SJCOG
SAN JOAQUIN COUNCIL OF GOVERNMENTS

TRANSPORTATION INNOVATION PLANNING STUDY

FINAL REPORT

April 2021

San Joaquin Council of Governments

Transportation Innovation Planning Study

Final Report

Prepared For:
San Joaquin Council of Governments

Funded by:
Caltrans Sustainable Transportation Planning Grant Program

Prepared By:
Kittelson & Associates, Inc.
2510 J Street, Suite 200
Sacramento, CA 95816
(916) 266-2190

Project Manager: Abby Morgan, Ph.D., P.E.
Project Principal: Matt Braughton, RSP
Supporting Authors: Rachel Grosso, Bincy Koshy, Richard Dowling, Ph.D., P.E., T.E.

Contract # C-20-037 SJCOG Transportation Innovation Planning Study
Project No. 24326

April 2021

Executive Summary

Transportation is evolving rapidly. The ways people and goods move are changing as new apps or new mobility devices enter the market. Across the country, agencies are trying to answer questions like: How will these innovations impact transportation and land use? What can local agencies do to prepare?

This final report summarizes the study process, findings, and recommendations of the San Joaquin Council of Governments (SJCOG) Transportation Innovation Planning Study. The study goals were to understand the impacts of emerging technologies in the region and to recommend an innovative technology solution to implement. The study objectives were to:

- Review SJCOG's existing technology initiatives.
- Develop a policy framework to advance transportation innovation in the region.
- Develop metrics to compare technology innovations.
- Recommend one technology innovation for further planning and piloting.

What are the impacts of transformational technologies?

Technology is a tool that can help SJCOG and its partner agencies address mobility challenges, supply new means of accessibility, improve the safety and equity of the transportation system, and support resilient communities. Some of the technologies considered in this study are connected and automated vehicles, ride hailing, e-bikes and e-scooters, electric and alternative fuel vehicles, mobile phone apps, 5G communication, hyperloop, and Intelligent Transportation Systems (ITS). These technologies impact safety, mobility, travel demand, infrastructure management, funding, and revenue streams.

What did we learn from this self-assessment?

The region's transportation needs were named based on a literature review of local and regional plans and initiatives, stakeholder input to an online survey, and input from the Innovation Working Group:

What technology will be common in 20 years?

When SJCOG updates the Regional Transportation Plan (RTP) in 2022, it should consider the following three potential future technology scenarios:

> The **Business-as-Usual** scenario continues the current trends in electric vehicle (EV) adoption, automated vehicle (AV) use, teleworking, regional mobility, workforce demands, and transportation system data collection and management.

The **Moderate Technology Transformations** scenario advanced transportation system management through agency investments in data collection and monitoring. These investments boost AV and EV adoption, telework, regional mobility, shifting workforce, and passenger/goods movement.

The **Extensive Technology Transformations** scenario has widespread investments in EV and AV for passenger and freight movement, along with widespread telework, high-speed internet access, and increased industry automation leading to shifting workforce demands and economic transactions.

How can SJCOG advance transportation innovation?

SJCOG should consider including the **Table ES-1** strategies and actions to accelerate transportation innovation in the region. Including these strategies and actions in the RTP will speed up cost-effective, environmentally friendly agency actions in the region. SJCOG and local agencies can request federal funding through the RTP implementation process (the Regional Transportation Improvement Program, or RTIP). Projects or actions in the RTP could potentially use the RTP Environmental Impact Report (EIR) as a basis for their own environmental clearance documents.

Table ES-1. Strategies and Actions to Accelerate the Transportation Innovation in San Joaquin County

	Moderate Transportation Innovation		**Moderate/Extensive Transportation Innovation**		**Extensive Transportation Innovation**	
Timeline	**Strategy**	**Actions**	**Strategy**	**Actions**	**Strategy**	**Actions**
Now	**Train Staff**	• Support ongoing staff education through industry conferences and webinars	**Update Policies**	• Review policies and plans • Develop diverse stakeholder working groups • Develop technology-agnostic policies • Set priorities and identify milestones for monitoring and updates	**Expand resources**	• Conduct an organizational self-assessment • Identify training, hiring, or resource needs
Short-Term	**Improve access to transit**	• Integrated fare payment (**EZHub*) • Mobility Hub Quick-Build Projects near key destinations (**Stockton Mobility Collective Project*) • Micromobility service expansion (**RTD Van Go!*)	**Expand Electric Vehicle use**	• Electric bus fleet partial transition (**RTD EV buses*) • Electric vehicle charging infrastructure (EVCI) expansion for carshare and passenger cars (**Stockton Mobility Collective Project – includes carshare EVCI*)	**Plan for fiberoptic high-speed communications expansion**	• Fiber City Checklist Plan • Intelligent Transportation System (ITS) Master Plan
			Pilot test CV technology	• Connected farm equipment safety pilot		
Long-Term	**Expand Zero-Emission Transport Modes**	• Electric bus fleet full transition • EVCI expansion for passenger cars, trucks, micromobility, etc. • Zero Emission solutions for rail transport	**Pilot test AV technology**	• Automated goods delivery pilot • Automated shuttles between Amtrak and ACE or between distribution centers and Mobility Hubs	**Adopt AVs at regional level**	• Fiberoptic communication expansion • Automated Truck-Only Lanes • AV-supporting infrastructure and roadway design

How can agencies prepare for technology innovations?

Agencies can act today to better prepare themselves and their staff for impacts of emerging technologies. First, agencies can self-assess their staffing, resource, and organizational readiness to address innovation. This self-assessment should inventory current resources, capabilities, plans, and policies and find any gaps or barriers.

Based on the self-assessment, an agency might choose to address the technology transition gaps found in their staffing or policy. Training or hiring specialized staff can address gaps in staff knowledge or ability. Industry conferences are affordable training opportunities.

When an agency is ready to update its plans and policies, it should develop *flexible policies* that can keep up with changing technology and transportation behavior without needing frequent updates. As agencies update their plans, they should involve diverse stakeholders. Agencies should also set priorities and name milestones or intermediate checkpoints where monitoring may show the need to revisit the plans.

What can SJCOG do now to advance transportation innovation?

SJCOG can promote innovation in the region through planning and pilot projects. Pilot projects give agencies first-hand experience and lessons learned with new technologies and their existing systems. Technology is changing rapidly, and agencies need to find effective ways to get smart about new systems, new data, and new transportation models. Finding challenges early on gives an agency the chance to make changes and act on lessons learned.

The Innovation Working Group and the study team named nineteen innovative solutions where technology could be applied as a tool to address some of the region's transportation needs. These solutions include potential pilot deployments, plans, or programs that SJCOG or its partner agencies could start to address the region's transportation needs and to support innovation. **Appendix I** provides additional details about the prioritization criteria and **Appendix J** provides the project evaluation ranking.

The Innovation Working Group and the Study Team prioritized the following projects based on their alignment with the region's goals, their ability to meet a regional mobility need, and their feasibility for implementation in the next one to two years:

1. Fiber City Checklist
2. Connected Farm Vehicle Safety Pilot
3. Mobility Hub Quick Build Pilot
4. Automated Vehicle Goods Delivery Pilot
5. Intelligent Transportation System (ITS) Master Plan
6. Microtransit Pilot

The recommended pilot action from this study is for SJCOG to conduct the **Fiber City Checklist**. As the most critical infrastructure in an increasingly digital world, fiber optic cabling can enable rural and urban areas alike to enjoy high-speed internet and 5G cellular service. The Fiber City Checklist is a compilation of best practices and recommendations. The checklist defines a clear, three-part process for readying the region for widespread fiber optic construction. It includes an existing inventory, a review of utility policies, and streamlining utility permitting. This checklist is the first step to building a public-private partnership with telecommunications providers.

Table of Contents

1. Introduction

Mobility is vital to the health and welfare of the residents of San Joaquin County and to the strength of the local economy. Applications of emerging technologies are revolutionizing mobility in the United States. SJCOG's role and responsibility is to ensure that the revolution in mobility proceeds equitably for all its residents, and efficiently and reliably for all freight and goods movements. SJCOG has various tools available for ensuring the equitable and sustainable roll out of mobility improvements in the region. These tools include partnerships, demonstrations, pilot tests, grants, financing, incentives, and regulations by SJCOG and its member agencies.

In May 2020, the San Joaquin Council of Governments (SJCOG) initiated its first Transportation Innovation Planning Study. This Transportation Innovation Planning Study builds off the thorough research SJCOG staff conducted on automated vehicle technology, potential impacts, and local policy and projects (*Emerging Planning Issue Briefing: Automated Vehicles*, May 2019).

The study objectives are to:

- Review existing technology initiatives led by SJCOG and other entities in the region.
- Develop a policy framework to inform SJCOG's regional role in advancing the adoption of transportation innovations in the region.
- Evaluate various technology innovations using criteria and metrics developed by a working group.
- Recommend one technology innovation for further planning and piloting.

A self-assessment was conducted of the region's transportation needs and readiness to accelerate technology adoption. **Figure 1** outlines the self-assessment process.

Figure 1. Self-Assessment Process

The self-assessment process included:

- Forming an Innovation Working Group to collaborate with SJCOG and the study team throughout the project.
- Reviewing current SJCOG initiatives, local and regional plans, and national guidance to understand what transportation problems in the region could be solved using technology as a tool. In this process, stakeholder input was collected from the Innovation Working Group and through an online survey. Potential technology applications were identified, which aligned with SJCOG's regional transportation goals and with the needs identified in the self-assessment.
- Developing policy development guidance to help SJCOG and its partner agencies review their local planning and development policies and update them as needed to be technology-agnostic.
- Developing high-level metrics to prioritize initial pilot project ideas before thorough plans have been developed, as well as more detailed metrics that could be used to prioritize projects once they have been more refined. This step also identified metrics that SJCOG and its partner agencies can monitor to assess the impacts of emerging technologies in the region.
- Identifying potential funding opportunities.
- Evaluating potential pilot projects based on their cost-feasible implementation.
- Forming future technology scenarios that address the needs and goals of the region for the consideration of the future Regional Transportation Plan and Sustainable Communities Strategies (RTP/SCS).

The self-assessment considered the mobility impacts for residents, as well as the transportation and warehousing economic sector. The pilot project identification was supported by Working Group input and an assessment of existing needs and feasible costs. This final report informs future RTP/SCS strategies.

Definitions and Key Terms

The transportation sector is using a vast array of technologies on our nation's highways, roads, streets, rails, air, and water. This SJCOG Transportation Innovation Planning Study focuses on the applications of new technologies for:

- Passenger and goods movement,
- Data collection and information sharing,
- System management and logistics, and
- Government services.

Appendix A provides more detailed definitions and additional terms.

- **Connected Vehicle (CV):** A vehicle that can communicate with other vehicles, infrastructure, or other wireless technologies.
- **Automated Vehicle (AV):** Also known as driverless cars or self-driving vehicles, AVs are equipped with sensors (for example: cameras, radar, LiDAR, computer vision, GPS, or CV technology), which allow them to drive with little to no human assistance. There are several levels of automation, some aid the driver but do require the human driver to perform most of the functions of the driving task.

- **Transportation Network Company (TNC):** Private transportation technology firms that provide services such as ride-matching, ridesharing, and ridehailing through vehicle-routing software platforms and licensing. Well-known TNCs include Uber, Lyft, Via, and TransLoc.
- **Mobility as a Service (MaaS):** Describes mobility as a commodity independent of mode, where a single platform handles all aspects of an individual's trip (payment, mode and vehicle choice, route planning, and navigation.) A common payment system and a common platform or app that combines public and private transportation services enables this shift. Users pay for trips on multiple modes using a single account. MaaS offers travelers mobility solutions based on their travel needs.
- **Micromobility:** The concept of using alternative travel modes for short trips or first- and last-mile connections. Typical examples include station-based or dockless bikes, electric-bikes, and electric-scooters. Micromobility services are often provided by a TNC, which owns a fleet of mobility sources and supplies the service as a shared use.
- **Ridehailing:** When a customer hails a ride often through a mobile app or kiosk. The driver takes the customer to a destination requested by the customer for a charge, and payment is made automatically through a mobile app. Ridehailing services are run by TNCs who adjust the cost of a ride based on current demand.
- **ACES:** An acronym used to refer collectively to Automated, Connected, Electric, and Shared-Use Vehicles (ACES).

2. Innovation Working Group

SJCOG formed an Innovation Working Group to understand policy, performance metrics, and funding opportunities for automated vehicle (AV) deployments and other transportation innovations in the San Joaquin region.

The Innovation Working Group goals were:

- Gather thoughts, goals, and aspirations for implementation of automated vehicles (AVs) and other innovative transportation solutions in San Joaquin County.
- Review policies, metrics, and funding sources for AV deployments from local, state, and national agencies. Find 2-3 alternatives in transportation innovation, which are solution-oriented, cost-effective, and implementable.
- Give feedback on AV policies, metrics, and funding sources.
- Select an innovative transportation pilot project.

The Working Group members represented public agencies, transit agencies, and advocacy organizations:

- SJCOG Citizens Advisory Committee (CAC)
- SJCOG Technical Advisory Committee (TAC)
- SJCOG RTP/SCS Working Group
- Standing Goods Movement Task Force
- San Joaquin RTD
- Port of Stockton
- Business Council
- San Joaquin County Development Services
- San Joaquin County Transportation Engineering
- San Joaquin Partnership
- Caltrans, District 10
- Caltrans, Division of Innovation

Over four meetings the Innovation Working Group gave input on the regional needs and opportunities for technology and provided feedback on pilot deployment ideas. The topics of the four meetings were to review and discuss:

- Regional Challenges, Needs, and Context
- Technology Applications to Address Regional Needs
- Priorities for Implementing Technology in San Joaquin
- Potential Future Scenarios for Planning

The Innovation Working Group has functioned as a liaison between the study team and the San Joaquin region municipalities and stakeholder organizations throughout the project. One of the keys to success for this project was the dedication and the diversity of the Innovation Working Group members and the organizations they represented.

Further information on the Innovation Working Group is available in **Appendix B**.

3. Impacts of Transformational Technologies on Land Use and Transportation

New technologies and their applications to transportation may impact travel and land use by reducing the time cost of travel compared to other modes, reducing the monetary cost of travel compared to other modes, or making new travel options available. The potential impacts of transformational technologies, such as connected and automated vehicles (CAVs) are varied and subject to technology development, market direction, infrastructure, and policy guidance. The impacts discussed in this section are broad and will likely change. As they develop, agencies like SJCOG will need to further refine their planning strategies to amplify or to mitigate these impacts.

Transformational Technologies in Transportation

This section outlines the transformational technologies considered in this study and their potential impacts. With thoughtful planning, agencies can use technology as a tool to achieve the region's broader transportation goals for safety, mobility, accessibility, and environmental sustainability.

Some of the technologies considered are displayed in **Figure 2**, and include (a) automated trucking and truck platooning, (b) hyperloop and high-speed interregional rail, (c) Broadband internet access, (d) electric and alternative fuel vehicles, (e) mobile phone apps and 5G communications, (f) sidewalk delivery robots and other automated delivery technologies, (g) on-demand transit and ridehail, (h) automated vehicles, (i) advanced traffic management and Intelligent transportation systems, and (j) unmanned aerial vehicles for last-mile deliveries, and (k) e-bikes and e-scooters.

The SJCOG Transportation Innovation Planning Study focuses on the applications of new technologies for:

- Passenger and goods movement,
- Data collection and information sharing,
- System management and logistics, and
- Government services.

Figure 2. Transformational Transportation Technologies

Guidance and Best Practices for Planning for the Impacts of Transformational Technologies

There are many resources available for regional and local planning agencies to find current guidance or best practices for planning for innovative transportation technology and for developing policy that is flexible and can adapt to changing technology. Please review **Appendix C** for further details. *NCHRP Report 924: Foreseeing the Impact of Transformational Technologies on Land Use and Transportation* (2019) provides a comprehensive assessment of transformational technologies and their potential impacts on travel, policy and planning challenges, and special considerations unique to rural areas. Anticipated impacts of transformational technologies include:

- **Safety and liability** – such as crash frequency, crash severity, and insurance requirements
- **Travel demand** – such as vehicle miles traveled (VMT)
- **Roadway systems** – such as capacity, infrastructure readiness, maintenance, and operations
- **Transit systems** – including common fare payment, on-demand transit, ridehail, mobility as a service, microtransit, and bus rapid transit. These new services should positively impact first- and last-mile connections, night and weekend service hours, sparsely populated areas, and ADA paratransit service provisions.
- **Funding** – New vehicle technologies have the potential to reduce funding revenues: Traffic violation revenue (shared, connected, automated), Motor fuel tax revenue (electric), Vehicle registration revenue (shared), or Parking revenue (shared, connected, automated). They also have the potential to provide new funding from road usage fees based on VMT, technology taxes, or non-shared ride fees.
- **Equity** – Technology applications need to be affordable, available, and accessible to users to need them.

- **Rural** – Rural areas experience different challenges than urban-centric technology deployments, like higher speeds, adverse weather, and limited broadband internet connections. Ongoing rural-focused CAV pilot testing includes:
    - The *Wyoming Connected Vehicle Pilot* across Interstate 80 is utilizing communication between on-board truck cab units and RSUs to provide real-time driver alerts about road closures, wind warnings, speed warnings, and truck parking information. https://wydotcvp.wyoroad.info/
    - The University of Iowa's *Automated Driving System (ADS) for Rural America* pilot is looking to improve the safety and enhance rural transportation options for mobility impaired populations by running an autonomous ADA-compliant mini-bus shuttle on a 47-mile loop in rural Iowa. https://adsforruralamerica.uiowa.edu/

The following resources provide additional guidance and best practices:

- National Cooperative Highway Research Program (NCHRP) Report 924: Foreseeing the Impact of Transformational Technologies on Land Use and Transportation. (2019)[1]
- NCHRP Report 952: Guidebook for Managing Data from Emerging Technologies for Transportation. (2020)[2]
- National Institute for Transportation and Communities (NITC) Report 1216: Matching the Speed of Technology with the Speed of Local Government: Developing Codes and Policies Related to the Possible Impacts of New Mobility on Cities. (2020)[3]
- National League of Cities (NLC), Model Code for Municipalities. (2018)[4]
- University of the Pacific, Warehousing, E-Commerce, and Evolving Trade Patterns in San Joaquin County. (2019)[5]
- UC Davis, How E-Commerce is Reshaping Warehousing and Impacting Disadvantages Communities. (2020)[6]
- UC Davis, The Impacts of Automated Vehicles on City Center Parking Demand. (2020)[7]
- National Association of City Transportation Officials (NACTO), NACTO Policy 2018, Guidelines for the Regulation and Management of Shared Active Transportation, Version 1. (2018)[8]

[1] www.trb.org/Main/Blurbs/179645.aspx
[2] https://doi.org/10.17226/25844
[3] www.nitc-utc.net
[4] https://www.nlc.org/resource/model-code-for-municipalities-0
[5] go.pacific.edu/cbpr and www.sjcog.org/DocumentCenter/View/4755/2019-The-Rise-of-Warehousing-and-E-Commerce-PDF-Document?bidId=
[6] https://escholarship.org/uc/item/1pv6t7q9
[7] https://escholarship.org/uc/item/63m6k29n
[8] https://nacto.org/wp-content/uploads/2018/07/NACTO-Shared-Active-Transportation-Guidelines.pdf

4. San Joaquin's Regional Transportation Needs

In the first step of the project, the study team conducted a self-assessment to identify the region's transportation needs. This self-assessment reviewed recent local and regional transportation plans, conducted an online stakeholder survey, and sought input and expertise from the Innovation Working Group.

The study team reviewed the following local and regional plans at the beginning of the self-assessment:

- SJCOG RTP/ SCS (2018)
- General Plans
  - County of San Joaquin (2016)
  - City of Escalon (2005)
  - City of Lathrop (2004)
  - City of Lodi (2010)
  - City of Manteca (2019, Draft)
  - City of Ripon (2006)
  - City of Stockton (2018)
  - City of Tracy (2011)
- SJCOG Staff Report: Transportation Innovation & Technology Infrastructure (2019)
- SJCOG Staff Report: Transit Ticketing Application and Innovation (2020)
- San Joaquin County 2019 – 2024 Comprehensive Economic Development Strategy (2018)
- Metropolitan Transportation Commission (MTC), Futures: Resilient and Equitable Strategies for the Bay Area's Future (2020)
- MTC, Autonomous Vehicles Perspective Paper (2018)
- MTC, Strategies to Manage Travel Demand Perspective Paper (2018)

In addition to the local and regional plan reviews, input from local and regional stakeholders was collected through an online survey and during the first meeting of the Transportation Innovation Working Group. For the online survey, the study team identified key stakeholders including representatives from advocacy organizations, non-profits, the building industry, business associations, local colleges and universities, and the San Joaquin Regional Transit District (RTD). The following stakeholders responded to the survey or participated in the first working group meeting:

- SJCOG Citizen's Advisory Committee (CAC) Representative
- Business Council
- San Joaquin County Transportation Engineering
- Port of Stockton
- Catholic Charities Environmental Justice Program
- Third City Coalition
- Caltrans, Division of Innovation
- UC Berkeley
- UC Davis (also representing California Air Resources Board (CARB))
- Ford Mobility
- Via
- MTC / Association of Bay Area Governments (ABAG)

Table 1 presents a summary of the region's transportation challenges that were identified in the local and regional plans and the stakeholder survey. In general, the stakeholder survey responses and Innovation Working Group meeting input was consistent with many of the challenges, needs, and opportunities addressed in the local and regional plans. Challenges shaded in blue indicate a planned strategy that was approved in the identified plan.

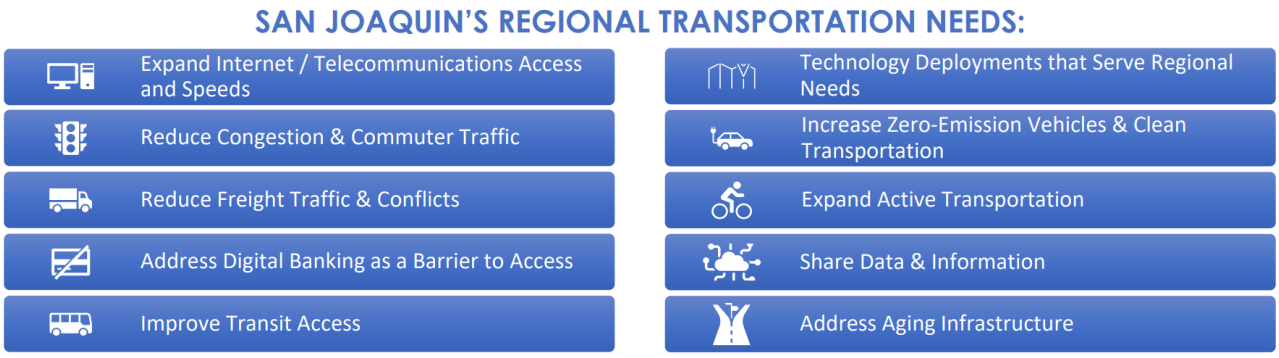
Table 1. Summary of Feedback and General Transportation Needs in San Joaquin County

Transportation Challenges	New Stakeholder Input from Survey or Working Group	City of Tracy General Plan (2011)	City of Stockton General Plan (2018)	City of Ripon General Plan (2006)	City of Manteca General Plan (2019, Draft)	City of Lodi General Plan (2010)	City of Lathrop General Plan (2010)	City of Escalon General Plan (2005)	County of San Joaquin General Plan (2016)	SJCOG RTP/ SCS (2018)
Aging infrastructure (ex: pavement or traffic signals)					■					■
Telecommunication technology					■					
Increasing commercial truck traffic					■	■				■
Increasing commuter traffic congestion					■	■				■
Safety					■	■				■
Local and Regional transit					■	■				■
Sustainable Transportation Alternatives					■	■				■
Equity					■					■
Transformational Technology Readiness					■					■
Data and Information Sharing					■					
Funding					■					
Land Use										

The stakeholders identified a key technology need for the expansion of broadband internet or fiber optic communications throughout the country. The COVID-19 pandemic emphasized the need to provide residents with more options for high-speed home internet to give them the option of working or learning from home or accessing e-commerce or telemedicine. Additionally, high-speed internet could create opportunities for satellite offices in San Joaquin to reduce commuting distances for residents and to bring more jobs to the county to offset the current jobs/housing imbalance.

The community advocacy groups also recommended continued communication and transparency from SJCOG and its partners related to technology projects, so that the advocacy groups can help to engage the communities and develop support.

The Study Team and the Innovation Working Group refined the region's transportation needs as:



Appendix D: Local and Regional Transportation Needs and Initiatives provides more details on the plans, the needs, and the stakeholder input.

5. Existing Technology Initiatives in San Joaquin County

SJCOG and its partners have already implemented several innovative transportation technology actions. The region can learn from and build upon these initiatives. This section briefly describes the region's existing technology initiatives. Additional information regarding continuing these pilots is included in **Section 8. Performance Monitoring Guidance**.

EZHub and Vamos Mobility App. SJCOG and Masabi partnered on EZHub[9], a cashless mobile ticketing and fare payment system available in the Vamos Mobility App from Kyyti. Vamos is a mobile and common digital payment system with the ability to connect multiple modes. The app will make using public transit safer and easier to access and pay for throughout San Joaquin County. Once downloaded, transit riders can use the Vamos Mobility app to plan their journeys and, thanks to the addition of EZHub, purchase tickets for any of the seven participating transit systems. The app connects residents of California's Central Valley with affordable and clean local transit.

Stockton Mobility Collective Project. In October 2020, SJCOG was awarded a $7.4 million Sustainable Transportation Equity Project (STEP) Grant by the California Air Resources Board (CARB) to implement the *Stockton Mobility Collective Project.*[10] The project will bring electric vehicle carsharing, e-bike sharing, Vamos mobility as a service, transit and shared mobility incentives, community engagement, and e-workforce development to Stockton.

