MEMORANDUM

To: Task Force on Autonomous Vehicles, Subcommittee on Public Transit
From: ODOT Staff/TriMet
Date: August 13, 2019
Re: Samples of Public Transit and Autonomous Vehicle Partnerships

Introduction

This memo highlights select sample initiatives underway through partnerships between local jurisdictions, transit agencies and autonomous vehicle manufacturers to prepare for automated vehicle technology integration with public transit. The samples below provide an overview of some pilots and work in this field, but are not intended to be comprehensive.

Sample Partnerships

Utah Department of Transportation and Utah Transit Authority

The Utah Department of Transportation and Utah Transit Authority started a year-long pilot of autonomous shuttle technology in April of 2019. The shuttle, provided by EasyMile, operates on several fixed routes throughout Utah. The purpose of the pilot is to identify opportunities for the application of autonomous vehicle technology and to educate the public about autonomous vehicles. More information about the Utah Autonomous Shuttle Pilot can be found here: http://www.avshuttleutah.com/

Contra Costa Transportation Authority (CCTA) and GoMentum Station

The Contra Costa Transportation Authority (CCTA) and GoMentum Station are testing an autonomous shuttle at Bishop Ranch, the largest mixed-use business community in Northern California, located in the city of San Ramon. This marks the first time the California Department of Motor Vehicles (DMV) has allowed a shared autonomous vehicle to travel on public roads in the state. After successful testing at the GoMentum Station autonomous vehicle proving grounds in Concord, California and in parking lots at Bishop Ranch, CCTA is advancing to the third phase of testing. The vehicles are currently staffed by trained testers. It is anticipated that additional predetermined testers and evaluators chosen from employees of various employers within Bishop Ranch will be able to ride the vehicles as they traverse public streets within the business park. More information about this test can be found here: https://ccta.net/2018/10/16/first-autonomous-shuttle-test-on-public-roads-in-ca/
Livermore Amador Valley Transit Authority (LAVTA) Shared Autonomous Vehicle (SAV)

The Livermore Amador Valley Transit Authority (LAVTA), operators of the popular Wheels and Rapid bus services and the Go Dublin partnership with transportation network companies, is exploring an innovative shared autonomous vehicle demonstration project within the City of Dublin in collaboration with the City of Dublin, Contra Costa County Transportation Authority, First Transit and the GoMentum Station in Concord, California. One project site is the East Dublin/Pleasanton BART station. LAVTA’s goals for the shared autonomous vehicle demonstration project include: Creating a mode shift from single occupant vehicles to transit to decrease congestion and improve the environment; Improving trip reliability and safety; Increasing transit jobs by increasing transit ridership and demand; and: Increasing farebox recovery for transit operations. More information can be found here: [https://www.wheelsbus.com/sav/](https://www.wheelsbus.com/sav/) and here: [https://www.wheelsbus.com/wp-content/uploads/2017/08/SAV-Brochure_Web.pdf](https://www.wheelsbus.com/wp-content/uploads/2017/08/SAV-Brochure_Web.pdf)

Houston METRO and Texas Southern University

Houston METRO has partnered with Texas Southern University for a pilot program in which an autonomous shuttle will operate on a 1-mile, closed-loop route along TSU’s Tiger Walk. To ensure customer safety, an attendant will be on board the shuttle during this pilot program but will not actually be operating it. The all-electric vehicle seats six people, with standing room for six others and operates on weekdays only. A 2017 statute approved the operation of autonomous vehicles on Texas roads. More information can be found here: [https://www.ridemetro.org/Pages/Autonomous-Vehicles.aspx](https://www.ridemetro.org/Pages/Autonomous-Vehicles.aspx)

