

A Survey of Universal Basic Mobility Programs and Pilots in the United States

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16. Abstract A lack of reliable and affordable transportation exacerbates socioeconomic inequities for low-income individuals, especially people of color. Universal Basic Mobility (UBM) pilots or programs are a relatively new approach to addressing financial barriers to travel among the transport-disadvantaged. UBMs provide individuals with funds for various mobility options, including transit and shared modes. This study reviews the UBM programs and pilots implemented in the United States. It also reviews international applications of Mobility as a Service (MaaS) platforms. These platforms may reduce the administrative cost of implementing UBMs and help users identify and compare available travel options. In addition, the review describes critical program design tradeoffs to consider when developing a UBM program or pilot. Finally, key UBM elements and lessons learned are summarized to assist other communities considering UBMs.					
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Executive

Summary

Executive Summary

A lack of reliable and affordable transportation exacerbates socioeconomic inequities for low-income individuals, especially people of color. Universal Basic Mobility (UBM) temporary pilots and ongoing programs are a relatively new approach to addressing financial barriers to travel among the transport-disadvantaged. They provide individuals with funds to pay for various mobility options, including transit and shared modes.

We identified eight UBMs in the United States (US) in various stages of implementation and planning. These include three different UBMs in Portland, Oregon, pilots in the California cities of Sacramento, Oakland, Los Angeles, and Stockton, and a pilot in Pittsburgh, Pennsylvania. This study uses expert interviews and available literature to describe and compare critical elements of existing UBM programs and pilots (Table 1).

Table 1. Pilot program overview.

Name (city)	When	Who	How many	Value	Funding
Parking District (Portland)	Since 2017	Residents and employees	6,500	~\$66/month (max)	Parking fees and negotiated discounts
New Movers (Portland)	Since 2022	Residents moving to new multi-unit buildings	86	~\$17-\$26/month (more for income-qualified)	Developer fees and negotiated discounts
Affordable Housing (Portland)	2019 -2022	Residents	1,000	~\$31/month	Local agency and negotiated discounts
RashAffordable Housing (Sacramento)	Since 2017	Residents who cannot drive	150 (annual)	\$100/month	State air quality and local agency
Universal Basic Mobility (Oakland)	2021-2022	East Oakland Employees and residents near new BRT	500	\$300 total for anticipated 3 months	Local agency
Universal Basic Mobility (Pittsburg)	Since 2022	Income-qualified Manchester residents	50	\$262/month	Foundation and shared mobility provider
Mobility Wallet (Los Angeles)	2023-2024 (12 months)	Income-qualified South LA residents	2,000	\$150/month	State air quality and local agency
Mobility Incentives (Stockton)	2023-2024 (18 months)	Income-qualified South Stockton residents	400	\$100/month	State air quality and local agency

Universal Basic Mobility Goals

The UBM programs reviewed in this study share the primary goal of increasing the use of modal alternatives to personal vehicles by reducing service costs for low-income people. Beyond this, however, are important nuances. For example, UBMs in Oakland and Los Angeles seek to gain insight into a scaled UBM program's effectiveness over a larger geographic area. As a result, they conducted broad-based engagement and enrollment efforts and attempted to select participants generally representative of a neighborhood community. In addition, pilots in Los Angeles, Portland, and Sacramento acknowledge a dearth of high-quality transit in specific communities by paying for ridehailing and taxi services. Other UBM pilots leverage and encourage new modes by targeting neighborhoods with, for example, a new bus rapid transit line in Oakland and new electric carsharing hubs in Los Angeles or specific locations with, for example, new electric carsharing and bikesharing services in Stockton. Finally, some pilots test new ways to distribute funds using traditional or new payment methods, such as the stored value in Pittsburgh's MaaS app and a transit card that includes public and private shared mobility services in Los Angeles.

Fund Allocation

From a program implementation perspective, the delivery method for UBM benefits has significant implications for users. The UBM delivery method determines payment flexibility, modal options, and program administration costs. Methods can be categorized into three options: (1) prepaid credit cards, (2) stored value on a public transit card or smartphone payment application, and (3) physical transit cards, passes, codes, and credits.

- **Prepaid credit cards** allow users to spend UBM funds to maximize their accessibility over the accrual periods allowed by the program (e.g., monthly, quarterly, or biannually). They make it easy to include many modal services. All that is required is a merchant code. Currently, UBMs can select from many low-cost prepaid credit card options that provide direct mailing to participants and backend systems to track participant expenditures.
- **Stored value** approaches can pay for public and private transit and shared mobility and can be fixed or non-transferable based on program design. However, some funds may not be available for UBMs that negotiate discounts for bulk purchases, for example, the Portland UBMs. These approaches also require expensive and time-consuming modifications to backend systems to include a broader range of public transit and private shared mobility services.
- **Physical fare media** fix UBM benefits by modes.

Prepaid credit cards and flexible stored value approaches both allow agencies to track expenditures and adjust total payments when participants are not using funds over specified accrual periods. On the other hand, flexible stored value approaches and physical fare media require services willing to participate in the program

design. Some private shared mobility operators may have concerns about competition with other providers on the same platform.

Our survey of UBMs suggests that the low activation rate of mailed cards may be a significant drawback for large-scale implementation. Oakland experienced this challenge. Cards can be confused with junk mail even when agencies distinguish the mailings and remind enrollees that the cards are on their way or have arrived. Low activation rates increase administrative costs related to replacing cards and fielding complaints. The Los Angeles pilot addressed the possibility of low activation rates from mailing by placing the Metro logo on the envelope to differentiate it from junk mail. They also sent follow up emails to ensure participants activated their cards. The activation rate for the Los Angeles pilot was 60%. Agencies with smaller pilots have distributed these cards in person (e.g., Sacramento, Stockton, and Portland) in conjunction with travel training. On the other hand, familiar fare media may be more readily recognized and, even better, already in participants' hands.

Evaluations

Evaluations of UBMs use different designs. Of the three documented evaluations with internal surveys in Portland and Oakland, none use statistical tests of significance. Instead, they show qualitative changes over time or differences relative to nonparticipants. Five programs, including Portland affordable housing, Oakland, Pittsburg, Stockton, and Los Angeles, use third-party evaluations conducted by universities. However, the only published third-party evaluation is for the Portland affordable housing UBM. The other evaluations are still in progress or have just started. These evaluations indicate that UBM pilots successfully enroll low-income people of color. In addition, UBM pilots have been most successful at increasing transit use relative to shared mobility services and decreasing overall personal vehicle travel.