RTD Electric Buses. In 2013, RTD introduced northern California's first 100% battery-electric buses into service in Stockton.[11] RTD was the second transit agency in California and the fourth in the nation to operate these battery-electric buses. Not only does this project support the CEC Electric Drive Strategic Plan

[9] https://www.sjcog.org/482/EZHub
[10] https://www.sjcog.org/DocumentCenter/View/5526/step-infographic-3?bidId=
[11] https://sanjoaquinrtd.com/1/electric-buses/

administered by CALSTART, but it also supports RTD's Strategic Plan by reducing energy consumption, waste, and pollution, while fostering vendor innovation and new technologies.

RTD Van Go! RTD's on-demand rideshare service pilot program offers wheelchair-accessible and seamless trips throughout San Joaquin County, including within Stockton.[12] Passengers book a trip using the RTD Van Go! app on their smartphone and pay using credit/debit card through the app or pay cash to the driver when they are picked up. Trips can be booked same day or in advance.

6. Opportunities for Technology Applications to Address Regional Needs

The Innovation Working Group and the study team reviewed the progress and status of the current pilot projects and identified potential innovative solutions where technology could be applied as a tool to address some of the region's transportation needs. A total of nineteen potential pilot deployments, plans, or programs were identified as initial actions that SJCOG or its partner agencies could take to address the region's transportation needs and to support the advancement of transformational technologies in the region. These potential actions are explained in more detail in **Appendix E** and include:

POTENTIAL PILOT DEPLOYMENTS:

Short-Term (1 – 3 Years)

- Connected Farm Equipment Safety Pilot
- Microtransit Pilot
- AV Goods Delivery Pilot
- Mobility Hub Quick-Build Pilot

Mid-Term (3 – 5+ Years)

- AV Shuttle between Amtrak and ACE
- AV Shuttle for Distribution Center Workers to Mobility Hub
- AV Truck-Only Lanes Pilot
- Drone & Sidewalk Automated Delivery Pilot

Long-Term (20+ Years)

- Regional Hyperloop
- Regional CAV Adoption

POTENTIAL PLANS & PROGRAMS:

Short-Term (1 – 3 Years)

- Fiber City Checklist
- Intelligent Transportation System (ITS) Master Plan
- EV Charging Infrastructure Acceleration Program
- Mobile & Common Payment Systems
- Rail-to-Trail Planning & Design

Mid-Term (3 – 5+ Years)

- Regional Traffic Management Center (TMC)
- Integrated Corridor Management (ICM) Partnership
- Hyperloop Testing Facility

Long-Term (20+ Years)

- Traditional Funding Alternatives

Technology is changing rapidly, and agencies need to find effective ways to get smart about new systems, new data, and new transportation models. Pilot projects give agencies first-hand experience and lessons learned with new technologies and their existing systems. Finding challenges early on gives an agency the chance to make changes and act on lessons learned.

[12] https://sanjoaquinrtd.com/van-go/

7. Potential Future Technology Scenarios for the RTP/SCS

SJCOG is in the process of developing its 2022 Regional Transportation Plan (RTP) and Sustainable Communities Strategies (SCS), which utilizes a 20+ year planning horizon. This section answers:

- What are the feasible technology innovations that may be common in the future?
- What RTP/SCS strategies will help encourage such technology?
- What are the mid-term milestones that may need to be addressed during the adoption of technology?

What are the feasible technology innovations that may be common in the future?

The 2022 update of the RTP could consider the following three Transformational Technology Scenarios:

The **Business-as-Usual** scenario is defined by the continuation of current trends in AV use, EV adoption, telecommuting, regional mobility, workforce demands, and transportation systems data collection and management.

The **Moderate Technology Transformations** scenario is defined by agency investments in data collection and monitoring which enables advanced transportation systems management. Increased EV adoption and charging infrastructure network supports passenger and freight movement. Increased full-time teleworking enables distributed workplace locations reducing hyper-commute demands and creating opportunities for higher-density, mixed use urban development. Advancements in transportation technology by the private industry begin to provide new automated mobility solutions for passenger and goods movement and some shift in workforce demands.

The **Extensive Technology Transformations** scenario is defined by widespread EV and AV adoption in passenger and freight vehicles. High-speed interregional rail provides new mobility options. Widespread teleworking and high-speed internet access attract employers to relocate jobs to the county and enables higher-density, mixed use development in urban areas. Automation in freight and agricultural industries reduces workforce demands in those sectors, meanwhile increased dependence on automation increases demand for higher-education software and data management jobs. Universal payment applications enable seamless transfers across modes and across service providers.

These scenarios are outlined in more detail in **Table 2** along with corresponding external forces and potential projects to implement plans or programs to support the scenario development.

Table 2. Potential RTP Technology Transition Scenarios

External Forces	Business as Usual	Moderate Technology Transformations	Extensive Technology Transformations	Projects
Transportation Technologies	• Partial bus fleet is electric • On-demand rideshare/hail • Shared micromobility (e-bikes, e-scooters) • Delivery drones carry light parcels short distances	• Full bus fleet is electric • Expanded transition to on-demand transit • Increased ridehail/rideshare use • Expanded ITS traffic monitoring and management with increased Vehicle-to-Infrastructure connectivity • Automated vehicles in use for goods movement and freight delivery drones	• Increased automation in goods delivery, farming, and warehousing • Some automated vehicles for passenger movement • Majority of light and heavy vehicle fleet is electric • Expanded Zero-Emission transportation across modes, including rail • Access to high-speed interregional rail	*See cells below for specific projects related to specific external forces.*
Automated Vehicle Market Share – Passenger	Individually owned, semi-automated vehicles (human-driven vehicles with advanced driver assistance systems)	Fully automated vehicles are entering the passenger vehicle fleet	Fully automated vehicles make up a significant proportion of the passenger vehicle fleet	• Automated Shuttle Circulator • On-Demand Microtransit • Automated Microtransit • AV Shuttle between Amtrak and ACE • AV Passenger Shuttle between transit and distribution centers
Automated Vehicle Market Share – Freight	Fully automated vehicles are entering the freight fleet (safety drivers are required in cab)	Fully automated vehicles make up a significant proportion of the freight fleet (safety drivers may still be required in cab)	Majority of freight is moved by automated vehicles with no driver in the cab	• AV Goods Delivery Pilot • Connected Farm Equipment Safety Pilot • AV Truck-Only Lanes Pilot • Drone and Sidewalk Robot Automated Delivery Pilots
Electric Vehicle Market Share	Continued EV growth at current market penetration rate	Increased EV growth in market penetration rate	Preponderance of vehicles are EV/ZEV; Batteries are renewable and recyclable	• EV Charging Infrastructure Acceleration
Shared Mobility Preference	Continued preferences of today	Increased preference for shared mobility in urbanized areas (microtransit, micromobility, carshare)	Preference and access to shared mobility in rural areas	• Mobility Hub Expansion • Active Transportation Network Improvements • Rail-to-Trail Planning and Design
Regional Connectivity	Continued commuter rail and freeway service	Higher-speed rail and increased connections	Interregional high-speed rail	• High-Speed interregional rail station exploration • AV Shuttle between Amtrak and ACE
High-Speed Internet Access	High-speed internet (100/10 Mbps) access grows at current rate	Expanded high-speed internet access in urban areas; Limited expansion in rural areas	All residents and employers have access to high-speed internet	• Fiber City Checklist • Dig Once Policy (further described in Section 11)
Workplace Preferences	Continued part-time telework	Increased full-time telework; increased local shared-office workspace	Full-time telework; Shared-office workspace; Employment centers move to county	• Fiber City Checklist • Dig Once Policy (further described in Section 11)
Workforce Needs	Continued labor demands for warehousing, freight distribution, agricultural jobs	Some automation in freight industry	Increased automation in farming, freight distribution, warehousing	• Local Workforce Development Partnership Working Groups and Procurement Requirements
Mobility Payment	San Joaquin integrated payment platform for transit	Regional integrated payment platform for transit and micromobility	Universal payment platform for regional transit, micromobility, ridehail, etc.	• EZHub Expansion • Mobile & Common Digital Payment System Regional Expansion
Data Collection	Continued collection and monitoring of big data sources; Manual data mgmt. and reporting required	Increased automated data collection, reporting, and sharing	Widespread automated data collection, reporting, and sharing	• Intelligent Transportation System (ITS) Master Plan • Regional Traffic Management Center • Enhanced Partnership for Corridor Management of Altamont Pass

What RTP/SCS strategies will help encourage such technology?

The RTP/SCS can encourage technology adoption to support the Moderate or Extensive Technology Transformation scenarios by defining goals, developing policies, and identifying plans, programs, and projects to implement.

Define Technology Goals

Each agency within the COG should develop their vision for technology and set technology goals related to advancing context-specific, community-informed technology applications. Once the vision and goals are set, share them with staff across the COG's members, and throughout departments and management.

Innovative technologies require new stakeholders to be involved in the planning process. Agencies currently involve residents, citizen groups, business groups, transit agencies, and representatives from relevant jurisdictions. Agencies could bring new stakeholders into the planning process through Working Groups or Task Forces, hiring experts, partnering with educational institutions, or partnering with the private sector. Examples of outside experts include:

- Other departments within an agency (such as the codes and ordinances departments)
- Other agencies with different expertise (such as fire, police, maintenance, or IT)
- Technology deployers or manufacturers
- Utility providers
- Trade groups
- Local universities and trade schools

Develop Flexible Policy

SJCOG and its partners can develop technology-agnostic and performance-based policy to support the use of technology to achieve their overall transportation goals of mobility, safety, equity, and sustainability. Agencies generally influence the adoption of new technology through setting regulations for the use of a new technology or for its service requirements, through setting fees for public services, through permitting or supporting deployment on public and private lands, or through regulating revenue through taxes. As new applications of technologies impact the transportation system, agencies may need to revise or enact new policies. Additional guidance is provided later in the report in **Section 9. Transformational Technology Policy Guidance.**

Identify Plans and Program Project to Implement

The plans and programs identified in this study were selected because they could address the region's transportation needs and challenges. The process used for assessing and prioritizing these projects is outlined in **Section 11. Project Prioritization Process**.

How can SJCOG plan for long-term success?

SJCOG and its partners can advance transportation innovation in the San Joaquin region *by ensuring connectivity, enhancing partnerships, and planning for emerging revenue sources.*

Ensure Connectivity

As transportation technologies continue to emerge and advance, SJCOG and its partners need a coordinated strategy for providing high-speed, secure telecommunications infrastructure. This task can be approached in two, collaborative steps:

- Fiber City Checklist – SJCOG and its partners could complete the Fiber City Checklist (described further in **Appendix E** and **K**) as the critical first step to prepare for a public-private partnership with telecommunications providers.
- Intelligent Transportation Systems (ITS) Master Plan – An ITS Master Plan is needed to guide the investment priorities for the region to achieve network connectivity. ITS technologies help advance transportation safety, mobility, and efficiency by integrating advanced communications capabilities into transportation infrastructure and vehicles. ITS technologies are supported by a fiber optic communications backbone and use sensors and communications networks to monitor traffic data and help agencies make operational improvements. SJCOG can prepare for the connected and automated future by supporting the development and maintenance of a regional ITS network.

Enhance Partnerships

Strong progress has been made towards unifying the transportation agencies of the Altamont Pass through the Caltrans Summit on the Summit, the Altamont Corridor Vision, and the SJCOG Congested Corridor Plan. As a key partner in the successful implementation of integrated corridor management, SJCOG can lead by example through adopting recommended projects into the RTP, continuing collaboration, and dedicating staff resources for innovative grant applications.

Plan for Emerging Revenue Sources

Vehicle technology, travel behavior, and parking patterns are changing. Transportation agencies and their partners need to look to alternative revenue sources to support the deployment of emerging technologies and to ensure sustainable funding beyond the catalyst funds supplied by grants. SJCOG and its partners could collaborate with economic forecasting and modelling specialists to study potential revenue sources over the long-term planning horizon for inclusion in the SJCOG Regional Transportation Plan.

What are the mid-term milestones to address during the adoption of technology?

SJCOG can monitor progress compared to its goals for technology, identify shortfalls, and adjust the programs or action plans to meet their goals. New technology is introducing new data sources and new data analytics capabilities. These new methods can provide more timely and cost-effective approaches to monitoring data, compared to the massive data collection efforts that agencies might conduct for a comprehensive plan update. The following section provides guidance on performance monitoring.

8. Performance Monitoring Guidance

Technology is evolving rapidly, costs are changing, and no one can predict with certainty which technologies have the staying power – one example of this turbulence is the quick rate that e-scooters replaced docked bikeshare in some cities across the country. Rather than focusing on specific technologies, which may be enhanced or become obsolete soon, SJCOG can plan for the *applications* of technology that best meet the needs of the community. For example, personal mobility applications considered in the Stockton Mobility

Collective Project (which include technologies such as docked or dockless bikeshare) are innovative solutions to support short trips or transit connections.

Local agencies can make better-informed decisions by establishing programs, funding criteria, and evaluations based on data-driven performance metrics. To monitor changes, SJCOG can incorporate new data sources into the planning processes. The metrics outlined in **Table 3** will help SJCOG and its partner agencies measure and monitor the effects of transformational technologies on their technology deployment goals. **Appendix F** contains a full list of recommended performance measures that correspond with the regional needs identified in this project.

Table 3. Candidate Metrics for Monitoring Impacts of Emerging Technologies

Impact	Candidate Metrics	Sources of Information
Growth	Population, Employment, Tax Receipts (Sales Tax, Property Tax, Transient Occupancy Tax, other taxes), Licenses and Permits	SJCOG data, State Finance Department, US Census, State Employment Department, Local and State Collection Agencies, Permit/License Issuing agencies and departments
Land Use and location	Permits Pulled	Issuing agency and department
Early Indicators of Code and Plan Problems	Complaints, code enforcement requests, conditional use permits, zoning variance requests, comprehensive plan amendments	San Joaquin County, Stockton, Tracy, Lathrop, Lodi, Manteca, Ripon, and Escalon planning/community development department
Parking	Curb, lot, and loading zone parking utilization, price, average stay	Operator records, video and/or volunteer monitoring, purchased data
Travel Demand	Daily ridership and vehicle miles traveled (VMT) by mode of travel	RTD data, purchased data, field sensors

Source: NCHRP Report 924: Foreseeing the Impact of Transformational Technologies on Land Use and Transportation (2019).

These performance metrics, like those already included on SJCOG's *Community Pulse*, will require data collection, aggregation, anonymization, analysis, security, and storage. SJCOG could create a new subsection on Community Pulse for Emerging Technology and include some of the metrics discussed below to support the successful deployment of transformational technologies in the San Joaquin region.

SJCOG can consider adopting the 'monitoring mindset' by keeping a pulse on:

- Guidance for adapting regional travel demand models to account for transformational technologies, including automated vehicles, ride-hail, and micromobility.
- Land use, population, and employment data of the San Joaquin region to identify early indicators of growth.
- Data from transit agencies, micromobility providers, and field sensors to identify early indicators of travel demand impacts. This data may also provide insights about the resiliency of the transportation system and how quickly residents and visitors return to normal travel demand patterns.

Each technology deployment may have different relevant performance metrics. Agencies should select metrics relevant to their goals. Candidate metrics include:

- Metrics of growth
- Metrics of land use and location changes
- Early indicators of problems with current codes and plans

- Metrics of parking demand changes
- Metrics of travel demand changes.

Table 4 identifies the relevant regional need and performance measures for each of the recommended near-term plans or programs. SJCOG can lead by encouraging transparent data sharing across member agencies and across partnerships with vendors or data providers through the Data Center on the Community Pulse website. As an identified regional need, Sharing Data & Information is crucial towards the successful planning for and implementation of emerging technologies.

Table 4. Innovative Plans or Programs & Related Performance Measures

Regional Need	Performance Measure	Mobility Hub Quick Build Pilot	Microtransit Pilot	Connected Farm Safety Pilot	Fiber City Checklist	ITS Master Plan
Deploy Technology that Serve Regional Needs	Number of New Partnerships	◆	◆	◆	◆	◆
Expand Internet Access & Improve Telecommunications Speeds	Percent of Residences with High-Speed Internet Access				◆	
	Percent of Businesses with High-Speed Internet Access				◆	
	Number of High-Speed Internet Subscriptions				◆	
	Average Connection Speeds				◆	
Reduce Congestion & Commuter Traffic	Change in Vehicle Miles Travelled	◆	◆			
	Passenger Travel Time Reliability					◆
	Change in Crash Rates	◆				◆
Reduce Freight Traffic Conflicts	Change in Freight Crash Rates			◆		
	Freight Travel Time Reliability			◆		
Address Digital Banking Access	Total Change in Financially Excluded Population					
	Total Change in Digitally Excluded Population					
Improve Transit Access	Change in Transit Ridership by Stop	◆	◆			
	Transit Time Reliability		◆			
	Percent of Population with Access to Transit	◆	◆			
Increase Zero Emission Vehicles	Change in Electric Vehicle Registrations		◆			
	Change in Air Quality	◆	◆			
Expand Active Transportation	Percent of Arterial and Collector Streets with Sidewalks					
	Percent of Arterial and Collector Streets with Bicycle Facilities					
	Percent of Population Making Everyday Trips by Active Transportation	◆				
Share Data & Information	Number of Metrics Tracked in Community Pulse	◆	◆	◆	◆	◆
	Number of Datasets Updated in the Past Year on the Data Center					
Address Aging Infrastructure	Percent of Infrastructure in State of Good Repair					◆
	Percent of Maintenance Projects with Funding for ITS Upgrades				◆	◆

9. Transformational Technology Policy Guidance

SJCOG and its partners can develop technology-agnostic and performance-based policy to support the use of technology to achieve their overall transportation goals of mobility, safety, equity, and sustainability. Agencies generally influence the adoption of new technology through setting regulations for the use of a new technology or for its service requirements, through setting fees for public services, through permitting or supporting deployment on public and private lands, or through regulating revenue through taxes. As new applications of technologies impact the transportation system, agencies may need to revise or enact new policies.

When an agency is ready to update its plans and policies, it should develop flexible policies that can keep up with changing technology and transportation behavior without needing frequent updates. **The key to writing policy that will remain valid as technologies change is to develop technology-agnostic policy.** Technology-agnostic policies are policies that emphasize desired performance rather than specifying a particular technology. As agencies update their plans, they should continue to involve diverse stakeholders. Agencies should also set priorities and identify milestones or intermediate checkpoints where monitoring may indicate the need to revisit the plans.

SJCOG could adopt a policy relevant to the promotion, implementation, and regulation of new technologies in the public sector. The explicit policy statement is something each agency must create on its own. One example of what such a policy statement might cover:

> *It is the policy of the San Joaquin Council of Governments and its member agencies to employ incentives and regulations to support the deployment of new technologies that promote the goals of the region for mobility, accessibility, sustainability, safety, and equity. SJCOG and member agencies will act as exemplars for the public and private sector by employing new technologies within each agency's operations to improve the efficient delivery of governmental services to the public.*

Note that the policy statement is a simple statement of principle, which the agency would then elaborate through a series of more specific objectives.

The technology transition policy development process includes four steps:

- **Preparation** – to establish goals, vision, and partnerships for new technology.
- **Self-Assessment** – to understand the potential gaps in staffing, resources, organizational structure, or policy that might hinder the advancement of technology in the region.
- **Action** – to address the gaps through hiring, training, or Task Force/Working Group partnerships to help the agency get smart on new technologies and to collaborate on new policy development.
- **Monitor and Adjust** – to monitor progress, identify shortfalls, and adjust their programs or action plans to meet the agency's goals.

This four-step process is explained in detail, along with policy examples from other agencies, in **Appendix G: Innovative Policy Framework**.

10. Potential Funding Opportunities

SJCOG's role in advancing transportation innovation within the region will be forming great partnerships, gathering the key stakeholders in working groups, adopting, and recommending best practices and policies for member agencies, and leading grant applications to fund local projects that further the region's goals for transformational technology readiness.

SJCOG already shares funding opportunities with its partner agencies through its Grants Database website (https://www.sjcog.org/381/Grants-Database). This section summarizes additional grant opportunities for the recommended pilot programs. As new grant opportunities are identified, SJCOG could update its Grant Database online to share this information with the region.

Appendix H: Potential Funding Sources for Priority Projects identifies preliminary cost estimates and potential funding opportunities at the federal, state, and private level, which SJCOG might pursue to implement some of these innovation ideas in the future. Grants for these types of transportation innovations projects are available in a wide range of support from $5,000 to over $10 million with many available for $150,000 or less. Some examples of these funding opportunities include:

- Smart and Connected Communities Program (National Science Foundation, Division of Computer and Network Systems): SJCOG might be able to use these federal funds for the Fiber City Checklist, ITS Master Plan, Connected Farm Equipment Safety Pilot, or Automated Vehicle pilots. Each of these awards will provide support for a period of one year and may be requested at a level not to exceed $150,000 for the total budget.
- The expansion of fiber optic cabling and broadband internet could potentially be funded through the California Smart City Challenge Grant Program (California State Legislature); High-Speed Broadband Grant (California State Library); or Distance Learning and Telemedicine Grant (Department of Agriculture).
- The Connected Farm Equipment Safety Pilot could potentially be funded through the Connected Vehicle Equipment Loan Program (US Department of Transportation); Advancing Wellness: Community Well-Being (The California Wellness Foundation); Community Health Needs Assessment Grant (Kaiser Permanente Northern California) – Manteca falls within a Kaiser Permanente Community Health Service Area; or California Smart City Challenge Grant Program (California State Legislature).
- The automated shuttle passenger or goods delivery pilots might be funded through Advancing Wellness: Community Well-Being (The California Wellness Foundation); Community Health Needs Assessment Grant (Kaiser Permanente Northern California); Clean Mobility Options (CMO) Voucher Pilot Program (CALSTART); or Energy Efficient Mobility Systems (EEMS) Program (Department of Energy, Office of Energy Efficiency & Renewable Energy and Vehicle Technologies Office).

11. Project Prioritization Process

Each of the nineteen potential innovative technology solution was evaluated using a prioritization process created for the Transportation Innovation Planning Study. The projects were evaluated for their effectiveness in addressing the needs of the region and their feasibility for implementation. The Innovation Working Group and the Study Team considered the following criteria to prioritize the potential strategies:

- Does this project relate to and support existing SJCOG objectives and projects?
- Does this project address an identified regional need?
- Is this project implementable in the short term (1 – 3 years)?
- Is this project fiscally reasonable?
- Will this project require a high level of effort and resources from SJCOG staff?

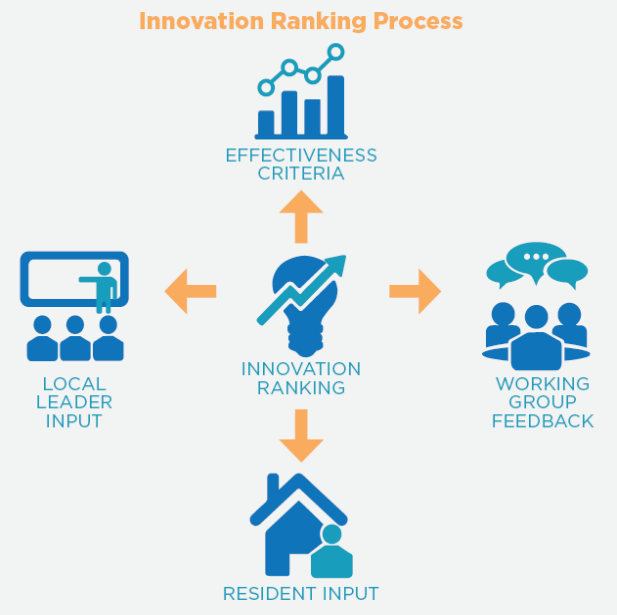


Figure 3. This Study's Innovation Evaluation Process

The Innovation Working Group and the Study Team prioritized the following projects based on their alignment with the region's goals, their ability to meet a regional mobility need, and their feasibility for short-term implementation:

1. Fiber City Checklist
2. Connected Farm Vehicle Safety Pilot
3. Mobility Hub Quick Build Pilot
4. Automated Vehicle Goods Delivery Pilot
5. Intelligent Transportation System (ITS) Master Plan
6. Microtransit Pilot

Appendix I contains additional details about the prioritization criteria and **Appendix J** provides the project evaluation ranking.

Fiber City Checklist

Ranking: Based on the prioritization and feasibility evaluation process, the Innovation Working Group and the Study Team recommends SJCOG consider initiating the **Fiber City Checklist** in the next 1 – 4 years to accelerate the advancement of transportation innovation in the region.

As the most critical infrastructure in an increasingly digital world, fiber optic cabling can enable rural and urban areas alike to enjoy high-speed internet and 5G cellular service. The Fiber City Checklist, a compilation of best practices and recommendations, defines a clear, three-part process for readying the region for widespread fiber optic construction. It includes an existing inventory, a review of utility policies, and

streamlining utility permitting. This checklist is the critical first step to prepare for a public-private partnership with telecommunications providers. **Appendix K: Fiber City Checklist** provides additional details from other municipalities who have conducted the Fiber City Checklist and entered into agreements with various internet service providers.

What is "high-speed" internet?

The Federal Communications Commission defines *broadband internet* as a minimum download speed of 25 megabits per second (Mbps) and 3 Mbps upload speed. Broadband, denoted as 25/3, is typically an acceptable level of service for simple online tasks such as general browsing, emailing, social media, streaming video, playing games, and video calling. High-speed internet is generally accepted as download/upload speeds of 100/10, 250/25, or 1,000/100 Mbps[13]. These internet speeds support increasingly demanding needs, such as telecommuting, e-learning, video conferencing, and high volumes of traffic on the network. Fiber optic networks offer what is known as a "symmetric" connection, which means that the download/upload rates are comparable in speed[14]. Increasingly, businesses need symmetric connections to maximize productivity. Similarly, as transportation systems continue to evolve, the symmetric connections will be necessary to support the communication of automated vehicle data.

