



San Mateo Countywide Automated Vehicles Strategic Plan

Final Report

INTELLIGENT DRIVING XP

Prepared by
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Executive Summary

Significant recent advances in transportation technology have presented a great opportunity to improve safety on San Mateo County roadways and improve access to transportation for all residents and visitors. The San Mateo County Transportation Authority (SMCTA) and City/County Association of Governments (C/CAG) have prepared this San Mateo Countywide Automated Vehicle Strategic Plan (AV Strategic Plan) to help public agencies in San Mateo County and the traveling public plan, fund, and prepare for the deployment of AVs. It will enable C/CAG and SMCTA to adapt to the AV industry's quickly changing environment. This plan includes prioritized strategies like AV pilots, projects, and activities that were supported through significant input from local jurisdictions and stakeholders. All recommendations align with the current federal and state policies and regulations while working to further local visions for AV deployment that may improve connectivity and mobility.

The goals of the Plan were established early in the project in close coordination with SMCTA, C/CAG and their partner agencies. These goals include the need to identify current local, statewide, and federal policy and regulatory frameworks for AV; establish a shared vision for AV deployment that aligns with county and state objectives; identify opportunities and challenges for AV deployment and pilot projects; and prioritize next steps for implementing AV Strategic Plan initiatives.

The Plan is intended to be used to encourage action and a path forward to keep the San Mateo County community safe while meeting its transportation, environmental, and other goals for the county and region. The Plan includes roughly two-dozen actions for public agencies to consider implementing over the coming decade. These actions are organized into five pillars: agency readiness, infrastructure readiness, outreach and partnerships, policy and AV pilots and testing. These pillars are intended to provide coherent organization to the AV strategies. As resources become available, San Mateo County agencies will implement the highest priority strategies. A near-term roadmap is presented at the end of the Plan with a proposed path to move forward.

Concerns about liability and local regulation are often raised when the topic of AVs is discussed. This Plan does not have specific guidance on those topics because those questions are being reviewed by the courts and/or state legislature and are not certain yet. The Plan will support the County and local jurisdictions as these issues are being worked out with private companies, along with state regulators to ensure the expansion of AV service into San Mateo County is done in a safe and thoughtful manner. Public agencies will need to continue to comply with existing laws to minimize risk, however, AVs are new, and the legal system will define liability as the technologies emerge and cases work their way through the courts. This Plan provides a framework, strategy, and structure for C/CAG and SMCTA to assist the County and local jurisdictions in responding to those challenges when they arise.

The adoption of this Plan will help San Mateo County get out in front of AV deployment issues that others in the region have faced. The Plan provides a list of near-term actions for SMCTA and C/CAG to undertake in coordination with their state and local partners. These recommendations are intended to leverage lessons learned from recent AV deployments and open lines of communication with key agencies and companies to ensure that AVs are deployed in a safe, sustainable, and equitable manner in the County.

1. Introduction

The San Mateo County Automated Vehicles Strategic Plan (AV Strategic Plan), jointly sponsored by the San Mateo County Transportation Authority (SMCTA) and the City/County Association of Governments of San Mateo County (C/CAG), will guide how San Mateo County responds to the evolution of automated vehicles (AV) and associated technologies on our public roads. The development of the strategic plan was informed by:

- An analysis of existing conditions and the current state of federal, state and regional policy
- Conversations with state regulatory agencies, cities, and private operators
- Engagement with members of the community

This plan is intended to help the county adopt technologies that will improve connectivity and encourage mode shift, advocate for county interests at the regional, state and federal levels, and partner with the private sector for mutually beneficial transportation solutions.

1.1. Purpose

AV technology is here and is rapidly evolving. At the commencement of this plan’s creation, several companies (e.g., Waymo, Cruise) were permitted to operate driverless commercial passenger service in the City of San Francisco. At its completion, only Waymo remains permitted for driverless commercial passengers but with expanded geography that encompasses all of San Francisco and much of San Mateo, Santa Clara, and Los Angeles Counties. Contra Costa and San Francisco Counties have also launched driverless shared automated vehicles (SAVs) with mixed success. Public transportation technologies across the nation have also started to adopt Advanced Driver Assistance Systems (ADAS) on their fleet (e.g., collision prevention, fleet storage). Finally, AV use cases for freight delivery are beginning to emerge with local companies such as Nuro providing self-driving delivery services in several pilot projects throughout the country.

The emergence and rapid development of this technology and its applications on public rights of way requires the County of San Mateo to be prepared to respond and prioritize the needs of residents. The goals of the Countywide AV Strategic Plan are to identify the current state of AV in San Mateo County, establish a shared-vision for AV deployment, identify opportunities and challenges for AV deployment in the county (including regulatory, legal, and operational), identify opportunities for AV pilots and other AV-related projects, and to develop an AV action plan with prioritized next steps that align with potential funding availability.

1.2. Project Background

On November 17, 2021, the San Mateo County Transportation Authority (TA) and SamTrans jointly hosted the “Towards an Autonomous Future in San Mateo County” workshop, which focused attention to the advent of AVs and to help San Mateo County local jurisdictions better understand the impact AVs may have on our local roads and streets.

As a result of the workshop, one of the high-priority next steps called for the development of a San Mateo Countywide AV Strategic Plan that identifies the regulatory framework for AV/SAVs in San Mateo

County, creates a shared vision for AV/SAV deployment, and outlines near-term and long-term strategies to preparing for a safe, equitable, and seamless transition to an AV future.

This plan was developed over three distinct phases in partnership with C/CAG’s Technical Advisory Committee, stakeholders, and the broader community. The project phases, along with community influence, are detailed in the Figure 1 below.



Figure 1: Countywide AV Strategic Plan Development Phases

<p>Phase 1: Existing Conditions</p>	<p>The project team conducted comprehensive research and stakeholder consultations to identify existing AV programs at the county, state, and federal levels.</p>
<p>Phase 2: AV Strategies</p>	<p>The project team utilized stakeholder and public feedback to formulate a framework for AV pilot programs, projects, and activities. This framework aligns with County policies, plans, and available funding opportunities.</p>
<p>Phase 3: Strategic Plan</p>	<p>The project shifted its focus to crafting the draft San Mateo AV Strategy. This stage involved synthesizing input from the public, stakeholders, and agencies to ensure a comprehensive and inclusive strategy that reflects the collective perspectives and addresses the identified needs and opportunities. The plan was then shared with the public, C/CAG’s Technical Advisory Committee, SMCTA Board, and the C/CAG Board successively.</p>

1.3. Basics of AV Technology

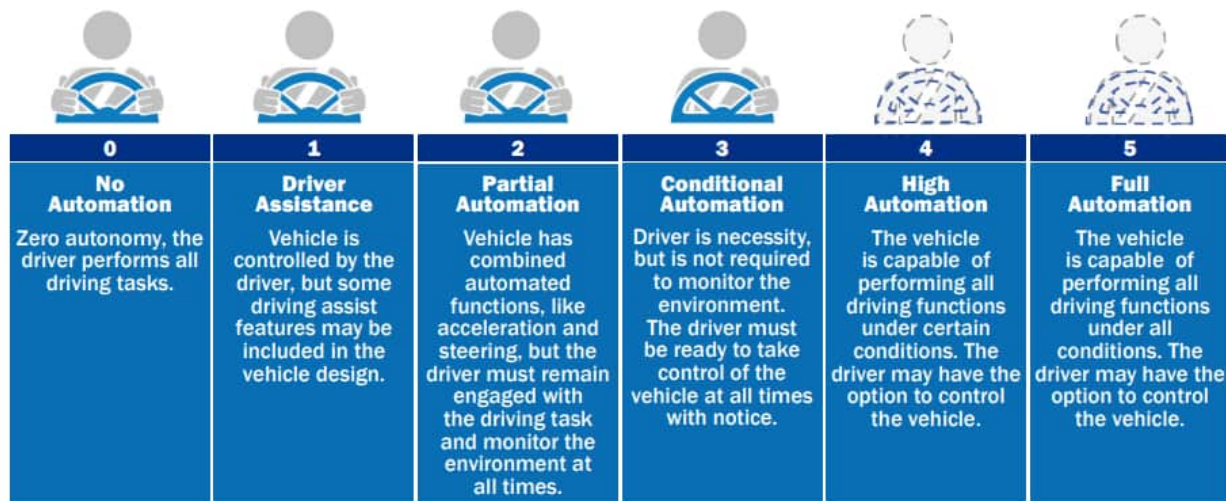
AV technologies are systems that allow vehicles to operate with varying degrees of human involvement. Depending on the level of automation, these technologies can assist with sensing, communicating, monitoring, navigating, and decision-making.

- An **Automated Vehicle (AV)** utilizes information obtained via sensors to make its own judgements and actions in a driving environment, limiting the need for human interaction.
- A **Connected Vehicle (CV)** is equipped with some form of wireless communication device that allows it to share information with other vehicles and infrastructure. CVs can be automated, and AVs can be connected, but neither is implied by definition.

1.3.1. Automation Levels

The Society of Automotive Engineers (SAE) Standard J3016 standardizes six automation levels, ranging from no automation (level 0) to full automation (level 5). A diagram of what these levels include is shown below in Figure 2.

In levels 1 and 2 of automation, the driver is primarily responsible for operating the vehicle, but there are features that can assist them with certain driving functions. These vehicles are widely available on the market today. In levels 3 and 4, the vehicle is primarily responsible for driving functions, and less human interaction is required than levels 1 and 2. These vehicles are actively being piloted within the San Francisco Bay Area and around the world, but they are not yet available for commercial use due to the fact that they often require specific conditions such as fixed routes, pre-mapped areas, or favorable weather conditions to operate without human interaction. Level 5 vehicles are the only category that are truly autonomous, meaning that they can perform all driving functions under all conditions without any interaction from a human operator. Level 5 vehicles are not currently operated on public roads and are years away from deployment.



Society of Automotive Engineers (SAE) Automation Levels Full Automation

Figure 2: SAE Levels of Vehicle Automation

1.3.2. AV Use Cases

As shown in Figures 3 and 4, there are several modes under the umbrella of AV including personal vehicles, ride hailing vehicles, transit, and freight described in the table below. Each of these modes will experience independent rates of adoption depending upon regulatory approval and permitting and market needs.



Figure 3: Physical Applications for AVs

Personal Vehicles	Automated personal vehicles will have the ability to increase safety on the roads, reduce congestion, and provide new mobility options to individuals who are unable to drive. Automated personal vehicles will still be purchased or leased by individuals from local car dealerships.
Ride Hailing Vehicles	Automated ride hailing vehicles will support existing public transportation by acting as first/last mile connections. These vehicles are part of a larger fleet that is owned and operated by a private company.
Transit	AV technology in transit is currently taking place through the use of driver assistance in mass transit and automated, low-speed shuttles that will provide first/last mile connections.
Freight	Automated freight vehicles will allow for a more efficient, safe, and inexpensive movement of goods. A variety of vehicle types fall into this category, including long-haul trucks, short-haul trucks, and last mile personal delivery devices. This last vehicle type, also referred to as delivery robots (see Figure 4), can be designed to travel in smaller rights of way such as sidewalks or bike paths to deliver food, packages, or medical supplies.



Figure 4: Last-mile Automated Delivery Service (Source: Nuro)

1.3.3. CVs and AVs

A CV shares and receives information from other vehicles on the road and elements of infrastructure such as traffic signals. CVs utilize satellite, cellular, Wi-Fi, or other short-range communication methods to maintain connectivity on the road. The primary purpose of CV technology is to provide real-time data to quantify crash risks and deliver warnings that help road users avoid crashes.

As shown in Figure 5, Connected Automated Vehicles (CAVs) employ both the communication capabilities of CVs and the sensor-driven, decision-making capabilities of AVs. The combination of these technologies enhances the benefits provided by each one. CV technology allows AVs to operate with context beyond the limit of what their sensors can perceive. AV technology allows CVs to streamline the link between information, decision-making, and action.

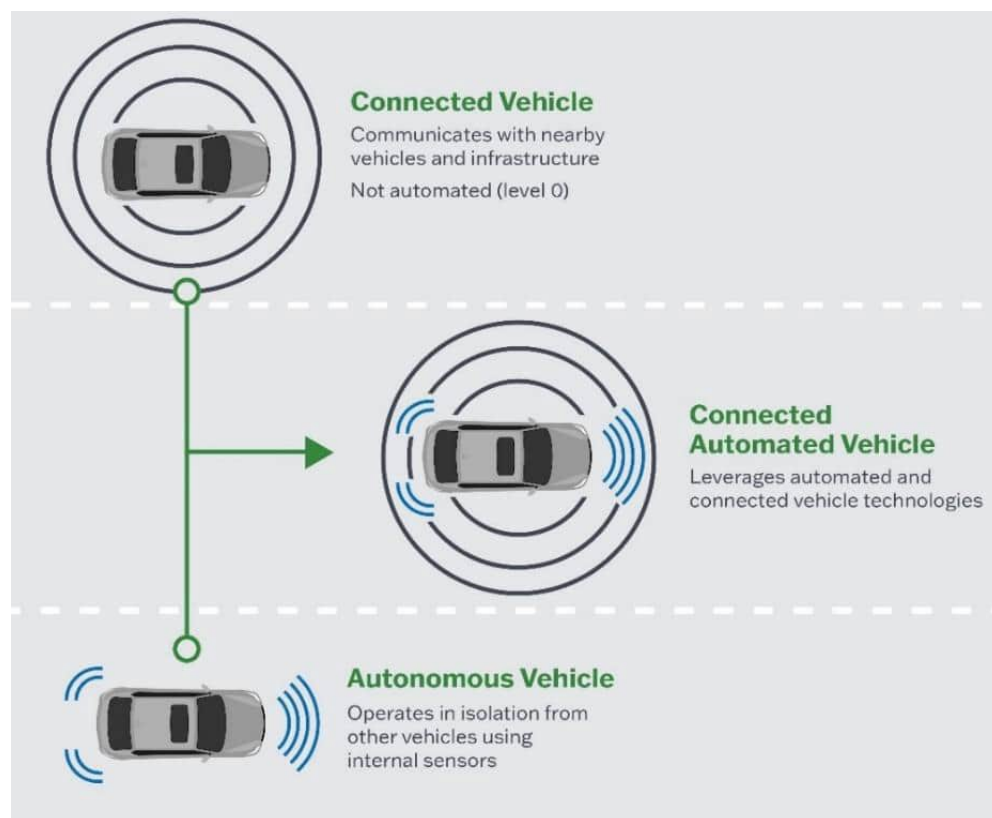


Figure 5: CAV Combines CV and AV Technology (source: USDOT)

1.3.4. Shared Mobility and AVs

Shared mobility refers to any form of transportation that services multiple users. All forms of public transportation fall under the category of shared mobility, as well as carpools, car-shares, and ride-hailing services. Shared mobility can take place simultaneously within the same mode, such as in the case of carpooling, or consecutively with multiple people using the same vehicle individually, such as in the case of car sharing. Because the definition of shared mobility is so vast, there are numerous opportunities to leverage AV technology in this space.

Shared AV shuttles are one example of automated shared mobility vehicles. These shuttles, known as SAVs, are typically electric, confined to a specific, low-speed operating context, and lack traditional controls such as steering wheels and pedals. SAV fleets are privately owned but can be operated in collaboration with public agencies. SAVs are not used in lieu of traditional public transportation, but instead provide supplemental services such as first/last mile connections. Community engagement is a crucial component of SAV implementation. When exposed to the vehicles early on, potential SAV users can provide feedback that is instrumental in adapting operations to meet evolving community needs. As a local example of this use case, the City of San Francisco recently conducted an SAV pilot demonstration on Treasure Island (see Figure 6).

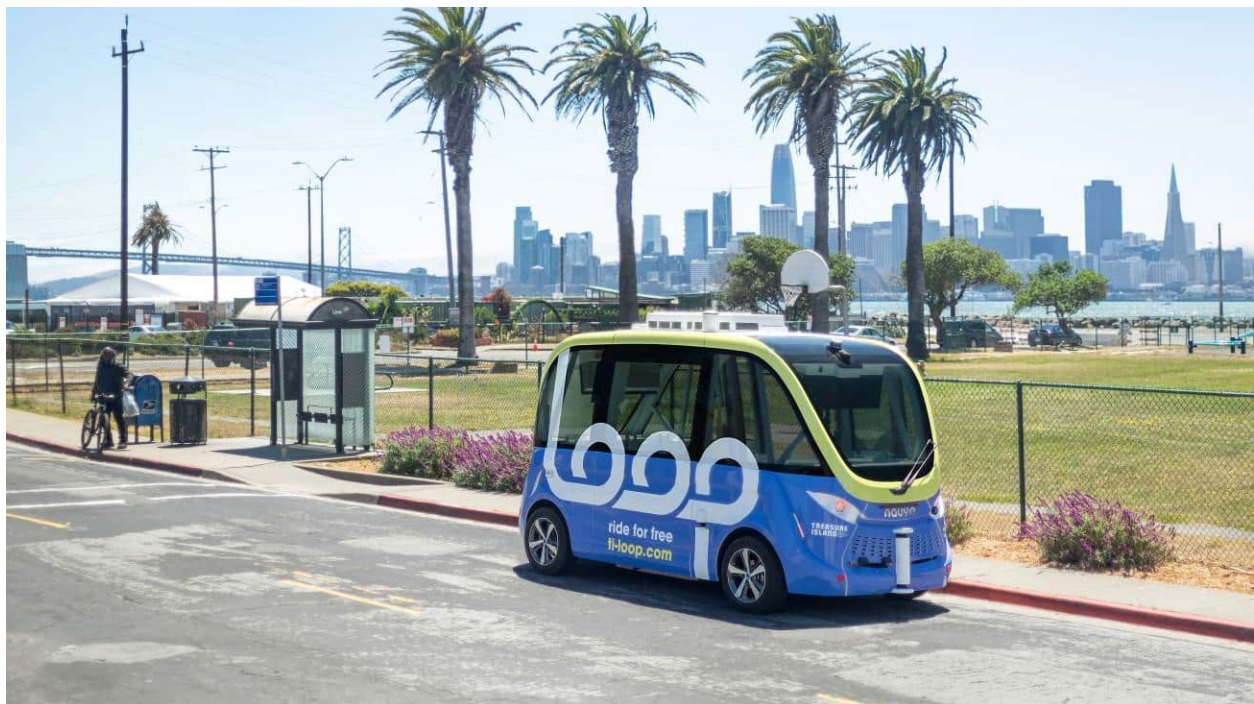


Figure 6: SAV Operating on Treasure Island in San Francisco (Source: SFCTA)

2. San Mateo County's AV Priorities

2.1. Roles & Responsibilities

The responsibilities for regulating and permitting AV technologies on public roadways in San Mateo County are split between multiple federal and state agencies. San Mateo County agencies currently have no role in AV regulation or permitting but they do have other responsibilities related to AV deployments. Figure 7 below defines where responsibilities currently lie as of Spring 2024 for federal, state, local/and or regional agencies, and private sector partners.

As shown in Figure 7, the approval and permitting of AV services in California is governed entirely by the California Department of Motor Vehicles (DMV) and the Public Utilities Commission (CPUC), and currently allows for minimal local control or public input.¹ Local and regional agencies including SMCTA, C/CAG and City agencies are responsible for infrastructure readiness, and planning and programming of AV projects and pilots. They are also responsible for certain aspects of AV operations as shown in the table. Note that for each local agency responsibility, the relevant strategies from Section 5 are noted. The federal government provides standards and guidance to ensure safe AV operations. Finally, the private sector provides the actual AV services in both pilots and deployments, and they have a responsibility to coordinate with the public and emergency responders during their AV operations.

























Regulation & Permitting		Operations	
	Permits for driverless commercial passenger operation on local roads/streets		Curbside access <i>(see strategies 2.1 - 2.4, 4.3 and 5.4)</i>
	Permits for driverless testing (no passengers) on local streets/roads		Operation of driverless vehicles (adhering to local traffic laws, etc.)
 	AV safety data sharing and reporting	 	Operational data sharing <i>(see strategies 2.2 - 2.4, 4.3 and 5.4)</i>
	AV safety standards and guidelines		Operation of first-last mile SAV solutions / technology integration <i>(see strategies 5.1 and 5.2)</i>
Infrastructure Readiness		Enforcement & Emergency Response	
 	Road maintenance/infrastructure enhancements (e.g., infrastructure maintenance needs identified by AVs) <i>(see strategies 2.1 - 2.4)</i>		Emergency response coordination
	Upgrades to bus stop and fleet maintenance facilities <i>(see strategies 2.1 - 2.4)</i>		Emergency response operations <i>(see strategies 1.2 - 1.4, 3.1, 3.2, 4.2 and 4.3)</i>
	Infrastructure standards and guidance		AV traffic enforcement <i>(see strategies 1.2 - 1.4, 3.1, 3.2, 4.2 and 4.3)</i>
Planning & Engagement		LEGEND	
All	Funding for new projects, pilots and studies <i>(see strategies 3.4, 4.5 and 5.1)</i>	Agencies & Organizations involved in regulating and planning for Automated Vehicles.	
 	Community outreach and engagement <i>(see strategies 3.1 and 3.2)</i>		Federal agencies <i>(e.g., FHWA and NHTSA)</i>
	Coordination with local and regional planning requirements <i>(see strategy 1.5)</i>		State agencies <i>(e.g., DMV and/or CPUC)</i>
			Local and/or Regional agencies <i>(e.g. SMCTA, C/CAG and city agencies)</i>
			Private Sector

Figure 7: Roles and Responsibilities in Managing AV Deployments

¹ <https://legiscan.com/CA/bill/SB915/2023>





2.2. Vision




AV technology is rapidly advancing and will soon become a reality on roadways in San Mateo County. It is important to SMCTA and C/CAG that AV deployment is done in a manner that reflects the values and priorities of both agencies as well as ensuring that any planning, funding, and implementation is supported by the County of San Mateo and local jurisdictions. The following vision statement was written with each of these core values in mind:

SMCTA and C/CAG will support strategic measures toward planning, funding, and implementing automated vehicle technologies that promote equitable levels of access, safety, reliability, and sustainability in San Mateo County.

2.3. Guiding Principles

In support of this vision and the values of both SMCTA and C/CAG, seven guiding principles have been identified. The following guiding principles will be used to advise AV deployment to ensure that all future AV applications provide benefit to the County of San Mateo:

 <p>Accessibility & Equity</p>	<p>Leverage AV technologies to make traveling more accessible and affordable for people of all ages, abilities, and income levels.</p>
 <p>Engagement</p>	<p>Conduct outreach with communities and the private sector to increase awareness about AV technologies and assess community priorities.</p>
 <p>Connectivity</p>	<p>Utilize AV technologies that connect to regional transit and community destinations to reduce traffic congestion and vehicle miles traveled.</p>
 <p>Safety</p>	<p>Apply AV technologies to enhance the safety of all road users and support local agencies in meeting their Vision Zero targets.</p>

 <p>Support Local Agencies</p>	<p>Provide technical assistance, funding, and training to local agencies to promote successful AV deployments.</p>
 <p>Sustainability</p>	<p>Prioritize AV technologies that reduce greenhouse gas emissions and support local agencies in meeting their climate action goals.</p>
 <p>Workforce Development</p>	<p>Utilize AV research, development, and deployment to promote job creation and economic vitality.</p>

3. State of Automated Vehicles in San Mateo County

The following sections of this plan were developed as part of the Existing Conditions Report. Further detail of these sections can be found in the SMCTA AV Strategic Plan Existing Conditions Report.

3.1. Relevant County Plans and Programs

San Mateo County, which consists of the cities shown in Figure 8, produces a number of different transportation-related programs and planning documents. While few of the programs and planning documents specifically reference AVs, many of the priorities and programs are directly applicable to AV efforts. This subsection presents the high-level countywide plans and programs and their connections to AVs.



Figure 8: San Mateo County & Cities (Source: San Mateo County Department of Housing)

3.1.1. Transportation Plans

[SMCTA Alternative Congestion Relief/Transportation Demand Management Plan \(ACR/TDM Plan\)](#)

This plan guides how SMCTA manages the Measure A Alternative Congestion Relief and Measure W Transportation Demand Management grant funding programs. The projects funded by these programs should work to reduce automobile dependence and enhance transportation efficiency in San Mateo County. Commute.org, a primary TDM program, operates shuttle services and incentives to decrease reliance on cars. While supporting Commute.org, additional funding allows exploration of AV and shared AV pilot programs, as well as other Intelligent Transportation System (ITS) solutions for improved transport and traffic management. The plan emphasizes innovative ITS projects to inform travelers, enhance safety, and optimize transportation networks, including Commute.org's interest in piloting SAV shuttle services. The ITS category can fund planning and design of AV-related projects while the competitive program category can fund implementation.

[Toward an Autonomous Future in San Mateo County Virtual Workshop \(2021\)](#)

On November 17, 2021, SMCTA and San Mateo County Transit District (SamTrans) jointly organized a workshop on the future of AVs in the county. The event featured speakers from public agencies and companies actively involved in developing or deploying automated vehicle technologies, including representatives from the Santa Clara Valley Transportation Authority, Connecticut Department of Transportation, Contra Costa Transportation Authority, Utah Transit Authority, Via Transportation, Cruise, and Zoox. The workshop delved into key questions surrounding the future of automated vehicles, such as their potential to surpass transit demand, the impact on travel demand models, and the importance of retaining the Level of Service (LOS) metric alongside Vehicle Miles Traveled (VMT). Panelists also discussed safety considerations, including guidelines for AVs to communicate with first responders and the crucial role of collaboration between agencies and AV operators, particularly within fire and police departments. Despite current automation levels, the panel acknowledged that a safe, affordable network of shared automated vehicles might take several years to become operational, even in California, which is ahead in regulatory processes and legislation for electrifying public vehicle fleets.

[C/CAG ITS Strategic Plan](#)

The 2005 San Mateo County ITS Strategic Plan aimed to enhance mobility, travel time reliability, and transportation system safety through advanced technologies and interagency collaboration. Identifying seven transportation elements, the plan prioritized 14 concepts aligned with AV Strategic goals. High-priority initiatives included funding allocation, operational efficiency, and upgrading traffic signal systems. Medium priorities focused on expanding fiber networks and implementing traffic monitoring links. Low priorities involved fog sensing, parking studies, real-time guidance systems, and smart corridor design. Some initiatives are implemented, ongoing, or planned, contributing to a robust ITS infrastructure. Leveraging these concepts can enhance AV deployment, ensuring reliable communications with infrastructure for safety and efficiency benefits in San Mateo County and beyond.

[C/CAG Countywide Transportation Plan 2040 \(SMCTP\)](#)

Created in 2017, SMCTP 2040 envisions an integrated approach to transportation and land use planning, aiming for a more livable and sustainable county. This comprehensive plan covers various elements such

as land use, roadway systems, bicycles, pedestrians, public transportation, transportation system management, demand management, parking, modal connectivity, and goods movement, with a specific focus on the potential of connected and automated vehicles to enhance traveler safety and reduce congestion. Emphasizing higher density and transit-oriented development, the plan advocates for site designs discouraging single-occupancy driving and supporting SAV deployment. By minimizing motor vehicle traffic from new developments, the county aims to encourage the use of shared AVs over single occupancy AVs, addressing safety and efficiency concerns. The plan also underscores equitable project benefits distribution, prioritizing the needs of communities of concern, including minorities, low-income residents, individuals with limited English proficiency, zero-vehicle households, people with disabilities, seniors, single-parent families, and renters facing housing cost challenges. The plan highlights the potential benefits of affordable, shared AVs, particularly for people with disabilities and seniors, ensuring increased accessibility and improved transit options tailored to community needs.