Funding

Six of the eight UBM pilots reviewed in this study are supported by a combination of local, state, and foundation grants instead of a reliable funding source. Three of the four pilots in California rely on cap-and-trade funds earmarked for equity and greenhouse gas reduction. All pilots require participants to have low incomes [1] or live or work in a marginalized community [2]. In contrast, fee-based programs in Portland do not restrict benefits to low-income people. However, they provide free or extended benefits to income-qualifying participants. It is important to note that UBM pilots generally provide significantly more monthly benefits to more low-income participants than programs funded by local fees or surcharges (\$100 to \$262 versus \$17 to \$66).

Key Findings

Pilot testing and evaluations of UBMs are still in the early stages. Based on preliminary information, UBMs are a promising approach to bridge the persistent income gap between the highest and lowest earning segments of the US population, allowing access to essential services and opportunities. In addition, UBMs may provide an important source of revenue to fund higher-quality transit and shared mobility services in low-income communities of color.

Achieving climate change goals will require a rapid transition to electric vehicles (EVs). Innovative auto pricing policies will be needed to shift buyer preferences. Unfortunately, low-income households are not well-positioned to bear the cost of new or used EVs, or to pay the high costs of owning personal vehicles. As a result, low-income households require robust alternatives to avoid deepening existing inequality in transportation access.

Contents

Introduction

A lack of reliable and affordable transportation exacerbates socioeconomic inequities for low-income individuals, especially people of color. Universal Basic Mobility (UBM) pilots or programs are a relatively new approach to addressing financial barriers to travel among the transport-disadvantaged. Programs provide individuals with funds to pay for various mobility options including transit and shared modes.

This study reviews UBM programs and pilots implemented in the US. It also reviews international applications of Mobility as a Service (MaaS). These platforms may reduce the administrative cost of implementing UBMs and help users identify and compare available travel options. The review aims to assemble information to assist interested jurisdictions in developing their own UBM pilots and programs.

Overview

We identified eight UBMs in the US in various stages of implementation and planning. These include three in Portland (two programs and one pilot), Oregon, pilots in the California cities of Sacramento, Oakland, Los Angeles, and Stockton, and a pilot in Pittsburgh, Pennsylvania (Figure 1).

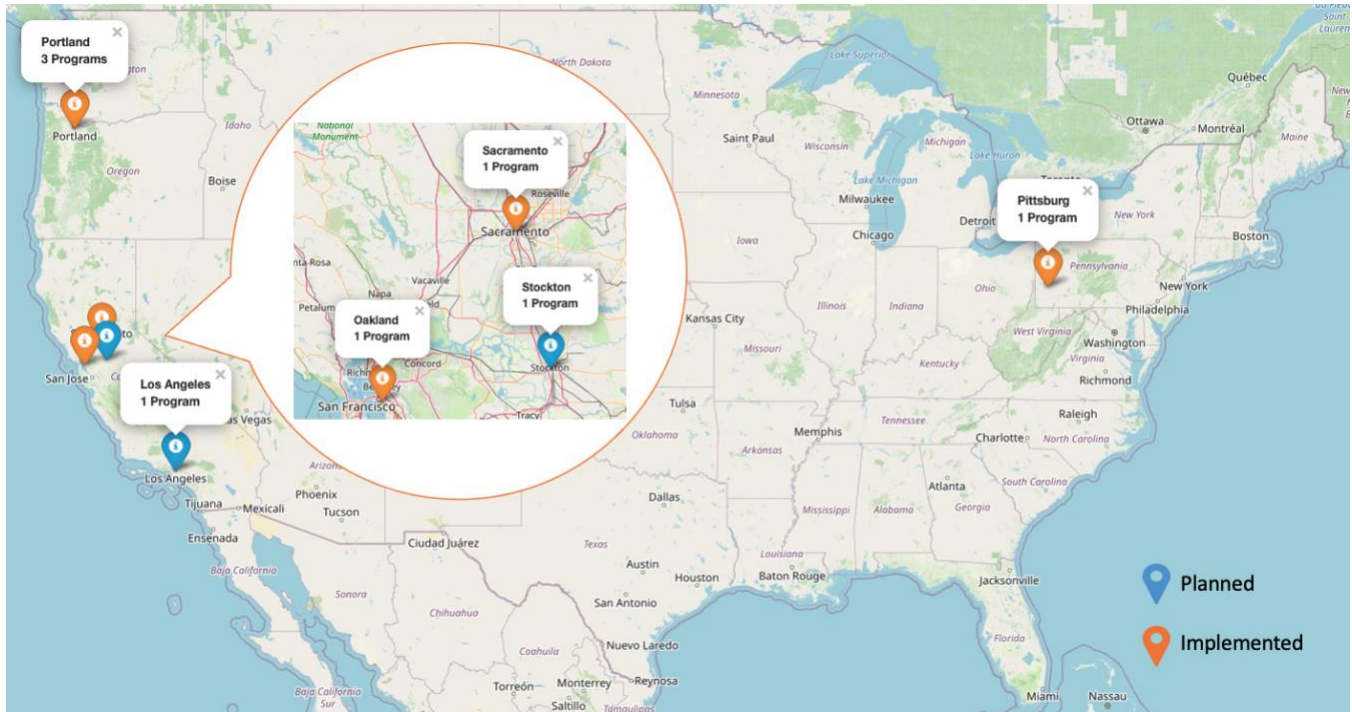


Figure 1. Map of Implemented and Planned UBMs in the US.

This study uses expert interviews and the available literature to describe and compare critical elements of UBM programs and pilots. The authors are partners on pilots in Stockton and Los Angeles. Table 1 below provides an overview of key elements of the eight UBM pilots and programs reviewed in this study, which is followed by a detailed description of each UBM.

Table 2. Comparison of US UBM.

Name (city)	When	Who	How Many	Value	Funding
Parking District (Portland)	Since 2017	Residents and employees	6,500	~\$66/month (max)	Parking fees and negotiated discounts
New Movers (Portland)	Since 2022	Residents moving to new multi-unit buildings	86	~\$17-\$26/month (more for income-qualified)	Developer fees and negotiated discounts
Affordable Housing (Portland)	2019 - 2022	Residents	1,000	~\$31/month	Local agency and negotiated discounts
Affordable Housing (Sacramento)	Since 2017	Residents who cannot drive	150 (annual)	\$100/month	State air quality and local agency
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Mobility Incentives (Stockton)	2023-2024 (18 months)	Income-qualified residents in South Stockton	400	\$100/month	State air quality and local agency

Portland

The three implemented Portland UBMs all take advantage of negotiated reduced transit fares and shared mobility fares [2]. Two of the Portland programs provide UBM benefits to low-income residents. This is in addition to programs that serve the general public and are funded by special fees [3]. Since 2017, the parking district-focused program has served 6,500 residents and employees and provided free benefits to low-income people [4]. Parking pass surcharges fund it. Twenty-two percent of UBM participants are income-qualified [4]. The program benefits higher-income residents and workers who give up their parking passes or pay \$99 annually [3]. The value of the parking district UBM is approximately a maximum of \$66 per month per individual. The goal is to reduce congestion in parking districts by equitably increasing the use of transit and shared mobility modes [4].

