



# Memorandum

**TO:** SMART CITIES AND SERVICE  
IMPROVEMENTS COMMITTEE

**FROM:** John Ristow

**SUBJECT:** AUTONOMOUS VEHICLES

**DATE:** November 28, 2018

Approved

Date

29 NOVEMBER 2018

## RECOMMENDATION

Accept this update report on Autonomous Vehicles.

## BACKGROUND

Autonomous vehicles – vehicles that have the ability to automatically perform some or all of the tasks that have been traditionally performed by a human driver – are rapidly moving towards widespread testing and implementation. Ultimately, autonomous vehicles could have a tremendous impact on the safety, mobility, sustainability, and livability of our community, and therefore, staff has been undertaking efforts to better understand and influence the development, testing, and deployment of autonomous vehicles. This memorandum describes recent and planned activity within and external to the City of San Jose related to the testing and deployment of autonomous vehicles.

## ANALYSIS

### Status of the San Jose AV Request For Information (RFI)

On June 1, 2017, the City's Department of Transportation and the Mayor's Office released a Request for Information (RFI) that invited companies and other entities working in the autonomous vehicle (AV) industry to provide information about how they might perform an AV pilot, or demonstration project, in San Jose. The purpose of the RFI and any subsequent demonstration project is to test AVs so that the City can positively and effectively influence, promote, and incentivize the development and implementation of AVs in San Jose. Any demonstration projects resulting from the RFI would allow the City to understand how AVs might advance the following goals:

- Promote safety for all transportation system users
- Reduce the environmental impacts of total vehicle miles traveled
- Build a balanced transportation system
- Improve mobility for all
- Create livable communities
- Obtain data that is critical for the planning of our future transportation system

As a result of the RFI, the City received a total of 31 responses; 13 of which conceptually described the testing of an AV on public or private streets. Of these 13 responses, two have developed into viable projects now being formally planned and implemented.

In May 2018, the City of San Jose signed a Memorandum of Understanding (MOU) with Mercedes Benz Research and Development North America (MBRDNA), Bosch, and Daimler to enter discussions for an AV pilot project within the San Carlos/Stevens Creek corridor. This project would eventually deploy up to ten AV sedans with Level 4 automation to support existing transit operations along and around the San Carlos/Stevens Creek corridor and the Diridon Transit station area.

On November 8, 2018, the City of San Jose, MBRDNA, Bosch, and Daimler announced their partnership and intention to launch an AV service in the San Carlos/Stevens Creek corridor. This announcement reached news outlets on five different continents and over 30 national and local publications.

Current plans call for the project to be implemented incrementally in a 3-phased approach. Phase 1 targets a point-to-point transit option between Diridon Transit Center and Santana Row and will be limited to a selective user base. This phase will focus on performing a “dry run” prior to broadening the service locations and users. Phase 2 seeks to expand service to users of the Diridon Transit Center and connect them to key destinations such as Valley Medical Center and San Jose City College. Phase 3 would incorporate feedback from previous users as well as information gathered from residents through a separate City-led community engagement process to inform new opportunities for providing residents with a transit service. This phase will utilize an online application process inviting residents to sign-up for this complementary service. The table below provides a summary and tentative schedule of the 3-phased approach.

Phase	#AV	AV Activity	Users	Time
1	2-3	Proof of technology and concept, point-to-point transit between Diridon and Santana Row	<ul style="list-style-type: none"> <li>• Community Leaders</li> <li>• MB/Bosch/Daimler Staff</li> <li>• City Staff</li> </ul>	Qtr. 3 2019
2	3-4	Expand to provide service to key destinations (e.g. VMC, SJCC) and users	Adds: <ul style="list-style-type: none"> <li>• Valley Medical Center Staff</li> <li>• San Jose City College Staff</li> </ul>	Qtr. 4 2019
3	4-10	Expand complimentary service to residents	Adds selected residents	2020



The next step is for the City and MBRDNA to enter into a Demonstration Agreement that would formalize the project terms and schedule.

The second pilot project involves testing of AVs in North San Jose and Santa Clara to study the AV-to-infrastructure connectivity performance of various communications systems. Communications systems being tested include Dedicated Short-Range Communication (DSRC), LTE, 4G and 5G, leveraging an edge compute device. Additionally, the AV route will cross jurisdictional boundaries and allow for AV testing with the different types of traffic signal systems used by San Jose, City of Santa Clara, and County of Santa Clara. Currently, the City is negotiating an agreement for the terms and schedule for the project and is not in a position to announce the partner company. Implementation of the pilot is expected to start in early 2019.