Why measure "access", "subscriptions", and "connection rates"?

Measuring *access* to high-speed internet quantifies where internet service providers (ISPs) provide service, in addition to how many ISPs service the area, while measuring *subscriptions* quantifies the approximate number of people who are accessing the internet through the high-speed connection. For example, in Stockton, approximately 35,000 people do not have access to *any* high-speed ISPs, even though 97% of Stockton residents are serviced by multiple ISPs[15]. The difference captured between these two metrics is that even though 97% of Stockton residents have *access*, or the availability to connect with ISPs, many people do not have a *subscription* meaning that even though there is internet service in their area, they are not accessing it. **Table 5** delineates the services available in the San Joaquin region, California, and nationwide.

In addition to understanding where access is available and who is accessing the internet, the speed at which internet access is available is also important in understanding what types of activities the internet speed can support, as described above.

Table 5. Percentage of Population with Broadband Providers

Speed	Location	No providers					One or more providers					Two or more providers					Three or more providers				
		All	Urban	Rural	Non-Tribal	Tribal	All	Urban	Rural	Non-Tribal	Tribal	All	Urban	Rural	Non-Tribal	Tribal	All	Urban	Rural	Non-Tribal	Tribal
≥ 25/3 Mbps	Nationwide	0.04	0.02	0.12	0.02	1.44	99.96	99.98	99.88	99.98	98.56	99.86	99.88	99.76	99.88	98.01	95.30	98.44	82.49	95.52	77.69
	California	0.00	0.00	0.00	0.00	0.00	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	98.50	99.42	84.24	98.54	76.37
	San Joaquin	0.00	0.00	0.00	0.00	--	100.0	100.0	100.0	100.0	--	100.0	100.0	100.0	100.0	--	99.92	100.0	99.21	99.92	--
≥ 100/10 Mbps	Nationwide	8.29	2.21	33.12	7.95	36.28	91.71	97.79	66.88	92.05	63.72	55.94	64.89	19.44	56.38	20.46	13.38	16.01	2.68	13.53	1.73
	California	4.44	1.45	50.24	4.39	29.87	95.56	98.55	49.76	95.61	70.13	68.01	71.47	14.92	68.12	11.60	23.09	24.39	3.22	23.13	1.19
	San Joaquin	**8.61**	**2.83**	**61.20**	**8.61**	--	91.39	97.17	38.80	91.39	--	45.94	50.02	8.85	45.94	--	**0.00**	**0.00**	**0.00**	**0.00**	--

Source: broadbandmap.fcc.gov as of December 2019 (latest public release)

[13] https://www.fcc.gov/consumers/guides/broadband-speed-guide
[14] https://rocketfiber.com/knowledgebase/fiber-vs-cable-the-importance-of-symmetrical-bandwidth/
[15] https://broadbandnow.com/California/Stockton

The estimate of probable cost for the Fiber City Checklist plan development is $100,000. Potential Funding Sources for Implementation include:

- California Smart City Challenge Grant Program
- California State Library High-Speed Broadband Grant – California State Library
- Distance Learning and Telemedicine Grant - Department of Agriculture
- Smart and Connected Communities Program – National Science Foundation, Division of Computer and Network Systems

Connected Farm Equipment Safety Pilot

Partnering with local farmers, freight operators, and Caltrans, this pilot could outfit existing farm equipment with automatic vehicle locator (AVL) devices that would communicate with hybrid beacons positioned at frequent crossing locations or along road segments with frequent low-speed farm equipment movement. When the connected farm equipment approaches, the beacons would flash, alerting freight and passenger vehicle drivers of the conflict ahead.

The deployment planning study could cost $150,000-$300,000, and a limited deployment implementation, which depends on the number of corridors and the length of corridors for deployment, could possibly cost $1-5 million. Potential funding sources include:

- USDOT Connected Vehicle Equipment Loan Program
- Advancing Wellness: Community Well-Being – The California Wellness Foundation
- Community Health Needs Assessment Grant – Kaiser Permanente Northern California
- Smart and Connected Communities Program – National Science Foundation, Division of Computer and Network Systems
- California Smart City Challenge Grant Program

Ranking: The Connected Farm Equipment Safety Pilot was ranked second due to its specific application to the San Joaquin valley safety needs, its focus on safety, and its potential to be scalable countywide. Unlike the other innovative solutions, this deployment does not directly benefit all travelers. However, the focused deployment could help to advance rural road safety and has the potential to offer a high benefit/cost ratio.

Mobility Hub Quick Build Pilot

Mobility Hubs are technologically integrated, multi-modal stations that empower communities to access their destinations with a variety of modes. Mobility Hubs often combine transportation options for transit, shared micromobility, electric vehicle (EV) charging infrastructure, and car-sharing. A Quick-Build Pilot could dedicate an existing parking structure for covered bicycle parking, docking stations, and a bus stop to facilitate intermodal trips, creating a foundation to add more multimodal options to in the future, such as a super charger for EVs, and parking spaces for shared vehicles. Mobility Hubs encourage active and ZEV trips while demonstrating the fun, convenience, and ease of creating multi-modal centers with community amenities such as street furniture, urban greenery, public art, and pop-up commercial areas.

SJCOG recently won a STEP Grant for the *Stockton Mobility Collective Project*. Learning from this experience, SJCOG could partner with RTD, the Pacific Gas and Electric Company, micromobility providers, and local businesses to create a pilot concept of a Mobility Hub building off the Stockton Mobility Collective in Stockton and expanding this concept to other municipalities in the county.

Example E-Scooter or Bikeshare Micromobility Pilot Preliminary Guidance:

- Consider tiered licensing fees for MaaS providers.
- Monetize the mobility data streams that agencies control.
- Update city ordinances to allow safe operation of micromobility and efficient storage of shared scooters and bikes.
- Define equity zones and develop requirements for MaaS providers to ensure equitable access to the vehicles across communities.
- Allocate curb space for micromobility parking/staging (See **Figure 4** for an e-scooter staging zone in San Diego).

Source: Fox News 5 San Diego.

Figure 4. Curbside Micromobility Parking Zone

Ranking: The Mobility Hub Quick Build Pilot was not at the top because of the desire to wait and learn from the Stockton Mobility Collective project.

Automated Vehicle Pilot

AVs are poised to transform both the transportation and technology spheres with the potential capability to improve safety, enhance mobility, and reduce greenhouse gas emissions. Pilot deployments using currently available technologies must be deployed to learn about and solve unknown challenges of AV operations in real-world situations. SJCOG could prepare the region for the connected and automated future by sponsoring an AV Pilot Deployment, such as a low-speed passenger shuttle or last-mile goods delivery vehicle. For example, SJCOG could deploy AVs for grocery and medicine deliveries in more remote areas of the region to learn about potential rural challenges and to train staff.

Example preliminary guidance for automated shuttle deployments include:

- Partner with local agencies to develop a smart community strategy for grant and other funding opportunities.
- Form public-private partnerships (PPPs) with a vendor that manages the operations and maintenance of an automated shuttle.
- Include ADA accessibility specifications in procurement requirements, because not all automated shuttles being tested today are equipped with wheelchair ramps.
- Engage with the National Highway Traffic Safety Administration (NHTSA) early in the planning process to learn the vehicle and operational review and exemption processes.
- Conduct public outreach and education to teach about the capabilities and limitations of automated vehicle technology.

Ranking: The AV pilot project did not rank as high due to the potential high cost of a deployment, the challenging operational conditions on rural or high-speed roads, and the inability of a pilot to be scalable to countywide deployment given the current state of automated driving system technology.

Intelligent Transportation System (ITS) Master Plan

Intelligent transportation systems cover a wide array of technologies and applications that help to increase safety and efficiency in transportation system operations. An ITS Master Plan is a planning document that guides investment decisions by identifying needs and recommending strategic projects (for inclusion in the RTP) throughout the county to maintain and update the critical infrastructure that will support the deployment of emerging technologies, such as automated vehicles.

ITS equipment is a significant investment for an agency. Pairing ITS improvements with regular infrastructure maintenance can be a cost-saving method for maintaining the state of good repair while also setting up the system for future success. An example of an ITS partnership between transportation and utility providers is a "**Dig Once**" policy.

> Under the "**Dig Once**" concept, any roadway maintenance project will take advantage of the ongoing construction to install underground conduit that can be used to installing fiber optic cabling, one of the key components of ITS infrastructure. Winter Haven, Florida is an example of a municipality that adopted a Dig Once policy and has been successfully working to expand their fiber network over time.

Other ITS infrastructure can include communications equipment, such as wi-fi enabled traffic sensors, field controllers, and data management centers that transmit traffic information for both agency analysis and public dissemination through real-time traveler information systems. In addition to traffic sensors, sensors that monitor the load, pressure, temperature, and other infrastructure conditions can also be connected to the ITS, which provides agencies with crucial information to identify and address potential problems before congestion or injuries occur. In this way, ITS equipment can help agencies maintain their infrastructure in a state of good repair.

The estimate of probable cost for the ITS Master Plan development is $100,000. Potential Funding Sources for Implementation:

- Infrastructure State Revolving Fund (ISRF) Program – Infrastructure and Economic Development Bank
- Carl Moyer Memorial Air Quality Standards Attainment Program – California Air Resources Board
- Access Broadband Connect – California Emerging Technology Fund
- California Advanced Services Fund (CASF) Infrastructure Grant – California Public Utilities Commission
- Community Connect Grant – Department of Agriculture
- Telecommunications Infrastructure Loans and Guarantees – Department of Agriculture

Ranking: The ITS Master Plan was recognized as a valuable planning exercise to create a regional plan for ITS development in the San Joaquin region. SJCOG does not own, operate, or manage ITS infrastructure, so it could lead the study but would not be able to implement the recommendations without partner agency support. This disconnect in authority led to a lower overall ranking for this alternative. The Dig Once Policy is a strategy that can be considered when SJCOG conducts the recommended Fiber City Checklist.

Microtransit Pilot

Microtransit is on-demand transit that offers flexible routing, flexible scheduling, or even flexible vehicle assignment to adapt to changing supply and demand within the existing transit service area. Some services offer artificially intelligent route optimization software that allows an existing fleet like RTD's to be utilized in a hub-to-hub manner that extends the service area while reducing wait times for riders.

Ranking: The microtransit pilot was not ranked high because San Joaquin Regional Transit District (RTD) is currently piloting a second phase of its RTD Van Go! on-demand rideshare service pilot program. The region can learn from RTD's pilot experience and use those lessons learned to inform future micromobility pilots.

12. Conclusions

SJCOG can use technology transition planning to find ways to use technology to achieve the region's broader transportation goals for safety, mobility, accessibility, and environmental sustainability. This SJCOG Transportation Innovation Planning Study focuses on the applications of new technologies for passenger and goods movement, data collection and information sharing, system management and logistics, and government services.

What strategies or actions could SJCOG consider for the 2022 RTP/SCS?

SJCOG could consider including the strategies and actions delineated in **Table 6** for inclusion in the Regional Transportation Plan (RTP) and Sustainable Communities Strategies (SCS) to accelerate the advancement of transformational technologies in the region.

Table 6. Potential RTP/SCS Technology Strategies and Actions

	Moderate Transportation Innovation		Moderate/Extensive Transportation Innovation		Extensive Transportation Innovation	
Timeline	**Strategy**	**Actions**	**Strategy**	**Actions**	**Strategy**	**Actions**
Now	**Train Staff**	• Support ongoing staff education through industry conferences and webinars	**Update Policies**	• Review policies and plans • Develop diverse stakeholder working groups • Develop technology-agnostic policies • Set priorities and identify milestones for monitoring and updates	**Expand resources**	• Conduct an organizational self-assessment • Identify training, hiring, or resource needs
Short-Term	**Improve access to transit**	• Integrated fare payment (**EZHub*) • Mobility Hub Quick-Build Projects near key destinations (**Stockton Mobility Collective Project*) • Micromobility service expansion (**RTD Van Go!*)	**Expand Electric Vehicle use**	• Electric bus fleet partial transition (**RTD EV buses*) • Electric vehicle charging infrastructure (EVCI) expansion for passenger cars (**Stockton Mobility Collective Project – includes carshare EVCI*)	**Plan for fiberoptic high-speed communications expansion**	• Fiber City Checklist Plan • Intelligent Transportation System (ITS) Master Plan
			Pilot test CV technology	• Connected farm equipment safety pilot		

Long-Term	**Expand Zero-Emission Transport Modes**	• Electric bus fleet full transition • EVCI expansion for passenger cars, trucks, micromobility, etc. • Zero Emission solutions for rail transport	**Pilot test Automated Vehicle technology**	• Automated goods delivery pilot • Automated shuttles between Amtrak and ACE or between distribution centers and Mobility Hubs	**Adopt AVs at regional level**	• Fiberoptic communication expansion • Automated Truck-Only Lanes • AV-supporting infrastructure and roadway design

What can agencies do now to prepare for technology innovations?

SJCOG and its partner agencies can self-assess their readiness to address new technologies by reviewing their staffing and organizational resources, their performance metrics and data collection practices, and their policies and plans.

Self-Assess Resources

Agencies should inventory current resources and capabilities and identify any gaps or barriers. Agency managers can look at their staffing, resource, and organization capabilities for addressing technology questions and impacts. This self-assessment might identify training, hiring, or resource needs. The Federal Highway Administration (FHWA) and the American Association of Highway and Transportation Officials (AASHTO) provide guidance on conducting a Capability Maturity Model or Capability Maturity Framework to improve program and project management.[16]

Monitor Impacts

Agencies like SJCOG need to monitor new performance metrics to measure the effects of new technologies compared to their regional transportation and land use goals. The planning process must incorporate these new performance metrics and adapt to the challenges presented by emerging technologies. Data collection, aggregation, anonymization, analysis, security, and storage will be crucial to the successful deployment of CAVs and other transformational technologies.

Review and Update Policies and Plans

The County and municipalities could examine their codes considering the technology transition facing transportation and land use, and to revise and update their codes as needed. **Appendix G** provides details on the questions agencies could ask themselves as they review their policy readiness.

Based on the self-assessment, an agency might choose to address the technology transition gaps identified in their staffing or policy. Agencies can address gaps in their staff knowledge or expertise by training or hiring new staff. Affordable training opportunities include sending staff to industry conferences. Some of the key annual conferences that address transformational technologies are:

- Consumer Electronics Showcase (CES) hosted by the Consumer Technology Association
- ITS America Annual Meeting
- Automated Vehicle Symposium (AVS) hosted jointly by the Transportation Research Board and Association for Unmanned Vehicle Systems International.

[16] https://ops.fhwa.dot.gov/publications/fhwahop16031/index.htm

When an agency is ready to update its plans and policies, it should develop flexible policy that can keep up with changing technology and transportation behavior without needing frequent updates. As agencies update their plans, they should continue to involve the diverse stakeholders. Agencies should also set priorities and identify milestones or intermediate checkpoints where monitoring may indicate the need to revisit the plans.

What plans or programs can SJCOG initiate now to advance technology innovation scenarios?

To advance the region's readiness for innovative transportation technologies and to drive the region toward the Moderate or Extensive Technology Innovation scenarios, SJCOG could consider conducting the **Fiber City Checklist** in the next one to two years.

SJCOG could also consider initiating the following innovative pursuits:

- Mobility Hub Quick Build Pilot
- Microtransit Pilot
- Connected Farm Safety Pilot
- Automated Vehicle Pilot
- Intelligent Transportation System (ITS) Master Plan

SJCOG's role in advancing transportation innovation within the region will be forming great partnerships, gathering the key stakeholders in working groups, adopting, and recommending best practices and policies for member agencies, and leading grant applications to fund local projects that further the region's goals for transformational technology readiness. SJCOG could supplement the references in its Grants Database website (https://www.sjcog.org/381/Grants-Database) with the grant opportunities identified in **Appendix H**.

The San Joaquin region is ready to embrance emerging technologies. Through communication, data sharing, training, and technology investments, the region will be able to learn best practices, share ideas, and find innovative solutions that meet the needs of the region.

13. Appendices

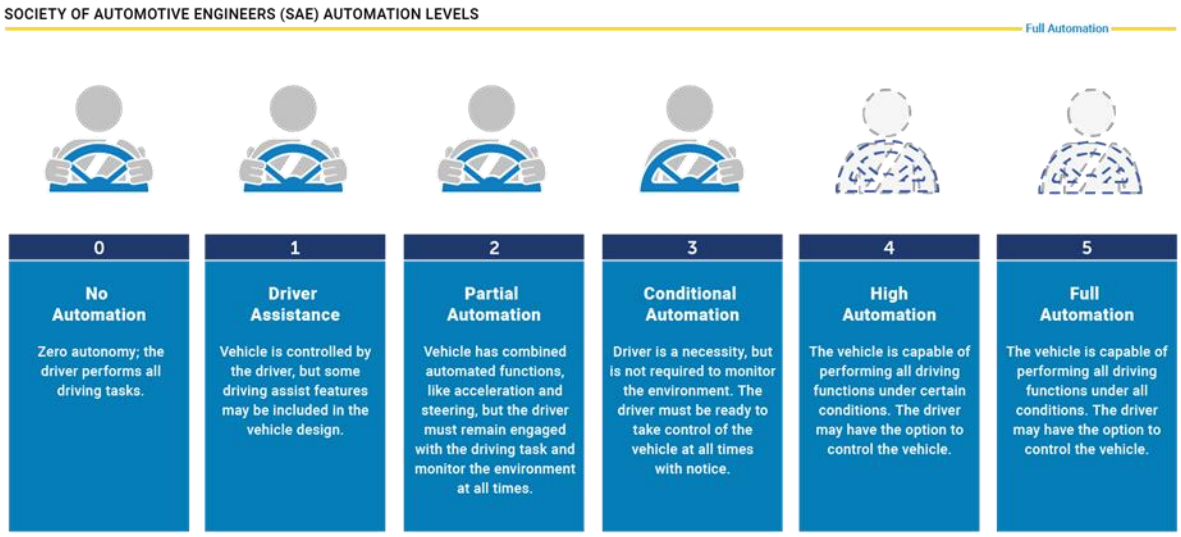
The following appendices are provided to give more details and background information on technologies, their applications, policy updates, needs, and guidance.

A. Key Terms and Definitions
B. Innovation Working Group
C. Guidance and Best Practices for Transformational Technology Planning
D. Local and Regional Transportation Needs and Initiatives
E. Potential Pilot Deployments, Plans, and Programs
F. Innovation Performance Measures
G. Innovative Policy Framework
H. Potential Funding Sources for Priority Projects
I. Innovation Prioritization Criteria and Application
J. Prioritized Project Evaluation
K. Fiber City Checklist

Appendix A: Key Terms and Definitions

Automated Vehicle (AV)

Also known as driverless cars or self-driving vehicles, AVs are equipped with sensors (for example: cameras, radar, LiDAR, computer vision, and/or GPS), which allow onboard computers to ***perform*** some or all driving tasks. The AV industry is currently categorized by the levels of automation as defined by the Society of Automotive Engineers (SAE) and the National Highway Traffic Safety Administration (NHSTA), displayed below. However, as the industry progresses, these terms are beginning to evolve, with AVs encompassing the current Levels 4 and 5, and advanced driver-assistance systems (ADAS) covering Levels 1 and 2. Although some progress has been made towards the current Level 3, a 'Conditional Automation' approach presents the thorniest human factors, liability, insurance, and law enforcement issues.



Five Levels of Automation

Source: Society of Automotive Engineers (SAE) and National Highway Traffic Safety Administration (NHTSA)

Bus Rapid Transit (BRT)

Much like how rail or metro systems function, bus rapid transit creates a convenient, fast, and reliable bus service in metro areas through the use of both technology and existing infrastructure. Key components of bus rapid transit are transit signal priority (detailed above), dedicated right-of-way (bus lanes), and center-aligned stations with off-board fare collection and platform level boarding.

Services like BRT are advanced by intelligent transportation systems in addition to deliberate policy, planning, and design to center active and shared mobility in the transportation system. Transit agencies have the unique capacity to incorporate connected and automated vehicles into their fleet and to expose large sections of their community to CAV technology.

Connected Vehicle (CV)

A vehicle that can communicate with other vehicles, infrastructure, or other wireless technologies. CVs today typically communicate using Wi-Fi, the LTE or 5G network, or the dedicated short-range communication (DSRC) radio frequency. CVs use a variety of equipment to sense, collect, and transmit real-time data, such as road or traffic conditions, weather conditions, vehicle speeds, etc. There are three key types of vehicle communications:

- V2V: Vehicle to vehicle communication

- V2I: Vehicle to infrastructure communication
- V2X: Vehicle to Internet-of-Things (IoT) communication

Intelligent Transportation Systems (ITS)

In general, CVs are supported by ITS infrastructure, which can include sensors, telecommunications equipment (such as fiber optic networks or DSRC), and data analytics equipment and software. ITS is a system in which information and communication technologies are applied to road transportation, including infrastructure, vehicles, and users, in traffic and mobility management. Intelligent transportation systems include a variety of safety, mobility, and efficiency impacts. As CAV pilots and deployments become more widespread and common, the policies that support and the infrastructure that provides ITS services will become increasingly important to the success of CAVs. Some examples of ITS technologies include:

- Road Weather Information System (RWIS)
- Remote Traffic Signal Monitoring
- Connected Snow Plowing
- Multi-modal Traffic Detection
- Emergency Vehicle Notification Systems
- Automatic Road Enforcement
- Variable Speed Limit Systems
- Collision Avoidance Systems

Micromobility

The concept of using alternative travel modes for short trips or first- and last-mile connections. Typical examples include station-based or dockless bikes, electric-bikes, and electric-scooters. Micromobility services are often provided by a TNC, which owns a fleet of mobility sources and provides the service as a shared use.

Microtransit

This type of transit began to gain popularity in the early 2010's, as GPS technology and vehicle-routing software became available. Encompassing a few different service types, microtransit can be a door-to-door service, like using a taxi or a ride-hailing service; point-to-point, which connects people to destinations such as employment centers, universities, or transit centers from other hubs; or be a first and last mile connection, meaning that the vehicle will operate from 'door-to-point' – this can be helpful for connecting people to traditional fixed route transit services. As a dynamic transit service, microtransit incorporates technologies such as automated vehicle location (AVL), a function of GPS, as well as vehicle routing services, which connect riders with drivers.

Some common characteristics that all microtransit services share include:

- Vehicles that are larger than a private automobile (sedan) and smaller than a traditional 40-ft public transit bus – typically 5- to 15-person passenger vans
- Intelligent Routing and Shared Rides: Using algorithms and trip data, the vehicle routing software optimizes each van's route to accommodate the most people with the shortest waiting times, which leads to shared rides
- Multiple Payment Options: In-app fare collection, in-vehicle cash, and transit pass
- Multiple Booking Options: in-app booking, online browser booking, or dial-in concierge booking

Additionally, as an emerging technology, some microtransit providers are exploring using data analytics, artificial intelligence, and autonomous vehicles with their fleets.

Mobility as a Service (MaaS)

Describes treats mobility as a commodity independent of mode, where a single platform handles all aspects of an individual's trip (payment, mode and vehicle selection, route planning, and navigation.) A common payment system and

a common platform or app that combines public and private transportation services enables this shift. Users pay for trips on multiple modes using a single account. MaaS offers travelers mobility solutions based on their travel needs.

Public Private Partnership (PPP or P3)

As an increasingly popular arrangement for the piloting of technologies for real-world application and learning, a public-private partnership combines the resources of government and business to provide for their communities. P3s are a crucial tool for the development of CAV technologies.

Ridehailing

When a customer hails a ride often through a mobile app or kiosk. The driver takes the customer to a destination designated by the customer for a charge, and payment is made automatically through a mobile app. Ridehailing services are operated by TNCs who adjust the cost of a ride based on current demand.

Transportation Network Company (TNC)

Private transportation technology firms that provide services such as ride-matching, ridesharing, and ridehailing through vehicle-routing software platforms and licensing. Well-known TNCs include Uber, Lyft, Via, and TransLoc.

Appendix B: Innovation Working Group

Innovation Working Group Meeting #1 – Prep Packet

We live in exciting times as rapidly evolving technology is changing the way we travel and what trips we make. The San Joaquin Council of Governments (SJCOG) is conducting a Transportation Innovation Planning Study to plan for these impacts and to identify an innovative technology solution to test through a pilot deployment. *You were identified as a key stakeholder for this study.* This meeting took place in July 2020 via videoconferencing platform Microsoft Teams.

Working Group Goals

- The Working Group will help SJCOG understand policy, performance metrics, and funding opportunities for automated vehicle (AV) deployments and other transportation innovations in the San Joaquin region.
- The Working Group will function as a liaison between the study team and the San Joaquin region municipalities and stakeholder organizations.

Please complete this short online survey.

Help us understand your organization's vision, plans, and needs related to emerging technologies.
Help guide our discussions during the Working Group meetings.
https://www.surveymonkey.com/r/SJCOGInnovationStudy (now closed)

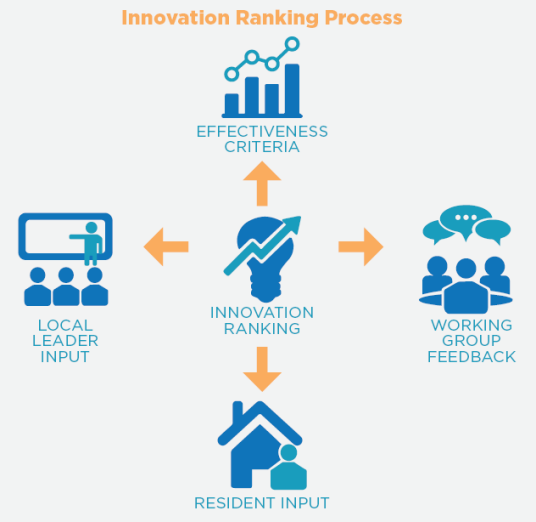
Working Group Meetings

We will host four working group meetings. During each workshop, the Working Group members will brainstorm initial ideas, provide data or community input, review study analysis and results, and provide critical feedback to inform the final study recommendations.

