engagement and education. This should also address deployments to meet ADA requirements for individuals with specific accessibility needs

- **Transit ITS requirements** – Most transit agencies struggle with the amount of data associated with ITS equipment and the ever-evolving software upgrades. Data management with ADAS/ADS technologies will only exacerbate these challenges as onboard systems collect millions of datapoints per second. Transit agencies will need to understand potential storage and cost requirements to operate and maintain fleets equipped with ADAS/ADS technologies. Furthermore, for ADAS and ADS solutions to support transit operations, numerous systems need to be integrated (AVL, APC, AFC, etc.) and further guidance with the level of effort, time, and cost to complete these integrations will help transit agencies better assess challenges with deployments.

Enabling Research

Following suggested research topics in the previous section (Priority Areas), APTA has developed high-level questions for further research consideration within the next five years:

- How can FTA support standardized use cases for ADAS and ADS technologies to guide workforce and specification requirements?
- Due to the vast amount of state and federal policy requirements, how, where, and when can transit agencies implement forms of ADS permanently versus short-term pilots?
- Knowing sensors that support ADAS and ADS technologies suffer from degradation which limits their effectiveness and accuracy, how will agencies be able to monitor degradation and how will this impact warranty specifications?
- If transit agencies begin to procure buses equipped with ADAS and ADS technology, how will agencies ensure they are complying with equity best practices?
- What are the specific skill sets and job training requirements necessary to operate and maintain vehicles that are equipped with ADAS and ADS technology?
- To what degree will ADAS and ADS technologies impact transit agencies cybersecurity requirements in relation to Public Transportation Agency Safety Plans?

Integrated Demonstrations

APTA strongly encourages the FTA to continue to move forward with all five integrated demonstrations (Transit Bus ADAS; Automated Shuttle; Maintenance, Yard, and Parking Operations; Mobility-on-Demand (MOD) service; and Bus Rapid Transit (BRT) for the STAR Plan 2.0 and assess opportunities to *increase* the number of ADAS/ADS deployments throughout the U.S. While research, webinars, and stakeholder engagement exercises are valuable, physical deployments offer the most return on investment and will expedite deployment readiness for transit agencies that receive hands-on experience. There is clear evidence that ADAS/ADS solutions increase fleet efficiency and safety, but uncertainties remain with reliability and workforce impacts. Increasing the number and variety of integrated deployments will provide tangible benefits to the transit community.

Challenges for deploying ADAS or ADS technologies include (but not limited to): Understanding capabilities and limitations of ADAS and/or ADS technologies *prior* to deployment; accurate and timely engagement with project participants; establishing and actively tracking key performance indicators (KPIs) to evaluate deployment success; and developing and following a risk management plan in case an unplanned event occurs.

There have been numerous ADAS/ADS success stories in the transit industry that APTA encourages the FTA to continue to fund. A few key projects include the first-ever automated BRT demonstration with CTDOT under the FTA Integrated Mobility Innovation (IMI) grant program providing over \$20M to 25 different projects. This project includes three battery-electric heavy-duty buses equipped with Level 4 buses equipped with ADAS capabilities enabling each bus to perform lane-keeping assist, precision docking maneuvers, and platooning buses to test improvements to headway management. Another success story falls under the FTA Accelerating Innovative Mobility (AIM) grant program that awarded \$14M to 25 projects. Western Reserve Transit Authority in Ohio partnered with Santa Clara Valley Transportation Authority to test AVs to supplement paratransit services as well as fixed-route bus. Dozens have projects that have received FTA funding and are continuously pushing the boundaries. APTA strongly encourages the FTA to evaluate projects funded thus far under AIM and IMI programs to help guide future investments in transit automation solutions. APTA also recommends funding projects that embrace Universal Design and promote mobility freedom, incorporating feedback from the transit workforce, and embracing the spirit of ADA requirements.

Infrastructure readiness is also an important part that impacts the deployment of ADS technologies. Intersection rule-based edge computing in conjunction with high-speed broadband connectivity, such as fiber network and 5G/6G, are crucial to provide additional layer of safety toward ADS operations. Data provided through this setup will further accelerate the smart city implementation.

Strategic Partnerships

Proven use cases for ADAS/ADS technologies that are applicable to transit include (but not limited to): Platooning, lane-keeping assist, and autonomous yard trucks.