### **Other AV Activities in San Jose**

San Jose's leadership in the AV space has been evident on multiple levels. In September 2018, the Mayor's Office of Technology and Innovation secured a \$1 million grant from the Knight Foundation to support community engagement work related to the advancement and implementation of AV technology. This grant will leverage the pilot project occurring on the San Carlos/Stevens Creek corridor and help build a community understanding and vision of AV.

Additionally, DOT is a member of a large California cities coalition that regularly discusses and collaborates on several important transportation issues, including traffic safety, funding, project delivery, legislative priorities, and technology. Participating cities include San Francisco, Los Angeles, Sacramento, Fresno, Oakland, San Diego and others. Two subcommittees have emerged out of this effort in which members of San Jose's DOT serve as Chairs. Ramses Madou, DOT Division Manager, serves as the Chair of a subcommittee organized to advance data collection, sharing, management, and utilization. Jill North, DOT Innovation Manager, serves as the Chair of an AV Subcommittee focused on advancing AV policies, standards and best practices. San Jose's leadership of these committees is ensuring that current and future work related to AVs is aligned with the goals and priorities of San Jose.

DOT is also currently creating an Access & Mobility Plan which will develop the Citywide strategies and policies to achieve the ambitious transportation goals of the Envision 2040 General Plan and Climate Smart San Jose. The Plan will develop a clearly defined and measurable framework through which DOT will select projects and assign resources. The planning effort will develop a comprehensive set of strategies harvested from the most effective multimodal transportation planning ideas and systems from around the world, refining them for the San Jose context. Models, analytics, data collection, and metrics will then be devised from these strategies to continuously monitor the City's implementation of the strategies, as well as give San Jose specific, real-world feedback as to the effectiveness of the strategies. Emerging Mobility trends such as AV, micro-mobility, and curb management will be addressed in the Access & Mobility Plan from a City goals' perspective. Questions such as how these new technologies can help the City reduce its environmental impact, support urbanization, address inequality, reduce vehicle miles traveled, and improve economic activity will be asked. The

Access & Mobility Plan is where the City will establish the overarching strategies to align current and emerging transportation with City goals.

Lastly, DOT staff has confirmed that six companies have performed “independent” testing on San Jose streets. Independent testing refers to companies that are testing on public roadways, under applicable State and/or Federal authority, with no formal agreement or partnership with the local government agencies. In some of these cases, companies have shared information about their operating plans and vehicle capabilities with the agency and community, but other arrangements or commitments such as performance and safety monitoring, data sharing, route designation, drop-off/pick-up locations, service and user needs, community engagement, and other parameters that would help the agency, company, and community prepare for an autonomous future are not formally established. The six companies that have operated in autonomous mode on San Jose roadway include Mercedes Benz, Bosch, Delphi/Aptiv, Drive.ai, NIO, and Intel.

### **AV Activity in California**

Within the state of California, the DMV regulates and issues the following four types of permits for AV testing and deployment by AV companies:

1. AV with a Driver – Testing
2. AV with a Driver – Deployment
3. AV without a Driver (Driverless) – Testing
4. AV without a Driver (Driverless) – Deployment

The DMV has defined testing as “the operation of an AV on public roads by manufacturer or designee for the purpose of assessing, demonstrating, and validating the AV’s capabilities. Under testing, manufacturers must receive a DMV permit and cannot receive compensation for rides.” Deployment has been defined as “the operation of an AV on public roads by members of the public for purposes of sale, lease, providing transportation services for a fee, or making them commercially available. Under deployment, manufacturers must receive the appropriate DMV permit.”