Since 2022, Portland's New Movers program provides benefits to low-income residents who move into qualified new residential multifamily unit developments [5]. It is funded by developer fees. Low-income residents receive expanded benefits to the base benefit of about \$17 to \$26 per month. In addition, this program aims to reduce personal vehicle use and related environmental impacts equitably [4].

The third Portland UBM pilot is grant-funded and serves affordable housing residents. The pilot reported in this study ran from 2019 to 2022 and served about 1,000 residents [1]. The monthly benefits of this program are about \$31 per month. In addition, this program aims to increase the overall accessibility of residents, who must income-qualify to live in affordable housing.

California

In California, a combination of local and California Climate Investments (CCI) grants fund implemented and planned UBMs with benefits ranging from \$100 to \$150 per month. Grants are funded by cap-and-trade auction revenues. These pilots supplement or help promote new transit and shared mobility programs in economically and environmentally disadvantaged communities. A significant share of CCI funds are allocated to improve access to alternatives to personal vehicle travel in disadvantaged communities.

Since 2017, the Sacramento pilot has provided benefits to about 150 non-driving affordable housing residents annually. This pilot closes the gap for residents who cannot access a free electric carsharing service at their development. This pilot was funded by CCI funded [6].

In Oakland, a pilot running from 2021 to 2022 provided benefits to 500 residents and employees in a disadvantaged East Oakland community [7]. Two \$150 payments could be received and expended in as little as one and a half months [7]. The pilot sought to increase accessibility and use of a new bus rapid transit service [7]. The Alameda County Transportation Commission funded the pilot with a local match [7].

A pilot implemented in May 2023, in Los Angeles (LA) will serve 2,000 low-income residents in two 12-month periods (1,000 in each period). It will operate in an underserved South Los Angeles community. Elements include new electric carsharing hubs, an e-bike library, active transportation street improvements, and

neighborhood shuttles. The project aims to make transit and shared mobility more affordable to residents, increasing access and reducing greenhouse gas emissions (GHGs).

Another smaller-scale UBM pilot, soon to be launched in Stockton, will benefit income-qualified residents of the disadvantaged South Stockton community shortly after the launch of new electric carsharing and bikesharing services in the same community. This pilot aims to provide a more affordable and robust alternative to personal vehicle travel to reduce GHGs. The program is smaller than LA's, serving about 450 residents over about 18 months. It plans to focus UBM recruitment at affordable housing developments with new EV carsharing hubs.

Other US Cities

A pilot UBM was implemented in Pittsburgh, Pennsylvania, in late 2022. It serves 50 income-qualified residents with the goal of affordable access to personal vehicle alternatives [8]. Foundations and shared mobility providers funded the pilot, which included a generous package of benefits valued at \$262 per month [8].

Modes

A variety of modes are included in UBM programs and pilots (Table 3). Modes included in the Los Angeles program (Table 3) are for the first phase of the program, which uses a pre-paid credit card, as well as the second phase, which will use an existing Transit Access Pass (TAP) card. The Los Angeles pilot originally intended to use the TAP card in both phases, but expanding the capability of the card to achieve full functionality has taken more time than originally anticipated.

UBM programs and pilots typically draw on available modal options to meet goals. In the relatively mode-rich cities of Portland, Los Angeles, Oakland, and Pittsburgh, UBMs offer more modes than cities with fewer high-quality options, such as Sacramento and Stockton. In Portland, ridehailing and taxis are excluded in a congestion reduction-focused parking district UBM and are included in an accessibility-focused affordable housing UBM. In Pittsburgh, ridehailing and taxi services may not have agreed to join the MaaS app. In Oakland, the only carsharing service did not accept pre-paid credit cards [9]. In Sacramento, an affordable housing UBM complements a free electric carsharing service by bridging the first and last-mile barrier to transit with ridehailing for those who cannot drive [10]. In Stockton, the UBM focuses on locations with new electric carsharing and e-bikesharing to enhance low-quality transit service. The Stockton UBM enhances these new modes' affordability, demand, and revenue during their pilot phase.

In its first phase, the accessibility-focused Los Angeles pilot included ridesharing, taxis, and car rentals. This pilot also provided smart phones and data plans. Early results suggest that most people already had a smart phone available, so this was not a major benefit to participants. If the second phase uses transit cards, then it will include an e-bikesharing service (run by the transit agency), electric carsharing service (public-private

BlueLA), and private ridehailing and taxi service (Uber and Curb Mobility). Los Angeles anticipates GHG reductions from the lower cost of modal alternatives to conventional carsharing, ridehailing, and taxis.

Table 3. Comparison of modes included in UBM. Modes with blue fill are provided by a given UBM.

Name (city)	Transit	E-bike	Carshare	Ridehail/Taxi	Other
Mobility Wallet (Los Angeles)— Prepaid Credit Card Phase	local+ regional	+E-bike library	conventional + electric		bike shop; rental cars
Affordable Housing (Portland)			conventional		
Mobility Wallet (Los Angeles)— TAP Transit Card Phase	local+ regional	transit agency service	electric	two vendors	
Universal Basic Mobility (Pittsburg)	local		conventional		moped
Parking District (Portland)	local		conventional		
Universal Basic Mobility (Oakland)					
Mobility Incentives (Stockton)	local		electric		
Affordable Housing (Sacramento)	local+ regional		free electric		
New Movers (Portland)	Local				

Method of Fund Distribution

The UBM programs and pilots described above use various methods to distribute benefits to recipients, including pre-paid cards, transit cards, transit passes, service credits or discounts, and stored value on MaaS or smartphone payment applications (Table 4). Many available low-cost pre-paid credit card options include direct mailing to participants and backend systems to track participant expenditures. Pre-paid cards also allow for more flexible use of UBM funds. For example, participants can spend UBM funds on any allowed travel service (restricted only by the availability of merchant code) at any point in time. For example, in Los Angeles, a bike can be purchased. UBMs in Sacramento, Oakland, and Stockton only use pre-paid credit cards.