1/ First, we will gather initial thoughts, goals, and aspirations on AV and other innovative transportation solutions in the San Joaquin region.

2/ Next, we will review information; local, state, and national policies; metrics; and funding sources for AV deployments and 2-3 alternatives in transportation innovation, which are solution-oriented, cost-effective, and implementable. We will work with SJCOG to present and review potential AV pilot projects and other feasible implementation strategies.

3/ Finally, we will approve AV policies, metrics, and funding sources. We will select an innovative transportation pilot project.



Innovation Working Group Meeting #1 – Summary

The goal of this meeting was to collect stakeholders' thoughts, goals, and aspirations on innovative transportation solutions in the San Joaquin region. Issues and related challenges identified during this meeting include:

Issue	Challenge
Congestion	Jobs-housing imbalance places a demand on the roadway system, primarily for residents who travel to the Bay Area for work
	Current solutions have been short-term fixes – increasing roadway capacity has induced demand
	Increased truck traffic on highways is pushing commuter onto city and rural roads
	Opportunity exists for smart traffic signal systems on main arterials
Truck Traffic / Agriculture	Increased truck traffic on local roadways causes congestion and safety concerns
	Increased truck traffic on highways is pushing commuter onto city and rural roads
	Increased high-speed traffic on rural roads near agricultural facilities creates safety concerns for slow-moving equipment for farming
Teleworking / Broadband Internet	Limited access to broadband internet creates a barrier to working and studying remotely
Port of Stockton	Need to reduce emissions from the use of older equipment
Funding	Dedicated funding streams are needed to solve larger transportation issues
	Electric vehicles decrease fuel-tax benefit without decreasing traffic demand

Innovation Working Group Meeting #2 – Prep Packet

The San Joaquin Council of Governments (SJCOG) is conducting a Transportation Innovation Planning Study to plan for the impacts of new and evolving technology and to identify an innovative technology solution to test through a pilot deployment.

YOU ARE A KEY STAKEHOLDER FOR THIS STUDY.

Help SJCOG understand policy, performance metrics, and funding opportunities for connected and automated vehicle (CAV) deployments and other transportation innovations in the San Joaquin region.

Function as a liaison between the study team and the San Joaquin region municipalities and stakeholder organizations.

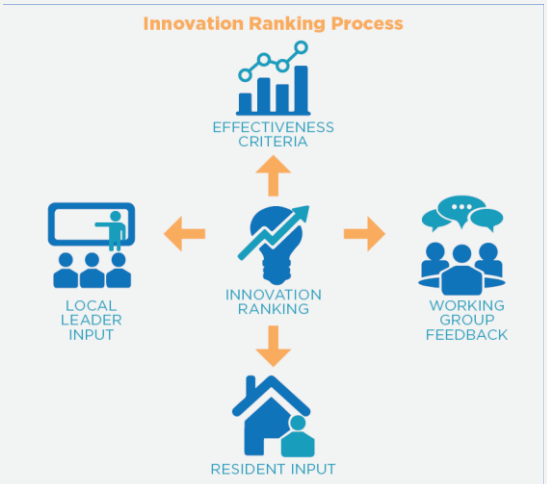
Meeting #1 Recap

In August 2020, we met for the first Working Group meeting to identify the region's transportation needs.

SAN JOAQUIN'S REGIONAL TRANSPORTATION NEEDS:

- Expand Internet / Telecommunications Access and Speeds
- Reduce Congestion & Commuter Traffic
- Reduce Freight Traffic & Conflicts
- Address Digital Banking as a Barrier to Access
- Improve Transit Access
- Technology Deployments that Serve Regional Needs
- Increase Zero-Emission Vehicles & Clean Transportation
- Expand Active Transportation
- Share Data & Information
- Address Aging Infrastructure

WE'RE LOOKING FOR YOUR INPUT



TECHNOLOGY DEPLOYMENTS

What potential technology deployments address the emerging transportation needs for the San Joaquin region?

POLICY NEEDS

What new or updated policies could incentivize innovation or remove barriers?

EFFECTIVENESS CRITERIA

How would you measure effectiveness for innovation?

INNOVATION RANKING

How do you prioritize the short- and long-term strategies?

Innovation Working Group Meeting #2 – Summary

The purpose of this meeting was to present potential short, mid, and long term strategies for deployments, plans, and programs that address the regional needs identified in Meeting #1, and gain feedback on policies, effectiveness criteria, and innovation rankings.

- Five survey responses were received, that ranked Mobility Hubs, Connected & Automated Shuttles, the Fiber Town Checklist, Enhanced Integrated Corridor Management for the Altamont Pass, a Regional Traffic Management Center, and Traditional Revenue Alternatives are the highest priorities for short, mid, and long term pursuits.
- Discussion of Freight Traffic
    - Identified need states a "reduction of freight traffic", however, this has been revised to state "a reduction of freight congestion"
    - Ideas to reduce freight congestion include: Freight Signal Priority, Freight Platooning, Freight Only Lanes, and Freight Specific Routes
    - The Connected Freight & Farm Equipment Safety Pilot is conceptualized as a small, farm-specific deployment to begin, with portable signage and tracking devices to test the implementation in multiple locations
- Discussion of Transit
    - While enthusiastic about high speed passenger transit, such as bus rapid transit and high-speed commuter rail, stakeholders did not think that an Hyperloop system was right for the San Joaquin region
    - Forming a partnership with Bay Area Rapid Transit (BART) was positively received
    - The current software application that RTD utilizes, Vamos, has integrated trip planning but cannot yet be used to purchase tickets
    - SJCOG is leading the effort for a common digital payment system with technology company Misabe to expand equitable mobile ticketing solutions
    - Additional work is being conducted to integrate with VanGO ticketing
- Discussion of Congestion
    - There is currently a nine-county metropolitan planning organization agreement circulating for the implementation of Bay Area-wide congestion pricing on freeway facilities
    - This would affect the San Joaquin residents who are "hypercommuters"
    - Any strategy for Enhanced ICM is recommended to include pricing
    - Pricing must be equitably enforced
- Discussion of Fiber Optic Connectivity
    - The Fiber City Checklist strategy was met with enthusiasm
    - Partnering with local colleges and universities for telecommunications training during the Checklist process was ideated
    - Due to the large implications that fiber optic connectivity present for the capabilities of smart infrastructure, the question was posed as to whether transportation/urban conduit, separate from commercial and residential internet access, should be considered
    - From a community standpoint, educating the public regarding the increased productivity, opportunity, and vitality of a fiber optic network would be crucial for key political support

Innovation Working Group Meeting #3 – Prep Packet

This document is intended to summarize relevant information for Working Group Meeting #3, to be held **Monday January 25th, 2021 between 1:30 – 2:30pm PST.** At the Working Group #2 Meeting in November 2020, our stakeholders helped us identify and refine potential projects that address San Joaquin's regional transportation needs. *The purpose of Working Group #3 is to prioritize one innovative project for SJCOG and its partners to implement in the near future.* This innovative project will realize the vision of implementing a regional, context-specific technology pilot to address identified transportation challenges while endeavoring towards the goals of the Regional Transportation Plan and Sustainable Community Strategy.

Planning for Long Term Success

Throughout stakeholder engagement and best-practice research, this study identified foundational steps that SJCOG and its partners can advance transportation in the San Joaquin region *by ensuring connectivity, enhancing partnerships, and planning for emerging revenue sources.*

Enhancing Partnerships

Excellent progress has been made towards unifying the transportation agencies of the Altamont Pass through the Caltrans Summit on the Summit, the Altamont Corridor Vision, and the SJCOG Congested Corridor Plan. As a key partner in the successful implementation of integrated corridor management, SJCOG can lead by example through the adoption of recommended projects into the RTP and the dedication of staff resources towards innovative grant applications as identified in the recently produced plans.

Planning for Emerging Revenue Sources

Vehicle technology, travel behavior, and parking patterns are changing. Transportation agencies and their partners need to look to alternative revenue sources to support the deployment of emerging technologies and to ensure sustainable funding beyond the catalyst funds supplied by grants. SJCOG and its partners could collaborate with economic forecasting and modelling specialists to study potential revenue sources over the long term planning horizon for inclusion in the SJCOG Regional Transportation Plan.

WORKING GROUP #3 LIVE POLL

DURING THE MEETING, ACCESS THE SURVEY BY CLICKING THIS LINK:

WWW.SURVEYMONKEY.COM/R/SJCOGWG3

(Now Closed)

Innovation Working Group Meeting #3 – Summary

- Discussion on project capabilities
    - Clarification was provided about extent of project – Main approach of the project is to focus on how to facilitate pilot programs and demonstrations to expand transportation capabilities. Ongoing stakeholder participation plays a vital role in this aspect. It is important to prioritize project types and recommend a project type that should be considered but also equally important to mention recommended project type along with all other project types in the Regional Transportation Plan (RTP). This project is keenly focused on helping understand the policies and plans in process related to the technologies. The RTP may recommend a project type and idea but will mainly focus on the plans and policy guidance of the project.
- Discussion on SJCOG's role
    - SJCOG's role is to mainly bring stakeholders together and strengthen partnerships with counties and other partners. SJCOG can facilitate stakeholder engagement to create the right team to pursue additional grants.
- Discussion on AV Infrastructure
    - AV infrastructure can be borrowed for a 'show and tell' style of demonstration. This can be done by inviting manufacturers to demonstrate the technology at events. (Example: Demonstrations at stadiums where shuttles can be used to provide shuttle service to parking lots.)
    - Infrastructure readiness could be challenging as the signal systems are not connected.
    - Identified the need to focus on early planning and setting the technology with what is provided rather than focusing on limiting factors. Focusing on small study areas and early planning for infrastructure readiness was positively received and agreed upon.
- Lessons Learned
    - Provide more financial information about project types to inform SJCOG about the financial element.
    - Clarify that this project is focused on the plans, policies and studies of the project types rather than on the implementation of the projects. SJCOG will play a main role in bringing together and coordinating with teams to focus on grants to fund the recommended project. The recommended project along with the plans and policies will be included in the RTP. Other project types will also be mentioned. SJCOG will not play a role in the implementation of these projects.

Innovation Working Group Meeting #4 – Prep Packet

The purpose of Working Group #4 is to review and discuss the potential Transformational Technology Scenarios for the Regional Transportation Plan (RTP) and their implications for the San Joaquin region. These Transformational Technology Scenarios could aid SJCOG in the implementation of innovative projects throughout the region.

Working Group #1 – July 2020

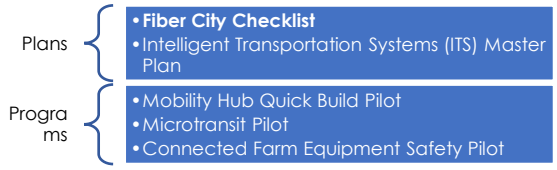
The first meeting of the Transportation Innovation Planning Study's Working Group engaged stakeholders to identify SJCOG's Regional Transportation Needs.

Working Group #2 – November 2020

Building from the identified Regional Needs from Working Group #1, the second meeting of the working group brainstormed creative **technology applications to address the regional needs** in the form of short-, mid-, and long-term deployments.

Working Group #3 – January 2021

The convening of the third Working Group **ranked the innovative ideas** based on the prioritization criteria collaboratively developed by the project team and SJCOG staff. The ranking process prioritized the following plans that SJCOG and its partner agencies could pursue or programs to initiate planning phases within the next 1-3 years.



Final Recommendation

A fundamental tool to support almost all the potential pilots and programs is the expansion of fiber optic communications throughout the region. The **Fiber City Checklist** is a compilation of best practices and recommendations, which defines a clear, three-part process for readying the region for widespread fiber optic construction. The Fiber City Checklist is intended to ready a place for rapid fiber optic network expansion regardless of internet service provider (ISP). SJCOG could lead the Fiber City Checklist within the next 2-3 years to prepare for a public-private partnership with telecommunications providers.

The fourth and final meeting of the Working Group will focus on the potential Transformational Technology Scenarios for the 2022 Regional Transportation Plan, which SJCOG is currently developing. The RTP/SCS can encourage technology adoption to support the Moderate or Aggressive Technology Transformation scenarios by defining **goals**, developing **strategies**, and identifying plan and program **projects** to implement. The three potential scenarios include:

- The **BUSINESS-AS-USUAL** scenario is defined by the continuation of current trends in AV use, EV adoption, telecommuting, regional mobility, workforce demands, and transportation systems data collection and management.
- The **MODERATE TECHNOLOGY TRANSFORMATIONS** scenario is defined by agency investments in data collection and monitoring which enables advanced transportation systems management. Increased EV adoption and charging infrastructure network supports passenger and freight movement. Increased full-time teleworking reduces hyper-commute demands and creating opportunities for higher-density, mixed use urban development. Advancements in transportation technology by the private industry begin to provide new automated mobility solutions for passenger and goods movement and some shift in workforce demands.
- The **EXTENSIVE TECHNOLOGY TRANSFORMATIONS** scenario is defined by widespread EV and AV adoption in passenger and freight vehicles. Widespread teleworking and high-speed internet access attract employers to relocate jobs to the county and enables higher-density, mixed use development in urban areas. Automation in freight and agricultural industries reduces workforce demands in those sectors, meanwhile increased dependence on automation increases demand for higher-education software and data management jobs. Universal payment applications enable seamless transfers across modes and across service providers.

Appendix C: Guidance and Best Practices for Transformational Technology Planning

There are many resources available for regional and local planning agencies to find current guidance or best practices for planning for innovative transportation technology and for developing policy that is flexible and can adapt to changing technology. The following publications were reviewed for this study:

- National Cooperative Highway Research Program (NCHRP) Report 924: Foreseeing the Impact of Transformational Technologies on Land Use and Transportation. (2019)[1]
- NCHRP Report 952: Guidebook for Managing Data from Emerging Technologies for Transportation. (2020)[2]
- National Institute for Transportation and Communities (NITC) Report 1216: Matching the Speed of Technology with the Speed of Local Government: Developing Codes and Policies Related to the Possible Impacts of New Mobility on Cities. (2020)[3]
- National League of Cities (NLC), Model Code for Municipalities. (2018)[4]
- University of the Pacific, Warehousing, E-Commerce, and Evolving Trade Patterns in San Joaquin County. (2019)[5]
- UC Davis, How E-Commerce is Reshaping Warehousing and Impacting Disadvantages Communities. (2020)[6]
- UC Davis, The Impacts of Automated Vehicles on City Center Parking Demand. (2020)[7]
- National Association of City Transportation Officials (NACTO), NACTO Policy 2018, Guidelines for the Regulation and Management of Shared Active Transportation, Version 1. (2018)[8]

Table 1 summarizes the key impacts of new technologies in transportation and the best practices or guidance for planning for them.

Table 1. Key Impacts and Best Practices for Emerging Technologies

Key Impacts of New Technologies	Best Practices or Guidance
Agencies must plan for impacts to land use, travel demand, travel behavior, and transportation systems management	NCHRP Report 924 developed a framework for planning for the impact of transformational technologies on land use and transportation.
Agencies must learn how to manage emerging technology data	NCHRP Report 952 developed a framework for ways in which transit agencies can better collect, store, and analyze big data from emerging technology, as well as guidance to consider when partnering with third-party data managers or providers.
Increasing online orders (e-commerce) is increasing truck traffic, which leads to	Policy and regulations can reduce commercial traffic on neighborhood streets, promote electrification of trucks, and incentivize aggregating deliveries.

[1] www.trb.org/Main/Blurbs/179645.aspx
[2] https://doi.org/10.17226/25844
[3] www.nitc-utc.net
[4] https://www.nlc.org/resource/model-code-for-municipalities-0
[5] go.pacific.edu/cbpr and www.sjcog.org/DocumentCenter/View/4755/2019-The-Rise-of-Warehousing-and-E-Commerce-PDF-Document?bidId=
[6] https://escholarship.org/uc/item/1pv6t7q9
[7] https://escholarship.org/uc/item/63m6k29n
[8] https://nacto.org/wp-content/uploads/2018/07/NACTO-Shared-Active-Transportation-Guidelines.pdf

greater exposure to pollution and noise in communities	
San Joaquin County is facing dynamic change in the goods movement system	University of the Pacific recommends that the County's goods movement system should be integrated with the rest of the Northern California Megaregion's strategy. New integrated business models are transforming the functions and roles of the goods movement system. New employment opportunities need to be supported by sustained advancement for the County's workers.
Regulations need to be flexible to stay relevant with evolving technology	NCHRP Report 924, the NLC, and NACTO guides provide examples of how to write flexible policies that are enforceable, performance-oriented, and technology-agnostic so that they can continue to deliver SJCOG's goals of mobility, equity, safety, and sustainability as new technologies become available.
Agencies need guidance on setting new policy for emerging technologies	NITC Report 1216 provides specific policy recommendations for emerging technology, specifically on curb management, parking, bike/scooters, and transportation network companies (TNCs).
Parking demand changes due to automated vehicles, which require more pick-up/drop-off curb space, instead of parking spaces	Curb usage and parking regulations will have to change throughout the day as the demand for pick-up/drop-off curb space changes. This is due to increases in empty-vehicle vehicle miles traveled (VMT) and time searching for parking as cities re-allocate curb space for pick-up-drop-off parking.
High-speed internet access and fiber optic communications enable new technologies	During this project, the COVID-19 pandemic emphasized the need for broadband internet access to support residents and employers in the region, as well as to support future advanced traffic management strategies. Broadband internet has historically underserved rural or low-income households. The Fiber City Checklist is a process to assess an area's readiness for fiber and to facilitate discussions with internet service providers.

Appendix D: Local and Regional Transportation Needs and Initiatives

SJCOG Transportation Innovation Planning Study – Stakeholder Survey

Advocacy Groups

Question 1: What are current obstacles to transportation or to technology for your members?

- Business Council: road availability, road conditions, traffic congestion, available hot spots for internet coverage.
- Catholic Charities: Not enough routes. Slow internet had been an issue for some residents due to the load of online work.
- Third City Coalition: Obstacles to transportation: safety on public transit/traveling to and from public transit stops, concerns from youth about being profiled by police while riding public transit, safety while using active transportation, perception of safety for walking/biking/riding public transit, frequency and reliability of public transit outside of BRT/main corridors. Obstacles to technology: growing digital divide for elderly and working families, language barriers in technology - many apps are English only
- Delta-Sierra Group – Sierra Club: Emissions caused by more vehicles per mile of road due to autonomous technologies.

Question 2: What obstacles to transportation or technology do you anticipate in the future?

- Business Council: the amount of space for travel time. internet speed
- Catholic Charities: Not enough funding for public transportation locally. For tech, there needs to be more push for EV charging stations.
- Third City Coalition: In a post-COVID world, I am unclear about what public transportation looks like.
- Delta-Sierra Group – Sierra Club (Paul Plathe): Emissions caused by more vehicles per mile of road due to autonomous technologies.

Question 3: What technology, policy, or process changes is your group advocating for?

- Business Council: more telecommuting abilities for businesses, Satellite options , rail options for hauling goods and train use for goods and if it makes sense services
- Catholic Charities: We are advocating for more EV chargers in the Central Valley. More funding for Active Transportation projects in the Central Valley
- Third City Coalition: Process changes: continued involvement and engagement of underrepresented transit users (elderly, working class, caregivers, etc.) in planning processes, continued data collection and evaluation of transit barriers in areas with fewer mobility options. Policy: increased investment in active transportation and first/last mile connectivity, rapid transition to clean, decarbonized transportation system for SJC
- Delta-Sierra Group – Sierra Club: decreased vehicle miles traveled and sprawl, decrease congestion and pressure to build new roads, as such technology could enable vehicles to travel safely with shorter distance between vehicles, allowing more vehicles per the same road space, reducing miles spent lost or searching for parking, and creating fewer accidents and decisions that impede traffic flow

Question 4: Who are your partners for these efforts?

- Business Council: business leaders in the communities we represent and technology providers
- Catholic Charities: Catholic Charities, Sierra Club, ClimatePlan, Leadership Counsel, UC Davis, Santa Clara University, CEJA, Third City Coalition, many more
- Third City Coalition: We have many partners, the most important being SJCOG!

Question 5: How can SJCOG and its member jurisdictions help you?

- Business Council: help plan next steps and collaborate with the organizations that are directly effected
- Catholic Charities: Keep us involved on things on SJCOGs side. Transparency helps us on advocating certain projects. Helps on community engagement.
- Third City Coalition: Continued open communication and opportunities for learning

Municipalities and Public Agencies

Question 1: What is your organization's vision for the connected and automated future?

- MTC/ABAG: Shared, with transit as the backbone
- San Joaquin County: To be able to do all reporting and scheduling requests online.

Question 2: What innovative or technology-related projects is your organization currently supporting?

- MTC/ABAG: Transit schedule coordination, digital wayfinding, employer trip reduction platforms, regional open data, next generation Clipper
- San Joaquin County: Developing a program to give first responders access to grower contact information in case of a pesticide drift.

Question 3: What technology, policy, or process changes is your organization planning?

- MTC/ABAG: Coordination between existing and emerging mobility, repositioning transit for the future, fare coordination and discount programs, EV acceleration
- San Joaquin County: We try to stay technologically savvy, we are developing a billing system which ties into a time keeping system. this will allow us to produce customer billing using live time information.

Question 4: Who are your partners for these efforts?

- MTC/ABAG: Cities, transit agencies, private mobility providers, community groups
- San Joaquin County: Depends on the program we are partnering with the California Agricultural Commissioners and Sealers Association for the first responders program, we are hiring Graviton to develop our timekeeping/billing application.

Question 5: What are current obstacles to transportation or to technology for local residents and employers?

- MTC/ABAG: Information not centralized, lack of coordinated information and tools, ineffective service
- San Joaquin County: From a governmental point of view it is simply the amount of time it takes to cut through the red tape.

Question 6: What obstacles to transportation or technology do you anticipate in the future?

- MTC/ABAG: obstacles are lack of funding for transit, and pandemic reducing resident's willingness to take transit. Future: AVs may be so affordable that no one will take a shared mode

- San Joaquin County: Transportation wise is the increase of commuter and hauling transportation traffic.

Question 7: How can SJCOG and its member jurisdictions help you?

- MTC/ABAG: Housing production, freight coordination, TDM coordation
- San Joaquin County: not sure, but commuter traffic increase does need to be addressed. Also the increase in rural urban interface has caused conflicts with Agriculture.

Private Industry

Question 1: What is your company's vision for the connected and automated future?

- Ford Mobility/ AV LLC: Enabling people through the freedom of movement
- Via: Via's Autonomous Vehicle (AV) solutions have grown out of our extensive experience as a developer and operator of on-demand transit systems. Our on-demand transit platform matches vehicle supply with rider demand in real-time, assigning riders to the best-suited vehicle across mixed fleets. Via's technology has paved the way for the incorporation of AVs within on-demand transportation systems. Via builds the digital infrastructure that connects AVs to end users and coordinates the movement of AV fleets. Our technology can integrate with any AV provider and is flexible to support a wider range of deployments. Crucially, we are the only mobility company with experience developing software that integrates with multiple AV providers to provide shared, dynamically routed, on-demand transportation.

Question 2: What innovative or technology-related projects is your company currently supporting?

- Ford Mobility/ AV LLC: A suite of mobility services from microtransit to micromobility to connected vehicles & AVs.
- Via: Via's mission is to become the world leader in planning, developing, and operating innovative public mobility systems. Today, Via is leading innovative transit solutions through over 120 partnerships with public agencies and institutions in more than 20 countries. Over the past seven years, Via has evolved from a revolutionary on-demand transit platform into an organization that can plan and manage every aspect of public mobility. As planners, we leverage the knowledge and expertise that our organization has built in designing and operating cutting edge mobility solutions across a broad range of use-cases, geographies, and contexts. Based on this experience, we are one of the only firms with the expertise to provide forward-looking recommendations that are pragmatic and actionable. Via's experience includes: -Integrated trip planning and payments systems: Via designed fare integration strategies for fixed-route and microtransit services in Seattle and in Sydney, Australia. -Electric vehicle charge tracking: Via designed an advanced EV fleet management strategy in Berlin, where we operate the largest public transit agency "owned' microtransit service in the world. -Shared, autonomous vehicle strategies: Via planned and operates shared autonomous vehicle services in Irvine, California and Coffs Harbour, Australia. -Travel demand management: Via developed and implemented a groundbreaking travel demand management tool on behalf of the Israeli Ministry of Transportation to encourage commuters to factor the real cost of their trip into travel decision making. -Advanced school transportation: Via has developed an advanced technology platform to power the New York City public school bus system, providing for advanced vehicle routing and tracking, enhanced communication with parents and caregivers, and other groundbreaking

functionalities. Via provides a similar system in the Sacramento region on behalf of the Washington Unified School District. -Advanced paratransit services: Via has developed and implemented paratransit systems that leverage technology to provide enhanced efficiency and customer experience through improved routing, vehicle tracking, and communication, and by integrating pre-scheduled and on-demand booking. We recently launched major paratransit operations and maintenance services on behalf of Hampton Roads Transit in Virginia and Green Bay Metro in Wisconsin.

Question 3: Who are your partners for these efforts?

