



Memorandum

TO: SMART CITIES AND SERVICE
IMPROVEMENTS COMMITTEE

FROM: John Ristow

SUBJECT: AUTONOMOUS VEHICLES UPDATE **DATE:** March 20, 2019

Approved

Date

RECOMMENDATION

Accept this update report on Autonomous Vehicles.

BACKGROUND

Autonomous vehicles (AVs) - 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.

At the December 6th, 2018 Smart Cities and Service Improvements Committee meeting, staff provided an updated status of the Autonomous Vehicle Request for Information (RFI) pilot projects along with a detailed analysis on AV activity within San Jose, within California, and across 48 cities within the US. Staff also reported on the development of a longer term AV plan focusing on 4 key strategies to further accelerate the development, testing, and implementation of this technology within San Jose. This memorandum serves to provide an update on AV activity within California, to further describe the Department of Transportation's (DOT) AV Strategy, and to present the status of AV pilot projects.

ANALYSIS

AV Activity within California Update

The California DMV currently issues 4 types of permits for AV companies and manufacturers. These permits include (1) AV Testing with a Driver, (2) AV Driverless Testing, (3) AV Deployment with a Driver, and (4) AV Driverless Deployment. There are currently 62 companies that hold active AV Testing with a Driver permit and one company (Waymo) that holds an AV Driverless Testing permit. To date, there have been zero AV deployment permits issued within California for either Deployment with a Driver or Driverless Deployment.

In February 2019, DMV released an annual report for the December 2017 through November 2018 time period. Based on this information, of the 62 companies issued an AV Testing with Driver permit, only 25 had operated in autonomous mode on public roadways in 2017, with a modest increase to 29 companies in 2018. It is important to note, that four companies operating in 2017 did not operate in 2018, and eight new companies initiated testing in 2018. The table below highlights the cumulative year-over-year activity for active AV companies in California.

Table 1 – California AV Activity

Year	# of Companies	Total Miles	Total Vehicles Driven on Public Roadways
2017	25	578,006	254
2018	29	1,880,300	383

Attachment A summarizes the number of miles and vehicles driven on California public roadways for each company in 2017 and 2018, as reported to the DMV. Key conclusions from this data include:

- The vast majority of total AV miles were driven by GM Cruise and Waymo.
- Similarly, the vast majority of total vehicles were operated by these two companies.
- In both years, most AV companies operating on public roads drove less than 10,000 miles; 22 out of 25 in 2017, and 19 out of 29.
- In both years, most AV companies operated with less than 5 vehicles.
- There have been no AV driverless testing miles driven to date on California public roadways.

Cumulatively, these considerations indicate that the majority of AV manufacturers continue to be in the very early stages of technology development and testing, with two companies beginning to scale.

San Jose's AV Strategy

Staff efforts continue to be focused on the original guiding principles for AV testing and implementation articulated in the June 2017 AV RFI. These guiding principles include:

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

Throughout the planning process for the AV RFI pilot projects, staff identified key initiatives that were foundational to moving AVs towards these goals. The table below summarizes these efforts and initiatives that were developed as a result of the AV RFI pilot negotiations:

Guiding Principle	Key Initiatives Taken
Eliminate all traffic related fatalities and reduce severe injuries	<ul style="list-style-type: none">• Develop AV safety plan with SJ Police Department• Upgrade traditional and smart infrastructure in the city to improve safety redundancy
Reduce environmental impact of total vehicle miles traveled	<ul style="list-style-type: none">• Continue to develop EV Charging Strategy• Promote shared and electric AV solutions
Build a balanced and equitable transportation system	<ul style="list-style-type: none">• Integrate with public transit by providing first-last mile solutions and complementary routes
Improve mobility for all	<ul style="list-style-type: none">• Encourage equitable service for the elderly, disabilities, and low income groups
Create livable communities	<ul style="list-style-type: none">• Engage community to shape future streets with AVs through design thinking
Share and utilize data	<ul style="list-style-type: none">• Develop data analytics capacity to inform transportation policy making• Form a data exchange model with AV companies

2019 AV Plan

Throughout the first quarter of 2019, staff has focused efforts on building a more detailed plan to further accelerate the development, testing and implementation of AVs in San Jose. This plan focused on the following four key strategies:

1. Proactively identify and engage companies that are in the best position to benefit from an AV testing and deployment partnership with the City.
2. Identify and leverage opportunities that provide the digital information that is necessary for AV testing and development.
3. Explore opportunities to capitalize on the City's advanced traffic signal management system and our smart cities capabilities.
4. Collaborate with other agencies to create cross-jurisdictional testing and deployment opportunities.