Transit cards that include shared mobility vendors and stored value payment applications on smartphone apps provide a middle ground between these two options. They provide spending flexibility but have limited service options compared to pre-paid credit cards. However, these options are costly to develop. In addition, vendors

may not be willing to participate, especially outside of major cities, because of competition concerns. Nevertheless, the large market in Los Angeles has attracted major shared mobility service providers to offer services on their transit card, which, as described above, may be used in the second phase of their UBM pilot.

The Portland UBM programs distribute discounts on familiar fare media that are fixed by the transit and shared mobility mode. They are typically mailed to participants. The affordable housing pilot in Portland supplements these discounts with a prepaid credit card. The possible modes included in this distribution method are limited by the willingness of vendors to negotiate discounts. The Portland UBM programs are moving toward a smartphone app to distribute discounts and credits. This will reduce the administrative costs of qualifying participants and mailing discounts and credits.

Interestingly, a county-wide MaaS smartphone app with planning and payment capabilities is available to Stockton residents. This app includes a first-level integration that shares data between the new electric carsharing and electric bikesharing pilots. Currently, it displays hub locations for EV and e-bikesharing and vehicle availability for the EV carsharing service. It is possible to click on a location and then be directed to the services reservation system, commonly called a “deep link.” The agency responsible for Stockton’s UBM program ultimately determined that it was too much of an administrative burden to administer stored value requirements for the backend payment system. They decided to provide a prepaid credit card.

The Pittsburg pilot originally anticipated distributing UBM funds through its MaaS smartphone app. However, they added paper credits to distribute funds to those without smartphones and adequate data plans. As mentioned above, ridehailing is not included in the app, possibly because of concerns about competition.

Table 4. Comparison of payment method types.

Name (city)	Pre-paid Card	Transit Card	Stored Value App	Pass	Credits
Parking District (Portland)		✓		✓	✓
New Movers (Portland)		✓		✓	
Affordable Housing (Portland)	✓	✓		✓	✓
Affordable Housing (Sacramento)	✓				
Universal Basic Mobility (Oakland)	✓				
Universal Basic Mobility (Pittsburg)			✓		✓
Mobility Wallet (Los Angeles)	✓	✓			
Mobility Incentives (Stockton)	✓				

More on Prepaid Credit Cards

There are many low-cost pre-paid credit card options available. These typically include direct mailing to participants and backend systems to track participant expenditures. However, agencies must carefully review

contracts to avoid unanticipated costs (e.g., fees for unspent funds). In addition, the quality of backend systems varies by company. Some companies only provide aggregate expenditure data (i.e., total by type). In contrast, others may provide expenditures by all available vendor categories and attach information about the socio-demographic attributes of participants. Contract development with prepaid card vendors in major cities can be complicated and time-consuming, as was the case in Oakland and Los Angeles programs.

The Los Angeles and Oakland pilots encountered challenges with participants not activating pre-paid credit cards mailed to them. Initially, Oakland had a 30% activation rate. After telephone follow-ups with those who had not activated their cards, Oakland switched to in-person pick-up locations and increased total activation rates to 50% [7].

Los Angeles learned from card activation challenges faced by Oakland. They worked with the pre-paid credit card providers to personalize cards for the UBM pilot, added the Metro logo to the mailing, and send numerous texts and emails alerting participants about the arrival of their cards. The activation rate for the Los Angeles pilot was 60%. To build-out the pilot to its intended capacity, another 450 applicants were randomly sampled from the remaining 1,100 applicants and invited to enroll in the program.

In contrast to the Los Angeles and Oakland pilots, the Portland parking district program uses travel payment products familiar to users. These included pre-loaded transit cards and coupon vouchers. This program did not report significant issues with non-use. As described below, smaller-scale pilots can distribute cards in-person to avoid problems activating cards (e.g., affordable housing pilots).

In Sacramento, participants reported problems paying for taxis and ridehailing services with prepaid cards issued for affordable housing pilots [6][11]. As a result, new programs that use prepaid cards should explore how companies will resolve such complaints as they arise.

Pre-paid card products allow program administrators to monitor monthly spending by each cardholder and enable the movement of unspent funds to subsequent time increments. For example, the Sacramento program has a "use it or lose it policy" whereby unused monthly funds are moved to the subsequent month and subtracted from the total monthly stipend [12]. Thus, if one participant had \$20 left in their account at the end of October, then only \$80 would be added to their account in November. In addition, agencies can monitor accounts to determine when sufficient funds are available to add new participants to the program. In this way, agencies can maximize the likelihood of expending funds by the end of the pilot or program.

Stockton uses a quarterly approach. Cards are loaded with three months' worth of funds at a time to accommodate participants who may have concentrated periods of travel such as appointments for a medical procedure, a series of job interviews, or a temporary commute. Community-based organizations (CBOs) gave feedback indicating that funds should be distributed to participants as needed, and the project should include as many participants as possible, given available funds.

An alternate mechanism for disbursing funds is showcased by Los Angeles' pilot. It allows the accumulation of funds until the end of the pilot period, when the accounts will be swept out of the program and likely into another travel discount program. The agency intentionally designed the pilot to give users maximum flexibility and to provide an experience similar to that of anyone with a budget and a bank card. The wide choice of modes available to pilot participants also reflects this.

Income Tax

The UBM benefits are exempt from income taxes. Of the eight programs reviewed here, only Los Angeles contemplated classifying UBM funds as taxable income. Los Angeles Metro found that their UBM promotes general welfare¹ because participants are selected based on need and are not paid for services rendered. Thus, funds are not income and cannot be taxed [13]. If UBMs were to be classified as taxable income, some participants' eligibility for other social services could be jeopardized. In addition, issuing a 1099 to participants would increase the administrative burden for all parties [13].

Recruitment, Eligibility, and Enrollment

Implemented and planned pilots and programs reviewed in this paper are generally focused on neighborhoods or specific sites (e.g., housing developments). Neighborhood-based UBMs encompass large or small-scale pilots and programs. Recruitment, eligibility, and enrollment methods vary by UBM (Table 5).

Neighborhood-Scale UBMs

Neighborhood-scale UBMs tend to include more participants than site-focused UBMs. For example, the Portland parking district program includes about 1,300 participants annually. Each 12-month phase of the Los Angeles pilot includes 1,000 participants. The Oakland pilot included 400 participants. These UBMs conducted broad-based engagement and recruitment efforts with community partners, including tabling, social media, emails, mailing, newspapers, and newsletters [7]. They use online applications to establish eligibility. In East Oakland, proof of employment or residency is required. In South Los Angeles, proof of residency and verification of low-income status via participation in government assistance programs or self-attestation with

¹ To qualify under the "general welfare exclusion" for the IRS (See *Bailey v. Commissioner*, 88 T.C. 1293, 300 (1987)); payments must: (1) Be for the promotion of the general welfare (that is, based on individual or family need), (2) Be made from a governmental fund (under legislatively provided social benefit programs), and (3) Not represent compensation for services. The UBM passes each test for the general welfare exclusion because: (1) it is for the promotion of general welfare only for low-income individuals in South Los Angeles, (2) is made from a governmental fund that is legislatively approved by two legislative bodies (California Air Resource Board (CARB), and the City of LA) and was approved by LA Metro's board, and (3) is not compensation for service. [13]

random audits are required. In Portland, documentation of low-income status and employment or residency in one of the two participating parking districts is required.