- Ford Mobility/ AV LLC: Public and private partners
- Via: Of our more than 120 deployments around the world, more than 30 are in partnership with public transit agencies. From paratransit service in Green Bay, Wisconsin, to on-demand first- and last-mile services in Dubai, to school buses in West Sacramento, California — Via brings best practices for creating innovative solutions to local and regional transportation challenges. We work with public transit providers to iterate aspects of their services to optimize overall system performance in accordance with their goals. A non-exhaustive but representative list of our partnerships with cities or public transit agencies includes: -AT Local with Auckland Transport in Auckland, New Zealand -Berlkoenig with Berliner Verkehrsbetriebe in Berlin and Brandenburg, Germany -Arlington On-Demand with the City of Arlington, Texas -West Sacramento On-Demand with the City of West Sacramento, California -Pickup with Capital Metro in Austin, Texas -COTA Plus with the Central Ohio Transit Authority in Columbus, Ohio -Espoo On-Demand with the Helsinki Regional Transport Authority in Espoo, Finland -Via Los Angeles with the Los Angeles County Metropolitan Transportation Authority in California -BusGo with the Land Transport Authority in Singapore -Metroexpress with Qatar Railways in Doha, Qatar -Rapid On Demand with the Michigan Department of Transportation and The Rapid in Grand Rapids, Michigan -Lone Tree Link with the City of Lone Tree, Colorado -Flex with Montgomery County, Maryland -RTL On-Demand with Réseau de Transport de Longueuil in Quebec, Canada -NewMo with the City of Newton, Massachusetts -Wheels2U with Norwalk Transit District in Connecticut -OCFlex with the Orange County Transportation Authority in California -FLX Pacifica with San Mateo County Transit District in Pacifica, California

Question 4: What is your company doing to remove obstacles to transportation or to technology?

- Ford Mobility/ AV LLC: R&D and partnerships
- Via: Leveraging our diverse and extensive experience, use our technology to increase access and remove obstacles to transit for our partners, including:
    - Increased Ridership: Via grows ridership by enhancing the convenience, flexibility, and accessibility of public transit. Our user-friendly platform attracts new customers while enabling our partners to transport more riders using fewer vehicles.
    - Reduced Costs: Our technology reduces operational costs by only deploying vehicles where and when they are needed. Via pools riders into efficient shared trips and dynamically routes vehicles in response to real-time demand and live traffic conditions. This automated technology provides unparalleled system efficiency, maximizing fleet utilization while minimizing the resources needed for service management.
    - Improved Customer Experience: Via delivers a personalized trip for each rider, without lengthy detours or wait times. We offer intuitive interfaces for booking trips, tracking real-

time trip information, and accessing customer support. As a testament to this service quality, most Via services maintain an average trip rating above 4.8/5.

- Scalability: Via's technology is designed to scale and adapt to new use cases, enabling our partners to grow their existing services and address new challenges over time. Based on tangible outcomes, such as increased ridership and reduced operational costs, several partners have expanded their services with Via through fleet size increases, service zone expansions, and contract renewals.
- Equity: As we have in all of our federally-funded deployments, Via will ensure communities meet their ADA and Title VI obligations. We understand the requirements for transit providers, including providing meaningful access to Limited English Proficiency (LEP) persons, promoting inclusive public participation, preventing discrimination, ensuring equity in service and fare changes, and achieving environmental justice. Via is dedicated to transit equity, and we work with partners to design services that deliver more mobility and more access to opportunity. We've taken special care to ensure the Via Platform is accessible to everyone, including customers with limited mobility, customers with visual or hearing impairments, and customers without smartphones. We are committed to working with these and other communities to better understand and accommodate their transit needs. For customers with limited mobility. Riders can indicate their need for a Wheelchair Accessible Vehicle (WAV) either in the rider app or over the phone with a dispatcher. The system will remember this preference, making a WAV request the default for future bookings. Since WAV boardings and dropoffs may take more time than those of fully ambulatory passengers, Via's algorithms account for the additional time that might be necessary and adjust routing decisions accordingly.
- For customers without smartphones. Customers without smartphones can request rides by calling the dispatch department. Dispatchers can look up accounts by entering the customer's name, phone number, or any other configurable field, and can easily book rides directly on behalf of customers.

Question 5: How can SJCOG and its member jurisdictions help you?

- Ford Mobility/ AV LLC: Provide insight and dialogue into what mobility challenges and opportunities SJCOG is facing collectively in the greater community
- Via: We would be grateful to have the opportunity to work with SJCOG and its member jurisdictions to improve access and mobility for all of its residents. We aim to be much more than a software provider: we want to be a true partner, committed to helping you reach your unique goals. With Via, you will have a partner who understands how and where technology can best be leveraged to support the health and growth of the region's entire transportation network.

Academia

Question 1: What are current obstacles to transportation or to technology for your students, faculty, or staff?

- CEE and Transportation Sustainability Research Center at UC Berk (Dr. Susan Shaheen): Access to WiFi, computers, smartphones and quiet spaces in light of COVID-19 (distance learning)

- UC Davis and CARB (Dr. Dan Sperling): answering generally: cost, availability of non-traditional services (ride-hailing, shared bikes and scooters, microtransit)

Question 2: What obstacles to transportation or technology do you anticipate in the future?

- Dr. Susan Shaheen: Access to digital technologies that enable mobility, along with access to credit/banking to facilitate transactions
- Dr. Dan Sperling: cost, willingness of companies to offer mobility services, ability of transit operators to offer expanded services, marketing of services, using transportation funding to support private services and public-private partnerships

Question 3: How are you integrating new transportation technology into the course material?

- Dr. Susan Shaheen: I teach a course in CEE at the graduate level on Transportation Sustainability. A good portion of the class focuses on electronic/wireless technologies, alternative fuels/vehicles, and ITS technologies (including connected and automated vehicles)
- Dr. Dan Sperling: included in many courses

Question 4: What partnerships do you have with local municipalities, public agencies, or private industry?

- Dr. Susan Shaheen: We have a number of projects with public and private sector partners throughout CA, as well as CBOs (e.g., TransForm)--e.g., City of Oakland, Lyft, Bird.
- Dr. Dan Sperling: many--with transit operators, CEC, CARB, caltrans, various MPOs, Lyft, Uber, Via, Lime, many others

Question 5: How can SJCOG and its member jurisdictions help you or your students?

- Dr. Susan Shaheen: Internships and project opportunities, as well as future employment. Possible MS and PhD thesis opportunities.
- Dr. Dan Sperling: how can we help SJCOG is better question

SJCOG Regional Needs and Goals

How do the regional needs align with SJCOG goals?

Regional Transportation Needs	Mobility	Transformational Technology Readiness	Equity & Accessibility	Economic Vitality	Environmental Sustainability	Safety
Deploy Technology that Serves Regional Needs	✓	✓	✓	✓	✓	✓
Expand Internet Access & Improve Telecommunications Speeds		✓	✓	✓		
Reduce Congestion & Commuter Traffic	✓			✓	✓	✓
Reduce Freight Traffic Conflicts						✓
Address Digital Banking Access			✓	✓		
Improve Transit Access	✓		✓	✓	✓	
Increase Zero Emission Vehicles	✓				✓	
Expand Active Transportation	✓				✓	
Share Data & Information		✓				
Address Aging Infrastructure	✓			✓		✓

Appendix E: Potential Pilot Deployments, Plans, and Programs

POTENTIAL PILOT DEPLOYMENTS:

Short-Term (1 – 3 Years)

- **Connected Farm Equipment Safety Pilot:** Partnering with local farmers, freight operators, and Caltrans, this pilot could outfit existing farm equipment with automatic vehicle locator (AVL) devices that would communicate with hybrid beacons positioned at frequent crossing locations or along road segments with frequent low-speed farm equipment. When the connected farm equipment approaches, the beacons would flash, alerting freight and passenger vehicle drivers of the conflict ahead.

- **Microtransit Pilot**: Microtransit is demand-responsive transportation that offer flexible routing, flexible scheduling, or event flexible vehicle assignment to adapt to changing supply and demand. Some services offer artificially intelligent route optimization software that allows an existing fleet like RTD's to be utilized in a hub-to-hub manner that extends the service area while reducing wait times for riders.

- **AV Goods Delivery Pilot:** The COVID-19 pandemic has illustrated the need for contactless delivery services that can both provide essential goods, such as groceries and medicine, while protecting both workers and consumers. An automated vehicle (AV) could deliver these essential goods on a route in rural areas of the county where access to groceries and medicine may be limited to people due to limited transit accessibility or due to COVID-related health risks.

- **Mobility Hub Quick-Build Pilot**: Mobility Hubs are technologically integrated, multi-modal stations to empower communities to access their destinations with a variety of modes. Mobility Hubs often combine transportation options for transit, shared micromobility, electric vehicle (EV) charging infrastructure, and car-sharing. A Quick-Build Pilot could dedicate an existing parking structure for covered bicycle parking, docking stations, and a bus stop to facilitate intermodal trips, creating a foundation to add more multimodal options to in the future.

Mid-Term (3 – 5+ Years)

- **CAV Shuttle between Amtrak and ACE:** Stockton is home to two passenger rail lines, located approximately 5 minutes driving distance from one another. A connected-automated vehicle (CAV) shuttle system could be used to connect the two stations to increase regional connectivity by rail.

- **CAV Shuttle for Distribution Center Workers to Mobility Hub:** Connecting distribution center employees, such as those who work in the industrial area by Navy Drive and by Arch Road, with direct shuttle service to the RTD downtown transfer center, could be an another pilot for CAV technology in Stockton.

- **CAV Truck-Only Lanes Pilot:** To address the freight traffic traversing San Joaquin County, two of the six lanes on SR-99 could be piloted as CAV Truck-Only Lanes between Ripon and Collierville. The high capacity lanes could serve to remove freight conflicts and allow for the testing of automated trucks or platoons of CAVs.

- **Drone & Sidewalk Automated Delivery Pilot:** SJCOG could form a partnership with the Amazon Fulfillment Center in Tracy, as well as the numerous Amazon Hub Lockers in Lathrop, Stockton, Lodi, and Manteca, to pilot the delivery of small packages via drone or sidewalk robot.

Long-Term (20+ Years)

- **Regional Hyperloop:** High-speed, long-distance passenger or goods movement on dedicated facility.

- **Regional CAV Adoption:** Widely adopt CAVs for use in shuttle operations, passenger movement, or goods deliveries throughout the region.

POTENTIAL PLANS & PROGRAMS:

Short-Term (1 – 3 Years)

- **Fiber City Checklist:** A compilation of best practices and recommendations for the preparatory work of jurisdictions necessary for the easy and quick installation of a fiber optic network. As the most critical infrastructure in an increasingly digital world, fiber optic cabling can enable rural and urban areas alike to enjoy high-speed internet and 5G cellular service.
- **Intelligent Transportation System (ITS) Master Plan:** This planning document could guide investment decisions by identifying needs and recommending strategic projects throughout the county to maintain and update the critical infrastructure that will support the deployment of connected and automated vehicles.
- **EV Charging Infrastructure Acceleration Program**: Promote the adoption of and transition to zero-emission vehicles (ZEVs) in the San Joaquin Valley for government fleets, passenger vehicles, and commercial fleets by adopting new development codes, supporting the RTD fleet transition, installing EV charging infrastructure at partner agency buildings and public parking lots, and facilitating partnerships to install EV charging infrastructure.
- **Mobile & Common Payment Systems:** Transit-dependent riders need access to new mobile payment options—particularly for travelers who are un-/under-banked or do not have access to a smartphone with a data plan. Mobile common payment plans can integrate smartphone and contactless payment options, which could remove barriers to exact change payments and facilitate easier transfers between transit routes. SJCOG is working to initiate a regional reloadable transportation fare cared, similar to the Clipper Card in the Bay Area.
- **Rail-to-Trail Planning & Design**: At least 10 abandoned railways exist in San Joaquin County. In addition to constructing active transportation shared-use paths for walking, biking, and rolling, these rights of way could be used to develop fixed routes for CAV testing or to house communications utilities like fiber optic cables.

Mid-Term (3 – 5+ Years)

- **Regional Traffic Management Center (TMC):** A TMC could serve as the mission control for the region's major street and highway network by monitoring all traffic signals, intersections, and roads to proactively manage congestion, coordinate special events, and provide emergency first response information. As the region's communications and intelligent transportation systems are expanded, data monitoring and management from a TMC will be crucial to the smooth functioning of CAVs.
- **Integrated Corridor Management (ICM) Partnership:** The Altamont Pass poses a critical congestion challenge to the region. Forming an expanded partnership for the management of the I-580 corridor could help to coordinate planning, maintenance, and operations investments on both sides of the pass. This would build on the SJCOG Congested Corridor Plan for I-205, I-5, SR 120, and SR 99.
- **Hyperloop Testing Facility:** The current Hyperloop testing facility outside of Las Vegas accounts for only 500 meters of the 2,000 meters (about 1.25 miles) necessary for the test vehicle to reach its full speed of 700 mph. Within San Joaquin County, there are multiple stretches of flat land that could be reallocated towards a hyperloop testing facility that is of adequate length for full-speed testing.

Long-Term (20+ Years)

- **Traditional Funding Alternatives:** As technology changes travel behavior, vehicle technology, and land use, traditional fuel tax, vehicle licensing, and traffic enforcement revenue programs will need to evolve to reflect the changes in the fuel sources, vehicle miles traveled, parking demands, and other factors.

Appendix F: Innovation Performance Measures

Recommended Performance Measures that Correspond with SJCOG Regional Needs

Mobility

Reduce Congestion & Commuter Traffic	Change in Vehicle Miles Traveled Passenger Travel Time Reliability
Improve Transit Access	Change in Transit Ridership by Stop Transit Time Reliability Percent of Population with Access to Transit
Expand Active Transportation	Percent of Arterial and Collector Streets with Sidewallks Percent of Arterial and Collector Streets with Bicycle Facilities

Environmental Sustainability

Increase Zero Emission Vehicles	Change in Electric Vehicle Registrations Change in Air Quality
Improve Transit Access	Change in Transit Ridership by Stop Transit Time Reliability Percent of Population with Access to Transit
Expand Active Transportation	Percent of Arterial and Collector Streets with Sidewalks Percent of Arterial and Collector Streets with Bicycle Facilities

Transformational Technology Readiness

Deploy Technologies that Serve Regional Needs	Number of New Partnerships
Expand Internet Access & Improve Telecommunication Speeds	Miles of Fiber Optic Network Percent of Residences with High-Speed Internet Access Percent of Businesses with High-Speed Internet Access
Share Data & Information	Number of Metrics Tracked in Community Pulse Number of Datasets Updated in the Past Year on the Data Center
Address Digital Banking Access	Total Change in Financially Excluded Population* Total Change in Digitally Excluded Population**

*Financial Exclusion: The lack of a financial account for making or receiving payments (unbanked or underbanked population)
**Digital Exclusion: The lack of internet access at home

Safety

Address Aging Infrastructure	Percent of Infrastructure in State of Good Repair Percent of Annual Budget for Maintenance
Reduce Congestion & Commuter Traffic	Change in Vehicle Miles Travelled Change in Crash Rates
Reduce Freight Traffic Conflicts	Change in Freight Crashes

Equity & Accessibility

Address Digital Banking Access	Total Change in Financially Excluded Population* Total Change in Digitally Excluded Population**
Improve Transit Access	Change in Transit Ridership by Stop Percent of Population with Access to Transit
Increase Zero Emission Vehicles	Change in Air Quality

*Financial Exclusion: The lack of a financial account for making or receiving payments (unbanked or underbanked population)
**Digital Exclusion: The lack of internet access at home

Economic Vitality

Address Digital Banking Access	Total Change in Financially Excluded Population* Total Change in Digitally Excluded Population**
Expand Internet Access & Improve Telecommunication Speeds	Miles of Fiber Optic Network Percent of Residences with High-Speed Internet Access Percent of Businesses with High-Speed Internet Access
Expand Active Transportation	Percent of Arterial and Collector Streets with Sidewalks Percent of Arterial and Collector Streets with Bicycle
Reduce Freight Traffic Conflicts	Freight Travel Time Reliability Change in Freight Crashes

*Financial Exclusion: The lack of a financial account for making or receiving payments (unbanked or underbanked population)
**Digital Exclusion: The lack of internet access at home

Metrics for Monitoring the Impacts of Emerging Technology

Technology is evolving rapidly, costs are changing, and no one can predict with certainty which technologies have the staying power at this time. Look at how quickly docked bikeshare was replaced by e-scooters in cities across the country. Rather than focusing on specific technologies, which may be enhanced or become obsolete in the near future, SJCOG can plan for the applications of technology that best meet the needs of the community. For example, personal mobility applications considered in the Stockton Mobility Collective Project (which include technologies such as docked or dockless bikeshare) are innovative solutions to support short trips or transit connections.

Local agencies can make better-informed decisions by establishing programs, funding criteria, and evaluations based on data-driven performance metrics. To monitor changes, SJCOG can incorporate new data sources into the planning processes. The following metrics will help SJCOG, and its partner agencies measure and monitor the effects of transformational technologies on their technology deployment goals.

Candidate Metrics for Monitoring Impacts of Emerging Technologies

Impact	Candidate Metrics	Sources of Information
Growth	Population, Employment, Tax Receipts (Sales Tax, Property Tax, Transient Occupancy Tax, other taxes), Licenses and Permits	SJCOG data, State Finance Department, US Census, State Employment Department, Local and State Collection Agencies, Permit/License Issuing agencies and departments
Land Use and location	Permits Pulled	Issuing agency and department
Early Indicators of Code and Plan Problems	Complaints, code enforcement requests, conditional use permits, zoning variance requests, comprehensive plan amendments	San Joaquin County, Stockton, Tracy, Lathrop, Lodi, Manteca, Ripon, and Escalon planning/community development department
Parking	Curb, lot, and loading zone parking utilization, price, average stay	Operator records, video and/or volunteer monitoring, purchased data
Travel Demand	Daily ridership and vehicle miles traveled (VMT) by mode of travel	RTD data, purchased data, field sensors

Source: NCHRP Report 924: Foreseeing the Impact of Transformational Technologies on Land Use and Transportation (2019).

These performance metrics, similar to those already included on SJCOG's *Community Pulse*, will require data collection, aggregation, anonymization, analysis, security, and storage. Creating a new subsection on Community Pulse for Emerging Technology, and including some of the metrics discussed below, will be crucial to the successful deployment of AVs and other transformational technologies in the San Joaquin region.

SJCOG can adopt the 'monitoring mindset' by keeping a pulse on:

- Guidance for adapting regional travel demand models to account for transformational technologies, including automated vehicles, ridehail, and micromobility.
- Land use, population, and employment data of the San Joaquin region to identify early indicators of growth.
- Data from transit agencies, micromobility providers, and field sensors to identify early indicators of travel demand impacts. This data may also provide insights about the resiliency of the transportation system and how quickly residents and visitors return to normal travel demand patterns.

SJCOG can lead by encouraging transparent data sharing across member agencies and across partnerships with vendors or data providers through the Data Center on the Community Pulse website. As an identified regional need, Sharing Data & Information is crucial towards the successful planning for and implementation of emerging technologies.

Appendix G: Innovative Policy Framework

Policy Framework

This appendix outlines the proposed policy framework that San Joaquin Council of Governments (SJCOG) and its partner agencies could follow to address current technologies as well of possibilities of new technologies being developed in the future to achieve their overall transportation goals of mobility, safety, equity, and sustainability.

SJCOG is conducting its first Transportation Innovation Planning Study. The existing technology initiatives led by SJCOG and other entities in the region are summarized in the **Appendix C: Local and Regional Initiatives**. **Appendix F** builds upon the current efforts to outline a policy framework to inform SJCOG's regional role in advancing the adoption of transportation innovations in the region. The next steps in the project are to evaluate various technology innovations using criteria and metrics developed by a working group and to recommend one technology innovation for further planning and piloting.

This appendix is organized as follows:

Section	Description
Policy Development Process	Outlines the process agencies could follow to develop new policies that support transformational technologies
Local and Regional Policy Assessment	Identifies questions agencies could ask themselves when they are updating their policies
Guidance For Technology-Agnostic Policies	Gives guidance on writing policies, regulating through incentives, empowering staff, forming partnerships, and advancing equity
Example Agency Policies	Provides references and lessons learned from other agencies who have enacted transformational technology policies
Policy Conclusions	Summarizes the policy development framework

Policy Development Process

This section outlines the process that SJCOG and its partner agencies could follow to develop technology-agnostic and performance-based policy to support the use of technology to achieve their overall transportation goals of mobility, safety, equity, and sustainability. The explicit policy statement is something each agency must create on its own.

Agencies generally influence the adoption of new technology through setting regulations for the use of a new technology or for its service requirements, through setting fees for public services, through permitting or supporting deployment on public and private lands, or through regulating revenue through taxes. As new applications of technologies impact our transportation system, agencies may need to revise or enact new policies. It is recommended that SJCOG consider adopting a policy relevant to the promotion, implementation, and regulation of new technologies in the public sector.

To give the process of developing an agency policy a kick start, here is one example of what such a policy statement might cover:

> It is the policy of the San Joaquin Council of Governments and its member agencies to employ incentives and regulations to support and promote the deployment of new technologies that promote the goals of the region for mobility, accessibility, sustainability, safety, and equity. SJCOG and member agencies will act as exemplars for the public and private sector by employing new technologies within each agency's operations to improve the efficient delivery of governmental services to the public.

Note that the policy statement is a simple statement of principle, which the agency would then elaborate through a series of more specific objectives.

The technology transition policy development process includes four steps:

Step 1: Preparation

Each agency should develop their vision for technology and set technology goals. Once the vision and goals are set, share them with staff across your agency's departments and management.

New technologies require new stakeholders to be involved in the planning process. Agencies currently involve residents, citizen groups, business groups, transit agencies, and representatives from relevant jurisdictions. Agencies could bring new stakeholders into the planning process through Working Groups or Task Forces, hiring experts, partnering with educational institutions, or partnering with the private sector.

Examples of outside experts include:

- Other departments within an agency (such as the codes and ordinances departments)
- Other agencies with different expertise (such as fire, police, maintenance, or IT)
- Technology deployers or manufacturers
- Utility providers
- Trade groups
- Local universities and trade schools

Step 2: Self-Assessment

Agencies can self-assess their readiness to address new technologies by reviewing their staffing, resources, and organization and by reviewing their policies and plans. This self-assessment should inventory current resources and capabilities and identify any gaps or barriers.

Agency managers can look at their staffing, resource, and organization capabilities for addressing technology questions and impacts. This self-assessment might identify training, hiring, or resource needs. The Federal Highway Administration (FHWA) and the American Association of Highway and Transportation Officials (AASHTO) provide guidance on conducting a Capability Maturity Model or Capability Maturity Framework to improve program and project management.[9]

[9] https://ops.fhwa.dot.gov/publications/fhwahop16031/index.htm

The County and municipalities could examine their codes considering the technology transition facing transportation and land use, and to revise and update their codes as needed. **Step 4** provides details on the questions agencies could ask themselves as they review their policy readiness.

Step 3: Action

Based on the self-assessment, an agency might choose to address the technology transition gaps identified in their staffing or policy.

Agencies can address gaps in their staff knowledge or expertise by training or hiring new staff. Affordable training opportunities include sending staff to industry conferences. Some of the key annual conferences that address transformational technologies are:

- Consumer Electronics Showcase (CES) hosted by the Consumer Technology Association
- ITS America Annual Meeting
- Automated Vehicle Symposium (AVS) hosted jointly by the Transportation Research Board and Association for Unmanned Vehicle Systems International.

When an agency is ready to update its plans and policies, it should develop flexible policy that can keep up with changing technology and transportation behavior without needing frequent updates. The key to writing policy that will remain valid as technologies change is to develop technology-agnostic policy. **Section 5** provides guidance on how to write performance-based, technology-agnostic policies and how to empower staff to make changes to policies or programs during initial trial-and-error periods or based on insights from data monitoring.

As agencies update their plans, they should continue to involve the diverse stakeholders. Agencies should also set priorities and identify milestones or intermediate checkpoints were monitoring may indicate the need to revisit the plans.

Step 4: Monitor and Adjust

Based on the agency's vision and goals for technology, they can monitor progress, identify shortfalls, and adjust their programs or action plans to meet their goals. New technology is introducing new data source and new data analytics capabilities. These new methods can provide more timely and cost-effective approaches to minoring data, compared to the massive data collection efforts that agencies might conduct for a comprehensive plan update.

Agencies should select metrics relevant to their goals. Candidate metrics include:

- Metrics of growth
- Metrics of land use and location changes
- Early indicators of problems with current codes and plans
- Metrics of parking demand changes
- Metrics of travel demand changes.

Next Steps

SJCOG could recommend to its member agencies that the city attorneys, planning directors, and public works directors examine their codes considering the technology transition facing transportation and land use, and

to revise and update their codes as needed. More guidance on reviewing and revising policies and the planning process is provided in *NCHRP Report 924: Foreseeing the Impact of Transformational Technologies on Land Use and Transportation*.[10]

Local and Regional Policy Assessment

SJCOG and its member agencies are responsible for setting local and regional policy. This section outlines those policies and lists questions agencies should ask to assess the readiness of their policies to support and not hinder technology advancement in the region.

Cities and Counties in California must develop the following local plans:

- General Plans – A general plan is each local government's blueprint for meeting the community's long-term vision for the future.
- Development Codes – The Development Title of San Joaquin County serves as the basis for all land use regulations adopted by San Joaquin County. The purpose of the code is to serve the public health, safety, and general welfare; to implement the San Joaquin County General Plan; and to achieve the county's development objectives.
- Zoning Codes – Zoning regulates what land can and cannot be used for in that area and regulates standards for new development building, including parking standards.
- Building Codes – Building standards ensure buildings follow new or changing laws and regulations for new construction to ensure safety and accessibility in their design and construction.
- Street and Highway Codes – The San Joaquin County Streets and Highways Code (Title 10) establishes the standards for road districts, traffic, encroachments, obstructions to traffic, and more. Street and highway designs are also subject to regulations developed by Caltrans.
- Capital Improvement Programs (CIP) – A City's CIP is its capital infrastructure and financial investment plan to support the City's investment and commitment to improving its: capital infrastructure, major grade separations and street improvements, utility improvements, and major regional improvement projects.