1. AV Partnership Opportunity Analysis

In January, staff analyzed current and historical DMV disengagement and collision reports of current AV permit holders. A key conclusion from the analysis indicated that the majority of companies that operate an AV on public roadways, traditionally test within 15-20 miles of their AV headquarters (base station). Strategic reasons for this close proximity include easy access to implement software updates, hardware configurations, data offloading and ingestion, electric vehicle charging, and additional service needs.

Of the 62 companies with active AV Permits for Testing with a Driver, staff was able to identify the base station location of 55 companies. Of significance is that a majority (51) of these companies are located in the Bay Area as shown in Figure 1. The other four companies are located in southern California. Table 2 summarizes the AV base stations in California by location:

Figure 1 – Bay Area AV Company Base Stations

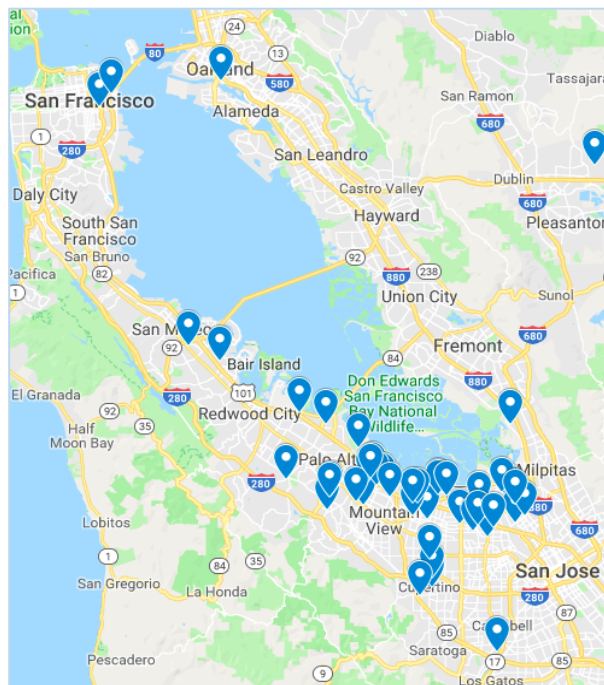


Table 2 – Base Stations of AV Companies in California

Region	Number of Base Stations
South Bay (between San Jose and Palo Alto)	40
Peninsula (between San Mateo and Menlo Park)	4
East Bay (Oakland, Dublin, Fremont)	3
Los Angeles Area	3
San Francisco	2
North Bay (Sonoma and Glen Ellen)	2
San Diego Area	1

Given the relationship of AV base station location and AV testing, staff identified a total of 42 companies within a 15-20 mile range of San Jose. Of these companies, a total of 25 have had vehicles testing on a public roadway at some point within the past 24 months. Attachment B summarizes this information. As described later in this update, staff is already working with three of these companies. Of the remaining 22 companies staff identified 18 companies to monitor for potential upcoming opportunities.

For the duration of 2019, staff efforts will be focused on establishing points of contact within these companies to collaborate on potential future partnership opportunities for AV testing within San Jose.

2. Digitizing Information to Further Support AV Operations

To identify and leverage opportunities that provide the digital information necessary for AV testing and development as part of the larger AV Strategy staff obtained feedback from AV technology companies, and developed a list of necessary digital information that could potentially make San Jose an attractive partner when considering where testing should take place. The following three foundational initiatives were identified as strategic to further ease the facilitation of AV testing:

- Transportation Data Platform to support, house, and share relevant data between the City and AV providers
- High Definition Map of pre-identified routes to serve as a base layer to support the mapping effort required for AV testing
- Real Time Construction/Work Zone Information feed to alert AV service providers of unplanned infrastructure maintenance events

In August 2018, staff entered into a proof of concept pilot with UrbanLogiq to build a customized and fully functional dashboard that enables staff to visualize transportation data in an open data environment. In addition to digitizing legacy transportation data, the UrbanLogiq platform provides the ability to incorporate incoming AV and connected vehicle data to be normalized into a common, shared tool. At the March 2019 Smart Cities and Service Improvements Committee meeting, staff and UrbanLogiq reported on the data platform, as well as outlining the upcoming work on integrating new datasets for transportation safety, planning, and operations purposes.

In February 2019, staff executed a Memorandum of Understanding to begin negotiations for a demonstration project with The Sanborn Map Company. The goals of this demonstration project are for the City to obtain High Definition Maps to support and accelerate AV testing for manufacturers in San Jose. Staff anticipates a demonstration project agreement will be executed in June 2019.