An objective of the Oakland and Los Angeles pilots was to understand the potential impacts if benefits were made available to all eligible members of study neighborhoods. As a result, pilots selected participants to approximate a representative sample of each neighborhood based on US census data [7].

For example, in Oakland, the pilot required applicants to complete an initial survey to capture respondents' basic socio-demographic attributes. Oakland selected 500 of the 1,000 qualified applicants based on a random sample stratified by race, household income, and census tract [7]. In Los Angeles, enrollment form queried applicants' socio-demographic attributes. Los Angeles recruited 2,000 applicants who met income and residential location requirements and randomly selected 900 applicants for phase one. A comparison of selected applicants and census data indicated that participants comprised a representative sample based on gender, student status, income, age, and residential zip code.

Site-Scale UBMs

Site-scale neighborhood UBM pilots and programs typically include fewer participants. Community-based partners may recruit participants. These programs often distribute UBM payment methods at community events where there may or may not be training activities.

For example, the Pittsburg UBM program partnered with a CBO to recruit 50 low-income participants from the Manchester neighborhood [8]. Each phase of the Los Angeles pilot includes 100 participants who are given smart phones and data plans because they were without them prior to the pilot. Ten CBOs from South Los Angeles prescreened participants who then attended in-person events to receive a UBM prepaid credit card, smartphone, data plan, and training. South Stockton CBOs will recruit a share of their 400 participants from areas with relatively high transit access and near new electric carsharing hubs. Those who qualify for Stockton's UBM program will be invited to UBM training fairs and receive prepaid cards.

Site-Based UBMs

Site-based UBM pilots typically focus on residents of specific housing developments. For example, affordable housing in Portland, Sacramento, and Stockton and new multifamily development served by high-quality transit. The pool of potential participants is already income-qualified, which streamlines recruitment and enrollment. This can free up resources to conduct in-person trainings and organize UBM benefit distribution events. These UBMs typically have fewer participants.

Table 5. Comparison of engagement and recruitment methods, eligibility criteria, and enrollment process.

Name (city)	Recruitment	Eligibility	Enrollment
Parking District (Portland)	Neighborhood newspapers, social media, direct mailers, partnerships with CMOs, and occasional tabling	Participate in government assistance or household income below 200% federal poverty level (documentation)	All applicants via website
New Mover (Portland)	New residents receive information in move-in packets	Participation in government assistance or household income below 200% poverty level (documentation)	All applicants via website
Affordable Housing (Portland)	Onsite informational transportation fairs	Income qualified-affordable housing residents in participating complexes	In-person first-come first-served at fairs; then via waitlist
Affordable Housing (Sacramento)	CBOs share program information at affordable housing complex and on website	Income qualified-affordable housing residents in participating complexes who cannot drive	CBO trains and helps enroll via website
Universal Basic Mobility (Oakland)	Thirty CBO partners, tabling, community events, transit station flyers, City newsletters, mailed flyers, and website	Resident or worker in East Oakland; signed up on website and filled out survey	Stratified random sample to select a representative sample by race and household income
Universal Basic Mobility (Pittsburg)	Local CBO hosts events and recruits	Low-income residents of Manchester neighborhood	Not available
Mobility Incentives (Stockton)	Informational transportation fairs at participating affordable housing; meetings with participants recruited by CBOs	South Stockton residents who are income-qualified-affordable housing residents; CBO screens for low-income documentation or self-attestation	In-person first-come first-served at fairs; then via waitlist; sign-ups via program website with in-person assistance
Mobility Wallet (Los Angeles)	Tabling; emails to transit card users; CBOs recruit participants without smartphones	Documentation or self-attestation of participation in government assistance or low-income household and live in South Los Angeles	Random selection of program applicants

Evaluations

Almost all UBM programs reviewed feature evaluations based on participant surveys and observed usage data. Three programs implement their own survey (two Portland parking districts and Oakland). Five programs use third-party evaluations conducted by universities. These include Portland affordable housing, Oakland, Pittsburg, Stockton, and Los Angeles programs. The only published third-party evaluation is for the Portland affordable housing UBM. The other evaluations are still in progress or have just started. The Sacramento program does not have a formal evaluation. Instead, it uses expenditure data to track program use and managers add members to the pilot based on that information.

Table 6. Comparison of evaluation data and key findings.

Name (city)	Data	Key Findings
Parking District (Portland)	Agency annual cross-sectional parking district survey of participants and nonparticipants; results for low-income UBMs not analyzed separately; membership data	Participants drive less and use more transit compared to nonparticipants; however, no use of control variables
New Mover (Portland)	Agency annual surveys for four years after completion of participating buildings; some included in parking district survey	None
Affordable Housing (Portland)	Third party pre- and post-survey of participants; membership and expenditure data	Most participants non-white; increased use of shared mobility services; addressed unmet travel needs; travel fairs promoted shared mobility use but could be improved
Affordable Housing (Sacramento)	None	None
Universal Basic Mobility (Oakland)	Agency pre- and mid-point survey of participants and expenditure data; third party survey before-and-after with participants and control	Most participants non-white; increased transit use and reduced driving, ride-hailing, and walking; most UBM funds spent on transit (90%); third party evaluation results not yet available
Universal Basic Mobility (Pittsburg)	Third party survey	Not yet available
Mobility Incentives (Stockton)	Third party pre-, mid-point, and post surveys of participants and expenditures	Not yet available; pilot in progress
Mobility Wallet (Los Angeles)	Third party pre-, mid-point, and post surveys of participants and control population; expenditure and transit use to be determined	Not yet available; pilot in progress

The evaluations of UBM pilots and programs use different designs showing qualitative changes over time or differences relative to nonparticipants. None of the three completed evaluations use statistical tests of significance. Pilots that select only a portion of applicants to participate in UBMs are well-positioned to conduct longitudinal surveys with treatment (participants) and control (waitlist) groups (e.g., Oakland and Los Angeles). Pilots that recruit on a first-come first-served basis conduct longitudinal surveys of participants only (e.g., Portland affordable housing, Oakland, and Stockton). Generally, quasi-experimental designs with control groups are considered superior to those without controls. Response rates are a challenge in all surveys, and researchers need to carefully weigh pros and cons of different potential study designs.

