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Comment – FTA Request for Information (RFI) on Transit Bus Automation Research and Demonstrations

Introduction

The [Community Transportation Association of America](#) (CTAA) staff, board and state/tribal delegates and members are dedicated to ensuring that all Americans, regardless of age, ability, geography or income, have access to safe, affordable and reliable transportation. CTAA members are in the business of moving people – efficiently and cost-effectively by a variety of means that include, but are not limited to, transit, paratransit, volunteer transportation, and specialized transportation. We support the development of autonomous vehicle technology and programs that will offer accessibility, safety, convenience, and affordability wherever people live.

We are enthusiastic about the Federal Transit Administration’s (FTA) efforts to encourage innovation, to engage in research, and to foster improved travel options and supportive technology. We offer our assistance in helping FTA to realize the ambitions of a second bold, five-year plan, STAR Plan 2.0.

FTA should lead in the research and implementation of bus automation, on-demand transportation, and in the flexible use of different vehicle types that automated, spontaneous scheduling will allow. FTA should also be improving safety and reducing stress on the driver workforce with driver-assist technologies.

CTAA and Automation

CTAA has become a leader in providing resources and analysis related to public transportation technology and it has a long history of monitoring automated vehicle technology developments for their potential impact on mobility options. In terms of vehicle automation, since 2018, CTAA has encouraged the development of automation technology and vehicles in keeping with our [Statement of Principles for Automated Vehicles](#). These principles, discussed below, are accessibility, equity, rural connectivity,

and safety. CTAA has used these principles to guide our efforts in encouraging appropriate federal and state legislation as well as to guide regulatory developments.

The work of CTAA extends to all states and communities in the US, including assistance with funding and guidance of the FTA. The [National Center for Applied Transit Technology](#) (N-CATT), an FTA-supported technical assistance center, explores and assists transit agencies with practical resources for replicable technological solutions and innovations. Our other federally-supported technical assistance centers, the [National Center for Mobility Management](#) (NCMM), also funded by FTA, and the [Transit Planning 4 All program](#) enable communities, states, and regions to expand and improve publicly-available transportation to increase equity and enable access to healthcare and education, as well as to reduce social isolation.

At CTAA, we educate transportation professionals across the United States, including providing automation-related technical assistance, presenting at conferences, and engaging in discussions with companies developing different aspects of automation and associated software. We monitor transit and transportation automation issues daily to stay abreast technological, legislative, and regulatory updates. Our work increasingly integrates emerging business models, public-private partnerships, and shared-use experimentation and advances.

In this comment, we refer to vehicles operating at Levels 4 and 5 of the [SAE International's standard J3016](#) as Automated Driving Systems (ADS) and Levels 2 and 3 as Advanced Driver Assistance Systems (ADAS). To be clear as we discuss automation technology in this comment, the dividing line between ADS and ADAS is the necessity that a human being operate and/or monitor a vehicle at all times when an ADAS system is engaged, whereas an ADS system is designed to not require a human operator to be physically present or to be immediately ready to take over operation of a vehicle.

General Comments

Automation will represent a significant shift for public transportation, but it is not the first such transition. Public transportation transitioned from horses to rails and motors; from telephone operators for demand-response transportation to one-call/one-click centers to websites and to apps; from standing on the side of the road or at a bus stop and hoping that the next bus will be on time to automated signage with information about when the next bus will arrive; and from often long waits for on-demand rides to apps that provide exact vehicle location and arrival time, sometimes with service available quickly. Transit agencies have shown themselves to be flexible and interested in new technologies. Current projects contemplate Mobility as a Service (MaaS) packages of transportation options, mobility on demand, automated personal rapid transit and BRT. Service changes and maintenance practices during the pandemic provide a perfect illustration.

CTAA's comments apply our automated vehicle principles to inform the successful adoption of ADS and ADAS technologies.

Accessibility

We urge FTA at this juncture, while automation technology for ADS and ADAS are still developing, to embrace a fully accessible transportation system for people with disabilities. This includes not only physical access to all "buses," however defined, but also access to interfaces used to determine vehicle location, schedules, requests for service, stops, and emergency interactions. This juncture, while technology is evolving, is the time to make sure that accessibility is fully embedded.