Denver Regional Transportation District (RTD) 61AV Pilot

After a six month pilot, Denver RTD concluded service of their self driving shuttle that connected passengers from the 61st and Peña commuter rail station to the Panasonic and EasyMile offices. The 61AV aimed to evaluate the use of an autonomous vehicle to offer first- and last-mile connections. RTD collaborated with the city and county of Denver, EasyMile, which supplied the vehicle, Panasonic, Transdev and L.C. Fulenwider, Inc. RTD explained that in addition to testing AV technology in a transit environment, the pilot program provided the partners with the ability to learn how such vehicles can be used in a variety of community settings. RTD staff will present the results of the pilot program to the RTD Board of Directors with the intent of exploring other opportunities to test self-driving shuttles as an option for moving RTD passengers. More at: [https://www.masstransitmag.com/alt-mobility/shared-mobility/bicycle-scooter-sharing/press-release/21091581/regional-transportation-district-rtd-denver-rtd-wraps-up-61av-autonomous-pilot](https://www.masstransitmag.com/alt-mobility/shared-mobility/bicycle-scooter-sharing/press-release/21091581/regional-transportation-district-rtd-denver-rtd-wraps-up-61av-autonomous-pilot)
Phoenix Valley Metro and Waymo

Valley Metro operates regional transit services in Phoenix, Arizona. On July 31, 2018, Valley Metro announced a 2-year partnership with Waymo. The first pilot in this partnership offered Valley Metro employees who reside in Waymo’s service area the option to take first/last mile trips in Waymo’s self-driving cars to transit stops. Over the past year approximately 30-40 employees made about 500 trips on the pilot service. The second pilot in this partnership will expand to serve customers of Valley Metro’s RideChoice program, an on-demand taxi service offering discounted rates for seniors and people with disabilities, by offering RideChoice and paratransit customers that live in Waymo’s service area the option to hail Waymo’s self-driving vehicles for curb-to-curb service. Valley Metro is identified as a strategic partner in FTA’s Strategic Transit Automation Research Plan; in this role, Valley Metro will exchange knowledge and lessons learned about the pilot demonstration with the FTA and the rest of the transit industry. Valley Metro was awarded $250,000 from the Federal Transit Administration’s (FTA) Mobility On Demand Sandbox grant to pair research activities with the Waymo/RideChoice pilot. Valley Metro is partnered with Arizona State University to conduct this research to collect data, conduct analysis, evaluate the project and develop a lessons learned report. More information about Valley Metro’s Waymo partnership can be found here: https://www.valleymetro.org/future.

Columbus Smart Circuit Automated Shuttle Pilot

A low-speed, automated shuttle is operating in downtown Columbus, Ohio on a pilot basis until fall 2019. The shuttle carries up to six passengers at a time and operates on a 1.5 mile loop with a handful of stops at popular tourist destinations. A fleet attendant is on board the vehicle. The pilot had served 9000+ riders as of April 30, 2019. It is planned to expand to serve a 2.7 mile residential route later this year. This pilot was sponsored by a partnership among City of Columbus, Ohio Department of Transportation, Ohio State University, and automated shuttle manufacturer May Mobility. More information about the Smart Circuit pilot can be found here: https://smartcircuitcbus.com/

Mercedes-Benz Future Bus

Mercedes-Benz demonstrated their Future Bus on a 12-mile route in the Netherlands in 2016. The Future Bus uses CityPilot, automated driving technology that relies on GPS, cameras, and long- and short-range radar systems help the vehicle navigate complex urban areas. The bus can recognize obstacles, especially pedestrians, and brake automatically. It recognizes traffic lights, communicates with them and safely negotiates junctions controlled by them. It approaches bus stops automatically, where it opens and closes its doors. It is also able to drive
through tunnels. More information about this project can be found here: https://www.daimler.com/innovation/autonomous-driving/future-bus.html

**Seimens Mobility Autonomous Tram**

Siemens Mobility, together with ViP Verkehrsbetrieb Potsdam GmbH, presented a research project on the world's first autonomous tram at InnoTrans 2018, with a demonstration running in real traffic along a six kilometer section of the tram network in Potsdam, Germany. The experimental tram being used to demonstrate autonomous driving at the world premiere is not designed for commercial use. The current project aims at identifying the technological challenges of autonomous driving under real-life conditions, then developing and testing solutions for them. More on this project can be found here: https://press.siemens.com/global/en/pressrelease/siemens-mobility-presents-worlds-first-autonomous-tram?content[]=MO
RECOMMENDATIONS

To: Task Force on Autonomous Vehicles, Subcommittee on Public Transit
From: ODOT Staff/TriMet
Date: August 13, 2019
Re: Recommendations for Public Transit and Autonomous Vehicles

Introduction

This memo highlights priority recommendations regarding public transit and automated vehicles. These recommendations are intended to be built upon, and complementary to, existing guidance documents and adopted plans listed at the end of this memo.