[SamTrans Short Range Transit Plan \(S RTP\)](#)

The S RTP for fiscal years 2023-2028 addresses the challenges posed by the COVID-19 pandemic, considering ridership decline and decreased fare revenue. SamTrans, facing difficulties in recruiting and retaining operating staff, implemented strategies to boost ridership, including the introduction of on-demand microtransit services in East Palo Alto and Half Moon Bay as an alternative to fixed-route operations. While AV strategies are not explicitly mentioned, the combination of these efforts, along with budget constraints, creates conditions favorable for potential public SAV pilots, especially for first/last mile connections to higher capacity transit. The potential benefits extend to meeting transit operator needs, such as precision docking, real-time information on safety-critical situations, and bus platooning, which could be facilitated by advanced connected and automated vehicle (CAV) technologies.

[Connect the Coastside](#)

Connect the Coastside is a community-based transportation plan to help improve mobility and safety for Coastside residents and visitors. It identifies programs and improvements for the Highway 1 and Highway 92 corridors to improve mobility and accommodate the Midcoast's future transportation needs. A key purpose of the Plan is to define priority projects that will then be eligible to apply for funding. The plan identifies a diverse range of road, highway and trail improvements. Categories in this plan include improvements to bike and walking trails, roadways and intersections, pedestrian routes, transit facilities and services, and parking. The short distance microtransit (Recommendation T2) in Connect the Coastside on page 104 could be an opportunity to use Shared AV technology in -lieu of traditional shuttles or microtransit with future feasibility study.

[Half Moon Bay Climate Action Plan](#)

The City of Half Moon Bay's Climate Action Plan (CAP) is designed to be a blueprint for the community's response to challenges posed by climate change and is a living document that reflects the ongoing efforts and challenges the community faces as the impacts from climate change grow more frequent, severe, and urgent. The CAP documents how Half Moon Bay plans to collaborate with partners in the county, state, federal government, along with community organizations and local businesses, to create new programs, services, and policies that will support the community in taking actions that reduce

greenhouse gas (GHG) emissions. The Half Moon Bay CAP identifies a desire to implement public and shared transit programs to increase transit mode share (measure T-2) and to increase bus zero-emission vehicles (recommendation TL-5) which both support the possible implementation of SAV shuttles. The recommendation T-2.5 states “Work with transportation partners to identify and implement a local electric shuttle system to close the ‘last mile’ gap for public transit. Seek and apply for grant funding to aid implementation and shuttle procurement.”

3.1.2. Transportation Programs

C/CAG TDM Program

The C/CAG 2021 update to the Transportation Demand Management Policy introduces a range of options tailored for Transit-Oriented Developments (residential or commercial development near higher-order transit stations or routes), Transit Proximate Developments, and Non-Transit Proximate Developments. Noteworthy measures include providing free/preferential parking for carpools, encouraging shared automated vehicles (AVs) in downtown areas, and supporting dedicated shuttle programs, possibly utilizing AV shuttles. Additional initiatives involve actively participating in commuter programs, offering guaranteed ride home services, promoting on-site car-sharing, and funding transit service shuttles. These measures target various demographics, benefiting workers with commute-focused programs, residents seeking diverse transportation options, and seniors/youth who may lack personal vehicles. The incorporation of AVs is highlighted, considering them as potential components in car-sharing fleets and shuttle services, catering to evolving mobility needs and preferences. A full description of the relevant Measures can be found in the SMCTA Automated Vehicles Strategic Plan Existing Conditions report.

San Mateo County's Transportation Demand Management Agency

Commute.org is a joint powers agency (JPA) located in San Mateo County, and is comprised of 19 cities and towns, with a focus on promoting alternative transportation methods. Their TDM programming aims to shift transportation demand towards walking, biking, transit, telework, and ridesharing. The agency's core programs include Engagement Programs, fostering the adoption of commute alternatives; Commuter Programs, offering tools and incentives for non-drive alone modes; and a Shuttle Program, providing first/last mile shuttle services to public transit stations. Anticipating advancements, AVs could play a role in ridesharing, dedicated shuttles, guaranteed ride home programs, or carsharing fleets within the agency's initiatives.

Peninsula Shuttle Program

SMCTA manages a Peninsula Shuttle Program whose purpose is to fund free shuttle service to the public to promote alternative modes of transportation and reduce congestion on highways in San Mateo County. The program allows for local jurisdictions and/or public agencies within the County to apply for and contend for funding. Funding for this program is provided jointly from Measure A and the C/CAG Congestion Relief Plan.

In 2021, SamTrans and Caltrain completed the [Peninsula Shuttle Study](#) which conducted a comprehensive review of the Shuttle Program. The study identified several service and management recommendations to strengthen the Program's responsiveness to changing conditions and to support

post-pandemic ridership recovery and growth. SMCTA has implemented the study’s recommendations related to the Shuttle Program Call for Projects as of the FY 2024-25 cycle. This program provides a great opportunity to fund future AV pilots and projects in the County.

3.2. Transportation Assets

This section documents the many transportation assets in San Mateo County that could support or be supported by AV pilots and deployments. It includes ITS and CAV, key travel corridors, transit services, and bicycle and pedestrian networks.

3.2.1. ITS and CAV

ITS and CVs have the potential to enhance future AVs by improving safety and efficiency. ITS comprises technology and applications for smarter and more efficient streets, highways, and transit systems. CV technology enables real-time communication among vehicles, traffic signals, and devices via a secure wireless network, transforming travel for people and goods. Industry leaders widely agree that connecting AVs to ITS infrastructure would significantly enhance their safety and efficiency. This section outlines San Mateo County's existing ITS projects aligning with AV Strategic Plan goals, potentially supporting future AV deployment.

C/CAG Smart Corridor

The San Mateo County Smart Corridor project, shown below in Figure 9, is a countywide traffic management system, utilizes technology and Intelligent Transportation Systems (ITS) devices to address congestion under various conditions. Implemented by C/CAG, the project enhances predefined local streets and state routes in three funded segments, aiming to minimize the impact of freeway incidents on local street traffic. Many of the ITS technologies deployed as part of the Smart Corridor could potentially support AVs by collecting and sharing data with connected AVs. The project also features a key asset in the form of a fiber optic cable infrastructure, connecting devices and enabling remote traffic management. Currently, 50 miles of fiber optic cable are installed, with 8.5 miles under construction and 5.3 miles planned for future deployment. Significant progress has been made in installing other key ITS assets, as detailed in Table 1, illustrating existing, under-construction, and planned Smart Corridor devices.

Table 1: Existing, Under Construction, and Future/Planned Smart Corridor ITS Assets

Devices	Existing	Under Construction	Future/Planned
Trailblazer Signs	117	7	13
Traffic Controllers	236	49	6
Vehicle Detectors	40	7	7
CCTV Cameras	270	81	57
Dynamic Signs	0	4	0
Total	663	92	83

Source: C/CAG

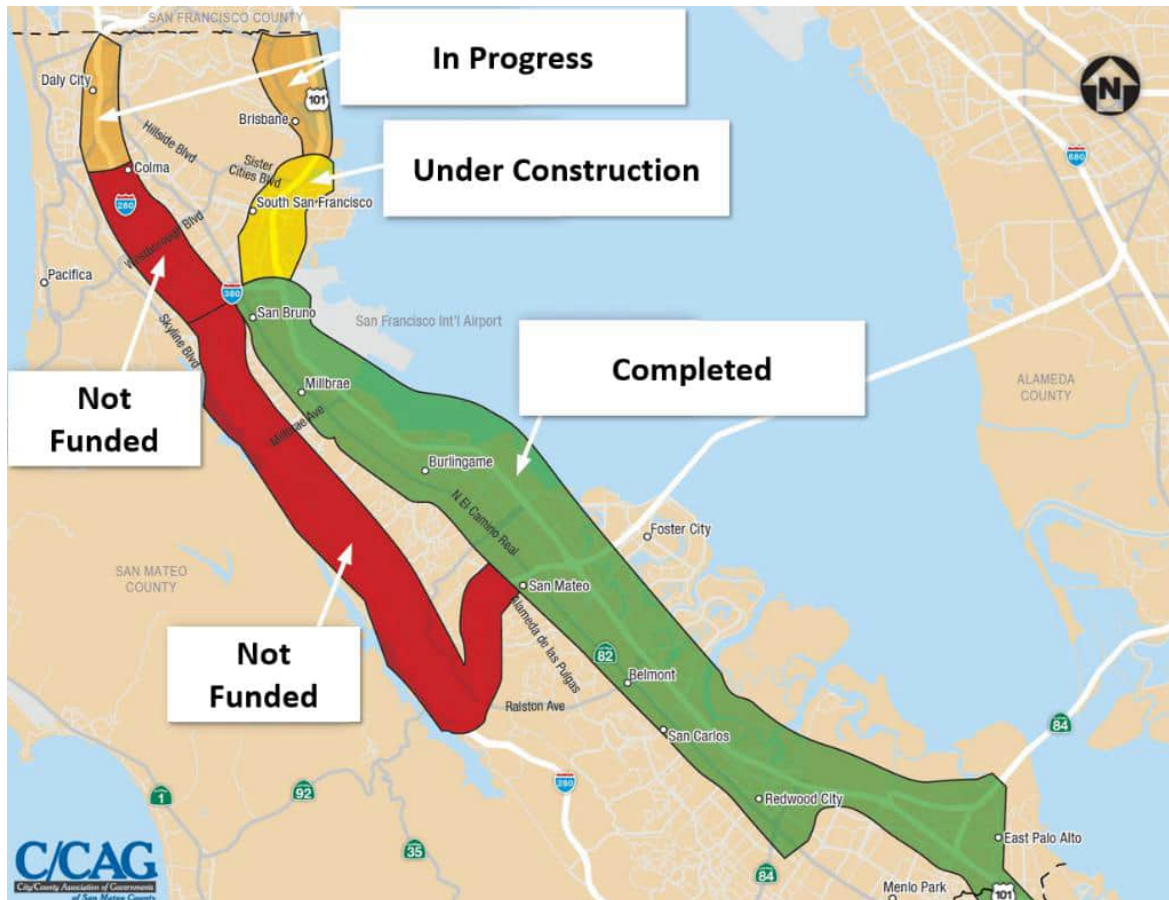


Figure 9: San Mateo Smart Corridor Project Limit and Status (Source: C/CAG)

C/CAG Intelligent Transit Signal Priority

A collaborative initiative involving C/CAG, SamTrans, and Sustainable Silicon Valley focuses on providing transit priority in the transit-dependent City of East Palo Alto. Funded by C/CAG, a transit signal priority pilot was implemented on University Avenue at intersections including Bay Road, Runnymede Street, Bell Street, and Donohoe Street. The pilot yielded positive impacts, reducing northbound and southbound intersection delays by 45% and 19%, respectively, translating to 18% and 7% reductions in travel time. Additionally, it increased average speeds by 11% (Northbound) and 4% (Southbound), offering a cost-efficient solution for an intelligent and streamlined transit system. These improvements, particularly in reducing bus travel times, suggest potential benefits for integrating AVs into the area, utilizing similar high-frequency location data to measure AV effectiveness against key performance indicators established for buses.

3.2.2. Key Travel Corridors

San Mateo County, situated between San Francisco and San Jose on the San Francisco Peninsula, spans from the San Francisco Bay to the Pacific Ocean. Figure 10 shows a map of the roadways in San Mateo County. The urbanized portion of the county lies between the Bay and I-280, while the region between I-

280 and the coast features a more rural landscape with open space preserves, parklands, beaches, and communities along Highway 1, such as Pacifica. Key highway corridors are depicted in Figure 5, illustrating that 10% of total miles are state highways, 15% are county roads, 73% are city streets, and 2% are other roads. Road types influence the feasibility and location of AV pilots, with varying management responsibilities for ITS infrastructure and traffic signals along different roads. For instance, Caltrans oversees signals on state-owned arterials, while some cities, like Hillsborough, lack signalized infrastructure. Certain communities in San Mateo County, characterized by hillsides with peaks and alleys, pose potential challenges for AV navigation and connectivity, particularly in areas with cellular drop-off zones.

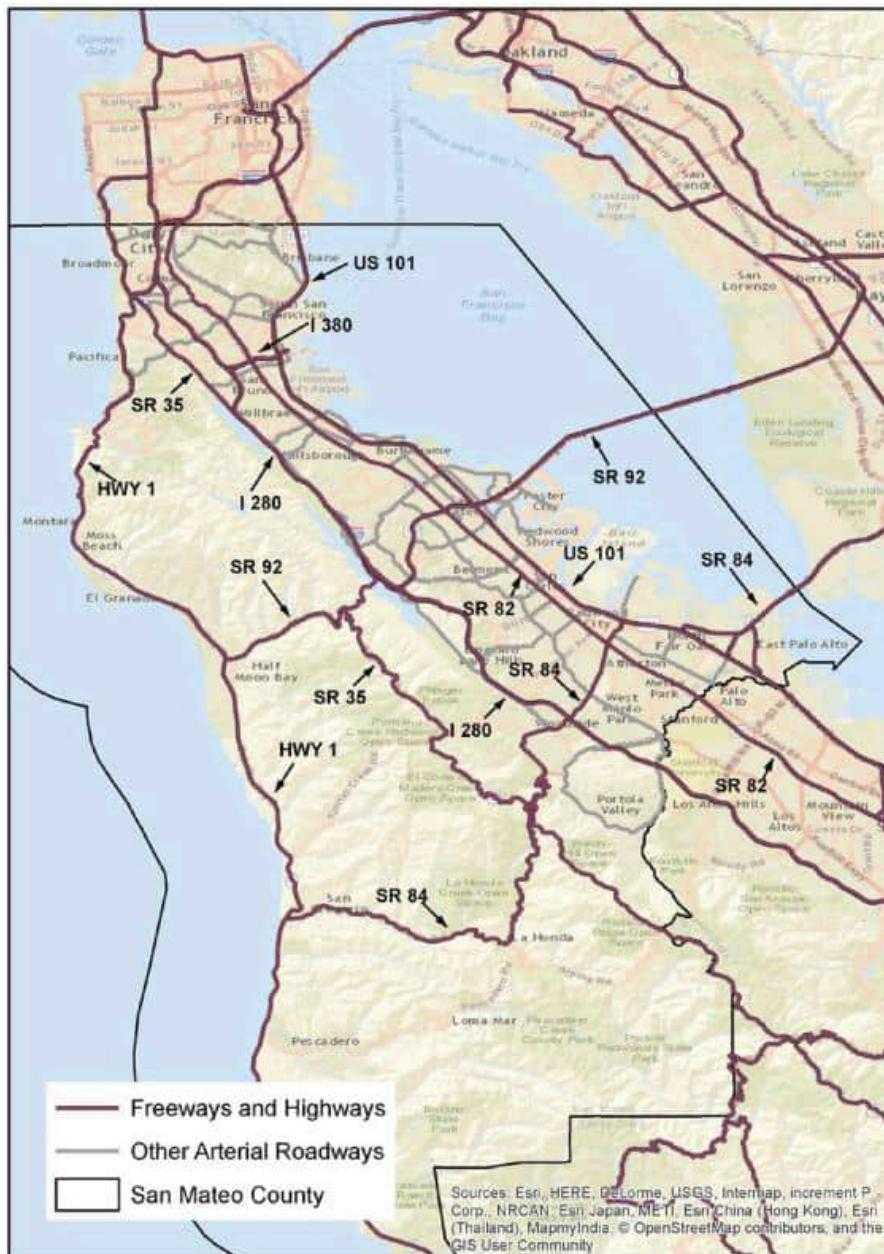


Figure 10: Map of the Roadway System in San Mateo County

3.2.3. Transit Service

San Mateo County transit services, provided by SamTrans, Caltrain, BART, and Commute.org, encompass local buses, commuter rail, and transportation demand management (TDM). SamTrans operates local buses, commuter buses to San Francisco, and paratransit, as depicted in Figure 11. Caltrain covers the county parallel to Highway 101, while BART serves the northern part, including San Francisco International Airport. Commute.org manages the TDM program and shuttles. Identifying current service areas provides a foundation for integrating AVs, whether by expanding existing routes or introducing new ones.

3.2.4. Bicycle and Pedestrian Networks

Active transportation and automated vehicles, though distinct, share overlapping safety considerations. Pedestrians and bicyclists, often termed vulnerable road users (VRUs) in the AV context, pose a significant safety challenge for developers. Enhancing safety involves deploying smart infrastructure that detects VRUs and communicates their location to AVs, benefiting both groups. The 2021 C/CAG San Mateo County Comprehensive Bicycle and Pedestrian Plan prioritizes safety, aiming to eliminate traffic fatalities and serious injuries. Strategic road designs, signals prioritizing crossings for cyclists and pedestrians, and intelligent traffic signals detecting small vehicles can enhance safety and efficiency for these modes, aligning seamlessly with AV integration.

3.3. AV Policies and Programs

Various automotive and tech companies are actively researching and developing AV technologies. Simultaneously, public agencies are increasingly interested in piloting and deploying these solutions to address transportation challenges and foster innovation. However, there exists a notable gap between the potential of AV technologies and their current capabilities. It is crucial for potential deployers to recognize this gap

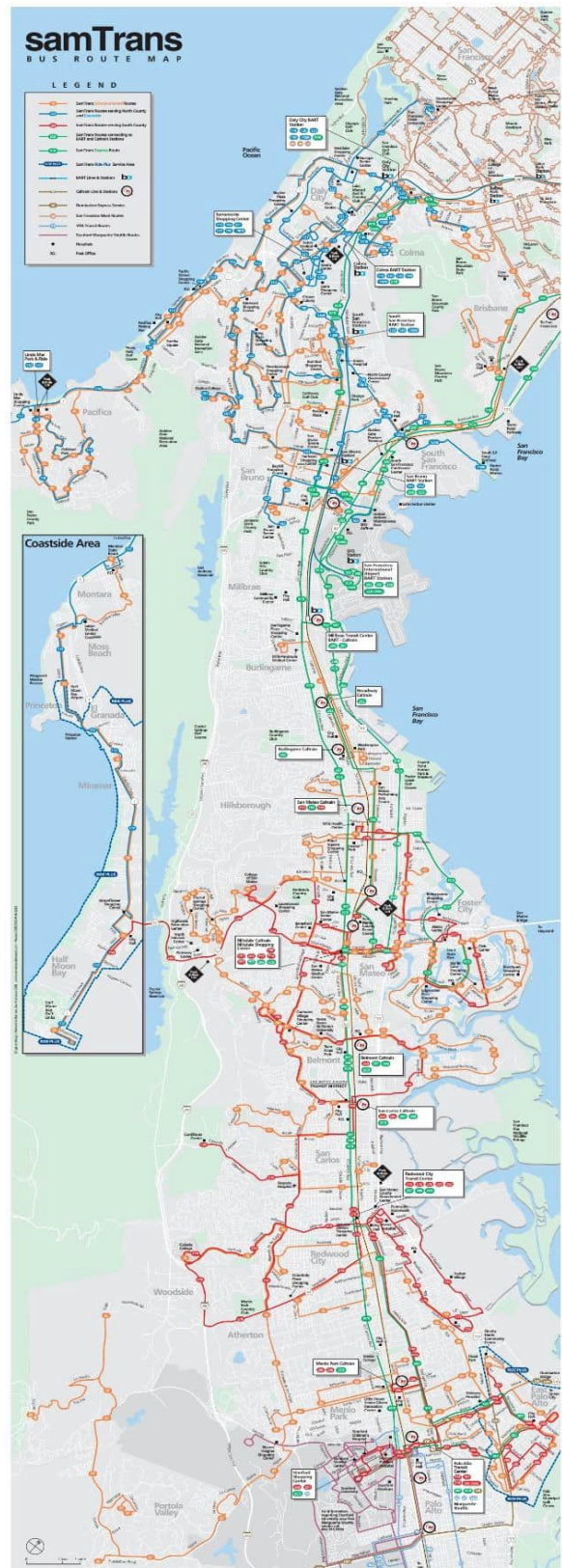


Figure 11: SamTrans System Map

before embarking on projects or choosing between different AV technologies.

Efforts at the federal, state, and local levels aim to provide guidance, regulation, or share lessons learned to assist agencies with limited AV experience in understanding the industry's current state and its potential applications. This section summarizes these efforts, aiming to identify implemented AV measures, as well as the obstacles and opportunities encountered in the past and anticipated in the future.

3.3.1. Local

This report stems from a virtual workshop held on November 17, 2021, summarized in the previous section, aimed at raising awareness about AVs in San Mateo County and understanding their potential impacts on local roads. The Countywide AV Strategic Plan emerged as a key recommendation from stakeholders. Despite no official AV policies or programs before or after the workshop, interest persists in deploying AVs in a balanced manner, including personal, transit, and shared vehicles, alongside countywide projects like express/managed lanes.

Although most AV regulations fall under state or federal jurisdiction, local regulations can influence aspects like parking, curb access, and sidewalk usage. For instance, cities reacted to transportation network companies like Uber or Lyft entering without permissions by imposing restrictions on passenger pick-ups at public facilities. Similar scenarios could arise for AVs, especially smaller ones like personal delivery devices, affected by local regulations on sidewalk use.

Key Takeaways for Consideration:

- **Curb Space Management and Parking:** new opportunities to digitize and manage the curb, as well as permit AV parking access in specially designated areas, as necessary, to prevent traffic disruption.
- **Access:** consider the needs of new users, e.g., sidewalk use by small, automated delivery vehicles.
- **Zoning:** create zoning by-laws that support automated vehicle storage and charging in certain neighborhoods with ideal characteristics (e.g., commercial or industrial zones).

3.3.2. Regional

San Mateo County is one of nine counties in the San Francisco Bay Area that falls under the Metropolitan Transportation Commission (MTC), which serves as the Bay Area's metropolitan planning organization (MPO). MTC supports programs for safer streets and fewer collisions through automated vehicle deployment. The Innovative Deployments to Enhance Arterials Shared Automated Vehicles (IDEA SAV)² Program, backed by MTC, offers financial and technical aid for shared AV projects, aiming to enhance transit service and equity. One such project, the Treasure Island SAV initiative, has received initial funding of \$2.5 million, with an additional \$1 million expected post-pilot. In the future, MTC plans to explore new AV applications, with a focus on serving users with disabilities.

² <https://mtc.ca.gov/operations/programs-projects/intelligent-transportation-systems/connected-automated-vehicles>

Key Takeaways for Consideration:

- **Policy Review:** continue to stay apprised of policy changes and lessons learned throughout the region that might impact any pilot programs.
- **Lobbying:** maintain close relationships with local leaders to educate and promote the consideration of AVs in local priorities and interests.
- **Funding-ready pilots and programs:** track new and emerging funding opportunities provided. Tailor pilots to align with regional priorities, where possible. This includes considerations for equity, accessibility, VMT reduction and other regional priorities.

3.3.3. Peer Agency AV Planning Efforts

Various AV planning efforts to support strategic plans and pilots have been completed or are underway by leading edge peer agencies across the nation. In the Bay Area, Contra Costa Transportation Authority (CCTA) and San Francisco County Transportation Authority (SFCTA) have the most AV deployment experience. While SFCTA and CCTA have some deployment experience with AVs, neither have developed public AV Strategic Plans such as this.

SFCTA has developed a [strategic paper](#) on AVs that outlines their involvement in pilot programs to gain insights into how local plans and policies influence AV deployment. They collaborate closely with SFMTA (San Francisco Municipal Transportation Agency) to monitor AV pilots, including driverless taxi services by Cruise and Waymo. The study indicates that challenges arise in managing AV operations in urban settings due to limited decision-making capabilities for non-standard situations.

While SFMTA and SFCTA have established dedicated teams for dealing with AV planning and operations issues, other Bay Area counties are not as far along in their AV planning or deployments. This does not, however, mean that other counties are not considering AVs. The Santa Clara Valley Transit Authority (VTA) has studied opportunities to deploy SAVs at the Palo Alto Veteran Administration Hospital and Alameda County Transportation Commission (CTC) has been deploying ITS applications for freight under the GoPort program³, potentially paving the way for future AV innovation.

Counties in other states that have developed their own AV Strategic Plans include Maricopa County in Arizona, Oakland County in Michigan, and the [MetroPlan Orlando](#) metropolitan planning organization in Florida. The reasons for doing so can be gleaned from Oakland County's vision statement:

With the emergence of Connected and Automated Vehicles (CAV) on Oakland County roadways, the Road Commission for Oakland County sees ample opportunity to continue to be at the forefront of supporting technology development, staff preparation, industry partnerships, and immediate deployments to enhance the safety and mobility of its residents and to plan for and fund a forward-looking transportation network.

More broadly, in 2019 the National Association of Counties (NACo) has developed the [Connected and Automated Vehicles Toolkit: A Primer for Counties](#) to provide an overview of and framework for engagement with the AV industry, as well as the closely related connected vehicle industry.

³ <https://www.alamedactc.org/fits-update>

Key Takeaways for Consideration:

- **Policy review:** stay apprised of policy development amongst peer agencies to determine changes in industry trends.
- **Knowledge sharing:** seek out opportunities for knowledge sharing between agencies including the development of a joint working group, a regular cadence of meetings, or other forum for collaboration.

3.3.4. Peer Agency AV Pilot Projects

Several pilot deployments, primarily focusing on Levels 3 or 4 of automation, have been conducted by local and regional governments or permitted within their jurisdictions. These typically employ low-speed automated shuttles lacking traditional vehicle controls and can operate on fixed routes or within predefined zones. Despite their automated nature, most shuttles still feature a human "safety operator" onboard.

Because automated shuttles are designed from the ground up as AVs, they have additional vehicle registration requirements, as compared to existing vehicles that have a steering wheel, pedals, and other standard features and are then outfitted with sensors and devices to become AVs. Specifically, most SAV shuttles do not meet Federal Motor Vehicle Safety Standards (FMVSS) and need an exemption from the National Highway Traffic Safety Administration (NHTSA) to operate. Part of that exemption process includes NHTSA reviewing and approving specific routes. The SAV shuttle vendor is then authorized only to operate in that specific, pre-approved location. Agencies see opportunities to deploy these shuttles to enhance or replace existing transit services, particularly addressing first/last-mile challenges. Additionally, these deployments serve as showcases for agencies embracing AV technology and provide valuable data for future developments.

Several peer agencies in the Bay Area have tested AV Pilot projects in recent years. These pilots included the following:

- **CCTA Automated Shuttle:** CCTA, in partnership with Beep, currently operates an automated shuttle PRESTO program in Bishop ranch offering passengers services between the San Ramon Transit Center and City Center. In 2018, CCTA received permission from NHTSA and DMV to test an SAV shuttle on public roads at Bishop Ranch. This is the first time a shared AV shuttle was allowed to travel on public roads in CA.
- **SFCTA Treasure Island Automated Shuttle:** SFCTA launched a free-to-ride automated shuttle service on treasure island in partnership with loop. The pilot ran from August 2023 and concluded by December 2023, earlier than initially scheduled. The early conclusion of the pilot was attributed to the significant funding required to re-map, obtain permits and test service on newly reconfigured roads on the service's route. SFCTA recently released a final evaluation report for this shuttle pilot, titled [The Loop Final Evaluation Report](#). Key lessons learned included the following:
 - Procuring shared AV vehicles is a challenge due to a limited number of operators and manufacturers.
 - Incident response and communications can require significant resources.