As FTA is well aware, our Civil Rights laws, and USDOT regulations promulgated to implement those laws, mandate that FTA and other agencies carry out their responsibilities by funding transit projects and providing other modal support to provide the full inclusion of all Americans, including people with disabilities. It is incumbent on FTA to adhere to the letter and spirit of the law and USDOT regulations so that ADAS vehicles in particular improve the lives of people with disabilities instead of leaving these individuals further behind.

Title VI and in USDOT regulations, declare that "no person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving Federal financial assistance from the Department of Transportation." (49 CFR 21.1; see also 42 U.S.C. § 2000d et seq.) USDOT regulations proscribe that Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 794) as amended, establish that "no otherwise qualified individual with a disability in the United States shall, solely by reason of his or her disability, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." (49 CFR 27.1) Section 508 of the Rehabilitation Act requires that any electronic and information technology used, maintained, developed, or procured by the Federal government allow persons with disabilities comparable access to information and technology. (29 U.S.C. § 794 (d))

ADS communication interfaces and the vehicles themselves implicate these laws and regulations so that people with disabilities will be provided with both physical accessibility and with technological accessibility for ordering, interacting with, and, in dire situations, stopping the operation of an ADS vehicle. Please be mindful that all disabilities are not alike and that FTA should support research relating to interfaces for people with visual, auditory, cognitive, and physical disabilities.

Designing for people with disabilities means designing better for everyone. All of the ADS shuttle pilots show this with their wheelchair ramps, but a prime example was the [Olli autonomous shuttle](#) a few years ago, which was [designed with and for people with disabilities](#) as much as for the general public. Not only were people with disabilities invited in, listened to, and asked questions, but even more important is that the Olli team designed to accommodate a range of different types of disabilities.

Research that promotes this type of private and public design are endeavors that CTAA strongly supports.

Changing Public Transportation Service Models to Accompany Increasing Automation

Another topic of research is how to assist transit systems as they are beginning now to work in a world where differences between modes are disappearing or blending into one another and where private on-demand transportation is increasingly available. Will transit be able to be flexible in designing new services and meeting customer needs? Should transit be permitted to engage in pop-up experiments to determine demand instead of engaging in long, costly planning and public outreach efforts before testing whether a service change might work?

We also urge FTA to research how transit and publicly subsidized passenger transportation will survive and thrive outside of major cities when ADS transit vehicles predominate.

While ADS first mile/last mile service may greatly improve transit for many Americans, this type of transit service must be equitable for those who live in low-income areas and for older adults and people with disabilities. The same caution is applicable to ADS on-demand shared-ride services. We have seen that people with disabilities and those who live in low-income communities have better employment prospects and upward mobility when they have good transit service. Let us use this moment in our transportation history to ensure that the automation technology transformation will be an improvement for everyone.

CTAA recommends that FTA initiate research on ways to promote accessible shared-ride passenger transportation, whether public, publicly subsidized, or private service that provides a connection to transit.

Connectivity

ADS public transportation service has the potential to greatly improve connectivity and reduce social isolation for many people, but this dream will only become a reality if FTA research is coordinated with those of its sister agencies at the USDOT, particularly with FHWA. The accessibility and walkability of the street network directly impacts the attractiveness of transit and other shared-use modes, such as shared on-demand service. These modes will only be cost effective for transit, and profitable for private companies, if

we reduce door-to-door rides and increase rides with common meeting points, such as bus stops (or, during the transition to ADAS and then to ADS, park and ride lots).

In order for people to get to an ADS bus, they must safely use our road space to walk or bike to transit. FTA must make sure that research is done about safely coordinating transit and publicly available automated transit service with pedestrian infrastructure, such as crossings, traffic signals, stop signs, and sidewalks, and with biking infrastructure. FTA must work with FHWA on researching strategies to encourage better infrastructure linkages to transit when technology makes possible instantaneous sightings of pedestrians and bikers.

Paratransit

Without a human driver, for those who are eligible for on-demand rides delivered by a transit system, the question becomes who will need human assistance to ensure arrival at a destination, for cognitive assistance and assurance, and for physical assistance? We need research to determine what the need and costs will be for this higher level of service and which paratransit riders will be better served with automated on-demand service.