Recommendations

Preserve and Enhance Public Transit:

- Use automated vehicle technology to preserve and enhance public transit service and access throughout Oregon for all people.
- Increase transit mode share with high occupancy public transit vehicles and routes, dedicating space where needed for transit to succeed, especially where public transit is most efficient.
- Provide equitable service through a careful evaluation of people and locations served, including exploration of on-demand automated transit in rural areas.
- Where possible, coordinate with automated vehicle fleet services to reduce competition with public transit already in place.

Utilize AV technology to Improve Safety and Expand Access to Transit:

- Encourage public transit operators to test and utilize automated driving systems and automated driver assistance technology to improve operations of public transit systems.
- Improve safety outcomes for all passengers onboard transit vehicles and for all roadway users outside of transit vehicles, including cyclists, pedestrians, and other vulnerable road users.
- Support and evaluate testing and deployment of automated shuttles and other related technology as early opportunities to learn about the potential utilization of the technology.
- Ensure that AVs can strengthen and enhance public transit by integrating first and last mile solutions to increase the reach of public transit.
- Investigate how automated vehicle technology could be incorporated into all types of transit (as outlined in the matrix on pg. 2) and identify differential needs and opportunities.
- Identify funding opportunities and proved technical support for the creation of mobility hubs as a means to facilitate more seamless transfers between multimodal transportation options.

The following documents offer additional statewide context:
Oregon Public Transportation Plan: https://www.oregon.gov/ODOT/Planning/Pages/OPTP.aspx
Emerging Technologies Impact Assessment: https://www.oregon.gov/ODOT/Planning/Pages/ETIA.aspx
## Public Transit in Oregon by Type

<table>
<thead>
<tr>
<th>Commuter Rail or Heavy Rail</th>
<th>Light Rail</th>
<th>Streetcar</th>
<th>Bus Rapid Transit or Higher-capacity Bus</th>
<th>Standard Bus or Local Shuttle</th>
<th>Paratransit</th>
<th>Express Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mostly dedicated right of way (ROW), but shared with freight trains; Some crossings at grade.</td>
<td>Mostly dedicated ROW; Often crosses other modes at-grade; Uses transit-specific signals.</td>
<td>Part dedicated ROW, part mixed traffic; Uses transit-specific signals.</td>
<td>Some dedicated ROW, some mixed traffic; May have transit specific signal phases.</td>
<td>Generally operates in mixed traffic; Targeted bus priority treatments where possible.</td>
<td>Door-to-door service for those who qualify; Many customers need help with boarding and securement device.</td>
<td>Mixed traffic; Long distances between stops; Services a few key points on longer routes.</td>
</tr>
</tbody>
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### Potential Evolution in SAE Levels Toward Automation Level 5

<table>
<thead>
<tr>
<th>SAE Level</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Driver assistance technology, including safety advisory information and momentary assistance (e.g., collision warnings, automatic emergency braking)</td>
</tr>
<tr>
<td>2</td>
<td>Partial automation to enhance safety and support driver (e.g., lane centering, adaptive cruise control)</td>
</tr>
<tr>
<td>3</td>
<td>Conditional automation in service with operator override when needed</td>
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<tr>
<td>4</td>
<td>Vehicle may operate in automated mode with no human intervention, but only within certain parameters. For example, the AV may only have detailed mapping information for Portland and would not be able to operate outside the city. Employee may not always be on board. Other operations needs define positions (customer service, concierge, fare enforcement, security.)</td>
</tr>
<tr>
<td>5</td>
<td>Fully automated. Employee may not always be on board. Other operations needs define positions (customer service, concierge, fare enforcement, security.)</td>
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