The Portland affordable housing study surveyed participants prior to the start of the UBM (N=475) and then again at the end of the UBM (N=278) [13]. Results showed that participants were most likely to be female (65%), non-white (64%), middle-aged (42% 45-64 years old), without a college degree (78%), without a vehicle (71%) or driver's license (53%), unemployed (59%), and earning less than \$25,000 per year (87%). The modes most frequently used by respondents were transit (90%), ride-hailing (52%), and taxis (31%). Less frequently used modes were bike share (12%) and e-scooters (15%). Older participants were more likely to use transit than shared modes. Participants most frequently made shopping/errands and social/recreational by transit, ride-hailing, and taxis. Medical trips were also made frequently by transit and taxis. Work/school trips were also made frequently by ride-hailing. Bike share and e-scooters were used most frequently for discretionary trips. Most participants agreed that the UBM pilots and programs helped them access destinations they could not have traveled to otherwise (86%) and helped them take more trips overall (87%). In addition, participants' ability to make important appointments improved significantly (89%). Finally, results suggested that the transit fair helped participants use new modes, and that more training was needed to use the smartphone app and for bikesharing and e-scooters.

As discussed above, the Oakland pilot surveyed participants at the outset of the and mid-way through the program [7]. Like the Portland affordable housing pilot, most of the pilot participants were non-white (89%). They were primarily Latino/Hispanic (40%) or Black or African American (30%) with income of less than \$40,000 per year (75%). Participants primarily traveled by transit, followed by driving a car. Only 21% of respondents indicated they could usually afford the travel modes they wanted to use, while 21% could not or sometimes could not (58%) use these modes. After using the pilot, 23% of respondents indicated they drove alone less by car. In addition, respondents indicated that they used the UBM most frequently to commute (66%), for errands/shopping (23%), and for medical appointments (8%). The agency compared respondents' primary mode in each survey, and the results suggest increased transit use and reduced driving, ride-hailing, and walking. The expenditure data indicated that most UBM program funds were spent on transit (90%). The analysis of before and after surveys with participants and those waitlisted (control) is ongoing.

The Portland parking district program conducts a yearly cross-sectional survey in UBM parking districts [4]. The survey includes a sample of UBM participants and nonparticipants living and working in the districts. The sample includes low-income and new mover UBM holders but does not segregate outcomes by these

categories. Over 50% of the sample owned one vehicle, and about 10% owned two. The results show that, compared to non-UBM holders, UBM holders use transit and e-scooters more and cars less (including taxis, ride-hailing, and carshare). However, as discussed above, the results may be confounded by differences in socio-demographic variables and modal accessibility at the home and workplace.

The Sacramento affordable housing pilot did not conduct a formal survey but analyzed usage data and continued contact with users [6]. The agency reports that this helped to modify the program's design, improve the wallet's effectiveness, and increase participants' use of the program [6]. This pilot reported that monthly consultations and call centers were critical elements of program success [6].

Mobility-as-a-Service Literature and Case Studies

Key takeaways from this review are: (1) for both private and publicly operated MaaS, payment integration services are typically routed through third-party vendors, such as Masabi, Trafi, Bitemark, or Transdev and (2) publicly operated services typically start with a pilot phase, which scale up by adding services or expanding geographically.

Although public MaaS operations offer maximum control to governments, questions remain about the long-term financial sustainability of this approach. It is unclear whether it can become solvent as the mobility landscape evolves and how private MaaS competitors may affect it. International examples showed applications more common in densely populated urban areas with robust transit and shared mobility landscapes. Publicly operated MaaS may work well in the US, where services are less robust and therefore less able to stoke a shared mobility market.

Appendix A provides a detailed international review of applied MaaS services. We used an internet-based search to identify case studies and best practices of MaaS.

Summary and Conclusions

UBM Goals

The UBM programs and pilots reviewed in this study share the primary goal of increasing the use of modal alternatives to personal vehicles by reducing service costs for low-income people. Beyond this, however, are important nuances.

For example, UBMs in Oakland and Los Angeles want to gain insight into the effectiveness of a program scaled up to cover a larger geographic area. As a result, they conducted relatively broad-based engagement and enrollment efforts and attempted to select participants generally representative of a neighborhood community. The Los Angeles pilot and the affordable housing pilots in Portland and Sacramento acknowledge a dearth of high-quality transit in specific communities by paying for ridehailing and taxi services. Other pilots leverage and encourage new modes by targeting neighborhoods with, for example, a new bus rapid transit line in Oakland and new electric carsharing hubs in Los Angeles or specific locations with new electric carsharing and bikesharing services in Stockton. Other pilots aim to test new ways to disseminate funds on traditional or new payment methods, such as the stored value in Pittsburg's MaaS app and a transit card that includes public and private shared mobility services in Los Angeles.

Method of Dissemination

From a program implementation perspective, the method of dissemination of UBM benefits has significant implications for payment flexibility, modal options, and program administration costs. Methods of payment dissemination can be categorized as: (1) prepaid credit cards, (2) stored value on a public transit card or smartphone payment application that can pay for public and private transit and shared mobility, and (3) physical transit cards, passes, codes, and credits.

Prepaid credit cards allow users to spend UBM funds to maximize their accessibility over an accrual allowed by the program (e.g., monthly, quarterly, or biannually). Physical fare media fix UBM benefits by modes. Stored value approaches can be fixed or non-transferable based on program design. However, some funds may not be available for UBMs that negotiate discounts for bulk purchases (e.g., Portland). Prepaid credit cards and flexible stored value approaches also allow agencies to track expenditures and adjust total payments when participants are not using funds over specified accrual periods.

In addition, prepaid credit cards make it easy to include many modal services; all that is required is a merchant code. On the other hand, stored value approaches and physical fare media require services that are willing to participate in the program design. Some private shared mobility providers may have concerns about competition with other providers using the same platform. Stored value approaches also require expensive and time-consuming modifications to backend systems to include a broader range of public transit and private

shared mobility services. Currently, UBM pilots can select from many low-cost prepaid credit card options that provide direct mailing to participants and backend systems to track participant expenditures.

Our survey of UBM pilots suggests that the low activation rate of mailed cards may be a significant drawback for large-scale implementation of pilots or programs. Both Oakland and Los Angeles have experienced this challenge. Cards can be confused with junk mail even when agencies distinguish their mailings and remind enrollees that cards are on their way or have arrived. Agencies with smaller pilots have distributed cards in person in conjunction with travel training (e.g., Sacramento, Stockton, and Portland). Low activation rates increase administrative costs related to replacing cards and fielding complaints. On the other hand, familiar fare media may be more readily recognized and, even better, already in participants' hands.