- Active platooning tests with long-haul semi-trucks are taking place across the U.S. and present safety and energy benefits. Depending on daily passenger capacities, transit agencies can stand to gain from platooning buses in Bus Rapid Transit (BRT) environments to increase service. Additionally, platooning buses may help standardize fleet size, which has the potential for cost savings to transit agencies.
- Precision docking has the potential to be a transformative element of BRT. By spending less time arriving and departing at stations, precision docking can help reduce overall travel time. More importantly it will enhance the experience and safety of all passengers.
- Lane-keeping assist is now a common feature in most passenger vehicles. This decreases the likelihood of vehicles unsafely drifting from one lane to the next and/or drifting into the median and is a NHTSA recommended safety technology. Installing lane-keeping assist on buses can decrease in-revenue incidents and decrease the amount of infrastructure that is typically required for dedicated BRTs.

- Autonomous yard trucks are becoming more common in shipyards ([Middle Harbor in San Pedro Bay](#))¹ and mining operations for use cases that involve daily, repetitive maneuvers. This can easily be replicated in bus depots where buses must consistently vault, wash, and park each day.

Stakeholder Engagement and Knowledge Transfer

APTA applauds FTA for their communication and stakeholder engagement efforts surrounding the FTA STAR Plan 1.0. The information was thorough, organized, and well distributed. Additional considerations to expand upon the existing STAR Plan platform to improve the effectiveness and reception of STAR Plan 2.0 include (but not limited to):

- Increasing collaboration with organizations supporting the development and acceptance of technical standards such as the International Organization for Standardization (ISO), Society of Automotive Engineers (SAE), and NHTSA.
- Develop toolkits to help support transit agencies plan, monitor, and evaluate integrated deployments to increase the likelihood of success.
- Expand the existing knowledge hub created for the STAR Plan 1.0 to include not only FTA STAR research, but research, webinars, and presentations from related research bodies such as the Transit Cooperative Research Program (TCRP) and the Intelligent Transportation Systems Joint Program Office (ITS JPO).
- Increase coordination between key governing bodies that support vehicle automation research and funding opportunities to better streamline results, reporting requirements, standards, and best practices. Organizations include (but not limited to): Federal Highway Administration (FHWA), FTA, Federal Motor Carrier Safety Administration (FMCSA), and NHTSA.
- Provide funding opportunities to develop regional testing centers in all nine FTA regions for transit agencies and OEMs to collaborate and provide real-world test scenarios to advance the effectiveness and reliability of ADAS and ADS technologies.

Workforce

APTA strongly believes FTA should continue to research and engage a wide variety of stakeholders to provide near-term recommendations for transit agencies to prepare for ADAS and ADS technology. Over 50 percent of urban transit agencies predict ADAS capabilities such as lane-keeping assist and collision avoidance will be available in the next five years,² but are bus mechanics equipped with the appropriate training to maintain and test this equipment? Do transit agencies understand the amount of data associated with this equipment and do they have the workforce to properly analyze the information? Will ADAS/ADS technologies increase the workload for operators versus decrease? How will ADAS/ADS technologies impact Federal requirements related to mandated labor standards? APTA encourages FTA to fund more workforce development opportunities to better understand what specific *new* job titles, including knowledge, skills, and abilities (KSAs), that will be required related to ADAS and ADS-equipped vehicles.

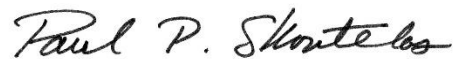
¹ "ISEE brings autonomous to shipping hubs with self-driving yard trucks" TechCrunch, June 2021, <https://techcrunch.com/2021/06/08/isee-brings-autonomy-to-shipping-yards-with-self-driving-container-trucks/>

² "The Impacts of Vehicle Automation on the Public Transportation Workforce", TCRP, 2022

Similar to the recent requirement with the FTA Low or No Emission grant program, transit agencies will need to develop detailed training plans and curriculums to provide the transit workforce with the appropriate amount of support and tools to safely and effectively operate and maintain ADAS/ADS vehicles. There are opportunities to help build these training curriculums with organizations like the Transit Workforce Center (TWC) to help consult transit agencies on best practices for creating new training curriculums and certifications to help attract and retain transit personnel.

We appreciate the opportunity to comment and look forward to further collaboration with FTA in this important endeavor. For additional information, please contact Linda Ford, APTA General Counsel, at (202) 496-4808, or lford@apta.com.

Sincerely yours,

A handwritten signature in black ink that reads "Paul P. Skoutelas". The signature is written in a cursive, flowing style.

Paul P. Skoutelas
President and CEO