Retraining for Drivers

As FTA has acknowledged in the past few years, there is a need to research and provide technical assistance for transit agencies and retraining of transit drivers. As the safety record and training for airline pilots demonstrate, partial automation systems, such as ADAS, require less of a driver in many common driving situations, but also necessitate split-second shifts back to operation of a vehicle in sometimes dangerous situations. At the moment, our driving workforce is not trained for such a scenario.

With ADS, some transit drivers will be able to fill other transit positions, but many others will be compelled to find work elsewhere, needing education and training to do so. FTA should research the employment possibilities within transit for current drivers, and the research the likely percentage of the workforce may need to shift to other lines of work.

FTA should research successful practices for retraining large numbers of workers and enabling those workers to find positions with equivalent income and benefit packages. That research should also include possibilities for innovative retraining practices and for determining what other supports drivers will need as they experience this substantial change in their careers.

Finally, CTAA suggests that FTA also research what increasing automation will mean for the transit rider. Through outreach to transit drivers and to passengers themselves, FTA will be able to improve the quality of public transportation for its passengers.

Comments in Response to Specific FTA Questions

Priority Areas

What topics should be a priority for FTA's transit bus automation research and demonstrations over the next five years? What specific activities or products should be a priority for FTA within these areas?

In applying CTAA's AV Principles of accessibility, equity, rural connectivity, and safety, CTAA urges FTA to focus on the priorities of equity, workforce training and development, capital investment, safety standards, cellular service availability and data transparency.

- **Equity:** Accessibility for people with disabilities and older adults must be part of the equity conversation and research surrounding ADS and ADAS. Tribal communities must also be included. Research should be conducted to encourage the creation of and the proliferation of transit vehicles with universal design. Automation has the potential to equalize transportation availability for those with low incomes, those who live in outlying areas, and those who have historically been discriminated against. After more than a century of the motor vehicle, which has perpetuated patterns of inequality and made it nearly impossible for many people with disabilities to participate in the workforce and in normal social activities, it is critical that we use automation, particularly ADS, for transportation to be a vehicle for opportunity.
- **Workforce:** ADS and ADAS will require special driver and maintenance-related training. We cannot assume that every community will have workers with sufficient training and education at the ready. The time to prepare is now as automation technologies are being developed and made available.
- **Capital investment needs:** Public transportation systems must be informed about and prepared financially to address the longevity and maintenance needs of ADS and ADAS systems, generally and in different climates. What are the likely supply chains for parts and will that affect the transit service of small urban and rural systems? Are cybersecurity and safety needs different outside of large metropolitan areas or at their outer edges? Will small transit systems have the financial resources to address such needs?
- **Data transparency, safety and performance standards:** Much of ADAS and ADS research and testing has been under the control of the private sector. For the public to have confidence in these technologies, sufficient data must be available to develop safety standards and to determine whether those standards are being met.
- **Cellular service:** For ADAS or ADS to operate safely requires a high level of connectivity. Testing and research must be conducted to ensure that all geographic areas can support safe vehicle operations.

For any priority areas identified, are there activities that stakeholders have undertaken? What were the challenges? Are there specific areas where FTA engagement may be needed?

The priorities identified above cannot be sufficiently addressed without the involvement of FTA or other modal agencies at the US Department of Transportation (USDOT). Some of these priorities will require coordination beyond the USDOT. The stakeholders related to public transportation in most US communities do not have the resources or research institutions available to address such priorities.

Thus far, automation vehicle transit pilot projects have been small-scale affairs that have made the public comfortable with the technology, but which have not significantly expanded transit service where it exists or affected the existing transit workforce. FTA engagement is needed to address workforce training and transition needs, to identify costs, and to create appropriate training and transition programs.

Enabling Research

What specific research questions should be addressed by FTA-supported foundational research within the next five years? Possible topic areas for research include, but are not limited to, cybersecurity, equity, standards, and workforce training.