Evaluations

Early survey evaluation results suggest that UBM pilots successfully enroll low-income people of color, increase transit use relative to shared mobility services, and decrease overall personal vehicle travel. Evaluations of UBM pilots use various designs showing qualitative changes over time or differences relative to nonparticipants. None of the three documented evaluations uses statistical tests of significance. Five programs use third-party evaluations conducted by universities. These include Portland affordable housing, Oakland, Pittsburg, Stockton, and Los Angeles. However, the only published third-party evaluation is for the Portland affordable housing UBM. The other evaluations are still in progress or have just started.

Funding

Six of the eight UBM pilots reviewed in this study do not have a reliable ongoing funding source. Instead, some combination of local, state, and foundation grants support these pilots. Three of the four pilots in California rely on cap-and-trade funds earmarked for equity and greenhouse gas reduction. All pilots require participants to have low incomes [1] or live or work in a marginalized community [2]. In contrast, fee-based programs in Portland do not restrict benefits to low-income people. However, they provide them for free or extended benefits to income-qualifying participants. It is important to note that UBM pilots generally provide significantly more monthly benefits to more low-income participants (\$100 to \$262 versus \$17 to \$66) than do the parking fee programs in Portland.

UBM programs and pilots are still in the early stage of testing and evaluation. However, the UBM framework may be a promising approach to ameliorate impacts of the persistent income gap between the highest and lowest earning segments of the US population by improving access to essential services and opportunities. In addition, UBM pilots may provide an important source of revenue to fund higher-quality transit and shared mobility services in low-income communities of color.

Achieving climate change goals will require rapid electrification of personal vehicles and the imposition of pricing on personal vehicles. Unfortunately, low-income households are not well-positioned to bear the cost of

new or used EVs, or to pay a higher cost for using personal vehicles. As a result, low-income households require robust alternatives to auto ownership to avoid deepening existing inequality in transportation access. It could be possible to avoid many of the administrative burdens of implementing UBM programs described in this study by simply adding funds—perhaps from new auto-pricing policies—to existing benefit accounts that use debit cards.

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Appendix: Lessons Learned from Mobility-as-a-Service Literature and Case Studies

A UBM can be a component, complement, or precursor of a *mobility as a service* (MaaS) platform or application. For example, a researcher at the University of Chalmers [14] defined MaaS as follows:

*Mobility-as-a-Service (MaaS) is a service concept that integrates public transport with other mobility services, such as car sharing, ride sourcing, and bicycle sharing. The core idea is that intermediary digital services make it easier for users to plan, book, and **pay for** complementary mobility services, thereby facilitating less car-centric lifestyles.*



Figure 2. Stages of MaaS. The stage 4 term, "integration of societal goals," can be interpreted to be an ongoing effort, which allows the implementing agencies to adapt the systems to meet social equity or economic goals [15].

A UBM pilot or program can be implemented as a payment integration tool that acts as a precursor to a MaaS platform [15]. However, the path toward MaaS may or may not be linear as the literature suggests (Figure 2). A diverse group of UBMs have been investigated in this study and there are dozens of different MaaS applications available globally.

Commonly, MaaS begins with booking and routing synchronization (e.g., widespread use of real-time General Transit Feed Specification). Next, pilots integrate booking and payments across operators. A final step might include integrating all service offerings. However, MaaS platforms may be developed and implemented in different ways. For example, some pilots begin as *MaaS Lite*, a term coined by researchers in Hong Kong. *MaaS Lite* platforms offer some components of a MaaS but may have a limited term or occur in a limited area [16].

The literature on MaaS is extensive. A few case studies and best practices of MaaS are highlighted here. These insights might inform UBM development as a near-term opportunity or a future MaaS system.

MaaS platforms often offer several of the following payment typologies, which aim to meet the needs of different users:


- Pay-as-you-go options allow a user to pay for a single trip;
- Stored value options allow users to bank money or credits in the application for use in a single trip, or they may offer an allocated stored balance that is replenished to a given level weekly; or
- Monthly subscription options provide a stored credit value that can be used within a given month for limited or unlimited access. Within monthly packages, different use models may exist. For example, rather than a “one-size-fits-all” model, European mobility consultants suggest adding “onion” packages that offer different levels of enrollment or “pick'n'choose” packages that are priced to meet unique rider needs [17].

Mobility as a Service Examples

Several MaaS platforms are cataloged below. Both private and public service providers offer MaaS. There are some robust examples of publicly operated (Vamos, Jelbi, and Mobil-Flat) and privately operated (Whim, Transit App, and iMove) MaaS platforms. However, as mentioned above, there are other MaaS models. In addition, most private operators partner directly with agencies in different ways, making their services more of a hybrid approach.

Publicly Operated Mobility as a Service Apps


Vamos: San Joaquin County MaaS App

Location: San Joaquin County	Participants: ~300	Modes:
Operational Timeframe: 2020–current	MaaS Payment Integration (Payment Platform): Stored Value, Pay-as-you-go (Masabi)	

The Vamos app has been implemented in San Joaquin and Stanislaus Counties in the largely rural Central Valley in California. Vamos provides trip planning and payment capabilities for fixed transit lines and demand-responsive local transit services. Vamos became fully operational in 2020 and has received public funding from the California Climate Change Investments fund and other state and local funding sources for expansion and further development. The pay-as-you-go service offers users the ability to search for travel routes and receive a recommendation for a combination of walking, demand responsive transit, and fixed-route bus and rail transit, and bike routes. The app also allows free reservations with a volunteer ride service, named VOGO, when transit service is unavailable for a specific trip. Users can purchase transit tickets for fixed-route transit within the app. Users are directed through a deep link to purchase and reserve microtransit and general dial-a-ride services on separately administered apps. Vamos incorporates transit routes and ticketing for all transit agencies in San Joaquin and Stanislaus counties. Real-time transit arrival times are available on the app when a transit service


has GTFS data to support this functionality. Currently, three larger cities in the counties support this functionality. A Vamos program goal is to expand to other counties throughout the Valley. This would allow jurisdictions to share the marginal costs of ongoing operations.