The table below indicates the total number of companies that have been granted each type of permit as of November 1, 2018 by California DMV:

Permit Type	With Driver Testing	With Driver Deployment	Driverless Testing	Driverless Deployment
# Issued	60	0	1	0



According to 2017 California DMV data, of the 60 companies that have been issued a With Driver Testing permit, only 12 operated on public roadways. Below is a table summarizing the number miles and number of vehicles driven on California roadways in 2017 as reported to the DMV by each company:

Company	AV Miles Driven	# of AV operated on public roads
Valeo	471	1
NVIDIA	505	2
Mercedes Benz	1,087	3
Telenav	1,243	1
Bosch	1,305	3
Delphi Automotive (Aptiv)	1,810	1
Baidu	1,935	4
Zoox	2,307	11
Nissan	4,516	5
Drive.ai	6,015	7
GM Cruise	128,727	94
Waymo	294,929	72
<b>Total</b>	<b>444,850</b>	<b>204</b>

A key conclusion from this data is that most of the AV manufacturers are in the very early stages of technology development and testing. The majority of companies that have permits to operate autonomously on California roadways have less than five vehicles and drove less than 2,000 miles during the one-year period, while two of the companies cumulatively accounted for 81% of the vehicles and 95% of the miles driven on California public roadways.

### **AV Initiatives Across the U.S.**

A 2018 study by Bloomberg Philanthropies and the Aspen Institute identified 48 cities within the United States where some form of AV activity is occurring. The Attachment to this memorandum illustrates this activity, which is also summarized below:

- 16 cities have done some form of AV planning or infrastructure work, including AV impact studies, potential route identification, and smart traffic signal or communications investment.

- Three cities are Active U.S. DOT Designated AV Proving Ground sites where AV companies can test vehicles on a closed test track.
- 12 cities have invested in some type of driverless shuttle service that generally operates within a 1 to 2-mile loop at an average of 8 mph with a maximum speed of 25 mph.
- Five cities have only independent AV testing occurring on their roadways
- Seven cities have multiple AV efforts underway (e.g. planning, driverless shuttles, and/or independent testing)
- Five municipalities have led the way in terms of notable AV efforts that include a partnership with one or more AV companies to test and operate AVs on public roadways. Three of these cities are in the Boston area and collaborated on a single effort. Greenville County, South Carolina and the San Jose are the other two municipalities with notable AV efforts occurring. The following further describes the notable AV efforts occurring in the Boston area and in Greenville County, South Carolina.

**Boston Area (Boston, Cambridge, Weymouth)** – A lack of mature state regulation opened an opportunity for the region given the presence of AV companies in the area. This opportunity allowed Boston to require and establish MOU's with various AV companies for AV testing within a designated area, which has occurred. Boston is now expanding beyond the originally designated area to serve other communities in Cambridge and Weymouth. Many of the requirements in the Boston region for AV testing mirror the permitting process California DMV has laid forth.

**Greenville County, South Carolina** – In 2016, Greenville County applied for a Federal Highway Administration grant to build an AV-based transit system. The \$4 million grant for a 3-phased AV transit pilot aims to connect Clemson University to a local technical college, expand to a residential area, and final expansion to a low income residential area. Robotic Research was selected to implement the AV-based transit system.

#### **Next Steps for San Jose's AV Efforts**

Staff remain committed to making efforts that align with the previously stated goals for AV testing and deployment, as well as making the City a highly desirable place for AV companies to develop, test, and provide their products and services. The immediate next steps related to AV include the following:

- Continue to develop, implement, and learn from the two AV pilot projects in progress.
- Continue to play a leadership role at the local, State and National level in AV related policies, standards, and best practices.
- Continue to monitor and learn from other AV efforts occurring across the country.
- Continue to develop the City's Access & Mobility Plan that further addresses how AV will support our broader City plans and goals.



Additionally, staff are in the process of creating a more detailed plan to further accelerate the development, testing, and implementation of AV in San Jose. This plan will focus on the following key strategies and would be completed in early 2019:

1. **Proactively identify and engage companies in the best position to benefit from an AV testing and deployment partnership with the City** – From the analysis of AV activity occurring in California and across the country, it is apparent that the companies which are established and scaling have done so independently. It is unlikely that they will see significant benefit from assistance by the City. They have already invested the infrastructure, technology, and testing to bring their products to scale. On the other hand, companies that are in the early technology development and testing stages, which is most of the companies at this time, would greatly benefit from a partnership with the City. Staff will develop and implement a method to gather updated information about the AV capabilities of these companies and to explore opportunities with them for new AV projects.
2. **Identify and leverage opportunities that provide the digital information that is necessary for AV testing and development** – As mentioned above, the few AV companies who are established and scaling have already collected or have the resources to collect the digital mapping information needed to safely test AVs. Specifically, they have spent the prerequisite hours – estimated at over 500 hours – needed to map an area to the point where an AV can reliably navigate. Most other companies don't have the resources to map larger areas of public roads to this extent. Staff intends to explore opportunities for funding and partnerships with various companies who might be interested in providing their digital mapping data for use by AV companies.
3. **Explore opportunities to capitalize on the City's advanced traffic signal management system and our smart cities capabilities** – Similar to the previous strategies, many companies in early testing and development stages would benefit from the City's traffic signal phase and timing data, which can offer a layer of safety redundancy. They would also benefit from testing their ability to connect with infrastructure using various communications systems. Staff intend to explore grants and other opportunities to enhance the City's infrastructure and make it more available for use.
4. **Collaborate with other agencies to create cross-jurisdictional testing and deployment opportunities** – Eventually, AV will need to easily travel between jurisdictions regardless of the differing traffic management systems and states of infrastructure that exist among them. Staff will look to engage neighboring jurisdictions and other local agencies to provide early opportunities for cross-jurisdictional AV testing and deployment.