In addition to these efforts, staff explored opportunities to leverage Verizon Telematics technology to enable a real-time construction activity feed to AV technology manufacturers. Staff identified HAAS Alert, a company that specializes in distributing Verizon Telematics information to navigation companies to potentially support the implementation of this initiative. A Memorandum of Understanding with HAAS Alert to negotiate a demonstration project agreement is in the execution process. Current plans target a demonstration project agreement to be finalized and executed in June 2019.

3. City's Advanced Traffic Signal Management System

Since 2015, staff has utilized an agreement with a demonstration partnership company to distribute the signal phase and timing data of the City's intersections to additional parties that enter into demonstration agreements with the City. Over time, staff identified a challenge related to the distribution of this feed flowing through a third party, in that additional latency of the near real time information was built into the process. Recently, Transcore, the City's traffic signal management system provider, built a functionality that enables direct distribution of the signal data feed. Efforts to transfer the assignment of the feed distribution to Transcore was completed in January 2019 and is currently being tested by current AV and Smart City solution partners.

4. Collaborate with other Agencies to Identify Opportunities

In 2019, staff met with the Valley Transportation Authority (VTA) to identify routes that have been discontinued or are planned to be discontinued with the intention to offer those routes to incoming AV partners. In March 2019, VTA provided DOT with a list of routes that are ideal for AV pilots based on their gap in service and coverage. These routes include:

- East Hills Route 45
- Hellyer Avenue between Silver Creek and Silicon Valley Blvd
- Leigh/Camden corridor between Hamilton and Blossom Hill
- North San Jose between Brokaw and Tasman
- Branham corridor
- Almaden Valley

Over the next few months, staff will explore these areas to further scope additional details such as potential pick-up and drop-off locations, and to capture additional unique features of the routes in an effort to provide options to AV technology companies that are ready to engage in a pilot that is a complimentary service for our residents.

Status on AV Pilot Projects

The AV Strategy roadmap for 2019 targets potentially three AV pilot projects to launch by year-end. As highlighted below, each project is in different stages of maturity, with some projects in the very beginning stages without formalized details.

1. Mercedes Benz/Bosch/Daimler AV Pilot Project: This AV pilot project will operate between Diridon Station and Santana Row, is targeting the initial phase of service in August of 2019, and run through the end of December 2019. The two to three vehicles deployed in the initial launch will primarily run a point-to-point service utilizing white curb pick-up and drop-off areas. The Federation of the Blind will be a primary target group for this initial effort to better understand how AVs may serve people with visual impairment. The demonstration agreement is in its final negotiation phases and is planned to be executed in April 2019.

2. AutoX Technologies Pilot Project: In February 2019, the City and AutoX Technologies executed a Memorandum of Understanding to enter into negotiations for an AV transit pilot. Early plans are focused on a service for San Jose State University students by replicating the current DASH route that will be discontinued when the Berryessa BART station comes online. Staff is currently working to solidify project scope details including start and end dates, number of vehicles, and service hours. Staff is working to execute a demonstration agreement in Summer 2019.
3. The final AV pilot project that is moving forward includes a potential first-last mile transportation option for new Berryessa BART users to be connected to the North San Jose business area. This project would include various communications systems to study how latency impacts AV-to-infrastructure connectivity, leveraging an edge compute device. This project is in the early stages of negotiation and staff is working with the company to define the project scope with a goal of executing a demonstration agreement in Summer 2019.

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. The City of San Jose continues to demonstrate leadership in AV technology through data analysis, evaluation, and iteration within its public/private partnerships. As the City continues to advance its AV guiding principles and strategy, communities and industry alike will reap the benefit of the active role the City has taken in this space. Over the remainder of the year, staff will move pilot projects from concept to deployment and will provide future updates to the Committee of these efforts.