SJCOG must develop the following plans:

- Regional Transportation Plan and Sustainable Communities Strategies (RTP/SCS) – The RTP is a federally mandated plan that guides SJCOG's transportation investments over a 20- to 25-year period. The RTP is updated every four years and is based on reasonably anticipated federal, state, and local funding.
- Regional Transportation Improvement Program (RTIP) – The RTIP is a program of highway, local road, transit, and active transportation projects that a region plans to fund with State and Federal revenue programmed by the California Transportation Commission in the State Transportation Improvement Program (STIP). Updated every two years, the RTIP is a subset of projects in the RTP. SJCOG's recent RTIP projects focused on freeway widening, roadway grade separation, or high-occupancy vehicle (HOV) lane projects to reduce congestion and increase roadway capacity and safety.[11]

[10] http://www.trb.org/Main/Blurbs/179645.aspx
[11] https://www.sjcog.org/DocumentCenter/View/3384/2018-Regional-Transportation-Improvement-Program-

The project team reviewed the general plans and RTP/SCS and summarized the existing technology initiatives led by SJCOG and other entities in the region in the "Local and Regional Initiatives Task 2 Memorandum" (September 4, 2020). The municipalities are generally silent on emerging technologies. The General Plans for Manteca and Stockton and the Mountain House Development Code each had sections on specific technologies:

- The City of Stockton's 2018 General Plan Update, *Envision Stockton*, identified actions to support automated vehicles and other transportation technology through monitoring technological advances and adjusting roadway infrastructure and parking standards to accommodate automated vehicle technology and parking needs and through developing curbside management policies for ride-sharing vehicles today and automated vehicles in the future.[12]
- The City of Manteca's 2019 General Plan states: "As new transportation technologies and mobility services…are implemented in Manteca and used by the public, the City shall review and update its policies and plans to maximize the benefit to the public of such technologies and services without adversely affecting the City's transportation network. Updates to the City's policies and plans may cover topics such as electric vehicle charging stations, curb space management, changes in parking supply requirements, policies regarding electric scooter use and docking, etc."[13]
- The Mountain House Development Code accounts for the increasing curb-space needs of rideshare pickups and drop-offs in the design of parking areas for Public, Office Commercial, or Industrial uses by requiring passenger loading areas for rideshare vehicles.[14]

Updating local and regional codes and plans is expensive, so they are typically updated on set cycles or when there is the need for a more frequent amendment.

As county and municipal policies are updated or amended, agencies should consider if they need to adjust their policy language to achieve the potential benefits of new technologies for their citizens. Agencies should ask themselves the following questions when reviewing and updating municipal or County land use regulations (*NCHRP Report 924*):

General Plans and Land Development Codes:

- *Are the automobile, truck, bicycle, and scooter parking (or stand) requirements in the agency's zoning and other codes consistent with current technology and usage trends?*
- *Are commercial loading zone and residential delivery box requirements adequate for current trends in technology, such as unmanned aerial vehicles (UAVs)?*
- *Are allowed land uses and noise limits by use type appropriate for current technology trends, such as UAVs? Are there noise limits appropriate for residential deliveries?*
- *Do zoning and land use regulations address the transitioning of uses as technologies evolve? For example, AVs may reduce conventional parking needs, opening parking structures for reuse by residential, industrial, and commercial uses.*

[12] www.stocktongov.com/files/EnvisionStockton2040GP_Draft.pdf
[13] https://manteca.generalplan.org/
[14] https://library.municode.com/ca/san_joaquin_county/codes/development_title?nodeId=TIT9DETI_APX1MOHODETI_CH9-1015MPALO_9-1015.5MDEPAAR

- *Are the agency's guidelines and requirements for land development review up to date with the new technologies?*
- *Are the proposed state highway and street cross-sections in the development consistent with expected trends in usage patterns and technology in the short term or over the life of the development project?*
- *Are the proposed state and local circulation infrastructure improvements consistent with expected trends in usage patterns and technology in the short term or over the life of the development project?*
- *Are provisions in place to enable the state and local agency to monitor the effects of technological changes over the course of the development and update project requirements as necessary?*

Building Codes:

- *Do building codes provide sufficient design, electrical, water, and other design loads for transitioning to new uses of structures that may be enabled by new technologies?*
- *Do building codes provide for structure designs that are sufficiently flexible for multiple uses of the same structure that may be enabled by new technologies and consistent with agency policy?*

Street and Highway Design:

- *Do the agency's standard highway and street cross-sections and designs allocate sufficient curbside space and travel way for vehicles and pedestrians under anticipated usage patterns with new technologies such as e-bikes, e-scooters, CVs, and AVs?*
- *Are the design loads, sight distances, and vertical/horizontal clearances for highways, streets, pavement, and bridges sufficient for anticipated technology trends, such as truck platooning?*
- *Do the agency's signing and striping standards support the safe introduction of new technologies such as e-scooters and AVs?*
- *Are curbside zones and markings adequate for the new parking and pick up/drop-off patterns occasioned by new technologies, like rideshare and AVs?*
- *Do the agency's designs support dynamic lane and curbside management?*

CIP or TIP:

- *Do the CIP and TIP support anticipated technology trends?*
- *Do the projects in the CIP and TIP as well as their designs support the rollout of desired new technologies by the public and/or private sector? For example, do the projects include sufficient right of way for broadband internet lines and/or for 5G cell towers?*
- *Do the CIP and TIP take advantage of anticipated technology trends?*
- *Do the projects in the CIP attempt to compete with or duplicate infrastructure already in place in the private sector?*
- *Do projects in the CIP implement older technology in cases where newer technology better fulfills the goals of the project?*

RTP/SCS:

- *Have the agency's goals and policies been expressed in the plan in such a way that they will remain valid under anticipated trends in technology?*
- *Do the socioeconomic growth models and forecasts and travel demand models and travel forecasts upon which the plan is based reflect anticipated technology trends?*
- *Are the housing, land use, and circulation elements in the long-range plan consistent with anticipated trends in technology?*
- *Are provisions in place to monitor the impacts of new technologies on socioeconomic, land use, and travel demand trends?*
- *Do the plans include intermediate checkpoints where monitoring may indicate the need to revisit the plans?*

The city and county attorneys, planning directors, and public works directors should examine their codes considering these technology transitions and update their codes as needed to make technology an effective tool to meet the regional transportation goals.

Guidance For Technology-Agnostic Policies

This section provides guidance on writing technology-agnostic policy, regulating new technology adoption through incentives, empowering agency staff to take action during the learning period of new policy development, forming new partnerships, and advancing transportation equity through policy.

Writing Technology-Agnostic Regulations

Nimble policy is performance-oriented and technology-neutral while also being clear and specific enough to be enforceable. These resources provide general guidance on writing local and regional regulations and ordinances:

- "Model Code for Municipalities" provided by the National League of Cities (NLC)[15]
- "Drafting Clear Ordinances: Do's and Don'ts" by PlanersWeb.com[16]

Today, there are two resources available on developing policy related to transformational technologies. As emerging technology deployments increase, more guidance documents like will become available.

- Automated Vehicle Pilots: *Autonomous Vehicle Pilots Across America: Municipal Action Guide*[17] by the National League of Cities summarizes the AV pilot deployment programs across the country and emphasizes the need for local governments to collaborate across departments, agencies, and industry to successfully deploy AVs and recommends the following actions:
    - Determine the city's goals and reasons for pursuing an AV pilot project
    - Build a consortium
    - Engage the private sector
    - Look to join or create a regional alliance
    - Scale appropriately (financial, temporal, geographic, and technical)

[15] https://www.nlc.org/resource/model-code-for-municipalities/
[16] http://plannersweb.com/2010/04/drafting-clear-ordinances-dos-and-donts/
[17] https://www.nlc.org/resource/autonomous-vehicle-pilots-across-america/

  - Work with the state
  - Pursue a phased plan

- Shared-Active Transportation: *NACTO Policy 2018, Guidelines for the Regulation and Management of Shared Active Transportation, Version 1* by the National Association of City Transportation Officials (NACTO) provides guidance for cities to manage shared active transportation companies (including dockless bike share and e-scooter share).[18] The guidance addresses setting minimum standards on:
  - Permitting frameworks
  - City/company communication mechanisms
  - Standards for communicating with the public
  - Data requirements
  - Minimum equipment safety standards
  - Customer privacy standards.

  The NACTO guidance also addresses how to evaluate local-level conditions, such as parking options for shared devices, community engagement programs, and incentive-based permitting mechanisms to encourage companies to meet the city's mobility and equity goals.

For an example of a performance-based, technology-agnostic policy, consider e-bikes. Rather than specifying that an ordinance applies to "e-bikes", an agency could consider describe the vehicle type the regulation applies to in terms of the gross vehicle weight range and maximum speed range. This technology-agnostic approach allows the policy to remain relevant if the technology changes slightly (such as the evolution from docked bike share with manual bikes to dockless bike share with e-bikes or e-scooters).

Regulating Through Incentives

Agencies can incentivize technology deployment and advancement. As discussed above, a local agency can incentivize electric vehicle charging infrastructure through local land use policy. The agency may also use fee-based incentives to encourage faster deployment or more equitable deployment. SJCOG and its local agencies might consider fee-based incentives to encourage the expansion of the fiber optic communication network to key locations in rural areas of the county. They might also consider fee-based incentives associated with "equity zones" for a future micromobility pilot program (such as a bike share or scooter share program) to ensure equitable access to the service in low-income areas. It will take trial and error to determine the fee levels needed to achieve the desired behavior, and agency staff need to monitor the programs and have the power to adjust the fees based on the data.

Empowering Staff

Agencies should empower their staff to adapt fees or adjust rules so they can quickly respond to observed transportation trends or impacts. This authority is especially valuable during testing or trial and error learning phases. Examples could be the fee-based incentives, new data sharing partnerships, or new pilot deployment programs.

[18] https://nacto.org/home/shared-active-transportation-guidelines/

Forming Partnerships

New technologies bring the opportunities for new partnerships for collaboration, data and information sharing, financing, education, and enforcement. In many cases, agencies need to form new partnerships with other agencies and with the private industry to learn and stay up to speed on new technology advanced and opportunities. Agencies should expand their partnerships and not get all their information from one company to get the most well-rounded perspective on the impacts and opportunities available to them.

Partnerships should also occur within agencies. Planners and engineers should work with the codes and ordinances staff to understand how local policies could be impacted by new technologies and to find solutions together. This within-agency coordination may also be helpful in discovering and expanding data-sharing opportunities.

Agencies could consider forming technical working groups involving a diverse group of stakeholders to get perspectives and insights from other departments (such as law enforcement and emergency responders), private industry, community advocates, and the utility companies (especially for electric vehicle charging infrastructure or telecommunications needs).

In San Joaquin, workforce development could be another critical partnership for a transformational technology pilot project. SJCOG and its member agencies could incentivize partnerships between local deployments and San Joaquin Delta College or University of the Pacific students to support the equipment installation and maintenance; data collection, processing, and analysis; and education and outreach areas while gaining real-world training. This exposure to new technology and new data will give these students an advantage over their peers and will advance the local workforce as jobs and skillsets evolve with changing technology.

Advancing Equity

Technology may create or expand barriers in transportation. Agencies can develop policies to let them use new technologies as a tool to advance equity in transportation. To address some of the equity challenges in transportation, SJCOG and its partner municipalities can require multi-lingual websites and mobile apps to reduce language barriers. They can also require cash-based payment options and SMS-based or phone-based access to new transportation apps and mobility services to address barriers for users who are unbanked or underbanked or who do not have access to a smartphone with data plan.

Example Agency Policies

Resources are available for agencies updating their local plans and codes. This section provides guidance and case studies related to:

A. Strategies to Advance Connected and Automated Vehicles
B. New Mobility Codes and Policies
C. Innovative Curbside Management Guidance
D. Regulating TNCs
E. E-Scooter Pilot Deployments
F. Fiber Optic Expansion
G. Electric Vehicle Charging
H. Managing Data from Emerging Technologies for Transportation

I. Data Governance and Crowdsourcing Data Readiness
J. Travel Information Engineer Role
K. Workforce Development

A. Strategies to Advance Connected and Automated Vehicles (NCHRP Research Report 845) – NCHRP Report 845 identified 18 policy and planning strategies to advance connected and automated vehicles.[19] The policies and strategies that apply to regional and local agencies include:

- Outcome: To encourage shared AV use:
  - Subsidize shared AV use
  - Implement transit benefits for SAVs
  - Implement a parking cash-out strategy
  - Implement location-efficient mortgages
  - Implement land use policies and parking requirements
  - Apply road use pricing
- Outcome: To enhance safety, congestion, and air quality benefits by influencing market demand:
  - Invest in CV infrastructure
  - Grant AVs and CVs priority access to dedicated lanes
  - Grant signal priority to CVs
  - Grant parking access to AVs and CVs
  - Implement new contractual mechanisms with private-sector providers

B. New Mobility Codes and Policies (National Institute for Transportation and Communities, NITC) – In June 2020, the NITC released guidance on *Matching the Speed of Technology with the Speed of Local Government: Developing Codes and Policies Related to the Possible Impacts of New Mobility on Cities*.[20] The guidance recommends agencies follow eight guiding principles when refining their regulatory framework.

1. Identify city goals as drivers of decision making
2. Create a clear modal hierarchy within the city's priorities for its transportation modes
3. Require citywide compliance with city transportation policy
4. Identify the purpose of the right-of-way as public space instead of the purview of automobiles
5. Identify use of the specific functions of street types and zones
6. Utilize overlay zones to provide flexibility to adopt different management priorities without systemic code changes
7. Increase funding for non-automobile infrastructure and decrease funding for automobile infrastructure
8. Require data sharing as an essential part of new mobility infrastructure.

[19] http://nap.edu/24873
[20] https://ppms.trec.pdx.edu/media/project_files/1216_Project_Brief_-_Speed_of_Technology_and_Local_Government.pdf

The NITC also provides guidance on how to develop stronger policies for new mobility:

- Explicitly describe the right of way
- Designate 'curb zones' or 'curb lanes'
- Add nimble flexibility to curb zone & other parking decisions
- Regulate bicycles and micromobility devices as one transportation mode
- Rename bike lanes to be inclusive of other micromobility uses
- Apply micromobility regulatory principles to all privately-owned vehicles
- Apply TNC regulatory principles to all privately-owned vehicles
- Prioritize pooled-ride for-hire vehicles
- Regulate TNCs to meet sustainability goals

C. Innovative Curbside Management Guidance (Washington, DC) – The District Department of Transportation (DDOT) also developed a step-by-step guide on Innovative Curbside Management, based on lessons learned from their parkDC pricing pilot in the Penn Quarter/Chinatown neighborhood. Based on the success of the pilot, DDOT decided to expand the pilot into additional neighborhoods that experience high parking demands and congestion related to vehicles circulating looking for available parking. The step-by-step guidance is provided in this appendix for reference. For more guidance, refer to the ITE *Curbside Management Practitioners Guide*.[21]

D. Regulating TNCs (San Francisco, California) – In response to a quick increase in TNC use in the metropolitan area, San Francisco County Transportation Authority (SFCTA) has become one of the leading communities to study the impacts of Mobility as a Service (MaaS) and TNC companies specifically. In 2017, SFCTA published an overview of the TNC landscape in San Francisco city and county. The result of the study was the City of San Francisco's 10 principles for TNCs (SFCTA, 2017):

1. Safety
2. Transit
3. Equitable Access
4. Disabled Access
5. Sustainability
6. Congestion
7. Accountability
8. Labor
9. Financial Impact
10. Collaboration

The SFCTA report recommends that the City should:

- Proactively partner with TNCs to develop innovative solutions to the city's transportation needs.
- Collect and warehouse data on TNC activities.
- Collect sufficient permit fees to fully recover cost of regulation.
- Conduct a study to identify equity gaps in TNC services for low-income users.
- Pursue TNC pilot programs to better support public transit.
- Increase and improve enforcement to encourage safe operation.
- Develop a curb management strategy that allocates and prices curb access appropriately.

[21] https://www.ite.org/pub/?id=C75A6B8B-E210-5EB3-F4A6-A2FDDA8AE4AA

E. E-Scooter Pilot Deployment (Hoboken, New Jersey) – Hoboken, New Jersey ran a six-month e-scooter sharing pilot program from June-November 2019. The city provided guidance to users about the pilot and about the rules and regulations that apply to e-scooter use (such as where to ride and where to park).[22]

F. Fiber Optic Expansion (Winter Haven, Florida) – Best practices and model legislation are shared in Fiber to the Home Council Americas' *Dig Smart: Best Practices for Cities and States Adopting Dig Once Policies.*[23] The City of Winter Haven implemented a "dig once" broadband initiative in 2004, where the City, in conjunction with other infrastructure projects, installs conduit and fiber whenever feasible. Now there is approximately 20 miles of City-owned fiber primarily in the city core that is available for lease to telecommunication service providers. Since 2004, the city, in Five percent of the lease revenue, along with a 5-percent-match from the provider, goes to a Science, Technology, Engineering, and Math (STEM) innovation fund, designed to encourage students to create business ideas. Additionally, using City-owned fiber, leased by a private provider; the City of Winter Haven Public Library was the first gigabit library in the State of Florida. Winter Haven's Inland Fiber and Data Park consists of two downtown properties that are the hub for regional broadband connectivity. The data park hosts numerous broadband providers, a secure data center, and numerous technology and software-related companies.[24]

G. EV Charging (Chicago, Illinois) – In April 2020, Chicago changed its municipal code to prepare its infrastructure to support the projected growth in electric vehicles (EVs). The changes expand the scope of the new developments that must install EV charging; increase the percentage of total parking spaces that property owners must designate for EVs; and specify that EV-designated parking spaces must be equipped with an electrical plug.[25]

H. Managing Data from Emerging Technologies for Transportation (NCHRP Report 952) – This guidebook provides guidance, tools, and a big data management framework. It lays out a roadmap for transportation agencies on how they can begin to shift—technically, institutionally, and culturally—toward effectively managing data from emerging technologies.[26]

I. Data Governance and Crowdsourcing Data Readiness (Federal Highway Administration) – The Federal Highway Administration (FHWA) provides management guidance when considering investing in crowdsourcing data for operations.[27] Originally, crowdsourced data has been used for traveler information and incident management, but now agencies are beginning to use it for maintenance, integrated corridor management, and more. FHWA funding opportunities include State Transportation Innovation Council (STIC) Incentive and the Accelerated Innovation Deployment (AID) Demonstration grants.

- Define the Problem
- Practice Data Governance
- Understand Data and Technology:
- *Understand nature of data* – It may be different in focus, quality, processing, and management
- *Technology readiness* – Growing technical skills and architecture approaches

[22] https://www.hobokennj.gov/resources/electric-scooters
[23] https://www.ncbroadband.gov/media/50/open
[24] https://www.mywinterhaven.com/business/economic-development/
[25] https://www.prnewswire.com/news-releases/new-electric-vehicle-ordinance-makes-chicago-national-leader-301047088.html
[26] https://www.nap.edu/catalog/25844/guidebook-for-managing-data-from-emerging-technologies-for-transportation
[27] https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/crowdsourcing.cfm

- Foster Organizational Change: Address policy, legal, procurement, funding and other mechanisms that may not suit the agile nature of crowdsourcing

The *Adventures in Crowdsourcing* webinar shares experience and lessons learned from the Kentucky Transportation Cabinet and NCDOT.[28]

J. Travel Information Engineer (North Carolina Department of Transportation) – North Carolina Department of Transportation (NCDOT) created a Travel Information Engineer position responsible for making sure private sector GPS navigation services give accurate and up to date information to their users. This person also passes on timely information about incidents and events to police, highway patrol, and agency maintenance personnel.[29] The figure below shows a list of contacts developed by NCDOT to facilitate communication and information sharing.

Company	How do they interface with NCDOT?	Incidents / Traffic POC's	Mapping POC's	Navigation/ Routing POC's	End Users
Waze	TIMS API & Waze Map Editor	closures@google.com Waze Map Editor Waze Mapping Contacts	contact@wazenc.us		Waze App
Traffic Cast	TIMS API	ntoc_list@trafficcast.com 608-957-7210 Overnight handled from Shanghai	Tom Tom		Sirius XM 80% of top U.S auto OEMs I Heart Radio: 20+ NC radio stations
HERE	DriveNC API	If colors shown on TIMS map does not match text of TIMS incidents contact HERE_Traffic_Alerts@here.com (This will most often be when TIMS says the road is closed and HERE is showing traffic moving in the closure or when HERE shows the road as closed (red/white dotted lines) and TIMS says it is open.) This email is monitored 24x7. You can also call them at (312) 348-6996 Also CC Robert Landolfi (robert.landolfi@here.com)on all email correspondence with HERE See HERE tab for additional HERE contact info	Wilmari.Diaz@here.com (new roads, construction) michael.holzer@here.com (new roads, construction- Eastern NC) taryn.williams@here.com (new roads, construction -Western NC) TCSTraffic@here.com (timing of map updates)	TCS@here.com	Garmin ~90% of in- vehicle nav systems,inlcuding every new BMW, Audi & Daimler Alpine, BMW, Mercedes, Hyundai, Pioneer, Volkswagen and Toyota Facebook, Amazon and UPS
TomTom	Traffic Cast	Traffic Cast - first NOC@tomtom.com - second	tomtom.com/mapshare/tools/#		Apple Maps Uber Tom Tom Device On Star Some Subaru, Fiat, Renault-Mitsubishi-Nissan (until 2021), Mazda, Toyota & Lexus
Google	Traffic Cast	Check Waze (???) + Traffic Cast Then email closures@google.com	Use this link to submit a map change to Google: https://support.google.com/maps/answer/30940887co=GENIE.Platform%3DDesktop&hl=en		Google Maps
INRIX		incidentsupport@inrix.com 425-284-3870		support@inrix.com	INRIX App Some in veh nav systems
Bing (Microsoft) (This is the base map for TIMS/DriveNC)	HERE	When speed colors are wrong or missing on Bing Map check HERE. If ok on HERE and not on Bing than email bmesupp@microsoft.com Note: Bing only shows speeds if HERE confidence > 0.7	When Bing map is wrong check HERE. If ok on HERE and not on Bing than email bmesupp@microsoft.com		Bing DriveNC.gov

NCDOT Crowdsourced Data Contact

(Source: https://transops.s3.amazonaws.com/uploaded_files/FHWA-NOCoE%20Webinar%20-%20Adventures%20in%20Crowdsourcing%20NCDOT%20Slides.pdf)

[28] https://transportationops.org/ondemand-learning/adventures-crowdsourcing-engaging-navigation-providers-edc5-webinar-series

[29] https://transportationops.org/ondemand-learning/adventures-crowdsourcing-engaging-navigation-providers-edc5-webinar-series

K. Workforce Development (Tampa, Florida) – The Tampa/THEA Connected Vehicle Pilot Deployment Program proposed using students from a local trade school to install the connected vehicle on-board units into the subject vehicles in the pilot.

As agencies update their plans and codes, they can look to these examples for guidance or lessons learned. As new technologies are introduced and as the industry learns more from monitoring new transportation data, there will likely be more case studies or guidebooks to learn from.

Policy Conclusions

SJCOG and its member agencies may need to revise existing policies or enact new policies in response to new technologies or to advance the adoption of promising technologies. This memo outlines the process that SJCOG and its partner agencies could follow to develop technology-agnostic and performance-based policy to support the use of technology to achieve their overall transportation goals of mobility, safety, equity, and sustainability. The explicit policy statement is something each agency must create on its own.

The technology transition policy development process includes:

- **Preparation** – to establish goals, vision, and partnerships for new technology.
- **Self-Assessment** – to understand the potential gaps in staffing, resources, organizational structure, or policy that might hinder the advancement of technology in the region.
- **Action** – to address the gaps through hiring, training, or Task Force/Working Group partnerships to help the agency get smart on new technologies and to collaborate on new policy development.
- **Monitor and Adjust** – to monitor progress, identify shortfalls, and adjust their programs or action plans to meet the agency's goals.

As agencies update their existing policies and plans, they should ask themselves the questions outlined in previous sections to determine if changes need to be made to advance the use of technology to address the region's transportation goals. It is recommended that SJCOG consider adopting a policy relevant to the promotion, implementation, and regulation of new technologies in the public sector. To give the process of developing an agency policy a kick start, here is one example of what such a policy statement might cover:

> *It is the policy of the San Joaquin Council of Governments and its member agencies to employ incentives and regulations to support and promote the deployment of new technologies that promote the goals of the region for mobility, accessibility, sustainability, safety, and equity. SJCOG and member agencies will act as exemplars for the public and private sector by employing new technologies within each agency's operations to improve the efficient delivery of governmental services to the public.*

Note that the policy statement is a simple statement of principle, which the agency would then elaborate through a series of more specific objectives.

When an agency is ready to update its plans or policies, the agency could follow the guidance in the previous sections to write performance-based, technology-agnostic policies that will remain valid as technology evolves or new technologies enter the market, regulate through incentives, empower agency staff to take action during the learning period of new policy development, form new partnerships, and advance transportation equity through policy.

Appendix H: Potential Funding Sources for Priority Projects

This appendix identifies potential funding sources and case studies of the short-term innovation plans or projects identified through the San Joaquin Council of Governments (SJCOG) Transportation Innovation Planning Study.

