

# MOBILITY AS A SERVICE

## Feasibility White Paper

FINAL REPORT

JULY 8, 2022



**SCAG**™

INNOVATING FOR A BETTER TOMORROW



## **ABOUT SCAG**

SCAG is the metropolitan planning organization (MPO) for six Southern California counties: Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura. Representing 191 cities and over 19 million residents, SCAG is the nation's largest MPO.

## **VISION**

Southern California's Catalyst for a Brighter Future

## **MISSION**

To foster innovative regional solutions that improve the lives of Southern Californians through inclusive collaboration, visionary planning, regional advocacy, information sharing, and promoting best practices.

# MOBILITY AS A SERVICE FEASIBILITY WHITE PAPER

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AIM	Accelerating Innovative Mobility
ALPR	Automated License Plate Reader
ATN	Anaheim Transportation Network
APC	Automated Passenger Counting
APDS	Alliance for Parking Data Standards
API	Application Programming Interface
ATCMTD	Advanced Transportation and Congestion Management Technology Deployment
AVTA	Antelope Valley Transit Authority
BBB	Big Blue Bus
BIPOC	Black, Indigenous, and People of Color
C-ITS	Cooperative Intelligent Transport Systems
Cal-ITP	Caltrans Integrated Travel Project
CalSTA	California State Transportation Agency
Caltrans	California Department of Transportation
CAT	City Airport Train
CAV	Connected and Autonomous Vehicle
CCI	California Climate Investments
CCPA	California Consumer Privacy Act
CFA	Call For Applications
CMO	Clean Mobility Options Voucher Pilot Program
CSMS	Curb Space Management Study
CTA	Chicago Transit Authority
CTC	County Transportation Commission
CurbLR	Curb Linear Reference
DLRCC	Dun Laoghaire Rathdown County Council
ECTA	East County Transit Alliance
FAST	Fixing America's Surface Transportation
FSI	Fareless System Initiative
FTA	Federal Transit Administration
HACLA	Housing Authority of the City of Los Angeles
GBFS	General Bikeshare Feed Specification
GCT	Gold Coast Transit
GDPR	General Data Privacy Regulation
GHG	Greenhouse Gas
GNSS	Global Navigation Satellite System
GOFS	General On-Demand Feed Specification
GPS	Global Positioning System
GTFS	General Transit Feed Specifications
GTFS-RT	General Transit Feed Specifications Real-Time
ICTC	Imperial County Transportation Commission
IE CMCP	The Inland Empire Comprehensive Multimodal Corridor Plan
IMI	Innovative Mobility Initiative
ISD	Internal Services Department



ISMS	Information Security Management System
IT	Information Technology
ITE	Institute for Transportation Engineers
IVT	Imperial Valley Transit
KPI	Key Performance Indicator
LA	Los Angeles
LACI	Los Angeles Cleantech Incubator
LADOT	Los Angeles Department of Transportation
LAWA	Los Angeles World Airports
LBT	Long Beach Transit
LiDAR	Light Detection and Ranging
LIFE	Low Income Fare is Easy
LPA	Leveraged Procurement Agreements
LPR	License Plate Recognition
MaaS	Mobility as a Service
MDS	Mobility Data Specification
MOD	Mobility on Demand
MPO	Metropolitan Planning Organization
MST	Monterey-Salinas Transit
MTA	Metropolitan Transportation Authority
NFC	Near-Field Communication
NTA	National Transportation Authority
NTT	The Nippon Telegraph and Telephone Public Corporation
OC	Orange County
OCTA	Orange County Transportation Authority
OD	Origin-Destination
OMF	Open Mobility Foundation
P3	Public-Private Partnership
PA-DSS	Payment Application Data Security Standard
PCI-DSS	Payment Card Industry Data Security Standard
PEV	Plug-In Electric Vehicle
POS	Point of Sale
RCTC	Riverside County Transportation Commission
RFP	Request for Proposals
RTA	Riverside Transit Agency
RTP/SCS	Regional Transportation Plan/Sustainable Communities Strategy
SaaS	Software as a Service
SANDAG	San Diego Association of Governments
SBCTA	San Bernardino County Transportation Authority
SCAG	Southern California Association of Governments
SCMI	Smart Cities & Mobility Innovations
SFMTA	San Francisco Municipal Transportation Authority
SOC	System Organization and Control
SOV	Single-Occupancy Vehicle
SQL	Structured Query Language
SUMC	Shared-Use Mobility Center
TAP	Transit Access Pass

TDM	Transportation Demand Management
TOD	Transit Oriented Development
TIRCP	Transit and Intercity Rail Capital Program
TNC	Transportation Network Company
UBM	Universal Basic Mobility
UCLA	University of California Los Angeles
U.S.	United States
VCTC	Ventura County Transportation Commission
VMT	Vehicle Miles Travelled
VVTA	Victor Valley Transit Authority
WRCOG	Western Riverside Council of Governments

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AECOM

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Orange County Transportation Authority  
Riverside County Transportation Commission  
San Bernardino County Transportation Authority  
Shared-Use Mobility Center  
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# EXECUTIVE SUMMARY

## STUDY PURPOSE AND METHODOLOGY

Southern California Association of Government's (SCAG's) 2020 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS), Connect SoCal, is a long-range visioning plan that builds upon and expands land use and transportation strategies established over several planning cycles to increase mobility options and achieve a more sustainable growth pattern. It charts a path toward a more mobile, sustainable and prosperous region by making connections between transportation networks, between planning strategies and between the people whose collaboration can improve the quality of life for Southern Californians.

Connect SoCal identified Key Connections that lie at the intersection of land use, transportation and innovation, meant to advance policy discussions and strategies to leverage new technologies and create better partnerships to increase progress on the regional goals. One of the Key Connections is shared mobility and mobility as a service (MaaS), emphasizing that the future of travel will be shaped by technology and the ability of residents to easily choose from and use a variety of travel options.

MaaS integrates transportation services into a single mobility platform that provides competitive alternatives over private vehicles, to promote universal basic mobility, encourage mode shift, and foster sustainable travel choices. SCAG studied the feasibility of implementing a MaaS system in the region based on these policy framework elements:

- **Infrastructure:** Reviews the physical and/or capital infrastructure for public transportation and other public and private modes needed to increase or sustain mobility choices.
- **Data and Technology:** Includes technological requirements and standards to support integrated payment systems, addressing issues surrounding data privacy and public private partnerships, as well as data ownership, sharing and security, data protection across stakeholders.
- **Management and Operation:** Identifies tools or strategies that enables implementation and the operability of the network, tools to nudge travel behavior and encourage social responsibility, and any necessary third-party negotiations for the operation of mobility services.
- **Governance:** Entails existing policies, and/or new policies that are put in place to facilitate implementation of MaaS, and effective strategies in addressing governance issues that inhibited implementation.
- **Finance:** Discusses the funding and financial structures of the identified case studies such as funding sources and availability, the understanding of funding commitments at the various levels of implementation and any necessary enabling policies.
- **Institutional Practices:** Discusses the organizational structures and whether/how these cultures are transformed to allow for additional innovation and experimentation of the MaaS model.
- **Equity and Public Engagement:** Outlines the public engagement and education undertaken to create equitable solutions and awareness among elected leadership, the general public, or other stakeholder groups about MaaS.

## ADVISORY GROUP

Public and private thought leaders, decision-makers, and potential MaaS champions were gathered to form an advisory group to guide the study and provide feedback to the project team throughout the project duration. A total of four advisory group meetings were held for this project and the meeting summaries can be found in Appendix A. The project team also conducted one-on-one interviews with the Advisory group members to understand how the MaaS concept is interpreted, implications of various on-going MaaS related programs and to identify areas of common interest or cooperation. Key takeaways from the Advisory Group meetings included the following, which were incorporated within this Report:

- The development of a MaaS system should be intentional, user centric, promoting multimodal travel options, and serving the population who need those travel options more.
- A more detailed definition of policy framework elements.
- State level political and funding support is needed for future MaaS development.
- It was suggested that a missing element of the existing MaaS research and development was a product mapping exercise to identify the most up to date MaaS related technology and products.
- Many barriers exist for MaaS implementation. The California Integrated Travel Project (Cal-ITP) is addressing some of the barriers such as closed-loop payments.
- Preference for using 2028 Olympics as a testing ground for MaaS implementation.
- Preference for a more consistent level of service across the SCAG region.
- Preference for data standards and data privacy to be a priority for any implementation guide.
- Preference for the timeline and schedule to be built into the implementation guide step by step.
- There was some skepticism around the relative success of mobility hubs and what MaaS can offer to the population who can benefit the most from it.
- Concerns were expressed about the financial cost and time needed to update the payment system to open-loop.
- LA County is eager to do MaaS pilots in unincorporated areas.
- Pilot projects should focus on demand-side subsidies to make market-rate services more affordable.
- Pilot projects should include robust community engagement.

Additionally, these are the key highlights from the 16 one-on-one tailored interviews with the advisory group members:

- MaaS is still risky as a sustainable business model.
- One of Cal-ITP's main goals is to help transit operators transition to open-loop payment systems.
- Some Advisory Group members believe a MaaS system should be led by a government agency to make sure that the driving factor of MaaS is the benefit to the communities it serves.
- Customer data protection can be a deterrent in finding partners for transit agencies since some private companies form their partnerships based on data access.
- Ventura County Transportation Commission (VCTC) has already introduced contactless payments, VCbuspass to foster future MaaS implementation and intends to be at the forefront of leading the implementation.

- Orange County Transportation Authority (OCTA) has introduced OC Bus App to enable more seamless integrated transit service access. The agency is intending to expand it as well as their OC Flex service.
- San Bernardino County Transportation Authority (SBCTA), Imperial County Transportation Commission (ICTC), and Riverside County Transportation Commission (RCTC) are not as developed as the other counties but are all interested in the MaaS concept.
- There are concerns that MaaS might shift some of the existing transit ridership to other modes.
- Some agencies do not support fare payment consolidation into a single app.
- On-demand transit service is a common interest in all counties due to its potential to serve certain communities and the cost-benefits of replacing inefficient fixed-route services.
- There is a lack of inter-county service integration or collaboration.
- MaaS should include congestion pricing into the system and will help GHG emissions. And the LA Metro TAP program is not the future of the transit system.
- There are concerns of how MaaS could negatively impact some transit-dependent populations.
- It was suggested that sometimes there is too much focus on unbanked communities which could inhibit development of creative solutions.
- Rider access to the banking system will continue to be an issue regarding payment methods.

## CASE STUDIES

Seven global implementations were reviewed for this study. They include Helsinki, Manchester, Vienna, Dublin, Stockholm & Gothenburg, West Midland, and Pittsburgh. Critical lessons learned from these implementations are summarized by each policy framework element below.

First, offering a wide range of transportation modes and investing in mobility hubs help a region lay a solid **infrastructure** foundation for MaaS implementation. Leveraging the private sector to handle the essential **data and technology** related to a MaaS platform can streamline MaaS implementation. The **management and operations** for each successful MaaS deployment can differ. It is important to consider the political, stakeholder, and public environments to determine the most fitting managerial structure for a MaaS system. Options can include either private or public operation. Regardless of the managerial structure, the public agencies should have control of the system, and it is also important that there are mutually beneficial agreements in place between public and private entities. A strong **governance**, such as mandating all mobility operators to provide an open API and making data access transparent, can steer the MaaS implementation to success. All funding sources can be leveraged to **finance** a MaaS implementation. A dominant contribution from public agencies can ensure its involvement over a MaaS system, regardless of system operator types. **Institutional practices** support the other elements through coordination between stakeholders. **Equity and public engagement** need to serve as one of the core values for a MaaS system. Strategies include, but are not limited to, a full public engagement throughout the MaaS pilot or project cycle, offering tiered subscription plans, and forming a subsidy program such as Universal Basic Mobility (UBM) programs.

## VENDOR SURVEY

The private sector was involved in this study through a survey process. Seventeen MaaS related industry vendors were contacted. Fifteen of them agreed to receive the survey. Overall, 13 survey responses were collected and summarized. These 13 vendors are: Via, Fluidtime, Axon Vibe, Skedgo, Mobilio, Spare Labs, Transit App, Cityway, Moovit, Moovel, Rideco, Ubigo, and Trafi.

Technology vendors emphasized the leading role public agencies can play in a MaaS implementation, while the vendors can be involved throughout to provide the support needed. Public agencies are recommended to focus on developing the required physical and data **infrastructure** for a multimodal transportation system. The vendors should be engaged to determine the physical and data infrastructure requirements to warrant compatibility with various software. For **data and technology**, most of the vendors already have the technologies to launch a MaaS implementation in place. The challenges are lack of data standardization and varying data privacy laws. Public agencies should work with the vendors to ensure the MaaS systems comply with policies from different levels of governing bodies. In terms of **management and operations**, the private sector is flexible filling any roles in a MaaS ecosystem. The vendor selection and role they play should be based on the specific project needs. The support which vendors provide can extend beyond the initial pilot or project launch phase to future operation and maintenance. Public agencies should take charge in **governing** the implementation. They can provide valuable direction by mandating vendor participation and developing integrated fare policy for transit agencies across the MaaS implementation geographic boundary. In **financing** the implementation, public agencies should consider a wide variety of funding options for MaaS. This may include public-private partnerships, public grants, public tax initiatives, and private investments. Many vendors underscored the importance of having a designated lead **institutional** organization that has dedicated staff for MaaS implementation. Public agencies should work with vendors to incorporate a range of **equity and public engagement** tools and features into the MaaS platform. The public agency should also be responsible for operating any subsidized fare programs for low-income or mobility challenged populations.

## EXISTING CONDITIONS

Existing MaaS infrastructure in the SCAG region includes physical, technological, and social **infrastructure**. Physical infrastructure, such as mobility hubs, curbside solutions, and electric charging stations for multimodal trip planning are either being planned or deployed at a small scale. To complement the physical and technological infrastructure construction, social infrastructure, such as public-private-partnerships and other regional funding sources, have been explored and leveraged. Overall, the existing infrastructure in the SCAG region is not in sync from a regional perspective. The largest infrastructure barrier remains the delivery of high-quality transit service.

**Management and operations** strategies of MaaS exist in the SCAG region but mode integration is still far from the requirement of a mature MaaS system. At the state level, efforts have been made to standardize information sharing, payment systems, and eligibility verification. However, the efforts have been focusing on transit only. At a regional level, transit agencies within the region have been testing mobile payment and account-based payment for different transit modes.

**Data and technology** standards have a strong base within the SCAG region and will help with MaaS implementation. Agencies like LADOT have already developed data sharing agreement examples (see Appendix F) that can be shared and distributed throughout the region. However, the ability to comply to the standards such as General Transit Feed Specifications-Realtime (GTFS-RT) remains a critical issue for smaller or rural transit agencies.

In terms of **governance** and **finance**, federal and state governments have shown support for MaaS development. At a local level, the interest in pursuing MaaS varies across municipalities. Funding sources beyond public funds, for example from the private sector, institutions, and other entities, are crucial to launch MaaS pilot programs at a local level.

Besides global and national institutions, Urban Movement Labs is a leading **institutional** organization in the SCAG region to aid MaaS development. Additional local organizations are needed to help advance MaaS in the SCAG region. The advisory group of this feasibility white paper presents a potential opportunity to formalize such an organization.

More outreach programs are needed to promote **public engagement** for MaaS. In addition, bundled mobility services should be provided to disadvantaged communities at a discounted rate, and payment barriers need to be removed for disadvantaged communities to address **equity** in deploying MaaS going forward.

## CHALLENGES AND OPPORTUNITIES

Based on the key factors that could contribute to a successful MaaS implementation, certain areas within the SCAG region have been identified as having high potential to be pilot project candidates when funding becomes available. Example areas include Willowbrook, Long Beach, Santa Ana, Moreno Valley, Ontario, Fontana/Rialto, and Oxnard.

However, several challenges still exist across the SCAG region to position these high potential candidates for implementation success. The infrastructure developments vary by county, data sharing and technology awareness continues to present hurdles in upgrading systems, the payment system is yet to be updated, and policies and regulations are not integrated enough at a regional level. There is an opportunity to leverage purchasing power as a large public group and implement funding transparency in launching pilots. When it comes to equity and public engagement, disadvantaged communities are often marginalized by technology-oriented projects.

However, opportunities also present themselves in the form of solutions or strategies to tackle these challenges, including the following:

- More planning studies related to MaaS-related infrastructure can be conducted.
- Projects can take advantage of Cal-ITP's demonstration to promote standardized data and open-loop payment trials.
- Putting the State's Leveraged Procurement Agreements into use for service and product procurement.
- Facilitating county-wide or regional policy integration.
- Creating a dedicated MaaS forum to foster collaboration and communication.
- Exploring different funding mechanisms.
- Brainstorming new outreach strategies.

- SCAG can support MaaS deployments through its regional functions such as facilitation, development, funding requirements, and regional advisory role.

## GOALS AND OBJECTIVES

The following goals and objectives have been developed based on SCAG's Connect SoCal strategy, the various analyses of this white paper, and feedback received from the Advisory Group. These include Key Performance Indicators (KPIs) to monitor multimodal transit development, sustainability, funding, equity, and regional collaboration.

1. Establish a set of key performance indicators (KPIs) to compare against baseline data:
  - Mode shift (Percentage of SOV that shifted to other modes)
  - Vehicle Miles Traveled (VMT) (Total annual VMT change)
  - Reduce Greenhouse Gas (GHG) emissions (Annual total GHG reduction)
  - Accessibility (Coverage ratio of transit service)
2. Pursue policies and strategies (e.g., transportation and land use) that facilitate the widespread implementation and adoption of more sustainable transportation modes.
3. Generate more revenue and/or funding sources to enhance transit.
4. Remove payment barriers for unbanked/underbanked population.
5. Facilitate greater regional collaboration and cooperation.
6. Identify pilot projects/locations that are inclusive to disadvantaged communities, including but not limited to seniors, disabled, low-income, and minority communities with community-based engagement programs.

## KEY STRATEGIES

Key strategies are formulated based on the opportunities and challenges that are identified per each policy framework element. Strategies include:

- Develop mobility hubs throughout the SCAG region
- Develop associated payment and digital infrastructure.
- Encourage and provide incentives to cities and transit agencies by leveraging Cal-ITP's support.
- Take advantage of the State's Leveraged Procurement Agreements for both equipment and bank processing services as a group.
- Make the implementation guide developed from this study available and/or create individual toolkits from this study for public transit providers.
- Create a comprehensive technology vendor product catalog put together by the State or SCAG to determine and tailor the management structure and meet the local pilot needs.
- Create policy incentives/enforcement for other transportation providers to have an open API ready for data sharing and system integration.
- Promote infrastructure standards such as mobility hubs and curb space for future integration across the region.
- Promote data standardization and secured data sharing by building on existing standards and principles such as GTFS, General Bikeshare Feed Specification, Mobility Data Specification, and the Mobility Data Interoperability Principles.
- All forms of funding should be explored, including agreements with private investors or local retail sponsoring campaigns in exchange for in-app promotions.



- Leverage the Advisory Group from this white paper to establish a dedicated forum to understand shared roles and responsibilities, leadership, and management for a future MaaS system.
- Launch county-led policies to encourage fare policy integration or product/service sharing at the regional level.
- Dedicated sessions discussing MaaS in regional public forums. Continuing direct public engagement to ensure MaaS investments support community needs and regional equity goals.
- Create an account-based subscription model with individual accounts that can be shared with friends and family. Discounts and subsidies can be applied for disadvantaged community families.

## IMPLEMENTATION GUIDE

The implementation guide consists of a timeline for MaaS implementation in the SCAG region, a checklist for agencies who are considering or starting a MaaS pilot, a checklist for private companies who are trying to support or get involved in MaaS pilots, and a set of performance measures to monitor the implementation.

The timeline includes a continuous action item, short-term (two years), medium-term (five years), and long-term (ten years) action items for the pertinent stakeholders in the SCAG region.

All the key strategies are incorporated into the checklist items. By applying the lessons learned from the case studies and vendor surveys and correlating this information to the existing conditions within the SCAG region, this white paper has identified the needed strategies and implementation measures to further progress toward successful MaaS deployment.

## REPORT ORGANIZATION

This report consists of seven chapters: Chapter 1 Literature Review and Case Studies, Chapter 2 Vendor Survey, Chapter 3 Existing Conditions, Chapter 4 Feasibility, Challenges and Opportunities, Chapter 5 Goals and Objectives Setting, Chapter 6 Key Strategies, Chapter 7 Implementation Guide and Conclusion. Chapters 1 and 2 draw experiences from cities across the world where MaaS has been implemented and vendors who have helped launch those implementations. Additionally, the findings from the Advisory group supplemented the research on the existing conditions of the region in Chapter 3. Chapter 4 lists the challenges and opportunities identified in the white paper and proposes high-potential areas where implementation could be considered. Chapter 5 sets goals and objectives to guide the contents in Chapter 6 and 7, where applicable strategies and an implementation guide for future actions are documented.

# CHAPTER 1- LITERATURE REVIEW AND CASE STUDIES

MaaS systems are in the early development stages, however, there are few examples where MaaS has been implemented and is currently operational. Examining case studies provides valuable information on the best practices for deploying MaaS. This research documents case studies from around the world to identify factors that have contributed to the success of MaaS implementations and provide important lessons to guide implementations in the SCAG region.

Since there are many different components that can influence the success of a MaaS system, each of the case studies are analyzed by the following six policy framework elements: infrastructure, data and technology, management and operation, governance, finance, institutional practices, and equity and public engagement.

Each case study highlights the key takeaways for the SCAG region and applicable lessons for MaaS development and implementation.

## CASE STUDY 1: HELSINKI

Helsinki is a world-leader in MaaS deployment. Helsinki originally began exploring MaaS to solve the growing air quality and traffic congestion concerns in the City. Policy makers in Helsinki made an ambitious goal to achieve carbon neutrality by 2050. To do so, Helsinki has implemented a MaaS system to reduce the number of private vehicle trips within the City.

Helsinki partnered with MaaS Global to develop its Whim app which allows users to plan and pay for their trips. The app officially launched in 2017, making Helsinki one of the first cities to successfully deploy MaaS. Whim offers users the option to pay by trip or for a monthly subscription. Whim offers two monthly subscription options: Urban (€59.70 per month/\$69.78 per month) and Unlimited (€499 per month/\$583 per month). For the Urban subscription, users receive unlimited public transportation and bicycle trips and discounted taxi rides. For the Unlimited subscription, users get unlimited use of all types of transportation. After one year of implementing MaaS, approximately six percent of Helsinki's population (approximately 70,000 people) had an active Whim account.

Helsinki effectively implemented a full-scale MaaS system in a short timeframe- the creation of the MaaS system to testing operation took less than three years. The following sections describe the different components that played a role in the initial success of Helsinki's MaaS system.

### Infrastructure

One of the biggest advantages Helsinki had in implementing MaaS was its existing infrastructure. Helsinki is a densely populated region, and, prior to the implementation of MaaS, people could already use one fare system across Helsinki's public transit network. Helsinki's buses, trams, regional trains, ferries, and other forms of public transit were already integrated into one payment system which allowed for an easier transition to develop MaaS within the City.

### Data and Technology

In terms of the digital platform, Helsinki worked closely with the private sector to launch the Whim app. The private sector developed the app and coding that enabled MaaS in Helsinki. Helsinki requires all mobility operators to provide essential data

on their services and make their ticket sales and reservations accessible from an API. This allows all providers to be easily incorporated into the Whim app. The collaboration with the private sector and the policies related to data sharing helped Helsinki expedite its deployment of MaaS.

Helsinki's MaaS system offers users direct access to bike sharing, taxis, car sharing, and conventional rental cars in addition to publicly operated transit. The Whim app requires users to have a smart phone. Finland's extensive 4G network and the high percentage of households that have smartphones have made the Whim app accessible to a significant portion of the population in Helsinki.

To allow people to use MaaS when they are traveling to other countries and cities, Whim developed a roaming feature. Roaming allows people to pay for trips in their own currency and without the need for additional registrations or forms of payment while they are traveling.

### Management and Operations

The Whim app allows users to access public transit, bike sharing, taxis, car sharing, and conventional car rentals. While the app integrates most transportation services in Helsinki, one of the main difficulties that Helsinki has encountered was that some service operators did not want to be integrated into the MaaS system because their competitors were also participating in the app. For example, if there were two bike share companies incorporated in the app, then the companies would be directly in competition with each other, and the app would recommend each other's competitor for certain trips. Other mobility service providers had technical difficulties getting incorporated into the app. These difficulties demonstrate the importance of coordinating with private mobility service providers and understanding their objectives during the development process. Another obstacle Whim needs to overcome is the number of countries and cities in Europe and how much they interact with each other. Whim enables roaming mode which allows users to pay everything in Whim's app in their own currency without any need for additional registration or forms of payment.

Whim offers a variety of payment options for users, including a pay-as-you-go option and an unlimited access pass. This range of payment models allows people to select the plan that works best for their needs. Additionally, Whim strives to ensure that subscribers can access different modes of transportation. Whim views rapid access to transportation services as one of the main keys to a successful deployment of MaaS.

### Governance

Helsinki opted to use a commercial integrator model to implement its MaaS system. A commercial integrator model is where the MaaS operator signs bilateral agreements with several transportation operators. This structure allowed Helsinki to deploy MaaS with minimal investment from the government and allowed the system to be user-friendly and integrate different mobility services. However, this model can lead to a system which favors the interests of the private company and has the potential to limit the City's involvement in the operation of MaaS. While there are some disadvantages to having a private company deploy and operate the MaaS system, this model has been working for Helsinki as the objectives of the operators and government largely align. This approach allowed the City to deploy MaaS on a faster timeline because it leveraged their experience in rolling out similar systems elsewhere and in managing the operation of MaaS systems.

## Finance

Helsinki's MaaS system was primarily funded through private entities. In 2015, €0.7 million (\$0.8 million) was raised by Transdev, Karsan, VR, Uber, and several other companies. A new round of fundraising in 2017 brought in €14.5 million (\$16.9 million). For the 2017 round of funding, several new investors contributed, including Toyota, Mitsubishi, and the real estate developer Mitsui Fudosan. This additional funding allowed MaaS Global to launch the commercial version of its Whim app in late 2017. In 2019, the company received €29.5 million (\$34.4 million) from private investors which brought the total investment to €53.7 million (\$62.7 million). MaaS Global also won the Global Unicorn Award in 2019 which further helped the company add new features and functionality to the Whim app.

## Institutional Practices

Business Finland's R&D funding provides loans and grants to companies seeking to conduct research and development activities. The program helps companies build international partnerships and helps companies begin providing service in new markets. This funding source helped MaaS Global, the operator of Whim, develop its MaaS platform and launch service within Helsinki.

## Equity and Public Engagement

The Whim app mainly targets commuters who are used to using several different modes of transportation. The unlimited subscription offer starts at €499 (\$565) per month which is a financial barrier for some users. As a result, six percent of Helsinki's population (approximately 70,000 people) had an active Whim account after the app's first year in operation.

One of the main lessons learned from deploying the Whim app is that communication with the public is very important. Since Whim offers several different packages for customers, it was very important to communicate what was included in each package and how the pricing worked for people to download, use, and subscribe to the app.

## Key Takeaways

Based on the information above on the Helsinki Case Study, SCAG can learn from the following key takeaways:

- 1. Infrastructure:** Having an integrated transportation network before implementing MaaS can lead to a more seamless deployment of MaaS.
- 2. Data and Technology:** Using an app that has been developed by a private company can streamline the implementation of a MaaS system.
- 3. Management and Operation:** Offering a variety of subscription packages can allow users to select a plan that best meets their needs. Having an account-based system will help users better manage multimodal trips, simplify payments, and enhance the overall user experience.

- 4. Governance:** Having a private company operate the MaaS system can minimize government investment. Even with a private operator, public agencies can still be involved with coordinating mobility operators. Requiring all mobility operators to provide essential data on their services and make their ticket sales and reservations accessible from an API can streamline the development of MaaS.
- 5. Finance:** Having a private company operate the MaaS system can attract private funding.
- 6. Institutional Practices:** Innovation and entrepreneurship loans can help the private sector develop a MaaS system.
- 7. Equity and Public Engagement:** Communicating with the public is very important for a successful deployment of MaaS.

## CASE STUDY 2: MANCHESTER

Transport for Greater Manchester (TfGM) is the public body responsible for coordinating transportation services throughout Greater Manchester in North West England. TfGM began developing a MaaS system in 2017. TfGM and its partners saw MaaS as a critical component of the transportation system that would be needed to achieve many of TfGM's 2040 goals, including:

- Making travel easier, seamless, flexible, and more affordable,
- Reducing traffic congestion from private car trips,
- Improving quality of life and protecting the environment,
- Developing an innovative city region, and
- Supporting sustainable economic growth.

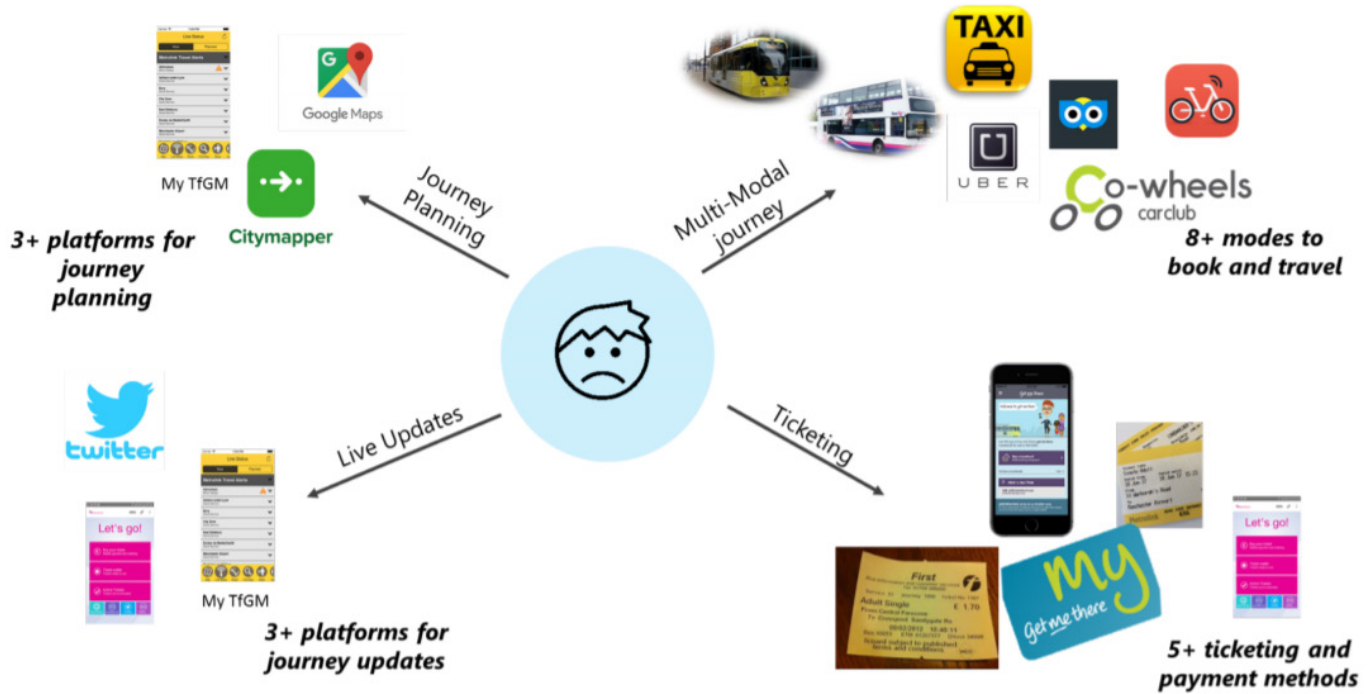
To achieve these goals, TfGM wanted to create a transportation solution that would make transit, bike share, car share, and Transportation Networking Companies (TNC) easier to use.

**Figure 1** demonstrates the problems TfGM users currently face when trying to move across different modes of transportation. These problems can be summarized as follows:

- Repetitive trip planning platforms that cause confusion;
- Different transportation modes are not integrated;
- Inconsistent platforms between trip planning and trip updates and;
- Ticketing and payment methods are not organized and tailored for customers' usages and preferences.



**Figure 1: TfGM Customer Experience without MaaS**



Source: Transport for Greater Manchester

TfGM created a multi-year, phased approach to explore MaaS in Manchester. The first phase served to test the concept of MaaS and began in January 2018. This phase had 39 participants, and it was operated as a concierge service where an operations team helped users find the best way to get to their destination. This first phase of deployment received positive feedback from participants. By the end of the study, the participants reported increased willingness to use transit and active modes of transportation than before the trial. Participants also reported that the real-time updates on services and integrated ticketing decreased trip planning-related stress.

The second phase of MaaS development was a pilot project called IMOVE. IMOVE was launched in August 2019 and had 62 participants. TfGM worked closely with Fleetondemand’s Mobbileo platform to consolidate multiple modes of transportation for the project into a single IMOVE branded app. To allow passengers to move seamlessly between modes, the app included buses, trains, trams, cars for hire, and car share programs that could be used as part of a traveler’s journey. At

the end of the pilot, the participants unanimously agreed that MaaS would be a benefit to the Manchester region.

The third phase of development was a pilot project called MaaS4EU. As shown in **Figure 2**, MaaS4EU was a larger effort that included a total of three case studies across Europe: Luxemburg-Germany, Budapest, and Manchester. The goal of this pilot project was to develop a framework for MaaS and remove barriers for the implementation of MaaS. MaaS4EU launched in December 2019 in Manchester and had approximately 150 participants. This pilot was similar to the IMOVE pilot, but also added subscription packages. However, the MaaS4EU program was greatly impacted by the COVID-19 pandemic. With the public lockdown, the use of public transportation greatly declined, which made it challenging to effectively implement the pilot program since the primary goal of implementing MaaS is to encourage mode shift to public transportation.

**Figure 2: MaaS4EU Pilots Summary**

Location	Operator	Business channels	End users
Budapest	independent company is the operator	business to customers (B2C)	locals, tourists
Manchester	public transport authority is the operator	business to business, business to customers (B2B, B2C)	locals, tourists
Luxembourg	mobility service provider is the operator	business to business, business to customers (B2B, B2C)	locals

Source: <https://www.interreg-central.eu/Content.Node/Learning-from-MaaS4EU.pdf>

Another pilot phase, known as MaaSEVOII was planned; however, due to COVID-19, the pilot has been indefinitely postponed.

While the COVID-19 pandemic has postponed the development and implementation of MaaS in Manchester, the initial pilots did show promise in the region. The following sections describe the different components that played a role in the initial success of the pilot projects.

## Infrastructure

Before TfGM began implementing MaaS, the region already had a variety of alternative modes of transportation which included buses, trains, trams, TNCs, and car shares. The variety of modal options made it possible for TfGM to offer users the most efficient ways to get to their destinations. In the future, TfGM plans to explore integrating other emerging modes of transportation, including automated vehicles and on-demand transportation options.

One of the lessons TfGM learned through its pilot programs is that MaaS must be scalable. In this regard, MaaS should be capable of providing opportunities to grow its network within and between MaaS initiatives and Public-Private Partnerships. These growth opportunities will allow new transportation infrastructure to emerge, increasing the options available to users. MaaS should allow for new business models to emerge, including joint ventures and partnerships between public and private entities—such as transportation service providers and business sponsors—and rely on the adaptation and new travel behavior of end-users and their willingness to share their travel information. Hence, peoples' active involvement in formulating the business models and associated infrastructure provision would become significant. Engaging the end-users in development processes will open previously unseen potential for cities and businesses. The success of the above will help MaaS offer flexible, customized, and competitive mobility package alternatives, such as carshare, cycle hire, and on-demand services to various customers.

## Data and Technology

To develop a digital platform to support MaaS, TfGM had to work with partners to create an interface that users would want to use. One of the critical components of making MaaS work was integrating multiple Application Interface Programs (API) to allow for connectivity between mobility services, data integration, and open interfaces for MaaS operators to test their services. These features enable the MaaS digital platform to include:

- Fare payment integration;
- Bookings across multiple modes of transportation;
- Real-time fleet availability; and
- Real-time information on schedule delays and traffic.

Access to data was supported by a data management infrastructure consisting of a published subscribable middleware for real-time access and a scalable data repository (based on big-data, no-Structured Query Language (SQL) technologies) for storing non-real-time information. It was important to create a common information model that achieves the necessary operation between the existing data sources of several mobility service APIs.

One of the key ambitions of MaaS4EU was to enable the combination of Open APIs to support the development and coordinated deployment of multimodal mobility apps and services. In MaaS4EU, a Common Information Model was created to achieve interoperability between the existing data

sources of mobility service APIs. The model established a common ground for the development and the coordinated deployment of specialized mobility apps and services, taking into account the diversity of existing standards and the required policies concerning security. Essential products to develop included:

- **Interoperable APIs** for mobility services interconnection, including fares, booking, fleet characteristics, available facilities;
- **Data adapters** for transportation data integration, including timetables, disruptions, available facilities, traffic information; and
- **Open interfaces** for MaaS operators to develop and test their services.

Data analytics was key to the data management infrastructure, and the business intelligence provided by analytics gave insights to optimally leverage and monetize the services. The data analytics help adapt and design services to usage patterns, create attractive service offerings, adapt and forecast capacities to usage needs and deliver the best user experience.

The system also provides personalized support and advice during service selection based on an elaborate user profile that captured individual preferences, habits, restrictions and requirements and inferred optimal offerings that satisfy travelers' needs with the optimal mixture of services at the right price. To address issues emerging from oversubscription or network disruptions and optimal usage of resources, the platform optimizes supply and demand by allocating and coordinating the available mobility resources. Recommendations will be offered to users, informing them how to efficiently use their MaaS subscriptions, minimizing the burden of coping with a multitude of mobility options.

The booking, digital ticket wallet and payment settlement provide a one-stop-shop access to the mobility services of the platform.

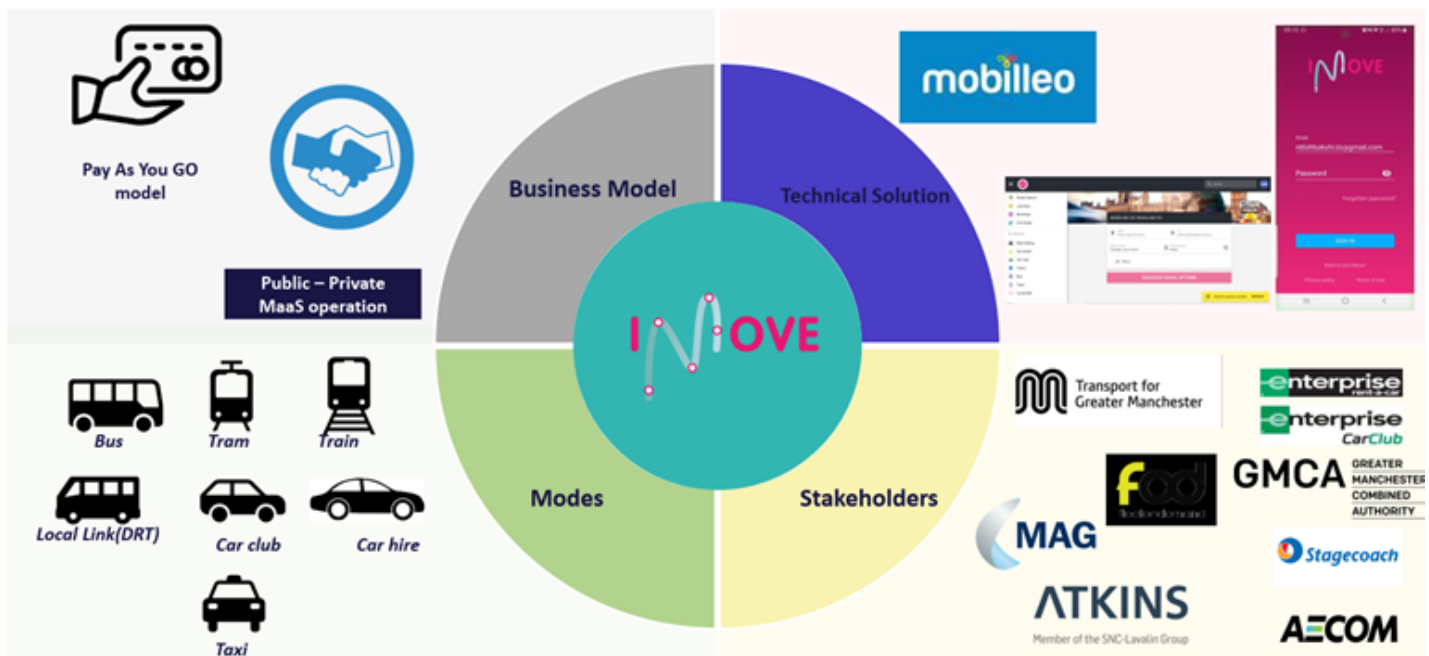
Manchester's implemented profile feature was a main component that made the platform work well for users. The user profiles allowed people to set their preferences for the modes they were comfortable using, which made it easier for people to adjust to the MaaS system. The platform also gave people "nudges" to encourage them to change their travel behavior, including offering them the ability to opt to use other modes of transportation instead of their cars.