- Technology can be unreliable, particularly with LiDAR, which can create extended service outages.
- Complex operating environments, including active construction present risks to pilot delivery.
- SAV deployments can require significant staffing and resourcing demands for planning, procurement, permitting, testing and operation.
- The pilot demonstrated demand for first and last mile solutions exists.
- Contracting mechanisms should include specific details about service delivery and compensation or consequences for meeting or not meeting service targets.
- A business case can help compare the benefits of SAV shuttles versus traditional public transit services.
- **VTA VIVA Campus Shuttle:** VTA, in partnership with Beep, is currently piloting a free shuttle service that provides connections within the Palo Alto Division of the VA Palo Alto Healthcare System.

Across the U.S. SAV shuttles have been tested and deployed – from snowy conditions of Minnesota to the blistering heat of Texas. Utah DOT sponsored SAV shuttle deployments across the state with a focus on building trust and collecting data on the traveler experience and perception of the technology. For instance, a Las Vegas pilot sponsored by AAA aimed to gauge public perceptions of SAVs by exposing tourists to the technology. Similarly, SAV shuttles are used for campus circulation and local transit, offering opportunities for public education on emerging technologies. Early adopters like CCTA, with its EasyMile shuttle pilot, or Virginia DOT’s Relay pilot in collaboration with Dominion Energy, have leveraged public and private funding for AV initiatives. Lessons learned highlight the importance of compliance with industry regulations, accessibility considerations, and the high initial costs of AV technology, often leading to lease agreements rather than purchases.

Key Takeaways for Consideration:

- **Pilot review:** maintain awareness on pilot projects developed by peer agencies to determine lessons learned.
- **Funding partnerships:** explore opportunities for inter-agency partnerships for projects that have achieved shared interest (e.g., pilots that facilitate connections across agency geographic boundaries).

3.3.5. State

Vehicle safety regulations are federally governed, while state jurisdictions oversee vehicle operators, akin to the division between federal vehicle safety recalls and state-level driver licensing and ticketing. States vary in their legislation and policy approaches to AVs, with some steadily implementing policies while others lag behind.

In California, key agencies such as Caltrans (California Department of Transportation), CalSTA (California State Transportation Agency), CHP (California Highway Patrol), DMV (California Department of Motor Vehicles), and CPUC (California Public Utilities Commission) play crucial roles in AV oversight.

Caltrans, responsible for state-owned highways, plays a pivotal role in AV operations by managing roadway infrastructure, including lane markings, signage, ITS equipment and traffic signals. They've

published and set AV goals aligned with their strategic plan and conduct research⁴, including operating a CV testbed in Palo Alto. This test bed includes 16 intersections equipped with vehicle-to-infrastructure technology that can communicate directly with CV-equipped vehicles, including CAVs. Caltrans has operated the CV testbed since 2005 and used it to test new traffic signal applications such as the Multimodal Intelligent Traffic Signal System (MMITSS). Caltrans is planning to expand the testbed concept and MMITSS to other parts of California.⁵

CalSTA provides state leadership on AV policy, publishing an AV Strategic Framework in 2022⁶, guided by a multi-agency workgroup's principles prioritizing AV deployments. Principals listed below:

- Shared use
- Low emissions
- Right sized
- An efficient multimodal system that:
 - Strengthens high-quality transit service rather than duplicating it
 - Replaces low-quality transit service
 - Strengthens active transport
 - Provides efficient freight transport and delivery
- Efficient land use
- Complete and livable streets
- Transportation equity

CHP enforces laws determined by other statewide entities. AV companies testing in California develop plans to interact with law enforcement, ensuring safe operation and addressing concerns. DMV and CPUC regulate AVs and issue permits for testing and deployment. DMV regulates all testing, issuing permits with rules, including safety operator requirements. CPUC issues permits for AV companies carrying paying passengers. Despite state-level control, local jurisdictions have limited regulatory authority. DMV mandates notifications to local authorities and law enforcement, along with law enforcement interaction plans. California mandates data sharing on disengagements and collisions for AV testing, excluding deployment permit holders. Some companies test elsewhere due to less stringent regulations, but many headquartered in California opt to comply with state requirements. Some recent movement has been made within the California State Senate to grant local agencies more control over AV permitting. However, at the time of the publishing of this report, no new regulations granting greater local authority over AVs has been passed.

Key Takeaways for Consideration:

- **Lobbying:** seek opportunities to promote local interests in the AV space for both public and private sector deployments. Contemplate the promotion of opportunities for more localized oversight of AV operations.
- **Policy review:** continue to stay apprised of policy changes instituted at the state level with influence on regional planning.

⁴ <https://dot.ca.gov/programs/traffic-operations/cav/plans-policies>

⁵ <https://caconnectedvehicletestbed.org/home>

⁶ https://calsta.ca.gov/-/media/calsta-media/documents/final_avsf_visionguidingprinciples-a11y.pdf

- **Funding:** Monitor the introduction of grant or other funding opportunities that can be utilized for pilot programs, transit fleet enhancements or infrastructure upgrades.

3.3.6. Federal

While some efforts have been made, a comprehensive federal regulatory structure for AVs remains undetermined. Factors such as the federal government's approach (voluntary standards vs. mandated requirements), inter-state and international variations, and the role of agencies like the National Highway Traffic Safety Administration (NHTSA) and the Federal Motor Carrier Safety Administration (FMCSA) will shape AV regulation. Despite initiatives like the AV Start Act, Congress has yet to pass federal AV legislation.

Federal agencies like NHTSA and FMCSA are developing safety standards and testing protocols for AVs, particularly in commercial motor carrier systems. The United States Department of Transportation (USDOT) has issued guiding documents on AV policies. Government-sponsored tests and data, from the federal level to state and local governments, provide reliable, unbiased information on AV capabilities, reducing reliance on proprietary data. Many USDOT grant programs include data sharing and reporting requirements. Past and current grant programs specific to AVs supported by USDOT have included:

- [SMART Grants](#) (Strengthening Mobility and Revolutionizing Transportation): Appropriating \$100 million annually for FY 2022-2026, these grants support demonstration projects focusing on smart community technologies to enhance transportation efficiency and safety.
- [ADS Grants](#) (Automated Driving System Demonstration) In 2019, \$60 million was awarded to eight projects across seven states to test the safe integration of automated driving systems on US roadways.
- [ITS4US Grants](#) (Complete Trip Program): \$38 million was allocated to five projects promoting independent mobility for all through innovative business partnerships, technologies, and practices.
- [AIM Grants](#) (Accelerating Innovative Mobility): With \$14 million distributed among 25 projects in 24 states, AIM grants aim to enhance transit industry innovation, improving service efficiency and frequency to retain riders.
- [IMI Grants](#) (Integrated Mobility Innovation): \$20 million was spread across 25 projects showcasing innovative practices, partnerships, and technologies to enhance public transportation effectiveness, efficiency, safety, and traveler experience.

AV projects also qualify for broader transportation grant programs like [INFRA](#) (the Nationally Significant Multimodal Freight & Highway Projects program) and [RAISE](#) (Rebuilding American Infrastructure with Sustainability and Equity). Concerns arise regarding the lack of funding for operations and maintenance post-pilot phase, necessitating consideration when applying. Leveraging these grants alongside public and private funding options, the industry operates amidst minimal government regulation, albeit with some uncertainty. Future federal regulation may impact vehicle design and development, while state regulation could influence operational capabilities, licensing, and enforcement, all crucial for AV mainstream deployment.

Key Takeaways for Consideration:

- **Policy Review:** continue to stay apprised of policy changes at the federal level that may enable or require augmentations to pilot programs.
- **Funding:** track new and emerging funding opportunities provided by federal agencies.

3.4. AV Permit Holders in California

As described on the CPUC website, the agency has authorized two pilot programs for the private prearranged transportation of passengers in test AVs:

- The "Drivered AV Passenger Service" pilot program allows for the provision of passenger service in test AVs with a driver in the vehicle. Under this pilot program, a safety driver is available to assist with operations if needed.
- The "Driverless AV Passenger Service" pilot program allows for the provision of passenger service in test AVs without a driver in the vehicle. Under this pilot program, a communication link between passengers and "remote operators" of the vehicle must be available and maintained at all times during passenger service.

To be eligible to participate in the AV Passenger Service pilot programs, participants must possess the appropriate corresponding Autonomous Vehicle Tester Program Manufacturer's Testing Permit from the California Department of Motor Vehicles (DMV) for AV testing with a driver or testing without a driver and comply fully with DMV's AV testing regulations (California Code of Regulations, Title 13, Article 3.7).

As of September 22, 2024, the following permits have been issued by CPUC, as shown in Table 2. These permits are subject to change. The latest updates, including the areas and conditions in which AVs are permitted to operate can be found on the CPUC site at <https://www.cpuc.ca.gov/regulatory-services/licensing/transportation-licensing-and-analysis-branch/autonomous-vehicle-programs/autonomous-vehicle-program-permits-issued>

Table 2: CPUC Permits

Number	Carrier Name	Drivered Pilot	Driverless Pilot	Operational Area Specified
TCP 39036	Aurora Operations, Inc.	Yes	N/A	N/A
TCP 38539	AutoX Technologies, Inc.	Yes	N/A	N/A
TCP 39080	Cruise LLC	Suspended	Suspended	Yes
TCP 40501	Motional AD Inc.	Revoked	N/A	N/A
TCP 38152	Waymo LLC	Yes	Yes	Yes
TCP 45411	WeRide Corp	Yes	Yes	N/A
TCP 38380	Zoox, Inc.	Yes	Yes	N/A

4. Stakeholder & Public Engagement

As depicted in Figure 12, Stakeholder and Public Engagement for this project was conducted in three distinct phases designed to create a collaborative process where participant feedback progressively built on itself. The final plan reflects this iterative feedback process and is consistent with participant input from each phase of engagement.

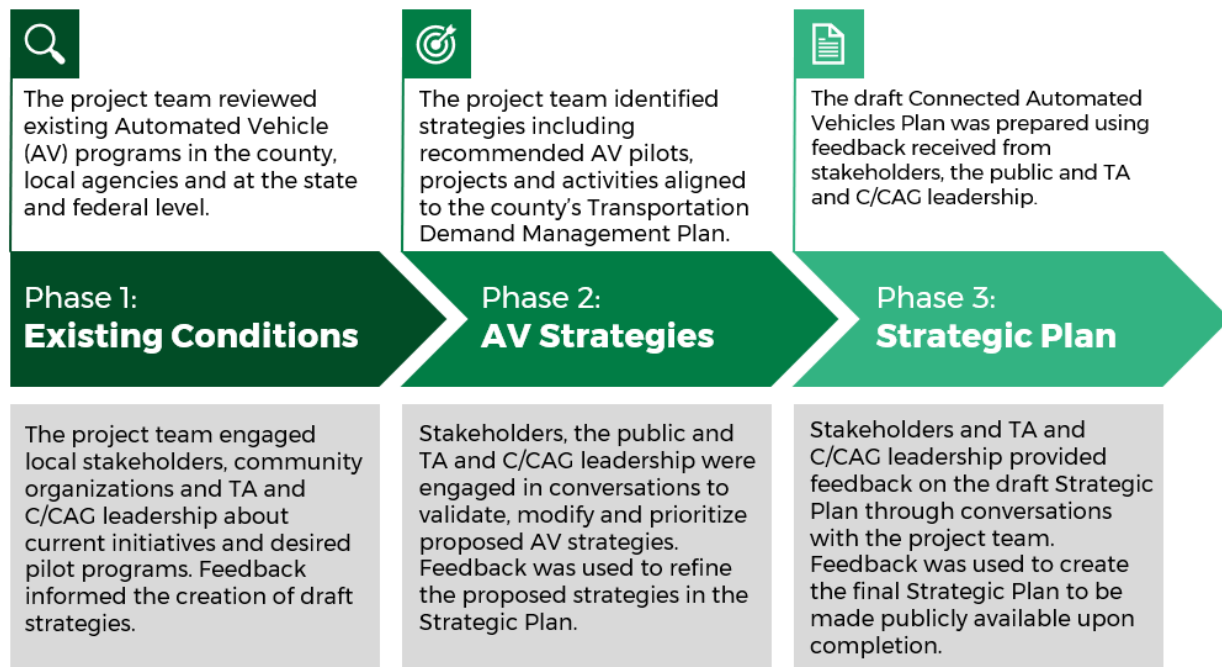


Figure 12: Stakeholder and Community Engagement Plan

4.1. Engagement Methods

4.1.1. Stakeholders

The engagement program for this project prioritized one-on-one or agency-to-agency conversations with people directly involved in decision-making, policy writing, permitting, response, and deployment of AV Strategies. In total, 13 conversations were held with different individuals from organizations across the Bay Area. All feedback was used to understand and prepare the Existing Conditions report and informed the development of the first draft Strategic Plan. A full list is provided below.

- Beep
- California DMV
- California PUC
- Caltrans
- City of Burlingame
- City of Hillsborough
- Commute.org
- May Mobility
- MTC
- SamTrans
- SFCTA
- SFMTA
- Undisclosed Private Operator

Summaries of the individual conversations can be found in the Appendices.

4.1.2. The Public

Public input was sought to inform the development of potential pilots that could improve transportation in the county. The public was also invited to provide comments on the draft Strategic Plan. The public was engaged in the following ways:

Website	A dedicated project website was established on SMCTA’s and C/CAG’s websites to host project information, the project fact sheet, relevant documents (e.g., Existing Conditions Report), information about upcoming events, the Public Workshop recording, contact information and more. The websites were updated between project phases.
Social Media	Social media advertisements were created for and posted on SMCTA’s Facebook, Instagram and LinkedIn to promote the public workshop and to offer the public an opportunity to provide feedback on the draft Strategic Plan prior to adoption.
Public Workshop	<p>A 2-hour public workshop was hosted on November 15, 2023, to formally introduce the project to interested members of the San Mateo community and solicit input on proposed pilot programs. Participants were offered the opportunity to ask questions and give feedback on the material presented. Specifically, participants were asked for feedback on four potential pilots:</p> <ul style="list-style-type: none"> ○ SAV shuttles ○ Advanced driver assistance on buses ○ Data sharing with AVs ○ Automated delivery robots <p>The recording of the meeting can be found on SMCTA’s YouTube channel.</p>
E-Blast	An e-blast was prepared following the release of the draft Strategic Plan to announce the release of the draft strategic plan and its availability for public comment. All participants who attended a stakeholder meeting or the public workshop received the e-blast.
Draft Plan Review	The Strategic Plan was shared in draft with TA and C/CAG advisory committees and boards prior to finalization. During this period, the draft document was also shared via the TA’s project website for public comment. Comments from committees, boards and the public were taken into consideration and addressed by the project team as appropriate.

4.2. Key Engagement Takeaways

All feedback from the various interviews, focus groups, and the public workshop was taken into consideration by the project team. The feedback was used by the project team to build a plan with strategies that reflects the aspirations of the community.

In particular, the following themes emerged as frequently in discussion with stakeholders and the community:

Safety	All audiences stressed the importance of safety as the top priority in the deployment of automated vehicles. Safety includes interactions with all modes of transportation including pedestrians, cyclists, scooters, and people with assistive devices.
Establish Reciprocal Partnerships	Partnerships with transportation network companies (e.g., Waymo) and private automated shuttle operators should be collaborative and mutually beneficial. That means that public agencies should work to set terms that benefit the broader community through data sharing, route setting and more.
Connectivity	As noted above, first-last mile solutions were commonly cited as a preferred method for deploying AVs in San Mateo. Participants listed some key destinations that could benefit from connection to schools, medical facilities, universities, and business parks or campuses.
Shuttle Service	Shuttle services are a preferred application of AV technology. Shuttles can serve as first-last mile solutions that get people from important destinations to higher-order transit like Caltrain and BART. This type of service also would meet state goals to reduce vehicle miles traveled (VMT) by providing drivers with a convenient transit alternative.

These key themes informed the development of the AV strategies outlined in Section 5.

5. AV Strategies & Roadmap to the Future

Based on the information and insights that have been gathered throughout the course of the Countywide AV Strategic Plan project, this section serves as a roadmap to San Mateo County’s mobility future, providing a foundational resource for agencies to consider and refer to as deliberations occur around the advancement and regulation of AVs in the County. It also provides guidance for public agencies, as well as private and community partners, on what to focus on and develop as the County prepares for AV technologies to safely test and deploy on public roadways.

AV Strategies represent the tangible actions that SMCTA and C/CAG can take while providing options for potential partnerships with other San Mateo County agencies and departments. The strategies were developed based on findings from the existing conditions review in Section 3 and discussions with various stakeholder audiences representing cities, transportation agencies and private companies as discussed in Section 4.

San Mateo County’s work is just beginning, and while much has been done to date, further planning and preparation are needed to fully address AV operations on public roads. The remainder of this section lays out the five pillars, or areas of needed attention by policy makers and agencies as preparations for AVs continue. The pillars are intended to provide coherent organization to the AV strategies that are presented in the roadmap. The five pillars are as follows:



The following tables identify a set of specific AV strategies for each pillar. A table of proposed strategies or actions has been developed with additional information. For each strategy listed, the table indicates value to the county, priority, timeline for potential implementation, estimated cost range, level of staff effort, and potential implementation leads. Details on each of the four measures are described in the following bullets.

- **Priority** – Priority level shows the criticality of each strategy as determined by key stakeholders including the C/CAG TAC and from the public workshop as high, medium, or low.
- **Timeline** – Timeframe indicates whether the strategy should be completed in the short-term (2 years or less), medium-term (2-5 years), or long-term (over 5 years).
- **Cost** – Cost indicates the amount of resources needed to execute a strategy. One \$ indicates the strategy is limited to staff time only. Two \$\$ indicates that both staff time and consultants or contracts are needed up to \$1M. Three \$\$\$ indicates that staff time and consultants or contracts are needed exceeding \$1M in value.
- **Effort** – Effort indicates the amount of attention needed by staff to complete a strategy. The measure indicates the number of full-time employees (FTE) needed to oversee a strategy and any associated tasks. One icon would represent an effort of up to one FTE, two icons would represent more than

one and up to two FTEs, and three icons would represent more than two FTEs would be needed to support the strategy.





5.1. Agency Readiness











Agency Readiness





Public agencies in San Mateo County, including SMCTA, C/CAG, and others, will need to be resourced and ready to manage the various aspects of AV operations on public roadways as AV technologies continue to be deployed in the Bay Area. To adapt and prepare for AVs, agencies will require training existing staff, hiring new staff where needed, updating policies and procedures, and ensuring that any underlying systems are prepared to provide the necessary support. Private partnerships with industry may also need to be leveraged and expanded to help build expertise within the county.

Strategy 1.1 – Joint AV Working Group		
<p>Description Establish a joint AV Working Group to coordinate AV activities in the County and monitor developments in the AV industry. The Working Group should have at least one representative from each partner agency to serve as a primary point of contact for AV activities. SMCTA or C/CAG should lead the AV Working Group, maintain the list of agency contacts and provide updates to the group as needed.</p>	<p>Value to the County A joint working group offers opportunities for collaboration, shared priorities and a unified approach to AV-related transportation solutions. The working group can offer oversight of other agency readiness strategies.</p>	<p>Priority </p>
	<p>Potential Implementation Leads SMCTA, C/CAG, San Mateo County, Emergency Services, SamTrans and representatives from local jurisdictions could all be part of the AV Working Group.</p>	<p>Timeline </p>
		<p>Cost </p>
	<p>Effort </p>	

Strategy 1.2 – AV Outreach and Awareness Program for Agencies		
<p>Description Establish an Internal AV Outreach and Awareness Program to educate agency staff on potential AV benefits and impacts. The Joint AV Working Group should assist with coordinating what type of outreach or knowledge sharing is most relevant in San Mateo County. Internal outreach activities could include things like lunch-and-learn presentations, peer-to-peer information exchanges or establishing an internal email list to share AV-related information.</p>	<p>Value to the County Educated staff will be knowledgeable and prepared to engage with private companies offering AV-related transportation solutions either in partnership with or independently. Educated staff may also be able to make informed decisions about local technological upgrades.</p>	<p>Priority</p> 
		<p>Timeline</p> 
	<p>Potential Implementation Leads SMCTA and C/CAG hold joint responsibility for engaging agencies at the local level about identified AV developments, benefits and challenges.</p>	<p>Cost</p> 
		<p>Effort</p> 

Strategy 1.3 – Determine AV Staffing Needs		
<p>Description Investigate AV staffing needs for county agencies and develop an AV staffing plan for locally supported public projects such as leading or operating Shared AV or other pilots. If local regulation of AVs becomes an option beyond current State and Federal processes, additional staff or departments may be necessary to support the monitoring and support potential private sector fleet/robotaxi operations.</p>	<p>Value to the County Adequate staffing places the County in a position to be responsive to emerging opportunities and challenges that maintain road safety, improve connectivity, enable economic development and other goals identified in this strategic plan.</p>	<p>Priority</p> 
		<p>Timeline</p> 
	<p>Potential Implementation Leads SMCTA and C/CAG hold joint responsibility for engaging agencies at the local level about identified AV benefits and challenges and developing a database of AV staff leads for each agency.</p>	<p>Cost</p> 
		<p>Effort</p> 

Strategy 1.4 – AV Training		
<p>Description Develop a training program and training resources for agencies in the county to remain current on the AV industry. For example, job training for agency staff to help them understand the benefits and challenges of AVs and how to appropriately include AVs in agency projects. This strategy builds on strategy 1.2 by providing more formal AV training for staff.</p>	<p>Value to the County Staff may need to be trained to operate or maintain county-owned automated vehicles or vehicles with advanced driver assistance systems. Training will build the skill sets of county employees, adding value to their careers and to county operations.</p>	<p>Priority </p>
		<p>Timeline </p>
	<p>Potential Implementation Leads SMCTA and C/CAG hold joint responsibility for engaging agencies at the local level about identified AV training opportunities. Implementing this strategy will likely require bringing in additional resources such as outside instructors.</p>	<p>Cost </p>
		<p>Effort </p>

Strategy 1.5 – Integrate AV into the Planning Process		
<p>Description Integrate AV into the county’s planning process by considering their impact on future traffic (e.g., congestion, safety, mode choice) in long-term plans like the Countywide Transportation Plan update and Travel Demand Model.</p>	<p>Value to the County Planning documents work best when they consider all variables. If AV technologies become more prolific in the Peninsula, San Mateo County will be prepared to adapt and consider best use cases for residents, workers, students and those visiting the county.</p>	<p>Priority </p>
		<p>Timeline </p>
	<p>Potential Implementation Leads C/CAG holds responsibility for countywide planning and engaging agencies at the local level about identified AV benefits and challenges.</p>	<p>Cost </p>
		<p>Effort </p>

5.1.1. Agency Readiness Implementation Approach

As AV technology advances toward deployment, it will be important for agencies within San Mateo County to be resourced and ready to manage the many varied aspects of AV operations on public roadways, from safety to transit operations. Ensuring Agency Readiness will include:

- Ensuring the ability to adapt as transportation infrastructure becomes increasingly intertwined with new mobility services, digital communication, and AVs.
- Establishing and maintaining strategic partnerships with public, private, and nonprofit entities.
- Sustaining an organizational structure that enables innovation and can operate in a nimble and pragmatic manner.

As an initial step, the TA or C/CAG may want to identify or hire a dedicated staff lead who is responsible for implementing early project actions including establishing a Joint AV Working Group and ensuring AVs are accounted for in policy updates. This will likely be a part-time responsibility, approximately 10-20 hours per week. The TA might be in the best position to take the staffing lead and be responsible for providing technical assistance to structure the program and monitor initial projects. Another initial action the TA or C/CAG could take is to ensure C/CAG's Countywide Transportation Plan and SMCTA's Strategic Plan address AVs at least at a high level.





After these initial steps are taken, the TA and C/CAG could start to create awareness of AVs among the TA, C/CAG and local agency staff and create a program for the provision of technical assistance to structure local pilot programs and initial projects.





5.2. Infrastructure Readiness







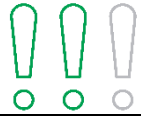



Infrastructure Readiness

Local agencies may consider investments into advancing transportation infrastructure networks to support AVs operating on public roadways. Infrastructure advancement may include physical changes such as improving pavement markings and striping or creating dedicated right of ways for AVs to separate them from other road users. Advancements may also include digital infrastructure such as improving the county's fiber network, data management capabilities, and wireless connectivity (e.g., broadband, 5G). Lastly, infrastructure readiness may also include making datasets available for AV use such as work zones and curb space.

Strategy 2.1 – Investigate AV Needs for Changes to Physical Infrastructure		
<p>Description Investigate the need to change physical infrastructure (e.g. pavement markings, bus stops) to support AVs and promote safe interactions between AVs and other road users (e.g., pedestrians/bikes). This activity should leverage research and guidance conducted by Federal Highway Administration (FHWA), National Cooperative Highway Research Program (NCHRP) and other organizations. This activity could also involve partnering with the private sector to gather information on infrastructure needs. Outcome is a summary of the infrastructure changes (e.g. wider lane stripes, narrower lanes, etc.) recommended to support AV operations.</p>	<p>Value to the County Safety and operational improvements to the physical infrastructure can be made now that will accommodate AV preparedness while also addressing current safety needs for all road users, creating efficiencies by applying investments to meet multiple needs.</p>	<p>Priority </p>
	<p>Potential Implementation Leads FHWA and federal research centers should fund the research with input from state (Caltrans) and local (SamTrans) agencies. SMCTA and C/CAG could compile a summary of findings to share with the cities.</p>	<p>Timeline </p>
		<p>Cost </p>
		<p>Effort </p>

Strategy 2.2 – Investigate AV Needs for Digital Infrastructure		
<p>Description Investigate AV needs for digital infrastructure (e.g., work zone data, curb space data, vehicle-to-infrastructure connectivity, digital mapping, etc.). This activity should leverage research and guidance conducted by FHWA, NCHRP and other organizations. Outcome is a summary of the digital infrastructure recommended to support AV operations.</p>	<p>Value to the County Improvements to the digital infrastructure that are made now will accommodate AV preparedness while also addressing current needs for better data exchange to improve transportation safety and mobility.</p>	<p>Priority </p>
	<p>Potential Implementation Leads FHWA and federal research centers should fund the research with input from state (Caltrans) and local (SamTrans) agencies. SMCTA and C/CAG could compile a summary of findings to share with the cities.</p>	<p>Timeline </p>
		<p>Cost </p>
		<p>Effort </p>

Strategy 2.3 – Infrastructure Assessment		
<p>Description</p> <p>Building on strategies 2.1 and 2.2, assess existing county infrastructure to determine locations with deficiencies or opportunities to upgrade county infrastructure to support AVs. This strategy could leverage data sharing with private AV companies, allowing them to function as road infrastructure inspectors. AVs, equipped with advanced cameras and lidar systems, can provide high-resolution photos and identify areas needing maintenance or upgrades to enhance AV safety and ensure smooth operation.</p>	<p>Value to the County</p> <p>Knowing the specific locations of infrastructure deficiencies and areas of need in the County will allow the County to determine the resources required to address these needs. Receiving data from AVs can more accurately and precisely identify the needs of AV operations and help prevent unnecessary upgrades to county infrastructure based solely on manual inspections or guidelines. It will also allow for a prioritized approach to make the necessary infrastructure improvements.</p>	<p>Priority</p> 
		<p>Timeline</p> 
	<p>Potential Implementation Leads</p> <p>SMCTA and C/CAG could collaborate with local towns and cities and AV companies to identify infrastructure improvement needs.</p>	<p>Cost</p> 
		<p>Effort</p> 

Strategy 2.4 – Upgrade County Infrastructure to Make it AV-ready		
<p>Description</p> <p>Building on strategy 2.3, strategically upgrade county physical and digital infrastructure to support AVs.</p>	<p>Value to the County</p> <p>Once the infrastructure needs have been determined, transportation agencies will need strategically implement those improvement projects over the coming decade. These improvements will ultimately result in a safer and more efficient transportation system.</p>	<p>Priority</p> 
		<p>Timeline</p> 
	<p>Potential Implementation Leads</p> <p>SMCTA and C/CAG can partner with local jurisdictions to implement infrastructure improvements across the county based on the identified needs from the infrastructure assessment.</p>	<p>Cost</p> 
		<p>Effort</p> 

5.2.1. Infrastructure Readiness Implementation Approach

Infrastructure investments must be made to ensure the existing network can support and efficiently enable AV operations. Infrastructure improvements includes both physical changes, such as improving pavement markings and striping, as well as digital infrastructure, such as advancing the county's ITS network, data management capabilities, and roadside connectivity in preparation to support various types of AV-related data directly from AVs and from partners (e.g., AV company testing information, city-level planning information, etc.).