These potential projects were identified through a regional transportation needs assessment and stakeholder input (summarized in *Task 2 Memorandum: Local and Regional Initiatives*, September 18, 2020). For each project, detailed descriptions, examples, and performance metrics were identified (summarized in the *Task 4 Memorandum: Prioritization Criteria & Performance Measurement*, March 25, 2021).

This memorandum focuses on the innovation ideas that SJCOG might consider including in the Regional Transportation Plan / Sustainable Communities Strategies or acting on withing the next two to three years:

- Fiber City Checklist
- Mobility Hub Quick Build Pilot
- Automated Vehicle Goods Delivery Pilot
- Connected Vehicle Safety Pilot – Connected Farm Equipment Pilot
- Intelligent Transportation System (ITS) Master Plan
- Regional Traffic Management Center (TMC)
- Integrated Corridor Management (ICM)

These potential funding sources supplement the list of grant opportunity references that SJCOG has already assembled on its website: https://www.sjcog.org/381/Grants-Database

Potential Funding Sources for Priority Projects

Readying the region for transformation technologies will require grant funding that will help SJCOG with the implementation of these innovation ideas. This section identifies potential funding opportunities at the federal, state, and private level that SJCOG might pursue to implement some of these innovation ideas in the future.

Fiber City Checklist

Fiber optic networks are the critical infrastructural backbone of the increasingly digital world, and the build-out of the fiber optic network, especially in rural areas, will hasten future technological changes that can address SJCOG Regional Transportation Needs. The *Fiber City Checklist* is a compilation of best practices and recommendations, which defines a clear, three-part process for readying the region for widespread fiber optic construction. It includes an existing inventory assessment, a review of utility policies, and streamlining utility permitting. The Fiber City Checklist, developed by Google Fiber, is intended to ready a place for rapid fiber optic network expansion regardless of internet service provider (ISP). The list is public so that any place could do it, as the steps in the checklist are broad enough that they would make any ISP's job easier and could facilitate a partnership between an agency/community and an ISP.

SJCOG and its partner agencies could prepare for a public-private partnership with telecommunications providers by completing the Fiber City Checklist within the next two to three years.

Cost Estimate

The cost of conducting the self-assessment outlined in the Fiber City Checklist is estimated at about $100,000. The expense of fiber cabling is installing the "last mile" (the term for the connection between a residence and the main network), with conservative estimates around $3500/household in ideal suburban scenarios.[30]

Examples

One of the original Fiber Cities is Irvine, California. Irvine announced a public-private partnership with Google Fiber in 2014 after submitting the Fiber City Checklist. Google laid the fiber optic cabling in 2017, and currently 19% of Irvine residents have access to residential fiber (from AT&T Fiber and Google Fiber).[31]

West Des Moines, Iowa and Mill Creek, Utah are the most recent cities to have their Fiber City Checklist approved by Google Fiber in 2020.

Funding Opportunities

The following section summarizes the potential funding sources that SJCOG could pursue to realize the vision of implementing the Fiber City Checklist.

- Smart and Connected Communities Program, National Science Foundation, Division of Computer and Network Systems – SJCOG might be able to use these funds to prepare the Fiber Town Checklist or ITS Master Plan. Each of these awards will provide support for a period of one year and may be requested at a level not to exceed $150,000 for the total budget.
- California Smart City Challenge Grant Program –These funds might be used to deploy fiber optic cabling and communications improvements that strengthen and enable network connectivity and mobility in a smart city.
- High-Speed Broadband Grant, California State Library – This grant could help connect existing libraries in the region to CalREN, which will benefit K-20 students, educators, researchers, and others working on libraries. The grant can be used for high-speed broadband construction or network equipment depending on the needs of the grantee. SJCOG might use this grant to purchase dark fiber network management software, wireless internet conduit, air conditioning (HVAC), uninterrupted power supply (UPS)/battery backup and fund electrical system upgrades.
- Distance Learning and Telemedicine Grant, Department of Agriculture – SJCOG might utilize this grant to purchase right-of-way for fiber optic connectivity, fund Dig-Once Policy upgrades, and provide the physical infrastructure to connect rural residents, schools, and medical centers with high-speed internet.

Mobility Hub Quick Build Pilot

Mobility Hubs are technologically integrated, multi-modal stations to empower communities to access their destinations with a variety of modes. Mobility Hubs often combine transportation options for transit, shared micromobility, electric vehicle (EV) charging infrastructure, and car-sharing. A Quick-Build Pilot could dedicate an existing parking lot for covered bicycle parking, shared micromobility docking stations, and an RTD bus stop to facilitate intermodal trips, creating a foundation to add more multimodal options to in the future. A Mobility Hub Quick Build could be deployed within three years.

[30] https://www.connectcalifornia.com/internet-service/google-fiber-expansion-status-california

[31] Ibid.

In October 2020, SJCOG was awarded a $7.4 million Sustainable Transportation Equity Project (STEP) Grant by the California Air Resources Board (CARB) to implement electric vehicle carsharing, e-bike sharing, Vamos mobility as a service, transit and shared mobility incentives, community engagement, and e-workforce development. *Vamos* is a mobile and common digital payment system with the ability to connect multiple modes. For this reason, the implementation of a Mobility Hub Quick Build Pilot would be even easier, as the *Vamos* app would facilitate the transfer between modes at the hub. SJCOG can partner with RTD, the Pacific Gas and Electric Company, micromobility providers, and local businesses to create a pilot concept of a Mobility Hub in a partner agency jurisdiction.

Cost Estimate

The estimate of probable cost for the Mobility Hub Quick Build Pilot could range between $10,000 - $50,000. Permanent Mobility Hub installations can range between $350,000 - $3.5 million.

Examples

- Regional Mobility Hub Strategy, San Diego Association of Governments (SANDAG): As part of its Regional Transportation Plan, *San Diego Forward*, SANDAG developed a strategy to show how transportation technologies and services can make it easier for communities to access transit and other shared mobility choices. SANDAG produced two memorandums namely, the Implementation Considerations Memorandum that recommends strategies, plans and policies to facilitate mobility hubs and the Equity Considerations Memorandum that summarizes the benefits and challenges of the equitable implementation of mobility hubs.

- Minneapolis Mobility Hubs Pilot: Minneapolis recently piloted the city's first Mobility Hubs where citizens can access transit and other forms of non-vehicular transportation such as shared bikes and e-scooters. The hub includes amenities such as bus stops, benches, designated bikeshare and e-scooter parking and way-finding signage with travel times to destinations. The intent of the three-month pilot program that created 12 hubs all over Minneapolis is to inform infrastructure changes for a longer-term program that could improve lighting, safety, and accessibility.

Funding Opportunities

The following section summarizes the potential funding sources that SJCOG could pursue to realize the vision of deploying the Mobility Hub Quick Build Pilot program.

- Community Impact Grant, The Home Depot – This up to $5,000 grant could be used for a community-based, tactical urbanism demonstration of a mobility hub.

- AARP Community Challenge, AARP Livable Communities – The AARP Community Challenge provides funds to quick-action projects that help make communities livable for people of all ages. SJCOG might use this fund to establish a Mobility Hub that will be a permanent physical improvement in the community which will use new and innovative services such as integration of multimodal networks, charging stations, green infrastructure etc. to bring residents together and make travel easy.

- Sustainable Communities Grant, Caltrans Department of Transportation Planning – SJCOG might utilize this grant to achieve community goals and fund multimodal improvements in the community. Funds could be used to integrate transportation and land use strategies such as improved walking and biking facilities; improved access to trails, open areas, and spaces; establishing docking stations and connected bus stops; and installing street furniture and urban greenery into the design of the Mobility Hub to uplift the community.

- Community and Economic Enhancement Grant Program – Preposition 68, Sacramento–San Joaquin Delta Conservancy – SJCOG might plan a Mobility Hub as the 'city center' to encourage usage of hiking trails, biking routes as part of tourism. Local art and designs can be incorporated in the Hub to be a welcoming site for tourists which can also facilitate easy mobility and access to different parts of the region through the mobility Hub.

- Our Town Program: Public Space Design, National Endowment for the Arts – Cost share/matching grants range from $25,000 to $150,000, with a minimum cost share/match equal to the grant amount. SJCOG might use this grant to incorporate local artists' work into the streetscaping of the Mobility Hub, in addition to utilizing green infrastructure for the design of the parking lot/vacant lot turned plaza that hosts the Hub.

- Greening America's Communities Program, Environmental Protection Agency – SJCOG could use this program to develop the technical assistance necessary to incorporate sustainable design strategies into the Mobility Hub location(s), in addition to working towards other environmental goals, such as EV charging infrastructure, improving walking and bicycling facilities, and other transportation actions that address environmental issues.

Connected Vehicle Safety Pilot – Connected Farm Equipment Pilot

Partnering with local farmers, freight operators, and Caltrans, this pilot could outfit existing farm equipment with automatic vehicle locator (AVL) devices that would communicate with hybrid beacons positioned at frequent crossing locations or along road segments with frequent low-speed farm equipment movement. When the connected farm equipment approaches, the beacons would flash, alerting freight and passenger vehicle drivers of the conflict ahead.

Cost

The planning study for a limited deployment could cost $150,000-$300,000, and a limited deployment implementation, which depends on the number of corridors and the length of corridors for deployment, could possibly cost $1-5 million.

Funding Opportunities

- Connected Vehicle Equipment Loan Program, US Department of Transportation – The Equipment Loan Program can help to reduce the cost of a temporary deployment by borrowing equipment for testing and demonstration.

- Advancing Wellness: Community Well-Being, The California Wellness Foundation – SJCOG could use this grant to test a CV application to improve safety on rural agricultural roads.

- Community Health Needs Assessment Grant, Kaiser Permanente Northern California – SJCOG might partner with Kaiser Permanente to deploy a CV safety application in Manteca, which falls within a Kaiser Permanente Community Health Service Area.

- Smart and Connected Communities Program, National Science Foundation, Division of Computer and Network Systems – SJCOG might be able to use these funds to deploy a CV safety pilot. Each of these awards will provide support for a period of one year and may be requested at a level not to exceed $150,000 for the total budget.

- California Smart City Challenge Grant Program –These funds could support a CV deployment that improves safety or mobility in a smart city.

AV Shuttles Pilot

Automated vehicles (AVs) are poised to transform both the transportation and technology spheres with the potential capability to improve safety, enhance mobility, reduce greenhouse gas emissions, and revolutionize digital data analysis, computation, and communications. Before these benefits are realized, pilot deployments using currently available technologies must be deployed to solve their challenges in real-world situations. AV Shuttles, which are currently low-speed or last-mile vehicles that can be used to transport goods and people, are being tested in numerous states across the nation. Piloting AV Shuttles is necessary to understand the unique needs and challenges of the San Joaquin region and to prepare the region for the automated future. Potential pilot deployments could travel between passenger rail stations, to deliver essential goods to remote parts of the region, or to connect large employers with transit centers.

The main goal of the AV Shuttles is to increase readiness for transformational technology and increase economic vitality. Within one to three years, SJCOG could develop a plan for an automated goods delivery or passenger movement pilot. This project will require significant effort from SJCOG, including SJCOG staff training, formation of a new working group with specific stakeholders unique to the innovative idea, adoption of new policies to facilitate the smooth deployment of the technology, and grant application efforts.

Cost Estimate

The estimate of probable cost for the AV Shuttles Pilot program could range from $500,000 to $1 million for the planning phase. The Smart Columbus AV planning documents cost $635,000 for city and consultant labor (included Concept of Operations, System Requirements Specifications, Interface Control Document, System Design Document, and Test Plan).

The deployment and testing costs could range from $3 million (Smart Columbus) to over $12 million (Lake Nona) depending on the route length, number of vehicles, duration of pilot, and other service design considerations. The Smart Columbus AV deployment cost $3,295,500 (including city labor for procurement, development, deployment, testing, operations, and maintenance).

Due to the potentially high cost of pilot deployment, a strong planning phase is needed with an active and engaged working group to identify best practices and to overcome obstacles in the planning phase.

Examples

- NHTSA's AV TEST Initiative: This interactive mapping toll provides information on the AV testing happening around the country.
- Automated Driving Systems (ADS) for Rural America: The University of Iowa is testing automated vehicles in rural route applications, which may be relevant to operational conditions on parts of San Joaquin County.
- Driverless Shuttle in Lake Nona, Florida: Automated, fully electric vehicles operated by mobility company, Beep were deployed as part of a research partnership between a Mobility-as-a-Service provider, an AV manufacturing company, and a private developer. Multiple routes currently operate in mixed traffic within the 17-square mile planned community, and future AV-only facilities are being planned. This example could apply to new developments in municipalities such as Mountain House.
- AV Shuttle Service, Columbus, Ohio (Smart Columbus, Smart City Challenge): Two AV shuttle routes were tested in Columbus, Ohio as part of the Smart Columbus deployment. A $40 million U.S. Department of Transportation Smart City Challenge grant awarded in 2016 is funding these initiatives and many other smart city applications. The costs are well documented.

- Mobility Pilot Technologies in Indiana: A Toyota Sienna equipped with Udelv's (autonomous delivery platform) Delivery Management System (DMS) which facilitates contactless delivery of goods will be deployed in Indianapolis in 2021. Two 6-month non-concurrent AV shuttle services for passengers will also be deployed by May Mobility (AV technology and shuttle operations) in the cities of Indianapolis and Fishers. Both Udelv and May Mobility are designated by Toyota Mobility Foundation (TMF) and Energy System Network (ESN) as part of the Future Mobility District Initiative which is established in collaboration with Indiana Economic Development Corporation (IEDC).

- Trucking Fleet Concept of operations (CONOPS) for Managing Mixed Fleets: The Virginia Tech Transportation Institute (VTTI) is using ADS technology in the movement of heavy trucks to transport goods, which will provide clear information on the safe implementation of ADS-equipped trucks. The total cost of the project is $13 million.

Funding Opportunities

- Advancing Wellness: Community Well-Being, The California Wellness Foundation – SJCOG could use this grant to provide connective service for rural San Joaquin residents to access essential goods and services such as grocery stores and medical appointments via connected and automated shuttle service. This could be a partnership between SJCOG, RTD, and local grocers and healthcare providers.

- Community Health Needs Assessment Grant, Kaiser Permanente Northern California – SJCOG might partner with Kaiser Permanente to provide CAV shuttle service for residents of Manteca, which falls within a Kaiser Permanente Community Health Service Area. This service could provide access to grocery stores as well as medical centers such as Kaiser Permanente-identified "safety net" partnership institutions.

- Clean Mobility Options (CMO) Voucher Pilot Program, CALSTART – The CMO provides voucher-based funding for "zero-emission carsharing, carpooling/vanpooling, bikesharing/scooter-sharing, innovative transit services, and ride-on-demand services in underserved communities." SJCOG could use this fund to implement non-petroleum based (CAV) shuttle service in the San Joaquin region to serve last-mile connectivity needs between major destinations or for commuting needs.

- Energy Efficient Mobility Systems (EEMS) Program, Department of Energy, Office of Energy Efficiency & Renewable Energy and Vehicle Technologies Office – EEMS supports research and development that investigates how disruptive forces such as automated, connected, electric and/or shared (ACES) vehicles will impact energy consumption in transportation. It also helps communities determine how they can plan for and encourage energy efficiency increases in mobility. SJCOG might partner with the EEMS program to become a pilot site for the deployment of ACES.

Intelligent Transportation System (ITS) Master Plan

Intelligent transportation systems cover a wide array of technologies and applications that help to increase safety and efficiency in transportation system operations. An ITS Master Plan is a planning document that guides investment decisions by identifying needs and recommending strategic projects (for inclusion in the RTP) throughout the county to maintain and update the critical infrastructure that will support the deployment of emerging technologies, such as automated vehicles.

Funding Opportunities

- Infrastructure State Revolving Fund (ISRF) Program – Infrastructure and Economic Development Bank

- Carl Moyer Memorial Air Quality Standards Attainment Program – California Air Resources Board

- Access Broadband Connect – California Emerging Technology Fund
- California Advanced Services Fund (CASF) Infrastructure Grant – California Public Utilities Commission
- Community Connect Grant – Department of Agriculture
- Telecommunications Infrastructure Loans and Guarantees – Department of Agriculture

Regional Traffic Management Center (TMC)

A TMC could serve as the mission control for the region's major street and highway network by monitoring all traffic signals, intersections, and roads to proactively manage congestion, coordinate special events, and provide emergency first response information. As the region's communications and intelligent transportation systems are expanded, data monitoring and management from a TMC will be crucial to the smooth functioning of automated vehicles.

Funding Opportunities

- Community Connect Grant – Department of Agriculture

Integrated Corridor Management (ICM) Implementation

The Altamont Pass poses a critical congestion challenge to the region. Forming an expanded partnership for the management of the I-580 corridor could help to coordinate planning, maintenance, and operations investments on both sides of the pass. This would build on the SJCOG Congested Corridor Plan for I-205, I-5, SR 120, and SR 99.

Funding Opportunities

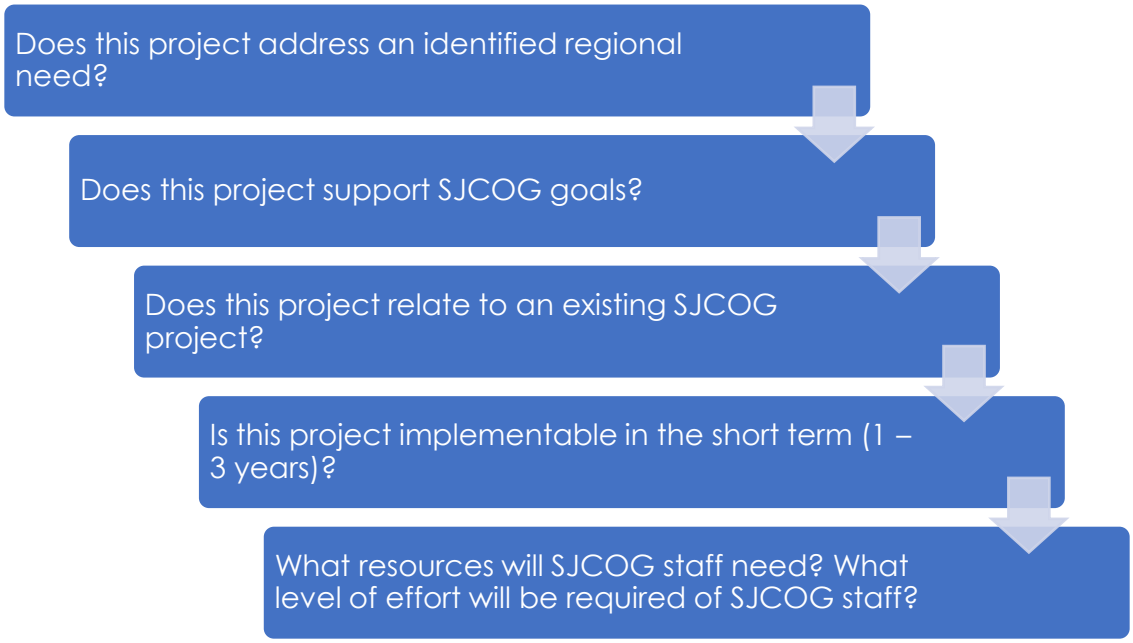
- Solutions for Congested Corridors Program (SCCP) – California Transportation Commission
- Intermodal Research: Integrated Corridor Management – Intelligent Transportation Systems Joint Program Office

Appendix I: Innovation Prioritization Criteria and Application

Innovation Prioritization Criteria

Limited funding prevents agencies like SJCOG from implementing every idea at once. This section of the memorandum explains the prioritization criteria developed to evaluate these innovative ideas. The following section goes into detail on the results of the prioritization process. SJCOG can use these high-level selection criteria or the more detailed FDOT criteria to evaluate new emerging technology planning activities in the future. Appendix I provides the detailed selection scoring for the three projects that ranked the highest based on the high-level prioritization.

The innovative idea prioritization method applied in this study is based on the following six questions:



The following sections discuss each question and provide further information and guidance on their applicability towards the prioritization of one pilot deployment for SJCOG.

1. Does this innovative idea address an identified regional need?

During the first meeting of the Innovation Working Group in July 2020, ten regional needs were identified by stakeholders as pressing issues that the San Joaquin region is currently facing. The first prioritization criterium acknowledges these important issues by initially asking: *Does this innovative idea address an identified regional need?*

To answer this question, Kittelson correlated each innovative idea with the need or needs that it addresses. The more regional needs that the innovative idea can address, the higher priority it becomes.

2. Does this innovative idea support existing SJCOG goals?

As outlined in SJCOG's Regional Transportation Plan and Sustainable Communities Strategy, the regional goals include: Mobility, Transformational Technology Readiness, Equity & Accessibility, Economic Vitality, Environmental Sustainability, and Safety. The second prioritization criterium recognizes these goals by asking: *Does this innovative idea support existing SJCOG goals?*

To answer this question, Kittelson correlated each innovative idea with the goal or goals with which it corresponds. The more goals that the innovative idea can support, the higher priority it becomes.

3. Does this innovative idea relate to an existing SJCOG project?

The third prioritization criterium acknowledges the important work already underway by asking: *Does this innovative idea relate to an existing SJCOG project?*

The projects that SJCOG pursues embody the goals described in the previous section. At the time of this study, some of the current projects that SJCOG is involved with include:

- Vamos Mobility as a Service (STEP Grant Implementation)
- Stockton Diamon Grade Separation (BUILD Grant Implementation)
- I-205 Managed Lanes (Caltrans Implementation)
- Fleet Electrification (RTD Implementation)

Corresponding with and complementing existing SJCOG work ensures that an innovative idea is supporting SJCOG goals and addressing regional needs, while also creating a stronger implementation network, built on existing resources, knowledge, and collaboration. The more cross-project relation that an innovative idea has, the higher priority it becomes.

4. Is this innovative idea implementable in the short term (1-3 years)?

One of the objectives of the Transportation Innovation Planning Study is to recommend an innovative pilot project that SJCOG could implement immediately given the existing state of technology and resources. For this reason, the fourth prioritization criterium asks: *Is this innovative idea implementable in the short term (1-3 years)?*

The objective of this criterium is twofold:

- To understand the development process of the technology itself.
- To understand SJCOG's readiness to interact with the technology.

The identified regional needs are pressing, and SJCOG must prioritize innovative ideas that can efficiently and effectively address these challenges. A project that is implementable in the short term indicates that the technology is both market-ready and that SJCOG staff is ready to welcome the challenge. For these reasons, shorter-term innovative ideas are ranked higher than mid- or long-term innovation ideas.

While still worth pursuing, innovative ideas that would require mid- to long-term implementation timeframes would also most likely require additional time or resources, or they might require product development on the technology front. Understanding the estimated implementation timeframe will help guide long-term investments in training, resources, and grant pursuits that will enable SJCOG to implement mid- to long-term innovative ideas in the future.

SJCOG could consider incorporating these longer-term projects in the Regional Transportation Plan and look for ways to fund and sponsor these projects over time.

5. What level of effort will be required of SJCOG staff?

The implementation timeframe for an innovative idea will depend both on the technology application itself, as well as the resources available within SJCOG and its partner agencies to support the implementation. The fifth criterium encapsulates this reality by asking: *What level of effort will be required of SJCOG staff?*

To answer this question, Kittelson identified actions that SJCOG would most likely pursue for each innovative idea. These actions include:

- **Grant Applications** – One or more grant applications will be necessary for each innovative idea, which typically requires staff time for creation, review, and management.
- **New Policies** – There will also likely be opportunities for SJCOG to adopt new policies that faciltate the smooth and productive deployment of the selected technology. Drafting policy language, incorporating stakeholder feedback, and adopting the new policies are all tasks that will be required of SJCOG staff.
- **Working Group** – Similarly, a new working group that includes specific stakeholders unique to the innovative idea will be crucial for successful implementation. Creating new contacts, strengthening existing relationships, organizing meetings, and preparing materials for the working group will require SJCOG staff effort.
- **Staff Training** – The pace of technological evolution is rapid, and to ensure the successful implementation of an innovative idea, SJCOG will likely require additional training to empower them to rise to the challenge. This worthwhile pursuit also requires time and budget. Affordable training opportunities include sending staff to industry conferences. Some of the key annual conferences that address transformational technologies are the Consumer Electronics Showcase (CES) hosted by the Consumer Technology Association, the ITS America Annual Meeting, and the Automated Road Transportation Symposium (formerly the Automated Vehicle Symposium (AVS)) hosted by the Transportation Research Board.

Agencies can self-assess their readiness to address new technologies by reviewing their staffing, resources, and organization and by reviewing their policies and plans. This self-assessment should inventory current resources and capabilities and identify any gaps or barriers.

Agency managers can look at their staffing, resource, and organization capabilities for addressing technology questions and impacts. This self-assessment might identify training, hiring, or resource needs. The Federal Highway Administration (FHWA) and the American Association of Highway and Transportation Officials (AASHTO) provide guidance on conducting a Capability Maturity Model or Capability Maturity Framework to improve program and project management.[32]

The County and municipalities could examine their codes considering the technology transition facing transportation and land use, and to revise and update their codes as needed. Policy review guidance is provided in the *Task 3 – Policy Framework Memorandum* (December 31, 2020).

Understanding the time and commitment that each innovative idea will require to implement is central towards understanding the feasibility of a potential project. For this reason, innovative ideas that require higher SJCOG staff effort are ranked as a lower priority.

6. What funding opportunities exist for this innovative idea?

SJCOG is committed to readying the region for transformational technologies but cannot do it alone. Pursuing grant funding will ultimately help SJCOG the vision of implementing a regional, context-specific technology pilot to address identified transportation challenges while endeavoring towards the goals of the Regional

[32] https://ops.fhwa.dot.gov/publications/fhwahop16031/index.htm

Transportation Plan and Sustainable Community Strategy. Naturally, the sixth criterium asks: *What funding opportunities exist for this innovative idea?*

To answer this question, Kittelson identified state, federal, and private grant opportunities, specific to each innovative idea. These potential funding sources will require grant applications, as discussed above, and in many cases will require local matches to share the cost of innovation. *Task 5 – Innovation Options and Potential Funding Sources Memorandum* (March 18, 2021) describes each potential funding source in greater detail. Innovative ideas with more potential funding sources are ranked as a higher priority.