## Management and Operations

For the proof-of-concept pilot, TfGM managed and operated the MaaS system. However, for the IMOVE pilot, TfGM partnered with several different stakeholders to make the pilot happen. As shown in **Figure 3**, the IMOVE partnership included Mobbleo, which developed the digital MaaS platform as well as several other public and private partners.

The MaaS4EU also had a combination of public and private partnerships that made the pilot possible. One of the challenges that TfGM faced with the public-private partnership (P3) approach was the balance of interests between the public and private sector partners. TfGM found that each stakeholder had its own interests and objectives which made it challenging to agree on decisions at times. In the future, TfGM would like to better understand the business case for the private partners to create a more mutually beneficial management model.

**Figure 3: IMOVE Partnership Approach**



Source: Transport for Greater Transit

One of the management challenges TfGM experienced with the IMOVE and MaaS4EU pilots was finding the right balance between public and private input and provisions. The public and private sectors have different goals for the MaaS programs. Another challenge was integrating fare payment and traveler information. With many service providers included in the pilots, it was challenging to create a fare and information system that worked for all the stakeholders. There was also a large variation in user needs depending on the context of the environment. What works in an urban area may not work in a suburban or rural area.

## Governance

The United Kingdom does not currently have a MaaS framework established. As a result, TfGM had to experiment with different management structures to see what would work in the region. With each of the different pilots, TfGM tested different ways to manage MaaS.

A number of governance models were identified for MaaS:

- **Model A:** TfGM is the MaaS operator and uses in-house resources – direct
- **Model B:** TfGM is the MaaS operator but outsources all its responsibilities (becomes commissioning authority) – external provision of services
- **Model C:** TfGM is the MaaS operator but outsources all its responsibilities except financial transactions – operational commissioning
- **Model D:** TfGM is part of a MaaS joint venture formed to manage and operate the system – joint provision, e.g., partnership
- **Model E:** TfGM is the MaaS operator but shares platform/resources with other providers to make financial savings and bring efficiency – Spin-out, mutual
- **Model F:** Private sector is the MaaS operator and has its full control on its operation – private sector operation - TfGM concluded that Models D and E were the preferred models for Manchester.

TfGM is still working to identify which framework works best for the region. During the first proof of concept pilot, TfGM used Model A. The other pilots used Model B for the other pilot programs. However, the decision to use these models was based on the resources available to TfGM to complete the pilots as opposed to preferred governance models. TfGM is still trying to determine what the right level of regulation is that will balance safety and interest from investors. Additionally, TfGM needs to determine how data will be used and stored.

## Finance

The commercial model was a work in progress; however, one potential commercial model was set out by TfGM. The model involved 'pump priming' externally sourced funding for TfGM to set up, data, advertising and benefitting from their party revenue (advertising, levies, etc.). Pump priming is the activity of raising external money to help a business, program, economy, etc. to develop. Operators would benefit from increased patronage, efficiency cost savings and income from farebox cuts. Users benefit from an improved transportation option and pay fares (subscription, per journey or pre-paid) for use. A balanced commercial model was not yet identified as part of this pilot; however, discussions with operators were ongoing. Further work was needed to fully understand the workings of the costs and benefits of the MaaS system from a financial perspective.

## Institutional Practices

TfGM continues to support MaaS in the Greater Manchester region.

## Equity and Public Engagement

The first two MaaS pilots in Manchester received a lot of positive feedback from the participants. In this pilot, from 230 volunteer residents, 39 participants were chosen to take part in the live trial. In-depth research, such as interviews and ride-alongs, highlighted some of the key issues that Manchester's commuters face. Participants received daily, personalized travel plans, including buses, trams, car-share, taxi, bike-share, on-demand shared mini-bus and walking – all offered through a single ticketing option. Real-time travel updates were provided along with re-routing during travel disruptions. A personal profile was created for each participant, and behavioral 'nudges' were sent to encourage changes in travel behavior. A quarter of nudges were accepted by participants, with responses providing early indicators of what motivates individuals to change their travel behaviors.

In the proof-of-concept pilot, 26 percent said that they were willing to use public transit more often and 21 percent said that they were willing to use active transportation more often.<sup>1</sup> In the IMOVE pilot, 100 percent of participants thought that MaaS would be beneficial to the region.

Overall, results from the real-world trial were "very encouraging". Six months after the trial, 82 percent of participants said they wanted MaaS back, a third of car owners wanted to give up their vehicle, and the majority were willing to increase their monthly travel spending for MaaS. The authority concluded that there was a strong strategic case for TfGM to invest in MaaS and that MaaS could be a significant tool in achieving TfGM's objectives, along with the wider city goals for sustainability and economic growth set by the Mayor. These examples demonstrate that there has been positive feedback regarding the public's acceptance of MaaS.

### Key Takeaways

Based on the information above on the Manchester Case Study, SCAG can learn from the following key takeaways:

- 1. Infrastructure:** MaaS will meet most people's needs when the existing infrastructure enables a variety of different transportation modes for users to choose.
- 2. Data and Technology:** Digital platforms should not only present options for users to customize their preferences but encourage users to try alternative transportation modes while meeting their needs. As mentioned above, systems can be designed to provide personal support and advice such as daily personalized travel plans. Incorporating features such as this that "nudge" users to use alternative forms of transportation can encourage behavior change in the long run.
- 3. Management and Operation:** Creating an effective P3 can be challenging. There may be different goals between public and private stakeholders, so it is important to establish a decision-making framework early in the implementation process to facilitate cooperation between partners.
- 4. Governance:** Manchester does not have an established governance model. Manchester is trying to develop a governance framework that balances the interests of private companies with safety and other community priorities.
- 5. Finance:** Manchester is still working on identifying a financial model for MaaS. TfGM provided most of the funding for the initial pilot projects.
- 6. Institutional Practices:** TfGM continues to support MaaS in the Greater Manchester region. Doing multiple MaaS pilots with different management structures can help identify which structure works best for the local stakeholders that are involved.

- 7. Equity and Public Engagement:** Pilot programs can provide valuable information in establishing the baseline of public's interest in MaaS.

### CASE STUDY 3: VIENNA

Vienna is another world-leader for MaaS. Vienna made its first attempt at implementing MaaS in 2012 with its SMILE (Simply MOBILE) app. The SMILE app was developed by a consortium that was headed by the Austrian Federal Railway Company and the City of Vienna Utility Company. To develop the MaaS platform, the project received about €7.7 million (\$9 million) from the Climate and Energy Fund and the Austrian Research Promotion Agency. The consortium included several private companies, including Fluidtime and NTT (The Nippon Telegraph and Telephone Public Corporation) Data. These companies led the development of the app. The app included trip planning and integrated payment systems across rail services, car sharing, bike sharing, taxi services, and other transportation services. Users paid for what they used, and there were no subscription options. The SMILE app was not a successful deployment of MaaS, and the service terminated in 2014 due to funding issues and disagreements between partners in the consortium.

While the SMILE app was not successful, Vienna has continued to implement MaaS platforms. Following the failure of the SMILE app, the Austrian Federal Railway Company and the City of Vienna Utility Company each decided to develop their own MaaS platform. The Austrian Federal Railway Company co-founded iMobility to develop the Wegfinder app that was released in 2016. The Wegfinder app provides multimodal information and ticketing all over Austria. On the other hand, the City of Vienna Utility Company partnered with Upstream to develop the WienMobil app which launched in 2017. The WienMobil app provides trip planning and payment integration only within Vienna.

In 2019, Whim launched in Vienna which provides another MaaS option for residents in Vienna. Whim partnered with Wiener Linien (which manages five subway lines, 28 tram lines, 129 bus lines and 5,390 stations), the taxi company Taxi 31300, Tier Scooters (from Feb 2020) and the City Airport Train (CAT).

Unlike other case studies, Vienna has three active MaaS platforms that are all operational. Considering that local contexts largely shape the success of the MaaS in integrating with other services, MaaS applications are primarily deployed in towns where the offer of alternative services to private cars is robust and attractive. The level of integration of pre-existing modes of transportation in the area is a determining factor in what is offered via the MaaS program. For example, WienMobil has replaced the public transportation network application which helped WienMobil grow in popularity.

The following sections describe the different components that played a role in deployment of these different systems.

### Infrastructure

Before MaaS was implemented in Vienna, public transportation was already the main mode of transportation in Vienna, with 39 percent of all trips made within the City being completed by transit. This high percentage of the population using public transportation created a large market for MaaS from the start. This demonstrates that the success of MaaS is largely shaped by local contexts. When MaaS is deployed in towns that already have a robust and attractive public transit system, MaaS is more likely to be successful.

Vienna also had an extensive multimodal transportation market

<sup>1</sup> <https://www.smartcitiesworld.net/special-reports/special-reports/manchester-road-tests-maas>



that included five rail lines, 129 bus routes, 28 tramway lines, nine express transit routes, eight e-scooter operators, 1,600 cars from car-sharing services, and 120 bike sharing stations. The variety of multimodal transportation options creates a robust network that allows people to utilize several different modes to complete their trips.

## Data and Technology

The SMILE app was built on a combination of routing, transportation providers, payment and mapping APIs which gave users the ability to look for information, plan and book different transportation solutions for their trips. While the SMILE app managed to integrate many different services and was fairly successful during its trial, the project was ultimately terminated in 2014 due to funding and partnership challenges.

WienMobil is a Level 3 MaaS service that includes the integration of information, booking, and payments. The WienMobil app provides users with direct access to public transportation, car-sharing, and bike sharing for the booking and payment. It has an option to call the taxi company, but it has a lower level of integration compared to the Whim app.

There were several factors that streamlined the development of the WienMobil app, including:

- A diversified and efficient mobility system
- Open data and data exchange infrastructure
- Open ticketing systems
- Good coverage by the mobile phone network and WiFi availability
- Facilitated physical intramodality

Another factor that has made WienMobil successful is that Vienna has been gradually making the WienMobil app the primary source of information for several of its transportation services. For example, people need to use the WienMobil app to find information on bus route schedules. This strategy significantly increased the usage of the app.

The WienMobil app uses anonymous Global Positioning System (GPS) data to determine which routes are best to use. Users authorize the use of GPS data through the app's setting, and approximately 50 percent of users have authorized GPS data to be used.

## Management and Operations

The SMILE project was terminated at the end of 2014, mainly due to the end of public funding as well as the divergences between the companies that had led it. Each of the involved companies (the City of Vienna Utility Company and the Austrian Federal Railway Company) decided to develop their own MaaS solutions. Austrian Federal Railway Company co-founded, in partnership with an Austrian venture fund, a start-up called iMobility, released the Wegfinder app in 2016.

The City of Vienna Utility Company founded a start-up subsidiary called Upstream in 2015. Upstream released the WienMobil app in 2017. The integration of mobility services that WienMobil offers is the result of the partnership between the Wiener Linien and various partner service operators. However, the range of transportation options was reduced when a car-sharing operator withdrew from the partnership to develop its own application. In the future, the City of Vienna will require bike share and car share providers to be integrated into the WienMobil platform.

## Governance

There are five different roles that government entities can take in the implementation and operation of MaaS, as summarized by **Table 1**.

Different entities that participated in developing MaaS in Vienna took on different types of governance roles. The Austrian Federal Railway Company took a Governing by Doing approach in its WegFinder project by leading the project, being the main operator of the system, and forming the Foundation of iMobility. The City of Vienna Utility Company took both a Governing by Doing and a Governing by Enabling approach. The City of Vienna developed several of the projects leading up to the WienMobil app, including, the Qando trip planning app and the WL ticketing app. For the WienMobil app, the City of Vienna Utility Company took a Governing by Enabling approach by working with Upstream to develop the platform.

There are many advantages to the Governing by Enabling and Governing by Doing approaches for WienMobil. Since the government took an active role in the deployment of MaaS, the government has the ability to impose fair and non-discriminatory rules and facilitate competition between MaaS operators while the private operators still have opportunities for innovation.

## Finance

The SMILE project was funded in 2012 by the Climate and Energy Fund. Later on, the Austrian Research Promotion Agency (FFG) also contributed funding to the project. The project received about €7.7 million (\$9 million) in total.

After the SMILE project was terminated, the funding for the SMILE project was reallocated to the WienMobil app. Initially, these funds provided €500,000 (\$556,112) per year. Later on, the City of Vienna contributed additional funds to the project. The subsequent costs are part of Wiener Linien's Research and Development budget which is included in its contractual agreements.

In Vienna, there are two main types of costs for operating MaaS: Information Technology (IT) costs and Legal Costs. The IT costs can range from several hundred thousand euros to a million euros per year. These costs cover expenses such as adapting products developed by companies to local specificities, the development and installation of digital products, the development of new features, and integrating new features and operations. The legal costs cover the lawyers who work on agreements between various entities.

## Institutional Practices

The WienMobil app and the Wegfinder app both have a partnership between public and private entities. While the private entities developed the applications for both of these agencies, the public entities view themselves as the MaaS operators. The public entities funded the development of the apps which allows the agencies to have more control over the system.

## Equity and Public Engagement

The SMILE app was the first indicator of strong public acceptance of MaaS in Vienna. The SMILE app resulted in:

- A 21 percent reduction in car use;
- A 22 percent increase in the use of public trains;
- A 10 percent increase in bike sharing;
- A 4 percent increase in car-sharing; and
- An overall increase in intermodal journeys

**Table 1: Governing Approach for MaaS**

Governing Approach	Actions for MaaS
Governing by Authority	<ul style="list-style-type: none"> <li>• Develop specific legislation/regulation enforcing the development of MAaS in a top-down fashion</li> <li>• Procure MaaS to a third-party through traditional tender mechanisms</li> </ul>
Governing by Enabling	<ul style="list-style-type: none"> <li>• Initiate public-private interactions</li> <li>• Define vision with strong quantitative objectives</li> <li>• Provide funding</li> <li>• Influence negotiations in favor of MaaS and leverage MaaS opponents using horizontal network governance</li> </ul>
Governing by Doing	<ul style="list-style-type: none"> <li>• Develop a MaaS solution in-house in the closed manner</li> <li>• Minimize collaboration with third parties</li> </ul>
Self-Governing	<ul style="list-style-type: none"> <li>• Provide all government employees with MaaS solutions to show the example for citizens to follow</li> </ul>
Governing by Laissez-Faire	<ul style="list-style-type: none"> <li>• Refuse to get involved in the development of MaaS</li> <li>• Adopt a wait-and-see approach</li> </ul>

Source: Audouin<sup>2</sup>

These statistics demonstrate a high acceptance of MaaS in Vienna. Currently, the WienMobil app is widely used in Vienna with one-third of the population as active users. Similar to other MaaS platforms, WienMobil mainly targets commuters that use several modes of transportation. One of the challenges WienMobil has experienced with improving user acceptance is the high service fees that are currently charged as part of the service. The user penetration data for the other MaaS apps, Whim and Wegfinder, is not publicly available as of this writing.

Another observation from Vienna’s MaaS deployments is that weather plays a role in the public’s engagement of MaaS. Inclement weather can decrease the usage of bikes and scooters which can lead to less usage.

### Key Takeaways

Based on the information above on the Vienna Case Study, SCAG can learn from the following key takeaways:

- 1. Infrastructure:** Starting with a well-connected public transit system that attracts ridership can make it easier for the public to embrace MaaS.
- 2. Data and Technology:** Partnering with a private company can make it easier to develop a working digital MaaS platform. All the digital MaaS platforms in Vienna were developed by the private sector.
- 3. Management and Operations:** Having a private company develop the app does not mean that a public entity has to give ownership to the private company. If the public entity funds the project, the public entity can remain the main operator of the system.

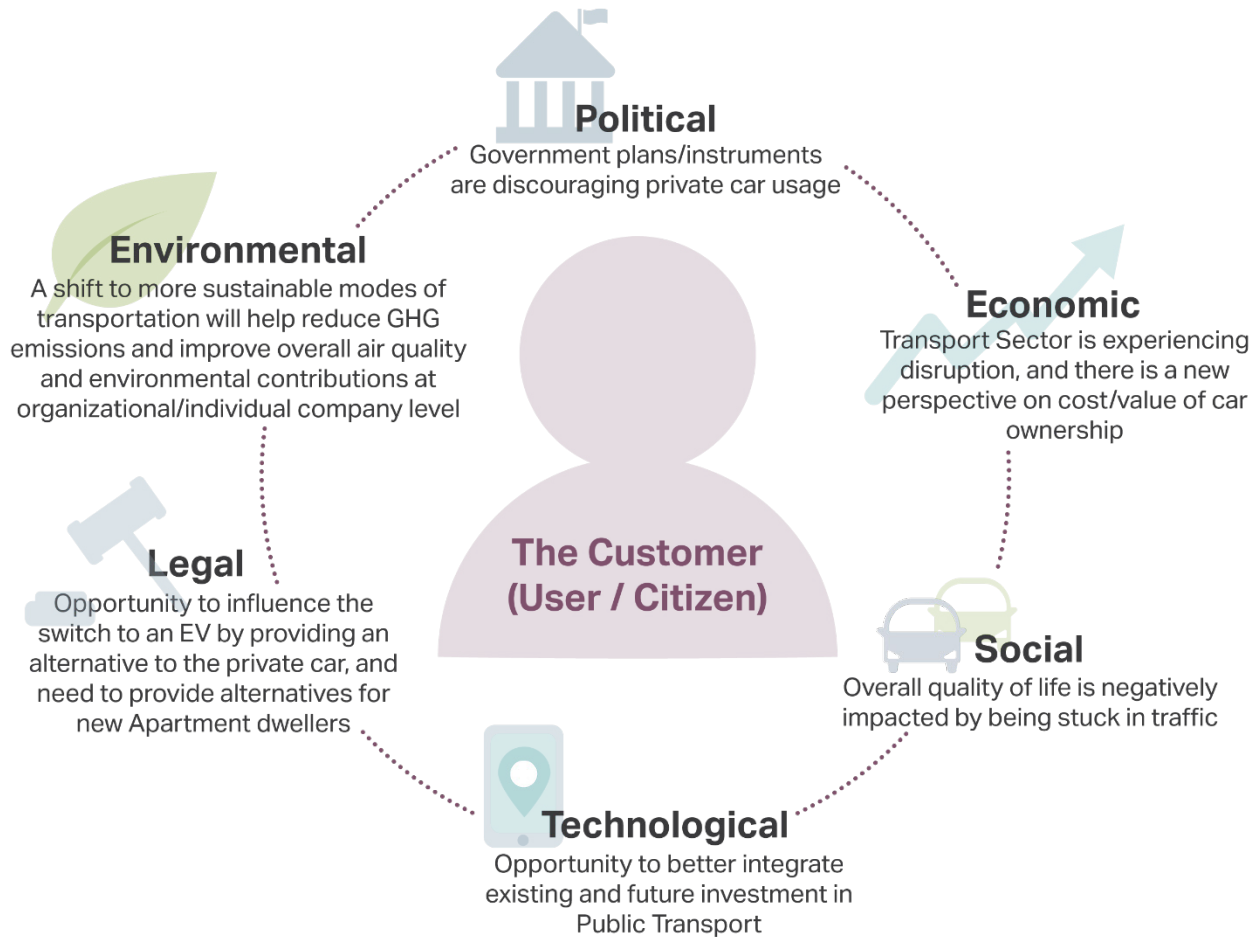
- 4. Governance:** There has not been official legislation on MaaS passed in Austria. The public sector has been the main driver of MaaS in Vienna and remains the primary operator of MaaS. The government in Vienna has primarily taken a Governing by Enabling and Governing by Doing approach.
- 5. Finance:** The initial deployment of MaaS was funded through public research funds. The public sector continues to provide most of the funding for its WienMobil MaaS platform.
- 6. Institutional Practices:** Coordinating with institutional partners is vital to the successful implementation of MaaS. The main reason SMILE failed was difficulties with communication between partners. Funding MaaS with public funds allows the public sector to have more control over operations.
- 7. Equity and Public Engagement:** Vienna had a strong public transit ridership base and high level of engagement with alternative transportation modes other than private vehicles before implementing MaaS. This made it easier for the public to adopt MaaS and travel across multiple modes. Since implementing MaaS, Vienna has observed a decrease in car usage and an increase in public transit usage.

<sup>2</sup> <https://www.sciencedirect.com/science/article/pii/S2352146519304144>

## CASE STUDY 4: DUBLIN

Dublin began developing MaaS in 2018 with the goal to change how people move around the city. As shown in **Figure 4**, there were several driving forces that caused Dublin to explore MaaS implementation.

**Figure 4: Dublin Driving Forces to Explore MaaS**



Source: Smart Dublin/AECOM

In 2019, Smart Dublin published a report called Recommendation to Initiate a MaaS Programme in Dublin. This document outlined the recommended roadmap for implementing MaaS in Dublin. Some of the key actions outlined by the plan included conducting additional studies to determine the readiness to implement MaaS, coordinate MaaS implementation with mobility hub development, and set design principles and data standardization guidelines. This document also established that MaaS in Dublin should be publicly led to give the most control to public authorities and deliver the most societal benefits to the public. However, some of the establishments could not be incorporated into the Smart Dublin pilot because it is not developed enough to be promoted to the general public.

Smart Dublin currently has a trip planning platform called mymobilityhub which allows users to search and book their trips based on real-time data. The platform has integrated bikes, public transportation, eCars, eBikes, and BleeperBike. It provides users with the option to track their travel behaviors and sustainability scores. This platform does not offer an integrated payment system across modes as it is currently focusing on serving enterprises/businesses rather than the

general public. However, there is an on-going discussion about integrating some of the existing payment systems.

While there have been workplace-specific deployments of MaaS, Dublin is in the process of conducting a MaaS Feasibility Study to understand how MaaS can be applied citywide. The following sections describe the different components that played a role in the development of MaaS in Dublin.

### Infrastructure

While Dublin has not implemented a full-scale MaaS system, it has taken several steps with its infrastructure to enable a future development. One of the most notable infrastructure investments is mobility hubs. Dublin recently launched a mobility hub pilot which allows people to take transit to work and then use e-cars, e-bikes, and push-bikes throughout the day. The mobility hub creates an area where a range of transportation modes are easily accessible to users to start, end, and make transfer of their trips, and potentially make payment for their trips, which are necessary for a MaaS deployment.

Additionally, in Dublin, most of the infrastructure is currently dedicated to cars that are parked 95 percent of the time. However, when cars are not individually owned, they will not need as much parking. As a result, Dublin is exploring how parking spaces can be repurposed to support pickup and drop off areas as well as dedicated places to park bikes and scooters.

The Dun Laoghaire Rathdown County Council (DLRCC) invested in eBikes to support their employees in making sustainable choices and reduce the need for car ownership. With the rise of eBikes and eScooters, Dublin plans to explore how to deliver safe infrastructure for these emerging modes. Many eBike and eScooter riders do not feel comfortable on roads which can cause conflicts with pedestrians. As a result, it was important to invest in infrastructure that will create a safe and comfortable environment for these modes of transportation.

## Data and Technology

Dublin has implemented the trip planning platform called mymobilityhub. While this app does not include an integrated payment system, it does allow users to plan their trips across multiple modes. This app is a prototype of a mature MaaS digital platform.

The mymobilityhub platform is designed to allow people to optimize their travel options. The platform integrates trip planning for public transportation, eCars, eBikes, BleeperBike, and other private travel options. It is intended to allow people to make more informed travel choices which results in a more efficient use of assets and a reduction in carbon emissions. The mymobilityhub platform tracks performance against emission-focused climate targets which helps government officials with managing assets and implementing transportation and environmental policies.

In preparation for implementing a MaaS system that includes integrated payment systems, Dublin is focusing on expanding and finalizing its mobility choices. Some of the priority actions include:

- Providing service in areas where high-capacity transit is not viable;
- Providing first/last mile connections to high-capacity transit to maximize the benefits of the investment;
- Enabling people to choose the mode that is appropriate for their trip depending on trip distance and purpose;
- Providing bikes or e-scooters, so trips can be made in a more sustainable manner; and
- Providing access to more modes of transportation.

The mymobilityhub team is currently working in collaboration with Trinity College Dublin to complete the development of the app for a MaaS system. The goal is for the platform to take into consideration people's circumstances to offer tailored options to users. The MaaS platform will integrate information from different modes of transportation across theCity while using advanced analytics to create seamless options.

Dublin views data sharing to be a key consideration and potential challenge to implementing MaaS. As a result, DLRCC plans to develop a digital MaaS platform with data protection measures to facilitate data sharing.

## Management and Operations

With the existing mymobilityhub platform, the app successfully provided DLRCC staff with access to three company pushbikes, more than 500 BleeperBikes, three electric bikes, four electric cars, a network of 220 trains, and a network of 3,000 buses.

While Dublin has not implemented a full-scale MaaS application

at this time, Smart Dublin and DLRCC have identified the actions that need to be taken in order to successfully deploy a MaaS system. The key actions include:

- **Formally initiate a MaaS Program:** A MaaS program should be initiated by a consortium of the relevant public bodies and other key stakeholders. This consortium should be comprised of mutually beneficial partnerships between public and private entities
- **Perform a MaaS Impact Assessment:** Each stakeholder should perform a high-level impact assessment as to how a Public-Led MaaS solution will impact their projects
- **Perform a MaaS Readiness Assessment:** Engage a service provider to perform a readiness assessment to implement a MaaS solution. This activity would work backwards to identify the building blocks needed to deliver a MaaS solution and the status of these building blocks locally
- **Trial of a MaaS solution:** The newly formed MaaS program should engage with white label MaaS solutions to do a trial solution for Dublin.

In addition to these actions, stakeholders also need to work towards identifying community mobility needs and gaps within the existing system. To address the community mobility needs, Dublin will continue exploring ways to integrate new mobility services within the public transportation system. Additionally, as new mobility services go into service, Dublin plans to explore ways to repurpose existing parking lots.

Other considerations that Dublin plans to take into account in its development of MaaS include the ability of MaaS to reflect public goals, respect consumer choices, provide a wide variety of transportation choices, provide flexibility for public authorities, and encourage innovation and mobility.

## Governance

There are currently no central government plans in place to deploy MaaS. There have not been any discussions with transportation operators at this point in time.

While there is not any framework in place for MaaS at this time, Dublin has identified five main areas of governance that need to be developed. These areas are:

1. Policy, Regulation, and Legislation
2. Data
3. Citizen Engagement
4. Technology
5. Payment Settlement and Revenue Recognition
6. Finance

## Finance

The mymobilityhub project received funding from the Science Foundation Ireland to research MaaS in Dublin. The mymobilityhub pilot also received funding from Government Live through Smart Dublin. Now that the project is past the pilot phase, DLRCC is directly funding the program.

## Institutional Practices

Dublin plans to publicly operate the MaaS system once it is implemented. It is anticipated that the publicly led model will allow public staff and officials to create a system that offers the most societal benefits, such as encouraging active lifestyles and social inclusion. Operating the MaaS system will also allow public officials to directly communicate with the public as opposed to via a private operator.

Another advantage of having a publicly led MaaS system is that there will be a more streamlined stakeholder process.



The National Transport Authority (NTA) has oversight over all public transportation operators in Dublin and could use that position to gain buy-in from all the different transit agencies in Dublin. The public option would also give public staff and officials access to aggregated data on travel patterns and behaviors which can inform future transportation planning decisions. Finally, the publicly-led model may also create a new revenue source that could increase funding for other transportation projects.

Smart Dublin has partnered with AECOM and Trinity College Dublin to develop its MaaS platform. The research team is also working with Transport Infrastructure Ireland and Dublin City Council to pilot Cooperative Intelligent Transport Systems (C-ITS) service that will help the development of MaaS.

## Equity and Public Engagement

The mymobilityhub app has demonstrated that interest in using a MaaS platform exists at least within the piloting group. Since launching the mymobilityhub app, there have been thousands of bookings across all modes of transportation, including bikes, eBikes, and public transportation. There were 900 trips booked by eCar. Additionally, the program reduced work travel emission associated with DLRRRC staff trips by 2.5t CO<sub>2</sub> per year. This demonstrates the interest from the piloting group in an integrated trip planning platform.

Moving forward, as Dublin gets closer to launching a full-scale MaaS system, trust from the public will be one of the most important factors for success. Dublin plans to continue to seek public input and involve the public in the progress of implementing MaaS.

## Key Takeaways

Based on the information above on the Dublin Case Study, SCAG can learn from the following key takeaways:

- 1. Infrastructure:** Investing in mobility hubs can improve connections between modes.
- 2. Data and Technology:** Implementing a trip planning app that includes both public and private mobility service providers before deploying a full-scale MaaS platform can build the market for an integrated transportation platform.
- 3. Management and Operations:** Having a publicly led MaaS system may benefit the agency and the system by streamlining stakeholder coordination, creating a new revenue source for transit project expansions, and providing access to valuable data for system planning purposes.
- 4. Governance:** There has not been formal legislation passed in Dublin related to MaaS. Dublin is still in the process of building the legislative framework for MaaS. So far, Dublin has established five key areas that need governance framework: policy and legislation, data, citizen engagement, technology, and payment settlement and revenue recognition.
- 5. Finance:** The pilot project received funding from a research center in Ireland and Smart Dublin. Now that the pilot project is over, the employer (DLRRRC) is funding the mymobilityhub program.
- 6. Institutional Practices:** Dublin plans to have a publicly led system which is anticipate to streamline stakeholder coordination and maximize the societal benefits of MaaS. Smart Dublin is working with a private consultant and Trinity College in Dublin to develop its MaaS system.
- 7. Equity and Public Engagement:** Engaging the public throughout the MaaS development process can help build trust with the public.

## CASE STUDY 5: STOCKHOLM & GOTHENBURG

Sweden began studying MaaS in 2014 to examine whether it was possible to offer a service that could reduce car ownership. The test took place in Gothenburg with a total of 70 households and 190 users. The trial tested UbiGo, a digital MaaS application that was developed by a company of the same name. The initial test was successful with a reduced use of private vehicles by 50 percent among participants, and it was determined that MaaS should be further explored as a transportation solution in Sweden.

In 2017, Fluidtime, a MaaS technology developer, partnered with UbiGo to further develop the digital platform. After the digital platform had been refined, UbiGo launched in Stockholm in 2019. The platform integrates many different transportation service providers, including Hertz car rentals, SL Trafiken (the public transit provider in Stockholm), Cabonline (a taxi company), and Move About (a bike and car sharing company).

UbiGo has a subscription-based model. There are different plans for bundling public transportation and cars. On each subscription plan users are given a set number of credits. If the credits are not used by the end of the month, the credits are rolled over to the next month. Credits can also be shared with other people. For example, a family can have one subscription plan, and each of the family members could use credits from a single subscription plan.

Since launching in Stockholm, approximately 90 percent of the bookings have been made for public transportation, demonstrating that MaaS has encouraged public transit use in Stockholm.

UbiGo has been effectively implemented in Stockholm. The following sections describe the different components that played a role in the initial success of UbiGo.

## Infrastructure

There is limited information available on this topic.

## Data and Technology

The physical components of the Stockholm MaaS system mostly focused on the development of the digital platform. Since Stockholm already had several established mobility providers, the main component that needed to be developed was the integrated trip planning and payment platform.

UbiGO is a service in Sweden that offers the whole multimodality package under a MaaS mobile application. It provides access to public transportation, car rental and car sharing, taxis and bikes, depending on users' needs. Fluidtime's technology forms the basis of the UbiGo app.

Once users are registered on the platform, they have access to all the participating transportation providers on the platform through subscription packages. A unique feature of the UbiGo app is that it allows users to share an account, so family members can share one subscription plan with each other. The app also has real-time data on departure and arrival times for all mobility options that makes it easier for users to plan their trips.

The app includes the following features:

- Single sign-on for all mobility options
- Easy booking through paying within the app
- Real-time data and information on the availability of mobility services
- Multimodal travel route planning

- User management system that allows people to verify their account, create user groups, and gain access to updates
- Integrated monthly billing by account on subscriptions. Subscriptions can be shared with friends and family.
- Tailored reports and data exports

## Management and Operations

UbiGo was first tested in 2014 in Gothenburg with 70 paying households which totaled 190 users. Since 2017, Fluidtime MaaS technology and UbiGo have been working together to accelerate the implementation of MaaS in Sweden. UbiGo was launched in Stockholm in Spring 2019 to approximately 200 households in cooperation with Fluidtime<sup>3</sup>. UbiGo was the world’s first MaaS app with Level 3 integration of transportation services.

UbiGo is a subscription-based service. Every month, the credit balance of the subscriptions is increased according to personal preferences, and any remaining balance is credited to the following month.

## Governance

Fluidtime ensures a successful transition to smart mobility.

At this time, Sweden has not passed any formal legislation related to MaaS. Individual public transportation authorities have implemented directives that allow third-party ticket sales.

**Table 2: UbiGo Stakeholders and Roles**

Stakeholder	Role
UbiGo	Mobility service provider/project lead
Via-ID	UbiGo investor
Fluidtime	SaaS provider/MaaS enabler
Citizens of Stockholm	Using the MaaS offer from UbiGo
City of Stockholm	Operational function
Hertz Car Rentals	Transportation service provider
SL Trafiken	Transportation service provider
Cabonline	Transportation service provider
MoveAbout	Transportation service provider

Source: MaaS Alliance

## Equity and Public Engagement

UbiGo has been well received by the public. The public likes the flexibility of the subscription-based service, and the fact that credits can be shared with family members and friends. During the Gothenburg pilot, the UbiGo app improved public acceptance multimodal options and reduced the use of private vehicles among the pilot participants by 50 percent.

Since launching in Stockholm, the platform has promoted the use of public transit, with 90 percent of bookings being for public transit and 10 percent being for car shares and rental cars. UbiGo users have said that they like being able to access a car when they need it, and that the MaaS system has

Additionally, Sweden is working to develop clear framework that specifies the role the public sector can play in MaaS implementation. Currently, there is no clear guidance on the procurement procedures for MaaS or how and if subsidies for MaaS should be distributed. Sweden does not have a legal definition of car sharing or car clubs which makes it challenging for that type of mobility service to develop in Sweden. Overall, while the Swedish government has not passed legislation regarding MaaS in the past, they are looking to create clearer policy framework in the future<sup>4</sup>.

## Finance

UbiGo’s main investors were a combination of public and private fund providers: the SL Trafiken (the regional transit provider) and Via-ID.

## Institutional Practices

UbiGo is a privately operated MaaS system. It is an example of a successful institutional cooperation in which UbiGo focuses on user needs while Fluidtime provides the digital platform. UbiGo and Fluidtime have contractually agreed that Fluidtime’s technology will support UbiGo on an ongoing basis. As shown in **Table 2**, UbiGo is the project lead and Mobility service provider.

even helped certain users go car free. About 1.6 persons per household are using the MaaS service.

## Key Takeaways

Based on the information above on the Stockholm and Gothenburg Case Study, SCAG can learn from the following key takeaways:

- 1. Infrastructure:** Having a variety of established mobility service provider network in place prior to implementing MaaS can serve as the foundation for integrating transportation services.

<sup>3</sup> <https://maas-alliance.eu/wp-content/uploads/sites/7/2019/10/MaaS-of-the-Month-Fluidtime-final.pdf>

<sup>4</sup> [https://www.nordicenergy.org/wp-content/uploads/2019/10/maas\\_web-1.pdf](https://www.nordicenergy.org/wp-content/uploads/2019/10/maas_web-1.pdf)

2. **Data and Technology:** Partnering with established MaaS companies like Fluidtime can streamline the development of the digital platform. Fluidtime provides the platform for a business-to-consumer (B2C)<sup>5</sup> MaaS solution in Stockholm, enabling an authentic and high-level MaaS experience for daily commute<sup>6</sup>.
3. **Management and Operations:** Having private companies operate the MaaS system can bring in private investors that can fund the development of the MaaS platform.
4. **Governance:** There has not been any formal legislation related to MaaS passed in Sweden. The private sector has been the main driver for MaaS in Sweden. In the future, Sweden is looking to create more clear guidance on the role the public sector should play in the implementation of MaaS and develop a definition for car share services.
5. **Finance:** The main investors for UbiGo was Vid-ID and SL Trafiken, the regional transit provider.
6. **Institutional Practices:** Since MaaS implementation has been driven by the private sector, there are no institutional practice takeaways for this case study.
7. **Equity and Public Engagement:** Implementing a flexible subscription system that can be shared between users can improve customer experience.

## CASE STUDY 6: WEST MIDLANDS

West Midlands was the first application of MaaS in the United Kingdom. In 2017, West Midlands partnered with Global MaaS to pilot the Whim app. The pilot program consisted of eight users that all had knowledge of how the public transportation system worked. The pilot allowed the participants to travel across buses, trams, taxis, and cars for hire. Due to the commercial nature of this pilot and limited marketing budget, the pilot was not able to reach the amount people needed to make the statistics of the pilot results applicable in other cases.

For the pilot program, participants used a point system to pay for rides. However, if MaaS were to progress to a more full-scale deployment, Global MaaS would offer subscription-based options and a pay-as-you-go option, similar to Helsinki.

Despite the pilot program, MaaS implementation has not progressed further in West Midlands. West Midlands encountered several challenges with implementing a MaaS system, including failed collaboration between service providers, lack of customer trust, and equity issues.

The following sections describe the different components of the MaaS deployment in West Midlands.

### Infrastructure

West Midlands has a robust multimodal network that consists of buses, trams, taxis, trains, bikeshares, rental cars, and car shares. This multimodal network creates a lot of opportunities for users to travel across multiple modes. While the multimodal network has many advantages to users, the number of service providers - there are 23 different private companies that operate buses alone - within this network makes coordination challenging. While West Midlands does have some alliances and consortiums which makes collaboration between the different providers less challenging, there are a lot of stakeholders that need to collaborate and cooperate with each other to make a MaaS system work.

5 B2C refers to the process of selling products and services directly between a business and consumers who are the end-users of its products or services. Most companies that sell directly to consumers can be referred to as B2C companies.

6 Fluidtime offers its complete technology service stack: Fluidtime's White Label App FluidGo is used as a frontend for the users. FluidHub is used to standardize the transport providers' integration process and simplify data management between them. The commercial back-office solution FluidBiz is used to manage accounts, subscriptions and related payments.

## Data and Technology

From the digital perspective, West Midlands opted to partner with Global MaaS, an established MaaS company that operates Whim. Since Whim was already established at the time of the pilot project, the main issue with implementing a working digital platform was data availability. There were no data sharing standards in place at the time of the pilot, so the operators had to work with Whim to figure out how to integrate their data onto the Whim platform.

The Whim West Mid app combined a trip planning platform with a points-based system for purchasing trips. The app gave users different travel options that included cost, time, and greenest, so users could choose the option that worked best for them.

From the pilot project, West Midlands determined that cooperation is key to success. Incentivizing operators to share information to enable users to travel across multiple mobility services is an important aspect of implementing MaaS.

Attempts were made to invite different ITS operators into the MaaS program to combine and share data from various operators. In this regard, MaaS Global provided a platform to share information and aggregate customer accounts across multiple mobility services providers. It then offered Transport for West Midlands (TfWM) and operators access to various metrics, dashboards, and anonymized data to optimize and improve the services they operate. However, no attention was given to operators' management, which may be one of the main reasons for the program's failure.

### Management and Operations

West Midlands takes an open approach to innovation. A representative for TfWM said, "Any company wanting to provide such disruptive services can set up in the West Midlands with or without our approval. We would prefer they worked with us so we can both learn and improve the overall transport provision for everyone." This open approach fosters innovation by allowing companies to innovate without working with the government; however, this approach also makes the government's participation optional which means the government has less control on how innovative project like MaaS are implemented.