1. Safety, performance standards, and workforce training – What can public transportation learn from the airline industry in terms of safe operation with automation? How can public transportation maintain its record of safe driving, far surpassing the average driver, with new technology? Should national safety standards be imposed?
2. Equity and accessibility – The role of FTA to support equity is unique. Public transportation enables access to education, to jobs, and to medical care. However, public transportation is underfunded and it does not nearly meet the needs or the demand of the many people who depend on it or who prefer to use it. FTA should research how automation, particularly ADS, will enable an abundance of universally-designed public transportation vehicles, whether and how ADS will increase the availability of transit in underserved communities, and how we can employ ADS to decrease our reliance on the private motor vehicle.
3. While cybersecurity is important, this is a concern shared across many different technologies and it is best if FTA coordinates with the appropriate agencies and stakeholders rather than duplicating other research.

Integrated Demonstrations

Are these demonstration areas still needed (Transit Bus Advanced Driver Assistance System (ADAS); Automated Shuttle; Maintenance, Yard, and Parking Operations; Mobility-on-Demand (MOD) Service; and Automated Bus Rapid Transit)? What additional or alternative demonstration areas are a priority?

Longer term pilots are needed to familiarize public transportation operators and maintenance staff with ADAS and ADS technologies. These agencies must be aware of the associated efficiencies, challenges and costs. It is doubtful that anyone at this point has conducted sufficient research or pilot programs to answer such questions. The following are the areas in which additional or alternative demonstration areas should be a priority:

- ADS BRT demonstrations – To glean a real-world idea of the transformative effect of full automation technology, these demonstrations should take place over the course of several months or a year and they should also be conducted outside of the center of large metropolitan areas, in different climate and weather environments, and with public transit systems of varying sizes and geographic ranges. Commuter and longer-distance transit service will be important in small urban markets. Research with universities and in extended areas surrounding universities will provide ready partners and the capacity for such demonstrations, as well as expand the transit service offerings. At this time, there is such a [pilot being conducted outside of Edinburgh, Scotland](#), but such pilots need to take place in the US across a range of markets and in different regions.
- Normal-speed and low-speed demonstrations – Because most non-urban roadways are higher speed environments than roads in the centers of large cities, it is important that demonstrations take place at a speed that matches the reality of rural and small urban communities. We should also continue to conduct demonstrations in low-speed environments where there is demand for service, such as hospital campuses, downtowns, and tourist areas.
- There are several on-road ADS MOD services operating in the US. These should be studied in detail for safety, responsiveness to passenger needs, accessibility, and equity. FTA should keep a careful watch on such research and operations in order to determine whether such private MOD services can complement traditional transit service or, in some situations, replace conventional bus or on-demand service.

What are the biggest successes or challenges to deploying ADAS or ADS technologies for transit?

The biggest challenges to deploying ADAS or ADS technologies for transit, particularly for small transit agencies, are (1) funding, (2) workforce training, and (3) vehicles that are accessible beyond the definition of the Americans with Disabilities Act (ADA), that are universally designed so that they better accommodate people with a range of sensory, cognitive, and physical disabilities. If we one day remove the driver, whose job it is to assist passengers with

disabilities, then we will need vehicles that enable independent use for all passengers.

ADAS may reduce maintenance and parking-related time and costs, but, on its own, this technology will not increase equity, improve accessibility or increase service. FTA should maintain its focus on increasing service to serve the goals of access and equity.

The biggest success for deploying ADS has been the willingness of the public to adopt it wherever pilots and demonstrations have been conducted. Just as with the first US subways more than a century ago, with trains decades before that, and with commercial aviation, the American public has been willing to embrace new technology to travel further, faster, and with more convenience. We must match the confidence of the public with safety, accessibility, and equity to ensure that automation furthers the goals of public transit systems across the country.

Strategic Partnerships

What ADAS/ADS technologies proven in other transportation applications would be useful and applicable to transit use cases? Please be specific and include examples where possible.

- Object detection technology that is able to detect pedestrians, people in wheelchairs, cyclists, and other road users: This type of technology, utilized by ADAS and ADS systems, and even in many cars today, is far from perfect and should not be solely relied upon in its current state. However, this technology is promising for safe operation of transit vehicles. Ensuring that people in wheelchairs are included is an important equity concern.
- The safety record and training for airline pilots demonstrate that partial automation systems, such as ADAS, require less of an operator in many common driving situations, but also necessitate split-second shifts back to operation of a vehicle in sometimes dangerous situations. At the moment, our driving workforce is not trained for such a scenario. What can public transportation learn from the airline industry in terms of safe operation with automation? How can public transportation maintain its record of safe driving, far surpassing the average driver, with new technology? Should national safety standards be imposed?