Innovative Idea Prioritization

This section details how the prioritization process was applied to the 20 innovative ideas identified through this project, which were described in the **Innovative Ideas** section above.

1. Does this innovative idea address an identified regional need?

To answer this question, Kittelson corresponded each innovative idea with appropriate regional needs, as illustrated in the following tables.

	Deploy Technology that Serves Regional Needs	Expand Internet Access & Tele-communications Speeds	Reduce Congestion & Commuter Traffic	Reduce Freight Traffic Conflicts	Address Digital Banking Access	Improve Transit Access	Increase Zero Emissions Vehicles	Expand Active Transportation	Address Aging Infrastructure	Share Data & Information
Connected Farm Equipment Safety Pilot	✓			✓						✓
Microtransit Pilot	✓		✓			✓	✓			✓
Automated Vehicle Good Delivery Pilot	✓			✓			✓			✓
Mobility Hub Quick-Build Pilot	✓		✓			✓	✓	✓		✓
Fiber City Checklist	✓	✓	✓						✓	✓
Intelligent Transportation System (ITS) Master Plan	✓		✓						✓	✓
EV Charging Infrastructure Acceleration	✓						✓		✓	✓
Mobile & Common Digital Payment System	✓				✓	✓				✓
Rail-to-Trail Planning & Design			✓					✓		

	Deploy Technology that Serves Regional Needs	Expand Internet Access & Tele-communications Speeds	Reduce Congestion & Commuter Traffic	Reduce Freight Traffic Conflicts	Address Digital Banking Access	Improve Transit Access	Increase Zero Emissions Vehicles	Expand Active Transportation	Address Aging Infrastructure	Share Data & Information
Automated Passenger Vehicle Shuttle between Amtrak and ACE	✓		✓			✓	✓			✓
Automated Passenger Vehicle Shuttle for Distribution Center Workers to Transit	✓		✓			✓	✓			✓
AV Truck-Only Lanes Pilot	✓			✓					✓	✓
Drone & Sidewalk Automated Delivery	✓									✓
Regional Traffic Management Center	✓		✓	✓					✓	✓
Enhanced Partnership for Corridor Management of the Altamont Pass	✓		✓							✓
Hyperloop Testing Facility										✓
Congestion Pricing	✓		✓							
Traditional Revenue Alternatives							✓		✓	
Regional AV Adoption				✓						✓

The **Mobility Hub Quick Build Pilot** addresses six of the ten regional needs. The **Fiber City Checklist**, **Automated Passenger Vehicle Shuttles**, and a **Regional Traffic Management Center** address five regional needs. Microtransit, Automated Vehicle Goods Delivery Pilot, Intelligent Transportation System (ITS) Master Plan, Electric Vehicle Charging Infrastructure Acceleration, Mobile & Common Digital Payment System, and an AV Truck-Only Lanes Pilot all address four regional needs.

Based on this analysis, the innovative ideas that meet the least number of regional needs are down-selected from the prioritization process. This eliminated: Connected Farm Safety Equipment Pilot, Rail-to-Trail Planning & Design, Drone & Sidewalk Automated Delivery, Enhanced Integrated Corridor Management Partnership for the Altamont Pass, Hyperloop Testing Facility, Congestion Pricing, Traditional Revenue Alternatives, and Regional AV Adoption based on alignment with the regional needs.

2. Does this innovative idea support SJCOG goals?

The following table illustrates the SJCOG goals, along with the innovative ideas that relate to and support them.

Regional Transportation Needs	Mobility	Transformational Technology Readiness	Equity & Accessibility	Economic Vitality	Environmental Sustainability	Safety
Mobility Hub Quick Build Pilot	✓	✓	✓	✓	✓	
Fiber Town Checklist		✓	✓	✓		
Microtransit	✓	✓	✓	✓	✓	
Automated Vehicle Goods Delivery Pilot		✓		✓		
Intelligent Transportation System (ITS) Master Plan	✓	✓				✓
EV Charging Infrastructure Acceleration		✓		✓	✓	
Mobile & Common Digital Payment System		✓	✓	✓		
Automated Passenger Vehicle Shuttle between Amtrak and ACE	✓	✓				
Automated Passenger Vehicle Shuttle for Distribution Center Workers to Transit	✓	✓				
Regional Traffic Management Center	✓	✓				✓
AV Truck-Only Lanes Pilot		✓		✓		✓

Of the innovative ideas, **Mobility Hub Quick Build Pilot** supports five goals and **Microtransit** supports four goals. The **Fiber City Checklist**, the **ITS Master Plan**, **EV Charging Infrastructure**, a **Mobile & Common Digital Payment System**, a **Regional TMC**, and an **AV Truck-Only Lanes Pilot** all support three goals.

The lowest-ranking projects based on alignment with regional goals still did align with two goals each: AV Goods Delivery Pilot and the Automated Passenger Vehicle Shuttles between Amtrack and ACE or between Distribution Centers and Transit. As AV technology advances, these systems could align with more of the regional goals, which is why ideas should be reevaluated as technology changes.

3. Does this innovative idea relate to an existing SJCOG project?

Of the innovative ideas outlined above, some are already being pursued by SJCOG. For example, a **Mobile & Common Digital Payment System** is a great idea for the San Joaquin region, and due to the hard work and collaboration of SJCOG and RTD, the agencies were recently awarded a STEP grant to implement the Stockton Mobility Collective Project, which includes *Vamos*, a mobile and common digital payment system with the ability to connect multiple modes. For this reason, the implementation of a **Mobility Hub Quick Build Pilot** would be even easier, as the *Vamos* app would facilitate the transfer between modes at the hub.

Another great example of this synergy is the innovative idea of an **Electric Vehicle Charging Infrastructure Acceleration Program** with that of the practical fleet electrification that RTD is currently pursuing. These two mutually support one another – as RTD continues to electrify its fleet, it will require additional charging infrastructure, and as electric vehicles continue to penetrate the market for all vehicle types, the wisdom that RTD has gathered while pursuing its fleet changeover will facilitate additional charging infrastructure.

In the near-term, Caltrans will embark on a managed lanes project along the I-205 corridor. This project could be mutually supported by a number of innovative ideas, such as a **Regional TMC**, an **ITS Master Plan**, and an **AV Truck-Only Lanes Pilot**.

4. Is this innovative idea implementable in the short term (1 – 3 years)?

The identified regional needs are pressing, and SJCOG must prioritize innovative ideas that can efficiently and effectively address these challenges. A project that is implementable in the short term indicates that the technology is both market-ready and that SJCOG staff is ready to embrace the challenge. For these reasons, short-term innovative ideas are ranked higher than mid- or long-term innovation ideas. These short-term innovative ideas include:

- Mobility Hub Quick Build Pilot
- Fiber City Checklist
- Microtransit Pilot
- ITS Master Plan
- Automated Vehicle Goods Delivery Pilot

5. What level of effort will be required of SJCOG staff?

Each of these highly ranked innovative ideas will require the dedication of SJCOG staff. All these ideas offer a chance to build staff capabilities, engage local partners (including students), and foster further regional collaboration. A **Microtransit Pilot** and a **Mobility Hub Quick Build Pilot** are both estimated to require the least effort from SJCOG (while still being meaningful and engaging pursuits), as SJCOG would most likely be a strong partner to RTD for these innovative ideas. The **Fiber City Checklist** and **ITS Master Plan** are both estimated to require a higher level of effort from SJCOG, as the COG would most likely lead these pursuits. An **Automated Vehicle Goods Delivery Pilot** is estimated to require the highest level of effort from SJCOG staff, due to the training, policy, and working groups necessary.

Regional Transportation Needs	Grant Application (s)	New Policies	New Working Group	Staff Training	Other Resources
Mobility Hub Quick Build Pilot	$				✓
Fiber Town Checklist	$	✓	✓	✓	
Microtransit	$				✓
Automated Vehicle Goods Delivery Pilot	$	✓	✓	✓	✓
Intelligent Transportation System (ITS) Master Plan	$		✓		✓

6. What funding opportunities exist for this innovative idea?

Based on feedback from SJCOG staff, stakeholders in the Innovation Working Group, and in-house expertise, at this point in the prioritization process, the innovative ideas were down-selected to include the following:

- Mobility Hub Quick Build Pilot
- Fiber City Checklist
- Automated Vehicle Goods Delivery Pilot

With ample funding opportunities available and the highest level of stakeholder support, these three innovative ideas were further researched and are detailed more fully in the *Task 5 – Innovation Options and Potential Funding Sources Memorandum*.

SJCOG Recommendations

The project's Innovation Working Group met on January 25, 2021 to review and prioritize the potential projects and select one project for recommendation to SJCOG to implement in the near term. The three projects that ranked the highest after this prioritization process are:

- Fiber City Checklist
- Mobility Hub Quick Build Pilot
- Automated Vehicle Pilot

A fourth action for SJCOG to consider is to conduct a planning study for a **Connected Farm Equipment Safety Pilot**. Although this project did not rank as high as others in the prioritization process, it does address three regional needs (deploying new technology, reducing freight traffic conflicts, and sharing data and information). It also addresses three regional goals (mobility, transformational technology readiness, and safety). Based on feedback from the working group members and an assessment of other technology deployments, it is feasible for SJCOG to initiate a planning study for the Connected Farm Equipment Safety Pilot project in the next 1-2 years. The pilot project also addresses specific safety issues in the region (conflicts with low-speed agricultural equipment on rural farm roads in the county), and it studies a use case that none of the major CV deployments across the country are focusing on. SJCOG's pilot could provide new insights to advance technology. The working group members supported the consideration of the Connected Farm Equipment Safety Pilot as an additional potential short-term action.

The final recommendation is for SJCOG to conduct the **Fiber City Checklist** as the first step in expanding the region's communications network and building a strong foundation for future traffic management strategies that address congestion, enable new travel modes, and support connected and automated vehicle technology. Additionally, the Fiber City Checklist supports the expansion of high-speed internet access for San Joaquin County residents and employers, which has benefits beyond transportation to bring jobs, education, and healthcare opportunities to residents to help strengthen the county's economy and quality of life.

The other potential projects that did not rank as high were still determined to be strong projects that SJCOG could consider incorporating into the Regional Transportation Plan potential future actions to pursue funding as the technology advances, or as the region builds up its communications network.

Appendix J: Prioritized Project Evaluation

Project Selection Criteria Evaluation

The Florida Department of Transportation (FDOT) developed project selection criteria and performance metrics for prioritizing emerging technology deployments and for evaluating the deployment results, which are published in *Florida's Connected and Automated Vehicles (CAV) Business Plan (2019)*[33]. FDOT requires that "all projects to be funded for deployment should follow the systems engineering (SE) process. A high-level operational concept should be developed to define user needs and perform stakeholder coordination." The FDOT project selection process scores projects on a 1-10 scale for each of the criteria listed in the table below. Many of the selection criteria that FDOT identified will be defined once specific deployment use cases and locations are defined. This study used high-level prioritization criteria that could be assessed without detailed use case and project plans. These criteria are informed by the detailed selection criteria above and were used to evaluate the potential projects identified in this Transportation Innovation Planning Study. SJCOG will need strong public-private partnerships to efficiently implement the potential pilot deployment projects. Once these partnerships are formed, the selection criteria can be evaluated in more detail.

The three top-ranked projects based on the high-level selection criteria are the Fiber City Checklist, Quick Build Mobility Hubs, and an AV Goods Delivery Shuttle. The study team evaluated these projects using detailed selection criteria modeled after FDOT's selection evaluation process. Fiber City Checklist ranked the highest. Project-specific planning studies will refine and better define these metrics, such as project evaluation and operations and maintenance.

Categories	Criteria	Preliminary Score (Yes=1; No/NA=0)			
		Fiber City Checklist	Mobility Hubs	AV Goods Delivery Pilot	CV Farm Equip. Pilot
Accelerate the CAV Program	Does this project accelerate the deployment and implementation of CAV technologies in San Joaquin County?	Yes	No	Yes	Yes
Safety	Does this project directly reduce or have the potential to reduce fatal, serious injury and/or secondary crashes?	No	No	Yes	Yes
Mobility	From a mobility perspective, does this project directly benefit all modes including pedestrians, bicyclists, disabled, economically disadvantaged, and aging road users?	Yes	Yes	Yes	No
Efficiency and Reliability	Does this project directly benefit (or have potential to impact) efficiency and/or reliability for all travelers, freight, transit riders, aging road users, pedestrians, and bicyclists?	Yes	No	No	No
Feasibility	Is this project implementable (technology-ready), scalable, and portable for countywide deployment?	Yes	Yes	No	Yes
	Do proposed technologies comply with or have the potential to comply with relevant state and federal safety law?	Yes	Yes	Yes	Yes
	Is the proposed project interoperable and/or does it have the potential to become interoperable with the existing or programmed CAV Projects? [*Existing project: Stockton Mobility Collective*]	Yes	Yes	No	No

[33] https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/traffic/doc_library/pdf/fdot-cav-business-plan-2019.pdf?sfvrsn=45b478ff_0

Funds	Does this project leverage federal, local, and/or private funds? Are there any private organization and/or local agency partners? If yes, what are their match types and roles? Is there an agreement or Memorandum of Understanding (MOU) in place? [*Funding would be needed. No MOUs in place yet.*]	Yes	Yes	Yes	Yes
Benefit/Cost	Does this project offer benefits with a high B/C and a good return on investment?	Yes	No	No	Yes
Data and Security	Does this project collect, disseminate, and use real-time traffic, transit, parking, and other transportation information to improve safety and mobility, and reduce congestion? Explain how the project will safeguard data privacy and deploy a cybersecurity platform.	No	No	No	Yes
Operations and Maintenance	Does this project address staffing, funding, and procedures for operations, maintenance, and replacement of CAV infrastructure, technologies, and applications?	No	No	No	No
Project Evaluation	Does this project have pre-defined performance measures? What and how are these outcomes measured? [*Planning studies needed*]	NA	NA	NA	NA
	Will there be a before and after analysis performed, and lessons learned documented? If yes, how will this be documented and shared? [*Planning studies needed*]	NA	NA	NA	NA
	Is there a systems validation and verification process in place? Explain how this will be performed. [*Planning studies needed*]	NA	NA	NA	NA
	Total Scores:	**8**	**5**	**5**	**7**

Detailed Project Prioritization

Fiber City Checklist

Goal	*Identified Needs*	
Transformational Technology Readiness		Expand Internet Access & Improve Telecommunication Speeds
		Address Aging Infrastructure
		Deploy Technologies that Serve Regional Needs
Visualization	*Description*	
 *Source: Brandfolder*	Completing the Fiber City Checklist would establish opportunities, needs, and challenges towards building out the fiber optic network that will support the implementation of intelligent transportation systems projects. SJCOG, by leading its partner agencies in this effort, will establish funding priorities and can ensure common equipment and data systems are implemented throughout the region, which will maximize the ease and efficiency of creating and upgrading the ITS network, while facilitating the implementation of advanced telecommunications infrastructure in San Joaquin County.	

Implementation Timeframe	*SJCOG Level of Effort*	*Opinion of Estimate of Probable Cost*	*Stakeholder Support*
Short/Mid Term: 1 – 5 Years	SJCOG Staff Training	$100,000 - $250,000	Second Highest Ranked Short Term Tech Deployment by Stakeholders

Existing Plan or Policy Relevancy	
	SJCOG Congestion Corridors Plan (2020)
	SJCOG Automated Vehicles Briefing (2019)
	SJCOG Regional Transportation Plan / Sustainable Communities Strategy (2018)

Potential Funding Sources	Federal	✓	State	✓	Private	

Mobility Hubs

Identified Needs		Goal
	Increase Transit Access	*Mobility*
	Reduce Commute Congestion	
	Expand Active Transportation	

Visualization	*Implementation Timeframe*
 *Source: CoMoUK*	Short/Mid Term: 1 – 5 Years
	Stakeholder Support
	Highest Ranked Short Term Tech Deployment by Stakeholders
	SJCOG Level of Effort
	New Working Group
	Opinion of Estimate of Probable Cost
	$10,000 - $50,000

Description

Mobility Hubs are technologically integrated, multi-modal stations to empower communities to access their destinations with a variety of modes. Mobility Hubs often combine transportation options for transit, shared micromobility, electric vehicle (EV) charging infrastructure, and car-sharing. A Quick-Build Pilot could dedicate an existing parking structure for covered bicycle parking, docking stations, and a bus stop to facilitate intermodal trips, creating a foundation to add more multimodal options to in the future, such as a super charger for EVs, a local food truck, and parking spaces for shared vehicles. Mobility Hubs encourage active and ZEV trips while demonstrating the fun, convenience, and ease of creating multi-modal centers with community amenities such as street furniture, urban greenery, public art, and pop-up commercial areas. SJCOG can partner with RTD, the Pacific Gas and Electric Company, micromobility providers, and local businesses to create a pilot concept of a Mobility Hub in a partner agency jurisdiction.

Existing Plan or Policy Relevancy	San Joaquin County Health Outcome Update & Small Area Focus Studies (2020)					
	SJCOG Regional Transportation Plan / Sustainable Communities Strategy (2018)					
Existing Local Project Relevancy	Vamos Mobility as a Service STEP Implementation					
	RTD Fleet Electrification					
	Electric Vehicle Charging Infrastructure					
	Stockton Diamond Grade Separation Project (BUILD)					
Potential Funding Sources	Federal	✓	State	✓	Private	✓

Automated Vehicle Delivery Pilot

Goal	*Identified Needs*	
Mobility		Improve Transit Access
		Increase Zero Emissions Vehicles
		Reduce Commute Congestion

Visualization	*Description*
 *Source: Local Motors*	Automated vehicles (AVs) are poised to transform both the transportation and technology spheres with the potential capability to improve safety, enhance mobility, reduce greenhouse gas emissions, and revolutionize digital data analysis, computation, and communications. However, before these benefits are realized, pilot deployments using currently available technologies must be deployed to solve their challenges in real-world situations. AV Shuttles, which are low-speed passenger or last-mile goods vehicles, are currently being tested in numerous states across the nation. In order to understand the unique needs and challenges of the San Joaquin region, piloting CAV Shuttles is necessary to prepare the region for the connected and automated future. A potential pilot deployment could deliver essential goods to remote parts of the region.

Implementation Timeframe	*SJCOG Level of Effort*	*Opinion of Estimate of Probable Cost*	*Stakeholder Support*
Short/Mid Term: 1 – 5 Years	New Working Group, New Policy	$500,000	Second Highest Ranked Short Term Tech Deployment by Stakeholders

Existing Plan or Policy Relevancy	SJCOG Automated Vehicles Briefing (2019)
	San Joaquin One Voice® Project Submissions & Regional Priority Selection Report (2019)
Existing Local Project Relevancy	Vamos Mobility as a Service STEP Implementation
	RTD Fleet Electrification
	Electric Vehicle Charging Infrastructure

Potential Funding Sources					
Federal	✓	State	✓	Private	✓

Appendix K: Fiber City Checklist

This document provides supplemental information on the Fiber City Checklist to answer:

- Where has the Fiber City Checklist been implemented?
- Who are the partners of Fiber Cities?
- What were the implementation challenges for Fiber Cities while completing the Checklist?
- Following the completion of the Checklist, how has the installation/expansion of the fiber optic network progressed?
- Where is the Fiber City Checklist currently being implemented?

Where has the Fiber City Checklist been implemented?

As of 2021, there are 19 cities where Google Fiber, the main proponent and ISP of the Fiber City Checklist is operating and providing high-speed internet service, including four California locations: **Oakland, San Diego, San Francisco, and Orange County**. Since 2014, there have been numerous communities that have completed the Fiber City Checklist to prepare for fiber optic network expansion, including California communities such as San Jose, Santa Clara, Sunnyvale, Mountain View, and Palo Alto. Although not currently active, the completion of the Fiber City Checklist has enabled these communities to expand their fiber optic network when the time is right.

In 2020, West Des Moines, Iowa and Millcreek, Utah announced they would pursue the expansion of the fiber optic network, beginning with the Fiber City Checklist. More information about these two recent cities is provided below.

Who are the partners of Fiber Cities?

AT&T Fiber and Google Fiber currently provide residential fiber internet service in California. The *Fiber City Checklist* was created by Google Fiber. The self-assessment can facilitate discussions with other internet service providers.

What were the implementation challenges for Fiber Cities while completing the Checklist?

- Detailed ownership, controlling body, and operational rights for all necessary information[34].
- Ensuring or modifying state laws, local ordinances, and commercial agreements to provide clear, predictable rules and reasonable terms to attach fiber to any municipality-owned infrastructure.
- Creation of a Permitting, Construction, and Maintenance Plan that identifies construction constraints[35] and provides potential solutions.
- Facilitation and execution of public-private partnerships.
- Ensuring access to renters[36].
- Pavement management with 'shallow trenching' for laying fiber conduit[37].

[34] "Charlotte's City Checklist for Google Fiber – Part 1". *Charlotte Hearts Gigabit*. April 8, 2014. https://www.charlotteheartsgigabit.com/blog/2014/4/7/charlottes-city-checklist-for-google-fiber-part-1
[35] "Charlotte's City Checklist for Google Fiber – Part 2". *Charlotte Hearts Gigabit*. April 10, 2014. https://www.charlotteheartsgigabit.com/blog/2014/4/8/charlottes-city-checklist-for-google-fiber-part-2
[36] State of Connecticut, "Why Would CT Want Gig Service? Case Study: Kansas City, KS". *Office of Consumer Counsel.* *https://portal.ct.gov/OCC/Telecom/Broadband/Broadband/Kansas-City-Kansas-a-case-study*
[37] Job Brodkin. "Google Fiber's biggest failure: ISP will turn service off in Louisville". Ars Technica. February 8, 2019. https://arstechnica.com/information-technology/2019/02/google-fiber-exits-louisville-after-shoddy-installs-left-exposed-wires-in-roads/

Following the completion of the Checklist, how has the installation/expansion of the fiber optic network progressed?

Google Fiber is operating in 19 cities as of February 2021, with expansion plans continuing to develop through public-private partnerships.

Austin, TX: "There is general agreement that Google's plan to bring ultra-high-speed internet to the masses ***led to more — and better — high-speed internet options*** for Austin consumers. Google Fiber's entry into the market spurred existing providers to raise their game, and the result has been ***better and faster internet service at lower rates***, industry experts say. It also has led to ***better connectivity in long-underserved areas***, such as East Austin[38].

Salt Lake City, UT: "If Google turns down the city, Salt Lake City will use the experience to lure other potential fiber network providers – we used this as an ***opportunity to be proactive*** and we developed what we call a 'fiber guide' in Salt Lake City", reported Jessica Thesing, Salt Lake City's economic development manager in 2014[39]. Now 2 Gigabit internet service is available in 17 neighborhoods of SLC.

Where is the Checklist currently being implemented?

West Des Moines, IA

Similar to the agreement that Google Fiber operates under in Huntsville, AL, a public-private partnership for the expansion of the fiber optic network in West Des Moines was announced in July 2020. This PPP is a 20-year agreement for the City of West Des Moines to invest $40 million in its conduit and cabling, of which Google Fiber will be the sole lease-holder, paying the city per household connected and at least $4.5 million in 'rent'. The partnership's objective is to provide high speed internet to all 67,000 residents in 2.5 years[40]. This arrangement is "*an uncommon model but allows each party to play to their own strengths – with cities handling infrastructure and technology companies providing services*"[41]. Conduit laying began in the final months of 2020 and following the lapse of the 20-year lease, the conduit will be an open-access network, allowing multiple ISPs to provide competitive internet service[42].

Mill Creek, UT

In July 2020, Google Fiber and the City of Millcreek jointly announced that a partnership for fiber optic network expansion would commence, with the goal of serving customers as early as 2021. This partnership is "essentially that of a franchisor/franchisee", as Millcreek will receive 2% of the gross revenues generated from the provision of high-speed internet within city right-of-way[43]. This non-exclusive license agreement includes the installation of infrastructure for the network[44].

[38] Hojun Choi & Kara Carlson. "High Speed, High Impact? How Google Fiber's arrival changed things in Austin". *Statesman.* January 3rd, 2020. https://www.statesman.com/business/20200103/high-speed-high-impact-how-google-fiberrsquos-arrival-changed-things-in-austin
[39] Ben Winslow. "SLC finished Google Fiber checklist". *Fox13 Salt Lake City*. May 2, 2014. https://www.fox13now.com/2014/05/02/slc-finishes-google-fiber-checklist
[40] Ry Marcattilio-McCracken. "West Des Moines to Build Citywide Conduit System with Google Fiber as First Provider". July 17, 2020. https://muninetworks.org/content/west-des-moines-build-citywide-conduit-system-google-fiber-first-provider
[41] Shelby Fleig. "West Des Moines set to become Iowa's first Google Fiber city". *Des Moines Register*. July 2, 2020. https://www.desmoinesregister.com/story/news/local/west-des-moines/2020/07/02/google-fiber-partner-west-des-moines-fiber-optic-internet-broadband-iowa-high-speed/3279256001/
[42] Plant the Seed. "Help Fast Internet Take Root in West Des Moines". *The City of West Des Moines. https://wiredwdm.org/*
[43] City of Mill Creek. "Fiber Information". https://millcreek.us/331/Fiber-Information
[44] ABC4. "Google Fiber expands to Millcreek". July 13, 2020. https://www.abc4.com/news/google-fiber-expands-to-millcreek/