For the MaaS pilot program, Whim worked with TfWM. The pilot included buses, trams, taxis, and vehicle for-hire service. One of the things that helped TfWM implement the pilot project was the relationships that TfWM had with bus operators and the agency's experience integrating payment systems across multiple providers.

During the pilot, several models were tested, including monthly subscription packages, pay-as-you-go accounts, information only systems, and enhanced first and last mile connectivity.

### Governance

West Midlands does not have an official MaaS governance model. For the Whim pilot, West Midlands let Global MaaS take the lead. However, due to many challenges the pilot faced, West Midlands is reconsidering their approach to MaaS. The following key considerations have been identified that need to be addressed before West Midlands considers implementing a

full-scale MaaS program:

- Developing a clear understanding of how a MaaS scheme might impact (positively and negatively) the delivery of local transport policy objectives, e.g. accessibility and delivery of concessionary travel.
- Developing scenarios that may play out through a MaaS scheme and identifying if any of these scenarios could lead to a potential market failure.
- Recognizing that changing modal demand and travel patterns resulting from customer participation in MaaS schemes may change land-use needs and, accordingly, incorporating agility within infrastructure plans.
- Determining what new alliances may be required and how this might impact stakeholder dynamics and relationships in the existing infrastructure.
- Assessing what existing infrastructure and investments can be leveraged to support the deployment and operation of a MaaS scheme, including what changes (e.g. Open Data initiatives) or new infrastructure may be needed.
- Determining on what commercial basis a supplier would be prepared to participate in a MaaS scheme including: scheme cost allocation, revenue allocation and settlement, revenue risks and liabilities, and clearly articulating this to the MaaS scheme operator(s).
- Assessing the value of current relationships with customers (from both a commercialization and control perspective) and the extent to which this relationship may be lost by participating in a MaaS scheme.
- Determining the extent to which your organization may look to be the MaaS scheme provider and/ or systems operator in order to enable you to deliver your strategic objectives.

## Finance

MaaS was operated by MaaS Global without any government subsidy.

## Institutional Practices

When West Midlands launched their pilot project, public officials decided that it was preferred to have a private company like Global MaaS operate their MaaS system. To implement the pilot, Transport for West Midlands, the public body responsible for coordinating transportation services within West Midlands, entered into a Memorandum of Understanding with MaaS Global. However, even with the private sector taking the lead, stakeholders still had to collaborate and cooperate with one another to make the system work. West Midlands encountered numerous challenges with collaboration between service providers, including:

- Concerns from providers that they would be disconnected from their customers because users would be booking and paying for trip through the MaaS system.
- Issues with the risk and liability of sharing information.
- Concerns about revenue allocation and settlement for service providers.
- Concerns about barriers to entry for participation and equity.

These challenges have contributed to the suspension of the development of MaaS. The West Midlands Combined Authority is now looking into ways to roll out MaaS in house as a public sector led solution.

## Equity and Public Engagement

Since the pilot project only had eight participants that already used public transportation, the pilot did not provide

a lot of insight into the public acceptance of MaaS in West Midlands. However, some of the main challenges that West Midlands encountered included trust from the public and concerns about equity.

When Whim launched in West Midlands, there continued to be issues with MaaS. The Whim trial did not reach as many people as public officials were hoping due to constrained marketing budget and other resources.

## Key Takeaways

Based on the information above on the West Midlands Case Study, SCAG can learn from the following key takeaways:

- 1. Infrastructure:** Creating a robust multimodal infrastructure network is the foundation for MaaS.
- 2. Data and Technology:** Partnering with an established private MaaS provider can streamline the process of creating a digital MaaS platform.
- 3. Management and Operations:** Collaborating with service providers to develop agreements that manage the risk for service providers is a crucial component of success
- 4. Governance:** There has not been any official legislation related to MaaS passed in West Midlands. However, a lesson learned from the pilot deployment was that implementing data standardization policies could make it easier to develop an integrated MaaS platform.
- 5. Finance:** MaaS Global financed the pilot project without any investment from the government.
- 6. Institutional Practices:** It is important to collaborate with transportation service providers early in the MaaS implementation process to garner support and address concerns.
- 7. Equity and Public Engagement:** Developing policies that will ensure an equitable implementation of MaaS is important for gaining trust with the public as well as collaboration among public stakeholders.

## CASE STUDY 7: PITTSBURGH

Compared to the European case studies covered above, the United States (US) has been a late adopter of MaaS. Pittsburgh is the first city in the US to launch a MaaS pilot program. For the pilot program, the City of Pittsburgh partnered with the Transit app to create an integrated trip planning and payment platform. The Transit app has become a well-known trip planning platform in the US over the past several years; however, the Pittsburgh pilot is the first time that users can pay for their trips in the app.

Pittsburgh's pilot incorporates buses, electric bikes, mopeds, scooters, carpooling, and car share. To facilitate transfers between modes, Pittsburgh is investing in mobility hubs near transit stations. There are currently 23 mobility hubs in operation, and Pittsburgh plans to invest in 27 additional mobility hubs in the near future.

The following sections describe the different components that played a role in the development of MaaS in Pittsburgh.

## Infrastructure

Pittsburgh focused on creating a strong multimodal network prior to implementing MaaS. Pittsburgh has made the commitment to implement 50 mobility hubs within the City to facilitate transfers between modes. The City has already constructed 23 mobility hubs and has the additional 27 scheduled to be completed in the near future. The mobility hubs promote transfers across modes and create a more seamless transportation system that is compatible with MaaS.



Additionally, Pittsburgh is investing in TransitScreens that will provide real-time arrival information on public transit services. The screens will also direct passengers towards other mobility services, such as bikes and scooters to complete their trips.

## Data and Technology

The City of Pittsburgh partnered with the Transit app to develop an integrated payment system that could be used with the trip planning software. The MaaS app is known as Move PGH. The app allows users to pay their bus fares, rent micromobility vehicles, find someone to carpool with, and rent an automobile. In the future, Pittsburgh hopes to create a MaaS system where users can pay a flat rate for their trip regardless of which devices they use.

One of the key things that made the development of the platform successful was the collaboration with the service providers. Spin, a scooter share company, worked with other mobility providers, such as Healthy Ride, Zipcar, Waze, and Scoobi, to bring services to Pittsburgh and work with the City to develop a MaaS system. The City entered an agreement with the mobility providers that they would be the exclusive operators of their respective modes within Pittsburgh for the two-year pilot program, and, in return, the City did not have to pay for the program.

## Management and Operations

The City of Pittsburgh also partnered with a local foundation to conduct a complementary pilot program known as the Universal Basic Mobility program. For six months, the project will cover the cost of all transportation services in the MaaS system for 100 low-income individuals. This program aims to gain more information on how the City of Pittsburgh can address equity concerns related to MaaS.

## Governance

Pittsburgh is trying to create a MaaS project that allows residents to pay a single fare for their trips that involve more than one mode. This has been a challenge since many of the operators that participate in the MaaS program have different payment structures and may be in competition with each other.

## Finance

The program is funded through \$500,000 in grant funds from the Richard King Mellon Foundation and Ford's micromobility subsidiary. Spin is also making funding contributions to the program.

## Institutional Practices

The City of Pittsburgh is leading the MaaS pilot project and has partnered with several private mobility providers. So far, Pittsburgh has had success in collaborating with the mobility providers, and the partners have come to a mutually beneficial agreement that minimizes public investment in the program. Private service providers collect useful data through this program and the City was given an opportunity to test new technologies in an inclusive manner with a limited budget.

Additionally, a team of Carnegie Mellon researchers have been invited to study the impact of the program. If the program is

successful, the City hopes to scale it to more residents.

## Equity and Public Engagement

Since the pilot project just launched in 2021, information is still being gathered on how the public has perceived the program. The three things Pittsburgh hopes to accomplish through the program are:

1. Ease of access across all independent mobility services
2. Reduce the amount of driving and carbon emissions
3. Increase access to transportation for disadvantaged residents

One of the advantages of partnering with the Transit app is that the app already has more than 40,000 users in the Pittsburgh area, creating an existing market for MaaS. Additionally, of those users, 74 percent do not own a car, so the program will be reaching many of the residents that could greatly benefit from MaaS.

The Universal Basic Mobility program further encourages an equitable deployment of MaaS and demonstrates how subsidizing trips for low-income populations can create a more equitable community. The intent of this program is to heavily subsidize fares to attract riders and allow disadvantaged residents travel at a low cost while implementing a more sustainable mode of transportation.

## Key Takeaways

Based on the information above on the Pittsburgh Case Study, SCAG can learn from the following key takeaways:

1. **Infrastructure:** Investing in mobility hubs can create seamless transitions between modes of transportation.
2. **Data and Technology:** Partnering with an established private company and streamline the development of the digital platform.
3. **Management and Operations:** Pittsburgh is one of the few case studies that has had success with a P3 setup. Ensuring that both the public and private sectors are benefitting from the project is key to success.
4. **Governance:** There has not been any formal legislation related to MaaS passed in Pennsylvania.
5. **Finance:** Leveraging grant funding can cover the initial implementation costs of MaaS. Partnering with private companies can bring private funding to the program.
6. **Institutional Practices:** Entering into mutually beneficial agreements with private mobility providers can balance the goals of the public and private sectors.
7. **Equity and Public Engagement:** Developing a subsidized program such as Universal Basic Mobility (UBM) programs for low-income populations can address many of the equity concerns associated with MaaS.

## SUMMARY

Each of these case studies demonstrates that there are different ways to implement MaaS successfully. All the cities have taken different approaches that meet their different physical and political environments. **Table 3** summarizes the key characteristics of each of the case studies.

**Table 3: MaaS Case Study Summary**

Characteristic	Manchester	Helsinki	Vienna	Dublin	Stockholm & Gothenburg	West Midlands	Pittsburgh
<b>Status</b>	3 pilots Completed; On Hold	Implemented	Implemented	In Development	Implemented	Pilot Completed; On Hold	Pilot In Progress
<b>Transportation Modes</b>	Transit, Bike Shares, Car Shares, and TNCs	Transit, Bike Shares, Taxis, Car Shares, and Car Rentals	Transit, E-Scooters, Car Shares, and Bike Shares	Transit, Car Shares, and Bike Shares	Transit, Bike Shares, Taxis, Car Shares, and Car Rentals	Transit, Taxis, and TNCs	Transit, Electric Scooters, Car Shares, Electric Mopeds, and Carpool Services
<b>Digital App</b>	IMOVE	Whim	Wegfinder, WienMobil, Whim	mymobilityhub	UbiGo	Whim	Transit app
<b>Public or Private Led</b>	Public	Private	Public (Wegfinder and WienMobil); Private (Whim)	Public	Private	Private	Public

Source: AECOM

## Overall Takeaways

The case studies examined in this study provided several valuable insights into the factors that can contribute to a successful implementation of MaaS. The following list summarizes the main key takeaways from the case studies that can be applied to the SCAG region:

- 1. Infrastructure:** MaaS will meet the most people’s needs when there are a variety of different transportation modes in place. Investing in mobility hubs can facilitate transfers between modes and support the implementation of MaaS.
- 2. Data and Technology:** Having a private company develop the digital platform can streamline the implementation of MaaS.
- 3. Management and Operations:** Each of the successful deployments of MaaS (Helsinki, Vienna, and Stockholm) used a different managerial structure. Helsinki and Stockholm are privately operated while Vienna is publicly operated. There are advantages and disadvantages to each of the managerial structures, and it is important to consider the political, stakeholder, and public environment of the SCAG region to determine the right structure. In addition, having the private companies be the system operator doesn’t mean the public agencies would lose control of the system.
- 4. Governance:** Requiring all mobility operators to provide essential data on their services and make their ticket sales and reservations accessible from an API can streamline the development of MaaS. Financing from the public agencies will ensure its control over the MaaS system regardless system operator types.
- 5. Finance:** The most common funding sources that have been used for the various MaaS system include research loans and grants, investments from private companies, and subsidies from public entities.
- 6. Institutional Practices:** Coordinating with partners is vital to the successful implementation of MaaS. Several MaaS systems, including SMILE in Vienna and other MaaS programs in West Midlands and Manchester, have failed or have been put on hold due to issues coordinating between stakeholders. It is important that there are mutually beneficial agreements in place between public and private entities.

- 7. Equity and Public Engagement:** Engaging the public throughout the development of MaaS will help create a system that people want to use. Offering different subscription plan options can allow people to find a plan that meets their needs and preferences. Forming a subsidy program such as UBM programs for low-income residents can address some of the equity concerns related to MaaS.

## CHAPTER 2 - VENDOR SURVEY

### INTRODUCTION

MaaS vendors were also surveyed to gain insight into the technologies that are available to support the implementation of MaaS. This chapter summarizes the responses from 13 vendors and findings from the vendor surveys.

### Survey Purpose

Many private companies have begun to develop and implement MaaS platforms. The vendor survey was meant to understand the implementation process and requirements for different MaaS platforms, and to learn more about the different technologies that could support the implementation of MaaS in the SCAG region.

The information in this summary was used to determine the vendor requirements for implementing MaaS as well as to document the different implementation approaches private MaaS vendors have used in the past. These insights informed the recommendations in the Implementation Guide of this MaaS feasibility study.

### VENDOR SURVEYING

The following sections summarize the methodology for designing the survey and selecting the vendors to participate in the survey.

## Survey Design Methodology

The vendor survey was designed to understand the infrastructure requirements, technological capabilities, management and operational support, governance requirements, organizational structure, funding mechanisms, and public engagement considerations of implementing MaaS. As such, the vendor survey was divided into nine main sections:

- 1. Company Overview:** Provides information on the role the vendor plays in the implementation of MaaS and the vendor's experiences with implementing MaaS.
- 2. Infrastructure:** Summarizes the infrastructure that the MaaS vendor needs in place for a successful implementation of MaaS and the vendor's compatibility with payment systems.
- 3. Data and Technology:** Provides information on the vendor's technological capabilities, user interface, and data sharing agreements.
- 4. Management and Operations:** Explains how vendors approach integrating different modes of transportation, developing agreements, providing training, and supporting long-term system maintenance.
- 5. Governance:** Summarizes any policies or legislation that needs to be put in place for the vendor to be able to implement MaaS.
- 6. Institutional Practices:** Provides information on whether the vendor collaborates with local authorities and other stakeholders.

- 7. Finance:** Summarizes the funding sources that the vendor has seen for MaaS implementation and assesses the use of public and private funds as sustainable funding sources.
- 8. Equity and Public Engagement:** Provides information on the measures vendors have taken to develop an equitable MaaS system and create a positive experience for users.
- 9. Overall MaaS Ecosystem:** Explains the role that the vendor sees public transit agencies playing in the implementation of MaaS.

The survey asked a series of standardized questions for each of the categories above. For a list of the questions, see Appendix B

## Vendor Selection and Overview

There are numerous vendors that offer products and services that can support MaaS implementation. To determine which MaaS vendors would participate in the survey, two tiers of vendors were identified. The first tier of vendors are companies that have a proven track record with implementing MaaS. The second tier of vendors are companies that provide MaaS related products and/or services, but their main business focus is on-demand transit or paratransit modernization. As shown in **Table 4**, there were 10 Tier 1 vendors and 4 Tier 2 vendors that received the survey (Cubic Transportation did not respond to the sent survey).

**Table 4: List of Vendors that Participated in the Vendor Survey**

Vendor	Headquarters	Operations in the US
<b>Tier 1 – Vendors with Proven MaaS Implementation</b>		
Moovit	Ness Ziona, Israel	Yes
Moovel	Portland, U.S.	Yes
Transit App	Montreal, Canada	Yes
Cubic Transportation (Umo)	San Diego, U.S.	Yes
UbiGo	Stockholm, Sweden	No
Fluidtime	Vienna, Austria	No
Axon Vibe	Norfolk, United Kingdom	Yes
SkedGo	Sydney, Australia	No
Trafi	London, United Kingdom	No
Mobilileo	Leeds, United Kingdom	No
<b>Tier 2 – Main Business is Either On-Demand Transit or Paratransit Modernization</b>		
Via	New York, U.S.	Yes
Spare Labs	Vancouver, Canada	Yes
Transdev (Cityway)	Issy-les-Moulineaux, France	Yes
RideCo	Toronto, Canada	Yes

Source: AECOM

## VENDOR SURVEY RESULTS SUMMARY

The following sections summarize the findings from the vendor survey results. The summaries are based on all the responses received from the survey.

## Infrastructure

### Infrastructure Requirements for MaaS

Based on the vendor responses, there is consensus among the vendors that infrastructure requirements for MaaS are necessary. A common theme in the vendor responses was the need for a comprehensive mobility system that includes

a variety of mobility options, including public transit, micromobility, and carshare services. For MaaS to work best, cities need to shift from being car-oriented to mobility-oriented. Elements that can contribute to the shift towards a mobility-friendly city may include investing in public transit, mobility hubs, bike lanes and bike parking. To underscore the importance of public transit, some vendors even categorize public transit as “infrastructure” for MaaS implementation.

Another common theme was the need for mobility service providers to be able to make data and payment systems available to third-party platforms through an open Application Programming Interface (API). Since MaaS is rooted in having a single platform where people can plan and pay for their trips, it is important for mobility service providers to have trip planning and payment information that can be integrated into the MaaS platform. For trip planning, mobility service providers need to have standardized timetables and trip information. Examples of essential trip planning data include General Transit Feed Specification (GTFS), General Bikeshare Feed Specification (GBFS), and General On-Demand Feed Specification (GOFS) data. Some of the vendors have the capability to help mobility service providers develop these Feed Specifications. From the payment perspective, the payment system needs to be able to be integrated into the MaaS system. The MaaS provider will need access to transaction information to reconcile payments across multiple mobility service providers.

Additionally, the vendors also emphasized the importance of having a well-connected cellular network. Since MaaS apps require mobile data or Wifi, it is important that users have access to a strong data connection so the app can function properly.

### **In Development Infrastructure for MaaS**

In addition to the infrastructure requirements outlined above, there are several concepts that are in development that are anticipated to support the implementation of MaaS. These concepts varied from vendor to vendor. One vendor is focusing on developing a common data framework to make sharing trip information across mobility service providers more seamless. Another vendor is focusing on offering MaaS to businesses to help them reduce their greenhouse emissions. This model would focus on providing alternative modes of transportation to driving alone to companies, to encourage employees to shift their travel behaviors to more sustainable modes of transportation.

Another MaaS vendor is in the process of developing the ability for the MaaS app to integrate with people’s calendars, so users can have their daily travel itinerary on their calendar and receive reminders about the schedule of their trips. Finally, a couple of other vendors are preparing to integrate other mobility options and infrastructure, such as electric vehicle (EV) supercharging stations and automated vehicles.

### **Integrated Payments**

Almost all the vendors that participated in the survey have systems that are compatible with open loop payment systems. Open loop payment systems allow customers to use the payment methods they already have on hand, such as credit cards and/or existing contactless forms of payment. Most of the vendors are flexible with the payment methods they accept. Payment methods that can be accepted by most vendors include credit/debit cards, PayPal payments, and other contactless forms of payment that allow transactions to be completed on smart phones.

In addition to offering open loop payment systems, some of the vendors offer equitable payment options for unbanked/underbanked populations. To do this, some vendors offer

options where people could pay transit operators and taxi drivers with cash. Other vendors allow users to book their trip through the MaaS app and select a cash payment. With this model, users are able to plan their trips with the MaaS platform, but they need to pay for their rides when they get picked up. Another vendor offers a reloadable payment card that can work with the MaaS system. People can pay cash to reload their card at certain retailers. The card can then be used to pay for mobility services on the MaaS platform.

A couple of vendors expressed challenges with offering cash options. Part of the MaaS concept is allowing users to pay for different mobility services on one platform, however, some platforms require a credit card or other digital payment to be on file to book trips. As a result, these providers do not offer a cash payment option on their platforms, such as TNCs.

## **Data and Technology**

### **User Preferences**

Most of the MaaS vendors offer options for users to customize their preferences. By default, most of the MaaS providers will suggest the most efficient route to reach a destination by considering the time it will take to get there and the cost of the trip. However, many of the platforms allow users to customize their preferences. The most common customizations the vendors support include allowing users to select a preference for the fastest route, routes with the least transfers, or routes that have the least walking. Many platforms will let users set their preferred modes of transportation, so the system will recommend the preferred modes as much as possible. Other common preference options include routes with low crowding and preferred departure and/or arrival times.

### **Mode Integration**

Most of the vendors’ technological systems can support a wide variety of travel modes. In fact, many of the vendors reported the ability to integrate just about any mode of travel. The most common modes of transportation or services that vendors had experience integrating were public transit (i.e. buses, light rail, trams, ferries, etc.), bike share, scooter share, ride hailing services, car share, car rental, parking, and EV charging.

### **Payment Options**

Almost all the vendors allowed users to pay with credit cards, debit cards, and PayPal. Some vendors offered additional payment options, including ApplePay and GooglePay. Most of the vendors offered pay-as-you-go systems; however, there were a couple of vendors that process monthly invoices to customers. Finally, some vendors have the capability to integrate with platforms like Token Transit, Masabi, and Cubic.

### **System Management**

Different vendors have different protocols for system management. Some of the vendors offer a turnkey operational solution where the vendor will provide the digital platform as well as handle the day-to-day operations of the MaaS system. Under this model, the private vendor would also maintain the digital platform and provide support to customers when needed.

Other vendors offer greater involvement for public transportation agencies in managing MaaS systems. With this model, the vendor will only provide the digital platform as a Software as a Service (SaaS) vendor, but the public transit agency would be responsible for the day-to-day operations of the service. The private vendor will usually provide system hosting and maintenance, but the public transit agency would be required to provide customer support and coordination between stakeholders.



## User Interface

All the vendors offer a digital platform that includes a user interface where customers can plan, book, and pay for their trips. All the vendors have digital platforms that are available to both Apple and Android users. Some of the vendors offer the option for public agencies to develop customized branding for the app through their white-label option. This means even though the functionality would be the same as other platforms developed by the vendor, the look and branding of the app can be customized for a specific agency and/or region. Other vendors do not allow customization of the user interface, and all agencies that use the app would have the same branding.

Most of the vendors reported positive feedback on their user interface. Several of the vendors reported average customer ratings of 4.5 stars and above.

## Data Privacy

All the vendors agreed that data privacy is of utmost importance to a successful MaaS system. A common theme among the vendors was the need to have data sharing agreements in place between stakeholders. The data sharing agreements ensure that all the participating mobility providers and participating stakeholders are on the same page with data sharing and usage. These agreements also provide legal protection for all the parties involved in the MaaS system.

Another common theme for data privacy was that many of the vendors tried to limit the personal data that is stored on the platform. Some vendors have opted not to collect or share individual usage patterns. Other vendors have agreed to only collect and share aggregated, anonymous data rather than individual trips that are associated with a specific account. Additionally, many of the vendors have invested in robust cybersecurity platforms that help keep any data that is collected secure.

Many vendors brought up that different jurisdictions have different policies for data privacy. As a result, almost all the vendors mentioned that they will work with local jurisdictions to make their MaaS platforms compliant with local regulations. Many of the vendors have MaaS systems that are compliant with the General Data Protection Regulation (GDPR) and the international standard for information security (ISO27001).

## Data Challenges

The most common data challenge that was brought up by the vendors was data standardization and accuracy. Many of the vendors have struggled with receiving varying data from different mobility service providers. The data may be in different formats and may contain varying levels of accuracy and quality. Since MaaS does rely on real-time data to determine the availability of certain mobility services, it is important for the mobility service providers to give accurate information on the availability of mobility service. If the data is inaccurate, the MaaS platform cannot accurately plan peoples' trips. Additionally, the lack of data standardization in the industry requires custom development for each MaaS system which can delay implementation.

Another problem that the MaaS vendors raised was the varying legal requirements for data privacy and storage across different jurisdictions. Some of the responses noted that the varying laws can sometimes cause delays and incur additional costs for implementing MaaS since some vendors may need to consult with lawyers to ensure their platforms are compliant with applicable regulations.

## Management and Operation

### Integrating Different Modes of Transportation

Different vendors took different approaches for integrating different modes of transportation into their MaaS platforms. Most commonly, MaaS vendors focused on developing an open API that allows a seamless integration of different modes onto the MaaS platform. One of the keys to making the open API approach work is having standardized data in the forms of GTFS, GBFS, and GOFs. The integration of these data sets into the digital platform is crucial for providing accurate information about the different modes of transportation on the platform.

Another approach that some vendors took to integrating multiple modes of transportation was coordinating with regional transportation agencies. With this structure, the vendors would work with the regional transportation agency to develop partnerships and agreements with the various mobility providers within the region. Then, the vendor would work with the mobility providers to integrate their data into the MaaS system. Similar to the open API approach, this process usually requires some form of standardized data regulations to be in place.

Some of the vendors have already integrated the readily available GTFS data in North America into their platforms. Additionally, some vendors have standing agreements with mobility providers to integrate their data into their MaaS platforms. These vendors can sometimes streamline the implementation of MaaS since they already have certain mobility providers integrated on their platform.

### Management and Operations Roles

Some of the vendors operate as both the MaaS operator and the technology provider while others operate as the technology provider only. For the vendors that serve as both the operator and the technology provider, they are responsible for the day-to-day operation of the MaaS system. In this case, the vendor is responsible for both the maintenance of the technology as well as providing customer support.

Most of the vendors serve only as the technology provider. In this role, the technology provider will maintain the digital platform, but will not be responsible for the day-to-day operation of the MaaS system. In this case, the day-to-day operations and customer support roles would fall to a separate MaaS operator. In most cases, the MaaS operator would be a public transportation agency; however, one vendor did mention the potential of having a 3rd party operate the MaaS system. The technology provider would coordinate directly with the MaaS operator if there were any issues with the digital platform but would otherwise be uninvolved in the operations of the MaaS system.

### Deployment and Training

Almost all the vendors offer some form of training on their MaaS platforms. Several of the vendors offer formal training that includes a training handbook, videos, and live webinars on key features of the MaaS platform. The trainings courses are designed to educate partners and operators on how the MaaS platform works. Some vendors offer training for different types of personnel. For example, there are different training courses for transit drivers versus customer support representatives. Most of the vendors that serve as the technology provider, but not the MaaS operator, provide training to ensure the MaaS operator is able to manage the day-to-day operations of the system while using the vendor's digital platform.

For vendors that serve as both the technology provider and operator, there are usually fewer training options available. In these cases, the vendors do not have a formal training program,

but training modules can be developed on a case-by-case basis depending on the roles of the stakeholders in the deployment of MaaS. In this model, MaaS customers would be able to reach out to the vendor for customer support with the platform.

In addition to the training programs that the vendors offer, many of the software vendors also have dedicated customer success staff (mostly in the SaaS operational model) that are available to answer questions as they come up. This means that the MaaS operator and/or stakeholder, such as a mobility service provider, can reach out to the vendors about specific issues as they come up.

### System Maintenance

All the vendors have a commitment to maintaining the digital MaaS platform, including providing updates and ongoing support. The vendors commit to providing regular updates to the software that adds new features and efficiencies to the MaaS digital platform. All the vendors also offer customer support, so the MaaS operator and/or project partners can receive support with the technology as needed. Additionally, if there are technological issues with the digital MaaS platforms, the vendors have support staff that can help resolve issues with the software.

### Governance

Many of the vendors that participated in the survey did not identify any specific policies that needed to be put into place to implement MaaS. However, a couple of vendors identified policies that impacted MaaS implementation. For example, one MaaS vendor noted that one of its clients adopted a policy that required all mobility providers to integrate their services into the MaaS platform.

Another MaaS vendor's response discussed how fare policy may need to be modified to implement MaaS. For example, if one provider's fare policy offers a discount for seniors and another provider's fare policy does not, it can be challenging for a MaaS system to identify and validate how much each person should pay for a trip. Coordinating fare policies across mobility providers can help simplify the payment structure for MaaS and make it possible to have user-profile based pricing structures.

Additionally, another vendor brought up that unionized public transit systems may need to create a new driver classification for on-demand services. The vendor noted that on-demand drivers usually have different responsibilities than other transit drivers like the fixed-route and traditional paratransit drivers. As a result, a policy might be needed to create a new classification for on-demand drivers. The vendor noted that this was most commonly needed at larger transit agencies.

### Finance

This element discusses the funding and financial structures of the identified case studies such as funding sources and availability, the understanding of funding commitments at the various levels of implementation and any necessary enabling policies.

The responses on financing MaaS varied greatly from vendor to vendor. Some vendors have primarily worked on MaaS projects that have been privately funded; however, most of the vendors that participated in the survey primarily used public grant funds or state and/or local funds to finance MaaS. For the vendors that were involved with MaaS systems that received private funding, the funds could typically be used for both startup costs, including costs associated with developing the digital platform, as well as operating and maintenance costs. For MaaS systems that were funded through a grant, the funds could only be used for startup costs. In some cases, the vendors reported

that their clients were able to secure an additional grant for operations and maintenance costs.

There were mixed opinions among the vendors on the role the private sector and public sector play in financing MaaS. Some vendors indicated that they did not view MaaS as a viable investment for private companies and that MaaS should only be funded through public funds. However, other vendors indicated that any form of funding should be explored, including agreements with private investors or local retail sponsoring campaigns in exchange for in-app promotions. Generally, vendors that have implemented MaaS in Europe saw private funding as an important source of financing MaaS especially in the startup phase. Vendors that primarily do work in North America believed that MaaS should be publicly funded and did not see it as a viable investment for the private sector since they have not seen MaaS generate enough income from trips alone to become profitable. These two schools of thought within the MaaS community demonstrate that there is not one way to finance MaaS and multiple funding mechanisms should be explored.

When it came to responses on the use of subsidies and incentives for MaaS, the vendors agree that user incentives/subsidies will be a key part of the implementation but had varying thoughts on the role subsidies and incentives could play in MaaS implementation. One vendor had experience using subsidies to allow low-income residents to use the MaaS system for free. Another vendor built in incentives for people to use more sustainable modes of transportation. This vendor took a "sustainability by design" approach where the lower cost options were usually the more sustainable options. As a result, people could save money by choosing a more sustainable option such as transit. A different vendor had not seen subsidies and incentives used for the MaaS systems that it had implemented but saw the potential of using incentives in the North America market to encourage people to get out of their cars.

### Institutional Practices

Based on the vendor responses, there are two different types of organizational structures for MaaS Implementation. The first type is privately led MaaS. Under this model, the private vendor is both the technology provider as well as the MaaS operator. The public sector is usually a stakeholder and helps with financing and/or marketing the MaaS system.

The second type is publicly led. Under this model, the private vendor is the technology provider while a public agency serves as the MaaS operator. The public sector is the main leader and is responsible for the implementation of MaaS while the private vendor provides the digital platform for MaaS.

All the MaaS vendors had a preference for one model or another. The vendors that serve as technology providers and MaaS operators favored the private led model while vendors that only provide technology solutions preferred the publicly led model. The vendors that favored the publicly led model noted that having a public agency, especially a transit agency, lead the deployment of MaaS can garner the strong support and buy-in from stakeholders that is needed for successful implementation. For the vendors that favored the privately led model, it was noted that the private sector can bring international knowledge and experience. The vendors that favored the privately led model also acknowledged that the public sector is a key partner for deploying MaaS and should participate in the marketing and branding of the MaaS system. Examples of marketing and branding strategies include incorporating MaaS related information in the transit agency's

website, ride guide, and posters at transit stops as well as on transit vehicles.

Several of the vendors identified lessons learned on the organizational structure of MaaS models. These lessons are summarized as follows:

- One organizational structure will not work for every deployment of MaaS.
- Having one organization that is responsible for regulating the various mobility operators can help create a more positive customer experience. For example, if there is an agency that has authority to standardize the regional fare system, customers can benefit from a simpler fare system.
- There should be dedicated staff responsible for managing the MaaS service, including conducting marketing activities for user acquisition, user communication, and KPI tracking. It is important that the team responsible for managing MaaS has the appropriate time and resources to devote to making the system run smoothly.
- Some vendors have found that a public led model works the best for MaaS implementation. This model gives clear responsibility to one entity while still allowing for coordination with other public and private stakeholders.
- MaaS is a nascent system that is quickly evolving, and all participating mobility and payment providers need to be ready to identify, react, and adapt to changes in the industry.

## Equity and Public Engagement

### Equity and Public Engagement Goals

Several of the vendors have included equity and public engagement goals in their MaaS implementation. A common theme among the vendors was the desire to create a MaaS system that would enable more people to use public transit. Several of the operators aimed to design a MaaS system that would remove barriers that prevent people from using transit. As a result, many of the MaaS vendors incorporated features into their systems that would help people who live in outlying areas access transit services as well as features that improve the quality of already accessible transit services, such as real-time arrival information.

In addition to the goal to increase transit riders, some of the vendors also made public engagement a priority in their MaaS implementation process. A couple of the vendors noted that they viewed public engagement as a key to a successful implementation of MaaS. These vendors emphasized that marketing and awareness are crucial to the implementation process. People need to know about the program and how it benefits them before they decide to give it a try.

### Customer Feedback

Almost all the vendors reported positive feedback on their MaaS implementation. Many of the technology providers have reported 4.5+ star ratings on their apps, indicating most people have liked their experience with their MaaS platform. Some of the vendors have reported winning awards for their platforms while others have received positive feedback from both members of the public and stakeholders.

### Safety

Since many of the vendors that participated in the survey are not MaaS operators, most of them had no safety concerns to report. Most of the vendors indicated that individual mobility providers were responsible for dealing with any safety concerns that occurred while customers were travelling. One vendor did note that people were generally more at risk when they opted to take modes such as carpooling and rental cars. For carpooling, people are one-on-one with a stranger and may be

more at risk of being involved in a safety event. For rental cars, as an example, users are driving themselves, and they may be more prone to getting into a car accident than if they were on public transit.

### Unbanked/Underbanked Populations

Some of the vendors offered payment options for unbanked/underbanked populations. The most common solution for unbanked/underbanked populations was offering the option to pay cash or providing a pre-paid reloadable fare card. A couple of the vendors deferred to the public transit agency for providing payment options for unbanked/underbanked populations. Two of the vendors did not offer any options for unbanked/underbanked populations.

### Populations Without Smart Phones

Many of the vendors offered alternative ways for people to access the MaaS platform for people that do not have access to a smart phone. The most common solution among the vendors was offering a call center and having a desktop-friendly website. There were a couple of vendors that did not offer an alternative way for people to access the MaaS platform.

### People with Disabilities

Many of the MaaS vendors have invested in designing an accessible MaaS platform that can be used by people with all levels of abilities. Several of the vendors mentioned partnering with organizations like Be My Eyes, RightHear, and the American Foundation of the Blind to develop their apps. Partnerships with these organizations have helped the vendors ensure their digital platforms can be used by people with hearing and/or vision impairments. App features for people with vision impairments include high-contrast display options and text-to-speech options. Other vendors have included options within their platform to allow people with mobility impairments plan routes that are accessible. These options ensure the routes suggested on the MaaS platform are wheelchair accessible. Additionally, several vendors noted that their apps are ADA compliant.

### Financial Discounts

Most of the vendors have the capability to apply discounted fares to certain accounts. Many of the vendors noted that they work closely with public transit agencies to determine which users qualify for fare discounts. One of the vendors offers a validation service which can verify that individual user profiles qualify for discounted fares. A few of the vendors offer vouchers and/or tokens that can be used as fares. These vouchers and/or tokens can serve as a subsidy for fares, and public agencies can work with MaaS vendors to distribute them to qualifying customers.

### Overall MaaS Ecosystem

Public Transit Agencies should lead or at least willing to participate and collaborate with other players in a MaaS implementation as transit is the backbone of a MaaS system. They have their own interests within the ecosystem, yet they should engage with other players to find the right balance between competition and collaboration within a MaaS ecosystem.

## KEY TAKEAWAYS

Based on the summary of the vendor responses above, the following statements summarize the key takeaways of the vendor surveys:

- **Infrastructure:** To prepare for deploying MaaS, public agencies should focus on developing their multimodal transportation systems, data standardization policies, cellular network, and payment systems. Most of the MaaS vendors had open loop payment systems. During the vendor selection process, it is important to work with the vendors to determine the data and physical infrastructure requirements for implementing their software.
- **Data and Technology:** Many of the vendors offered options for users to set custom preferences on their platforms. The most common customizable options were the ability to set preferences on routes, including the fastest route, the route with the least transfers, and the route with the least walking. Most of the vendors could integrate any mode of transportation into their platforms. The most common payment options supported by the vendors were credit cards, debit cards, and PayPal. All the vendors offered ongoing support for system maintenance. Public agencies should work with the vendors to implement updates to the MaaS system. All the vendors had an app that users could download. Public agencies should work with the vendors to put data sharing agreements in place. Most of the vendors had robust cybersecurity systems and policies to prevent users' data from getting stolen. The biggest challenges for data are lack of data standardization and varying laws about data privacy. Public agencies should work with the vendors to ensure the MaaS systems comply with the local, state, and federal privacy policies that apply to the MaaS service area.
- **Management and Operations:** Developing an open API was key for many of the vendors to integrate multiple modes of transportation. Public stakeholders are preferred to help coordinate or even mandate agreements between project partners. The roles vendors play varies case by case, some of the vendors serve as both technology providers and MaaS operators while others only serve as technology providers. The vendor selection and role they play should be based on the pilot's needs. Product training to project partners as well as on-going maintenance and support of their platforms can be expected from vendors.
- **Governance:** The vendors identified policies requiring mobility operators to participate in MaaS, fare standardization policies, and defining a classification for on-demand drivers can help facilitate the implementation of MaaS. Public agencies should prioritize forming a policy that requires all MaaS vendors within the MaaS service area to participate in the MaaS platform. Additionally, public agencies should collaborate to develop a standardized fare policy for transit across the MaaS service area.
- **Finance:** The vendors had mixed opinions on the roles the public and private sectors should play in financing MaaS. Some of the vendors believed private funding is needed during the startup phases of MaaS implementation. Other vendors believed that MaaS should be funded solely by the public sector. Most of the MaaS systems the vendors have worked with were funded either privately or through public grants. Public agencies should consider a wide variety of funding options for MaaS. This may include public-private partnerships, public grants, public tax initiatives, and private investments.
- **Institutional Practices:** Most of the vendors that participated in the survey were technology providers that believed the public sector should lead MaaS implementation. However, there were a couple of vendors that were technology providers and MaaS operators that preferred a privately led model. Many vendors emphasized the importance of having a designated lead organization that has dedicated staff for MaaS implementation. At the start of MaaS deployment, a lead organization should be identified. Most of the vendors indicated that public agencies should be involved with facilitating coordination between stakeholders and should assist with marketing the MaaS platform.
- **Equity and Public Engagement:** Many of the vendors have the goal to create positive outcomes for the communities they work in. Most vendors provide features to address equity concerns, but the features are often not comprehensive. Several of the vendors offer cash and pre-loaded card options for unbanked/underbanked populations. A couple of the vendors offer call centers and desktop websites that allow people who do not own a smartphone to access the MaaS system. Many of the vendors have developed apps that can be used by people with hearing and/or visual impairments. Some vendors have incorporated a user preference option that will make the platform only show wheelchair accessible routes. Most vendors have the capability to offer discounts to qualifying populations. Public agencies should work with vendors to incorporate these features into the MaaS platform. The public agency should also be responsible for operating any subsidized fare programs for low-income or mobility challenged populations.

### Overall MaaS Ecosystem

Transit service is the backbone of a MaaS system. As a result, public transit agencies should lead the MaaS development and engage other service providers to facilitate benign competition and collaboration.

## CHAPTER 3- EXISTING CONDITIONS

This chapter discusses the existing conditions for MaaS implementation in the SCAG region, focusing on the following areas:

- Existing essential infrastructure for MaaS implementation;
- Existing strategies and tools that enable implementation and operation, such as integrated fare programs;
- Existing data standards and technologies that are being formulated and leveraged through partnerships between MaaS platform providers and payment vendors;
- Existing legislations for governance structure and financing resources at the local, state, and federal levels that could potentially catalyze or hinder MaaS development and implementation;
- Current institutional practices facilitating MaaS in the SCAG region;
- Current efforts to educate the public to increase acceptance on MaaS concepts; and
- Current mobility stakeholders within the SCAG region that could serve as system champions or even operators if MaaS proves to be feasible.

