**Project Title:** Co-designing Safety-Enhancing ADAS with Transit Operators

**Recipient/Grant (Contract) Number: Carnegie Mellon University, Grant #:** 69A3552344811

**Center Name:** Safety21 National University Transportation Center for Promoting Safety

**Research Priority:** Promoting Safety

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**Project Partners:**

- AFL-CIO
- Transport Workers Union
- Amalgamated Transit Union

**Research Project Funding:** $100,000.00

**Project Start and End Date:** 07-01-2023 to 06-30-2024

**Project Description:**

Public transportation is critical infrastructure serving millions of people across the United States. With roughly 4 billion individual trips occurring annually, it is the primary mode of transportation for many commuting to and from work, school, and leisure activities. Over the past several years, there has been an increase in investment in automated vehicle (AV) technology for buses. The use of AV technology has the potential to fundamentally impact public transit operations. While there are ambitious plans for automated bus deployments across the country, operating transit is more complex than light-duty passenger vehicles. Buses, for example, are significantly larger and operate in highly variable environments near vulnerable road users. Even in the case of smaller vehicles such as vans, there are still many technical challenges to overcome to navigate these complex environments safely. Furthermore, transit operations require supporting passengers and maintaining safety inside the vehicle. Due to both technical and operational challenges, transit vehicles, including buses and vans, will continue to require skilled human operators, even as automated vehicle capabilities are incorporated. Introducing new technology will impact operator's duties and actions, as well as passenger safety and experience.  To help maintain transit's high level of safety for passengers, it is essential to understand how automation stands to affect the roles and day-to-day tasks of trained operators. Driver assistance automation, such as pedestrian warnings and lane-centering, can potentially improve the safety and workload of trained operators. At the same time, automation can create new kinds of safety issues caused by the interactions in human-autonomy teams and can intensify work as people primarily take over from automation in the most challenging situations. It is crucial to consider the safety of incorporating automation technologies into fleets and to develop training for operators to work effectively with such technologies. Our research first examines how autonomous vehicle technologies could impact transit operations, and specifically the jobs of transit workers. We will then collaborate with transit drivers to understand the kinds of advanced driver-assistance systems (ADAS) and interfaces that would help them in their work and improve transit operations.  Through a participatory design approach, this project will examine past and ongoing transformations of transit infrastructure in order to envision the future of transit with operators. Centering safety and equity of the socio-technical infrastructure of transit, this project aims to develop novel, operator-driven systems that could further enhance operations. This is expected to yield (1) empirical findings on the forms of autonomy (current and proposed) drivers perceive as being helpful to their work, as well as necessary components of implementation (e.g., training, human-machine interfaces), (2) methodological insights on co-design strategies for generating novel directions for ADAS within transit, as well as accounting for the potential, unintended harms of autonomy, and (3) theoretical findings that contribute core understandings on autonomous systems impacts to safely and workload.

**Outputs:**

The research seeks to identify the types of autonomy that transit operators perceive as beneficial for their work, along with necessary components for successful implementation such as training and human-machine interfaces. Through a collaborative approach, the project will generate ideas for innovative systems that enhance transit operations based on the insights and needs of transit workers. Specifically, we will produce the following outputs: Two academic papers about the perceptions of ADAS among transit operators. The first will draw from a large-scale survey of operators in North America. The second will report on findings from a series of collaborative hazard analysis activities. A set of design proposals informed by our empirical research with operators. These proposals will be shared via an online webinar. We will invite transit organizations, policy analysts, and vehicle manufacturers, and host a live question and answer period. We will later share a recording of the presentation online. A white paper translating our academic findings into actionable policy insights. This will be informed by our experience preparing and disseminating a 2022 policy report that was circulated throughout the Department of Transportation (Fox and Caldwell delivered an in-person briefing on this report in Fall 2022).

**Outcomes/Impacts:**

This project will distribute much-needed knowledge about the impacts of autonomy on the transit sector, critical infrastructure to millions of Americans. As a part of this research, we will (1) engage members of the transit workforce to assess existing or proposed driver assistance technologies according to how they do or do not meet their needs, (2) draw from our empirical work to author articles for academic publication (e.g., CHI or CSCW) and public-facing outlets (e.g., The Atlantic, Nature Cities), (3) produce a webinar translating our research into guidance for transit organizations on human-autonomy teaming, and (4) circulate findings with local and national policymakers to help inform the legislative debate around transportation policy. Additionally, we will connect with the American Public Transportation Association, Advocates for Highway and Auto Safety, the Center for Advanced Automotive Research, and the Intelligent Transportation Society of America to share our insights. We may also connect with vehicle manufacturers; We have been in conversation with Beep, a company focusing on Mobility as a Service, and operating small AV transit pod operations around the US.