

Equity Considerations



I. INTRODUCTION

This memo represents a first step in assessing how mobility hubs can best serve disadvantaged communities in San Diego and Imperial counties. Some of the equity-related benefits, challenges, and best practices associated with different mobility hub features are identified. These findings are then used to recommend features that could benefit disadvantaged populations at 11 mobility hub design prototypes around San Diego County.

The analysis of equity is complex because it requires consideration of a variety of disadvantaged populations with different needs, which can sometimes conflict. For example, walking and bicycling are among the most affordable ways to get around, and are well-suited for short trips. At the same time, walking and bicycling may be challenging for seniors with limited mobility. In addition, many mobility hub features such as bikeshare, drop-off spots for on-demand ridesharing, and real-time travel information are relatively new in practice. Consequently, there is limited information on the impacts of these features on social equity. However, there is a growing body of research, which includes real-world examples, that can clearly guide planners toward establishing mobility hubs that promote social equity.

In the past, the San Diego Association of Governments (SANDAG) analyses of social equity have examined the impact of projects on a variety of disadvantaged groups, including people living in poverty, households with limited English proficiency, unemployed people, and people with less than a high school education. The current SANDAG analysis focuses on three key disadvantaged groups, highlighted below. These groups were the focus of the equity analysis for San Diego Forward: The Regional Plan, and we use the same definitions here:

- **Low-income:** People age 16 and over earning less than \$25,000¹ per year. SANDAG has found that low incomes are correlated with unemployment, limited education, limited English proficiency, and many other indicators of disadvantage.
- **Minority:** People who are non-white, including Latinos, blacks, American Indians, Asians, and members of other or multiple races.
- **Seniors:** People age 75 and over. SANDAG stakeholders have identified 75 as an age at which seniors may become transit-dependent, but are still mobile.

¹ SANDAG has defined low-income households as households with incomes at or below 200 percent of the federal poverty level, in order to account for the high cost of living in the San Diego region. For example, \$25,000 is roughly double the 2016 federal threshold for individual poverty status, which is \$11,880. The income threshold in the American Community Survey that is closest to twice that value is used and the dollar threshold is adjusted based on the year and the number of people in a household.

II. OUR PROCESS

A. Equity impacts of mobility hub features

A literature review was used to assess the equity-related benefits, barriers, and best practices associated with different mobility hub features. The review also was used to identify which features are most appropriate for mobility hubs situated in different types of disadvantaged communities. Our work on mobility hubs considers the design and placement of specific features. However, research on equity tends to more generally focus on the impacts of different transportation modes. Consequently, we categorized mobility hub features into four modes: driving, transit, shared mobility services, and active transportation. Cost is a key factor for many disadvantaged communities, so the average cost – both upfront and per-mile – was estimated for each mode. The following three types of benefits and barriers that correspond to the three disadvantaged population groups used by SANDAG in equity analyses were then assessed:

1. Cost and payment issues that may impact low-income populations:

A number of mobility hub features require credit cards for payment in person or via smartphones to access services. Of all households in the San Diego region, 3.1 percent do not have access to a bank account and 20.6 percent have bank accounts but look outside of the financial system to meet some of their needs for payment and credit.² Meanwhile, more than one in three Americans do not have smartphones,³ and only 50 percent of households earning less than \$30,000 per year own one. In addition to examining the overall costs of each mode to determine whether it is more or less affordable than other modes, we assess barriers that people with limited access to banks and technology face, and best practices to help people overcome these barriers.

2. Linguistic or cultural issues that may affect minorities:

Many mobility hub features convey messages on signs or online, and such information may be inaccessible to people who are not proficient in English. Some communities may view certain mobility hub features, such as those related to shared mobility services, with some skepticism because they are not culturally familiar with these services. Also, a legacy of systemic underinvestment in minority communities has resulted in a lack of some services or infrastructure in those communities. SANDAG assesses these barriers, identifies instances in which minorities can especially benefit from certain features, and discusses best practices in overcoming linguistic and cultural barriers.

² 2015 FDIC National Survey of Unbanked and Underbanked Households, *Banking Status for San Diego-Carlsbad, CA Households*, Federal Deposit Insurance Corporation, 2015, https://www.economicinclusion.gov/surveys/place-data.html?where=San_Diego_Carlsbad_San_Marcos_CA&when=2015.

2013 FDIC National Survey of Unbanked and Underbanked Households, Federal Deposit Insurance Corporation, October 2014, <https://www.fdic.gov/householdsurvey/2013report.pdf>.

³ Smith, A., "U.S. Smartphone Use in 2015," Pew Research Center, April 1, 2015, <http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/>.