### EXISTING INFRASTRUCTURE

Over the past several years, various components of a MaaS system have been piloted around the SCAG region. This existing infrastructure can serve as a starting point for implementing



MaaS in the region. The evaluation of existing infrastructure that is related to MaaS encompasses three categories: physical, technological, and social infrastructure. Technological infrastructure, especially the hardware components, are largely embedded in physical infrastructure.

## Physical and Technological Infrastructure

Physical and technological infrastructure enables interoperability across different payment platforms and devices and facilitates multimodal trip planning.

### Payment Infrastructure

A MaaS system needs an integrated fare payment and validation system. Infrastructure like scanners at transit stations/stops or in-vehicle validators are essential. Currently, transit agencies across Los Angeles (LA) County, Orange County, Riverside County, San Bernardino County and Ventura County, including Metrolink, LA Metro, OCTA, Riverside Transit Agency (RTA), VCTC, Gold Coast Transit, Mountain Transit, and Omnitrans, have implemented mobile fare payment, and some agencies have installed contactless validation readers on their transit systems.

LA Metro's Transit Access Pass (TAP) program was implemented in 2008. Three fare products were included in TAP-participating agencies: Stored Value, EZ Transit Pass, and Agency Pass. In September 2020, LA Metro launched their mobile TAP app through the Apple App Store and enabled a contactless payment function leveraging near-field communication (NFC) that allows riders to reload their TAP cards on iPhones and use the cards across LA Metro service modes which include fixed-route buses, light rail, heavy rail, and microtransit shuttles as well as transit services provided by all the other major transit operators within LA County that accept TAP card's. Riders can pay and manage their accounts using the TAP mobile app. Additionally, LA Metro launched the Android version of the TAP mobile app in mid-2021. The transfer policies of Metro service consist of three scenarios<sup>8</sup>:

- Fare payment with TAP includes 2 hours of unlimited transfers to Metro rail and bus in one direction (no roundtrips).
- Additional 75¢ charge for the Silver Line and the Express Bus Lines 460, 487, 489, 501, 550, and 577
- Additional 50¢ charge for a transfer to non-Metro buses within 2.5 hrs.

Besides being part of the TAP Program, the Los Angeles Department of Transportation (LADOT) also has its own fare payment and trip planning app called LA Mobile. LA Mobile is available for both iPhone and Android mobile devices. The app allows users to purchase, store, and use fares for LADOT's DASH and Commuter Express services. The mobile ticket needs to be displayed to the operator when boarding the bus. Transfers to other modes or transit services provided by other agencies require another fare payment. The app also has real-time information and trip planning tools to help users identify which transit route will take them to their destination and when the next bus is expected to arrive.

7 Note: these agencies/systems are: Angels Flight Railway, Antelope Valley Transit Authority (AVTA), Baldwin Park Transit, Beach Cities Transit, Burbank Bus, Carson Circuit, Compton Renaissance Transit System, Culver CityBus, Foothill Transit, Gardena GTRANS, Glendale Beeline, Glendora Transportation Division, Huntington Park Transit Unlimited, LA County Department of Public Works, LADOT, Los Angeles World Airports (LAWA), Long Beach Transit, Metro, Montebello Bus Lines, Monterey Park Spirit Bus, Norwalk Transit, Palos Verdes Peninsula Transit Authority, Pasadena Transit, Santa Clarita Transit, Santa Monica Big Blue Bus, Torrance Transit

8 <https://www.metro.net/riding/fares/>

9 <https://www.bigbluebus.com/Rider-Info/Making-Contactless-Fare-Payments-on-BBB.aspx>

10 <https://omnitrans.org/wp-content/uploads/2021/01/Transfer-Policies-Jan-2021.pdf>

11 <https://www.riversidetransit.com/index.php/pass-fares-types>

Some other TAP agencies are taking mobile ticketing one step further such as the Big Blue Bus. Since July 12, 2021, Big Blue Bus no longer accepts cash and tokens on board. Customers are required to make contactless fare payments with TAP or a mobile ticket, instead of cash and tokens<sup>9</sup>. These changes underscore how imperative it is to convert cash users to digital payment users in an equitable, and future-oriented transportation system.

OCTA launched the OC Bus Mobile Ticketing app for both iPhone and Android mobile devices in January 2019. Riders can purchase and use the mobile tickets only on OCTA fixed-route buses through the latest OC Bus Mobile 2.0 app which is an upgraded version of their previous mobile app. Validators are present on OCTA buses to validate the mobile tickets. Transfers to other modes such as OC Flex or transit services provided by other agencies require another fare payment.

Omnitrans enabled its customers to make mobile payments for their fixed-route tickets in June 2020 via the Transit App and Moovit app, which are both available for iPhone and Android mobile devices. Their newly launched on-demand service – OmniRide has its own mobile app and allows credit/debit card payment via App Store and Google Play. The mobile ticket needs to be displayed to the operator when boarding an Omnitrans bus. Generally, Omnitrans does not allow passengers to use transit passes from other agencies to transfer to the Omnitrans system. However, riders may use their Omnitrans pass for a free transfer to Foothill Transit at the Montclair Transit Center and the Pomona Transit Center. LA Metro TAP users can also receive free transfers to Omnitrans buses at these two locations. Riders may use their Omnitrans pass to transfer free to RTA and Sunline Transit Agency where Omnitrans, RTA, and Sunline bus stops connect. Omnitrans accepts multi-use passes from Victor Valley Transit Authority (VVTA), Mountain Transit, and Beaumont Transit as a free transfer at points of connection. Riders may use their one-way Metrolink ticket for one free ride on an Omnitrans bus departing from a Metrolink station<sup>10</sup>. They can also use their round-trip Metrolink ticket or multiday pass for one Omnitrans bus trip to and from a Metrolink station.

RTA partners with Token Transit to offer a mobile ticket option to iPhone and Android users. RTA users can purchase and use their mobile tickets on all fixed-route buses. Validators are present on RTA buses to validate the mobile tickets. Corona Cruiser, Omnitrans and Pass Transit (Banning and Beaumont) one-day and multi-day passes are accepted for base fare on local fixed-route buses at transfer locations only. The OCTA one-day and multi-day passes are accepted on Routes 200 and 205 for base fare within Orange County. Passengers are required to pay any additional fares that are required by the OCTA system. OCTA passes are not accepted in Riverside County. RTA will accept valid Metrolink passes for customers traveling to or from a Metrolink station during the period from one hour before to one hour after Metrolink's service hours<sup>11</sup>.

Gold Coast Transit (GCT) in Ventura County also partners with Token Transit to provide a mobile payment option for both iPhone and Android users. The mobile ticket needs to be displayed to the operator when boarding the GCT buses.

Token Transit is currently only valid on GCT buses and does not allow transfers to another transit system, including VCTC or the Ojai Trolley<sup>12</sup>.

VCTC's current card-based fare payment system, VCbuspass, is a county-wide contactless payment system. This card can be purchased by anyone, with or without a smart phone. Validators are present on VCTC buses to validate the transit pass. The VCbuspass is accepted by eight transit agencies<sup>13</sup> including VCTC to facilitate transfers between systems. The current transit pass system has transitioned to an online option where users can purchase their fare through the Umo mobility app. The Umo app is now available to both iPhone and Android users.

Mountain Transit also partnered with Token Transit in 2020 to provide a mobile ticketing option to their passengers. The app allows riders to purchase their bus passes on their smart phones. When passengers board a bus, they show the driver the digital pass on their phone screen. The app is available to both iPhone and Android users. In addition to the mobile ticketing app, Mountain Transit recently approved a fare free pilot program for its trolley and airport service in Big Bear Valley. The two-year pilot project was launched on October 31, 2021. Three trolley routes (Red, Blue, Gold) take riders to major attractions and amenities in Big Bear, including the ski resorts, Boulder Bay, The Village, Supermarkets and the Airport<sup>14</sup>. At the end of the pilot project, Mountain Transit will assess financial and performance data to determine if the fare free program will continue.

Some cross-county regional transit providers such as Metrolink, Amtrak, and Amtrak Pacific Surfliner offer mobile ticketing services to both iPhone and Android users. The mobile ticket users from these three agencies can board with contact-free eTicket scanning. Users can either show their mobile tickets or printed tickets to the conductor on board for validation purposes. Mobile ticketing can be used on all Metrolink trains, connecting bus operators, Metro Rail, and Amtrak trains through the Rail 2 Rail program.

### **Integrated Multimodal Mobility Infrastructure**

In addition to mobile ticket payment systems and validators, physical and technological infrastructure that meets the needs of individual transportation modes and infrastructure that allows for transfers between modes are just as important to achieve a seamless MaaS trip.

#### *Mobility Hubs*

Mobility hubs are where a range of transportation options connect and interact with each other. They often provide an integrated suite of mobility services and serve as the nucleus of the physical infrastructure in a MaaS system. Mobility hubs are essential for a safe and convenient transfer between transportation modes and enhance the overall traveler experience by supplying dynamic, real-time travel information as well as location-based information.

The concept of a mobility hub has been developing in the SCAG region over the last decade. The Imperial ICTC and the San Diego Association of Governments (SANDAG)<sup>15</sup> collaborated to develop a Regional Mobility Hub Implementation Strategy in 2017. As part of this project, a Mobility Hub Features Catalog<sup>16</sup> was issued. Conceptual designs were developed for three locations: Brawley Mobility Hub<sup>17</sup>, El Centro Mobility Hub<sup>18</sup>, and Imperial Valley College Mobility Hub<sup>19</sup>. SCAG, ICTC, and the City of Calexico conducted a collaborative study to determine the feasibility and preferred location for a new intermodal transportation center near the Calexico West Port of Entry pedestrian crossing. The new Calexico intermodal transportation center will serve as a regional mobility hub that will accommodate bus bays for Imperial Valley Transit in addition to the City of Calexico's private transit operators, taxis, and farm labor buses. The environmental phase for this intermodal transportation center has been completed. Design is underway and right-of-way acquisition started in Summer 2021<sup>20</sup>.

RTA in partnership with the City of Hemet is preparing a Downtown Hemet Specific Plan. One of the central components of this plan is to develop a mobility hub that integrates mobility technologies to boost the local economy by creating a vibrant downtown core for the City.

Additionally, the RTA Board has approved a conceptual plan for the Vine Street mobility hub across from the Riverside Downtown Metrolink Station. This mobility hub will incorporate the latest electric vehicle technologies in preparation for RTA's zero-emission bus deployment and will also integrate with different modes of transportation. RTA hosted a virtual workshop from August 5 through August 11, 2021, to share information about the mobility hub to the public. These two mobility hub projects will expedite the development of multimodal integration in Riverside County and promote a complete trip planning concept.

As noted in the Customer-Based Ridesharing and Transit Interconnectivity Plan published by SCAG, Omnitrans, and SBCTA in June 2018<sup>21</sup>, the Fontana Metrolink Transit Center is a major inter-modal transit hub in the Omnitrans service area. This facility is regarded as a key link between high-frequency east-west routes. Parking is available at this location. In addition, Metrolink commuter rail stops at this location, providing transit users the opportunity to park-and-ride and transfer between bus and rail service.

The City of Santa Paula in Ventura County also presented a blueprint in their 2040 *General Plan*<sup>22</sup> update for an expansion of the multi-modal hub located at the intersection of Ventura and Mill Streets. It will include a variety of public transit options such as bus and shuttle services. It will also serve as a regional connection point that makes transit transfers and connections easier. The mobility hub will include: "Kiss-and-Ride"/rideshare drop-off and pick-up, long-term and short-term bicycle parking, electric vehicle charging, and pedestrian amenities

12 <https://www.gctd.org/fares-rider-guide/fares/mobile-passes/>

13 *Camarillo Area Transit and Dial-a-Ride, Gold Coast Transit, Moorpark Transit, Ojai Trolley, Simi Valley Transit, Thousand Oaks Transit, Valley Express Transit and Dial-a-Ride, VCTC*

14 <https://www.mountaintransit.org/free-big-bear-trolley/>

15 SANDAG is not located within the SCAG region. SANDAG is also a Metropolitan Planning Organization.

16 <https://www.sdfordward.com/fwddoc/mobipdfs/mobilityhubcatalog-features.pdf>

17 [http://www.imperialctc.org/media/managed/pdf/Brawley\\_12\\_7\\_17.pdf](http://www.imperialctc.org/media/managed/pdf/Brawley_12_7_17.pdf)

18 [http://www.imperialctc.org/media/managed/pdf/EL\\_Centro\\_12\\_7\\_17.pdf](http://www.imperialctc.org/media/managed/pdf/EL_Centro_12_7_17.pdf)

19 [http://www.imperialctc.org/media/managed/pdf/Imperial\\_Valley\\_College\\_12\\_7\\_17.pdf](http://www.imperialctc.org/media/managed/pdf/Imperial_Valley_College_12_7_17.pdf)

20 <http://www.imperialctc.org/calexico-intermodal-transportation/>

21 <https://www.gosbcta.com/wp-content/uploads/2019/10/Existing-Conditions.pdf>

22 <https://spcity.org/DocumentCenter/View/1710/2040-General-Plan-Section-3---Circulation-and-Mobility-Element>

such as shelters, benches, and trash cans to make waiting more comfortable.

The City of Los Angeles has been exploring the concept of mobility hubs since 2016. They published the Mobility Hubs Readers Guide in summer 2016<sup>23</sup>. In 2019, the City together with LA Metro and the City of Long Beach published a Request for Proposals (RFP) to implement integrated mobility hubs in Los Angeles and Long Beach at existing Metro rail stations<sup>24</sup>.

Most recently, in March 2021, SCAG and Los Angeles County approved the I-710 North Mobility Hubs Plan to evaluate existing conditions, identify existing modes of transportation, and analyze multimodal supportive infrastructure strategies<sup>25</sup>. In the same month, the OCTA board approved the development of a strategy for determining where mobility hubs should be located, what they should look like, and what features they should include. The objectives of creating mobility hubs for OCTA include:

- Increasing transit ridership on OC Bus, OC Flex, OC Streetcar, Metrolink, rideshare and other public options
- Providing convenient alternatives to single-occupancy vehicle trips and reducing car dependency
- Increasing the amount of shared rides
- Reducing air pollution and encouraging active transportation
- Providing equitable transportation solutions that meet the needs of all communities.

The Orange County Mobility Hubs Strategy is in the first stage, and part of the study will be outlining next steps once the concept is further refined. Those concepts will require more detailed planning, engineering and coordination between partners to move forward<sup>26</sup>.

### *Curbside Space*

With the increasing concern for balancing the needs for all roadway users and the growth of TNCs, like Uber and Lyft, as well as online shopping and associated deliveries, demand for curbside pickups, drop-offs, and dwell times is growing dramatically. Curbside management seeks to inventory, optimize, allocate, and manage curb space to maximize access for the wide variety of curb demands and mobility interoperability. Usage of the curbside includes the following:

- Private vehicles for parking;
- Ridesharing/ridehailing services for pickups and drop-offs;
- Delivery services;
- Connected Vehicle/Autonomous Vehicle pickups and drop-offs;
- Micromobility parking;
- Transit infrastructure;
- Charging facilities;
- Pedestrians/Bike safety treatment; and
- Local businesses.

Currently, the Cities of Los Angeles, West Hollywood, and Santa Monica have active curbside management systems and services. Some of the curbside management solutions such as Automated License Plate Recognition (ALPR) systems, Global Navigation Satellite System (GNSS) speed standards, Light Detection and Ranging (LiDAR) objects, asset inventory and management, and data analytic solutions require networked assets like cameras, sensors, meters, and dynamic message signs.

### *Charging Stations*

There are four types of charging stations in the SCAG region according to the Southern California Plug-in Electric Vehicle (PEV) Atlas<sup>27</sup>: legacy charging stations, direct current fast charge, level 1, and level 2 charging stations. **Figure 5** shows the distribution of charging stations within the SCAG region.

23 <http://www.urbandesignla.com/resources/docs/MobilityHubsReadersGuide/hi/MobilityHubsReadersGuide.pdf>

24 <https://www.Citymart.com/bids/lamobilityhubs>

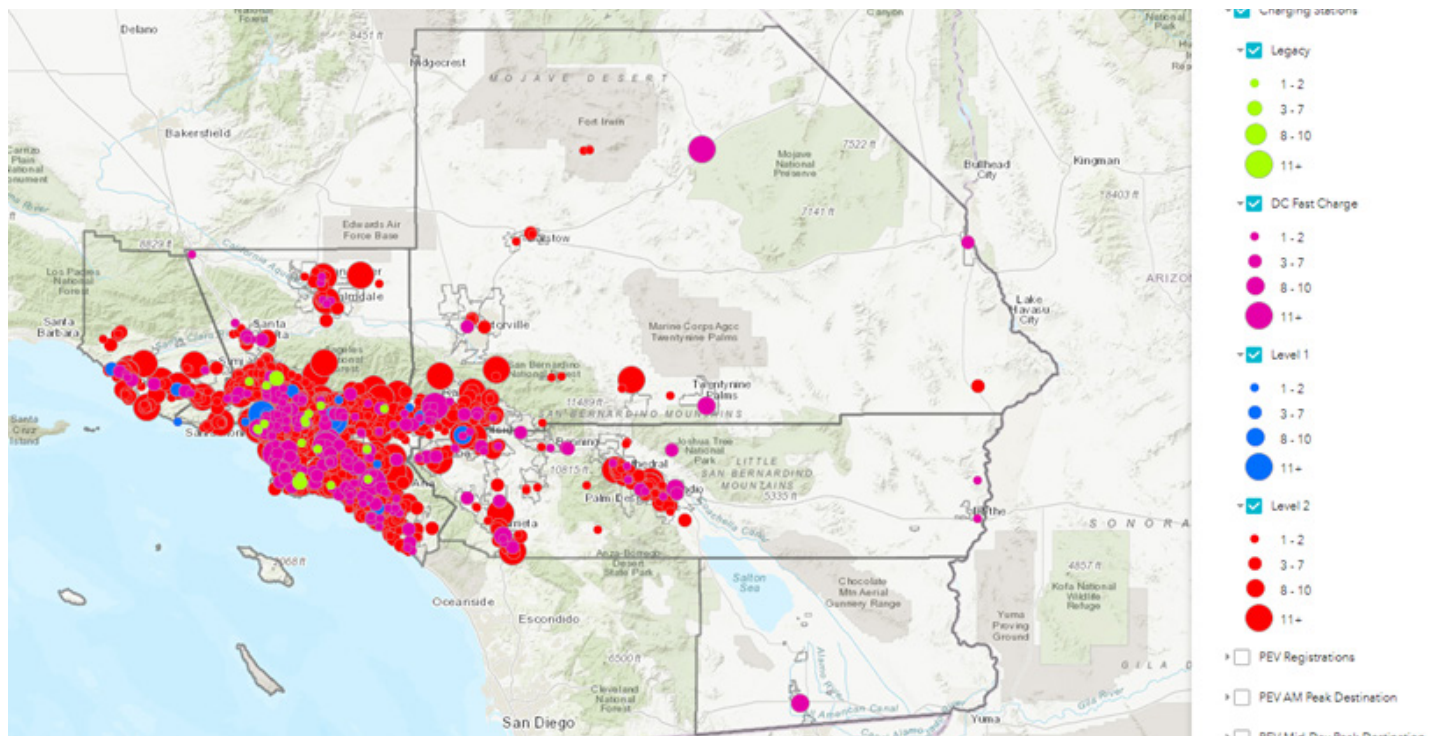
25 <https://scag.ca.gov/sites/main/files/file-attachments/eac033121fullpacket.pdf?1616727661>

26 <https://www.octabonds.com/orange-county-transportation-authority-ca/about/news/i4719?newsId=23121>

27 SCAG PEV Atlas Map: [https://maps.scag.ca.gov/electric\\_vehicle/index.html](https://maps.scag.ca.gov/electric_vehicle/index.html)



**Figure 5: Charging Stations Distribution in the SCAG Region**



Source: SCAG PEV Atlas.

**Table 5** provides a high-level comparison of the three modern charging stations mentioned above.

**Table 5: Comparison of Modern Charging Stations**

Charging Station Type	Cost per Charge	Primary Location	Charging Speed
Direct Current Fast Charge	\$\$\$	Public	Fast
Level 2	\$\$	Residential, public, work	Medium
Level 1	\$	Residential	Slow

Source: <https://freewiretech.com/difference-between-ev-charging-levels/>

As electric vehicles become more mainstream due to environmental concerns, policy requirements, financial subsidies, and consumer demand, a comprehensive and high-quality charging station network in the SCAG region is essential for a mature MaaS system.

Charging for micromobility solutions, especially scooters, is currently undertaken by independent contractors, which are collected and charged in their own living spaces. In January 2020, the company Charge partnered with REEF Technology and deployed the first Charge SmartHub in downtown Los Angeles located adjacent to the Staples Center<sup>28</sup>. The Charge SmartHub is an e-scooter mass charging center. Having a centralized place for contractors to charge the scooters provides many benefits to the community, such as a potential income increase through economies of scale and freeing up living spaces from charging.

According to the Mobility Hub Readers Guide published by LADOT, charging stations for vehicles are vital to central mobility hubs and regional mobility hubs. Charging stations are critical in meeting the zero-emission vehicle deployment goals in California and jurisdictions within SCAG has been developing path forward

in achieving the goals. The City of Los Angeles is taking a leap with its commitment to increase the percentage of zero-emission vehicles on city roads to 25 percent by 2025, 80 percent by 2035, and 100 percent by 2050. As a result, by 2030, direct current fast chargers for public and workplaces in Los Angeles will need to grow by a factor of 33 to about 3,900 chargers, while public Level 2 chargers will need to increase by a factor of 8 to about 21,500 chargers. Workplace charging will need to increase to at least 25,000 chargers by 2030. Los Angeles will also need approximately 536,000 home chargers by 2030 to accommodate roughly 1.3 million electric vehicles. These home chargers make up 90 percent of the total charger needs and account for 60 percent of the total electric vehicle energy demand<sup>29</sup>.

However, most electric vehicle charging is likely to continue at home, where it is less expensive and more convenient than public options. Los Angeles will need approximately 536,000 home chargers by 2030 to accommodate roughly 1.3 million electric vehicles. These home chargers make up 90 percent of the total charger needs and account for 60 percent of the total electric vehicle energy demand.

<sup>28</sup> <https://www.businesswire.com/news/home/20200117005421/en/Charge-Installs-First-E-Scooter-Mass-Charging-Center-in-Los-Angeles>

<sup>29</sup> <https://theicct.org/sites/default/files/publications/LA-charging-infra-feb2021.pdf>



## Parking

Although a MaaS system inherently suggests that the requirement and desire for private car ownership and single-occupancy vehicle trips will decline, parking spaces will still be relevant as MaaS is implemented because spaces are still needed for maintaining, and charging shared vehicles, even if private vehicle ownership is greatly declined. However, traditional curbside parking and parking garages would be redefined as smart parking solutions to accommodate these new mobility services. The LA Express Park<sup>30</sup> which launched in 2012 is an example of smart curbside parking. Technologies like License Plate Recognition (LPR), dynamic pricing, mobile payment, and real-time enforcement have the potential to make parking more cost efficient and less time-consuming.

In terms of garage parking, the recent LA World Airports (LAWA) “smart parking” service contract<sup>31</sup> awarded in October 2020 illustrates a MaaS-ready parking operation. The new and improved services include:

- Guidance/wayfinding signage;

- Automated parking infrastructure, such as automated gates with contactless payment functionality, ALPR, credit card and bar code readers, and pay-on-foot machines; and
- Electric Vehicle (EV) charging and a one-step payment process for EV parking.

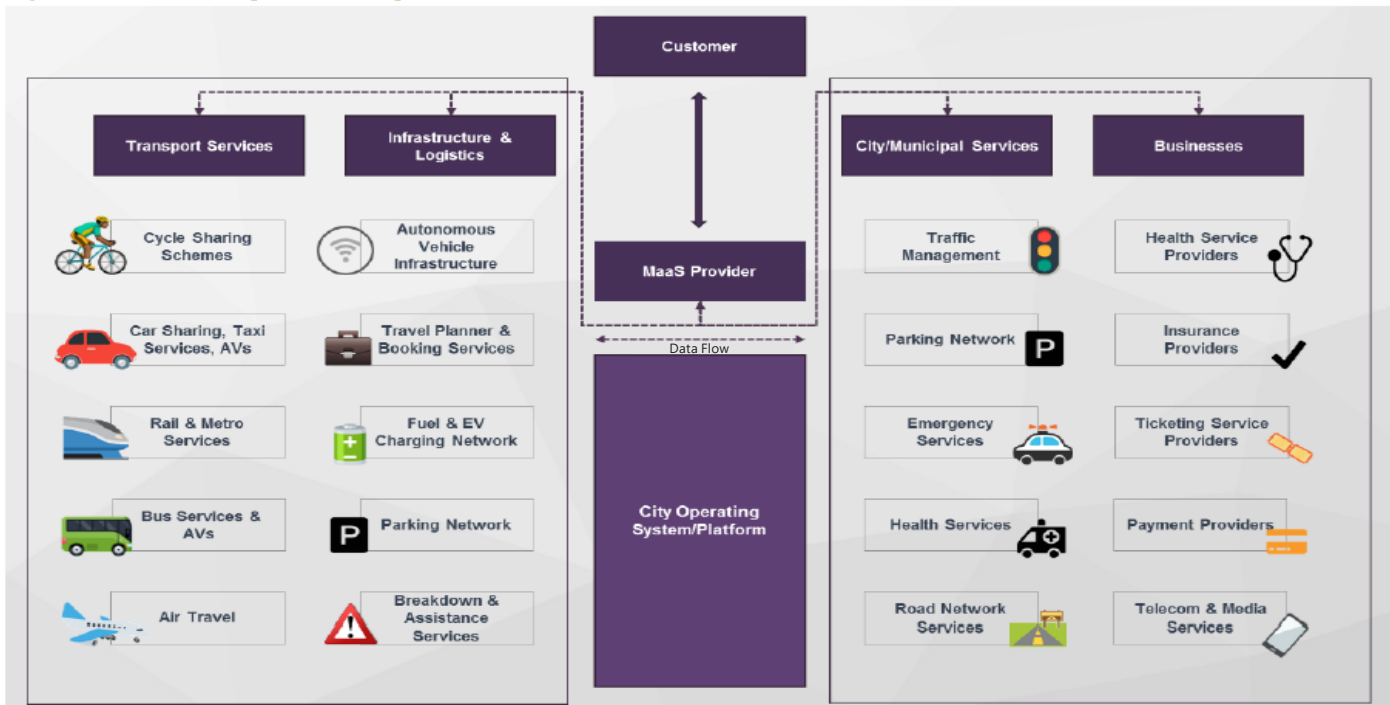
## SCAG Mobility Initiatives

SCAG has released the Call for Applications (CFA) with a focus on Smart Cities & Mobility Innovations (SCMI) projects to fund innovative mobility plans proposed by local agencies, cities, counties, and other tribal governments. These studies include curb space data inventories, technology assessments, or adoption plans that entail smart parking strategies, mobility hubs, curbside management, and connected and autonomous vehicles.

## Social Infrastructure

As shown in **Figure 6**, a MaaS system is a layered and interconnected system with public players and private players. MaaS cannot be successfully implemented without collaboration and partnership between the public sector and private sector.

**Figure 6: MaaS System Players**



Source: Juniper Research

P3s benefit both the public and private sectors by taking advantage of the efficiency from the private sectors to streamline limited resources, reduce costs, and leverage the public sector to integrate societal goals, especially equity goals, into MaaS<sup>32</sup>. The public sector's role has also been recognized as important in removing legislative barriers to MaaS implementation<sup>33</sup>. In addition, P3s may spark more

innovation and unique solutions to tackle challenges, such as lack of experience in complex planning and procurement processes. More specifically, the private sector has significant capital potential to provide funding support or investment in order to launch emerging mobility solutions like MaaS or major corridor projects.

P3s have been widely incorporated into the planning and

<sup>30</sup> <https://ladotparking.azurewebsites.net/parking-meters/la-express-park-and-parking-in-la/>

<sup>31</sup> <https://www.lawa.org/news-releases/2020/news-release-053>

<sup>32</sup> Eckhardt, J., Aapaoja, A., & Haapasalo, H. (2020). Public-private-people partnership networks and stakeholder roles within MaaS ecosystems. In A. M. Amaral, L. Barreto, S. Baltazar, J. P. Silva, & L. Gonçalves (Eds.), *Implications of mobility as a service (MaaS) in urban and rural environments*. Hershey: IGI Global. <https://doi.org/10.4018/978-1-7998-1614-0>.

<sup>33</sup> Eckhardt, J., Lauhkonen, A. & Aapaoja, A. *Impact assessment of rural PPP MaaS pilots*. *Eur. Transp. Res. Rev.* 12, 49 (2020). <https://doi.org/10.1186/s12544-020-00443-5>.

construction of major transit and freeway projects in the SCAG region, such as LA Metro's Sepulveda Transit Corridor and I-710 Corridor project.

## MANAGEMENT AND OPERATION

Tools or strategies that are currently being deployed to enable the implementation and the operability of MaaS should be identified. As MaaS development for the SCAG region is still at the feasibility study phase, an analysis will be conducted to study existing fare programs, such as the California Department of Transportation (Caltrans) Cal-ITP, LA Metro's TAP system, and other regional fare programs. An integrated fare payment system serves as a gateway to a successful MaaS deployment.

## CALTRANS

Supported by the California State Transportation Agency (CalSTA) and Caltrans through a grant from the California Transit and Intercity Rail Capital Program (TIRCP), the Cal-ITP is a statewide initiative to simplify travel and make travel more cost efficient for all Californians.

In August 2019, CalSTA and Caltrans organized a kickoff meeting with companies and organizations in the payment, banking, and trip-planning industries. The meeting identified barriers to an integrated fare system with seamless trip planning, such as the lack of uniformity among California's transit providers, lack of reliable transit information, and lack of statewide fare payment standards. In April 2020, a Cal-ITP Feasibility Study<sup>34</sup> was released and proposed three initiatives to tackle the barriers and the issues identified in the 2019 meeting and quantified the economic benefits of these initiatives. The three initiatives are:

1. Ensure standardized statewide access to reliable transit information
2. Create a standardized statewide fare payment system using global payment standards
3. Create a statewide eligibility verification program for transit riders with discounted fares

In order to support the three initiatives, Cal-ITP has formulated three key tangible strategies:

1. Enabling contactless payments
2. Automating discounts
3. Providing accurate and complete data and information for trip planning in real time

To secure the provision of accurate, complete, consistent, and up-to-date data, Cal-ITP released a publication establishing the California Minimum General Transit Feed Specification (GTFS) standards, GTFS Realtime (GTFS-RT), as well as Mobility Data Interoperability Principles to provide guidance for transit providers and technology companies to ensure that all systems using mobility data can communicate using the same language. Cal-ITP was working to ensure statewide GTFS static coverage by the end of 2020 and GTFS-RT by the end of 2021<sup>35</sup>. The Mobility Data Interoperability Principles were collaboratively developed among transit agencies. They will create an industry-agreed upon vision, definition and direction for achieving interoperability with clear roles and responsibilities. The purpose of the principles is to foster a transit industry where

mobility data flows freely and securely between systems, between operators, and between providers and the public users, empowering transit agencies and other mobility service providers and transportation system managers to provide better service and improve the customer experience<sup>36</sup>.

These strategies were brought together in two implementations: Monterey-Salinas Transit (MST)'s first open-loop contactless fare collection demo and the launch of contactless fare collection on Sacramento Regional Transit (SacRT)'s Green Line system in June 2021<sup>37</sup>. The MST's contactless fare collection system demo allows riders to tap contactless bank cards to make payment. Older adults would receive a transit discount when they tap to pay, and the complete GTFS data feeds are accessible through MST's trip planning app partner, Transit App. In the MST's demonstration, one of the objectives is to provide seamless process for transit riders to verify eligibility for discounts which can be better handled by open-loop payment system.

SacRT partnered with Caltrans, Visa, Littlepay, and SC Soft to offer a contactless method for payment on light-rail trains. The touch-free fare payment technology allows riders to tap a contactless credit, debit, prepaid card, or contactless-enabled mobile or wearable device (e.g., smartwatch) to pay fare when boarding light-rail trains. SacRT is the first transit agency in California to introduce a contactless payment solution on a light-rail train system<sup>38</sup>. During the initial demonstration period, only the basic single ride fare will be available. SacRT is looking into discount fare options in the future<sup>39</sup>.

Cal-ITP intends to host demonstration projects on the following topics in the future.

- Fares, including fare media, policies, and interagency transfers
- Automated discount eligibility verification for Veterans and low-income riders
- Text-to-speech for stop and route names
- Text-to-speech for describing interior pathways
- Elevator and escalator status
- Shared infrastructure
- Extending the GTFS specification to describe CAD/AVL outputs and other backend data
- Automated Passenger Counting (APC) technology GTFS data for demand-responsive transit
- Visualization and validation tools to improve GTFS accuracy and consistency

Another three meetings were held after the kickoff which took place in July 2020, August 2020, and February 2021. At these meetings, participants discussed passenger counting technologies, payment issuance, and accounts for multimodal trips.

Cal-ITP has laid a solid foundation from a state level for an integrated fare payment and trip planning system by setting data standards, conducting stakeholder involvement and outreach, and supporting pilots and demos in California. It could serve as a resource center for MaaS operating in the SCAG region and help facilitate the management and operation of a MaaS system when implemented.

34 <https://dot.ca.gov/-/media/dot-media/cal-itp/documents/calitp-feasibility-study-042420-a11y.pdf>

35 <https://www.calitp.org/>

36 <https://interoperable-mobility.github.io/principles/>

37 <https://dot.ca.gov/-/media/dot-media/cal-itp/documents/cal-itp-carb-market-sounding-kick-off-event-presentation-021621-a11y.pdf>

38 <https://www.sacrt.com/apps/sacrt-to-offer-contactless-fare-payment-onboard-green-line-light-rail/>

39 <https://dot.ca.gov/cal-itp/technology-demonstrations>

## LA Metro

LA Metro's TAP program, as described in the previous Physical and Technological Infrastructure section, partially bridged the gap between mobile payment and trip planning systems. It achieved an integrated fare payment system at a limited capacity because it is only applicable to 26 transit agencies. Additionally, one of LA Metro's fare products known as the EZ transit pass, which is available across 23 transit agencies, is a monthly pass that allows for reduced transit fares for travel within specified zones.

The new TAP system could serve as a foundation for a MaaS platform. The implementation and operation of the network, level of data collection and aggregation, experience of guiding travel behaviors, and fare payment have accumulative effects for LA Metro to potentially serve as the system operator in a MaaS system in the SCAG region.

Before the official launch of the TAP mobile app, other efforts such as fareless transit and fare capping policies which remove some of the payment barriers of disadvantaged communities have been made to pave the way for an integrated mobile payment and a more equitable transit system which are essential for an inclusive MaaS system.

Around the same period of the mobile TAP app launch, Metro's Fareless System Initiative (FSI) Task Force started the process of exploring the feasibility of eliminating fares on Metro buses and trains.

Metro's Board approved the plan to move forward on a 23-month pilot program in May 2021. Some prerequisites need to be met before an official pilot launch, including a comprehensive plan on how to cover the program cost which was estimated at \$250 million<sup>40</sup>. The first phase of the proposal has been approved by Metro. In August 2021, Metro tested fareless transit with six schools and districts, distributing more than 5,600 test TAP cards to students. Metro and the region's other transit agencies cover the majority of the cost of the two-year pilot program. K-12 districts pay \$3 per student annually, and Community Colleges pay \$7 per student annually. The Board also approved a motion that will significantly expand heavily discounted fares through the Low Income Fare Is Easy (LIFE) program. The motion eliminates the paperwork needed to get LIFE fares and provides three months of fareless transit to new LIFE enrollees. Additionally, Metro is offering a variety of discounts on Metro passes, including some promotional rate discounts when fare collection resumes on buses on January 10, 2022<sup>41</sup>. This initiative would help improve transit accessibility and provide financial relief to low-income residents in LA County. It could also have significant environmental implications by inducing more transit usage which could lead to a reduction in greenhouse gas emissions and smog. Regardless of the efforts made by Metro in promoting fareless transit, many of the municipal transit operators have no plans to follow Metro's lead in implementing fareless transit in fear of losing their already limited fare revenue.

Fare capping represents a growing trend in transit because it offers a win to both agencies and riders. In May 2020, the Metro Executive Management Committee passed a motion that could reduce transit fares during the COVID-19 recovery. Further, the committee directed Metro to report back on a plan to implement fare capping<sup>42</sup>. The motion also:

- Directs Metro's CEO to develop a marketing plan to let riders know about the pass reductions and how to take advantage of them by using TAP cards;
- Calls for similar cost reductions on Regional EZ Transit Passes;
- Asks for a report on a fare capping/best fare system that would allow a rider to use a pass without having to shoulder the cost upfront; and
- Asks for a report from Metro within 120 days of the reduced fares detailing pass sales and ways they might permanently reduce costs<sup>43</sup>. The report was published on March 18, 2021<sup>44</sup>.

By introducing fare capping, single fares paid by riders are "capped" when they reach the cost of an unlimited-ride pass. Advanced fare payment technologies such as mobile payments count how many times a rider uses the system within specific time spans and stops charging after the daily cost-equivalent is hit. Therefore, capping incentivizes riders to switch to mobile or card payment options, reducing agency overhead associated with cash handling. Meanwhile, riders who cannot afford the upfront cost of a pass no longer end up paying more<sup>45</sup>.

Overall, the fare programs implemented by LA Metro have started laying the foundation for the future MaaS development in the SCAG region by incorporating more transportation modes in an equitable way.

## VCTC

As described in the previous Physical and Technological Infrastructure section, VCTC launched the VCbuspass on the Umo Mobility App in 2021. VCbuspass users are able to plan their trips among all eight participating transit operators and rideshare options and make payments via the app.

## Others

Other practices and programs in the SCAG region to facilitate and manage an interoperable payment network include Metrolink's Rail 2 Rail program, OCTA's Bus Mobile 2.0, and Victor Valley Transit Authority (VVTA)'s Umo Mobility app.

The Rail 2 Rail program allows Metrolink Monthly Pass holders to travel on the Amtrak Pacific Surfliner trains within station pairs of their pass at no additional charge. In addition, the Amtrak Pacific Surfliner and Metrolink both have cooperative agreements with their connecting bus service providers.

OCTA's Bus Mobile 2.0 has switched partners from INIT to Bytemark as of July 2020 and transitioned to an account-based payment system.

VVTA adopted the Umo Mobility App<sup>46</sup> and Pass<sup>47</sup> to enhance

40 [https://media.metro.net/2020/fsi\\_fact\\_sheet\\_ENG.pdf#page=3](https://media.metro.net/2020/fsi_fact_sheet_ENG.pdf#page=3)

41 <https://thesource.metro.net/2021/09/23/metro-board-approves-fareless-plan-for-k-14-students-and-easier-access-to-discounted-fares-for-many-riders/>

42 <https://la.streetsblog.org/2020/05/26/metro-motion-proposes-cutting-fares-in-half-introducing-fare-capping/>

43 <https://www.welikel.com/metro-board-votes-to-cut-rider-pass-costs-in-half/>

44 <https://boardagendas.metro.net/board-report/2020-0704/>

45 <https://transitcenter.org/fare-capping-formula-fairer-fares/>

46 *Umo App: A colorful, user friendly experience with best-in-class multimodal trip-planning and fare payment capabilities all in one app. Developed in partnership with Moovit.*

47 *Umo Pass: An account-based fare collection platform for transit agencies that reduces the cost burden of traditional fare collection and makes it easier for riders to pay through various touchless options, including both electronic payment and cash-preferred riders.*

their services in February 2021. The Umo system replaced their previous TouchPass electronic fare collection system that launched in January 2020 after Cubic's acquisition of Delerrok<sup>48</sup>. The app includes trip-planning which includes all service area transportation options, from fixed-route buses to rideshare and mobile payment functions, and the pass is an account-based fare collection platform. These two solutions both help the high desert region within the SCAG region achieve a more integrated payment system.

These programs have shown the attempts of public transit operators in the SCAG region to break the barriers between other operators and prepare for a MaaS future through account-based and platform-based solutions.