To ensure that San Mateo County roads are ready to support AV operations, SMCTA and C/CAG should first leverage research conducted by FHWA, NCHRP, and other entities to determine what types of infrastructure improvements are needed for the safe and efficient operations of AVs. This effort would summarize the physical and digital infrastructure changes needed for AV operations. Next, SMCTA and C/CAG should work with local agencies to identify and prioritize infrastructure investment needs in the county. The study should prioritize investments that meet today's needs while considering tomorrow's technologies to support efficient and safe AV operation in the near- and long-term. The needs assessment should address the level of need for physical and digital infrastructure investments, as well as funding approaches, resources, and partnerships needed to achieve the desired outcome. Finally, San Mateo County will need to implement the infrastructure improvements recommended in the needs assessment.

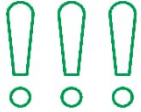



5.3. Outreach and Partnerships











Public Outreach and Partnerships

The operation of AVs in San Mateo County has broad implications for a wide variety of stakeholders and communities in the region. Information about AVs should be communicated to the public in an accessible, transparent, and equitable way. Facilitating increased awareness of the technology among the public, legislators, and local agencies can build trust and facilitate information sharing. There are also opportunities to build partnerships with private AV companies to increase awareness and leverage private sector investments.

Strategy 3.1 – Industry Collaboration		
<p>Description</p> <p>Foster collaboration and monitor developments in the AV industry by attending AV-related conferences, seminars, information exchanges and events. Network with peer agencies and private sector AV providers to stay abreast of the latest AV developments and issues.</p>	<p>Value to the County</p> <p>Collaboration and coordination with the AV industry technology developers, trade associations, and other public and private sector entities will support the county’s efforts around building readiness and preparations for AV operations.</p>	<p>Priority</p> 
		<p>Timeline</p> 
	<p>Potential Implementation Leads</p> <p>SMCTA and C/CAG could be responsible for maintaining visibility and presence at industry events and other opportunities to foster collaboration</p>	<p>Cost</p> 
		<p>Effort</p> 

Strategy 3.2 – Public Education and Outreach		
<p>Description</p> <p>Develop public outreach plans and fund outreach efforts that lay the groundwork for focus groups, user testing, public meetings, and other community events related to AV engagement and education. This activity may also involve the creation of a website or dashboard to communicate AV activities to the public. Outreach should focus on communicating the benefits of AV deployments such as safety, enhanced mobility and how AVs can improve the lives of citizens. Outreach should target groups with mobility challenges such as persons with disabilities, seniors and economically disadvantaged.</p>	<p>Value to the County</p> <p>Public education, input gathering, information sharing, and providing opportunities to safely experience AVs all enable an open and transparent public process that directly involves San Mateo County residents.</p>	<p>Priority</p> 
		<p>Timeline</p> 
	<p>Potential Implementation Leads</p> <p>SMCTA and C/CAG will hold ownership for the creation of public-facing information and capacity building materials for use and distribution by towns and cities.</p>	<p>Cost</p> 
		<p>Effort</p> 

Strategy 3.3 – Legislative Outreach		
<p>Description Develop outreach plans to educate and engage public officials for future AV policy and regulation needs. AVs will need to be incorporated into the TA’s legislative platform and will need to be considered at the C/CAG legislative committee. This strategy will also involve monitoring and assessing legislative bills related to AV operations.</p>	<p>Value to the County Educating the legislators on AVs and their potential impact on the public will be essential to ensure appropriate AV policy and regulation.</p>	<p>Priority </p>
		<p>Timeline </p>
	<p>Potential Implementation Leads SMCTA and C/CAG can lead coordination with regional and state legislators. Support from cities and towns will be needed at the local level.</p>	<p>Cost </p>
		<p>Effort </p>

Strategy 3.4 – Public Private Partnerships		
<p>Description Explore new public-private business models and partnerships to facilitate AV deployment. An example of this type of partnership could be getting large employers to share in the cost of an SAV pilot if it benefits their employees.</p>	<p>Value to the County Collaboration and coordination with the AV industry technology developers and other public and private sector partners will leverage private sector investment to help fund potential AV pilots and projects and offset agency costs.</p>	<p>Priority </p>
		<p>Timeline </p>
	<p>Potential Implementation Leads SMCTA and C/CAG will be responsible for holding conversations with industry to facilitate mutually beneficial partnerships in cooperation with State agencies and MTC.</p>	<p>Cost </p>
		<p>Effort </p>

5.3.1. Outreach and Partnerships Implementation Approach





The operation of AVs in San Mateo County has broad implications for a wide variety of people in the state. Information about AVs should be communicated to the public in a comprehensive, transparent, and inclusive way. Facilitating increased awareness of the technology will build broad trust and will support information sharing amongst stakeholders so lessons are learned together. County agencies could provide public education and outreach to advance understanding around the benefits and limitations of AV and related technologies (such as ADAS), to encourage safe, equitable, and effective deployment. In addition, intentionally cultivating strategic partnerships with industry and associations will support clear identification of needed actions, investment, and infrastructure needs to be addressed by the state, and will help build expertise within county agencies on an ongoing basis.





5.4. Policy











Public sector agencies may be faced with the need to develop policies to manage the safe, cost-effective, equitable and environmentally sustainable deployment of AVs in the county. Policies should be consistent at the local, regional, and state level and they should align with federal AV policy (as it evolves). In California, most AV regulatory policy (i.e., permitting) is set by the Department of Motor Vehicles (DMV) and the California Public Utilities Commission (CPUC) but local agencies can provide input to these state agencies to influence policy updates.

Strategy 4.1 – Support Regional AV Goals		
Description Work with MTC and other local agencies to support regional goals and policies related to implementation of AV. For example, pursue policies that limit workforce displacement resulting from AVs.	Value to the County Establishing AV goals and policies that are consistent with regional and state AV goals and policies will align San Mateo County with the rest of the region and state in terms of having a common approach to successful AV deployment.	Priority
	Potential Implementation Leads SMCTA and C/CAG in cooperation with State agencies (Caltrans, DMV, CPUC), local agencies (SamTrans) and MTC.	Timeline
		Cost
		Effort

Strategy 4.2 – Engage with State Regulatory Agencies		
<p>Description Monitor state regulations set by California DMV and CPUC on AVs. Engage with these agencies as appropriate to understand and influence state rules about how AVs interact with law enforcement/first responders and data sharing with AV companies.</p>	<p>Value to the County Learning from San Francisco’s experience, it will be critical to establish an open line of communications with state regulators as soon as possible to ensure that local needs and issues are considered in AV regulation.</p>	<p>Priority </p>
		<p>Timeline </p>
	<p>Potential Implementation Leads SMCTA and C/CAG will need to work in cooperation with State agencies (Caltrans, DMV, CPUC) to preserve local interests.</p>	<p>Cost </p>
		<p>Effort </p>

Strategy 4.3 – Establish a Data Sharing Policy for AVs		
<p>Description Establish metrics for measuring AV impacts (e.g., VMT, transit ridership, crash rates, near misses, etc.) and establish a list of data desired from AV companies that deploy in the county. Share data needs with State agencies and request data provided by AV service providers. Share data needs with local agencies to ensure a unified approach to data collection and sharing across San Mateo County.</p>	<p>Value to the County It will be important to establish a solid list of metrics that will help define the true impacts of AVs on the County. The data provided by AV companies is needed by state and local agencies to conduct ongoing AV Incident reporting and analysis to better understand AV safety impacts.</p>	<p>Priority </p>
		<p>Timeline </p>
	<p>Potential Implementation Leads SMCTA and C/CAG in cooperation with State agencies (DMV, CPUC), MTC and private operators (as appropriate).</p>	<p>Cost </p>
		<p>Effort </p>

Strategy 4.4 – Establish an Equity Policy for AVs		
<p>Description Develop policy that requires equity consideration as part of public spending supporting AV testing and deployment. Equity considerations may include racial equity, low income, physical and cognitive disabilities. The needs of persons with disabilities shall be considered in all AV pilots in the County. This countywide equity policy will be shared with local agencies to ensure a unified AV approach across San Mateo County. Equity must be considered in all AV pilots before public funding is released.</p>	<p>Value to the County AVs have the potential to ensure equal service and improve accessibility in all communities and neighborhoods without bias. Having an equity policy in place will promote this ideal.</p>	<p>Priority </p>
	<p>Potential Implementation Leads SMCTA and C/CAG in cooperation with State agencies and MTC.</p>	<p>Timeline </p>
		<p>Cost </p>
		<p>Effort </p>

Strategy 4.5 – Incorporate AVs into County Funding Programs		
<p>Description Look for opportunities to incorporate AV concepts into existing county funding programs to encourage local municipalities and/or companies to explore and lead their own AV projects.</p>	<p>Value to the County Providing local agencies with a potential source of AV funding will empower them to take on their own AV initiatives and advance AV deployment and understanding throughout the county.</p>	<p>Priority </p>
	<p>Potential Implementation Leads SMCTA can update Measure A and W funding programs to include AV pilots and projects such as the Alternative Congestion Relief/Transportation Demand Management and Shuttle Programs. C/CAG and SMCTA can collaborate with other agencies to seek opportunities to fund AV projects.</p> <p>C/CAG’s Measure M program, \$10 vehicle registration fee, can also be another potential source of funding for AV projects.</p>	<p>Timeline </p>
		<p>Cost </p>
		<p>Effort </p>

5.4.1. Policy Implementation Approach

AVs have the potential to increase safety and reduce injuries and fatalities related to vehicle incidents. Establishing policies and expectations for AV operations and interactions with road users is imperative to ensure safety for all. The safety potential that AVs present is not guaranteed and will depend on what requirements are placed on developers as well as what infrastructure and tools are available to them, including engagement with and education for law enforcement and first responders, AV incident reporting and analysis, and ongoing monitoring of AV activities to improve equity and safety-related legislative and operational policies.

SMCTA and C/CAG will need to work with state regulatory agencies to ensure that AV companies understand their responsibilities in terms of data sharing, communicating with local emergency responders and promoting equity before deploying their AV services. SMCTA and C/CAG should engage with emergency responders across the county to help them understand how to interact with AVs and to better understand their needs and challenges. The county should also work to remove barriers to AV access by engaging with impacted communities to understand current and expected barriers and then define and implement effective, cohesive policies for equitable AV access and use without undue burden or unintended impacts.

5.5. Pilots and Testing








Pilots and Testing

The proliferation of AV technology requires agencies to have access information on performance, capabilities, applications, and data collection. Testing and pilots will enable agencies to understand potential benefits and see what is needed to support them in the future, paving the way for further developments.

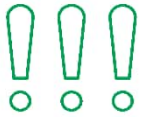



There are a variety of different use cases that could be explored via testing and pilots – including transit, paratransit, ride hailing, last mile goods delivery, and private passenger AVs – to better understand each use case’s specific needs, opportunities, and impacts in real-world context to identify realistic opportunities and actions the county can make to prepare for AVs.





Strategy 5.1 – AV Pilot Planning		
Description Hold discussions with peer agencies and self-certified, permitted AV companies and the public about testing in San Mateo County. Conduct a suitability analysis and compile a list of potential funding sources and concepts for future pilot and testing activities. This should include an assessment of key destinations that can be linked through short distance shared AVs including within neighborhoods with infrequent	Value to the County Through AV testing and pilots, the county and its localities can learn valuable lessons and increase its knowledge base of AV technologies, services, benefits, impacts, and opportunities to evolve its regulatory approach to prepare for safe AV operations. The first step is to compile a list of potential pilots, partners, and funding sources.	Priority
		Timeline

transit services. Outreach efforts should help prioritize where such services could best benefit residents, visitors, and employers. AV pilot planning should include allowing the public to experience different AV types prior to pilots.	Potential Implementation Leads SMCTA and C/CAG in collaboration with private operators.	Cost 
		Effort 

Strategy 5.2 – Shared AV Shuttle Pilot		
<p>Description</p> <p>Fund and execute a shared AV shuttle pilot at one or more locations in the county to improve first/last mile connections to transit. A key criterion for selecting pilot locations should be serving equity priority communities. From discussions with stakeholders and the community workshop, potential locations for an AV shuttle pilot include:</p> <ul style="list-style-type: none"> • Millbrae to Burlingame <ul style="list-style-type: none"> ○ Connect Millbrae BART station to Broadway Caltrain Station along California Drive (~3-mi) • Shuttles to connect to BART Stations and Caltrain Stations <ul style="list-style-type: none"> ○ BART: Daly City, Millbrae ○ Caltrain: San Mateo, Hillsdale, Redwood City, Millbrae • Senior living centers such as Bell Haven Community in Menlo Park • Shuttles to connect travelers from park and ride facilities to beaches and parks near the Pacific Coast. • Shuttles connecting the Coast with to the rest of the peninsula (e.g. over SR 92) • Shuttle service to Canada Community College, Sequoia Hospital, Bair Island Neighborhood in Redwood City. • Belmont Caltrain Station to the Notre Dame Belmont campus 	<p>Value to the County</p> <p>AV shuttles offer an alternative mode of transportation to citizens lacking access to a vehicle and they can provide viable first/last mile transit solutions. They typically travel at lower speeds (below 25 mph) and carry 5 to 15 passengers.</p>	<p>Priority</p> 
	<p>Potential Implementation Leads</p> <p>SMCTA and C/CAG with input from cities, towns and possible funding support from Caltrans or FHWA.</p>	<p>Cost</p> 
		<p>Effort</p> 

<ul style="list-style-type: none"> San Carlos shuttle between the Caltrain Station and businesses to the north and south of the station 		
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Strategy 5.3 – Transit ADAS Pilot		
<p>Description Fund and execute for an AV pilot to equip SamTrans buses with ADAS to improve driver safety. Potential ADAS features to consider in the pilot include:</p> <ul style="list-style-type: none"> Blind spot warning Lane keeping assist Emergency braking Pedestrian detection Precision docking Bus platooning in bus rapid transit lanes 	<p>Value to the County Buses equipped with partial automation or ADAS have the potential to greatly reduce the number of collisions with other vehicles and vulnerable road users in addition to reducing stress and workload on bus drivers.</p>	<p>Priority </p>
	<p>Potential Implementation Leads SMCTA and C/CAG with input from cities, towns and possible funding support from Caltrans or FHWA.</p>	<p>Timeline </p>
		<p>Cost </p>
		<p>Effort </p>

Strategy 5.4 – AV Data Sharing Pilot		
<p>Description Fund and execute an AV pilot focused on data sharing with an AV partner. The pilot could focus on several potential data sharing use cases including:</p> <ul style="list-style-type: none"> • providing work zone data to an AV partner to improve AV safety • providing curb use data to an AV partner to improve operational efficiencies and safety at typical pick-up and drop-off locations • providing 2-way data exchange between AVs and emergency responders to improve safety and awareness at incident scenes. 	<p>Value to the County Sharing of real-time data between AVs and public agencies can improve the safety and operational efficiency of AVs, which ultimately benefits everyone in San Mateo County.</p>	<p>Priority </p>
		<p>Timeline </p>
	<p>Potential Implementation Leads SMCTA and C/CAG with input from cities, towns and possible funding support from Caltrans or FHWA.</p>	<p>Cost </p>
		<p>Effort </p>

5.5.1. Pilots and Testing Implementation Approach

As AV technologies continue to evolve, and the County continues to evaluate potential policy approaches to enabling the safe operation of AVs on San Mateo County’s roadways, AV testing and conducting pilots provides the opportunity to experience AVs in a real-world environment to better understand how AVs operate, the benefits they may bring, and the impacts and implications they may introduce.

Conducting AV testing and pilots in San Mateo County would allow the County to:

- Provide the public with the opportunity to have first-hand experience AV technology and services, building a better understanding and awareness of these technologies.
- Enable the exploration of various operational considerations unique to San Mateo County as it prepares for future AV deployments, such as unique geographic, socioeconomic, and equity considerations and policy approaches.
- Identify approaches to increase equitable access, such as leveraging AVs to provide services in disadvantaged communities and close transit gaps in underserved communities.
- Better understand agency capabilities and limitations, training and partnership opportunities, and policy and organizational needs.

The goal of this pillar is for San Mateo County to conduct several county-sponsored and managed AV pilots in multiple locations countywide. The sponsored pilot should focus on ensuring public safety, expanding public awareness, gathering public input on needs that AV services could address, and identifying opportunities and hurdles for increasing equitable access to AVs. SMCTA and C/CAG should also encourage local municipalities and/or companies to manage their own AV projects.

The first step in conducting county-sponsored pilot is to develop an AV Pilot Plan as described in Strategy 5.1. The TA could fund this project by applying for funding through their ACR/TDM ITS program to set up an AV pilot program and request technical assistance. The AV Pilot Plan should include a list of potential pilot concepts, partners and funding sources. This list should include pilot concepts that cover strategies 5.2, 5.3 and 5.4. Once this list has been developed, the County should reach out to peer agencies that have recent experience conducting similar AV pilots. For example, SFCTA recently conducted an SAV pilot on Treasure Island ⁷ and CCTA is conducting an SAV pilot at Bishop Ranch in San Ramon⁸. San Mateo County can learn a lot from these exchanges including a more detailed estimate of pilot costs, route considerations and potential issues to be aware of. Next, the County will need to prioritize which pilots they wish to pursue first depending on county needs, stakeholder enthusiasm and funding availability. If adequate funding is not available for a pilot, the County will need to develop a strategy to secure the necessary funds (see Section 6 for potential funding sources).

Once the highest priority pilots have been defined and funding secured, the next step is to set a path for executing the pilots. This will involve the following steps:

- Identify and resource a lead agency to oversee the pilot.
- Lead agency to further define the pilot service plan and specific locations,
- Lead agency to identify and coordinate with agency partners,
- Lead agency to secure and manage industry partners,
- Lead agency to oversee pilot operations.
- Lead agency to complete the pilot and comply with any grant funding requirements.

As AV pilots are executed, there will be opportunities to share benefits, challenges and lessons learned with the broader AV community. This is where the pilots and testing pillar intersects with the other AV roadmap pillars by building agency readiness and partnerships, informing the need for infrastructure readiness, supporting public outreach and informing policy needs.

⁷ <https://www.sfcta.org/projects/treasure-island-autonomous-shuttle-pilot>

⁸ <https://ridepresto.com/>

5.6. Roadmap for the Future

Given that resources, such as funding and staff time, are limited, this list of strategies is more than San Mateo agencies can handle at one time. Responding to stakeholder feedback and drawing from the engagement plan takeaways in Section 4.2, the roadmap for the future has been broken into near term and mid-term actions specifically for C/CAG and SMCTA. The themes of safety, partnerships, connectivity, and the launch of shuttles to meet sustainable first and last mile needs had emerged as frequently in discussion with stakeholders and the community, which informed the development of the AV strategies. The rest of this section presents a list of specific short-term actions for C/CAG and SMCTA to consider. Each action is mapped to a strategy from AV roadmap.

Specific Short-term C/CAG and SMCTA Actions

<p>Establish Reciprocal Partnerships</p>	<p>Short Term Action 1 - Identify or hire a dedicated staff lead between the TA & C/CAG who is responsible for implementing early project actions including establishing a Joint AV Working Group and ensures AVs are accounted for in policy updates. This will likely be someone part-time responsibility, approximately 10-20 hours per week. The TA might be in the best position to take the staffing lead to establish the program. They can also provide technical assistance to structure the program and monitor initial projects. (Aligns with Strategy 1.3)</p> <p>Short Term Action 2 - Establish a Joint AV Working Group to guide both pilot feasibility study and other programmatic work like educational, training and safety campaigns. (Aligns with Strategy 1.1,1.2, 3.1 and 3.2)</p> <p>Short Term Action 3 Ensure C/CAG's Countywide Transportation Plan and SMCTA's Strategic Plan address AVs. The CTP should acknowledge the ability of AVs to help meet its goals. SMCTA's Strategic Plan should allow AV pilot operations under the Measure A Shuttle Program category, consider AV transit infrastructure in the Regional Transit Connections Program category, and continue to allow AV planning, programs, and design work under the ACR/TDM ITS category. (Aligns with Strategy 1.5)</p>
<p>Shuttle Service / Connectivity</p>	<p>Short Term Action 4 - Apply for the TA's ACR/TDM ITS program to set up a shared automated shuttle pilot program and request technical assistance. A planning project to assess the feasibility of AV pilots in equity priority areas should be established and include engagement with those communities to identify pilot routes. (Aligns with Strategy 5.1)</p>

Specific Mid-term C/CAG and SMCTA Actions

<p>Establish Reciprocal Partnerships</p>	<p>Mid Term Action 1 – Create awareness for the TA or C/CAG staff amongst local jurisdictions and create a program for the provision of technical assistance to structure local pilot programs and initial projects. (Aligns with Strategy 1.3)</p> <p>Mid Term Action 2 - Maintain the joint AV working group to guide both pilot feasibility studies and other programmatic work like educational and safety campaigns. (Aligns with Strategy 3.2 and Strategy 5.1)</p> <p>Mid Term Action 3 - Update C/CAG Countywide Transportation Plan and SMCTA Strategic Plan address AV's. Clarify how AVs are represented in the CTP and SMCTA Strategic Plan based on prior experience and actions. (Aligns with Strategy 1.5)</p>
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Shuttle Service / Connectivity	Mid-term Action 4 - Based on the planning feasibility study, apply for funding to implement a pilot focused on connecting underserved areas of San Mateo County with regional transit and other key community identified destinations. (Aligns with Strategy 4.4 and Strategy 5.2)
Safety	Mid-term Action 5 – Create a Public Education Campaign related to public and private AVs on the roadways. Consider applying for an OTS grant and/or ACR/TDM funding to advance this action. (Aligns with Strategy 3.2)

When looking at the strategies collectively, a roadmap for future action becomes clear. Figure 13 presents a proposed timeline for implementing the strategies. The Plan has outlined 13 short-term strategies that can be acted on relatively soon as resources allow. Most of these could begin in less than two years’ time, if not immediately if resources were unlimited. The list of short-term strategies could be further reviewed based on priority, cost, and efforts measures. The medium-term and long-term strategies typically take more resources and should be reviewed annually to determine if action is warranted and if funding is available to move the strategy forward.

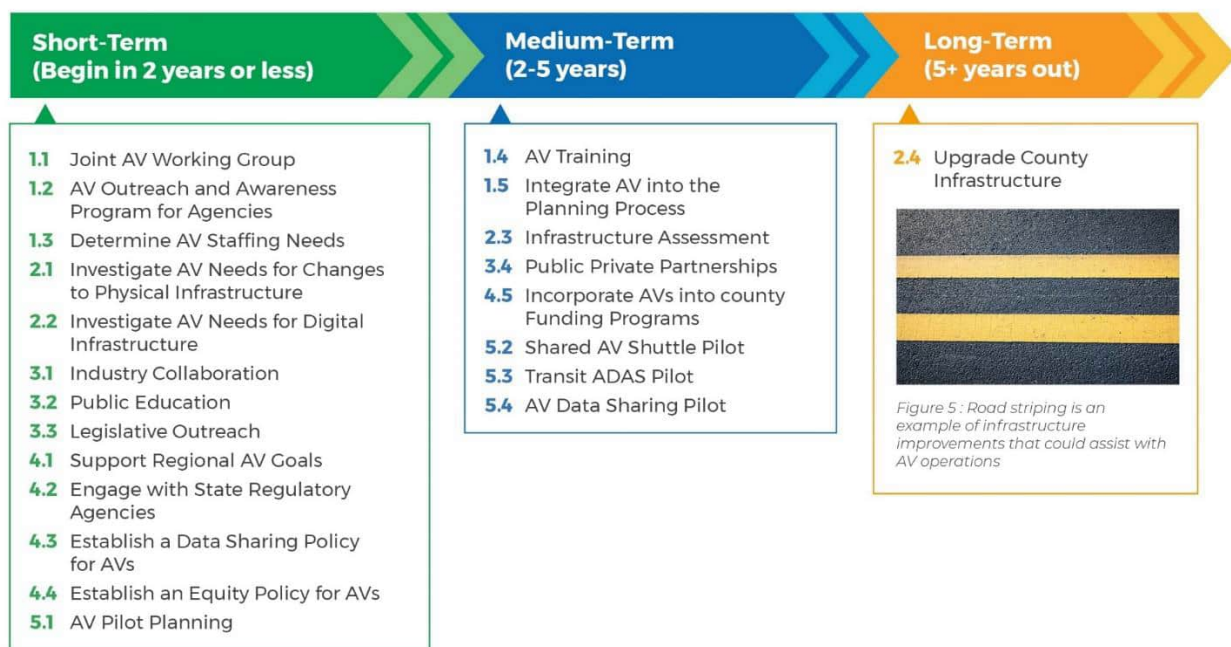


Figure 13: Strategy Implementation Timeline

6. Funding Opportunities

As the San Mateo County AV Program grows in scope and budget, additional funds and resources will be needed to realize the vision described in Section 2.2. Therefore, it will be critical to follow a funding approach that considers the shifting infrastructure funding landscape and the new opportunities that are becoming available. In recent years funding efforts at the regional, state, and federal levels have increased the available formulaic and discretionary funds available for transformative infrastructure programs such as the county's AV program. San Mateo County and their partners have the opportunity to capture many of these funds to advance their AV program.

This section outlines many of the current funding sources available to fund the strategies detailed in the AV roadmap. As shown, several federal, state, regional, local, and partner fund sources may be utilized to support the development and delivery of the county's AV program and projects. There are several project-specific funding sources that may apply to specific projects in the overall program. For example, the federal SMART grant program would most likely provide grant funding to implement the projects listed under the pilots and testing pillar. A description of potential funding sources is provided below.

6.1. Federal

There are currently several competitive federal funding programs available to fund the strategies listed in the AV roadmap. The largest and most applicable of these federal funding sources are described below.

6.1.1. *Strengthening Mobility and Revolutionizing Transportation (SMART)*

The Bipartisan Infrastructure Law (BIL) established the SMART discretionary grant program with \$100 million appropriated annually for fiscal years (FY) 2022-2026. The SMART program was established to provide grants to eligible public sector agencies to conduct demonstration projects focused on advanced smart community technologies and systems in order to improve transportation efficiency and safety. Eligible entities include public state and local agencies, transit agencies, metropolitan planning organizations and federally recognized Tribal governments. Eligible projects include automated vehicles, connected vehicles, delivery innovation, and smart traffic signals.