In terms of strategic governmental partners, within the USDOT and beyond, we suggest:

- Federal Aviation Administration (FAA) – The FAA and the airline industry are experienced with automation and pilot-assist technologies. They have developed effective strategies for safe operations and necessary redundancies so that human

pilots and other operational personnel do not become bored, fall asleep, or become otherwise disengaged from the essential tasks of safe operations.

- Federal Highway Administration (FHWA) – FHWA is a necessary partner for increasing the safety on all types of roads, including research on the application and interaction among new technologies, such as traffic signals and roadway monitoring technologies.
- Federal Motor Carrier Safety Administration (FMCSA) – FMCSA should be a partner for determining the challenges and sufficiency of ADS and ADAS for large buses, including commuter buses and intercity transportation.
- National Highway Transportation Safety Administration (NHTSA) – NHTSA is a natural partner for increasing the safety of ADS and ADAS for those inside vehicles and for other road users. Our current situation of ever increasing injuries and fatalities on our nation’s roads demonstrates each and every day how the terrible combination of roads designed for speed, driver inattention and distraction, and ever bigger vehicles – along with increased automation – are making our roads less and less safe. The excellent safety record of public transportation makes FTA a valuable partner for achieving increased safety overall.
- Agencies outside of USDOT– How will transit demand change with ADS? Already we see the demand for transportation change in rural and small urban communities with specialized medical care often at a great distance, with telework opportunities increasing for some workers, and with corporate decisions about the location of supply chains likely to continue changing as we live for the next few decades with the lessons of the coronavirus pandemic. The research across the federal government will be quite informative for FTA. Here are agencies with which FTA should be partnering:
 - Department of Agriculture – Rural Utilities Service, Rural Business Development, and Rural Business Cooperative Service
 - Department of Labor
 - Federal Communications Commission
 - Department of Energy
 - Department of the Treasury – Treasury currently has funding to address severe infrastructure challenges laid bare by the pandemic
 - Department of Education
 - Veterans Administration
 - National Science Foundation – Technology, Innovation and Partnerships (TIP): Regional Innovation Engines, Partnerships for Innovation

Stakeholder Engagement and Knowledge Transfer

Are FTA's methods of stakeholder engagement (webinars, interviews, convening peer agencies, and presentations at conferences) sufficient? What other methods should FTA consider?

The methods of stakeholder engagement mentioned in FTA's RFI are mainly useful for teaching and knowledge transfer rather than for engagement. In-person and one-on-one conversations, if possible, are better than webinars or conference sessions for engaging in detailed conversations to explore the thoughts of transit leaders about the different factors involved with safety and service-related successful planning and implementation.

Stakeholder engagement will require commissioning trusted partners to conduct active and detailed one-on-one listening sessions with a range of transit agencies that operate across the full spectrum of types of markets and areas of the country. FTA must devise an engagement strategy that focuses on listening to those who lead and who work for transit systems in rural, tribal and small urban communities. Their perspectives about their needs and their services will be critical to successful implementation of ADAS and ADS technologies. CTAA conferences, as well as regional and statewide meetings, are perfect opportunities.

- FTA should engage CTAA to conduct stakeholder engagement as part of its work with transit agencies in all types of communities and at all levels of state and local governments.
- FTA must go beyond engaging transit agency and state DOT staffs to listen to transit passengers, particularly people with disabilities and older adults, to learn about the perspectives of those whom transit serves. Automation should incorporate the needs of the passenger as the passenger perceives their own needs. This is the essence of the statement "Nothing about us without us."
- Peer visits with transit agencies are excellent opportunities for both of the above. These can be conducted in conjunction with CTAA-led technical assistance.
- FTA should call upon its technical assistance centers to reach out to those who plan and implement technology projects at transit agencies as well as those who serve passengers, such as mobility managers, travel trainers, and one-call/one-click center staffs.
- FTA should itself, or through its partners, utilize social media for engagement and listening by encouraging the public to share its vision for how automation can open up a world of possibilities for improving and expanding public transportation and MOD. Public transit operators interact with the public on a daily basis, sometimes being the only people having a conversation with a rider on a particular day. Their ideas should be welcomed and utilized because the fact is that public transportation drivers do far more than drive: They provide securement, they monitor health and ability, and they provide physical assistance. Whether the driver is taking an older person to life-sustaining medical care, to education for adults with cognitive disabilities or to community college, or enabling people in low-income communities to work, those drivers know quite well the range of passenger needs. Social media provides inexpensive and flexible