## DATA AND TECHNOLOGY

Data and technologies, especially trip planning and payment integration, ignited the development of the MaaS concept and serve as the building blocks for a MaaS system. **Figure 7** shows how data flows through different users in a MaaS system and how technologies are enabling the flow. The top of **Figure 7** shows how the different data items will be linked, while the bottom provides additional details for each item. The figure is split into three sections: data input, user-oriented data processing, and data aggregation system. Square boxes highlight the MaaS data and technology ecosystem components while round boxes represent a data input, output, or justification to support those components. As data privacy and cybersecurity are central to all aspects of the system, their respective technological requirements need to span all users and data across the entire system.

## Data Standards and Security

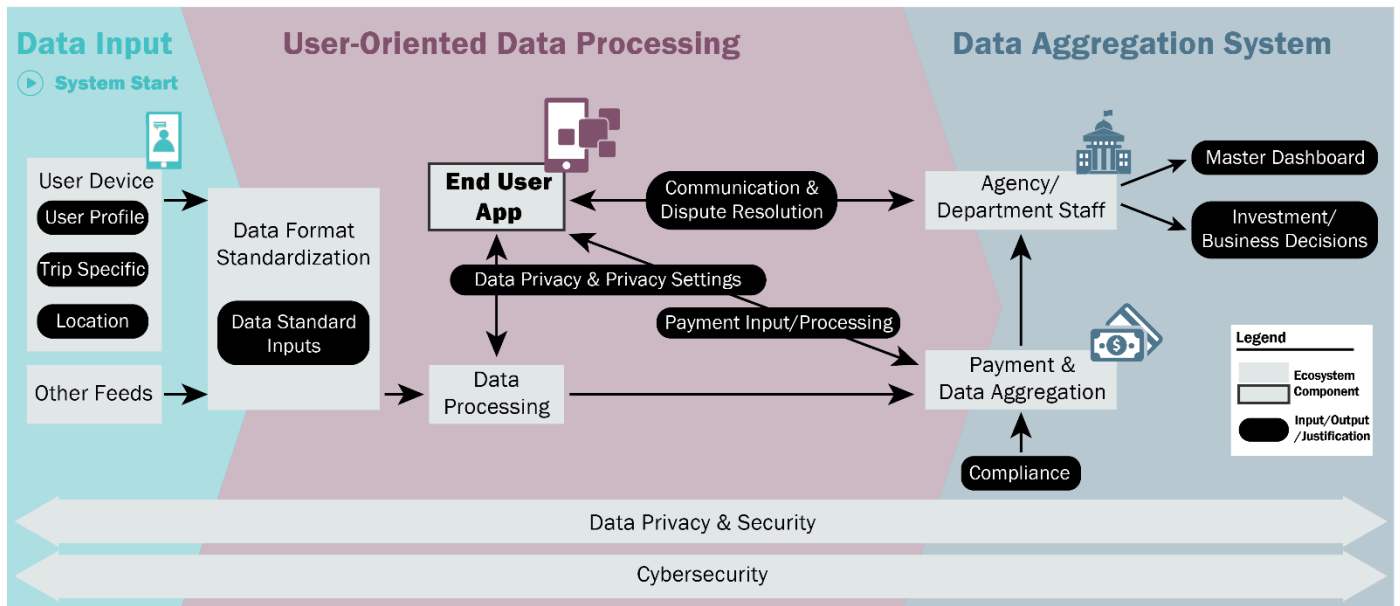
There are various data standards that need to be considered and incorporated in the development of a MaaS system. Many of the existing data standards have program specific data guidelines that the vendor and participating operators must comply with and are based on the Mobility Data Specification (MDS). All data should be geospatial (GIS-based) and temporal (time-stamped) to enable visualization and analysis. **Table 6** provides a summary of all MaaS relevant data standards.

The California Consumer Privacy Act (CCPA) and European Union's General Data Protection Regulation (GDPR) are being adapted across the industry to become the norm for data privacy. This includes a "right to be forgotten" feature that allows users to delete the data accrued on them if they choose to leave the platform. GDPR should be considered to protect European Union citizens who reside in California. Similarly, CCPA covers all California State residents, which went into effect on January 1, 2020. The vendor should be in compliance with the laws, but interpretation of the law should be up to the vendor with reviewed and approval by a data privacy expert with legal counsel.

As the volume of the data in a MaaS system can be vast, and most data will likely be stored in the cloud, all private service providers and third parties accessing the MaaS system should be System Organization and Control (SOC) 2 compliant for management and storage of customer data in the cloud. It is considered a technical audit which requires companies to establish and follow strict information security policies and procedures. SOC 2 compliance is about having policies, procedures, and practices rather than a binary action of achieving a compliance checklist.

<sup>48</sup> <https://www.businesswire.com/news/home/20200106005375/en/Cubic-Strengthens-NextCity-and-NextMission-Strategies-with-the-Completion-of-Delerrok-and-PIXIA-Acquisitions>

**Figure 7: MaaS Data/Technology Ecosystem**



**User Profile:**

- Mode Preference
- First&Last Mile Preference
- Willingness to Walk/Bike/Micro-mobility
- User Constraints (ADA, children)
- Payment Information/Method

**Trip Specific:**

- Origin/Destination
- Timestamp
- Travel Time
- Mode Choice (Including First&Last Mile)
- Parking Preferences
- Length of Parking Stay
- Override of Any User Profile

**Other Feeds**

- Data Providers

**Data Standard Inputs:**

- Linear Referencing System (Location)
- OGC-compliant Web services
- MDS
- APDS
- CurbLR
- GTFS/GTFS-RT

**End User App**

- Contactless/E-Payment
- Various Payment Methods
- Personal Dashboard

**Data Processing**

- Payment System
- Dynamic Pricing
- Real-time Communication
- Cross Platform Datasharing

**Payment Input/Processing:**

- Debit Card
- Credit Card
- Bank Account
- Other Electronic/Mobile Wallet
- Other Payment API

**Communication & Dispute Resolution:**

- Real-time Messaging
- Marketing, Advertising, Outreach
- Dispute Resolution

**Payment & Data Aggregation**

- Unified Management System
- Anonymized Data Reporting
- Cloud Storage
- Cross Platform Data Processing
- Publicly Available APIs
- Qualified Security Assessment
- Geofencing Standard
- Geofencing Restrictions

**Compliance:**

- Civil Rights Act Title VI Compliance
- The Payment Card Industry Data Security Standard (PSI DSS)
- Data Privacy and Consumer Welfare Law Compliance

**Agency/Department Staff**

- Socioeconomic Analysis
- Revenue Validation
- Performance Management
- Existing Technology Integration
- Service requests/311 Integration

**Dashboard:**

- Travel Choices
- Sustainability
- Health
- Service Request Status

Source: AECOM



**Table 6: Data Standards Summary**

Data Standard	Description
<b>Alliance for Parking Data Standards (APDS)</b>	A consensus-built international set of open global data standards for a common language for parking operations and sharing parking related data with other industries.
<b>Curb Linear Reference (CurbLR) by SharedStreets</b>	Data standard for describing curb regulations using linear referencing to link regulation information back to the street.
<b>General Bikeshare Feed Specification (GBFS)</b>	GBFS is the open data standard for bikeshare that provides real-time data feeds in a uniform format publicly available online, with an emphasis on findability. No private user data is included.
<b>General Transit Feed Specification (GTFS)</b>	GTFS is a data specification that allows public transit agencies to publish their transit data in a format that can be consumed by a large array of software applications. It is currently used by thousands of public transportation providers. There exists a static component (e.g., schedule, fare, geographic transit routes/stops) and a real-time component (e.g., arrival predictions, vehicle positions, service advisories).
<b>General Transit Feed Specification-Real Time (GTFS-RT)</b>	GTFS-RT Realtime is a feed specification that allows public transportation agencies to provide real-time updates about their fleet to application developers. It is an extension to GTFS. GTFS-RT Realtime was designed around ease of implementation, good GTFS interoperability, and a focus on passenger information.
<b>Mobility Data Specification (MDS) by Open Mobility Foundation</b>	MDS is a set of Application Programming Interfaces (APIs) that are focused on dockless e-scooters, bicycles, mopeds, and carshare vehicles with the goal of providing a standardized way for municipalities or other regulatory agencies to collect, ingest, compare, and analyze data from mobility service providers, and to give municipalities the ability to express regulation in machine-readable formats.
<b>Payment Card Industry Data Security Standard (PCI DSS)</b>	PCI DSS helps protect the safety of payment information for merchants, financial institutions, or other entities that store, process, or transmit cardholder data.
<b>Payment Application Data Security Standards (PA-DSS)</b>	PA-DSS define security requirements and assessment procedures for software vendors of payment applications. Use of a PA-DSS compliant application by itself does not make an entity PCI DSS compliant.

Source: AECOM

All data must be securely stored, transported and otherwise technically and physically protected against unauthorized access, destruction, modification, disclosure, or loss. Inappropriate disclosure of personal information and misuse of data for activities, such as identity theft, are significant concerns for a MaaS system.

Data security can be achieved through the implementation of an information security management system (ISMS) certified to the ISO/IEC 27001 standard. This requires companies to develop and implement policies, plans, and monitoring controls in areas such as network security, change management, system software maintenance, vulnerability management, and patch management.

## Technologies

### Trip planning Technologies

Algorithms are essential for trip planning systems to find the optimal transportation mode and route based on origin-destination (OD) data.

This optimization should also be customizable per users’ preferences.

It should be noted that each third-party application would have its own algorithm, but when aggregated in a MaaS system, the system may be more complex iterating through the third-party vendors APIs and possibly have to call them several times per calculation. API call limits by applicable mobility providers should be considered when developing the MaaS trip planning

algorithm and possible extensions negotiated with the third-party service providers should be considered if necessary.

For analytical purposes, as well as to justify pricing for different transportation modes, the MaaS platform must have sufficiently accurate supply data. This data should include transit capacity and availability, parking occupancy, and other on-demand modes’ availability that can be analyzed over specific time periods and geographies. Provision of real-time data updates will ensure the accuracy of the supply data.

Trip planning services should be linked with the data standards listed in **Table 6** above.

Currently, there are limited multimodal trip planning applications that meet the requirements mentioned above in the SCAG region such as VVTA and VCTC’s Umo Mobility platform. Most of the trip planning features in the SCAG region are implemented by transit agencies and only allow users to plan trips using transit, such as LA Metro and Metrolink. LA Metro, for example, offers trip planning through the Transit app. Currently, riders can plan trips across Metro bus, Metro rail, and Metro Micro. The Integration with Metro Micro is a new feature that was recently introduced. The new feature allows users to request a ride within a Metro Micro zone directly from the trip planning app.

VCTC has an existing service called Valley Express that integrates a variety of transit modes in one trip planning platform. Valley Express includes fixed route service, demand response service, and paratransit service. Another study VCTC is currently leading is the *Transit Integration and Efficiency*

*Study*<sup>49</sup>. This study aims to expand the lessons learned from Valley Express and identify potential efficiencies in the delivery of quality local and regional bus transit throughout Ventura County. VCTC engages ten different transit providers including VCTC Intercity, GCT District, Valley Express Bus, Simi Valley Transit, Camarillo Area Transit, Thousand Oaks Transit, Moorpark City Transit, Ojai Trolley, Kanan Shuttle, and Connect – East County Transit Alliance (ECTA) Intercity Dial-a-Ride to coordinate this study.

In San Bernardino County, the Customer-Based Ridesharing and Transit Interconnectivity Plan explores transfers between buses and commuter rails and the relationship between bike, pedestrian, and transit modes. A more recent publication in October 2020 is the Inland Empire Comprehensive Multimodal Corridor Plan (IE CMCP)<sup>50</sup> which was produced through a partnership between Caltrans District 8, RCTC, SBCTA, Western Riverside Council of Governments (WRCOG), and SCAG to provide multimodal strategies across the SCAG region. This study facilitates more detailed assessments of corridor conditions with multimodal corridor improvement strategies, including transportation demand management (TDM), freight bottleneck relief, transit-oriented development (TOD) initiatives, complete streets, and integrated corridor management strategies that include freeway/arterial operations and safety improvements. This study defined some of the trip characteristics of the Inland Empire residents. The trips within the study area are heavily auto-centric with 92 percent of commute activities occurring by car; 8 out of 10 of those trips are internal-internal trips, meaning they start and end within the study area. This plan, and the localized trip characteristics identified, will help a MaaS system planner/operator tailor trip planning functions to meet the local needs and determine how advanced a MaaS system should be in certain geographies.

### Payment Technologies

A MaaS system needs account-based mobile payment technologies, such as contactless closed-loop multimodal transit card, open-loop credit/debit card, digital wallet (i.e., Apple Wallet and Google Pay) and/or QR code validation to support seamless multimodal trip planning and transfers for users.

Consideration of equitable payment options for the unbanked population and/or those without a credit/debit card is needed. This can include developing partnerships with local participating stores to accept cash to transfer to a virtual wallet. Providing free or subsidized smartphones could also encourage utilization of a virtual wallet. Fare capping could be considered as an equitable payment option in order to allow users who go over a certain number of transit trips to ride for free the rest of that month once an established threshold has been achieved.

In the SCAG region, account-based mobile payment technologies have been developed by major transit agencies such as LA Metro, Metrolink, and OCTA as mentioned above, and they are expanding to smaller jurisdictions. Because they are moving forward by public transit agencies, equitable

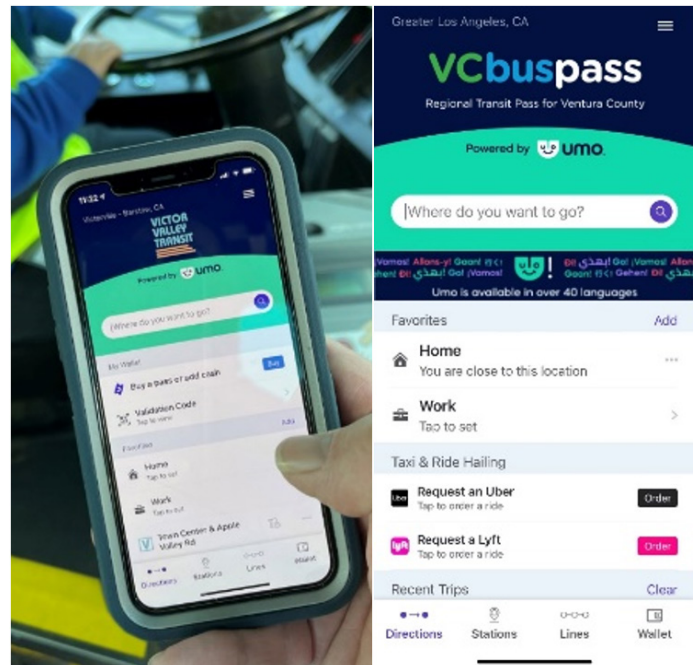
payment options such as cash payment on board and cash to mobile payment are usually taken into consideration. Currently, there is no regional or state-wide cEMV (Contactless ticketing system) within the SCAG region or in California. However, Cal-ITP is promoting global payment standards to support interoperability among operators without the need to deploy a statewide payment system.

### Case Study - Cubic-Moovit Partnership

In January 2020, Moovit, a MaaS platform, announced a partnership with Cubic Transportation Systems, the business division of Cubic Corporation which is a ticketing, fare collection, and management solutions company for public transit systems. Cubic's contactless fare payment systems include but are not limited to OMNY Tap and Go in New York and the Clipper card in San Francisco<sup>51</sup>.

A year after the announcement, their MaaS product Umo Mobility was launched in January 2021. It is a suite of products that allows users to plan trips and make payments on the same platform. Their trip planning integrates most of the transportation options, ranging from buses, trains, trams, and ferries to rideshare, scooters, and bikes. Umo Mobility also operates on a subscription-based model. The first Umo products are available in 15 markets across the US. The agencies that are and will be implementing this in the SCAG region are VVTA and VCTC (See **Figure 8**).

**Figure 8: Umo with VVTA and VCTC**



Source: VVTA, AECOM

49 <https://www.goventura.org/vctc-transit/ties/>

50 [https://www.gosbcta.com/wp-content/uploads/2020/09/IE\\_CMCP\\_Final\\_Oct\\_1\\_2020.pdf](https://www.gosbcta.com/wp-content/uploads/2020/09/IE_CMCP_Final_Oct_1_2020.pdf)

51 <https://moovit.com/blog/moovit-partners-with-cubic/>

LEGISLATION EVALUATION  
(GOVERNANCE + FINANCE)

As a newer concept in the US, there has been limited formal legislation passed in relation to MaaS. Throughout the US, the transportation industry is in the process of conducting pilot projects and other research to inform policies on MaaS and develop best practices for the deployment of MaaS in the US. The following sections summarize the current legislative environment for MaaS.

**Federal**

At the federal-level, legislation related to MaaS has focused on providing funding to agencies across the nation to conduct pilot programs on integrated mobile payment systems and trip planning applications. The Fixing America’s Surface Transportation (FAST) Act that was passed in December of 2015 emphasized the importance of funding projects that incorporate innovative mobility solutions. The FAST Act established several grant programs that focused on the deployment of emerging mobility technologies, including

integrated payment systems and trip planning platforms.

One of the grants that was established by the FAST Act is the Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) initiative which is a competitive grant program that provides funding to develop model deployment sites for large-scale installation and operation of advanced transportation technologies that improve safety, efficiency, system performance, and infrastructure return on investment. ATCMTD has provided funding for piloting advanced traveler information systems that help travelers make informed decisions regarding when to travel, routes to use, and/or modes to use. ATCMTD has also funded projects that implement electronic pricing and payment systems that permit users to electronically conduct financial transactions for mobility services across jurisdictions and agencies, including unified fare collection and payment across transportation modes.

The ATCMTD program closely aligns with the Connect SoCal goals. **Table 7** summarizes the Connect SoCal goals that align with the ATCMTD program.

**Table 7: ATCMTD Alignment with Connect SoCal Goals**

Connect SoCal Goal	ATCMTD Alignment
Improve mobility, accessibility, reliability, and travel safety for people and goods	Provides funding to deploy technologies that create a more accessible, reliable, efficient and safe transportation network.
Increase person and goods movement and travel choices within the transportation system	Funds pilots for advanced traveler information systems which help users make informed decisions about which modes could be used to make a trip. Additionally, this program allows agencies to implement integrated payment systems which create more seamless transitions between modes.
Leverage new transportation technologies and data-driven solutions that result in more efficient travel	Allows agencies to deploy emerging transportation technologies to measure the impact the technologies make on the efficiency, safety, and reliability of the transportation system.

Source: AECOM

The FAST Act also funded the Federal Transit Administration (FTA) Section 5312 funds. Section 5312 provides funding to transit providers to develop innovative products and services that help agencies better meet the needs of their customers. Over the past several years, FTA has used Section 5312 funds to create several competitive grant opportunities, including the Low-No Emissions grant, the Mobility on Demand (MOD) Sandbox Demonstration grant, the Innovative Mobility Initiative (IMI) grant, and the Accelerating Innovative Mobility

(AIM) grant. These grant programs have funded a variety of integrated payment and trip planning pilot projects across the nation and aim to allow transit providers to foster innovative transit technologies, practices, and solutions.

The grants under Section 5312, funds strongly align with the Connect SoCal goals. **Table 8** summarizes the Connect SoCal goals that align with the 5312 programs.

**Table 8: 5312 Alignment with Connect SoCal Goals**

Connect SoCal Goal	5312 Alignment
Improve mobility, accessibility, reliability, and travel safety for people and goods	Funds public transit projects that utilize technologies that improve mobility and reliability for users.
Increase person and goods movement and travel choices within the transportation system	Enables agencies to pilot new types of mobility solutions. Funds projects that create solutions to help users make informed travel decisions and move between modes.
Reduce greenhouse gas emissions and improve air quality	Funds projects that implement electric vehicles (EV) technologies.
Leverage new transportation technologies and data-driven solutions that result in more efficient travel	Allows agencies to deploy emerging transportation technologies to measure the impact the technologies make on the efficiency, safety, and reliability of the public transportation system.

Source: AECOM

On August 10, 2021, the Senate passed the Bipartisan Infrastructure Deal. The bill was officially passed in November of 2021.

The new infrastructure bill includes funding for advanced transportation technologies and innovative mobility deployment. This section of the bill states that the “Secretary shall provide grants to eligible entities to deploy, install, and operate advanced transportation technologies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment.” This grant opportunity established by the Bipartisan Infrastructure Deal is comparable to the FAST Act’s ATCMD grant opportunity and provides funding for integrating payment systems across modes.

The new bill also establishes a new Congestion Relief program that can fund the “deployment and operation of mobility services, including establishing account-based financial systems, commuter buses, commuter vans, express operations, paratransit, and on-demand microtransit.” This new opportunity provides additional grant funding that can be used towards the implementation of MaaS.

In addition to the legislation on funding, FTA has allowed federal funding to be used to subsidize micromobility and transportation networking company TNC trips. As a result, many public agencies have been partnering with the private sector to implement first mile/last mile programs and use private transportation companies to supplement paratransit services.

As an example, Tri Delta Transit in Contra Costa County California, is one of many agencies that has piloted programs with Uber, Lyft, and local taxi companies to provide subsidized paratransit trips. Many of the pilot programs across the nation have proved that subsidizing TNC and taxi trips costs less to the agency than providing traditional paratransit services. These partnerships also have created greater flexibility for qualifying individuals because they can order trips when they need them as opposed to having to schedule the trips in advance.

Many agencies have also piloted programs that provide either free or discounted TNC rides for trips that start or end at a transit stop. For example, the Solano Transportation Authority piloted a first mile/last mile TNC partnership for essential workers during the COVID-19 pandemic. Participants in the program received an 80 percent discount off rides that started

or ended at a transit stop. Another agency that has piloted a TNC partnership is OCTA. OCTA and San Clemente partnered with Lyft to launch a subsidized rideshare program to replace fixed-route service in low ridership areas. With the program, transit riders can receive up to a \$9 subsidy on their Lyft trip within the designated area.

These recent pilot projects have demonstrated that micromobility, TNCs, and taxis can work seamlessly with public transit to address critical gaps in the system. With FTA funding available to subsidize these programs, it is becoming more feasible to implement these programs across the US.

### State

California is at the forefront of implementing MaaS in the US. In 2004, California Legislature amended the Government Code Section 10436.6 to state:

“(1) Rail passes offering unlimited travel on certain passenger rail and associated transit services for a specified period of time and a fixed price have been a success in Europe, Canada, and Alaska.

(2) A ‘California Pass,’ valid on state-funded intercity and commuter rail lines, state-funded feeder buses, and major local transit systems would be a major benefit to tourism, while at the same time providing a package of transportation options which do not worsen highway congestions.

(3) Use of a single payment mechanism make existing mass transportation services easier to use, by eliminating the need for familiarity with multiple complex tariffs and need for correct change.

(b) The department shall investigate, and if feasible implement, a ‘California Pass’ which would be valid, to the extent possible for all the following transportation services:

(1) State-funded intercity rail services in the San Diego-Los Angeles, Los Angeles-Santa Barbara, Los Angeles-Fresno-bay area/Sacramento, and Sacramento-bay area rail corridors.

(2) State-funded feeder buses operated in conjunction with the intercity rail services, including, but not limited to, the service operated between Merced and Yosemite National Park for the San Joaquin trains.

(3) Commuter rail services.

(4) Public transit service.



(5) Other transportation services.

(c) The department shall consider offering passes valid for travel over a specified consecutive number of days, as well as so-called ‘flexi-passes’ valid for a specified number of days within a longer period of time. In addition, the department shall develop a procedure for distributing pass revenues to each participating operating entity, and for marketing the pass to prospective users.

(d) Prior to implementing the ‘California Pass’ program, the department shall consult with each participating operating entity. The department shall not adopt procedures for the distribution of pass revenues without first submitting the proposed procedures to each affected operating entity

(e) Nothing in this section precludes the department from implementing, as an interim measure, any marketing device to increase ridership on state-funded rail and bus services.”

This strong push from California’s legislation for integrated payment systems in the early 2000s paved the way for subsequent initiatives and policies at the state level. The state formed Cal-ITP which is dedicated to an initiative to facilitate easy and accessible travel planning and payments across California. In collaboration with other state transit initiatives and regional partners, Cal-ITP is leading an effort to implement a statewide integrated trip planning and fare payment program. The effort started in 2017 with a study of European integrated payment systems<sup>52</sup>.

Additionally, in 2020, Executive Order N-79-20 identified an integrated, seamless transportation system across the state as a key component of addressing the current climate crisis. The Executive Order stated:

“The State Transportation Agency, the Department of Transportation and the California Transportation Commission, in consultation with the Department of Finance and other State agencies, shall by July 15, 2021 identify near term actions, and investment strategies, to improve clean transportation, sustainable freight and transit options, while continuing a ‘fix-it-first’ approach to our transportation system, including where feasible:

a) Building towards an integrated, statewide rail and transit, network, consistent with the California State Rail plan, to provide seamless, affordable multimodal travel options for all.

b) Supporting bicycle, pedestrian, and micro-mobility options, particularly in low-income and disadvantaged communities in the State, by incorporating safe and accessible infrastructure into projects where appropriate.

c) Supporting light, medium, and heavy duty zero-emission vehicles and infrastructure as part of larger transportation projects, where appropriate.”

This previous legislation has set the precedence for the desire to have multi-jurisdictional, integrated mobility payment and trip planning systems in California. **Table 9** summarizes how these policies align with the Connect SoCal Goals.

**Table 9: California Innovative Mobility Legislation’s alignment with Connect SoCal Goals**

Connect SoCal Goal	California Legislation
Improve mobility, accessibility, reliability, and travel safety for people and goods	Encourages the deployment of a statewide integrated trip planning and payment system across different modes of transportation. This system would make transportation more accessible across the state.
Increase person and goods movement and travel choices within the transportation system	The state views offering multiple modes of transportation to residents and visitors a key solution to the current climate crisis. Having a statewide-integrated payment and would make it easier for users to transfer between modes.
Reduce greenhouse gas emissions and improve air quality	The state views offering multiple modes of transportation to residents and visitors a key solution to the current climate crisis.
Adapt to a changing climate and support and integrated regional development pattern and transportation network	The state intends to develop a statewide integrated, multimodal transportation system that addresses the current climate emergency.

Source: AECOM

In addition to the legislation supporting the implementation of MaaS, there are state-specific funding opportunities for piloting innovative mobility projects through the California Climate Investments (CCI) initiative which is funded by the state’s Cap-and-Trade program. One of the programs that is funded through the CCI is the Clean Mobility Options Voucher Pilot Program (CMO) which funds “zero-emission car-sharing, carpooling/vanpooling, bikesharing/scooter-sharing, innovative transit services, and ride-on-demand services in California’s historically underserved communities.”<sup>53</sup>

The CMO program is administered by CALSTART, the Shared-Use Mobility Center (SUMC), and the Local Government Commission (LGC). In 2020, the inaugural year of the funding opportunity, the program provided a total of \$20 million to

mobility projects around the state. The CMO program could be a viable source of funding for implementing a MaaS pilot project within the SCAG region.

<sup>52</sup> <https://caltransit.org/cta/assets/File/2018%20Fall%20Conference/Concurrent%20Sessions/OPS-Maas-Gradinger.pdf>

<sup>53</sup> <https://www.cleanmobilityoptions.org/about/>



## Local

At the local level, municipalities within the SCAG region have begun adopting plans and policies related to trip planning and mobile payment options. The City of LA adopted the Urban Mobility in a Digital Age plan in August 2016<sup>54</sup>. The plan outlined a strategy for building a solid data foundation, leveraging technology and design for a better user experience, creating partnerships for complimentary shared services, establishing feedback loops for services and infrastructure, and preparing for an automated future. The plan identifies

specific short-, mid-, and long-term recommendations for creating a transportation system of the future. The long-term recommendations in the plan include adopting a universal fare system for Los Angeles and creating an integrated trip-planning platform.

In January 2020, LADOT published a Technology Action Plan to achieve the vision that was outlined in the *Urban Mobility in a Digital Age Plan*<sup>55</sup>. In the plan, LADOT establishes its role in innovative mobility as planning, regulatory, and operations, and shown in **Figure 9**.

**Figure 9: LADOT's Role in Innovative Mobility**



Source: LADOT, Technology Action Plan

The Technology Action Plan also discusses LADOT's efforts to develop the MDS to give the City an efficient and cost-effective way to manage the right-of-way for transportation modes enabled by technology. LADOT views the MDS as the "connective tissue between the physical and digital public realms." The MDS allows the City and the mobility companies to communicate digitally about what is happening in the transportation ecosystem. The MDS is currently used with dockless mobility, but there are plans to expand its application to other forms of transportation, including microtransit,

autonomous vehicles, last-mile delivery, and urban air.

<sup>54</sup> [https://ladot.lacity.org/sites/default/files/2020-03/transportationtechnologystrategy\\_2016.pdf](https://ladot.lacity.org/sites/default/files/2020-03/transportationtechnologystrategy_2016.pdf)

<sup>55</sup> [https://ladot.lacity.org/sites/default/files/documents/ladot-tap\\_january-2020-update\\_v2.pdf](https://ladot.lacity.org/sites/default/files/documents/ladot-tap_january-2020-update_v2.pdf)

Finally, both the Technology Action Plan and the LADOT Data Protection Principles address privacy. These principles aim to limit the amount of personal information that is collected from users to only what is necessary for operational and regulatory needs. The City has also committed to limiting access to raw trip data, enhancing its security system to secure the data, and providing a clear description of what data is being used by

LADOT and for what purpose<sup>56</sup>.

The City of Los Angeles has adopted several plans and policies that have put the region on the right path towards implementing MaaS. **Table 10** summarizes how these policies align with the Connect SoCal Goals.

**Table 10: City of Los Angeles Plans and Policy Alignment with Connect SoCal Goals**

Connect SoCal Goal	City of Los Angeles Plans and Policies
Improve mobility, accessibility, reliability, and travel safety for people and goods	LADOT is actively working towards creating an integrated mobility system in LA that leverages technologies to create a safe, accessible, and reliable transit system.
Enhance the preservation, security, and resilience of the regional transportation system	LADOT has begun to develop a privacy and security framework to protect users' data
Increase person and goods movement and travel choices within the transportation system	LADOT is working towards making it more convenient for people to move between modes by considering a universal payment system
Reduce greenhouse gas emissions and improve air quality	LADOT has developed strategies for using innovative technologies to create a more sustainable transportation system.
Leverage new transportation technologies and data-driven solutions that result in more efficient travel	LADOT has identified a variety of innovative technologies that it plans to deploy to create a more efficient transportation system

In addition to all the plans and policies that have been adopted at the local level within the SCAG region, other municipalities across the nation have also been adopting policies and ordinances to regulate the implementation of emerging mobility technologies and trends. While these policies and ordinances do not directly apply to the SCAG region today, they do provide valuable lessons that can be applied to future policies that further prepare the region for a full-scale MaaS deployment.

For example, the City of Chandler in Arizona was the first municipality in the nation to adopt an innovative zoning ordinance that incentivizes developers to incorporate pickup and drop-off areas for TNCs and automated vehicles into their developments<sup>57</sup>. The ordinance gives developers a parking reduction for adding dedicated curbspace for pickup and drop-

off areas. This ordinance was adopted in 2018 and was intended to prepare the City for the transition to shared mobility and automated mobility by providing dedicated curbspace for pickups and drop-offs while minimizing the amount of parking that is constructed that will likely be underutilized in the future as mobility evolves.

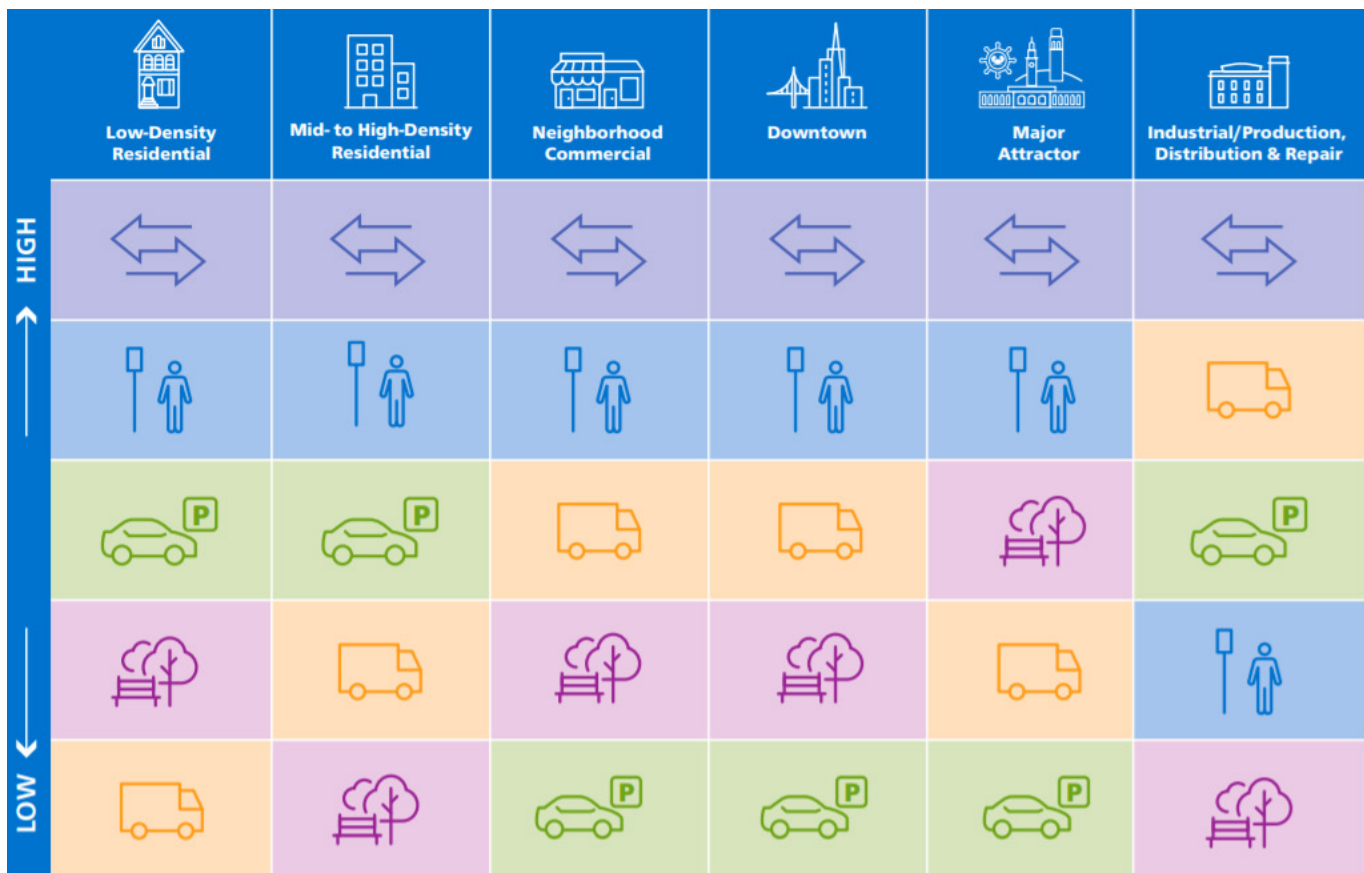
The San Francisco Municipal Transportation Authority (SFMTA) is another example of an agency that has taken an innovative approach to curbspace management. In February 2020, SFMTA adopted a Curbspace Management Strategy plan that outlined specific objectives and implementation strategies to address existing and future demands for curbspace access<sup>58</sup>. As shown in **Figure 10**, the plan developed guidelines for curbspace prioritization based on land use which was used to develop specific strategies for how to manage curbspace access throughout the region.

56 [https://ladot.io/wp-content/uploads/2019/03/LADOT\\_Data\\_Protection\\_Principles-1.pdf](https://ladot.io/wp-content/uploads/2019/03/LADOT_Data_Protection_Principles-1.pdf)

57 <https://www.chandleraz.gov/news-center/chandler-first-nation-include-autonomous-vehicles-and-ride-sharing-zoning-code>

58 [https://www.sfmta.com/sites/default/files/reports-and-documents/2020/02/curbspace\\_management\\_strategy\\_report.pdf](https://www.sfmta.com/sites/default/files/reports-and-documents/2020/02/curbspace_management_strategy_report.pdf)

**Figure 10: SFMTA Curb Function Prioritization Matrix**



Source: SFMTA, Curb Management Strategy

Other municipalities have passed ordinances that regulate micromobility and other shared mobility platforms. For example, the City of Boulder in Colorado recently passed a new ordinance on micromobility in April 2021. The ordinance expanded their existing policies to allow e-scooters and skateboards to be used on residential streets, in bike lanes, on multi-use paths, and sidewalks<sup>59</sup>. This ordinance reversed previous legislation that had banned e-scooters in Boulder’s public right-of-way.

Since micromobility and curb management are relatively new concepts to many local governments, there are constantly new ordinances being passed at the local level both within the SCAG region and around the US that are trying to regulate these systems to increase safety for all users. Some of these early plans, policies, and ordinances have set the precedence for other local municipalities to implement similar legislation.

### INSTITUTIONAL PRACTICES

There are several innovative mobility organizations and institutions that have been at the forefront of advancing the development of MaaS. The following section summarizes the existing organizations that are currently working collaboratively at the national and international levels to establish industry best practices for MaaS.

### MaaS Alliance

The MaaS Alliance is currently the main established organization that has been at the forefront of instituting best practices for implementing MaaS. The MaaS Alliance is a public-private partnership that is creating the foundation for a common approach to implementing and operating MaaS. The MaaS Alliance is an international organization with members from Europe, Australia, Asia, and the US. As the leading industry organization for MaaS, the MaaS Alliance has a toolkit that includes a MaaS Market Playbook, MaaS Guidebook, and a white paper on the preconditions for establishing MaaS. These resources provide a helpful framework for agencies that are new to studying and implementing MaaS.

### Institute for Transportation Engineers

The Institute for Transportation Engineers (ITE) is an international membership association of transportation professionals who work to improve mobility and safety for all transportation system users. In December 2018, ITE established MaaS as an Institute Initiative to inform its members about the changing mobility landscape. ITE has both a Steering Committee and Technical Working Group dedicated to studying and developing resources on MaaS. These committees include members from public agencies, private organizations, and universities. In collaboration with its members, ITE has published several documents on MaaS in the past couple of years, including a document on case studies on trip planning apps.

59 <https://www.dailycamera.com/2021/04/13/boulder-city-council-approves-micromobility-regulations/>

## Shared-Use mobility Center

The SUMC is a public-interest organization dedicated to achieving equitable, affordable, and environmentally sound mobility across the US through the efficient sharing of transportation assets. The SUMC was established in 2014 and has become a clearinghouse of information about emerging transportation technologies. To achieve this, the SUMC has published numerous research reports and studies that are applicable to MaaS, including a guide to seamless payment systems and a guide on how to implement MaaS in the US.

## Open Mobility Foundation

The Open Mobility Foundation (OMF) is a new global non-profit that supports the development of open-source standards and tools that provide scalable mobility solutions for cities. The organization is currently focusing on MDS. OMF is governed by municipalities across the US and has both public and non-public members. Public members are from across the country, and there are several agencies from California participating, which include the City of LA, Contra Costa Transportation Authority, and the City of Long Beach. Non-public members include many shared mobility companies, including Bird, Ford Autonomous Vehicles, Spin, and Waymo. While OMF is still new, it has created a collaborative environment to help cities navigate new transportation innovations and is attempting to help the nation develop a playbook for mobility data sharing.

## Urban Movement Labs

Urban Movement Labs is a LA specific organization that facilitates collaboration between government agencies, businesses, and the public on testing and implementing innovative transportation technologies. Urban Movement Labs is focused on understanding how innovative transportation technologies impact the quality of life for LA residents. This organization is in the process of identifying locations around LA to establish as urban proving grounds, which will be areas around LA that will test innovative transportation solutions.

## EQUITY AND ENGAGEMENT

Effective community engagement is a critical piece of planning for equity, and MaaS is no exception. Although data can help cities and regional authorities understand where certain access gaps such as systematic exclusion and pricing and payment barriers exist, engagement can highlight the human experience behind the numbers. Because MaaS is still new to a large segment of the population, especially in the US, it is critical to understand how the public feels about this concept and to gather input from all demographics in the SCAG region. The outreach programs that would both educate the public and ensure that MaaS truly addresses people's mobility needs as a tool for their daily life requires time, a dedicated budget, staff trained in community engagement, and organizational flexibility to respond to community needs. An important aspect of this outreach is recognizing that additional investment is fundamental to the current transportation system to help improve infrastructure and service. Basic transit components such as adequate and useful bus stops or service frequency increases will greatly enhance, or conversely, hinder, the success of a MaaS program.