SMART is a two-stage program. Stage 1 (\$250,000 to \$2 million) grants are to be focused on planning and prototyping. Stage 2 projects (up to \$15 million) should be implementation projects that show a scaled-up demonstration of the stage 1 project. Stage 1 of SMART does not have a local match requirement. More information is available on USDOT's website at <https://www.transportation.gov/grants/SMART>.

Advanced Transportation Technologies and Innovation (ATTAIN)

The ATTAIN program provides funding to deploy, install, and operate advanced transportation technologies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment. This program was previously known as the Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) grant program. Eligible applicants include state and local governments, transit agencies, planning organizations, and academic and research institutions. Eligible activities include planning, construction, equipment, operations and maintenance, technology demonstrations, technical assistance, workforce development, and

training/education, research and development, and accessibility. Many of strategies in the AV Action Plan would be eligible under this program.

ATTAIN is funded at \$60 million annually with a maximum of \$12 million per project and a 20% local match. More information is available on USDOT's website at <https://www.fhwa.dot.gov/bipartisan-infrastructure-law/attain.cfm>.

Safe Streets and Roads for All (SS4A)

The SS4A program funds regional, local, and Tribal initiatives through discretionary grants to prevent roadway deaths and serious injuries. Eligible entities include counties, cities, towns, transit agencies, and other special districts that are political subdivisions of a State; metropolitan planning organizations; federally recognized Tribal governments. The Bipartisan Infrastructure Law provides \$5 billion over 2022 to 2026 to this discretionary grant program with nearly \$1.3 billion available in FY 2024.

The program is designed to encourage communities to develop and carry out Vision Zero Action Plans, or comprehensive safety plans, aimed at reducing road fatalities and injuries. Grant funding can be used to develop these safety plans, to develop strategies to implement the safety plans, and to implement those strategies. Since technology is a key a key component in helping communities reach their Vision Zero goals, this program can be used to fund some of the strategies described in this report such as AV pilots and digital infrastructure including V2X and ITS technology. More information is available on the following USDOT website: <https://www.transportation.gov/grants/SS4A>.

6.2. State

There are also relevant state funding programs available to fund the strategies listed in the AV roadmap. The largest and most applicable of these state funding sources are described below:

6.2.1. SB1 Local Partnership Program

Senate Bill 1 created the Local Partnership Program (LPP) that continuously appropriates \$200 million annually to be allocated by the California Transportation Commission (CTC) to local or regional agencies. Eligible recipients include jurisdictions with voter approved taxes, tolls, or fees, which are dedicated solely to transportation improvements. The LPP provides funding to local and regional agencies to improve:

- Aging Infrastructure
- Road Conditions
- Active Transportation
- Transit and Rail
- Health and Safety Benefits

The LPP has both a formulaic component and a competitive component. Eligible projects include improvements to the state highway system, improvements to the local road system, improvements to transit service (including acquisition of vehicles), improvements to bike and pedestrian safety and improvements to mitigate environmental impact. To date, most of the LPP funds have funded highway improvements but past LPP funded projects have also included local street improvements such as traffic

signal enhancements and transit improvements. It is possible that some of the strategies mentioned in the AV roadmap could be eligible for these funds. More information is available on the CTC website: <https://catc.ca.gov/programs/sb1/local-partnership-program>.

SB1 Solutions for Congested Corridors Program (SCCP)

SCCP is a statewide, competitive program that provides funding to achieve a balanced set of transportation, environmental, and community access improvements to reduce congestion throughout the state. The program was created by the Road Repair and Accountability Act of 2017 (SB 1). The SCCP makes \$250 million available annually to projects that implement specific transportation performance improvements and are part of a comprehensive corridor plan, by providing more transportation choices while preserving the character of local communities and creating opportunities for neighborhood enhancement.

Regional transportation planning agencies, county transportation commissions, and Caltrans are eligible to apply for program funds. Eligible agencies must nominate projects to apply for SCCP funds. All nominated projects must be identified in a currently adopted regional transportation plan and an existing comprehensive corridor plan.

Eligible project elements within the comprehensive corridor plans may include improvements to state highways, local streets and roads, rail facilities, public transit facilities, bicycle and pedestrian facilities, and restoration or preservation work that protects critical local habitat or open space. So far, the SCCP program has not funded any AV-specific projects, but it has funded many ITS infrastructure enhancements and transit improvements including purchasing of zero emission transit vehicles. Therefore, it appears that some of the strategies in the AV Action Plan could be eligible for SCCP funds, especially as part of a larger corridor project (e.g. US-101). More information is available on the CTC website: <https://catc.ca.gov/programs/sb1/solutions-for-congested-corridors-program>

Transportation Fund for Clean Air (TFCA)

The Bay Area Air Quality Management District (BAAQMD) is authorized by the State to levy a fee on motor vehicles. Funds generated by the fee are referred to as the TFCA funds. These funds are used to implement projects to reduce air pollution from motor vehicles. For San Mateo County, C/CAG has been designated as the County Program Manager to receive the funds. C/CAG distributes funds to qualifying projects that reduce air pollution, greenhouse gas emissions, and traffic congestion by improving transportation options. Cities, towns, county and transit agencies in San Mateo County are eligible to apply. Eligible projects must support the TFCA Program goals. In the past, projects have included arterial traffic management projects using advanced transportation technology and projects that improve transit service. As an example, Commute.org recently used TFCA funds to operate shuttles that provide first/last mile connections between BART stations and residential and employment locations in San Mateo County. This could be a potential funding source for some of the SAV pilot ideas described in Strategy 5.2.

6.3. Regional and Local

In addition to federal and state funding programs, there are regional programs administered by MTC and county programs administered by SMCTA that could be a funding source for some of the strategies in the AV roadmap. A few of them are described below:

6.3.1. *Innovative Deployments to Enhance Arterials (IDEA)*

MTC established the IDEA program to improve arterial operations and enhance the Bay Area's readiness for connected and automated vehicle technologies. IDEA is both a funding program and a technical assistance program to support local Bay Area agencies in deploying advanced technologies along arterials to enhance mobility, sustainability, and safety across all modes. At its core, the IDEA program seeks to:

- Improve travel time and travel time reliability along arterials for autos and transit vehicles;
- Improve safety of motorists, transit riders, and pedestrians;
- Decrease motor vehicle emissions and fuel consumption; and
- Improve knowledge and proficiency in the use of advanced technologies for arterial operations.

Since 2018, the IDEA program has provided over \$13 million in federal funds to help cities, counties and transit agencies improve the operation of major arterial roadways and to make these streets more ready for CAV technologies. Many of these past projects involved piloting of shared AV shuttle service. Since the IDEA program includes Federal funds, the program requires local matching funds. It should be noted that MTC has recently shifted the focus of this program away from funding SAV pilots and towards transit signal priority projects but there still might be eligible AV projects to consider.

6.3.2. *San Mateo County Measure A and W Programs*

San Mateo County has two voter-approved measures dedicated to transportation improvements: Measure A, a half-cent sales tax approved in 1988 and reauthorized in 2004 and Measure W another half-cent sales tax approved in 2018. Both programs provide long term funding for county-led transportation projects that support highways, local streets, transit, bicycles and pedestrians, regional connections, and alternative congestion relief programs. These two funding programs are guided by goals and a vision that are similar to the AV goals and vision described in Section 2 (i.e. enhance safety, reduce congestion, improve regional connectivity, increase mobility options, etc.). As described in Strategy 4.4, the County should explore how these two programs can be expanded or modified so that AV projects such as those in the AV action plan can be eligible for funding. More information on the Measure A/W programs is available on the SMCTA web site: <https://www.smcta.com/about-us/strategic-plan-2020-2024/measure-w-programs>.

6.3.3. Funding Considerations

In recent years, competitive grants at all levels of government have started to prioritize multimodal investments, with a greater emphasis on environmental and social justice. Most funding opportunities also attract more competition for those funds, so the grant capture strategy should include creative ways to increase the competitiveness of the grant application, such as bundling projects in a way that increases eligibility and maximizes legitimate synergies amongst the disparate projects. To increase the chances of success in applying for discretionary funds, the application process cannot be reactive to announced solicitations, but rather proactive in terms of gathering information, fostering relationships, and following a pre-determined plan. For example, the County should immediately start to build partnerships with other agencies and private sector companies that have a shared interest in deploying potential AV pilots and projects throughout the county.

It is also important to note that a successful funding approach does not end with securing and programming the funds. It must take into account managing disbursements and expenditures deadlines and reporting requirements. AV projects often must deal with uncertainties which may impact their ability to receive or to spend certain funds. Having the necessary resources and processes in place for an efficient fund management process that manages these risks will be critical as the county's AV program grows.

7. Conclusion

The San Mateo Countywide AV Strategic Plan project was established to identify current local, statewide, and federal policy and regulatory frameworks for AVs; establish a shared vision for AV deployment that aligns with county and state objectives; identify opportunities and challenges for AV deployment and pilot projects; and prioritize next steps for implementing AV Strategic Plan initiatives.

This Plan has summarized the steps taken throughout the project to define the basics of AV technologies and clarify San Mateo County's priorities along with the latest activities to indicate the state of AVs locally. The Plan also highlights the key efforts and takeaways from extensive stakeholder outreach conducted in 2022 and 2023. Stakeholder outreach led to a series of strategies that collectively form San Mateo County's roadmap for action to embrace AVs within the community as transportation technologies continue to advance.

This roadmap aligns well with several current funding programs at the local, state and federal levels that are summarized in the Plan. The roadmap also encourages collaboration among public and private partners that is critical to ensuring successful AV deployment in the County. Lastly, the roadmap also encourages further engagement with stakeholders and the public in alignment with Strategic Plan goals and to tailor implementation to community needs.

8. Appendices

Appendices have been aggregated to provide additional information and resources relevant to the development of this Strategic Plan. The following appendices can be found on subsequent pages.

- **Appendix A:** Project Website
- **Appendix B:** Project Fact Sheet
- **Appendix C:** Stakeholder Outreach Summaries
 - One-on-One Interviews
 - SamTrans Roundtable
 - SFMTA & SFCTA Peer Exchange
- **Appendix D:** Public Workshop Presentation
- **Appendix E:** Draft Countywide AV Strategic Plan Stakeholder and Public Comment Resolution Matrix

San Mateo Countywide Automated Vehicles Strategic Plan



Appendix A: Project Website



San Mateo Countywide Automated Vehicles Strategic Plan

Automated Vehicles (AV) are rapidly emerging as a transformative technology with the potential to revolutionize various sectors of transportation. From personal vehicles to shuttles, transit, freight, delivery and more, automation will reshape mobility in San Mateo County. Recognizing this potential, the San Mateo County Transportation Authority (SMCTA) and City/County Association of Governments of San Mateo County (C/CAG) are working together to develop the San Mateo Countywide Automated Vehicles Strategic Plan.

[FACT SHEET](#)

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Project Overview

The SMCTA and C/CAG are co-sponsoring a Strategic Plan coupled with a five year action plan to prepare for the advent of AV in San Mateo County. The plan will include strategies and recommendations for the prioritization of AV pilots, projects, and activities that align with the federal, state, and local visions for AV deployment to improve

connectivity and mobility.

Project Team

- SMCTA (Implementing Agency and Co-Sponsor)
- C/CAG (Co-Sponsor)

Project Goals

- Identify current local, statewide, and federal policy and regulatory frameworks for AV
- Establish a shared vision for AV deployment that aligns with county and state objectives
- Identify opportunities and challenges for AV deployment and pilot projects
- Prioritize next steps for implementing AV Strategic Plan initiatives

Project Timeline

- **Phase 1 (Summer 2023):** Identify the existing AV programs at the county, state, and federal levels through research and conversation with stakeholders, and local and state agencies
- **Phase 2 (Fall 2023):** Using stakeholder and public feedback, develop a framework for AV pilot programs, projects, and activities that align with County policies, plans, and funding opportunities
- **Phase 3 (Winter 2023):** Prepare the draft San Mateo AV Strategy, incorporating the feedback received from the public, stakeholders, and agencies

Ways to Get Involved!

- **Virtual Workshop**
 - SMCTA and C/CAG hosted a virtual public workshop on November 15th, 2023 from 6:00pm - 8:00pm to seek feedback on the development of the San Mateo Countywide Automated Vehicle Strategic Plan. A meeting recording and the presentation slides are provided below.

Recording Available: [SMCTA Youtube Channel](#)

Presentations: [English](#) [Español](#) [Simplified: 简体](#) [Traditional: 繁體](#) [Tagalog](#)

Documents

- Towards an Autonomous Future in San Mateo County Virtual Workshop (November 17, 2021)
 - [Video Recording](#) (YouTube)
 - [Summary Fact Sheet](#)
- [Draft Existing Conditions Report - August 2023](#)

For more information or questions, please email info@smcta.com

Sign up for service updates and rider news, manage your existing account or unsubscribe

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San Mateo Countywide Automated Vehicles Strategic Plan

Appendix B: Project Fact Sheet

San Mateo Countywide Automated Vehicles Strategic Plan

FACT SHEET

Automated Vehicles (AV) are rapidly emerging as a transformative technology with the potential to revolutionize various sectors of transportation. From personal vehicles to shuttles, transit, freight, delivery and more, automation will reshape mobility in San Mateo County. Recognizing this potential, the San Mateo County Transportation Authority (SMCTA) and City/County Association of Governments of San Mateo County (C/CAG) are working together to develop the San Mateo Countywide Automated Vehicles Strategic Plan.

Project Scope

The SMCTA and C/CAG are co-sponsoring a Strategic Plan coupled with a five year action plan to prepare for the advent of AV in San Mateo County. The plan will include strategies and recommendations for the prioritization of AV pilots, projects, and activities that align with the federal, state, and local visions for AV deployment to improve connectivity and mobility.

Project Goals

- Identify current local, statewide, and federal policy and regulatory frameworks for AV
- Establish a shared vision for AV deployment that aligns with county and state objectives
- Identify opportunities and challenges for AV deployment and pilot projects
- Prioritize next steps for implementing AV Strategic Plan initiatives

Project Timeline



- Phase 1 (Summer 2023): Identify the existing AV programs at the county, state, and federal levels through research and conversation with stakeholders, and local and state agencies
- Phase 2 (Fall 2023): Using stakeholder and public feedback, develop a framework for AV pilot programs, projects, and activities that align with County policies, plans, and funding opportunities
- Phase 3 (Winter 2023): Prepare the draft San Mateo AV Strategy, incorporating the feedback received from the public, stakeholders, and agencies

Key Project Benefits

The AV Strategic Plan will:

- Help transportation agencies and the public in San Mateo County plan and prepare for future AV deployment
- Develop a cohesive strategy for the implementation of AV pilots and programs
- Set a vision for shared and connected AV infrastructure
- Position the county to strategically compete for funding and economic development opportunities related to future AV programs

San Mateo Countywide Automated Vehicles Strategic Plan

FACT SHEET

FAQ

What are AVs?

AVs perform the primary driving functions of vehicles (i.e. steering, acceleration, and braking) with varying degrees of human intervention. These systems can assist with sensing, communicating, monitoring, navigating, and decision-making, depending on the level of automation (illustrated below).

0	1	2	3	4	5
No Automation	Driver Assistance	Partial Automation	Conditional Automation	High Automation	Full Automation
Zero autonomy, the driver performs all driving tasks.	Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.	Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.	Driver is necessary, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.	The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.	The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.





Society of Automotive Engineers (SAE) Automation Levels Full Automation

What are some of the impacts of AVs in San Mateo County?

AVs have the potential to impact traffic safety, highway and road congestion, efficiency and movement of people and goods, and even introduce transportation options for individuals who have physical limitations or disabilities.

What are some practical applications for AV?

There are several modes under the umbrella of AV including personal vehicles, ride hailing vehicles, transit, and freight.

PERSONAL VEHICLES	RIDE HAILING VEHICLES	TRANSIT	FREIGHT
			
Automated cars may improve safety, reduce congestion, and provide new mobility options for individuals who are unable to drive.	AV shuttles and taxis to supplement public transport and provide first and last-mile connections.	Driver assistance technologies for mass transit and autonomous first/last mile shuttles.	Automated trucking and package delivery aimed at increasing supply chain efficiency, improving safety, and reducing costs.

FOR MORE
INFORMATION

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 650 - 508 - 6200

San Mateo Countywide Automated Vehicles Strategic Plan

Appendix C:

Stakeholder Outreach Summaries

Prepared by



San Mateo County AV Strategic Plan Discussion – MTC

August 15, 2023

Attendance

- MTC: Rob Rich
- SMCTA: Vamsi Tabjulu
- WSP: Ben McKeever, Katie McLaughlin

Notes

- Rob: Which agencies are involved in this project?
 - Ben: It's countywide, and we're working with both C/CAG and SMCTA. We will be engaging with a subset of cities in the county as well.
- Rob: Is the scope Level 4 of automation and up?
 - Ben: The scope is flexible and nothing is off the table. The focus is on Level 3 and up, but there could be some Level 2 applications, such as ADAS for transit safety.
- Ben: We have also had initial discussions about pursuing a SMART grant.
 - Rob: Don't think that MTC will apply this cycle, but sure that a number of agencies in the region will. It's a quick turnaround time, especially if you're still in the outreach stage.
 - Ben: Will note that a SMART Phase 1 Grant does not require a match.
 - Rob: Generally, the concern with grant funding is that it does not include O&M after the initial pilot period. This should be accounted for in the application.
- Rob: Has the TA or C/CAG identified goals/objectives for the AV program, or dedicated funding?
 - Vamsi: The AV Strategic Plan is intended to help identify where we need to invest funds and which pilot projects we may want to pursue grant funding for. It will include an action plan. The AV Strategic Plan itself is being funded through internal funds that we had available and that were dedicated 2-3 years ago.
- Vamsi: The SMART grant application may be for an AV shuttle-type project. The program is for \$250k to \$1 million projects. In the process of determining whether to pursue a grant on the smaller end.
 - Ben: The phase 1 grant request would likely be for less than a half million dollars and could include a deployment plan or diving into a couple high priority actions.
- Rob: Is there a project phase that includes identifying stakeholder needs?
 - Ben: Yes, that's what we're doing right now. We're meeting with cities and conducting a peer exchange with SFCTA, all as part of Phase 1. There will also be a public workshop in November or January.
- Ben: MTC has an AV grant program called the IDEA program. Could you talk about MTC's role as it relates to AV deployment and in supporting these kinds of projects in the region?
 - Rob: The IDEA grant program provided initial funding for projects. That program was deployment-focused, so it didn't typically fund planning work. The follow up program, IDEA SAV (Shared Automated Vehicle) had a sharper focus, with a pre-defined scope of work that we wanted awardees to meet.
 - The \$2.5-million-dollar IDEA grant program is fully committed, with awards to VTA (automation of on-board tasks for bus drivers) and SFCTA (Treasure Island SAV).

- We still have an additional \$1 million (OBAG-3 program) that falls within our larger AV program. We are planning to move forward with committing those funds once we see the results of the initial IDEA-funded pilots.
- Rob: Last time, the IDEA Program was very focused on low-speed automated shuttles. They are still an unproven application for first/last mile service. They are slow, and reliability and user acceptance are key questions.
 - MTC just closed on an RFP to evaluate the Treasure Island AV Shuttle. That shuttle launches tomorrow for a 9-month pilot period.
 - MTC is also working with VTA, though as more of a funder than a partner, mostly due to challenges related to procurement.
 - MTC is also monitoring the Presto shuttle in Contra Costa County and knows that LAVTA is looking at the technology with WSP.
- Rob: Going forward, we will be adding more focus on serving users with disabilities. We plan to explore new use cases and new engagement with the funding we can provide.
 - Our Transportation Services Plan, which is in the process of being finalized, has some ideas that we would like to explore.
- Rob: VTA has a low-speed shuttle project, but they are also looking at how they can take away nondriving tasks from transit drivers. For example, they are going to mount a speech application so that customers can make requests for things like traveler information or wheelchair securement, which would normally require the transit driver's assistance.
 - The scope also includes safety/security, related to monitoring the interior of the vehicle.
 - That project has been significantly delayed because they haven't been able to get their bus. Don't know how the timing will work.
- Rob: ADAS for transit operations is something MTC's hasn't really looked at. It may be something for the transit operators to take on since it's already market ready.
- Ben: Was the IDEA grant program a one-time thing?
 - Rob: Yes. We do still have \$1 million for follow up through OBAG-3. It's hard to dedicate more funding for that program since there's a lot of focus on core needs for transit right now (e.g. TSP)
- Ben: At a policy level, is AV integrated in with regional plans and policies?
 - Rob: AV is not really integrated into the RTP. The real connection is to high-level needs, as long as AV solutions are in line with the region's high-level policy goals. The goals are to strengthen transit and to make transit accessible. The appeal of low-speed shuttles was for first/last mile connections. With increasing pressure on operational funding, there's still a role for that.
 - Rob: Going forward, the question is, what is the next step after all these pilots have been done? Is there a business plan to provide these services on an ongoing basis? What is the value of more jurisdictions doing an AV pilot, especially when AV vendors are very tight fisted with their data?
 - Ben: That's what is holding LAVTA up right now. They are looking for a long-term solution and not just a demonstration pilot.
 - Rob: It's a question about the viability of the service and where it fits in operationally and financially.

- Rob: Will there be a private sector component to this strategic plan? Will you be talking to companies like Waymo and Cruise?
 - Ben: Yes, as well as Beep. We are curious whether they have plans to continue with their current business models or if they plan to operate differently in the future. It does seem like MTC's focus is on the transit space, rather than private AVs.
 - Rob: Yes, that's generally true. We have been monitoring legislation at the state and federal level, but there isn't a regional legislative policy initiative related to AVs. This may change if we start to see more cities pushing back on what the CPUC is allowing. Local people sit on the board, including the City and County of San Francisco.
- Ben: What about freight?
 - Rob: Alameda County Transportation Commission seems like they've been handling most of the next generation freight applications in the region. We invited Peloton to an event, but that's as far as we've gotten.
- Ben: Are you part of any AV working groups? Wondering if someone should represent San Mateo County on any of those.
 - Rob: There are informal exchanges, partially because there are 3 Beep projects going on in the region. There has been talk about creating a more formal working group around AVs, and MTC should probably play a role in that. This could just start slowly with a quarterly call.
 - Ben: This could even be a working group focused on low-speed automated shuttles.
- Ben: Have you engaged with Caltrans or other state-level agencies?
 - Rob: We were interviewed by Caltrans for their CAV Deployment plan and would attend CalStart calls.
- Ben: Do you have any ideas or suggestions for a pilot?
 - Rob: Recommend you loop in equity priority communities like East Palo Alto. It will depend on what your use cases and applications are, but you should consider the people who have historically been impacted the most by transportation systems. However, areas that have a lot of needs don't necessarily lend themselves to AV applications.
 - Rob: Know that there are on-demand shuttles already operating in San Mateo County. One of the reasons Treasure Island was awarded the IDEA SAV Grant was that they already planned to have a shuttle. That fits in with MTC's overarching vision – the degree to which AVs support existing transit/paratransit rather than forcing something new just to have an AV pilot. However, this does bring risks related to impacts on existing users.
 - Rob: Will also mention the work zone pilot and the work zone data exchange. The idea is that there would eventually be one feed for AV companies to find out about work zones, in order to mitigate impacts on their operations. This is a need of AV operators and not necessarily a local need. But haven't been able to find an AV company that has allowed us to track their use of it yet.
 - Rob: Have heard about the impacts of special events on AV operations in San Francisco. Going forward, cities will have to consider this, otherwise AVs won't be scalable.
 - Rob: Data for Automated Vehicle Integration (DAVI) is another federal initiative. Not sure if it has a website with more information. If you want more information, you can email nahmed@bayareametro.gov or find a copy of his slides from ITS World Congress.

- Rob: Please keep MTC (Rob or Stephanie) in the loop on major deliverables.

San Mateo County AV Strategic Plan Discussion – May Mobility

August 21, 2023

Attendance

- May Mobility: Taylor Gygi, Daisy Wall
- SMCTA: Vamsi Tabjulu
- C/CAG: Audrey Shiramizu
- WSP: Katie McLaughlin, Ben McKeever

Notes

- Taylor: May Mobility’s business model is to address the government market for public transit with AVs – robo-transit, not robo-taxis. The goal is to connect to public transit systems with first/last mile solutions.
- May Mobility is based in Ann Arbor, Michigan. They have launched 11 programs on public roads in the past six years and have had accelerated growth in the past 6 months.
- They provide the vehicle, software, maintenance, and operations – anything that would be part of a turnkey service. They do so by leveraging a network of partners, including Via and Rideco.
- They like to partner on the front end with public agencies to make sure that what they’re doing actually solves a transportation problem. Their solutions strive to reduce VMT and the use of single occupancy vehicles by increasing the use of public transit and providing shared rides. Seek to reduce congestion, emissions, and demand on future infrastructure by pooling riders headed in the same direction.
- All services right now are on-demand within a zone. They start by mapping fixed points of interest, and the service can dynamically travel to each of the points. Like to include existing transit stops as points of interest.
- May Mobility’s main investor is Toyota and their primary platform is a Toyota Sienna. It performs at level 4 autonomy within a confined operational design domain. Also have operations with level 3 autonomy at some locations. Received a California AV test permit about 2 months ago.
 - Ben: Do you plan on eventually applying for a deployment test permit in California?
 - Taylor: Yes, we are working with a public partner in California on a deployment (partner has not yet been announced publicly).
- The vehicles have a 5-person seating configuration – which comfortably seats 4. There is also an accessible version of the vehicle that has a rear-loading wheelchair ramp. The capacity of that vehicle is 2 (in the captain’s chairs) and the wheelchair user.
 - Audrey: If there’s no driver onboard, how is the wheelchair user able to board?
 - Taylor: Right now, the operator is trained to help. But have partnerships in place to automate this with an electric ramp and an automated restraint system in the future.
- Partner locations include Ann Arbor (have provided 11,000 free rides) and Grand Rapids, Michigan. Grand Rapids was completed last year, but it is still worth noting because it was a 3-year deployment to transition from a fixed route to an on-demand service that significantly reduced wait times for passengers.
 - Arlington, Texas is another notable deployment, for which they have recently been awarded a contract extension.