/s/

JOHN RISTOW

Acting Director of Transportation

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

Attachments

Attachment A: 2017 and 2018 Miles Driven in California by Company

	2017		2018	
Company	# of Vehicles	Miles	# of Vehicles	Miles
Valeo	1	471	0	0
TuSimple	1	662	0	0
Bosch	3	1,305	0	0
Delphi (Aptiv)	1	1,810	0	0
Telenav, Inc	1	1,244	1	29
aiPod, Inc	0	0	1	31
BMW	0	0	1	41
Honda	0	0	1	168
CarOne LLC (Udelv)	1	272	1	189
Qualcomm Technologies, Inc	0	0	2	240
Toyota Research Institute	0	0	3	381
Almotive	0	0	2	475
SAIC Innovation Center, LLC	0	0	2	634
Mercedes Benz	3	1,148	4	1,654
SF Motors, Inc	0	0	1	2,561
Nullmax	1	143	1	2,893
Phantom AI	1	146	1	4,003
NVIDIA Corporation	2	505	7	4,142
Drive.ai	7	6,130	12	4,501
Nissan	5	5,156	4	4,833
Roadstar.ai	1	287	2	7,252
UATG (Uber)*	20	188,826	13	8,075
PlusAi Inc	1	5,768	1	9,618
WeRide Corp (Jingchi)	4	3,810	5	15,122
Pony.ai	2	1,585	6	16,213
Baidu USA LLC	4	3,089	3	16,939
AutoX Technologies Inc	1	5,340	3	22,102
Nuro, Inc	6	8,324	13	24,438
Apple Inc*	8	974	16	25,668
Aurora Innovation	3	3,406	5	28,173
Zoox, Inc	11	2,945	10	30,126
GM Cruise LLC	94	143,105	162	433,242
Waymo LLC	72	334,660	98	1,216,266
Total	254	721,111	381	1,880,300

*Company no longer testing in 2019

Attachment B: AV Base Station Distance from San Jose and Past 24 Month Activity

Company	Base Station City	Miles from San Jose	Activity within Past 24 Months
AutoX Technologies, Inc ¹	San Jose	0	X
SAIC Innovation Center, LLC	San Jose	0	X
Faraday & Future	San Jose	0	
NIO USA	San Jose	0	
Continental Automotive Systems, Inc	San Jose	0	
Intel Corp	San Jose	0	
NVIDIA	Santa Clara	6.2	X
Ambarella Corporation	Santa Clara	6.5	
SF Motors, Inc	Santa Clara	7.2	X
Qualcomm Technologies, Inc	Santa Clara	7.3	X
Bosch ¹	Sunnyvale	8.1	X
Telenav	Santa Clara	8.2	X
Renovo.auto	Campbell	9	
PlusAi, Inc	Cupertino	9.2	X
Apple, Inc ²	Cupertino	9.9	X
Jingchi Corp	Sunnyvale	10.5	X
Pony.ai	Fremont	10.6	X
Baidu	Sunnyvale	10.8	X
Nissan	Sunnyvale	10.9	X
Gatik.ai, Inc	Sunnyvale	10.9	
Mercedes Benz ¹	Sunnyvale	11	X
Roadstar.Ai	Cupertino	11	X
Honda	Mountain View	11.1	X
Drive.ai ³	Mountain View	11.3	X
Samsung Electronics	Mountain View	11.3	
DiDi Research America, LLC	Mountain View	11.3	
Xmotors.ai, Inc	Mountain View	12.9	
Nuro, Inc	Mountain View	13	X
Delphi Automotive (Aptiv) ³	Mountain View	13.3	X
Almotive, Inc	Mountain View	13.5	X
Phantom AI	Mountain View	13.8	X
Voyage	Palo Alto	14.3	
Apex.ai	Palo Alto	14.3	
Waymo ⁴	Mountain View	14.5	X
Udacity, Inc	Mountain View	14.5	
BMW Technology Office	Mountain View	14.8	X

Toyota Research Institute	Los Altos	15.4	X
Aurora Innovation	Palo Alto	17.1	X
Tesla Motors	Palo Alto	18.7	
Ford	Palo Alto	18.8	
CYNGN, Inc	Menlo Park	19.2	
Lyft, Inc	Palo Alto	19.5	
Helm.ai Inc	Menlo Park	20.9	
Zoox	Menlo Park	21.4	X
Volkswagon Group of America	Belmont	27	
Valeo North America	San Mateo	29.6	X
Nullmax	Dublin	37.8	X
Boxbot, Inc	Oakland	39.9	
GM Cruise	San Francisco	47.4	X
Ridecell, Inc	San Francisco	48.5	
Imagry Inc	Glen Ellen	94.3	
aiPOD, Inc	Pasadena	340	X
Subaru	Cypress	372	
ThorDrive, Inc	Huntington Beach	372	
TuSimple	San Diego	455	X

Legend

1. Company is already in an AV partnership with the City (3)
2. Company is no longer active in the AV industry (1)
3. Company has moved operations out of California (2)
4. Company is already scaling and may not benefit from a partnership with the City (1)