Microtransit pilots and various fare programs in the SCAG region have facilitated new mobility and integrated payment education for the public and increased community acceptance. For example, LADOT's "LANow" pilot which began in 2019<sup>60</sup> and LA Metro's "Metro Micro" in 2020 provided communities in LA a platform-based mobility solution. Via's partnership with LA Metro, Lyft's partnership with Big Blue Bus and City of Monrovia, on "Mobility on Demand Every Day Program" and "GoMonrovia" respectively, have informed the public that there are more mode options for trip planning and a mobility option where public transit agencies work together with private service providers. A potential champion for further equity and engagement efforts would be academic institutions like Oregon State University Cascades Mobility Lab. The Mobility Lab aims to educate the community, inform policy, and test transportation technologies to encourage their implementation. They have promoted various new mobility programs such as Ride Bend microtransit pilot, Zagster Bike Share, and e-scooter pilots<sup>61</sup>.

A missing piece related to equity is payment barriers that technologies impose upon disadvantaged communities. Transit agencies need to develop strategies to help disadvantaged community members to gain payment credentials, waive annual fees of credit/debit cards, and transition cash users to digital payment users. For instance, Cal-ITP's demonstration project with MST distributed Square debit cards to its pilot users for free and enabled automated discounts based on the user's account profile. Another example is the Universal Basic Mobility Pilot launched by City of Oakland and City of Pittsburg. Under the Universal Basic Mobility Pilot, residents receive either subsidies for transit and other mobility modes on prepaid cards or monthly subscriptions for these services.

Additionally, equity is a top priority for both SCAG and its partners. In July 2020, SCAG's Regional Council adopted a resolution that affirmed "its commitment to advancing justice, equity, diversity, and inclusion throughout Southern California" and formed the Special Committee on Equity & Social Justice<sup>62</sup>. SCAG recently adopted their *Racial Equity Early Action Plan* in May 2021 which is intended to advance racial equity throughout SCAG's policies, practices, and activities. To uphold these important initiatives and policies, any implementation of a MaaS system will need to apply the recommended policies and actions to ensure MaaS is implemented in an equitable and inclusive manner.

Other agencies within the SCAG region have also made equity and inclusion a top priority for transportation programs and services. LADOT recently published the Changing Lanes: A Gender Equity Transportation Study which identified barriers for women who depend on transportation. As a result of the study, LADOT plans to focus on providing services to connect women to transportation, focus on creating a "15-minute city," and implement new mobility devices within low-income Black, Indigenous and People of Color (BIPOC) communities. One of the first service changes to be implemented as a result of the study is allowing riders on DASH routes to request stops at locations that are not designated bus stops. A MaaS system in the SCAG region should consider the findings of the Changing Lanes study to create an integrated transportation system that is safe, comfortable, and accessible for everyone in the region. Metrolink also has adopted their "Accessibility and Affordability Study" in April 2021.

<sup>60</sup> Please note, due to COVID-19 impacts, LANow was temporarily suspended and resumed November 2021.

<sup>61</sup> <https://www.oregon.gov/odot/Planning/Documents/MaaS%20White%20Paper%20Final%205-13-2020.pdf>

<sup>62</sup> <https://scag.ca.gov/our-work-inclusion-diversity-equity-and-awareness>



The purpose of the study was to develop a framework on how Metrolink can optimize its role in the region as a transportation agency that provides transit service and helps reduce traffic congestion and greenhouse gas emissions<sup>63</sup>.

## CURRENT MOBILITY STAKEHOLDERS

Within the SCAG region, there are a variety of public and private stakeholders and partners that will play a key role in deploying MaaS in the region. Many of these stakeholders have begun to build the framework for implementing MaaS. The following sections identify the key stakeholders in the region and summarize existing MaaS-related efforts that are underway.

### Public Transit Agencies

The SCAG region has several public transit agencies that will be key stakeholders in the deployment of a MaaS system. Many of these agencies have existing framework, as described in the following sections, in place that will need to be considered during the implementation of a regional MaaS system.

### Network and Operations Management Technologies

Network and operations management technologies provide the digital framework that is needed to make a MaaS system work. It includes the APIs that allow applications to communicate with each other. Since MaaS is rooted in the concept of having one user system for all payments across modes, the API is a critical component of successfully deploying MaaS. The public transit agencies in the SCAG region have worked with several different network and operations management technologies. The following sections summarize the existing technologies that have been used around the region.

#### LA Metro

As mentioned in the previous Physical and Technological Infrastructure section, LA Metro has implemented its TAP program which allows users to use the TAP card to pay for transit services around LA County.

#### Metrolink

Metrolink currently has a mobile ticketing app that offers contactless ticketing to users. The existing app does not currently include any features to integrate payment or trip planning with other transit systems or other modes.

#### LADOT

LADOT has been participating in an open-source project to form their MDS. MDS allows LADOT to communicate with private mobility providers in real-time using code. MDS enables LADOT to manage dockless scooters, bikes, and buses by collecting data on where each trip starts, where the trip ends, the percent battery charge, the utilization of the vehicle, the operating cost, the customer cost, and parking verification. The MDS is based on a set of APIs that communicates data from mobility providers to LADOT. LADOT is currently working on integrating the City's taxi fleet into its system. This integration will move LADOT towards a more integrated mobility management system.

In 2016, City of LA entered a public-private partnership with Xerox to pilot a mobile trip-planning app. The app was known as Go LA which was designed to be a comprehensive trip planning platform that would allow users to plan their trip across multiple modes, including transit and TNCs<sup>64</sup>. The app showed users the variety of modal options that were available to reach their destination. It also had options people could select to find the fastest route, the cheapest route, or the greenest route to

their destination. To develop the app, Xerox worked with local transportation providers to integrate dozens of APIs into a single interface. The app was officially discontinued in January of 2018.

#### OCTA

Bytemark is partnering with the OCTA to replace the agency's mobile-ticketing system<sup>65</sup>. The upgraded contactless payment system will allow users to seamlessly pay for transit services on a mobile app. Bytemark's platform allows users to also plan their trip using the app. The framework provided by Bytemark's platform opens the opportunity to expand to include bikes, scooters, and TNCs.

### General Transit Feed Specifications

GTFS is a standard format for describing transit schedules and certain geospatial information for trip planning applications. Transit agencies across the country use GTFS to provide information about their transit system. GTFS has expanded in recent years to include real time transit information, including important alerts for riders about the system.

Cal-ITP published statewide guidelines on GTFS in 2020 to ensure transit data across the state meets the needs of the public. The guidelines include a checklist that agencies can use to identify opportunities to improve their rider information. Cal-ITP also offers assistance to transit agencies in California to develop high-quality GTFS data.

Each of the transit service providers in the SCAG region have GTFS data that could be used to develop trip planning platforms. For example, LA Metro updates their GTFS files regularly. Their rail GTFS files are updated daily to include any temporary service changes while the bus GTFS files are updated every couple of months to reflect larger scale changes. Only some of the transit agencies in the SCAG region offer their GTFS data to developers on open data-sharing websites.

### Data Sharing and Cyber Security

Data sharing and cybersecurity are important topics to address when implementing a MaaS system. By nature, MaaS systems collect a lot of data to create the best experience for users. To make trip planning work, MaaS systems need to know the location of micromobility devices, TNCs, and buses to provide accurate results. Additionally, to process payments, users need to give personal information, such as their names, addresses, and credit card information to use the system.

With all the sensitive information that MaaS systems need to operate, it is important for top-of-the-line cybersecurity and privacy measures to be in place. Also, to make all the APIs work together, all partners need to be willing to share data.

LADOT developed data protection principles for its MDS. The City of LA has designated raw trip data as Confidential Information which makes the information exempt from the CPPA. This policy means that only people who need to see the data for operational and regulatory needs will have access to the data. LADOT also minimizes the amount of data that is collected and stored and is committed to aggregating, de-identifying, obfuscating, or destroying raw data when it is no longer needed. The City of LA has enacted safeguards to keep the information collected through its MDS secure and conducts ongoing tests to ensure the data is secure. Finally, LADOT publishes a list of data types that are collected and how long they are retained to be transparent with the public.

### Other Existing Programs and Stakeholders

In addition to the framework and programs described in the

63 <https://metrolinktrains.com/about/agency/accessibility-affordability/>

64 <https://www.news.conduent.com/news/City-of-LA-introduces-new-Xerox-Go-LA-app>

65 <https://www.bytemark.co/press/octa-selects-bytemark-to-replace-existing-mobile-ticketing-application>



previous sections, there are also several public agencies that operate carshare, rideshare, and vanpool programs within the SCAG region.

### *Rideshare Programs*

The County of LA's Internal Services Department (ISD) Rideshare provides several shared transportation option programs to reduce traffic congestion, air pollution, and commuter costs<sup>66</sup>. The ISD Rideshare program helps pair commuters with carpools (up to four people per vehicle) and vanpools (five or more people per vehicle). ISD Rideshare has a website where commuters can apply to join a carpool or vanpool.

Similarly, LA Metro, OCTA, and VCTC offer a rideshare and shared mobility program<sup>67</sup>. The platform, RideMatch, helps commuters find a carpool, vanpool, bike partner, or transit route that will get them to where they want to go. To use the platform, people need an account and then they can be matched with the rideshare service that will best meet their needs. For people who participate in rideshare programs, LA Metro, OCTA, and VCTC offer a guaranteed ride home in the event of an emergency. This allows for rideshare users to have peace of mind when opting to use the rideshare services.

RCTC and SBCTA offer a similar rideshare program called IE511. Similar to RideMatch, IE511 helps commuters fund carpool, vanpool, and transit options to get to and from their jobs. It is an account-based platform, and employees of participating employers can receive up to a \$2 subsidy per day for participating in the program.

### *TNC Partnerships*

In 2019, SBCTA partnered with Lyft to provide discounted Lyft rides to and from the Ontario International Airport (ONT)<sup>68</sup>. Under this program, Metrolink riders receive a \$35 discount off their Lyft ride if their trip provides a connection between ONT and one of the Metrolink stations at Montclair, Upland, Rancho Cucamonga, or Ontario-East. The pilot program was designed to increase the use of public transportation services to and from ONT.

### *Carshare Programs*

The City of LA partnered with Blink Mobility to implement BlueLA, an electric car share program<sup>69</sup>. The program started in 2015 when the City was awarded a state grant to pilot an electric vehicle car-sharing program in low-income communities. The project was implemented by the LA Mayor's Office of Sustainability, the Shared Use Mobility Center, Blink Mobility, and a committee of community-based organizations. The program has been a success so far, and there are plans to expand the program to include other communities in LA.

The Los Angeles Cleantech Incubator (LACI), the Housing Authority of the City of Los Angeles (HACLA), Nissan North America, and Envoy operate two other car share programs at affordable housing developments in the region<sup>70</sup>.

The cars are stationed at the HACLA Rancho San Pedro and Pacoima properties to provide affordable access to vehicles for the residents. The pilot was launched in 2020 and is currently ongoing.

### *On-Demand Microtransit*

LA Metro operates Metro Micro which is an on-demand microtransit service that currently operates in seven neighborhoods around Los Angeles:

- Watts/Willowbrook
- LAX/Inglewood
- Compton/Artesia
- North Hollywood/Burbank
- El Monte
- Highland Park/Eagle Rock/Glendale
- Altadena/Pasadena/Sierra Madre

Metro Micro gives its riders their first two rides free. After that, rides cost \$1. Users can book their ride either through an app, on an online platform, or by calling a designated phone number. The project launched in December 2020 and is continuing to expand. LA Metro has plans to expand the program in August and September of 2021 by adding two new service areas. North West San Fernando Valley will be implemented in August 2021 and UCLA/Westwood/Century City will be added in September 2021<sup>71</sup>.

Omnitrans also launched a pilot microtransit service in September 2020 called OmniRide. The pilot program serves Chino and Chino Hills. As part of the pilot project, Omnitrans implemented an app called OmniRide On-Demand which allows people to request rides within the service area. After a passenger requests a ride, a microtransit vehicle will arrive within 15 minutes of the request. The service will then drop off the passenger close to their destination. Currently, the fare for OmniRide is \$4 per trip.

Calexico On-Demand Transit is a demonstration of demand-response service proposed by ICTC. This proposed service would cover 7.5 square miles of service area with curb-to-curb pickups and drop-offs. This service will also feature:

- Three 6-passenger PHEVs
- A custom-branded passenger application for app-based ridehailing;
- Drivers, vehicles, and full operations, including customer service;
- Two Level 2 chargers to be located at the Imperial County Transportation Commission Bus Yard in El Centro (SB 535 disadvantaged zone); and
- Seamless integration with Imperial County Transportation Commission's fixed-route system

ICTC has applied for a \$1 million grant to cover cost and operations for two years of service. This grant requires ICTC to be committed to fund a third year at \$500,000<sup>72</sup>.

## **Private Mobility Service Providers**

Private mobility service providers are important partners for integrating data on micromobility devices, TNCs, taxis, and

66 <https://rideshare.lacounty.gov/about/>

67 <https://www.metro.net/riding/rideshare/>

68 <https://www.gosbcta.com/new-partnership-gets-travelers-from-train-to-plane-at-the-ontario-international-airport-from-four-metrolink-stations-with-sponsored-lyft-rides/>

69 <https://blinkmobility.com/>

70 <https://lincubator.org/laci-san-pedro-pilot/>

71 <https://micro.metro.net/>

72 [http://www.imperialctc.org/media/module/content\\_item/ICTC\\_TAC\\_Agenda\\_04222021.pdf](http://www.imperialctc.org/media/module/content_item/ICTC_TAC_Agenda_04222021.pdf)

other mobility solutions. Private mobility service providers need to be open to sharing their data with partners and developing payment systems that can be integrated with the MaaS framework. The following sections summarize the existing industry practices of private mobility service providers.

### **Network and Operations Management Technologies**

Private mobility service providers are constantly innovating in the network and operations management technologies space. There are numerous private companies that are working towards developing a MaaS application that will meet the needs of communities across the globe. One notable example is the Vulog and Citymapper partnership. Vulog is a leading shared technology provider while Citymapper is known for its transportation application. The two companies are hoping to develop a MaaS application that makes mobility accessible and sustainable. By integrating the companies' platforms, users will be able to easily locate Vulog electric cars, mopeds, and kick scooters<sup>73</sup>. Both companies currently operate in LA, which means that the SCAG region will be one of the locations that can benefit from this partnership.

### **Related Industry Specifications**

Similar to the public sector with GTFS data, the private sector has data specifications that help with sharing data. The GBFS is the open data standard for shared mobility systems, like bike share and scooter share. GBFS provides a uniform format for data that is publicly online in real-time. GBFS does not include any personally identifiable information since it is publicly available data. The specification was designed to show the status of shared mobility systems in real time. This information could be used to help develop trip planning platforms. GBFS is similar to MDS data; however, MDS data is not intended for public use while GBFS is designed to be open source.

### **Data Sharing and Cyber Security**

Most private mobility service providers follow the regulations set forth by the jurisdictions that they operate in. For example, the City of LA requires all micromobility providers to share data with the City to operate there. TNCs on the other hand have historically been resistant about sharing certain information with cities.

In terms of cybersecurity, most companies do strive to ensure the user data is safe; however, there has been a history of data breaches in the past with private shared mobility companies. For example, Uber had a data breach in late 2016 that exposed personal information for more than 57 million customers and drivers. States across the US have adopted regulations related to data breaches that require companies to notify anyone who is impacted by the breach. Cybersecurity is an ongoing conversation in the MaaS space and continues to be a concern for many users.

### **Private Stakeholders**

In the SCAG region, there are many private companies that currently operate ride hailing, micromobility, and car share programs. This section summarizes the various companies that currently operate in the SCAG region that will be stakeholders in implementing a MaaS system.

#### *TNCs*

TNCs operate ride hailing services. Currently, Uber and Lyft are the most prevalent TNCs in the region; however, there are smaller companies that operate in Los Angeles, such as RideYellow and Wingz. All of these companies allow users to order point-to-point rides to reach their destinations.

#### *Micromobility*

There are five micromobility companies that operate in the more urban areas of the SCAG region: Bird, Lime, Lyft, Spin, and Wheels. These companies offer a variety of dockless bicycle and scooter sharing options. All these providers partnered with the LADOT MDS program.

#### *Car Share*

Envoy, Nissan North America, and Blink Mobility all operate car share programs in partnership with local agencies. These companies provide electric vehicles for car share programs.

## SUMMARY OF EXISTING CONDITIONS

Existing MaaS infrastructure in the SCAG region includes physical, technological, and social infrastructure. Physical and technological infrastructure that enables agencies to incorporate mobile payment systems into their service have been incorporated in portions of the transit system, which prepares them for further payment integration with other service providers. Infrastructure, such as mobility hubs, curbside solutions, and charging stations for multimodal trip planning are either being planned or deployed at a small scale. To complement the physical and technological infrastructure construction, social infrastructure, such as P3 and other regional funding sources, have been explored and leveraged. Overall, the existing infrastructure in the SCAG region, while starting to lay a foundation for an integrated transportation system, is not in sync from a regional or state level. The largest barrier still remains the delivery of high-quality transit service. Some efforts are being made at the state level to synchronize the infrastructure needed for a better-quality transit system and leverage the procuring power of transit agencies as a group to gain better access to well-suited technology mobility solutions.

Current management and operability strategies of MaaS have been focusing on integrated payment systems that act as the gateway to a successful MaaS implementation. At the state level, efforts have been made to standardize information sharing, payment systems, and eligibility verification. However, the efforts have been focused on transit only. At a regional level, LA Metro, Metrolink, OCTA, VVTA, RTA, and VCTC have all been testing mobile payment and account-based payment for different transit modes. Among which, VVTA and VCTC started to incorporate other modes such as ridesharing. Additionally, VCTC's integrated payment system is available for all public transit operators in Ventura County. However, from a management and operation strategy perspective, mode integration in the SCAG region is still far from the requirement of a mature MaaS system.

The SCAG region is a pioneer in establishing data standards for payment, trip planning, and consumer privacy. Multimodal trip planning has been embedded in some transit agencies' mobile solutions. Integrated and mobile payment solutions are being more ubiquitously implemented by transit agencies in the SCAG region. Data and technology standards have a strong base within the region and will help with MaaS implementation. However, the ability to comply to the standards such as GTFS-RT remains a critical issue for smaller or rural transit agencies.

In terms of governance and finance, federal and State governments have shown support for MaaS development. At a local level, the interest in pursuing MaaS varies across municipalities. Efforts need to be made to promote concepts such as micromobility and curbside management to local governments in the SCAG region so they can coordinate at a regional level and leverage different funding resources to

73 <https://www.vulog.com/pressreleases/vulog-citymapper-shared-mobility-app/>

develop a MaaS system. Funding sources from institutional organizations and other entities are crucial to launch MaaS pilot programs at a local level.

Institutional practices are essential to facilitate and promote MaaS implementation from a third angle other than public and private. Besides global and national institutions, Urban Movement Labs is the leading institution in the SCAG region to aid MaaS development. Additional local organizations are needed to help advance MaaS in the SCAG region. The advisory group of this feasibility study could be a potential opportunity to formalize such an organization.

The implementation of microtransit and other micromobility projects has helped educate and engage disadvantaged communities to participate in future MaaS development. It has encouraged technology-oriented mobility solutions to be accessible and equitable. As a relatively new concept for a large number of SCAG communities, more outreach programs are needed to educate the public and help improve public acceptance on MaaS. In addition, bundled mobility services should be provided to disadvantaged communities at a discounted rate, and payment barriers need to be removed for disadvantaged communities to address equity in deploying MaaS going forward.

Public transit agencies and private mobility service providers are the two primary candidates to act as the final MaaS system operator. Currently, only public transit agencies have launched agency-wide programs in the SCAG region and some of them voiced the interest to serve as the system operator if the MaaS concept comes to reality. However, the case studies analyzed in Chapter 1 have shown that private mobility service providers and institutional organizations are also feasible choices.

The SCAG region's infrastructure is fragmented and not synced to the most up-to-date technologies, especially for transit services. It has solid data standards either in place or under development. The technology for trip planning and payment digitization is developing but far from being developed for a MaaS implementation. In addition, more efforts need to be made to develop management and operation strategies such as a unifying payment system among transit agencies. A more streamlined governance structure and finance channels need to be created at a state level. Lastly, public engagement strategies could be further diversified to target more disadvantaged communities to better understand people's needs and ensure MaaS directly supports those needs.

## CHAPTER 4- FEASIBILITY, CHALLENGES AND OPPORTUNITIES

MaaS is responding to trends where multiple transportation options are routinely combined by users to complete a single trip. In addition, the advent of on-demand transportation solutions, autonomous and connected vehicles, and growing expectations for high quality and safe transportation all require a rapid and responsive digital system to plan trips and provide equitable payment options. One of the core principles underpinning MaaS as an equitable future-oriented mobility solution is its customization and personalization based on user preferences and habits.

It has been concluded in the case studies chapter that:

- MaaS needs to integrate a range of mobility modes and deliver an array of mobility solutions. A less private-vehicle dependent travel behavior will exponentially increase the likelihood of successful MaaS implementation.
- Leveraging private companies to develop the platform is more efficient and cost effective.
- No one managerial structure fits all; however, the public sector needs to be involved in the decision-making process to prioritize public interests.
- Regulations and legislation on data-sharing and open Application Programming Interface (API) should be developed.
- Cooperation between different sectors and entities is essential.
- The public needs to be engaged throughout the implementation process.

Furthermore, MaaS will be able to address most people's mobility needs when a wide range of mobility options are offered. When discussing people's mobility needs, options do not only refer to the modes that are included in a platform, but also account details and management. For example, in the Stockholm and Gothenburg cases, multimodal travel options are provided by account on a subscription basis with an integrated monthly billing. The subscriptions are able to be shared with friends and family. This model simplifies the process of using a MaaS service, hence expanded access for people's mobility options. Investing in mobility hubs or other related infrastructure can facilitate the implementation of MaaS. If the target audience of implementation is less reliant on using private vehicles to travel, the more likely they are to shift to the other alternatives presented in a MaaS platform. Conversely, mode shift to transit alternatives for a target audience that has reliable access to a private vehicle is more difficult, because private single-occupancy vehicle (SOV) trips are generally simpler to plan than MaaS trips. Having a private company develop the digital platform can streamline the implementation of MaaS due to their implementation experience across the world. Each of the successful deployments of MaaS (Manchester, Helsinki, Vienna, and Stockholm) used a different managerial structure. For instance, Manchester managed to successfully launch the MaaS proof of concept pilot with the public agency leading the effort. Helsinki and Stockholm used a model where private companies lead the charge such as the commercial integrator model in Helsinki, while Vienna tested Governing by Doing and Governing by Enabling approaches where the public and private sectors worked closely like partners. There are advantages and disadvantages to each of the managerial structures, and it is important to consider the political, stakeholder, and public environment of the SCAG region to determine the right structure. It is worth noting

that no matter what managerial structure is used, the public agencies should be involved in decision-making to help elevate the interests of the general public as a top priority.

From the legislative perspective, requiring all mobility operators to provide essential data on their services and make their ticket sales and reservations accessible from an API, streamlines the development of MaaS.

Additionally, coordinating with various institutional partners is vital to the successful implementation of MaaS. Several MaaS systems, including SMILE in Vienna and other MaaS programs in West Midlands and Manchester, have failed or have been put on hold due to issues related to coordination between stakeholders. It is important that there are mutually beneficial agreements in place between public and private entities. For example, the governance model D (Transport for Greater Manchester (TfGM) is part of a MaaS joint venture formed to manage and operate the system) and E (TfGM is the MaaS operator but shares platform/resources with other providers to create financial savings and bring efficiency) in the TfGM case were concluded to be the preferred models for the City where both parties' interests could be valued. Another example is the governing approach in the Vienna case. The Governing by Enabling and Governing by Doing approaches encouraged the government to take an active role in MaaS deployment, which propels more fair and non-discriminatory rules to be in place facilitating competition while private operators took advantage of public funding support and active public-private interaction for innovation. Lastly, engaging the public throughout the development of MaaS will help create a system that is desirable and useful for people. Offering different subscription plan options and forming subsidy programs can allow different groups of people, including disadvantaged communities, to find a plan that meets their needs and preferences.

The SCAG region's infrastructure is fragmented and not synced to the most up-to-date technologies, especially for transit services. The region has some data standards that are either in place or under development. The technology for trip planning and open-loop payment is developing but far from being mature enough for a full MaaS implementation. In addition, more efforts need to be made to develop management and operation strategies such as coordinating regional payment policies of transit agencies and testing payment methods that would remove the barriers for disadvantaged communities. A more streamlined governance structure and finance channels need to be created at a state level. Lastly, public engagement strategies could be further diversified to better target disadvantaged communities to enhance their awareness and alleviate their concerns or reluctance on technology-oriented mobility solutions such as MaaS.

This chapter summarizes the challenges and opportunities for implementing MaaS in the SCAG region. Based on the case studies, existing regional conditions, and the challenges and opportunities that are identified here, this chapter also provides insights on the feasibility of implementing MaaS in the SCAG region and proposes next steps for the region.

## CHALLENGES

SCAG collected data and consolidated feedback regarding challenges of MaaS implementation through research papers, one-on-one interviews and meetings with advisory group members, and industry leaders at conferences and webinars.

To understand the challenges associated with deploying MaaS systems in the SCAG region, it is important to examine the overall population composition and travel behaviors throughout the region as well as geographic characteristics of the region.

**Figure 11** indicates that the SCAG region is still an SOV-dominant metropolitan area. Imperial, Los Angeles, Orange, and Ventura Counties have similar existing mode share. Los Angeles County has the highest public transportation usage while Imperial County has the lowest public transportation share.

Appendices C - E include demographic maps by county within the SCAG region. To help identify which areas of the SCAG region are most likely to be transit dependent, the following demographic data were used: household density below the poverty line; zero vehicle household density; and minority household density. Based on this analysis, the areas listed below will most likely be transit dependent and/or try alternative transportation options other than private vehicles. Therefore, these areas should be prioritized for equity concerns:

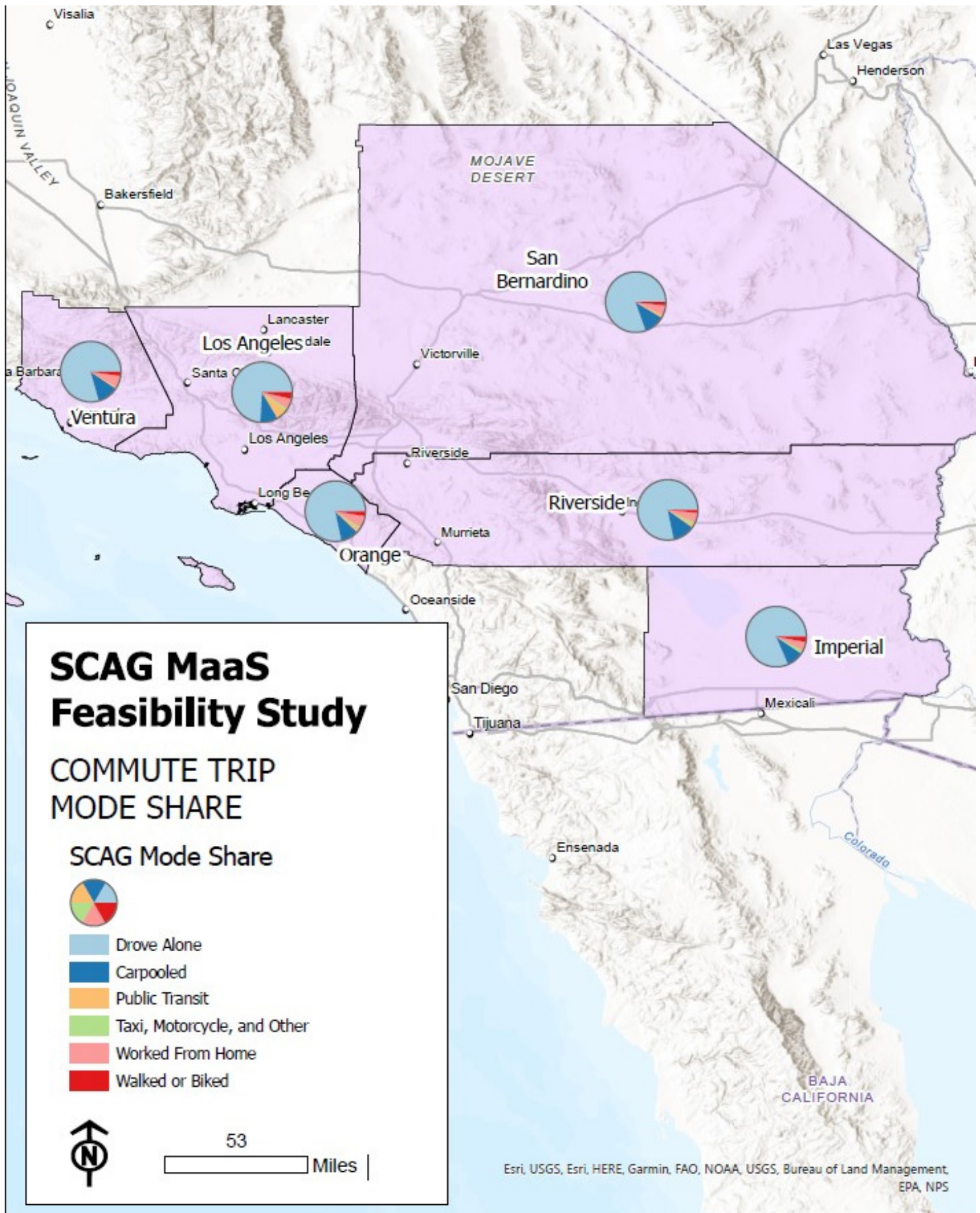
- Downtown Los Angeles
- South Los Angeles
- Willowbrook
- Long Beach
- Santa Ana
- San Jacinto/Hemet area
- Moreno Valley
- El Centro
- Ontario
- Fontana/Rialto
- San Bernardino
- Oxnard

SCAG adopted the 2020 RTP/SCS, called Connect SoCal, presents a vision for integrated land use development decisions and transportation investments to achieve regional goals. As discussed in Connect SoCal, creating dynamic, connected built environments that support multimodal mobility, reduce reliance on single-occupancy vehicles and reduce greenhouse gas emissions, is critical throughout the region. Connect SoCal uses an approach called center focused placemaking that supports attractive and functional places for residents to live, work and play, in urban, suburban rural settings. Consequently, strategies to improve mobility options in less-dense SCAG counties will be different than those in higher-density counties. Furthermore, strategies for lower density areas within a county will also be different than the strategies for high-density areas within the same county.

The following sections break down the challenges of implementing MaaS in the SCAG region per identified framework element.



**Figure 11: Commute Trip Mode Share by County**



Source: ACS 2019 5-Year Estimates

## Infrastructure

The level of physical infrastructure development varies widely across the SCAG region which makes it difficult to provide meaningful mobility alternatives.

As discussed in the Existing Conditions chapter, infrastructure in the SCAG region related to MaaS includes payment scanners or validators, mobility hubs, managed curbside space, charging stations, and smart parking facilities.

### Payment Infrastructure

The ideal payment method for a MaaS deployment is an open-loop payment system where a payment processor like a point of sale (POS) machine is ubiquitous in the vehicles provided by different mobility service providers. Benefits of an open-loop payment system include, but are not limited to, a simplified user experience, time savings on transactions and boarding/alighting vehicles, and facilitating interoperability with private mobility providers who also provide open-loop options for their customers. A local example being the LADOT's pilot of an open-looped payment system on their Commuter Express service since February 2022<sup>74</sup>.

For the existing closed-loop payment systems implemented in the SCAG region, the infrastructure development varies by subregions. LA County has been trying to sync its fare payment infrastructure for all transit operators. For example, LA Metro's Transit Access Pass (TAP) program enables mobile ticketing and payment, and some Metro buses and trains have payment validators and scanners. However, some transit agencies with their own mobile ticketing systems or other third-party mobile ticketing systems (Transit app as their official app or Token Transit) such as LADOT and Santa Monica Big Blue Bus (BBB) sometimes need the mobile tickets to be displayed to the operator on some of their vehicles in situations where in-vehicle validators are not present or malfunctioning. BBB, in order to make transit payment safer, faster, and more convenient for its users, stopped accepting cash and tokens on board as of July 12, 2021. Customers are now required to make contactless fare payments with TAP or a mobile ticket, instead of cash and tokens<sup>75</sup>.

In Orange County, the Orange County Transportation Authority (OCTA) operates most of the transit service. Some cities such as the City of Laguna Beach operate trolley and on-demand services and the City of Anaheim has the Anaheim Transportation Network (ATN). OCTA currently has its own mobile ticket system, and all of their vehicles have validators present. The City of Laguna Beach provides free transit service and does not require ticketing infrastructure. The ATN provides a mobile ticketing option through the app "A-Way WeGo", a standalone app yet to be integrated into the OCBus system and

has in-vehicle validators.

There are five transit operators in San Bernardino County: City of Needles, Morongo Basin Transit Authority, Mountain Area Regional Transit Authority, Omnitrans, and Victor Valley Transit Authority (VVTA). Omnitrans and VVTA are now accepting mobile ticketing and have validators in their fleet. However, Omnitrans makes their mobile tickets available through Token Transit, Moovit, as well as Transit app while VVTA launched an Umo system. The other transit operators do not have mobile ticketing for their services.

There are five transit operators in Riverside County: Riverside Transit Agency (RTA), Sunline Transit, Palo Verde Valley Transit, Pass Transit, and Beaumont Municipal Transit System. The City of Corona also operates two fixed-route lines within the City. Among all the transit operators, RTA, Beaumont Transit, and Sunline Transit all partnered with Token Transit and have a mobile ticket option for riders. They have validators on their fleets. However, other operators such as the Pass Transit in Banning do not have mobile ticketing capabilities.

Ventura County is a good example of unifying all transit operators into one payment system to facilitate county-wide travel and ensuring the needed infrastructure for fixed-route service and some demand response services are in sync. There are nine transit operators in the County – Ventura County Transportation Commission (VCTC) Intercity; Gold Coast Transit (GCT) District; Valley Express; Simi Valley Transit; Camarillo Area Transit; Thousand Oaks Transit; Moorpark City Transit; Ojai Trolley; Kanan Shuttle; and Connect-ECTA Intercity Dial-a-Ride. VCTC launched VCbuspass, which enables county-wide mobile ticketing for riders. However, similar to the situation in LA County, GCT also partnered with Token Transit and provides their own mobile payment option for riders who do not do a lot of cross-county traveling outside of Oxnard and Ojai. Their mobile tickets need to be displayed to operators when boarding the GCT buses.

Imperial Valley Transit (IVT) is the transit operator in Imperial County. Imperial County Transportation Commission (ICTC) is the County Transportation Authority. IVT does not offer a mobile ticket option for their riders.

Given the above, not only is the development of payment infrastructure uneven, the maintenance of the infrastructure is also not streamlined. **Table 11** sourced from SCAG's SoCal Connect Transit Technical Report summarizes asset management plans that are currently available for different transit agencies operating within each county or intercounty. Most of the transit agencies in the SCAG region have the latest TAM Plans dating back to 2018, and some agencies started releasing RFPs to update their plans in 2021.

<sup>74</sup> <https://www.mobility-payments.com/2022/02/23/exclusive-los-angeles-city-transit-agency-plans-open-loop-payments-pilot-targets-underbanked-and-unbanked-riders/>

<sup>75</sup> <https://www.bigbluebus.com/Rider-Info/Making-Contactless-Fare-Payments-on-BBB.aspx>

**Table 11: Asset Management Plan Summary by County**

County	Transit Agency	Plan Date
Imperial	Imperial County Transportation Commission	9/28/2018
Los Angeles	Access Services Los Angeles County	9/30/2018
Los Angeles	Antelope Valley Transit Authority	September 2018
Los Angeles	City of Commerce Municipal Bus Lines	12/20/2018
Los Angeles	City of Gardena's Gtrans	October 2018
Los Angeles	City of La Mirada	1/30/2019
Los Angeles	City of Los Angeles Department of Transportation	September 2018
Los Angeles	City of Redondo Beach, Beach Cities Transit	9/26/2018
Los Angeles	Culver City Municipal Bus Lines	October 2018
Los Angeles	Foothill Transit	9/28/2018
Los Angeles	Los Angeles County Metropolitan Transportation Authority	October 2018
Los Angeles	Los Angeles County Tier II Providers (Metro Group Plan)	10/1/2018
Los Angeles	Long Beach Transit	11/1/2018
Los Angeles	Montebello Bus Lines	10/30/2018
Los Angeles	Norwalk Transit	September 2018
Los Angeles	Santa Clarita Transit	2018
Los Angeles	Santa Monica's Big Blue Bus	10/1/2018
Los Angeles	Torrance Transit	10/1/2018
Orange	Anaheim Transportation Network	October 2018
Orange	OCTA	9/21/2018.
Riverside	City of Corona Transit Service	10/26/2018
Riverside	City of Riverside Special Transit	2019
Riverside	Riverside County Transportation Commission	9/26/2018
Riverside	Riverside Transit Agency	10/1/2018
Riverside	SunLine Transit Agency	9/21/2018
San Bernardino	City of Needles	10/1/2018
San Bernardino	Morongo Basin Transit Authority	9/21/2018
San Bernardino	Mountain Area Regional Transit Authority	10/1/2018
San Bernardino	Omnitrans	December 2018
San Bernardino	Victor Valley Transit Authority	9/28/2018
Ventura	Gold Coast Transit	November 2018
Ventura	VCTC	October 2018
InterCounty	MetroLink	Available <sup>76</sup>

Source: SCAG

<sup>76</sup> [http://metrolink.granicus.com/DocumentViewer.php?file=metrolink\\_3655b3cf645e3e8d4b477aac36bd787.pdf&view=1](http://metrolink.granicus.com/DocumentViewer.php?file=metrolink_3655b3cf645e3e8d4b477aac36bd787.pdf&view=1)



## Mobility Hubs

Mobility hubs have been developing throughout the SCAG region over the past decade. However, similar to the payment infrastructure, implementation of mobility hubs varies across the SCAG region.

According to the Mobility Hub Readers Guide published by LADOT, they have identified three types of Mobility Hubs (See **Figure 12**): Neighborhood Mobility Hubs, Central Mobility

Hubs, and Regional Mobility Hubs. Neighborhood Mobility Hubs are smaller ancillary station areas generally found in lower density neighborhoods. Central Mobility Hubs are typically located in a more urban context and encompass one or more stations/ bus stops. Regional Mobility Hubs are the largest scale station areas in either dense urban areas or end of line stations where they connect to other regional transit providers.

**Figure 12: Mobility Hubs Comparison**

Mobility Hub Amenities	Bicycle Connections			Vehicle Connections			Bus Infrastructure		Information-Signage			Support Services				Active Uses		Pedestrian Connections	
	2.1. Bike Share	2.2. Bike Parking	2.3. Bicycling Facilities	3.1. Ride Share/Pick up-Drop off	3.2. Car Share	3.3. EV Charging Stations	4.1. Bus Layover Zone	4.2. Bus Shelters	5.1. Wayfinding	5.2. Real-time Information	5.3. Wi-Fi / Smartphone Connectivity	6.1. Ambassadors	6.2. Waiting Area	6.3. Safety and Security	6.4. Sustainable Approach	7.1. Retail	7.2. Public Space	8.1. To the Mobility Hub	8.2. At the Mobility Hub
(N) Neighborhood	●	●	■	■	○	○	■	○	●	○	○	■	○	○	○	■	■	○	○
(C) Central	●	●	○	●	●	●	○	●	●	●	○	○	●	●	○	●	●	●	●
(R) Regional	●	●	●	●	●	●	●	●	●	●	●	●	○	●	●	●	●	●	●

Legend: Vital: ● Recommended: ○ Optional: ■

Source: LADOT

Mobility hubs in Imperial, Ventura, and Riverside Counties are still in the planning stages. Orange County started its mobility hub assessment in the Fall of 2021 along with public engagement and webinars. Its final mobility hubs strategy is scheduled to be issued in Spring 2022<sup>77</sup>. Only San Bernardino County and Los Angeles County have operational transit hubs that are similar to the concept of mobility hubs. The one in San Bernardino County is leveraging the existing Montclair Transit Center (See **Figure 13**) where commuter service, fixed-route service, and Metrolink service connect with a park-and-ride facility<sup>78</sup>. Mobility hubs in LA County (See **Figure 14**) include central mobility hubs like the Wilshire/Vermont Metro Station and Willowbrook/Rosa Parks Station which encompass amenities such as car share, bike share, bus shelters, and next bus information, or regional mobility hubs like the Union Station and North Hollywood Station which offer amenities like secure bike parking, bus layover zones, and other infrastructure

built into the station itself<sup>79</sup>.