- Grand Rapids, Minnesota is the first-ever accessibility-focused, rural, self-driving pilot. It will include 35 miles of autonomous-capable roadways.
- They also just won a contract with the City of Detroit to introduce AV service in underserved communities, with the long-term goal of this service being transitioned over to DDOT and incorporated as part of their transit network. May Mobility's vision as a company is to be part of the existing transit network and complement it in different ways.
- Ben: For the ongoing deployments, are any driverless or do they all have a safety driver?
 - Daisy: We operate from a technology perspective at level 4 autonomy, but they all have a safety operator onboard at this point in time. Most deployments, with the exception of Ann Arbor, are federally funded by grants, so a driver is required.
- Ben: What is your business relationship with your clients? Do you generally provide a turnkey, all-in-one service?
 - Daisy: There's flexibility because the service model is pretty new, and it can be a bit different with different agencies in different stages. Turn-key is the most common model.
 - Taylor: The most common project set up is an RFP leading to a government contract for an all-in-one service. Then there is a fixed fee for set up and a monthly operational fee. Many deployments are grant-funded, so they don't want to buy an asset, though that may be an option in the future. Contracts today are usually for a 24 to 36-month period.
 - Daisy: The contract will include the vehicle, operations, maintenance, insurance, community engagement, etc. Another model is for May to provide the vehicles and the supervisory system, and then the local transit operator can manage day-to-day operations. A third model in the future could be a Software as a Service (SaaS) subscription, with a fee for the software and purchase or lease of the vehicle done separately.
- Ben: Are there any other infrastructure needs we should be aware of?
 - Taylor: May Mobility can operate without C-V2X, as we have computer vision cameras that recognize traffic lights. Currently we do not have the requirement for additional infrastructure but can test and integrate with it if the client desires to do so.
 - The vehicles currently being used are gas-hybrid, so charging infrastructure is not as big of a consideration as it would be for fully electric vehicles. Encourage potential partners to separate the electrification component from automation – many cities couple EVs and AVs but like to encourage cities to re-think that and decouple the two, prioritizing automation in this case.
- Ben: For project set-up, do you need to map the area prior to deployment?
 - Taylor: Yes, that would be part of the turnkey, all-in-one service. The Sienna's would be manually driven on the roadways so that the software team can create a virtual railroad for the vehicles to operate on.
 - Daisy: Another big component during this stage is community engagement. Engage focus groups, identifying different demographics and potential users. Can bring learnings from this process that weren't the original project scope, in order to shift operations and operating hours to respond to needs.
- Vamsi: How does the on-demand service work?

- Taylor: Designate points for boarding/alighting, but not the chronology of them.
- Taylor: Currently authorized to operate a maximum of 32 mph.
 - Ben: Who decides that limit?
 - Taylor: It's a process of self-certification that considers what we're able to do and what is permitted by the local partner.

San Mateo County AV Strategic Plan Discussion – DMV & CPUC

August 8, 2023

Attendance

- DMV: Miguel Acosta, Nate Gargiulo
- CPUC: S. Pat Tsen, Doug Ito
- SMCTA: Vamsi Tabjulu, Amy Linehan
- WSP: Ben McKeever, Katie McLaughlin

Notes

- Miguel: California has 40 companies currently approved by the DMV for testing AVs. There are three levels of testing.
- Doug: As we discuss the region's AV strategies and priorities, are we just focused on those that are within the scope of funding authority that the agencies already have, or are we looking more broadly at the transportation planning structure of the region?
 - Ben: We are still in the early stages of assessing existing conditions and developing AV strategies, but both of those topics would be within the scope of this project.
- Pat: At CPUC, there is a pending application from Waymo for a permit to operate driverless AV passenger services. That application includes San Mateo County as part of the geographic area or operational design domain (ODD). Had reached out to San Mateo County at the staff level, but possibly did not reach out to the right people.
 - Ben: We knew that Waymo has a driverless permit to test in San Francisco but were not aware that that extended into San Mateo County.
 - Miguel: They can currently do goods delivery in San Mateo County. The final step is to go through the Commission to get approval for driverless passenger service.
 - Ben: Will someone from the County be looped in?
 - Pat: When the permit application came in, staff at CPUC did reach out to the County.
- Doug: The DMV and CPUC rules and processes are about 4-5 years old. They have established rules that companies need to follow to get into service using AVs. The DMV has issued over 40 permits across the state. The Commission is getting more involved.
 - Establishing the trajectory of where the state is in implementing AVs would be a good starting point for determining existing conditions.
 - The next step would be to figure out where within San Mateo County would be best for AVs to operate and who needs to be communicated with. When DMV/CPUC provides notifications to jurisdictions, they may not be hitting all the right people, so that would be helpful to know for future engagements.
- Miguel: Part of the DMV's regulations for when a company like Waymo is authorized to start testing is that they are required to notify local jurisdictions, including law enforcement, in order to get their permit. Waymo is currently authorized to test in portions of San Mateo County without a safety driver, and they are currently doing driverless testing within the County. But they can't carry passengers or collect revenue at this time.

- Miguel: When they want to remove a safety driver, they have to define the ODD and describe precisely where they would be operating. When there is a safety driver onboard, they can test on any California public road under the “testing with safety driver” permit.
- Waymo is authorized in San Mateo County but Cruise has not established an ODD within the County. Nuro does AV activities in that region as well, but just goods movement (no passengers).
- Miguel: Beep is an example of a low-speed shuttle. There are additional requirements to operate related to registration, as the vehicles do not meet Federal Motor Vehicle Safety Standards (FMVSS). They need an exemption from NHTSA to operate.
 - In the case of Beep, they are importing their vehicles from another country and must seek an exemption from USDOT/NHTSA before they are authorized to operate on public roads in the US. Part of that exemption process includes NHTSA reviewing and approving specific routes. They are currently only authorized to operate in specific, pre-approved locations.
 - Ben: So even though they have approval in California, they’d have to submit for San Mateo County separately.
- Ben: Cruise and Waymo don’t need NHTSA approval?
 - Nate: Correct. And there are other shuttle companies such as May Mobility that do not need Box 7 exemptions from NHTSA because they are using FMVSS-compliant vehicles (in May Mobility’s case, a Toyota Sienna).
 - Beep works with multiple manufacturers, so in the future they may not have to get that exemption. It depends on the vehicle platform used.
 - There is still not a process for domestically produced shuttles to gain an exemption. There is a regulatory gap at the federal level. Therefore, there are currently no US-made automated shuttles. There was Local Motors, but they went out of business. Their vehicles have been bought by Beep though, so they may come back.
- Pat: Will defer to DMV for road operations safety questions. But for the information gathering stage for this project, the Commission’s website has a page on their AV program that describes the regulations as well as past Commission decisions that set out the framework for AV passenger service.
- Pat: We are anticipating putting together stakeholder meetings for municipalities in which AVs will be operating. Who should we include for SMCTA? It looks like we had reached out to Jessica Epstein at SMCTA.
 - Vamsi: She’s the right person. I will reach out to her to make sure she got the email and is aware of the situation. And SMCTA is the right agency – there are several county-level agencies, and SMCTA manages anything transportation-related within the County.
- Ben: How does equity factor in?
 - Pat: When we started framing out the program, equity was one of the topics we considered as a top priority. We wanted to make sure that access to AVs was available to everyone. Other top priorities were related to environmental impact and reduction in greenhouse gases. Safety is also very important.

- The website has links to decisions made by the Commission and how these factors were considered as these programs were put together.
- Doug will send an email to connect the project team with Terra Curtis, the AV program manager, for additional information.

San Mateo County AV Strategic Plan Discussion – DMV & CPUC

September 25, 2023

Attendance

- Commute.org: Alton Chen, John Ford
- C/CAG: Audrey Shiramizu
- SMCTA: Vamsi Tabjulu, Amy Linehan, Patrick Gilster
- WSP: Ben McKeever, Shalini Gosh

Notes

- Ben: What does commute.org do? When we talked to other agencies, they suggested identifying ideas for first and last mile solutions that leverage the existing shuttle routes.
 - John: Shuttles are a third of what we do. Our goal is to reduce Vehicle Miles Traveled (VMT). Shuttles are operated to encourage people to use transit. The shuttles we operate are first and last mile travel solutions for 20 different transit routes. About 80% of the routes are funded using San Mateo County Transportation Authority (TA) funds and private sector contributions. For the rest of the routes the matching funds come from cities instead of the private sector.
 - John: The shuttles are operated at peak hour commuting times from Monday to Friday. The capacity of the shuttle ranges from 20-40 passenger vehicles. The 10-year contract for the fleet of buses used is going to end in 1.5 years. There will be a new RFP led by SamTrans for a new procurement in July of 2025, which coincides with a call for transit projects by the TA for funding. Our shuttles are only first and last mile travel for BART, ferries, and Caltrain. Thus, our ridership depends on the ridership of these transit options.
- Ben: Which ferry does the shuttle connect to?
 - John: South San Francisco. It will connect to Redwood City in the near future. It has been a long time in the making and also has political support.
 - Patrick: It is in the environmental assessment phase and we (TA) are the primary funder.
 - John: Shuttles connect to BART stations in Balboa Park, Daly City, Millbrae and to Caltrain in San Mateo, Hillsdale, Redwood City, and Millbrae.
- Ben: Where and what are the opportunities for AV pilots? Are there any specific routes you have in mind?
 - Alton: One route we have in mind is a connection from Millbrae to Burlingame. It would be a combination of two previous routes. It will connect Millbrae and the Broadway Caltrain Station (around 3 miles round trip). The main road for the shuttle will be California Drive.
 - Ben: What is the speed limit on California Drive?
 - John: 35 miles per hour.
 - John: We support AVs for wherever it can improve transit. Our aim is to get people to use more transit.
 - John: Only Caltrain and BART riders ride this shuttle. So, our shuttles get ridership only when they're easier. With the electrification of transit, it may become better.

- John: The aim of our future shuttle routes is to go from a station to workplaces (office) and on the loop back go through residential areas during the PM peak.
- Ben: The challenge with AV shuttles are speeds. The next generation can go more than 15mph. So, a 35mph road is probably okay for them to operate on. 25mph - 30mph is probably the upper bound for AV speeds. Is there a minimum passenger capacity for it to be useful?
 - John: A 5 passenger EV is too small like the GEM E6. 7- 12 passengers is the appropriate capacity. But whether the vehicle will be ADA compliant or not needs to be studied. It's tricky to load wheel-chair passengers.
- John: There is a second route option for an AV pilot since the first route option we discussed has a grade separation project planned at the Broadway intersection. The other route (Midpoint Route) can be from Redwood City Caltrain to Stanford Hospital and Campus in Redwood City. Stanford can be a contributing partner since it is one of the end points. This is a straight route that could be serviced by 2 shuttles.
- John: Another route option for an AV pilot that has no current existing shuttle service is from the Belmont Caltrain Station to the Notre Dame Belmont campus. Stanford bought the Notre Dame campus and will have students and student housing. Stanford has a need. It would be a short distance, high frequency and low-capacity shuttle with speeds between 25-35mph. It is less than a mile distance from the station to campus.
 - Ben: This will be a good use case. It may need safety a driver for now.

John: Another example for a suitable location for a shuttle service is on the east of US 101. Currently, it is almost a transit desert. Genentech runs an intra campus shuttle under their gRide program on city streets, controlled by them. They are organizing Oyster Point Mobility circulator shuttles which instead of first and last mile shuttles will connect collector locations for longer haul shuttles. They are doing that in their campus. But they want to do it in a broader area.

John: Another example is the San Carlos shuttle between the Caltrain Station and businesses to the north and south of the station. It was not a good route for us previously because there wasn't a lot of demand. But there have been new developments owned and operated by Alexandria Real Estate. It is a slow speed and a controlled location that is getting more developed.

- Ben: What are your concerns with AV projects? Are there any pushbacks from union drivers? Any safety concerns? What are some things to look out for?
 - John: Pushback from union labor is always a possibility when talking about private sector involvement. SamTrans is operating a non-union on demand shuttle now called Ride Plus. So, union pushback may not be that big of a problem.
- Ben: What about safety? When we talked to San Francisco their concern was that they hinder with fire and emergency response.
 - John: We don't share that concern. The bugs will get worked out.
 - Ben: public shuttles are more controlled than privately controlled robo taxis.
 - John: We don't see it as an issue to worry about.
- Ben: What about data needs or an evaluation matrix?

- John: a lot of data is needed to be provided to funders. Ridership data, ADA compliant enunciators, ridership counters, etc. Thus, obtaining VMT and ridership data from vendors should be standard.
- Ben: But safety data like near misses are hard to get. And a regulator would want that data.
- John: Yes. We get information from our current shuttle drivers when something like that happens. In AVs we might get double that. But we are supportive of AVs as long as it helps reduce VMT.
- Ben: What are your key goals for an AV?
 - John: Our goal is to equitably reduce VMT and make the program available in a cost-effective way.
 - Patrick: We also need to make sure the TA or agencies are open to AV shuttles as pilots.
- Ben: What would be the business model? Transit agencies don't want to buy it or operate it. They generally hire a company and have annual leasing contracts. How do you identify ongoing OEM costs?
 - John: There is a new procurement in 1.5 years, and it will be on the street in 9 months. But based on the requirement to use alternative fuel vehicles, we need to make sure all vehicles used have electric batteries or are going to be hydrogen powered. It will be needed for Caltrans funding in the future.
- Patrick: Would connecting the ferry with Redwood Caltrain be a good option for a pilot?
 - John: Yes. Connecting Burlingame south or Bayside route to the ferry can be a good option. It will be a slower speed, higher frequency and higher occupancy shuttle. But it may not be an immediate option since it involves multiple partnerships. We are looking for a single partner for immediate pilot programs.

San Mateo County AV Strategic Plan Discussion – City of Hillsborough

August 24, 2023

Attendance

- City of Hillsborough: Paul Willis
- SMCTA: Vamsi Tabjulu
- WSP: Ben McKeever, Katie McLaughlin

Notes

- Paul: Personally excited about AVs, though aware of the controversy going on in San Francisco. A good AV program will prevent DUIs and increase safety.
- Paul: Hillsborough is a hillside residential community.
 - One issue is cut-through traffic between I-280 and US 101 – see a use case for east-west connectivity. US 101 is the biggest thoroughfare in the County.
 - Another great opportunity would be connecting to the airport. Hillsborough is close to the airport, but there aren't great connections to it.
- Paul: One concern is related to AV navigation and connectivity – if an AV relies on cellular communications. Hillside communities like Hillsborough tend to have drop-offs in connectivity. The AV would have to “fly blind” until pockets of connectivity are re-established. Do these vehicles have an emergency stop functionality? Or a way for passengers to request one?
 - Ben: It depends on which mode the vehicle is operating in. Currently, each AV shuttle has an attendant onboard and a red stop button that the attendant can press if needed.
 - There are some driverless robo-taxis operating in the city. Those do have remote connections to an operations center, since there is nobody in the actual driver's seat or in the vehicle, so they do rely on having that connectivity.
 - Recently there were stories during the Outside Lands Festival that there was so much cellular activity that the system got jammed up and the AVs could not operate. Agree that there needs to be some level of redundancy for when signals are lost, as well as an emergency plan for if things go wrong.
- Paul: Would assume that before the vehicles start using local streets, they go out and pre-map all of the roadways to store them in their database. So, they are following not just cellular, but also that pre-mapping.
 - Ben: That is correct. AV companies do lots of digital mapping of their ODDs. Because they rely on this, work zones and other dynamic changes to the roadway can be a challenge. Cities providing work zone information can be helpful.
- Ben: We found out through this project that Waymo is testing in the County.
 - Paul: Yes, have seen their vehicles around.
- Paul: Other big need is senior mobility. Seniors can have a hard time once they cannot drive themselves. Providing alternatives for them to shop or see their doctor would be very useful.
- Ben: What priorities do you have for safe and smart deployments of AVs?
 - Paul: Safety, senior mobility, east-west connectivity.

- There is some existing bus service, but it isn't frequent, and it doesn't travel into the communities that it would be most useful for (stops are maybe a mile away, which is not walkable for all residents).
- Connections to Caltrain are important. Every city on the Peninsula has a major Caltrain station. They are heavily used, especially for major events. Caltrain does a good job of increasing frequency for major events.
- A potential use case could be service from residential locations to Caltrain stations. Finding parking at the Caltrain stations can be a challenge, so this would save time, save cost, and lower the risk to users of there not being parking available. Overall, it would provide a higher level of convenience.
- Ben: Would on-demand service or fixed route work better?
 - Paul: Depends on the location. On-demand would probably be the most efficient since it would only run when there is demand.
- Paul: Peninsula Transit Service (i.e., commute.org) operates minivans/buses (extended vans) as a shuttle service. Services in Redwood City, for example, take many passengers from Caltrain to local businesses/employers. Local tech companies and Stanford all contribute to fund that service with SamTrans and the TA. They are part of commute.org.
 - Ben: Our meeting with MTC included the suggestion of leveraging existing shuttle routes. They demonstrate that there already is a transportation need, and that new technology can help save costs and make it safer and more efficient.
- Ben: Part of our existing conditions report is capturing any AV programs that already exist. Are you aware of any AVs activities, pilots, or programs going on in your city or the county, other than seeing Waymo vehicles on the roads?
 - Paul: Not aware of anything in this area.
- Paul: Another big traffic issue we have is related to school pick-ups and drop-offs. School buses were eliminated in the peninsula many years ago. It causes traffic jams and is also an issue for parents trying to manage their time. Would you ever consider transportation for school aged children using AVs?
 - Paul: You wouldn't have to do background checks for drivers, but there could be other concerns/challenges. Maybe the ability to track the kid's location through an app (and their own phone) would increase comfort.
 - Ben: Maybe not day 1, but that's a good idea to consider.
- Ben: Do you have any concerns related to safety or any other possible issues?
 - Paul: As far as safety, Hillsborough is a residential community with mostly 25 mph roads and a few 35 mph roads. There are a lot of safety benefits to trying AVs, but the challenge may be with cellular service drop-offs and work zones. However, as long as the mapping system is very robust, then these AVs should be able to find a way around.
- Ben: Does the City have an information system to track work zones or construction activities?
 - Paul: Nothing that's dynamic. There are static maps whenever a new project is started that are published on the website. Residents also receive mailers.
 - Paul: There are no traffic signals that are managed by the City of Hillsborough. The main arterial corridor (El Camino Real) that does have traffic signals is owned and operated by Caltrans.

- Katie: Do you have any concerns related to equity?
 - Paul: Not really. We know which communities in the County are most disadvantaged when it comes to transportation and resources, so that should be considered.
 - Paul: Senior mobility is probably the biggest need. The town does not have a senior center, but many residents are over 55. Making it easier for them to get around, whether it's with the community, to Caltrain, or to the airport, is important.
- Paul: You are unlikely to get the same pushback here that you get in San Francisco, in part because there isn't as much of an existing, trustworthy, reliable transportation service. AVs might be able to provide a better service.

San Mateo County AV Strategic Plan Discussion – City of Burlingame

September 9, 2023

Attendance

- Burlingame: Syed Murtuza
- SMCTA: Vamsi Tabjulu
- WSP: Ben McKeever, Katie McLaughlin, Shalini Ghosh

Notes

- Syed: Are the shuttles like BART, where they don't have a driver onboard, but they do have an attendant and a remote operating center?
 - Ben: Yes
- Syed: When you talk about grant opportunities, are they for deploying AVs or for preparing plans to do so?
 - Ben: Both. Often the first phase is for planning activities and then a second phase provides more funding for deployment.
 - Vamsi: For planning, there is no local match required.
- Syed: Have you talked to commute.org?
 - Ben: We are hoping to. There could be good opportunities to deploy AVs to supplement their shuttle routes.
 - Syed: Yes, there are many shuttles in the county that travel from BART stations to employment centers. We are always trying to find new ways to serve people. We are currently experiencing some driver problems – the costs of contracts have gone up due to inflation and there are challenges related to driver availability.
 - Syed: There's a shuttle between the Millbrae BART station and the Broadway Caltrain station that could be a good candidate for AVs.
 - Syed: There was also a community shuttle that ran between the hotels by SFO and businesses downtown. It had economic benefits, including helping residents travel to the bayside or downtown without using their cars.
 - That shuttle is not currently operational due to impacts from COVID.
 - All SFO hotels are located in Burlingame. The shuttle traveled from those hotels and picked up passengers along the way to downtown.
 - Syed: When applying for funding, it's not just the vehicle. It's also the management of the service and any improvements needed on the road. A full turn-key service would be optimal.
- Syed: The city has a lot of contracted services. When starting something new, it's very important to have a turn-key service and a customer service line for people to call if something goes wrong.
 - Before an AV is deployed, it will be important to fully test it to the degree that we feel satisfied that it is ready.
 - Syed has ridden several automated vehicles himself. It can take a while to get used to it, and though he feels comfortable now, it was scary at times.

- As part of the strategic plan, it'll be important to know what the risks are and how to mitigate them. From a transparency point of view, it's also important for public education and alleviating any fears.
- Syed: Make sure to have stop announcements. Another safety concern is related to crosswalks and ensuring proper visibility. There are many marked crosswalks. However, some intersections do not have marked crosswalks, but people do still cross at those intersections. This is legal according to state law, but it can still lead to safety issues.
 - The visibility of bicyclists can also be challenging because of their size.
 - The safety of other motorists is also important.
 - In residential areas, on local streets, there aren't necessarily lane markings.
- Syed: When we talk about shuttles, we are used to big buses. But that may not be the future concept. It may be a shuttle for 12-15 people, which is a different model. Those will be better able to maneuver into local neighborhoods with narrow streets.
- Syed: Need to look into what the big benefits are, from a needs point of view. Need to determine how we can improve the quality of life for people by embarking on this technology.
- Syed: Priorities are safety, transparency, public education, improving the quality of life of citizens, equity, and environmental/climate change.
 - Equity is important – making sure all communities within the city are included and are ready for AVs.
- Syed: Would love to hear updates on next steps.

San Mateo County AV Strategic Plan Discussion – Caltrans

August 21, 2023

Attendance

- Caltrans: Inder Preet Singh, David Man
- SCMTA: Vamsi Tabjulu
- WSP: Ben McKeever, Katie McLaughlin

Notes

- David: Is this a fiscally unconstrained plan?
 - Ben: Yes, it's a strategic plan rather than a deployment plan.
- Ben: Where is Caltrans and the state in general in their approach to AVs?
 - David: We finalized a CAV page on our website a few months ago and are staffing up a new "transformational mobility" group to support the program.
 - CalSTA developed and published an AV Strategic Framework in 2018 <https://calsta.ca.gov/subject-areas/autonomous-vehicles-strategic-framework>. We plan to roll that into our strategic and Implementation Plan.
 - We are hoping to start setting some guidance in terms of what we want to deploy and which areas we want to look at. We need to have a cohesive network for AVs from jurisdiction to jurisdiction.
 - We are developing an application roadmap to determine which use cases to focus on in the short term.
 - We are trying to strategically figure out what the statewide architecture will look like.
 - The operations office is working with research to have roles and responsibilities clarified. The idea is that research will work on off-system development and operations will be focused on implementation. Want to make use of the test beds throughout California.
 - All of this has to wrap into the statewide TSMO Plan. The actual plan will be launched in the next few months.
- David: Safety is a top priority and has led the strategic direction. Other priorities are similar to the priorities of Caltrans as a whole: equity, environment, climate change, etc.
 - Refer to the AV Strategic Framework for more information on priorities.
 - The Framework has been published in 2022. Not sure what's ongoing in terms of updating it. There is still a lot of coordination between agencies, supported by CalSTA.
- Ben: How do local agencies participate in these statewide activities?
 - Ben: For example, MTC talked about convening a working group at the regional level.
 - David: That would be good, as would consistency from region to region. The Caltrans CAV Deployment Plan included outreach with local agencies, but there isn't active engagement.
- Ben: How is the transformational mobility group organized?
 - Inder Preet: The is my responsibility and we have three groups:
 - Connected Ecosystems: This is really CAV rather than just AV. Connectivity is a big focus. Broadband/fiber infrastructure, cybersecurity, and CAV research (nationwide and statewide) are all considered.

- Delivery: This is the group that is currently being built up. It is focused more on research.
- NextGen Mobility: Focused on all the other modes. This may not be a full-fledged office, but more of a specialist position.
- All 3 offices roll up to the Transformational Mobility subdivision in Traffic Ops. So essentially, CAV is one piece of Transformational Mobility. There will be a lot of overlap between the three groups.
- Ben: What are the roles of some of the statewide agencies?
 - Caltrans is the IOO - infrastructure owner-operator.
 - CHP is enforcement.
 - CPUC/DMV is regulatory.
- Inder Preet: The CalSTA AV Strategic Framework acknowledged that all AV adoption has a high chance of proliferation of AVs on the network. That's something we need to consider as part of VMT strategies and other statewide priorities – promoting shared use, pooled, low emissions, right sized vehicles and determining how they fit as part of a multimodal system.
 - Also want to strengthen rather than replace transit. AVs may replace low quality transit, but not transit that's working well.
 - Also need to consider the impacts on land use and street space.
- Inder Preet: Anything related to CAV deployment at Caltrans is housed in Operations.
- Ben: The County is aware of and considering the SMART federal grant program. Were you considering responding to the solicitation for anything CAV related? Would there be interest in partnering with the County?
 - Inder Preet: We are planning to do some nominations. SMCTA would have to coordinate with District 4 Ops (Sean Nozzari). Districts know the priorities best, so they work with local agencies to put together and share proposals with Headquarters. The deadline for Districts to provide proposals to Headquarters is tomorrow.
 - Ben: We probably won't be able to know by then.
 - Inder Preet: Use this exercise to develop that pipeline, to consider for the future.
 - Ben: Is the process that Caltrans does internal voting on the applications you like the best and only nominate a few?
 - Inder Preet: Yes. There are 12 Districts plus Headquarters, so there are only so many projects that Ops can support. Divisions can also nominate their own projects.

San Mateo County AV Strategic Plan Discussion – Beep

August 21, 2023

Attendance

- Beep: Jen Davenport
- SMCTA: Vamsi Tabjulu
- C/CAG: Audrey Shiramizu
- WSP: Katie McLaughlin, Ben McKeever

Notes

- Katie: What AV pilots and programs have you deployed to date?
 - Jen: Beep focuses on first and last mile deployments for public and private sector clients. Approximately 50% of deployments to date have been with the public sector. Service locations have included:
 - Hillsborough Regional Area Transit and Pinellas County, Florida; Peachtree Corners, Georgia; North Carolina Department of Transportation; Yellowstone National Park.
 - There have also been a few pilots in California – one with CCTA and another with SFCTA (Treasure Island).
 - Actively working with various providers of current generation AV technology. Technologies to date have been provided by Local Motors and Navya – 8-10 passenger shuttles at SAE level 3. There is a safety attendant on board and available at all times to take over if needed.
- Katie: How do your agreements with cities generally work?
 - Jen: We always have an agreement with the agencies and cities we work with. We provide a turnkey operation for a set monthly fee, with all the resources, command center, insurance, cleaning, etc. included, so it is relatively hands off for the agency. Client success managers engage in regular reviews, at a minimum monthly, though agency partners are generally much more closely involved (on a daily basis).
- Ben: What are the current maximum speeds for your shuttles?
 - Jen: The fastest we're currently able to achieve is 13-15 mph. All the shuttles currently deployed are maxing at 12 mph.
 - Expecting to have a technology refresh for the Olli shuttles – from Robotics Research to a drive system by Oxa (formerly Oxbotica). The shuttles will then be able to travel 15-16 mph (in limited circumstances). Every route and deployment is different, so while the capabilities are there, the AVs are not always able to get to the maximum speed.
 - Beep will have vehicles from two new suppliers in the market in late 2024. Those will be able to operate up to 35 mph, expanding the ODD quite significantly.
 - The focus right now is to grow experience with operating a command center, in anticipation of greater AV capacities in the coming years.
- Ben: What capacity will those new vehicles have?
 - Jen: They are built for purpose, for first/last mile service. The first vehicle is being supplied from a subsidiary of Benteler, an AV with a capacity of 11 seated and 4

- standing. The second is from the supplier ZF, who owns Oceaneering. They are bringing a level 4 vehicle with a capacity of approximately 22, depending on the layout of the AV.
- Beep’s command center will remain the same for all of these vehicles. The management solution is vehicle-agnostic and can plug and play with essentially any autonomous drive system or technology that comes to market, assuming the supplier is willing.
 - Ben: Do these vehicles provide fixed route or on demand service?
 - Jen: Mostly fixed route right now. Beep does not plan to deploy robo-taxis that travel door to door on demand, like Lyft, Uber, or Cruise. But they may provide on demand or demand responsive service point to point within a zone at some point, for example for special events or other scenarios.
 - Ben: Does your pricing and business model allow for flexibility in service?
 - Jen: There are two components to pricing. The fixed price component includes the vehicle rental and all associated management services (insurance, registration, etc.) The variable component is attendant hours. But as we move into next generation vehicles, we may be removing the attendant from the vehicle. That’s what the command-and-control center is all about. But Beep has not explored pricing by service hour yet.
 - Vamsi: How does incident response work?
 - Jen: The command-and-control center is staffed for all operational hours, and there are field support staff. Field staff are and will continue to be available even when an operator is no longer in the vehicle. So, if an event is detected, the vehicle will notify the command center, which will be able to issue remote, pre-tested commands to instruct the vehicle what to do. In some extreme situations, field staff would respond. Are seeking to locate the command centers close to the actual deployment sites so that vehicles aren’t stranded for a long period of time
 - Also train emergency responders on how to navigate the vehicle in the event they would need to. It’s a double-pronged approach to incident response in case field staff aren’t available right away.
 - Katie: Are there any infrastructure or built environmental changes that should be considered for future AV deployment?
 - Jen: Only if you’re looking to operate an AV on roadways where the speed limits exceed 25 mph. Beep would want the vehicles in a dedicated lane in that case, an operational lane at least 10 feet wide so it can escape anyone encroaching on its path.
 - Also look for roadside units, ideally with C-V2X capabilities. Some states are still allowing DSRC, but Beep is trying to migrate to C-V2X. The AVs may not require C-V2X in the future, as they are looking at sensor fusion for next generation vehicles. For example, the Oxa drive system reads traffic signals rather than using C-V2X. But it would still be good to keep C-V2X as a fall back.
 - Ben: C-V2X also provides additional advantages, such as the potential for transit signal priority.
 - Ben: What is your approach to data sharing, looking at California DMV requirements for example.
 - Jen: There are approximately a dozen data elements that Beep has access to and is willing to share. Typically, the autonomous drive system provider limits information from

the camera or black box, because it takes specialized skills to interpret that data. There are also potential issues related to liability. So, Beep is limited in the data they can provide. What they do provide is things like ridership counts, manual disengagements, hard stops, near misses, up town and down time, and autonomous efficiency. Always try to work with the agencies for a clear definition of what's expected.