## **CONCLUSION**

AV technology is advancing rapidly, but still has a long way to go before it is ready for wide-scale adoption as a safe and effective mode of transportation. As such, the City is a leader in AV on many fronts, including policy development and working with the industry in a way that will ultimately advance important City goals while helping AV companies develop and test AV technology. Future work by the City will continue build upon the efforts completed and underway, as well as focus on some key strategies to accelerate development, testing, and deployment of AV in San Jose.

/s/

John Ristow

Acting Director of Transportation

For questions, please contact Jill North, Innovation Program Manager, at (650) 451-8065.

Attachment



## ATTACHMENT - U.S. AV Activity

City	Planning	Proving Site	Shuttles	Independent	Partnership	Funding	AV Planning (Studies, route identification, AV plan, RFI, RFP for AV related services, Infrastructure Upgrades, Smart Corridor, AV Task Team)
Camblee, GA	X					\$45k	Active U.S. DOT Designated Proving Ground Site (Multiple companies testing within a private location)
Houston, TX	X					\$250k	
Knoxville, TN	X					Private funding	
Lincoln, NE	X					\$100K	
Los Angeles, CA	X						
Louisville, KY	X						
Nashville, TN	X						
Orlando, FL	X					\$12.3 million	
Peachtree Corners, GA	X					\$2 million	
Portland, ME	X						
Portland, OR	X						Driverless Shuttles
San Antonio, TX	X						
San Diego, CA	X						
Santa Monica, CA	X						
SeaTac, WA	X						
Seattle, WA	X						
Ann Arbor, MI	X	X				\$6.3 million	
Concord, CA	X	X					
Dublin, OH	X	X				\$45 million	
Bryan, TX	X		2		Texas A&M		Independent AV Testing (AV companies testing on public roadway, independent of City)
Columbus, OH	X		3			\$4 million	
Denver, CO	X		1			\$12 million	
Detroit, MI	X		1			\$1 million	
Gainesville, FL	X		1			\$2.7 million	
Grand Rapids	X		1			\$250k	
Jacksonville, FL	X		1			\$500k	
Reno, NV	X		1				
Sacramento, CA	X		1			Private funding	
San Ramon, CA	X		2			\$500k	Partnership for AV Service with City and Not Funded (Agreement)
Tampa, FL	X		1			\$500k	
Toledo, OH	X		1			\$1.8 million	
Atlanta, GA	X			Waymo		\$3 million	
Chandler, AZ				Uber/Waymo			
Frisco, TX				Drive.ai			
Miami, FL	X			Ford		\$2.1 million	
Pittsburg, PA	X			Uber		\$1 million	
Arlington, TX	X		2	Drive.ai		\$343k	
Austin, TX	X		2	Waymo			Funding and Investment Amounts for AV (Grants/City Investment/RFP/Private investments)
Las Vegas, NV	X		1	Aptiv/Lyft		Private funding	
Phoenix, AZ				Waymo			
San Francisco, CA	X		3	GM Cruise/Zoox		\$11 million	
The Villages, FL	X		1				
Washington D.C.	X			Ford			
Boston Area (MA)	X			nuTonomy, Optimus Ride, Delphi/Aptiv	nuTonomy, Optimus Ride, Delphi/Aptiv		
Greenville, SC	X		8-12			\$4 million	
San Jose, CA	X			Delphi/Aptiv, Mercedes Benz, Bosch, NIO, Intel, Drive.ai	Mercedes Benz, Bosch, Intel	\$1 million	