According to the Mobility Hub Readers Guide published by LADOT, a mobility hub needs to be equipped with at least pedestrian connections, bicycle connections and supporting facilities, vehicle connections and supporting facilities, bus infrastructure, information/signage, and other support services such as waiting areas and safety security systems.

Even with the guidance of published documents like the Mobility Hub Readers Guide, the amenities in different transit hubs are not consistent. For example, bike share and pedestrian amenities are often missing in regional mobility hubs like NoHo Metro Station and Montclair Transit Center. Electric charging facilities are sometimes left out in central mobility hubs like the El Monte Bus Station, Willowbrook/Rosa Parks and Wilshire/Vermont Stations.

77 <https://www.octa.net/Projects-and-Programs/Plans-and-Studies/Mobility-Hubs-Study/?frm=13900>

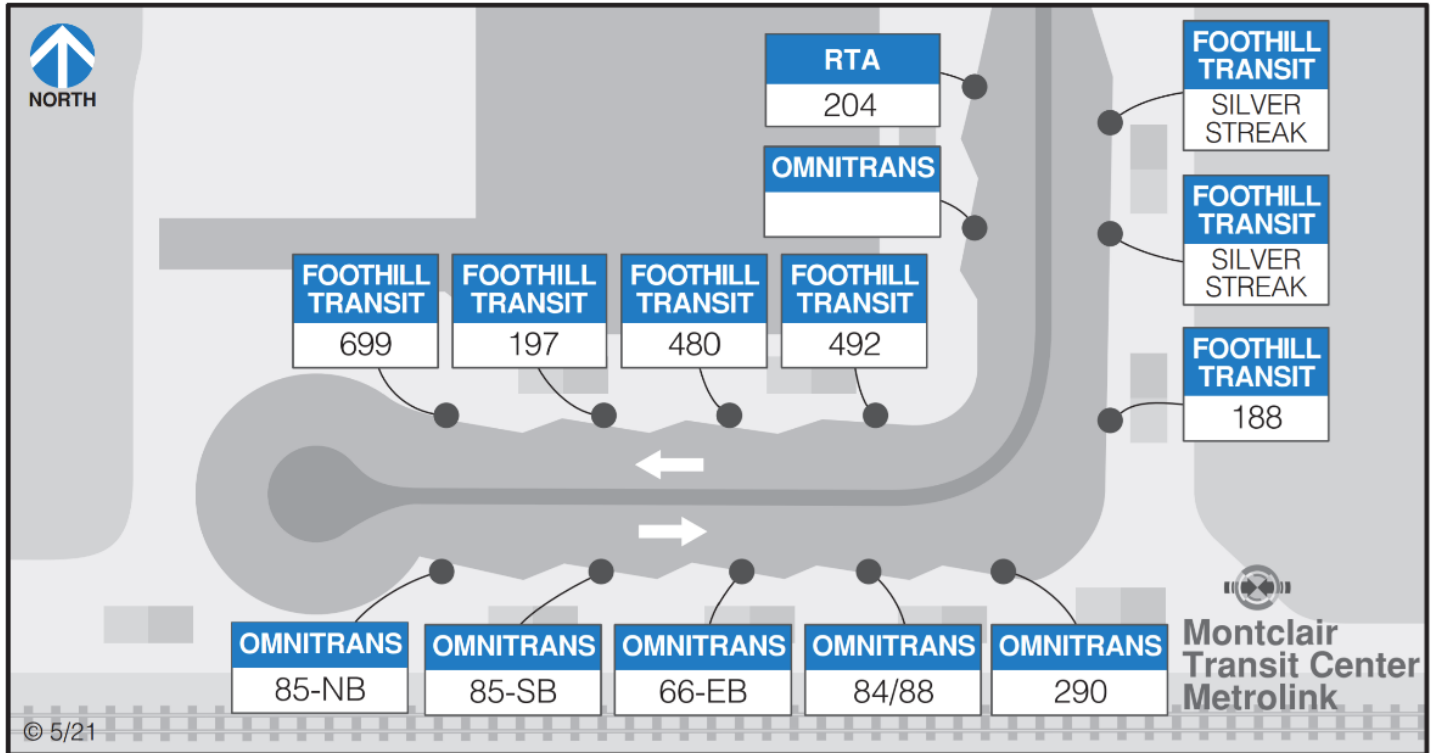
78 <https://www.gosbcta.com/wp-content/uploads/2019/10/ARRIVE-Corridor-ULI-Briefing-Book.pdf>

79 <http://www.urbandesignla.com/resources/docs/MobilityHubsReadersGuide/hi/MobilityHubsReadersGuide.pdf>



Figure 13: Montclair Transit Center Layout

# Montclair Transit Center



Source: <http://foothilltransit.org/lines-and-schedules/transit-centers/montclair-transcenter/>

**Figure 14: Central Mobility Hub and Regional Mobility Hub Examples in Los Angeles**



Sources: Top Left: <http://walknridela.com/roaming-the-region/deco-by-metro/>

Top Right: <https://archinect.com/firms/release/15872618/stantec-designed-willowbrook-rosa-parks-station-construction-wraps-revitalized-station-provides-critical-renovation-and-improvements/150280665>

Bottom: <https://www.neighborhoods.com/blog/5-reasons-to-live-in-north-hollywood-california>

### **Managed Curbside Space**

Curbside management projects are less developed, and their implementations have not matured in all counties in the SCAG region. Only cities in LA County, such as Los Angeles, West Hollywood, and Santa Monica, have active curbside management systems in place.

For example, the City of Santa Monica partnered with Conduent

Transportation to optimize the City's parking program and provide online and mobile options for users to resolve their parking citations and procure various parking permits offered by the City. The same vendor also provides dynamic pricing software and hardware for LADOT's LA Express Park™ program. This on-street parking solution offered by Conduent enables the department to manage curbside usage, increasing turnover

on space usage, and ultimately reducing curbside congestion.

In addition to the parking program launched by the City of Santa Monica, the City has also partnered with Los Angeles Cleantech Incubator to explore how curbside management can facilitate zero-emission vehicles for goods delivery<sup>80</sup>. The City of West Hollywood Department of Public Works launched an online portal<sup>81</sup> where users could explore schedules of public services such as street sweeping and trash pickup time based on their address within the City.

Most cities with an active curbside program are still focusing on parking management. Although many cities have acknowledged the importance of including other modes such as freight vehicles,

on-demand vehicles, and Connected and Autonomous Vehicles (CAVs) into curbside management, the implementation has been delayed. For instance, the City of Beverly Hills outlined a recommendation to “pilot a curbside management program to address passenger loading around Metro Purple Line stations, and test concepts like shared use/autonomous vehicle mobility zones and digitized curb space near stations and/or along commercial corridors.”, in their 2019 Complete Streets Plan. No recent updates have been found on that recommendation<sup>82</sup>.

### Charging Stations

**Table 12** and **Figure 15** below show the number of electric vehicle charging stations by County in the SCAG region:

**Table 12: Total Electric Vehicle Charging Stations by County**

County	Total Charging Stations	Population (2020)	Population per Charging Station
Imperial County	3	179,702	59,900.7
Los Angeles County	2,416	10,014,009	4,144.9
Orange County	1,248	3,186,989	2,553.7
Riverside County	380	2,418,185	6,363.6
San Bernardino County	245	2,181,654	8,904.7
Ventura County	191	843,843	4,418.0
Total	4,483	18,824,382	4,199.1

Source: <https://www.arcgis.com/home/item.html?id=2311c011625b42d4a49f53e7da09a3d6>. March 2021. <https://datacommons.org/place>

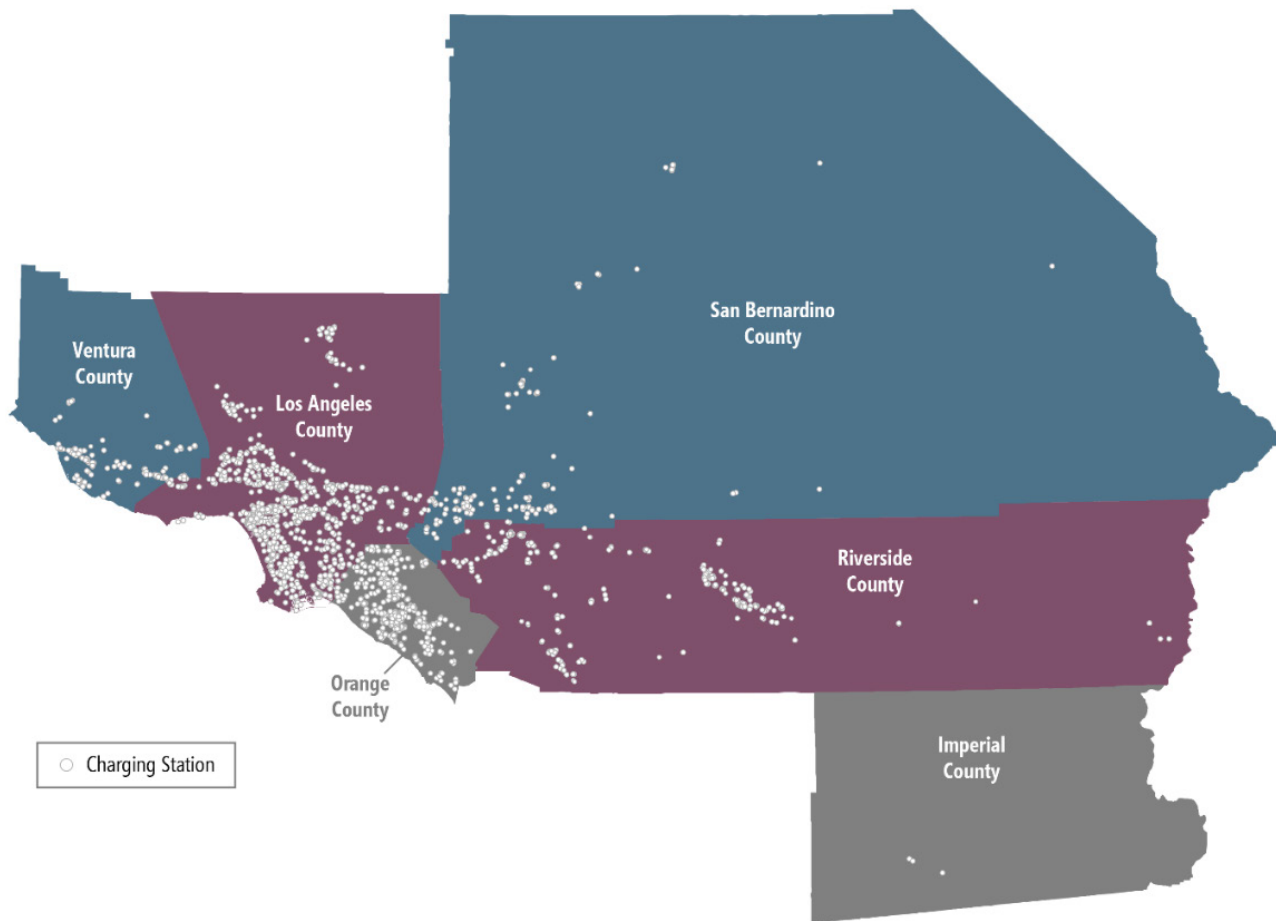
<sup>80</sup> <https://www.smartcitiesdive.com/news/doe-grants-cities-test-commercial-ev-fleets-smart-traffic-curbside-management/605088/>

<sup>81</sup> <https://gis.weho.org/CurbsideServices/>

<sup>82</sup> [https://beverlyhills.granicus.com/MetaViewer.php?view\\_id=&event\\_id=4001&meta\\_id=397291](https://beverlyhills.granicus.com/MetaViewer.php?view_id=&event_id=4001&meta_id=397291)



**Figure 15: Charging Station Distribution by County within the SCAG Region**



Source: <https://www.arcgis.com/home/item.html?id=2311c011625b42d4a49f53e7da09a3d6>. March 2021. AECOM

Based on the summary in **Table 12**, the supply of electric vehicle charging stations is the most sufficient for Orange County, LA County and Ventura County which have about the same supply per capita. Riverside County, San Bernardino County, and lastly Imperial County are relatively further behind in terms of electric charging station supply compared to other SCAG Counties. In conclusion, the charging station implementation per capita for Orange County is the highest among all six counties, while San Bernardino and Imperial Counties are the lowest.

## Data and Technology

**Data sharing between private mobility providers and public agencies is yet to be mandated and regulated to encourage information sharing, optimize decision making, and protect user privacy.**

When it comes to data sharing between private mobility providers and public agencies, the dispute between LADOT and Uber cannot be neglected. Dating back to October 2019,

LADOT suspended Uber's permit to operate its Jump e-scooters and bikes, citing their refusal to comply with the Mobility Data Specification (MDS). In March 2020, Uber filed a federal lawsuit against LADOT over its MDS, which requires micromobility operators to provide the agency with real-time vehicle data. The company accused LADOT of real-time rider surveillance, which could reveal personally identifying information about a rider. Uber claimed that real-time data collection is not an appropriate way for cities to plan infrastructure and other efforts. Then the company withdrew the case in June 2020 and informed LADOT of its intention to comply with MDS requirements as LADOT was reviewing their six-month permit extensions for micromobility operators.

The latest lawsuit brought by dockless scooter riders against MDS was dismissed by a Federal judge in February 2021<sup>83</sup>. The ruling said the citizens did not have their legal or constitutional privacy rights violated by MDS, although the judge did recognize the Plaintiffs' concern with the unprecedented breadth and scope of the City's location data collection.

83 <https://www.smartcitiesdive.com/news/federal-judge-dismisses-lawsuit-against-ladot-data-sharing-requirements/595817/>



## Lack of roadmap for technology products to guide public sector procurement

Private vendors are creating MaaS related payment infrastructure, service, and products. Public agencies are partnering with vendors without streamlined and well-informed guidance. For example, it was brought up in the Advisory Group August 2021 meeting and in interviews with Advisory Group members that a roadmap needs to be built to help guide the public agencies to navigate through all the technology products and services private vendors are providing.

This effort requires funding support to coordinate with vendors and solicit their product information. Additional statewide regulatory policies would also help facilitate conversations with private vendors.

## Management and Operations

### Difficult to transition to an open-loop payment system

One of the principal reasons why U.S. transit agencies have been hesitant to implement an open loop payment system is the prolonged authentication time of tapping a contactless card, smartphone or wearable. Prior to contactless EMV standards, the amount of time to authenticate a transaction took much longer than the few seconds it takes now<sup>84</sup>. Contactless EMV standards enable a faster processing time for transit agencies to know that a card is genuine at the gate. Another reason for transit agencies to hold on to a closed-loop system is their control over all of the passenger data which is essential for agencies to understand trip patterns and allocate their service resources. An open-loop payment system has the potential to significantly increase the personal data generated and collected by transit agencies as well as their private partners and make personal data vulnerable to a data breach if not properly handled. Before the public agencies can present a comprehensive approach to safeguard user data, it is risky to blindly switch over to an open-loop system. For example, Ireland's Dun Laoghaire Rathdown County Council plans to develop a digital MaaS platform with data protection measures to facilitate data sharing as the City of Dublin views data sharing to be a key challenge to implementing MaaS. Additionally, the City of West Midlands tried to anonymize Personally Identifiable Information of the collected data to protect users. Also, Transport for London was able to achieve 500 millisecond transactions using deferred authorization (allowing a traveler to tap into a gate swiftly) and aggregation rules to accommodate the high density, low transaction value environment of mass transit<sup>85</sup>.

An additional factor that contributes to the hesitation of transitioning to an open-loop system is the cash payment. Cash payments are an important component of mass transit and are particularly critical for low-income and unbanked travelers. However, cash acceptance is a costly payment option to be included for transit authorities from an operational standpoint. In a Boston Federal Reserve study, it was found that cash handling comprised 22.9 percent of the total operating costs<sup>86</sup>.

In summary, to alleviate the concerns of transit agencies to adopt an open-loop payment system, dedicated funding sources need to be leveraged to help convert cash users to card

or digital payment users in the long-term, and the cards issued to them need to meet the EMV standards.

However, there have been open-loop payment system examples in the United States.

In August 2013, the Chicago Transit Authority (CTA) launched the Ventra system. According to an article published on Intelligent Transport: "Ventra is a fully open-loop system which also features an agency-issued card that operates closed-loop within the Ventra network and has the option of open-loop for other merchants should the cardholder wish to activate the prepaid capability of the card."<sup>87</sup>

Also, in the same Intelligent Transport article: "In 2017, TriMet in Portland launched the Hop system, allowing users to tap their Apple or Google Pay devices to gain access to the system or use the closed-loop Hop Card. TriMet has expanded this capability by allowing Android users to load their Hop Card into the Google Wallet."

Since January 2021, Metropolitan Transportation Authority (MTA) in New York City completed all OMNY reader installations at all 472 stations, on all 5,800 buses and at Staten Island Railway stations<sup>88</sup>. OMNY stands for One Metro New York, a contactless fare payment system, currently being implemented for use on public transit in New York City and the surrounding area. Customers are able to use OMNY to pay their fares by tapping contactless bank cards or smart devices equipped with digital wallets on OMNY readers.

Today, the California Integrated Travel Project's (Cal-ITP) demonstration with Monterey-Salinas Transit (MST), CTA's Ventra, TriMet's Hop, and MTA's OMNY are the only transit systems accepting open-loop payments in the U.S.<sup>89</sup>.

## Governance

### Issues with regional fare policy integration including transfer policies and others

Currently, transfers within each SCAG county are generally easier compared to intercounty trips. This is due to coordination efforts made by individual county transportation commissions. However, some residents in certain geographies within the SCAG region require more intercounty travelling than the rest of the region. At a regional level, **Figure 16** indicates where the low-wage jobs and low-wage workers are relatively distributed throughout the SCAG region based on the low-wage jobs to low-wage workers ratio by census tracts. Intercounty commuter trip hot spots are places where the ratios are not balanced including: Camarillo, Long Beach, San Bernardino, Ontario, Anaheim, Temecula, and Palm Springs.

The 2020 Connect SoCal Environmental Justice Technical Report has projected that trends of vehicle ownership in the SCAG region are increasing in percentage of car-free households and decreasing in percentage of households with three or more vehicles. The future trends in the SCAG region will further increase the transit need and transfer demand at the locations where the low-wage jobs to low-wage workers ratios are on the two ends of the spectrum and commuter trips are needed to get workers to jobs.

84 The EMV standard is a security technology used worldwide for all payments done with credit, debit, and prepaid EMV smart cards.

85 <https://www.mastercard.us/content/dam/public/mastercardcom/na/us/en/documents/mastercard-transit-solutions-london-contactless-case.pdf>

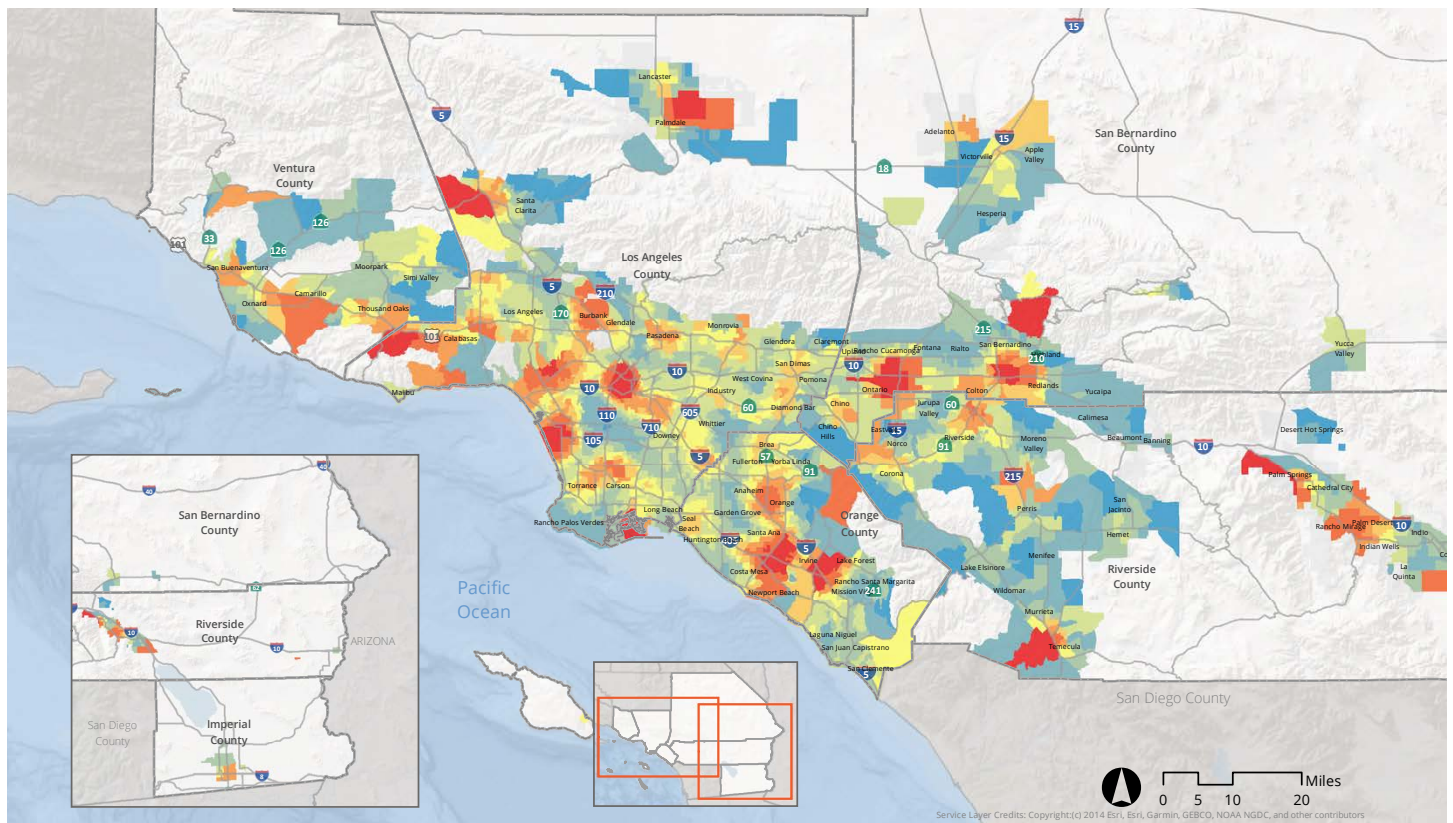
86 <https://www.americanbanker.com/payments/slideshow/data-mass-transit-is-the-gatekeeper-for-digital-payments>

87 <https://www.intelligenttransport.com/transport-articles/78096/open-loop-payments-united-states/>

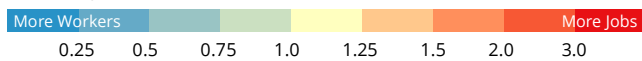
88 <https://www.masstransitmag.com/technology/fare-collection/fare-collection-equipment/article/21204439/mta-new-york-city-transit-new-york-mta-completes-systemwide-omny-rollout>

89 <https://www.intelligenttransport.com/transport-articles/78096/open-loop-payments-united-states/>

**Figure 16: Job-to-Worker Ratio for Census Tracts**



Ratio of Jobs to Workers for Census Tracts, 2016

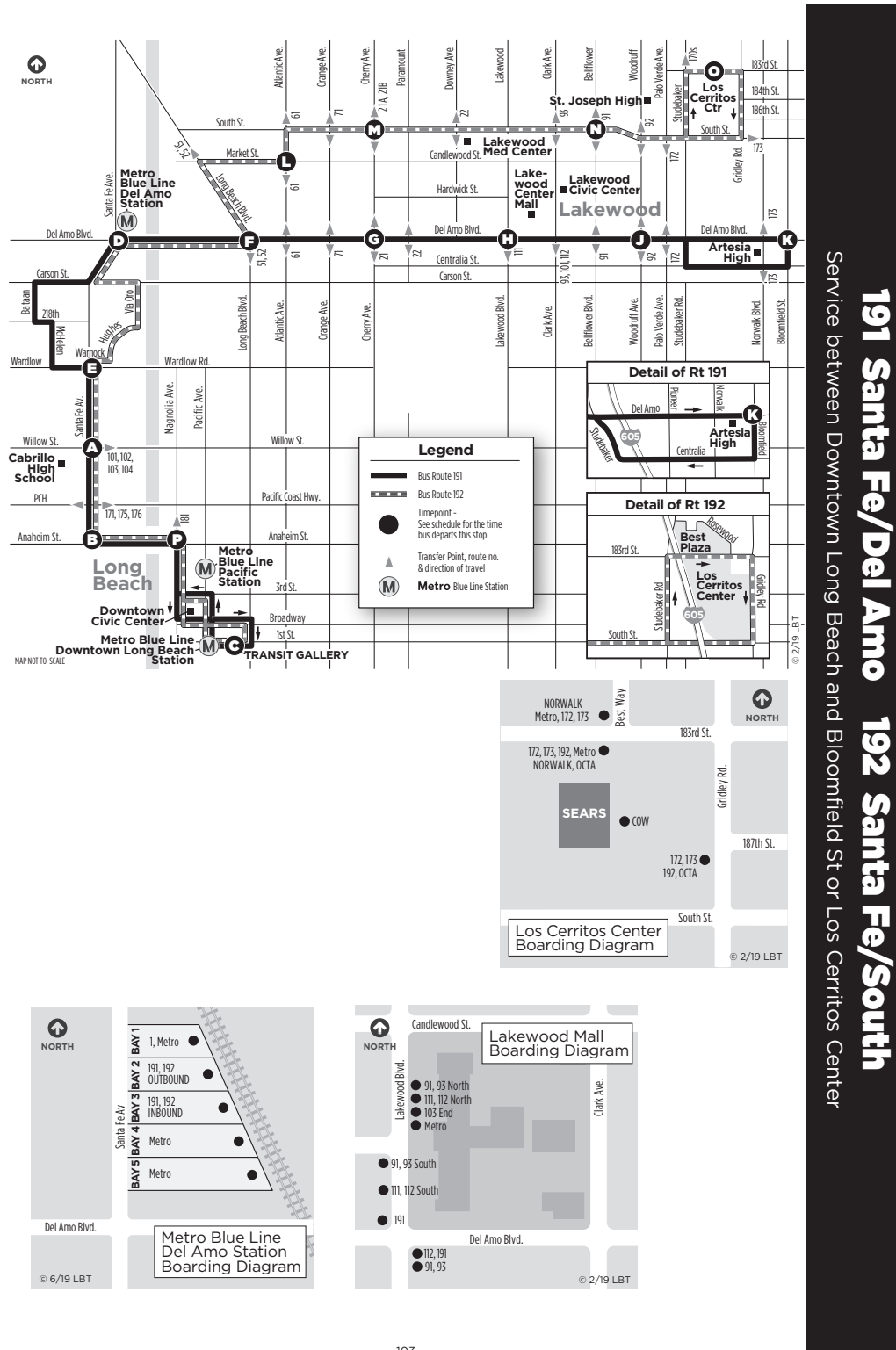


Note: Low Wage” = Jobs with earnings \$1250/month or less; “Med. Wage” = Jobs with earnings \$1251/month to \$3333/month; “High Wage” = Jobs with earnings greater than \$3333/month)

Source: Job and worker data were obtained from U.S. Census Bureau, LEHD Origin-Destination Employment Statistics (LODES 7.4) Workplace Area Characteristics (WAC) Primary Jobs data file and Residence Area Characteristics (RAC) Primary Jobs data file for year 2016.

At the route level, for example, Long Beach Transit (LBT) route 191 and 192 (See **Figure 17**) connect the Transit Gallery in downtown Long Beach with the LA Metro A Line and OCTA route 38 at Artesia High School. LBT accepts OCTA's Day Passes for one ride at the point of connection in lieu of an Interagency Transfer. No other OCTA fare media will be accepted. However, OC Bus One-Day Passes are not accepted on return trips originating on Long Beach Transit 90.

**Figure 17: Long Beach Transit Route 191 and 192**



**191 Santa Fe/Del Amo** **192 Santa Fe/South**  
 Service between Downtown Long Beach and Bloomfield St or Los Cerritos Center

Source: Long Beach Transit

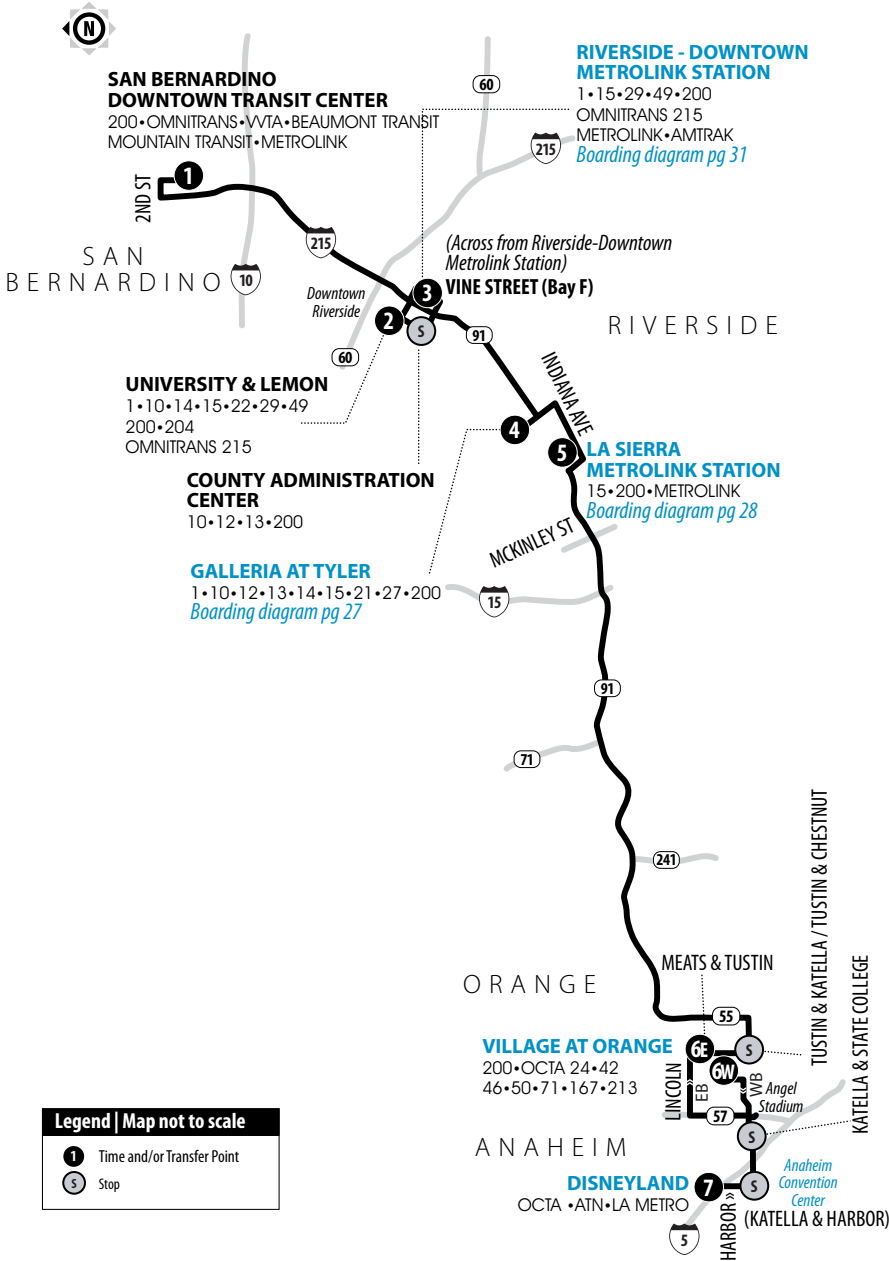
90 <https://www.octa.net/Bus/Routes-and-Schedules/Connections-and-Transfers/>

Another example is RTA route 200 (See **Figure 18**), which connects with Omnitrans, VVTA, Pass Transit, Mountain Transit, and Metrolink at the San Bernardino Transit Center, and also connects with OCTA and LA Metro at the Anaheim Convention Center. OC Bus will honor RTA one-day and 31-day passes on OC Bus directly connecting with RTA routes 200 and 205. Metro day passes cannot be used on OC Bus, only monthly passes will be accepted. The Los Angeles County Regional EZ Pass is not part of this program.<sup>91</sup>

**Figure 18: RTA Route 200**

# 200 SAN BERNARDINO - RIVERSIDE - ANAHEIM

Routing and timetables  
subject to change.  
Rutas y horarios son  
sujetos a cambios.



Source: OCTA

91 [https://www.octa.net/ebusbook/RoutePDF/Section00\\_Transfers.pdf](https://www.octa.net/ebusbook/RoutePDF/Section00_Transfers.pdf)



As demonstrated above, many of the intercounty transfer policies between different transit operators are limited to day passes and sometimes the returning trips are not eligible for day pass transfers. These regional fare policy discrepancies make it harder to integrate all transit services across different counties in the SCAG region regardless their type of payment system.

## Institution

### Lack of experience in purchasing equipment and streamlining bank processing services from public agencies as a group

Government procurement systems are filled with complex processes that can make the purchasing process lengthy. According to John Kamensky, an Emeritus Fellow at the IBM Center for the Business of Government, “One path to address this imperative involves a buying reform widely used in the commercial world and other countries – notably the United Kingdom – called ‘category management.’ Given its potential for driving reform and reducing unnecessary spending, category management is increasingly seen as one of the federal government’s top Cross-Agency Priority Goals.”<sup>92</sup>

Category management is a strategic approach for how an organization buys goods and services from vendors as a single entity. A 2016 study estimates that when used effectively, this approach can conservatively generate cost efficiencies of 7.5 to 12 percent of total procurement spending<sup>93</sup>.

An example of the implementation of category management is the U.K. government. It mandated agency use of category management to recover from the 2009 global recession. It set a goal of cutting procurement costs by 25 percent over the following four years in nine categories of common spending, such as travel, fleet, printing, and IT. The implementation was not smooth; however, many insights have been gained through the implementation. Some insights summarized in the paper “Buying as One: Category Management Lessons from the United Kingdom”<sup>94</sup> include but are not limited to:

- Category management should not be a free-standing initiative but be integrated into broader acquisition reform efforts and have sustained leadership from the top.
- Inventory and leverage uniform data in each category to drive savings.
- Strategically manage spending and demand by developing greater ability to analyze data.
- Strategically manage suppliers that contract with multiple agencies.

Transit agencies in the SCAG region don’t currently have a lot of experience in implementing this approach in their businesses and it would be a challenge to translate the category management approach overseas to a local context.

## Finance

### Funding transparency

Another issue brought up by the Advisory Group was that the spending of public agencies is not transparent enough to the public. In addition, the justifications of funding allocation on transit projects are not well laid out.

<sup>92</sup> <https://www.govexec.com/management/2019/02/how-government-could-successfully-leverage-its-buying-power/155014/>

<sup>93</sup> *ibid*

<sup>94</sup> <https://www.businessofgovernment.org/report/buying-one-category-management-lessons-united-kingdom>

<sup>95</sup> <https://www.itf-oecd.org/sites/default/files/docs/pricing-efficient-public-transport-maas.pdf>

## Equity and Engagement:

### Barriers to disadvantaged communities

#### Social barriers

Transportation itself is a socioeconomic issue as it interconnects with race, age, physical and cognitive ability, and more. Systematic exclusions happen particularly with technology-oriented transportation solutions, as some communities will not have a voice represented at the table as the priorities of the funding agencies are addressed first. In addition, their mobility needs often require additional customization which would usually increase the production cost of the solutions significantly, which further discourage some technology-oriented solutions, such as MaaS, to include their needs in the implementation design due to lack of strong funding support.

#### Financial barriers (payment and pricing)

Social barriers are not the only factors preventing disadvantaged communities from accessing MaaS. Some financial barriers are also hindering wider access to MaaS by the general public.

In terms of pricing, the MaaS concept proposes the introduction of subscription-based mobility packages and other incentives to improve the popularity of sustainable transit modes. One of the main benefits of subscriptions is their simplicity. However, with the advent of new payment technologies, usage-dependent (such as pay-as-you-go) and even dynamic pricing become much easier to communicate and administer. An article published by the International Transport Forum points out that the single, digital customer interface of MaaS offers a unique opportunity to implement marginal cost pricing in public transportation, thus improving the efficiency of this mode.<sup>95</sup>

In the case of private companies serving as MaaS operators, it is unlikely that they prioritize social welfare. If profit maximization is their top objective, it is expected that the pricing mechanism will depart from marginal cost pricing to a monopoly mark-up application.

In conclusion, the pricing barriers can be removed by implementing new payment technologies and imposing strong oversight on private operators if they are in charge of operating a MaaS system.

In terms of payment methods, the biggest challenge lies with converting cash, unbanked and underbanked transit users into digital payment users as the world goes through a phase of digital transformation accelerated by COVID-19. Other barriers to be removed to make that conversion a reality include lack of open-loop payment systems and disproportionately low smart phone access rates for disadvantaged communities.

## OPPORTUNITIES

Some of the challenges also present the SCAG region opportunities to start tackling them as technologies mature and funding opportunities increase.

## Infrastructure

### Region-wide study and implementation of mobility hubs can lead to more mobility hubs and standardized mobility hub implementations

The development of mobility hubs varies by county within the SCAG region, so are the naming convention and definitions of the mobility hubs. Terms like “mobility hubs”, “multimodal transit

center”, and “regional transit center” have all been mentioned in documents published by transit agencies in the SCAG region.

This presents an opportunity to develop a unified definition for mobility hubs and policies on what elements need to be included in a mobility hub. Having the policies and definition in sync will help agencies across the region understand the concept in a more consistent manner and further align the infrastructure development in different counties.

### **SCAG’s Curb Space Management Study presents opportunities to guide MaaS related infrastructure investment and promote multimodal traveling**

SCAG is currently conducting a Curb Space Management Study (CSMS) to conduct a comprehensive review of some of the most congested and complicated curb space locations within the region and assess policies, strategies and infrastructure investments and their impacts on curb space activity. The CSMS builds off SCAG’s previous Last Mile Freight Study which, while focused on delivery and pick up of shipments via commercial vehicle operators and their relationships with retail/receiver customers, recognizing that the confluence of vehicles utilizing curb space adjacent to loading zones and other commercial parking areas has quickly become a pertinent issue. Simultaneously, SCAG through its Sustainable Communities Planning grant program is funding several studies on curb space data collection and inventory, to explore innovative data collection methods and advance plans, studies and activities to help the region understand and regulate the growing need for curb space use. Both efforts present opportunities for future pilot demonstration of curb space management solutions.

### **TIRCP presents opportunities to increase capital investment on integration of transit infrastructure**

Transit is an important transportation mode in a MaaS program. One of the challenges previously identified is the lack of integrated infrastructure, especially transit infrastructure, which makes it hard to provide meaningful mobility alternatives.

The Transit and Intercity Rail Capital Program (TIRCP) was created to fund major capital improvements that will modernize California’s multimodal transit systems to reduce emissions of greenhouse gases, vehicle miles traveled, and mitigate congestion. The California State Transportation Agency (CalSTA) released the 2022 TIRCP Call for Projects in November 2021. This program presents an opportunity for California transit agencies to enhance and upgrade their existing transit system, as well as promote multimodal integration within their transit network.

## **Data and Technology**

### **Cal-ITP presents opportunities to promote GTFS and GTFS-RT to more transit agencies**

There is an opportunity to promote data standards such as GTFS and GTFS-RT developed through Cal-ITP in the SCAG region. In terms of other data standards such as the MDS, the on-going legal challenges and media exposure can likely enhance its development and refinement. It also encouraged a dozen cities and private partners to launch the Open Mobility Foundation (OMF) to build and govern open-source transportation technology tools.