- For data like down time, also include what contributed to it and potential mitigation plans going forward. If there is any sort of safety event or incident, provide incident reports with log analysis/root cause analysis from the supplier.
- Audrey: Are the current vehicles and the next generation vehicles ADA accessible?
 - Jen: Yes, they are ADA accessible and compliant.
- Katie: Are they FMVSS compliant?
 - Jen: Working on getting into compliance with NHTSA. Taking various approaches:
 - Working to promote the creation of FMVSS for AVs – standards that don't call for things like rear view mirrors. If NHTSA were to publish those, AVs would have something to be in compliance with. But the government works on their own timeline.
 - Also working with new suppliers to get an ODD exemption from NHTSA, so that while the government is working on new AV standards, if we deploy a vehicle in alignment with its ODD then we won't need to get a special exemption per route. Happy to provide updates on that process.
 - Lastly, for the timing being and within the current exception process, Beep has received well over 50 route-specific waivers from NHTSA and has fully stood up a practice to continue to do so.
- Vamsi: Do you have any public or private sector deployments planned in San Mateo County?
 - Jen: Not that I'm aware of.

SamTrans Roundtable Interview

Subject	Automated Vehicle Strategic Plan - SamTrans Roundtable Interview
Date Time	September 27, 2023 9:00am – 10:00am
Location	Microsoft Teams
Attendees	SamTrans – David Olmeda, Mehul Kumar, David Santoro, Joshua Mello SMCTA: Patrick Gilster, Vamsi Tabjulu, Amy Linehan C/CAG: Kaki Cheung, Audrey Shiramizu WSP: Ben McKeever, Severin Skolrud, Shalini Ghosh, Ryan Adamson

Meeting Purpose

Sam Trans was invited to participate in a Roundtable Interview to:

- Discuss SamTran’s objectives and potential applications for emerging technology (CV, AV, CAV); and,
- Identify long-term goals towards shared AV usage, connected transportation infrastructure and transportation demand management solutions.

Input from the Roundtable will help inform the development of an Existing Conditions Report and guide the creation of draft AV strategies for the Countywide Automated Vehicles Strategic Plan.

Summary

The following section highlights key takeaways from the discussion with SamTrans. The summary is intended to provide a thematic overview of the conversation.

Future plans for AVs in the county

- SamTrans’ immediate aim is to meet Innovative Clean Transit (ICT) guidelines with a focus on Hydrogen cell operated buses.
- AVs are not currently being considered in near term planning but are considered in the long-term vision. They have been monitoring AV developments.
- It will be easier for Samtrans to implement AV technology when it becomes mainstream and integrated into the regular procurement process.
- Low operating margins make it difficult to adopt technology that hasn’t been tested and standardized in the industry.

Energy Savings of ADAS and ADS technology

- There are three major ways ADAS and ADS technology improve energy saving for transit operations:
 - Bus Platooning – it improves the aerodynamics and hence the fuel efficiency;
 - ADAS increases efficiency by reducing accelerating and maneuvering techniques used by human operators; and,
 - ADAS such as ACC results in easier acceleration on steeper slopes.

Expected Safety Improvements from ADAS

- A reduction in collisions from following too closely and hitting fixed objects or low hanging trees.
- The current average number of crashes for the Samtrans fleet is 15-22 per month.
- Samtrans sees potential for ADA to improve safety by reducing rear-end collisions, ped collisions and collisions with other objects.
- Samtrans bus fleet is about 300.

Possible location/routes for implementation of AV technology

- El Camino Real in San Mateo County.
 - Busiest route in the county could provide an opportunity for AV pilots.
- Dumbarton Corridor:
 - BRT is being planned for more affordable and competitive transit. AV uses case such as platooning could be tested on BRT routes.
 - ADAS could allow for narrower BRT lanes (only 11 feet).
 - Precision docking could decrease size of bus stops.
 - The fiber installed on the corridor can also support AVs and CAV infrastructure in the future.

Concerns and Challenges

- Low operating margins make it difficult to adopt technology that hasn't been tested and standardized in the industry.
- Infrastructure and resources needed for the implementation, operations and maintenance of the technology is unknown.
- Staff and resources are stretched thin due to current projects and challenges in meeting ICT requirements.
- Need to consider workforce development for future AV deployments.

Meeting Notes

Q. David O.: At the beginning of the presentation, you mentioned alignment with state and federal objectives. Can you elaborate on what the state is intending to do? There are a lot of projects going on in different parts of the state. But what is the general strategy of the state and the role of it in making a framework for us to understand potential projects.

Ben: The state's management of AVs is currently fragmented. However, the regulatory activity is managed by the DMV and CPUC. CPUC only handles the regulation of privately owned robo taxis, not transit AVs. The policies needed to be followed by cities and counties are from CALSTA and includes safety, equity and climate change goals.

David O.: We are looking at improvements from an environmental perspective. The state already has an ICT plan, and we are already buying vehicles that comply to those policies.

Ben: There is no requirement or mandate at the state or federal level to force AI or AVs in transit fleet. They are encouraged and there are rules to be followed if AVs and AI s are implemented, but there is no requirement.

Q. Severin: California is setting the pace. There is a focus on heavy-duty bus fleets on the ADAS side. We are looking for opportunities for ADAS systems that support drivers. ADS systems can be used in sealed off driver systems. There are a few near term BRT implementations in the work. But the technology is not going to lead transit agencies to replace operators at least for the next decade. The strength of the technology is to do repetitive maneuvers.

Ben: How narrow should the lanes be for lane keep assist?

Severin: 11 feet from mirror to mirror. There are a couple of use cases where a driver assistance system can help. There are still a lot of unknowns, and we need to have in depth conversations with the drivers

David Olmeda: You are referencing energy savings. Where are we going to save energy when we have those vehicles?

Severin: There are three instances for energy savings. First, platooning improves the aerodynamics and hence the fuel efficiency. Second the techniques of accelerating or maneuvering by human operators impacts battery efficiency by about 20-35%. Those losses can be saved by driver assistance systems or AVs. Third, at steep inclines some operators struggle with a two peddle system where the bus needs to drop 2-3 ft to accelerate. An ADS system can help with that.

Q. Ben: We want to hear what your interests are. Out of the use cases Severin gave did any of it stand out as something SamTrans would be interested in the near future?

Josh: A kick-off study could be on El Camino Real in San Mateo County. It is the busiest route. But we are not sure if there is an opportunity for an enhanced station to incorporate this automation.

David O. El Camino Real is interesting. It is a state highway in partnership with CalTrans. The complication is the inner lining for our routes doesn't exist on our corridor itself. Traffic is bad in some parts. If we had an opportunity to work with other cities we can create a small loop for a bus that would serve only the area going up and down the corridor. It can also include school service. Our primary interest from the operations perspective in implementing technology to assist drivers in avoiding rear end collision and pedestrian strikes since they have immediate impacts from a safety perspective. We are looking at opportunities to improve any of these accidents. On

average, collisions from following too closely or hitting fixed object with mirror or a low hanging tree is about 15-22/month for a fleet of 300 buses.

Q. Ben: Do you have ADS or any technology in any of your buses right now?

David O.: No

Ben: It can be an immediate safety improvement.

Severin: Are you pulling reports for safety issues and in yard incidents? This will help us with benefit cost analysis for the technology.

David O.: Operators are already instructed to report in-yard incidents. The failure to report incidents leads to termination. So, all incidents are reported and recorded in our system.

Ben: Was there anything you were already thinking of in the area of AVs and implementation?

David O.: We have been monitoring what is happening in AI from an overall fleet deployment perspective. We have been participating in seminars and monitoring key projects. It is still relatively new for us to. Considering the challenges of meeting ICT guidelines, our staff is stretched thin. We believe AV is going to be implemented in the future, but we don't have a timeline yet. It is difficult to think about this given all the projects we have right now. In the long term, we have talked about partnerships with BART for charging infrastructure for battery electric buses (BEBs). The challenge is that we have decided to modify our ICT plan and are going to use a hydrogen battery operated fleet.

Ben: Are there any safety concerns for AV?

David O.: Infrastructure needs to be improved for the implementation of AVs. It will be beneficial to have a vehicle that can park itself or tell when a vehicle is ready. But the infrastructure, and resources to take care of this system is an unknown. Resource allocation needs to be identified. We are working on some resource allocation for new technology now, like training emergency responders and others about hydrogen battery cell buses and how to interact with them. In terms of opportunities for us, it would be helpful once this technology becomes mainstream. Making it is easy for us to select which technology to implement. Tested standardization is important for us. Since our services operate at low margins, we need to have those options. Our buses need to deliver services as promised. Our service needs to be reliable and we do not have any room for anything that can impact service.

Ben: Do you see BRT as a need or just a good addition?

David O.: There are some challenges in the Dumbarton corridor. El Camino was viewed as a possible option for that too.

Josh: For Dumbarton, it can help in a couple of ways. It would make the service more affordable and competitive.

Mehul: For Dumbarton, we can leverage fiber on the corridor and use those assets to help AVs on that corridor.

Ben: You have a lot on your plate for collaboration. Do you see an opportunity for collaboration with TA, C/CAG, Sam Trans?

David O.: We are always about collaboration when there is a right opportunity.

Ben: Does anyone else have any questions?

Patrick: How do you think AV technology can impact the SamTrans shuttle program?

David O.: There have been changes to governance with the shuttle program. We don't deliver the service. We have a contracts with service providers. It is difficult for us to own and operate the service. We have lost ridership before and that leads to losing funding as well.

SFMTA & SFCTA Peer Exchange

Subject	San Mateo Countywide Automated Vehicles Strategic Plan
Date Time	September 12, 2023 3:00pm – 4:30pm
Location	Microsoft Teams
Attendees	SFMTA: Darton Ito SFCTA: Jean Paul Velez SMCTA: Patrick Gilster, Vamsi Tabjulu, Amy Linehan C/CAG: Kaki Cheung, Audrey Shiramizu WSP: Ben McKeever, Shalini Ghosh, Ryan Adamson

Meeting Purpose

SFMTA and SFCTA are invited to participate in a Peer Exchange to:

- Discuss successes, challenges and lessons learned from AV pilot implementation in San Francisco; and,
- understand future directions and priorities for AV deployment in San Francisco.

Input from the Peer Exchange will help inform the development of an Existing Conditions Report and guide the creation of draft AV strategies for the Countywide Automated Vehicles Strategic Plan.

Summary

The following section highlights key takeaways from the discussion with SFMTA and SFCTA. The summary is intended to provide a thematic overview of the conversation. Full meeting notes can be found below.

Lessons Learned from Shuttle Pilots

- The Treasure Island Shuttle Pilot model is a preferred approach to AV pilots because:
 - The pilot operates in a controlled environment as it operates in a low-traffic density environment, supports first and last mile trips and operates on a fixed route.
 - Comprehensive data about operations, malfunctions and collisions are available.
 - The pilot is operated by a public agency.
 - Stakeholders have a say in protocols and operations.
 - The pilot gives public agencies the ability to apply traditional planners tools effectively providing more say / control.

San Francisco Commercial Automated Vehicles (robo taxis)

- Current commercial automated vehicle operations in San Francisco by companies like Cruise and Waymo are permitted by CPUC.
- Companies are allowed to self-certify to obtain permits for commercial operations.
- The current AVs operate in a complex urban environment creating challenges from limited decision-making capabilities for non-standard situations such as:
 - Construction sites
 - Active fire or emergency sites
 - Interactions with first responders or human traffic controllers
 - Interactions with public transit operations (Muni)
- The data made available is not comprehensive as companies are not obligated to provide complete data or make data publicly available. Measures of success or an accurate estimate of incidents is difficult to determine and is mostly received through reporting (e.g., public complaints, reports from Muni, reports from first responders).

- The city and county are unable to use typical planning tools to limit or scale operations. The city and county are considering how planning tools can be used to manage operations (E.g., zoning for vehicle storage and charging facilities).
- The city and county are considering anti-idling by-laws to limit the amount of AVs parked without turning off (operational efficiency tactic from the operators).
- There are concerns that commercial automated vehicles may cannibalize ridership from transit which contradicts the goal of multimodal transportation in the city and county.

Permits

- Operating permits obtained for AVs are classified into two main categories – “testing” and “commercial/passenger.” Each type of permit has additional subcategories depending on whether the vehicles would be operated with or without a safety driver, who can take over the vehicle in case of malfunction.

Data Reporting

- The requirements for reporting operational data to the DMV is higher for AV companies when operating with a testing permit. Requirements for data reporting wane after obtaining a commercial permit as it is perceived that successful testing was completed.
- The city and county do not receive comprehensive data about the operations of robo taxis. The only data received is through 911 calls, social media or through city staff (e.g., emergency responders, transit operators).
- The available data is generalized and doesn't provide the granularity needed to understand full operations at the local level.
- CPUC collects more detailed data from the commercial AV companies, but the data is not publicly available.

Staffing and Long-term Plans

- There are small, dedicated groups for AV planning within SFMTA and other staff in different parts of the organization who are partially involved with AV planning giving perspectives from their departments.
 - For example, someone in the transit team involved with AV planning can give better perspectives about the interaction of AVs with transit systems and the ongoing challenges they face.
- SFMTA and SFCTA are growing their AV staffing resources.
- SFCTA is a smaller organization so it does not have as many staff working on AV. Jean Paul Velez (SFCTA) spends approximately 80% of his time on AV topics.

Evaluation of AV Operations

- Safety and emergency response, climate, and equity are all applied to AV evaluation similar to traditional realms of transportation planning.

Future Goals (Short-, medium- and long-term)

- Obtain grants for more pilots and planning programs for AV implementation into transit that align with “transit first” policies.
- Investigate curb digitization.
- Increase the efficiency of vehicle miles travelled (e.g., higher vehicle occupancy).
- There is not currently a focus on AV supportive infrastructure as AVs are being developed for existing environments and are currently able to self-certify their ability to operate within existing conditions.

Agency Collaboration & Working Groups

- SFCTA and SFMTA are not participating in any current working groups. The agencies previously participated in California City Transportation Initiative (CACTI) with larger cities in California to coordinate legislation and mitigate the impacts of AVs.

Meeting Notes

Q. In San Francisco there are robo taxis like Waymo or Treasure Island AVs. What are some of the successes and challenges associated with current programs? Let's start with robo taxi pilots.

Darton – There are other companies too. But Waymo is operating commercially.

Jean – We have some level of success. There are actual AVs. A couple of key regulations that were put in place in 2014 and 2018 have enabled the industry to develop. Billions of dollars have been invested and AVs have enough capabilities to operate in cities.

Jean - The challenge at the local level is that regional entities don't have direct authorities to regulate or manage services.

Ben – So SMCTA or SFMTA don't have any regulatory say?

Darton – We have a say, but not more than anyone else. DMV and CPUC are consistent active voices on shaping regulations. From our perspective, there is a long way to go. Some of the work here is to align county with state goals. When we started engaging with DMV and CPUC we were talking about our goals and realized our shared goals were framed in different ways. How state goals are related to county goals needs to be communicated with DMV, CMC, SMTA to support statewide effort to be adopted by different statewide agencies.

Darton - For success, we see the completion of hundreds or thousands of AV driving miles. Though, we do not have a way to confirm that. Most of those miles go off without any notice. They are able to navigate lanes mostly and stay within the speed limits. There have been exceptions that we have seen in news articles. There have been mishaps along the way.

Darton – Since there isn't a good publicly available reporting of information on the successes, like how many vehicles are in the fleet, miles travelled or people carried, all we are able to report are on what we are observing. Since we are only notified when something goes wrong, there is no way to know about the successes.

Ben – Has data sharing been a problem? DMV collects some data about the AVs.

Darton – Yes, they majorly have data on collisions. One of the challenges is that a lot of the information is statewide whereas what is happening is localized.

Ben – So the granularity of the data is not clear? Like where the collisions were taking place?

Darton – Some information is there but at county or city level. NHTSA releases that information in their reports. So some factors like frequency of reporting, permits (DMV permit, CPUC permits) and information under each permit gets lost. It is hard to put together a complete picture.

Jean – DMV set up a data report focused on collisions and disengagements. There are two types of permits - Testing permit and Deployment permit (commercial passenger). Other break downs are whether they operate with or without a safety driver. Most permits given are for testing with safety drivers. The most complex permit is for commercial passenger deployment without safety drivers. The DMV is of the opinion that if they are past testing and ready for deployment there is no need to gather as much data. Since they have passed testing and proven themselves.

Ben – Moving from testing to deployment lowers the data requirement?

Jean – Yes. That is true for DMV. CPUC still has data but the data are not public. Permits with a safety driver call for reporting of disengagements, which is when the safety driver takes over control of the vehicle. But disengagements are not relevant for deployment permits without a

safety driver since there is no driver to take over. There need to be new data types associated with the deployment permits without a safety driver to better assess safety.

Ben – What about the Treasure Island SAV (AV Shuttle)?

Jean – The successful deployment of the AV is the success – To have an AV on the ground that is run by a public agency on public infrastructure. This is the only use case in California to do so.

Jean - There are a series of challenges – crash, vehicle malfunction. The service was paused for a while.

Darton – The service was shut down for a few weeks as an abundance of caution after a collision. The collision was reported to NHTSA and California DMV. After conversation and approval from NHTSA the service was then resumed.

Ben – Did the car crash into the shuttle?

Jean – Yes. The car was at fault. There are some challenges in the contract. There needed to be a spare vehicle. But the spare vehicle malfunctioned before the incident, so when the other vehicle crashed there was nothing to run.

Jean – Among the pilots we are talking about, the Treasure Island approach is how we want to see this happen - Testing on controlled environment. Treasure island has slow traffic density, and the AV shuttle is used for the first and last mile travel instead of a full trip. It also runs in one loop making it easier to manage. This technology fills the gaps in achieving mobility goals. But, on the other side of the spectrum the other AV services work as TNC (Transportation Network Companies) deployed in the city with input from the city. There is conflict between transit and TNCs. The TNCs takes ridership from transit and adds congestion operating in dense complex areas of the city. They provide 24*7 service with no restriction on the number of vehicles. All this adds to the complication.

Ben – Were the robo taxi operations scaled back after the Golden Gate Park concert incident?

Jean – Yes. And, also because of the crashes on cruise vehicles.

Darton – After the incident in treasure island – there were meetings with police, agencies, first responders to agree on protocols. The shortcoming is more on the data reporting side. What information can be generated and how can we use that to understand the operations better. We can learn from operator perspective what it takes to have a service like this in place.

Ben – So, there are two different perspectives - Treasure Island Shuttle – Stakeholders have more say in the process along with emergency responders. It also has more public understanding.

Q. What are some of the safety concerns with the Waymo and other operation pilots?

Darton – There are two parts to it - street safety and network performance. What we observed as the shortcoming of safety was resolved by a human operator. When vehicles got into the situation where it didn't know how to react, they slowly come to a stop and the human operator took over. When operators were taken out of these vehicles they were found stopped at different locations and interfering with emergency responders. There were 40 incidents where they interfered with emergency response teams like blocking the ingress or egress to fire stations, or active fire sites. These have the highest priority to be resolved.

Darton – There were other incidents where transit operators reported being stuck or stalled by vehicles and unable to provide service like being stopped at light rail tracks. In another situation a

Cruise vehicle ran into wet cement, unable to understand indicators or construction sites like cones, yellow tape etc.

Darton – The last category of safety concerns are during human traffic control. Like, in case of an event - human traffic controllers override traffic signals. In those cases the AVs are programmed to stop for lights, not manual hand signals.

Darton – When we receive these reports it demonstrates they are not going as well as the companies are saying. But due to a lack of other information it is hard to tell what else is happening. There are a lot more questions yet to be answered like other incidents that are not being reported. We have been advocating to get reports on more than just disengagements to know how to measure those and how to resolve them. For example - Some companies see removing a stalled vehicle in 15 mins as a victory but it's a major problem if the vehicle is stalled on a major street.

Jean – To obtain permits for operation these companies self-certify their capabilities. There is no third-party assessment. The companies submit their own capabilities report about their safety plan and first responder interaction plans. Their expansion plans and complexities are not reported formally.

Jean – These reports speak to the technology's readiness for standard road condition, not for construction or fire zones, etc. which are more common for California than other states. When vehicles confront these situations, they don't have solutions for them and shut down and become immobile. Thus, becoming a safety concern.

Q. What are some lessons learned to apply to future pilots and initiatives in controlled vs city environments?

Ben – From the above discussion we can say that there is no way to evaluate success because there is no real third-party evaluation in San Francisco.

Jean – We don't have data to do evaluation. The information gathered is ad hoc and not formal, like 911 calls or information from social media. Companies are not asked to self-report, thus making it challenging to produce evaluation. So, we can talk about metrics for assessment but not entire data.

Ben – What are the metric categories that are important to have for evaluation?

Jean - Road safety. In a broader sense – emergency response, climate and equity. The categories are the same as traditional realm of questions but, broader than traffic engineering.

Darton – We learned a lot from the early days of TNCs. MTA worked with TA to get a lot of information and discussed data reporting with CPUC on the TNC side. There was an AV data workshop held by CPUC a month ago and we gave a list of comments and questions to CPUC, examples of types of information we were able to gather and what we have been sharing with CPUC.

Q. What are the short-, medium- and long-term goals for the usage of AV technology?

Darton – A couple of years ago we started applying for energy grants modelling for how these vehicles can reduce emission. How can these AV services connect first and last mile transit especially on harder terrains like steep hills. How they can help fill gaps in transit network like during late night hours. What are the opportunities to provide people with connection with ride hail AVs. But we didn't have enough time before the grant deadline to figure the logistics between

private companies, research committees and government agencies. We submitted for the grant without a mentioning a service provider and hence did not get funded.

Darton – If safety concerns are addressed how best can these services be integrated to transportation system to align with transit first policy.

Ben – Is lowering VMT a goal for city?

Darton – There are no specific goals. The goal is more about productivity and having higher efficiency of miles travelled (i.e., having more number of people travel per car)

Jean – We received a smart grant to digitize the curb. Smart curb should be essential for AV projects to be able to provide clear directions to them. That can be the only stake for cities in the successful operation of AVs.

Ben – We asked Waymo about their needs. They said they needed digital data on curbs.

Jean – That is something to track - Whether it is enough for AVs to work with current tools, like work zone feeds or are there additional needs for geofencing at work zones? Fire response zones can be more challenging too. Would it be better if emergency vehicles can issue data signals that can be received by AVs and can prevent them from coming close to the areas of the first responder vehicle. Whose responsibility is it to address this issue? AV projects have caused these problems. But they want to solve issue in their own way.

Jean – Both AV providers have different protocols for first responders and how to engage with their vehicles. Right now, the onus is on the city officials to manage those responses and for the city to dictate how they want this to be dealt. There is a struggle to get started to address them.

Ben – So potential pilots with AV companies can be to better utilize information like work zone and curb space data?

Jean – But AV companies say they need the city's help while at the same time they have self-certified that they can deal with it. The system has a gap.

Q. How are AVs factored in planning and staffing? Are they factored into long range transportation plans?

Jean – It is a work in progress.

Darton – We had MTA and CTA put together guiding principles for guiding mobility. It identified areas most critical to safety and services complementing transit. The framework is still evolving, and we are trying to make it more specific to AV concepts. Though nothing is formalized yet.

Ben – What about staffing? Any specific or dedicated staff or team for AVs?

Darton – At MTA we hired someone 5 years ago to start tracking on both regulatory and legislative side at state and fed level and engage with companies to find what should be our long-range vision. We added a second position earlier this year. So, currently we have a two-person team whose role is to collect everything AVs, work with subject matter experts throughout the agency like, talking to someone from transit where AVs are interfering with transit, or with someone from traffic or accessibility viewpoints.

Ben – So there is an informal AV working group?

Darton – Yes. We have a network of people who have contact in different parts of the agency.

Ben – What part of the organization are they in. Planning or operations?

Darton – The group has been in planning. But, its shifting to the Chief of Staff's Office with the taxi and mobility division. Once the permits are implemented – they track and oversee those.

Ben – What about SFCTA?

Jean – The Performance Management and Assessment team has been involved for a long time. They have roots in TNC performance and impact assessment. I am a more recent addition to the team. I spend 3/4th of my time on AVs.

Ben – Who is managing the Treasure Island SAV?

Jean – The planning team. The county is dedicating more resources to manage operational impacts. San Francisco is bearing the cost of staffing, managing impacts of function or research and development of these providers.

Ben – Are there any city or state working groups that meet regularly and discuss these topics?

Darton – We are not aware of statewide active groups currently. There have been in the past like the CACTI group in the larger cities in California. They talked about coordinating on legislation and impacts of AVs. But most of what was happening was isolated in San Francisco. Most cities did not have people very engaged in that realm. Santa Monica and LA are starting to have more of it. We are engaging with them informally now. At the national level, NACTO published guidelines that we contributed to. There are working groups that they organize and coordinate.

Q. Is any infrastructure adaptation to consider? Like parking and curb management?

Darton – Primary efforts are related to but not solely AVs. We made some efforts 5-6 years ago to reduce conflicts introduced by TNCs like Uber and Lyft. Companies are designing to operate vehicles with the environment as is. Doing restriping, etc. is outside our capacity to accommodate as well. We are not seeking to use infrastructure that way.