Jelbi

Location: Berlin	Size: ~45,000 vehicle trip segments	Modes:
Operational Timeframe: 2019–current	MaaS Payment Integration (Payment Platform): Pay-as-you-go (Trafi)	

Jelbi is a MaaS system operated by Berlin’s primary public transport operator, Berliner Verkehrsbetriebe (BVG). The MaaS system uses the Trafi [19] base application, with a product launch period of six months, which is a faster than typical MaaS launch time period. Jelbi allows users to book public transit and shared mobility services (e.g., e-mopeds, kick scooters, bicycles, taxis, or carshares) from a single mobile app. The Jelbi app features a trip planner that calculates prices and enables sorting based on real-time traffic times and weather. Any trip found in the planner can be booked entirely in-app. Jelbi payment accepts bank accounts, debit/credit cards, or PayPal. Trafi summarized the concept behind Jelbi by sharing that “Successful MaaS starts with deep level Mobility Service Provider integrations” [18].

Mobil-Flat


Location: Augsburg, Germany	Participants: ~341	Modes:
Operational Timeframe: 2018–current	MaaS Payment Integration (Payment Platform): Monthly Subscription (Masabi)	

Mobil-Flat began operation in 2018 with a small pilot of 45 participants. It fully launched in 2019 with a monthly subscription for €79 (\$86.79). Mobil-Flat is operated by the public transit agency in Augsburg, Germany, named *Stadtwerke Augsburg* (SWA). The operator envisions providing more holistic mobility options so that residents can avoid car usage and ownership. The program includes 175 bicycles and 200 cars in the SWA carsharing fleet [17].

Mobil-Flat was the subject of a study from the University of Sydney and ETH Zurich to identify the impacts of MaaS uptake and behavioral change. This study showed that, among the 341 users that purchase monthly packages on Mobil-Flat, carsharing usage increased by up to 84%. However, the researchers questioned whether there are overall GHG benefits to including carsharing in the package because this could lead to reduced transit or micromobility usage [19].


Privately Operated Mobility as a Service Apps

Transit App

Location: Los Angeles Metro and ~60 other agencies	Participants: Unknown	Modes:
Operational Timeframe: 2019–current	MaaS Payment Integration (Payment Platform): Pay-as-you-go, Monthly Subscription (Masabi, Token Transit, Bytemark)	

Transit App already partners with Los Angeles Metro to offer a multimodal trip planner displaying transit, bike, or ridehailing options for a given route. As a trip planner, Transit App is a long-established player. The app originated in Montreal in 2011. In 2019, Masabi began to offer EZfare, which allows apps like Transit or Uber to integrate with their Application Programming Interface (API) to offer a full MaaS integration. Transit app presently offers pay-as-you-go transit service through approximately 60 operators. In addition, Masabi is working with Denver and Las Vegas to integrate fare capping and cash digitalization into their mobility ecosystem. Transit App also works with Token Transit, which operates a service similar to Masabi, facilitating payment integration for 30 agencies in North America, including Oakland-based AC Transit in the East Bay of the San Francisco Bay Area, and the big blue bus in Santa Monica [20].


Citymapper

Location: London	Participants: Unknown	Modes:
Operational Timeframe: 2019–current	MaaS Payment Integration (Payment Platform): Weekly Subscription (Travel Credit Card, Mastercard)	

Citymapper is a trip planning app with over 50 million users in over 58 cities worldwide. In 2011, it began as a for-profit business in London and launched a two-tiered subscription service with unique “passes” in 2019. The Citymapper “Pass” gives unlimited access to public transit in most of London for £34.70 per week. The Citymapper “Super Duper Pass” includes the same benefits as the regular “Pass” and adds unlimited 30-minute rides to London's Santander Cycles docked bicycle system, a £10 weekly credit for use with Gett's black cabs, FREE NOW's ride hailing, or Lime e-bikes and scooters for £40.70 per week. Citymapper plans to add additional modes and providers in the future.

The system operates through a travel credit card (Mastercard) that uses contactless payments either through the card or smartphone wallet apps (Apple or Google Pay). For black cab, ride hailing, e-bike, and scooter options, payments are processed using the card through the companies' respective apps.


Whim

Location: Helsinki, and others	Participants: ~70,000	Modes:
Operational Timeframe: 2015–current	MaaS Payment Integration (Payment Platform): Pay-as-you-go, Monthly Subscription (Transdev)	

Whim began operating in 2015 as a for-profit business based in Helsinki, Finland. Now, they also operate in Turku, Finland; Vienna, Austria; Belgium; Switzerland; West Midland, UK; and Japan's Greater Tokyo area. Whim is operated in a partnership with Transdev, a service provider that operates fixed-route transit and on-demand service throughout the US. Whim now offers a €62 (~US\$73) monthly subscription in Helsinki and the same monthly ticket for only €34 for students (~US\$37). These monthly memberships offer free and discounted purchasing power for participating mobility providers. For example, monthly passes grant participants transit passes for buses, trains, the Metro, trams and the ferry, as well as a free monthly bikeshare ride, a free day of co-working space access, unlimited taxi rides with a 35% discount, and discounted daily car rental rates through three participating car rental vendors [21].

These offerings appear to be scaled down considerably compared with pre-pandemic offerings. In 2019 a monthly pass for €499 (\$USD543) would grant participants unlimited public transport rides, unlimited taxi trips of 5 kilometers or less, unlimited rental car use, and free 30-minute bikeshare trips. This more comprehensive service had various impacts (coined as “whimpacts” in a 2019 report from Danish researchers), including aiding in the first last mile. Public transit was the backbone of Whim, and 68% of users rode transit. Bikes were commonly used with public transit, 12% of riders used bikes in the 30 minutes prior to a trip, and 30% in the 90 minutes after a public transit trip. Whim riders also took over twice as many taxis as the typical Helsinki resident [22].

iMove MaaS Trial (Tripi)

Location: Sydney	Participants: ~100	Modes (Future Planned):
Operational Timeframe: 2019–2021	MaaS Payment Integration (Payment Platform): Pay-as-you-go, Monthly Subscription (Tripi, SkedGo, Opal)	

The iMove MaaS operated a service for employees of Insurance Australia Group (IAG). The pilot concluded in 2021 and was evaluated based on a research partnership with the University of Sydney. It included a pre-pilot phase in 2019 to assess the travel market. The pilot paused in 2020 due to the pandemic. For payment integration, a proprietary “Opal Card” was issued by the employer, AIG. To address the integration of

ridehailing, the company added participants as “members” of a central Uber business account, allowing for centralized billing for all trips.

Key findings from the study are: (1) car drivers made up 82% users, showing that MaaS can be attractive to those with access to vehicles; (2) only 17% of trial participants after the trial would consider carsharing; (3) participants report that monetary incentives were the main driver of participation; (4) users value having single point of access to a breadth of mobility providers; and (5) “Relationship building and trust between mobility providers, customers, digital platform developer and provider, the broker, and regulators is possibly the most challenging part of the MaaS delivery program” [23].