venues for sharing individual thoughts and experiences for the invaluable driver and passenger perspectives.

Workforce

What activities have agencies undertaken to understand and prepare for the impacts of automation on their workforce? Please be specific and include examples where possible.

Although quite a few transit agencies or others within their geographic areas of service have conducted ADS demonstrations or pilots, most have not and most transit agencies are low-funded operations without sufficient staff for long-term technology preparation. Most rely on national organizations, technical assistance centers, and consultants for translating information about new technologies, for recommendations and guidance, and for assistance with adoption and implementation. The most innovative (and affluent) of the small urban transit agencies have become the examples that others look to from less well-to-do urban, rural, and tribal agencies.

It is by far the exception, rather than the rule, of transit agencies outside of large cities that have contemplated workforce needs for when automation will significantly alter the current transit workforce. Even such transit agencies as those in [Grand Rapids](#), MI, and [Jacksonville](#), FL, that have, respectively, conducted or planned impressive ADS pilots have not released plans that envision what the ADS-enabling workforce will look like. In such a place as [Arlington, Texas, that has created an ADS MOD transit service](#), such service is not focused on providing estimates of the cost and workforce requirements of conventional ADS bus service or large-scale ADS MOD service. However, Arlington, which has [expanded its project](#), does provide a useful learning opportunity.

It is the view of CTAA that we stand at the starting point for a full exploration of the workforce needs, training, and changes that substantial automation will bring to the broad range of US public transportation agencies.

What types of new skills, training, and resources may be required for transit workforce development and transition?

ADAS requires new skill sets for safe driving, as well as for maintenance, repair, and inspection functions. This is an area that requires more research and workforce training. Many maintenance and inspection tasks can themselves be automated. What computer or other skills are necessary for transit employees to master and what levels of previous education will be required? TCRP or another organization's research on this topic is needed.

What specific areas of workforce-related research should FTA consider?

It is critical that transit remains available and that services increase, but the driver workforce generally – and for public transit – has been decreasing and becoming older. Research is needed to ensure that ADS will actually be a realistic solution, that skilled workers will be available wherever transit exists to perform support functions in maintenance, repair, inspection and supervision of employees. Do those employees and those who will be available in the next decade or two have the requisite level of education to perform necessary tasks required in relationship to ADAS and ADS technologies? Can those who currently work for transit agencies be trained to safely operate ADAS vehicles?

FTA must also determine whether ADS can replace all of the tasks that drivers perform beyond driving. Will a differently-skilled employee need to be present on transit vehicles, perhaps in a caretaking or monitoring role? How will such a shift affect costs for transit agencies?

What types of resources could FTA provide to help agencies and their workers adopt transit bus automation?

What will assist public transportation agencies now in the transition to transit bus automation are technical assistance, community college or other technology training programs, and transparency about how well automation technologies perform and what is necessary so that they perform safely and are sufficiently secure to protect agency and passenger data.

With ADS, some transit drivers will be able to fill other transit positions, but many others will be compelled to find work elsewhere, needing education and training to do so. FTA should research the employment possibilities within transit for current drivers.

FTA should research successful practices for retraining large numbers of workers and enabling those workers to find positions with equivalent income and benefit packages. That research should also include possibilities for innovative retraining practices and for determining what other supports drivers will need as they experience this substantial change in their careers.

Conclusion

CTAA is grateful for the opportunity to contribute comments and our staff is available to assist in any way as our nation's public transportation providers assess, plan, and transition to incorporate ever increasing levels of technology and automation.