Vamsi – Companies already do 3D mapping. Is that not enough?

Darton – Not sure if they can capture the complexity of information we are trying to capture. Like varying usage of curbs at different times of the day. The curb management team has been working on simplifying curb usage.

Ben – Do you provide a feed for work zones?

Darton – The Open Mobility Foundation manages mobility data specification and curb specifications. We are part of the group that includes public and private entities to develop standards for information given and received to standardize these specifications.

Patrick – Did city or county staff do an inventory? Or did the companies?

Darton – It's a combination of resources the city is utilizing. There is no information that we are getting from AV companies.

Ryan – Has SFCTA or SFMTA Determined how AVs fit into its broader strategies?

Darton – Yes. Those are our core policy goals and something we always refer to. We are more focused on immediate operational challenges.

Ben – Are there plans to get into more DOE grants we spoke about earlier?

Darton – Yes.

Wrap Up & Next Steps

Ryan – Our next step is hosting public workshop on November 15th (tentative).

Darton – We would be happy to provide inputs on drafts for the workshop.

Darton – In the previous slide about intersection of AVs and electric vehicles – San Francisco AVs are all electric. Charging infrastructures are a mix of public, private. We are engaging with planning department to understand how land use regulations are shaping where the companies are seeking to charge their fleets. Proposals are being written for companies to lease or buy parking garages in downtown areas. That is another area and group that gets involved in the conversation.

Jean – Land use control remains at local level and it will allow cities to exert some of their policies and needs.

Jean - AVs tend to get credit for being EVs. But their CPUs emit so much GHGs that they might decrease some of the benefits. This needs to be accounted in climate goals.

Darton – There was a complaint recently about AVs parked along neighborhood parks without being turned off. Generally, they keep AVs running because it takes time to start it back up if shut down. Are we able to enforce idling limitations? Especially since on hotter days a lot of energy would be consumed in cooling the computers in an AV.

Jean – Just like transit system needs planning for layover maybe AVs layovers could be planned as well. That can be a potential tool for city to exert control.

San Mateo Countywide Automated Vehicles Strategic Plan



Appendix D: Public Workshop Presentation



San Mateo County Automated Vehicles (AV) Strategic Plan

Public Workshop

November 15, 2023

Thanks for joining! We will begin shortly.



1

Workshop Agenda

- 6:00 – Introductions & Opening Remarks
- 6:15 – Project Overview Presentation
- 6:45 – Q & A
- 6:55 – Breakout Room Discussions
- 7:40 – Breakout Sessions Debrief (Return to Main Session)
- 7:50 – Next Steps & Conclusion



2

2

Opening Remarks



Patrick Gilster
SMCTA
Director, Planning and Fund Management



Kaki Cheung
C/CAG
Deputy Director

This project is co-sponsored by San Mateo County Transportation Authority (SMCTA) and City/County Association of Governments of San Mateo County (C/CAG)



3

3

Project Overview Presentation



4

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Project Background

Workshop on **Towards an Autonomous Future in San Mateo County**
on November 17, 2021

Identified Next Steps:

- Organize an AV Task Force or Working Group
- Develop a San Mateo Countywide AV Strategic Plan
- Plan for and fund AV pilots



5

5

Why Do We Need an AV Strategic Plan?

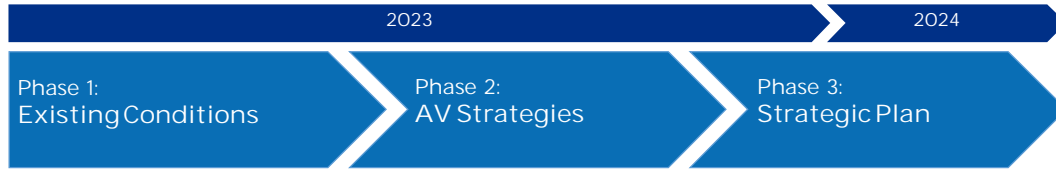
- Identify current policy and regulatory frameworks for AVs
- Develop a cohesive strategy for AV pilots and programs
- Strategically compete for funding and economic opportunities
- Help prepare for future automated vehicle deployment



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Project Timeline



Phase 1 (Summer 2023): Identify existing AV programs at local, state, and federal levels

Phase 2 (Fall 2023): Develop a framework for AV pilot programs, projects and activities

Phase 3 (Winter 2023): Prepare the draft San Mateo Countywide AV Strategic Plan



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About the Technology: Overview



Automated Vehicles:

- Use internal sensors to interpret the environment
- Range from assistance to full automation



Connected Vehicles:

- Use information received from external systems
- Information can come from other vehicles or infrastructure like traffic signals



Connected Automated Vehicles:

- Use both sensors and external communication technology









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Levels of Automation

➤ Vehicle autonomy exists on a range:

0	1	2	3	4	5
 <p>No Automation</p> <p>Zero autonomy, the driver performs all driving tasks.</p>	 <p>Driver Assistance</p> <p>Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.</p>	 <p>Partial Automation</p> <p>Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.</p>	 <p>Conditional Automation</p> <p>Driver is necessary, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.</p>	 <p>High Automation</p> <p>The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.</p>	 <p>Full Automation</p> <p>The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.</p>

Society of Automotive Engineers (SAE) Automation Levels Full Automation




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Automated Vehicle Applications

➤ How are automated vehicles used in the real world?

PERSONAL VEHICLES	RIDE HAILING VEHICLES	TRANSIT	FREIGHT
 <p>Automated cars may improve safety, reduce congestion, and provide new mobility options for individuals who are unable to drive.</p>	 <p>AV shuttles and taxis to supplement public transport and provide first and last-mile connections.</p>	 <p>Driver assistance technologies for mass transit and autonomous first/last mile shuttles.</p>	 <p>Automated trucking and package delivery aimed at increasing supply chain efficiency, improving safety, and reducing costs.</p>



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What Research Have We Done?

- Reviewed County Transportation Plans & Programs
- Conducted One-on-One Interviews with Cities, Agencies and Private Sector AV Operators
- Conducted In-depth Discussions with Peer Agencies



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Existing Conditions Report Findings

- AV testing is happening in San Mateo County
- This is the first county program or plan to address AVs
- Learn from local, state, and federal AV policies and programs
- Focus areas include pursuing an AV pilot to address specific transportation needs
- The Existing Conditions Report is posted online at:
www.smcta.com/planning-projects/SMCAVPlan



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Draft - Vision Statement








- SMCTA and C/CAG will support strategic measures toward implementing automated vehicle technologies that promote equitable levels of access, safety, reliability, and sustainability in San Mateo County.



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Draft - Strategic Plan Goals






-  Accessibility & Equity
-  Engagement
-  Connectivity
-  Safety
-  Support Local Agencies
-  Sustainability
-  Workforce Development



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Draft - Strategic Pillars

-  Agency Readiness
-  Infrastructure Readiness
-  Public Outreach & Partnerships
-  Policy
-  Pilots & Testing



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Example AV Strategy A: Shared AV Shuttles

What is it?

- Small automated transit vehicles for 6-20 passengers
- Low speed (under 25 mph)
- Typically operated by a private partner

Uses & Benefits

- Provides increased mobility options to all travelers (incl. those without cars) on fixed routes or on-demand service
- Can reduce single occupancy driving and increase transit usage
- Ideal for first/last mile services and closed environments
 - Connections to transit hubs (e.g., SamTrans BART, Caltrain)
 - Campuses (e.g., universities, office parks, planned communities)



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Example AV Strategy B: Advanced Driver Assistance

What is it?

- Sensors and devices for safety
 - ❑ Automatic breaking
 - ❑ Blind spot monitoring & increased camera visibility
 - ❑ Lane keeping
 - ❑ Precision docking (self-parking)



Uses & Benefits

- Can improve safety and driver awareness on public transit vehicles (e.g., SamTrans buses)
- Can reduce collisions with other vehicles, bicyclists and pedestrians



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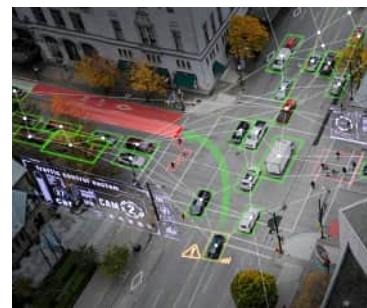
Example AV Strategy C: Data Sharing with AVs

What is it?

- Providing real-time data from agencies to improve AV safety and operations

Uses & Benefits

- Providing personal and shared AVs with:
 - ❑ Active construction zones
 - ❑ Lane closures
 - ❑ Emergency vehicle locations & active incidents
 - ❑ Curb usage data (parking restrictions, availability)
- Improves situational awareness for AVs to make them safer and more efficient



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Example AV Strategy D: Automated Delivery Robots

What is it?

- Providing last-mile delivery services via local streets and sidewalks
- Low speeds (up to 25 mph), remote control capabilities if needed

Uses & Benefits

- Provides delivery of food, packages and medical deliveries
- Typically used in closed environments (Universities and colleges, Business campuses, Hospitals, etc.)
- Could be used to reach underserved communities
- Smaller delivery vehicles require less infrastructure



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Project Timeline



- **Phase 1 (Summer 2023):** Identify existing AV programs at local, state, and federal levels
- **Phase 2 (Fall 2023):** Develop a framework for AV pilot programs, projects and activities
- **Phase 3 (Winter 2023):** Prepare the draft Countywide Automated Vehicles Strategic Plan



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Next Steps

- Thank you for joining today!
- Please provide feedback on this workshop by taking the survey
- Feedback from today's session will be used to help prioritize projects and programs in the Strategic Plan
- The Countywide AV Strategic Plan and an action plan will be completed in early 2024



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Questions/Feedback

Project Website/Factsheets/Draft Existing Conditions Report Available at: <https://www.smcta.com/planning-projects/SMCAVPlan>

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San Mateo Countywide Automated Vehicles Strategic Plan

Appendix E:

Draft Countywide AV Strategic
Plan Stakeholder and Public
Comment Resolution Matrix



Countywide AV Strategic Plan Stakeholder & Public Comment Resolution Matrix

The Draft Countywide Automated Vehicles (AV) Strategic Plan was published online on May 16, 2024 and was available for public and stakeholder comment until July 15, 2024. The draft Strategic Plan was made available online with an easy-to-use virtual platform that enabled participants to place comments directly in the document online. The virtual platform was available through SMCTA's website. The project team also made presentations on the Draft Plan to the C/CAG Technical Advisory Committee (TAC) on May 16, 2024, and C/CAG's Board on June 13, 2024.

The first table provides a summary of comments received during presentations and online through the virtual tool. The project team received a request from a member of the public to provide feedback over the phone as an accommodation for visual impairment. This request was accommodated with efforts to find future solutions to ensure that all members of the public can contribute to future plans with similar levels of access.

The second table provides a summary of edits recommended by the SMCTA and C/CAG project team. Both tables document how comments have been answered or addressed in the Final Plan.

Table 1: Draft Strategic Plan Comment Matrix | Stakeholder and Public Feedback

Input Channel	Comment	Resolution
Phone Call	Shared automated shuttles would be helpful for communities with seniors like Belle Haven in Menlo Park.	The Strategic Plan proposes shared automated vehicle pilots as a method of providing transit solutions to those without a vehicle. Specifically, strategy 5.2 focuses on planning and conducting a shared AV pilot. Strategy 5.2's description has been updated to include Belle Haven as a potential pilot location and noted that specific communities (such as those with mobility challenges) will be prioritized in future AV pilot plans.
Phone Call	Automated delivery vehicles, operating on sidewalks, may cause difficulties for pedestrians with visual impairments or other disabilities.	Automated delivery vehicles are not currently a strategy being pursued in the AV Strategic Plan. However, since they could be considered at a future date, Strategy 4.4 has been updated to specifically mention that the needs of persons with disabilities shall be taken into consideration on any future AV pilot in the County.
Phone Call	People with visual impairments may experience difficulties when using automated vehicles operated by private rideshare companies (e.g., Waymo or Cruise). Examples of potential difficulties include using smartphone applications or	The private rideshare companies are regulated by DMV and CPUC, and not the County. Strategy 4.4 recommends that the County establish an equity policy for automated vehicle deployment. This policy covers people with visual impairments and

Appendix E: Stakeholder & Public Comment Resolution Matrix

Input Channel	Comment	Resolution
	activities, safe boarding, and simple activities like finding vehicles when they arrive.	would apply to any AV pilot or program that utilizes public funding. Strategy 4.4 has been updated to say that companies or agencies must show adherence to equity goals/metrics before public funding is released.
Phone Call	Automated vehicles are typically electric which are much quieter than combustion engine vehicles. The quietness of the vehicles can be dangerous for visually impaired pedestrians.	The Strategic Plan does not have the authority to regulate vehicle safety requirements. Vehicle safety is regulated by the National Highway Traffic Safety Administration (NHTSA). SMCTA and C/CAG can advocate or lobby on behalf of the county and its residents for enhanced safety regulations. Advocacy is captured under Strategy 4.2 – Engage with State Regulatory Agencies.
Phone Call	Consider ongoing engagement with organizations representing differing abilities or with committees currently managed by SamTrans.	Ongoing engagement with organizations representing people with differing abilities or committees managed by SamTrans can be addressed by Strategy 3.2 - Public Education. The strategy has been renamed “Public Education and Outreach” and now includes language about engaging with the groups mentioned.
Virtual Platform	Regarding Strategy 5.2 – Shared AV Shuttle Pilot Would it be feasible to have a pilot on the coastside, possibly in the summer to help with shuttle folks between a park and ride site and perhaps beaches or recreational areas?	Strategy 5.2 has been updated to include connections to beaches and parks on the Pacific Coast as a potential location for an AV shuttle pilot.
Virtual Platform	Regarding Strategy 5.2 – Shared AV Shuttle Pilot Are we saying that we are trying to connect Bart Stations to Caltrain stations? How the bullet is currently phrased can be confusing. Where would be the starting points and ending points for these shuttle connections?	Updated the description of strategy 5.2 to show, “Shuttles to connect to BART stations AND Caltrain stations.” A minor typo was corrected and the text that describes potential AV shuttle pilot locations has been updated.
Virtual Platform	Regarding Strategy 5.2 – Shared AV Shuttle Pilot Redwood City is one word.	Revised to address comment.
Virtual Platform	Regarding Sustainability Guiding Principle Automated Vehicles are inherently a less green option than almost all existing (buses, trains, etc.) or emerging	Pilots implemented or funded by SMCTA will focus on public safety and transit solutions to complement and increase mobility and access to existing transit services (e.g, BART and SamTrans). Current pilot

Appendix E: Stakeholder & Public Comment Resolution Matrix

Input Channel	Comment	Resolution
	<p>technologies (electric vehicles). With the power draw of the sensors, they're significantly less energy efficient than real drivers. I see no need for our county to assist in deploying a floundering technology when we are under-investing in proven solutions like SamTrans and BART. We should be raising wages to attract transit drivers (especially so they can live close to work), building transit lanes (or exclusive right of ways), expanding bus service coverage (cities with much lower density than most of the Peninsula have much more bus service), expanding BART through San Mateo County, and converting primary corridors (like the ECR route) to rail. Automated vehicles by design do little to discourage personal car ownership and, even if used, does not significantly decrease energy use per mile per person. It's fine to establish regulations to oversee private entities attempting to roll out AVs as an option, but any state, county, or city funding should be directed at public transit.</p>	<p>recommendations include Advanced Driver Assistance Systems (ADAS) on the SamTrans fleet, data sharing to improve AV safety and shared automated vehicles to provide first and last mile transit solutions to connect commuters to higher order transit like BART and Caltrain.</p>
<p>Virtual Platform</p>	<p>Regarding Section 4.1 – Relevant County Plans and Programs</p> <p>Speaking for the Coast - we are concerned that this Chapter does not seem to feature any Coastal transportation plans. We are considering some AVs locally for the 'last mile' so are concerned the Coast is not featured.</p>	<p>Coastal transportation plans with relevance to AV technology have been sourced and are now included in Section 4.1 – Relevant County Plans and Programs. The coastal transportation plans included and their relevance to AV planning are identified below:</p> <p>Connect the Coastside:</p> <p>The short distance microtransit (Recommendation T2) in Connect the Coastside on page 104 could be an opportunity to use Shared AV technology in - lieu of traditional shuttles or microtransit with future feasibility study.</p> <p>Half Moon Bay - Climate Action Plan:</p> <p>The HMB Climate Action Plan identifies a desire to implement public and shared transit programs to increase transit mode share (measure T-2) and to increase bus zero-emission vehicles (recommendation TL-5) which both support the possible implementation of shared AV shuttles. The recommendation T-2.5 states “Work with transportation partners to identify and implement a local electric shuttle system</p>

Appendix E: Stakeholder & Public Comment Resolution Matrix

Input Channel	Comment	Resolution
		opportunities to close the ‘last mile’ gap for public transit. Seek and apply for grant funding to aid implementation and shuttle procurement.”
Virtual Platform	<p>Regarding Strategy 5.2 – Shared AV Shuttle Pilot</p> <p>Many of our Coastal residents need shuttles to medical appointments over Hwy 92. I realize this stretch of road is problematic, but it would help our residents if shuttles from the Coast to the rest of the Peninsula were incorporated into the planning process. It would also be great to have shuttles from the 280 corridor to beaches.</p>	Coastal locations have now been considered. Strategy 5.2 was updated to include coastside routes and SR 92 as potential locations for an AV shuttle pilot. The details of any potential AV shuttle routes will be determined in a future project.
Email Submission	<p>Regarding Strategy 2.1 – Infrastructure Readiness</p> <p>One idea is to add a strategy for infrastructure readiness or to enhance Strategy 2.1. Instead of solely relying on public agencies to prepare physical infrastructure for autonomous vehicles (AVs), we can involve AVs in this process. Public agencies could establish a reporting system for active AV, allowing them to function as road infrastructure inspectors. AVs, equipped with advanced cameras and lidar systems, can provide high-resolution photos and identify areas needing maintenance or upgrades to enhance AV safety and ensure smooth operation.</p> <p>For instance, if an AV detects faded or unclear lane stripes, it can take photos and report the issue directly to the relevant local agencies for maintenance.</p> <p>Value to the County: This approach can more accurately and precisely identify the needs of AV operations. It can help prevent unnecessary upgrades to county infrastructure based solely on manual inspections or guidelines and reduce the workforce required for AV-related tasks.</p> <p>Potential Implementation Leads: SMCTA, C/CAG, San Mateo County, and local cities</p>	<p>The private sector can have a role in data sharing to support operations and maintenance. Figure 6: Roles and Responsibilities has been updated by changing “traffic management data” under Operations to “operational data sharing.” Under infrastructure readiness, consideration for the involvement of private sector AVs has been considered under “road maintenance/infrastructure enhancements by adding the phrase, “infrastructure maintenance needs identified by AVs”. The private sector icon for this item.</p> <p>Strategies 2.1 and 2.3 have been updated to include the private sector in determining infrastructure needs and participating in the infrastructure assessment process. Finally, strategy 4.3 (data sharing policy) has been updated to incorporate the private sector’s involvement in infrastructure readiness.</p>
C/CAG TAC	The Plan is timely with the news that Waymo is commencing statewide	In-Meeting Response:

Input Channel	Comment	Resolution
	<p>operations in California, including San Mateo County. Does this change anything for our approach to the Strategic Plan? Does it require any changes or augmentations to the plan to consider expanded operations?</p>	<p>The recent expansion of Waymo operations demonstrates the relevance of the strategic plan. The plan seeks to equip the County with strategies to respond to the changing AV landscape.</p> <p>Strategic Plan Resolution: No change. The Plan proposes strategic partnerships with private operators like Waymo to explore transportation solutions or data sharing to enhance safety and reduce conflict with work zones, emergency vehicles, and public transit operations.</p>
<p>C/CAG Board</p>	<p>How can we assess the cost of electric cars using our roadway, particularly for TNCs like Waymo. This is an equity issue as you have more and more people with higher incomes purchasing electric vehicles and people driving combustion engine vehicles, low-income people, are footing the bill for roads through the gas tax.</p>	<p>In-Meeting Response: The Metropolitan Transportation Commission has a road usage charging committee exploring how to modernize how funds are collected for roads and highways.</p> <p>Strategic Plan Resolution: The plan seeks to find equitable solutions for the county.</p>
<p>C/CAG Board</p>	<p>What level of discussion have you had with TNCs?</p>	<p>In-Meeting Response: The team interviewed private operators in the existing conditions phase.</p> <p>Strategic Plan Resolution: Existing conditions section and appendices provide this information.</p>
<p>C/CAG Board</p>	<p>Is this strategic plan intended to manage TNCs or the county's own vehicles?</p>	<p>In-Meeting Response: There are strategies within in the plan that are intended to address the deployment of private vehicles, as well as fleet vehicles and/or operations for shared automated shuttles.</p> <p>Strategic Plan Resolution: The strategies in the plan are designed to be open to each of these scenarios. In future phases prioritization will occur to select more specific strategies to pilot and/or deploy.</p>
<p>C/CAG Board</p>	<p>Appreciation shared for including both accessibility and workforce development within the guiding principles. Can you speak to how this addresses workforce development in the county?</p>	<p>In-Meeting Response: Comment is noted and appreciated. Workforce development is addressed throughout the plan</p> <p>Strategic Plan Resolution: The Strategic Plan proposes potential pilots to enhance SamTrans fleet safety and</p>

Input Channel	Comment	Resolution
		operationalize automated shuttle services to provide first and last mile solutions to higher order transit. These pilot programs will require new staff and/or staff training to ensure that county and local agencies are prepared to operate and manage pilot programs. Workforce development may occur in a range of roles including fleet maintenance technicians, operators, transit planners, and management.
C/CAG Board	What role do local agencies play in implementation? Would local jurisdictions need to create their own sub plans?	<p>In-Meeting Response: The Strategic Plan creates a vision and set of guiding principles to oversee the implementation of AV pilot programs in the County. Local agencies can partner with SMCTA and C/CAG on implementation of pilots and strategies, but local jurisdictions do not need to create their own plans. The plan also provides a framework for potential funding strategies through an organization like SMCTA and C/CAG.</p> <p>Strategic Plan Resolution: Reviewed related language and confirmed local roles.</p>
C/CAG Board	Are you working with the Silicon Valley Leadership Group ?	<p>In-Meeting Response: Thank you for the recommendation. We may reach out to you to connect with SVLG.</p> <p>Strategic Plan Resolution: No change.</p>
C/CAG Board	Personal experience shared about the difference safety approximate to Waymo vehicles as opposed to Cruise which had a lot of problems. For equity, the private operators may be a little cheaper because you don't have to tip.	<p>In-Meeting Response: No immediate response was provided.</p> <p>Strategic Plan Resolution: No change.</p>
C/CAG Board	We are erecting many new 5G cell towers. Will 5G cell towers help the operation of automated cars?	<p>In-Meeting Response: It depends on how the AV companies set their systems up. AVs typically rely on a cellular communications link to an operations center for remote support. Thus, this could be possible for stronger, more reliable 5G cellular network to help with the operation of automated vehicles.</p> <p>Strategic Plan Resolution: No change.</p>

Input Channel	Comment	Resolution
C/CAG Board	Is there a reason why Hillsborough and Burlingame were involved as interviewees over others?	<p>In-Meeting Response: We presented to the C/CAG TAC as one of our first engagements. We polled them to see who might participate in conversations with us about AV priorities. They were the TAC members that raised their hands.</p> <p>Strategic Plan Resolution: Not applicable.</p>
C/CAG Board	We may be interested in reviewing the document again in September.	<p>In-Meeting Response: We will work with staff to get it on the agenda for additional discussion and review of updates.</p>

Table 2: Draft Strategic Plan Comment Matrix | Revisions from Project Team Review

When reviewing the comments received and making other edits, the following changes were requested through the project team review process.

Input Channel	Comment	Resolution
Project Team Review	Various spelling/grammar related comments	<ul style="list-style-type: none"> • Various sections have been edited to improve clarity and readability • Titles have been bolded for consistency • Table breakage has been addressed • Readability has been improved
Project Team Review	<p>Regarding the Roles and Responsibilities Table – Figure 7.</p> <ul style="list-style-type: none"> • Wouldn't the private sector also have some roles with data and data sharing? Should we coin this term in a more generic manner, like AV data, and put both local agencies and the private sector responsible? • What are some of the reasons that bus stop upgrades are relevant to AV deployment here? 	<ul style="list-style-type: none"> • The roles and responsibilities graphic has been updated to reflect the involvement of the private sector and updated the title of “traffic management data” to “operational data sharing.” • Under Regulations and Permitting, “driverless vehicle reporting” has been updated to read “AV data sharing and reporting” and now includes the private sector icon to demonstrate private sector responsibility. The regulation of data sharing covers the AV safety data (e.g. crashes and disengagements) that needs to be reported to the DMV. The operations data sharing covers real time data sharing of things like traffic data, SPaT data, EV data, workzone data and curb usage data. • Some bus stops may require upgrades or changes to accommodate Advanced Driver Assistance Systems (ADAS) if integrated into

Appendix E: Stakeholder & Public Comment Resolution Matrix

Input Channel	Comment	Resolution
		SamTrans fleet. This would enable potential operational enhancements such as platooning or precision docking.
Project Team Review	<p>Regarding the description of the SFCTA Treasure Island Automated Shuttle pilot in section 4.3.4.</p> <p>SFCTA had released an evaluation report on the AV service, please include a link to the report in this plan.</p>	SFCTA's Treasure Island Automated Shuttle Pilot final report has been incorporated into section 4.3.4. The link to the report has also been added for the reader's benefit.
Project Team Review	<p>Regarding state regulatory authority in section 4.3.5</p> <p>We should make reference to Senate Bill 915 and describe that here.</p>	Given the uncertain future of Senate Bill 915, Section 4.3.5 includes general reference to legislation aimed at providing local jurisdictions with more control over AV permitting.
Project Team Review	<p>Regarding section 6.4.1 Policy Implementation Approach</p> <p>Concerns were raised about responsibilities held by the TA and C/CAG. We can help facilitate but stating that we would ensure that the responders understand the interaction is a bit outside of our scope.</p>	Section 6.4.1 was revised to appropriately assign responsibility to the correct agencies.
Project Team Review	Section 4.4. – Review AV Permit Holders in California	Reviewed and updated list of permits that have been issued by CPUC.
Project Team Review	<p>Regarding Strategy 5.2 – Shared AV Shuttle Pilot:</p> <ul style="list-style-type: none"> • The mid term actions that are described made references to equity focus areas or under-served areas. However, the proposed sites identified in the shuttle pilots aren't exactly disadvantaged communities. How do we reconcile this? • Is this to connect people from the Millbrae Bart station to the Caltrain station, or are we talking about just connecting the City of Millbrae in general with the Broadway station? How was this location selected? • Balboa Park is a SF County station. Can you elaborate on why that site is chosen? 	<ul style="list-style-type: none"> • Strategy 5.2 has been updated to note that equity priority communities will indeed be prioritized. Data input may include MTC's Equity Priority Framework. • Language was added to clarify the Millbrae to Burlingame route Generally, the list provided recommends ideas for further consideration as potential options. This specific recommendation was received from commute.org as a potential AV pilot location. Commute.org suggested a 1.5-mile route along California Drive to connect the Millbrae station with the Broadway Caltrain station. • This recommendation was received at the virtual public meeting. The Balboa Park recommendation has removed as it is not in San Mateo County.