### **On-going legal battles between public agencies and private service providers present the opportunity to develop regulations related to data sharing agreement with private mobility providers, revenue distribution and priorities**

As previously discussed in the challenges section, there are still private mobility service providers unwilling to share data with public agencies. The outcomes or dispositions of lawsuits between the City of Los Angeles and Uber present an opportunity to facilitate government regulations on the legality of personal privacy, using customer data, and regulating private mobility providers. An example of principles that are already in place include the Mobility Data Interoperability Principles launched by a coalition of transit agencies, cities, non-profits, planning organizations, and state departments of transportation on November 3rd 2021.

The five principles established are<sup>96</sup>:

1. All systems creating, modifying, or consuming mobility data should be interoperable.
2. Interoperability should be achieved through the development, adoption, and widespread implementation of open standards that support the efficient exchange and portability of mobility data.
3. Transit agencies and other mobility service providers should have access to tools that present high-quality mobility data accessibly, equitably, and in real time to assist travelers in meeting their mobility needs.
4. Transit agencies, other mobility service providers, and travelers should be able to select the mobility technology components that best meet their needs.
5. All individuals and the public should be empowered through high-quality, well-distributed mobility data to find, access, and utilize high-quality mobility options that meet their needs as they see fit, while maintaining their privacy.

### **Cal-ITP identified an issue of not having an inventory of technology products which presents the opportunity of creating one to help unite transit agencies’ buying power and sync the infrastructure**

Developing a roadmap of technology products for all the transit agencies and relevant public entities creates the opportunity for the public sector to better harness the State’s Leveraged Procurement Agreements and enhance equipment and bank processing services. When procurement is planned as a group, it will be easier to identify the gaps between different agencies and make sure the gaps are filled in the procurement process.

### **Existing P3 tools and resources present the opportunity to develop support toolbox for public and private transportation providers for better partnership and interoperability**

Developing a roadmap of technology products creates opportunities in payment infrastructure as well as data and technology development. It also catalyzes conversations between the public and private service providers and creates the path for a better P3 environment and interoperability between different sectors.

The following list presents a high-level summary of available resources for assembling a supporting toolbox to improve a P3 environment:

96 [https://musercontent.com/de63eb52330683a7f7ced7d2a/files/489767f6-7ca7-3f5d-5cc8-bdc3cd6f6270/2021\\_11\\_03\\_Mobility\\_Data\\_Interoperability\\_Principles\\_Press\\_Release.pdf](https://musercontent.com/de63eb52330683a7f7ced7d2a/files/489767f6-7ca7-3f5d-5cc8-bdc3cd6f6270/2021_11_03_Mobility_Data_Interoperability_Principles_Press_Release.pdf)

- FHWA P3 Toolkit<sup>97</sup>: The P3 Toolkit includes analytical tools and guidance documents to assist in educating public sector policymakers, legislative and executive staff, and transportation professionals in implementation of P3 projects.
  - Publications
  - Analytical Tools: The P3-VALUE 2.2 spreadsheet
  - Webinars
  - Programs, Institutions and Financial Instruments
- P3 Infrastructure Delivery: Principles for State Legislatures<sup>98</sup>
- P3 Planning and Assessment Toolkit – U.S. Department of State Secretary’s Office of Global Partnerships Public-Private Partnerships Planning and Assessment Analytical Tools<sup>99</sup>

## Management and Operations

### Cal-ITP’s demonstrations present opportunities to promote open-loop payment solutions through small agencies

Open-loop payment systems have numerous benefits such as a simplified user experience and time savings on transactions and boarding/alighting vehicles. Additionally, transit agencies do not need their own unique fare media, as this is not needed in an open-loop system.

Cal-ITP has started doing demonstrations on smaller transit agencies in northern California. As the demonstrations expand to southern California, it would be an opportunity to promote the system transition from closed loop to open loop.

## Governance

### Some practices of having county-wide mobile payment platform encourage regional fare policy integration

As indicated in the definition of MaaS, its implementation requires an integrated transit system, hence integrated fare payment policies in regards to transfer policies and an agreed upon revenue sharing mechanism.

An implementation of MaaS, even within a SCAG subregion, would facilitate conversations among different transit service operators and catalyze communications and discussions on formulating policies to share revenue of regional passes and develop free transfer windows.

## Institution

### Creation of the advisory group from this project presents the opportunity to establish a dedicated MaaS entity for the SCAG region

Organizations like the MaaS Alliance in Europe have played a pivotal role in facilitating the public awareness on MaaS, mode integration, identifying funding resources, providing guidance and input in formulating policies, and coordinating efforts between public and private sectors.

Establishing such an entity for the SCAG region has the potential to generate similar benefits in pushing MaaS development and implementation forward. The advisory group assembled through this project could be considered as a candidate.

<sup>97</sup> <https://www.fhwa.dot.gov/ipd/p3/toolkit/>

<sup>98</sup> [https://www.ncsl.org/Portals/1/documents/transportation/P3\\_Infrastructure\\_080117.pdf](https://www.ncsl.org/Portals/1/documents/transportation/P3_Infrastructure_080117.pdf)

<sup>99</sup> [https://securitypolicy.syr.edu/wp-content/uploads/2015/11/DOS\\_Evaluation\\_Tool-mwedit111715.pdf](https://securitypolicy.syr.edu/wp-content/uploads/2015/11/DOS_Evaluation_Tool-mwedit111715.pdf)

<sup>100</sup> <https://www.transit.dot.gov/research-innovation/enhancing-mobility-innovation>

<sup>101</sup> <https://www.transit.dot.gov/AIM>

<sup>102</sup> <https://www.sempra.com/>

<sup>103</sup> <https://ww2.arb.ca.gov/lcti-south-los-angeles-universal-basic-mobility-pilot-program>

## Taking advantage of the State’s Leveraged Procurement Agreements for both equipment and bank processing services from public agencies as a group

It was brought up in the Advisory Group August 2021 meeting and interviews with Advisory Group members that public agencies should take advantage of the State’s Leveraged Procurement Agreements for both equipment and bank processing services as a group in the technology solution market.

Transit agencies in the SCAG region could adapt the Category management experiences from other countries mentioned in the Challenges section above to transform the buying of common goods and services “as one” in years to come.

## Finance

### The funding mechanism of City of Pittsburgh and some European cities present the opportunity to pursue public, private, and institutional funding

The case studies have shown that while traditional public grants such as FTA’s “Enhancing Mobility Innovation”<sup>100</sup> and “Accelerating Innovative Mobility”<sup>101</sup> opportunities exist for MaaS implementation, institutional funding and private funding are also crucial for some cities’ MaaS implementations. For instance, the City of Pittsburgh’s Move PGH and the Universal Basic Mobility projects are funded by a grant from the Richard King Mellon Foundation. Spin, a private scooter service provider, also offered funding for researchers at Carnegie Mellon University to study the project. Another example is the City of Helsinki. Its MaaS system was primarily funded through private entities including Transdev, Karsan, Uber, Toyota, Mitsubishi, and real estate developer Mitsui Fudosan in two separate rounds.

For any potential implementations in the SCAG region, private and institutional funding opportunities such as the University of California Los Angeles (UCLA), or the Sempra Energy Foundation, which invests in areas such as new environmental and energy technologies<sup>102</sup> and infrastructure development and improvements, should be explored.

## Equity and Engagement:

### Limitations of current market strategies and direct community feedback present an opportunity to create new marketing strategies

In response to addressing equity concerns for MaaS implementation, it was brought up in the Advisory Group that there is a lifeline assistant phone program for vulnerable populations. This is an opportunity to preinstall a MaaS app on these phones and expand public access to the MaaS solution and micro-target those who need it the most.

Another strategy is referencing the Universal Basic Mobility (UBM) programs that have been implemented in the cities of Los Angeles<sup>103</sup>, Pittsburgh and Oakland. A UBM toolkit could be put together for other cities to help make transit pricing more affordable and inclusive.

**Potential Feasibilities Within the SCAG Region**

Feasibility needs to be evaluated within specified contexts. The SCAG region consists of a wide range of geographies, demographic compositions, political environments, and priorities which make it difficult to determine the feasibility of MaaS implementation at a regional level. However, based on the key factors covered above that could contribute to a successful MaaS implementation, certain areas within the SCAG region have high potential to be the candidates for pilots when funding becomes available.

Some areas such as Willowbrook, Long Beach, Santa Ana, Moreno Valley, Ontario, Fontana/Rialto, and Oxnard within the SCAG region have been identified in the Challenges section to be considered in the context of implementing MaaS.

**Integration Requirements**

After identifying some high potential areas within the SCAG region, the next step is to envision what to expect in a trial implementation or a pilot. For a MaaS system, the services are supposed to be integrated from the back-end data collection and analysis to the front-end user experience. The first thing that needs to be integrated are the transit services from different operators. As discussed in the previous challenges and opportunities section, a model needs to be created among all transit operators to share data and revenue generated from the system. Transfer policies need to be developed in a way that riders within the selected pilot service areas can achieve a seamless transfer between different fixed-route service providers because these services are not on-demand.

**CHAPTER 5- GOALS AND OBJECTIVES SETTING**

The following goals and objectives are based upon SCAG’s Connect SoCal document, the prior research of this study, and feedback received from the Advisory Group. They are intended to guide the implementation of MaaS in the SCAG region.

**GOALS AND OBJECTIVES**

1. Establish a set of key performance indicators (KPIs) to compare against baseline data:
  - Mode shift (Percentage of SOV that shifted to other modes)
  - VMT (Total annual VMT change)
  - Reduce GHG emissions (Annual total GHG reduction)
  - Accessibility (Coverage ratio of transit service)
2. Pursue policies and strategies (e.g., transportation and land use) that facilitate the widespread implementation and adoption of more sustainable transportation modes.
3. Generate more revenue and/or funding sources to enhance transit.
4. Remove payment barriers for unbanked/underbanked population.
5. Facilitate greater regional collaboration and cooperation.
6. Identify pilot projects/locations that are inclusive to disadvantaged communities, including but not limited to seniors, disabled, low-income, and minority communities with community-based engagement programs.

**ROLES AND RESPONSIBILITIES**

**Table 13** provides details which will assist with implementing MaaS in the SCAG region. This includes a lead agency or entity, the role of that agency or entity, and any relevant stakeholders or partners.

**Table 13: Roles and Responsible Parties by Goal/Objective**

Goal/Objective	Lead Agency/Entity	Role	Stakeholder(S) And Partner(S)
1: KPIs	SCAG	Establish metrics to monitor the effects of MaaS related implementations.	Local Transit Authorities, SCAQMD, County Transportation Commissions (CTCs)
2: Policies and Strategies	SCAG, CTCs, Local Jurisdictions and Transit Authorities	Promote active transportation, shared transportation, and micromobility options	Caltrans, Community-based organizations
3: Revenue	CTCs, Local Jurisdictions	Implement sales tax, property tax, or other revenue sources such as development impact fees to fund and support transit projects.	SCAG, California Transportation Commission
4: Payment Barriers	Transit Operators	Minimum balance fee is one of the access barriers for low-income people to get a debit card. Regulators should work with banking institutions to implement policies to help unbanked/underbanked population access basic checking accounts. Or other cash purse platforms.	SCAG, Caltrans, Financial Institutions, Public Policy Makers
5: Regional Collaboration	SCAG, CTCs, transit agencies	Facilitate communication between transit agencies in the SCAG region. Identify policy differences and create solutions or alternatives to mitigate differences and foster collaboration.	Local Transit Authorities
6: Pilot Projects	SCAG, CTCs, and Relevant Local Authorities	All levels of public agencies need to work together on identifying pilot locations that are inclusive and easy to implement with minimal political friction.	Relevant local communities, CTCs, Local Transit Authorities, and private mobility providers



## CHAPTER 6- KEY STRATEGIES

This chapter summarizes key strategies formulated based on the input from previous research and feedback from the advisory group. The strategies are categorized by policy framework element.

### KEY STRATEGIES IDENTIFICATION

The strategies are kept at a high level to function as regional guidance from SCAG. Each strategy should be tailored to an individual pilot based on its scale, geography, and local political climate.

### Infrastructure

Two strategies were developed under the Infrastructure policy element:

#### 1. Develop mobility hubs throughout the SCAG region.

Mobility hubs are places of connectivity where different modes of transportation come together. They are the infrastructure foundation for multimodal trip planning and promoting mode shift. The transportation modes to be included in a mobility hub include but are not limited to public transit, active transportation, and shared vehicles. The mobility hubs should also be equipped with infrastructure that grants internet access through either cellular data or WiFi to enable app-based trip planning or other online activities. Funding needs to be identified and secured for mobility hubs at critical connection points throughout the region. The planning, design, and construction of the mobility hubs should be led by County Transportation Commissions (CTCs). SCAG can play a role in coordinating the distribution of mobility hubs at a regional level and provide funding support to the CTCs.

#### 2. Develop associated payment and digital infrastructure.

Physical payment infrastructure includes validators and payment targets installed at the fare gates and fareboxes. Similar to the technology products under the “Data and Technology” element below, Leveraged Procurement Agreements (LPAs) could be used to procure payment hardware and other digital infrastructure. A strong wireless network can enable all activities related to transactions, such as authentication, validation, and adjudication. Wireless access points (cellular and/or Wi-Fi) are needed to ensure all users and service providers have access to the MaaS system. From an equity perspective, providing free wireless communication at key locations throughout an area will offer access points for populations who do not have mobile data plans. Another crucial element of the digital infrastructure is the cloud for data storage and retrieval. The digital infrastructure should be developed by both public agencies and private companies. Legislative bodies such as the California State Assembly, California State Senate, county governments, and transit agencies need to develop policies and regulations to help align the infrastructure expansion and upgrade to the standards.

## Data and Technology

Three strategies were developed under the Data and Technology policy element:

#### 1. Encourage and provide incentives for cities and local transit agencies within the SCAG region to leverage Cal-ITP’s support and start open-loop payment demonstrations. Test shared product systems and post-payment solutions.

As part of Cal-ITP’s demonstration, Monterey Salinas Transit and Sacramento Regional Transit have launched their contactless fare collection systems which allow riders to tap contactless credit cards, debit cards, prepaid cards, or contactless-enabled mobile or wearable devices to pay fare. In addition, these two demonstrations aimed at verifying eligibility for discounts in an open-loop payment system. According to Gillian Gillett, Program Manager of California Integrated Mobility at the California Department of Transportation, “Agencies that are demonstrating with Cal-ITP are given a link to a small piece of software that allows seniors to associate their eligibility with their debit or credit card automatically. It is a proof of concept – that works – and which we hope to expand to more eligibilities and more agencies as we build Cal-ITP.”<sup>104</sup> Cal-ITP has the intention to host more demonstration projects throughout California in the future. Interested cities or local jurisdictions within the SCAG should leverage this opportunity to participate in Cal-ITP’s demonstration projects and test open-loop payment concepts.

An open-loop payment system does not necessarily indicate an integrated payment system. It could be modeled as a shared product system where services maintain their independence while users enjoy seamless trip planning through standardized data sharing and service optimization among all mobility providers. If the technology and all parties involved agreed, a post-pay solution could also be considered to test how much of a customized user experience it will create compared to a prepaid solution.

Interested transit agencies, cities, or other local jurisdictions should take the lead in seeking partnership with Cal-ITP and provide a necessary local funding match to launch pilots. Cal-ITP and SCAG could provide technical guidance and additional funding support to cities and transit agencies as needed.

#### 2. Take advantage of the State’s Leveraged Procurement Agreements for both equipment and bank processing services as a group.

LPAs allow departments to buy directly from suppliers through existing contracts and agreements. LPAs are available to California’s state, county, city, special district, education, and other government entities.

Transit agencies or other government bodies that are interested in MaaS should purchase technology and infrastructure through LPAs to maximize their purchasing power by sourcing directly from suppliers to help lower their administrative costs related to procurement. The consolidated purchasing power could also be leveraged to negotiate with banking institutions to lower barriers for unbanked/underbanked populations by creating accounts, access to the banking system, and potentially waiving process or service fees. Caltrans can provide support upon request. In addition, under no circumstances should a public sector grant a technology provider with exclusive license

<sup>104</sup>More detailed information could be requested via [hello@calitp.org](mailto:hello@calitp.org).

to provide an end-user app that integrates with the data aggregation system. Doing so would bring substantial risk to the public sector investment in the data feeds and payment systems necessary to establish MaaS in the region if users do not choose to use the integrated and exclusive app. MaaS is the most financially profitable when a private company can create a “walled garden” where multiple services are accessed exclusively through a single user app and/or platform- effectively creating a regional monopoly for the utility-like system of regional mobility services. This greater level of profitability will be a transfer from both the public sector and individual users of the application. In such a scenario, the exclusive app provider will be allowed to let the features and capabilities of their single app potentially languish while continuing to enjoy monopoly benefits.

**3. Make the implementation guide developed from this study available and/or create individual toolkits from this study for public transit providers.**

The implementation guide consists of a timeline/schedule for MaaS deployment in the SCAG region; a checklist for agencies who are considering or starting a MaaS pilot; and a set of performance measures to monitor the implementation.

SCAG can distribute the implementation guide to its member agencies and other interested parties. SCAG will also work with the CTCs and provide support to transit agencies or cities to create toolkits tailored to their MaaS implementations. The transit agencies and cities should lead the effort of adapting the toolkit to meet their unique mobility needs.

## Management and Operation

One strategy was developed under the Management and Operation policy element:

**1. Leverage a comprehensive technology vendor product catalog to be developed by the State or SCAG to determine and tailor the management structure and meet the local pilot needs.**

It is important to understand the industry and have access to a full catalog of MaaS products provided by various vendors across the world. A product catalog should be created and kept up to date through surveys, meetings, and other communications between the State, SCAG, and individual vendors.

The State and SCAG could partner and build off the Vendor Survey task from this study to create the product catalog. The State and SCAG should also schedule quarterly check-ins with the vendors and make sure their product descriptions and associated documentations are comprehensive and up to date. Any data or updates collected from the quarterly check-in meetings will be stored in an internal cloud-based database or a website which serves as a publicly available tool and resource for agencies in the region. Cities and transit agencies can reference this product catalog before starting their own procurement process.

## Governance

Three strategies were developed under the Governance policy element:

**1. Create policy incentives/enforcement for other transportation providers to have an open API ready for data sharing and system integration.**

Transportation service providers do not always provide an

open API or provide an API with the same specifications as other providers for data sharing in the same ecosystem.

All levels of legislative bodies and governments should develop policies, such as creating dedicated funding resources or waiving some administrative processes to incentivize the creation of an all-purpose API specification for MaaS and/or a strategy to reach one common standardized way to exchange information between all stakeholders and service providers. If incentives are not effective, public funding agencies such as SCAG could enforce it through funding eligibility requirements. These incentives or requirements can be passed down by funding recipients to other interest parties who might not be eligible to apply for funds through their procurement processes. As a result, parties other than public entities, such as private companies, could be leveraged to promote MaaS development regardless of their funding eligibility.

**2. Promote infrastructure standards such as mobility hubs and curb space for future integration across the region.**

LADOT published the Mobility Hub Readers Guide to help navigate the establishment of mobility hubs and standardize implementation. For example, the City along with the City of Long Beach partnered with LA Metro to request professional services to implement integrated mobility hubs in LA and Long Beach at existing Metro stations.

Additionally, SCAG launched a Curb Space Management Study to examine some of the most congested and complicated curb space locations within the region. The outcome of this study will help assess policies, strategies, and infrastructure investments and their impacts on curb spaces activities throughout the region. The assessment will serve as a foundation to formulate infrastructure standards for curb spaces in the SCAG region.

The development of the standards should be led by CTCs to incorporate their local transit agencies’ needs. Coordination from regional institutions such as SCAG will be needed to ensure seamless cross-county travel.

**3. Promote data standardization and secured data sharing. Build on existing standards and principles such as GTFS, GBFS, MDS, and the Mobility Data Interoperability Principles.**

Cal-ITP and LADOT have either led or helped develop certain data standards and principles, such as GTFS, GBFS, MDS, and the draft Mobility Data Interoperability Principles. These data standards need to be promoted to all service providers in a MaaS system. Agencies like LA Metro and LADOT have already developed some data sharing agreement examples (see Appendix F) which could be shared with other interested agencies as reference to their vendor procurement process. However, legislation or regulation may be needed to enforce the compliance to the standards in place for system participants. In addition, data that is shared in a MaaS system needs to be transparent for public scrutiny.

Regional governments like SCAG should develop and promote the data standards as well as data sharing templates. Local transit agencies and CTCs are responsible to coordinate with the State legislature and private mobility providers to mitigate conflicts and help enforcement.

## Finance

One strategy was developed under the Finance policy element:

### 1. Any form of funding should be explored, including agreements with private investors or local retail sponsoring campaigns in exchange for in-app promotions.

It has been proven in the case studies that all forms of funding structures can and should be explored for MaaS, as there is no existing dedicated funding source. There are pilots funded by private investors and by public grant funds such as state and/or local funds. The private funding could typically be used for both startup costs as well as operating and maintenance costs. For MaaS funded through grants, however, the funds could only be used for startup costs, which typically include the development of the digital application, initial marketing and branding, and potentially a pilot program. Most discretionary grant programs in the US only provide funding for capital infrastructure projects and pilot deployments of technologies and cannot be used for operations and maintenance costs. Only certain formula grant funding can be used for operations and maintenance costs.

Generally, MaaS implementations in Europe consider private funding as an important source of financing MaaS. To-date, the MaaS industry in North America does not see it as a viable investment for the private sector since MaaS has not generated enough income from trips alone to become profitable.

Consequently, for any future MaaS implementations in the SCAG region, it is anticipated that public grant funding will be the primary funding source. The region should explore Federal, State, and regional funding opportunities to support any future MaaS development. Cities and transit agencies could consider new revenue mechanisms to increase the startup funding. However, there are ways for cities and transit agencies to attract private funding, such as agreements with the private sector or local retail sponsorship campaigns in exchange for in-app promotions. To fund a permanent program, cities and transit agencies will need to establish a dedicated funding source to cover the annual maintenance and operation costs.

## Institutional Practices

Two strategies were developed under the Institutional Practices policy element:

### 1. Leverage the Advisory Group from this study to establish a dedicated forum to understand shared roles and responsibilities, leadership, and management for a future MaaS system.

Several advisory group members have voiced that SCAG is instrumental in creating dialogue, convening and analyzing existing conditions, creating toolboxes for agencies, and developing funding requirements for further MaaS implementation. Other members mentioned that a coalition will be needed to bring all parties together, form working groups, align capital expenditures, and tackle the mobility issues and new mobility solutions from a regional level. Creating an forum like the MaaS Alliance in Europe might be a way to help stakeholders in the SCAG region understand shared roles and responsibilities, leadership, funding, and management for a future MaaS system.

SCAG should consider and evaluate options to lead or

facilitate the formation of this forum, in collaboration with local, regional and state partners.

### 2. Launch county-led policies to encourage fare policy integration or product/service sharing at the regional level

Some counties within the SCAG region have achieved fare integration in terms of having a common fare media, such as the VCbuspass and Metro's TAP Program. However, a complete fare integration could optimize customer experience which could include common fare media, common transfers, and integrated tickets which allows one fare to cover multiple modes for one trip (for example, a free ride on the regional rail from the inter-city rail terminal and the use of a campus shuttle with paid parking). If agencies in the region are hesitant to transition to a complete fare integration, the shared product model discussed under Data and Technology could be explored.

CTCs should lead the fare integration conversation at a county level. SCAG and the potential dedicated forum should coordinate at the regional level.

## Equity and Public Engagement

Two strategies were developed under the Equity and Public Engagement policy element:

### 1. Dedicated sessions discussing MaaS in regional public forums. Continuing direct public engagement to ensure MaaS investments support community needs and regional equity goals.

The advisory group meetings from this study provide a platform for stakeholders within the SCAG region to discuss MaaS. Additionally, other public forums are needed to continue the conversation and discussion after the conclusion of the feasibility white paper. One potential platform is SCAG's annual General Assembly, where most of the local jurisdictions in the SCAG region will be present and a presentation about MaaS progress could be given, with the goal of stimulating further conversation on the topic for policy considerations, near term and in future. Also, the proposed dedicated MaaS forum should involve the general public and could host a quarterly or monthly meeting to continue the conversation and discussion. Both stakeholders and members of the public should be regularly engaged. Strong leadership and human capital will be required to host these public meetings and community events, distribute surveys, and conduct outreach through social media. A good example of how a public forum contributed to a decision-making process that generated tangible solutions for the public is the Mobiliti conference in Pittsburgh. The knowledge shared at Mobiliti helped the formation of Pittsburgh Micromobility Collective, a self-organized, private consortium that aims to bring a range of "new mobility" services across the city<sup>105</sup>.

Regional governments like SCAG should lead the effort to further the MaaS conversation with stakeholders within the region. CTCs, cities, transit agencies, and community organizations should assist with better engaging the public.

### 2. Create an account-based subscription model with individual accounts that can be shared with friends and family. Discounts and subsidies can be applied for disadvantaged community families.

Based on the Stockholm & Gothenburg case study, there are different plans for bundling public transportation and cars. On each subscription plan users are given a set

<sup>105</sup> <https://www.bloomberg.com/news/articles/2019-10-11/a-new-mobility-supergroup-assembles-in-pittsburgh>

number of credits. If the credits are not used by the end of the month, the credits are rolled over to the next month. Credits can also be shared with other people. For example, a family can have one subscription plan, and each of the family members could use credits from a single subscription plan. A similar program was launched by LA Metro in November 2021, Low-Income Fare is Easy (LIFE) program<sup>106</sup>. LIFE offers discounted weekly and monthly transit passes that can be shared within a family (household sizes ranges from 1-6, with qualifying annual income levels) on various Metro services. To be eligible, a family of four, for instance, would need to make an annual income of \$59,100 or less. Information on discounts for groups and families is available on the program website. To build on this model, a discount/subsidy layer could be added to the mobility account for disadvantaged community families.

This model should be tested by agencies who are

launching MaaS pilots. SCAG and CTCs could provide support as needed .

SCAG can also coordinate with the California Department of Social Services to make state-issued Electronics Benefits Transfer cards capable of open loop payment systems to help deliver benefits and discounts effectively and digitally. This will give all MaaS providers, particularly public transit agencies, the opportunity to grant free or reduced fares to those receiving public assistance. It will also allow publicly funded mobility wallets to be loaded on common, statewide cards.

## SUMMARY

The following table summarizes the strategies and their potential responsible parties:

**Table 14: Strategies and Responsible Parties**

Strategies	Responsible Parties
<b>INFRASTRUCTURE</b>	
1. Develop mobility hubs throughout the SCAG region.	Lead: CTCs Support: SCAG
2. Develop associated payment and digital infrastructure.	Lead: Transit Agencies Support: Private Companies, all levels of government, and Cities
<b>DATA AND TECHNOLOGY</b>	
1. Encourage and provide incentives for cities and local transit agencies within the SCAG region to leverage Cal-ITP's support and start open-loop payment demonstrations. Test shared product systems and post-payment solutions.	Lead: Transit agencies, interested cities or other local jurisdictions. Support: Caltrans, SCAG
2. Take advantage of the State's Leveraged Procurement Agreements for both equipment and bank processing services as a group.	Lead: Transit agencies, interested cities or other local jurisdictions. Support: Caltrans
3. Make the implementation guide developed from this study available and/or create individual toolkits of this study for public transit providers.	Lead: Transit agencies, interested cities or other local jurisdictions. Support: SCAG, CTCs
<b>MANAGEMENT AND OPERATION</b>	
1. Leverage a comprehensive technology vendor product catalog to be developed by State or SCAG to determine and tailor the management structure and meet the local pilot needs.	Lead: The State government and SCAG Support: Cities and transit agencies
<b>GOVERNANCE</b>	
1. Create policy incentives for other transportation providers to have an open API ready for data sharing and system integration.	All levels of governments
2. Promote infrastructure standards such as mobility hubs and curb space for future integration across the region.	Lead: CTCs Support: SCAG
3. Promote data standardization and secured data sharing. Build on existing standards and principles such as GTFS, GBFS, MDS, and the Mobility Data Interoperability Principles.	Lead: SCAG. Support: Transit agencies, interested cities or other local jurisdictions, CTCs.
<b>FINANCE</b>	
1. Any form of funding should be explored, including agreements with private investors or local retail sponsoring campaigns in exchange for in-app promotions.	Lead: Transit agencies, interested cities or other local jurisdictions. Support: Federal Government, Caltrans, SCAG, CTCs, private companies.

<sup>106</sup> <https://www.metro.net/riding/life/>



**Table 14: Strategies and Responsible Parties (Continued)**

Strategies	Responsible Parties
INSTITUTIONAL PRACTICE	
1. Leverage the Advisory Group from this study to explore options to establish a dedicated forum to understand shared roles and responsibilities, leadership, and management for a future MaaS system.	Lead: SCAG Support: CTCs, State Government, local jurisdictions
2. Launch county-led regulations and policies to encourage fare policy integration at the regional level.	Lead: CTCs Support: SCAG, Dedicated MaaS Forum.
EQUITY AND PUBLIC ENGAGEMENT	
1. Dedicated sessions discussing MaaS in regional public forums. Continuing direct public engagement to ensure MaaS investments support community needs and regional equity goals.	Lead: SCAG Support: Cities, CTCs, transit agencies, and community organizations
2. Create account-based subscription model with individual account that can be shared with friends and family. Discounts and subsidies can be applied for disadvantaged community families.	Lead: Transit agencies, interested cities or other local jurisdictions. Support: SCAG, CTCs

## CHAPTER 7- IMPLEMENTATION GUIDE

The implementation guide consists of a timeline/schedule for MaaS deployment in the SCAG region, a checklist for agencies who are considering or starting a MaaS pilot, a checklist for private companies who are trying to support or get involved in a MaaS Pilot, and a set of performance measures to monitor the implementation.

### KEY ITEMS

#### Timeline and Schedule

##### 1. Continue building needed infrastructure for transit

**(ongoing):** Transit serves as the backbone of an equitable and sustainable MaaS system. Establishing a strong transit network and providing quality transit service will facilitate the development of MaaS. However, it takes time and funding to build such a strong network. As a result, continuous efforts should be made in developing and maintaining a strong and well-connected transit infrastructure for a long-term MaaS program. This item requires contribution from all levels of governments. Regional government bodies like SCAG or the dedicated MaaS forum could help facilitate inter-county coordination.

##### 2. Short-term (Next two years)

- Develop mobility hubs throughout the SCAG region: Expanding mobility hubs in all six counties within the SCAG region will help promote the concept of multimodal travel and enable mode integration. CTCs will lead this effort with SCAG's support.
- Develop MaaS associated payment and digital infrastructure: Transit agencies should start incorporating mobile payment into their systems and launch trials of open-loop systems. The testing of those digital payment solutions will help agencies evaluate their existing system and identify gaps to transition to a MaaS system. Transit agencies should lead this item and leverage support from other government bodies and private companies.
- Explore options of forming a forum to facilitate MaaS implementation, and execute policies: A dedicated MaaS forum could expedite the early phase of MaaS development and ensure all the input from various parties are incorporated. SCAG should take the lead to form this forum and get support from local, regional, and state partners.
- Select cities to launch MaaS pilots in collaboration with Cal-ITP and test open-loop payment, subscription-based models, and multimodal bundle services: SCAG should work with Cal-ITP and identify the cities within SCAG to launch MaaS pilots. The findings from the challenges and opportunities analysis could be potential resources but a more thorough analysis could be performed if necessary. SCAG and Caltrans should lead this item and collaborate with local cities and transit agencies.
- Explore a variety of funding sources: The early stage of MaaS development often lacks stable funding source to enable a continuous development. The transit agencies and local jurisdictions should be creative in finding resources to fund their pilots. Funding partners include, but are not limited to, regional government, state government, institutions, and private companies.
- Take advantage of the State's Leveraged Procurement Agreements (LPAs): The State's LPAs should be used in piloting MaaS programs. Local cities should lead this item.

- Make this Implementation Guide document available to public transit service providers: This implementation guide could help CTCs, transit agencies and cities develop plan their MaaS program development.

##### 3. Medium-term (Next five years)

- Finalize data sharing standards and MaaS infrastructure standards: The data standards include the data format of different transportation modes on data collection and sharing agreements between different parties. SCAG should lead in developing and promoting the data standards such as the MDS to its member agencies. Policy incentives should also be created to encourage service providers to have an open API for data sharing and system integration. Local transit agencies and CTCs are responsible to comply with the standards and coordinate with private service providers and help enforcement.
- Build scalable MaaS pilot models for other cities in the SCAG region: SCAG should lead a successful pilots that could be easily referenced and duplicated in similar areas across the region.
- Start launching county-wide pilots: CTCs will lead this item and get support from SCAG and Caltrans.
- Identify dedicated funding resources: The early phase of the MaaS development will prove the feasibility of the implementation and will need a dedicated funding source to ensure a sustainable program in the long run. Transit agencies and local jurisdictions should negotiate with regional and state governments to ensure a dedicated funding source can be allocated to their MaaS programs.
- Draft regional integrated fare policies and determine transfer policies and opportunities for revenue sharing: In order to create a seamless travel experience for MaaS users, efforts need to be made to coordinate transfer policies and fare policies between different transit agencies, between public service providers and private service providers. In addition, marketing and outreach programs need to be created so the users are well-informed with those policies. This item will be led by SCAG and supported by CTCs.

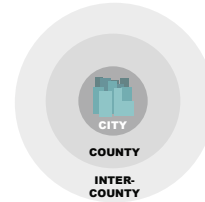
#### 4. Long-term (Next ten years)

- Accomplish significant mode shift from SOVs to multi-modal trips: The mode shift goal should be formulated by the agency who is launching the program. However, a long-term goal such as a 20% reduction of single-occupancy vehicle usage is a starting point. This is based on the SMILE program in Vienna (case study analysis). This item should be led by transit agencies and local jurisdictions and supported by CTCs and SCAG.

- Start launching inter-County MaaS pilots: CTCs efforts to launch county-wide pilots will be fundamental to this effort. SCAG will lead this item with support from CTCs.

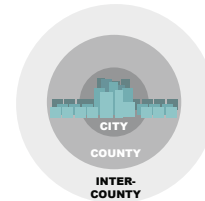
#### Phase 1 (2022-2023)

Proof of Concept Pilot Led by Cities and Other Jurisdictions



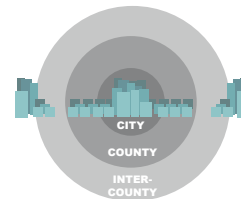
#### Phase 2 (2024-2029)

County-Wide Pilot Led by CTCs



#### Phase 3 (2030-2040)

Inter-County Pilot Led by Coalition



Source: AECOM

### Checklist for Agencies

- 1. Mobility hubs that can accommodate multi-modal trip planning and trip making.** Reference the Literature Review and Case Studies Chapter and the Existing Conditions Chapter for mobility hub examples in European cities and existing examples in the SCAG region. The Feasibility, Challenges and Opportunities Chapter also documents existing standards in the SCAG region that can be referenced.
- 2. Data reporting and sharing standards.** Reference the Existing Conditions Chapter and the Feasibility, Challenges and Opportunities Chapter for the existing data standards for reporting such as the GTFS, GTFS-RT, and MDS. Reference the Appendix F for an example data sharing agreement provided by LADOT.
- 3. Product catalog of technology vendors.** Reference the Feasibility, Challenges and Opportunities Chapter for the opportunity under "Data and Technology". Transit agencies and local jurisdictions will have access to an inventory of technology vendor products and can use it to inform their pilot and procurement decisions.
- 4. P3 toolbox to facilitate partnerships.** Reference the Feasibility, Challenges and Opportunities Chapter for another opportunity under "Data and Technology". This opportunity lists available resources to assemble a supporting toolbox to help transit agencies and local jurisdictions to improve P3 environment.
- 5. Capability or support to launch open-loop payment systems.** As outlined in the opportunity under "Management and Operations" of the Feasibility, Challenges and Opportunities Chapter of the feasibility white paper, Cal-ITP has launched several demonstrations related to open-loop payment solutions. The MaaS program launching agency should either have the capability to test an open-loop system on their own or should be equipped with staff and resources to support initiatives such as Cal-ITP's demonstration.
- 6. Staffing plan to enable technology-oriented in-house monitoring and review of outsourced work conducted by technology vendors or consultants.** Per the Dublin case study of Literature Review and Case Studies Chapter, The Dun Laoghaire Rathdown County Council (DLRCC) staff were given access to the MaaS platform where they were able to use and experience the app and communicate their feedback with the vendor. This case study example indicates that having staff with direct exposure of the platform and the technologies could generate direct benefits in managing the vendor and the program.

## Checklist for Private companies

- 1. An open API offered by mobility service providers.** Reference Helsinki's case study in the Literature Review and Case Studies Chapter, one of the lessons learned is having an open API from all mobility operators. This can streamline the development of MaaS.
- 2. Standardized and accurate trip information from mobility service providers.** Reference the data standards either developed or promoted by public agencies. Private companies should have the capability to comply with those data standards so the data of the MaaS system can be more efficiently processed.
- 3. Safety measures by mobility service provider.** According to an estimate conducted by the University of California Los Angeles (UCLA), the following rate of injuries per one-million trips by mode is:
  - 115 on e-scooters
  - 104 on motorcycles, and
  - 15 on bicycles<sup>107</sup>.Private companies such as e-scooter providers need to make sure they have safety measures in place to help reduce the safety risks their services bring to a MaaS system.
- 4. The capability of offering open-loop payment system and equitable payment options by payment service provider.** This checklist item accounts for some of public agencies' MaaS pilot requirements. Having an open-loop payment system will likely make their service more future-proof and less inclined to become obsolete.
- 5. Develop data sharing agreements with agencies and compliance on local regulations by MaaS platform provider.** This checklist item also accounts to some public agencies' requirements on data sharing and ensures that the data collected by private companies can be audited and that they comply with local regulations.
- 6. Training and continuous maintenance provided by MaaS platform provider.** The Vendor Chapter summarized how surveyed vendors are offering training along with their platform and services. Product training to project partners as well as on-going maintenance and support of their platforms should be expected from vendors.

## Performance measures for agencies

- 1. Mode shift (Percentage of SOV shift to other modes)**
- 2. VMT (Total annual VMT change)**
- 3. Reduced GHG emissions (Annual total GHG reduction)**
- 4. Accessibility (Coverage ratio of transit service)**
- 5. Percentage of trips utilizing a mobility hub**
- 6. Percentage of service hours generated by private mobility providers**
- 7. Percentage of open-loop payment users vs. cash users**
- 8. Percentage of unbanked/underbanked registered users**

## CONCLUSION

Mobility choices have increased over the last couple of years, but this has at the same time revealed the complexities and challenges in the transportation world. MaaS offers added value to mobility with one payment system instead of multiple channels to access a range of mobility options. At the core of MaaS is the ability to equitably offer customized mobility options for all persons. In addition, the COVID-19 pandemic has further proved that future transit, in order to create a more integrated network and provide better quality services, needs secured funding and a mobility management system. MaaS serves an integral purpose in planning a user-centric transit future as a mobility integration tool.

With this in mind, an established deeper understanding of MaaS was accomplished through this whitepaper. Ultimately, MaaS is potentially feasible in the SCAG region. However, obstacles exist in some areas such as: poor transit service quality and low utilization; lack of guidance for standards on data management and contractual agreements; lack of regional coordination and collaboration; absence of dedicated funding sources; no identified leading institution or agency champion; the need for more policies and regulations to protect riders and ensure public agencies' benefits in partnering with the private sector; and the disengagement between technologies and those population groups who benefit the most from an advanced mobility solution.

This whitepaper recognizes that public transportation providers are essential for, and should be at the forefront of, the successful implementation of MaaS. Public transportation providers should strive to be collaborators, enablers or managers of MaaS implementation including initiating, influencing and setting strategic mobility goals and objectives, and determining how to achieve them. Public transportation providers are best positioned to ensure equity and data access, while instilling confidence in the mobility network.

SCAG, as the Metropolitan Planning Organization responsible for developing the RTP and the Federal Transportation Improvement Program (FTIP), can help overcome these obstacles and support MaaS deployments through facilitating conversations including through regional convenings; leading a forum similar to the MaaS Alliance, building on the Advisory Group of this white paper; developing consensus on priorities; providing funding to demonstrations; and promoting established data standards and formulating new standards.

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<sup>107</sup> <https://www.dailymail.co.uk/sciencetech/article-10692971/Study-finds-e-scooter-riders-greatest-risk-suffering-injury.html>



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