3. Physical or data access issues that may impact mobility hub users:

Several mobility hub features pose potential challenges for seniors and people with disabilities, so vehicles and infrastructure should be designed to accommodate wheelchairs and other mobility aids. Some of these features, such as public transit, pedestrian paths, and other infrastructure, are required to comply with the Americans with Disabilities Act (ADA). Other features, such as most shared mobility services that are not publicly funded, are not required to comply with the ADA. People with disabilities, including seniors, can face a variety of mobility challenges. SANDAG assesses potential barriers associated with each mode of transportation, identifies benefits where modes are required to accommodate people with disabilities, and discusses best practices to ensure that people of all abilities have access. The challenges that many low-income households face accessing and paying for certain mobility hub features because they do not have smartphones also apply to seniors; only 27 percent of people older than age 65 own smartphones.⁴

4. Demographic analysis

A preliminary demographic analysis was conducted to screen for disadvantaged communities that are located near the 11 prototype mobility hub sites. The goal was to show how a social equity analysis could offer decision makers valuable information. These sites, chosen for illustrative purposes, exhibit potential for investing in mobility hubs. The purpose of this analysis is to show how SANDAG, moving forward, can identify disadvantaged populations that live near mobility hubs, as well as identifying what type of conclusions might be drawn.

The SANDAG analysis, focusing on low-income individuals, minorities, and seniors, used data from the 2014 American Community Survey (ACS) five-year estimates. The ACS estimated population characteristics for all residents, and outputs from the SANDAG regional travel model represent transit riders traveling to and from the stations around which mobility hubs will be centered. The goal was to determine if these data sources produced different results. Table 1 shows how SANDAG defines each population group, and how each definition was translated into the terms used by the ACS.

⁴ Smith, A., "U.S. Smartphone Use in 2015," Pew Research Center, April 1, 2015, <http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/>.

Table 1: Population groups considered in the equity analysis

Population group	SANDAG definition	ACS definition
Low-income	People living below two times the federal poverty level	Population age 16 and over with earnings who earned less than \$25,000* ⁵ in the past 12 months (table B20001)
Minority	People who are non-white	Population where ethnicity = Hispanic or race = Black, American Indian, Asian, Hawaiian/Pacific Islander, Other, or two or more races (tables B02001 and B03002)
Senior	People 75 and older	Population age 75 and over (2014 ACS five-year estimates, B01001)

Because mobility hubs enable people to travel to stations by different modes, we examined disadvantaged groups within different travelsheds:

1. The five-minute walkshed (about a quarter of a mile) around the station
2. The five-minute bikeshed (about three quarters of a mile) around the station
3. The five-minute driveshed (about two miles) around the station

For the eight mobility hub prototypes identified in the San Diego region, we mapped travelsheds based on network travel distances using detailed street network data from SANDAG. Street network data for Imperial County was unavailable, so “as the crow flies” buffers to map travelsheds were used. Demographic data were then joined to Census TIGER/Line shapefiles to map ACS data at the block group scale. Demographic data also were joined to shapefiles from SANDAG in order to map travel model data at the Master Geographic Area (MGRA) scale. Next, all block groups or MGRAs that were touching each travelshed were selected. Finally, total households across all block groups and in each travelshed for each population group were summed.

III. EQUITY IMPACTS OF MOBILITY HUB FEATURES

Table 2 summarizes SANDAG recommendations to emphasize or de-emphasize certain mobility hub features in areas with different types of disadvantaged communities based on the information reviewed above. These are general recommendations based on whether research suggests that different disadvantaged populations would benefit from or face barriers to using the features in question. A key is provided below the table.

⁵ The ACS provides data on people who are below the poverty line, but not people at or below 200 percent of the federal poverty level. Since the threshold for individual poverty status is \$11,880, the income cut point in the ACS that is the closest to twice that value is used.

Table 2: Summary assessment of key mobility hub features

Mobility Hub Feature	Low-Income	Minority	Senior	Sample Best Practices
Driving				
Smart parking	↓		↓	
Electric vehicle (EV) charging	↔			Provide incentives to support EV purchases; offer shared mobility services that use EVs; conduct outreach to promote charging opportunities
Park & Ride Stations	↓		↓	
Transit				
Transit signal priority	↑	↑	↑	
Real-time travel information	↑	↔	↔	Ensure that information is provided via screens at stations and in locally-spoken languages; pilot beacon technology to target information on accessible features to seniors
Enhanced waiting areas	↑	↑	↑	
Dedicated transit lanes	↑	↑	↑	
Shared mobility services				
Shuttle service	↔		↑	Provide free or low-cost shuttles; subsidize service for low-income communities
Car, electric bike, and scootershare	↔	↔	↓	Subsidize service for low-income communities; conduct targeted outreach and education in low-income and minority communities; offer assistance for people without smartphones or bank accounts
Neighborhood electric vehicles (NEVs)	↔	↔	↑	Subsidize service for low-income communities; conduct targeted outreach and education in low-income and minority communities; offer assistance for people without smartphones or bank accounts
Bikeshare	↔	↔	↓	Subsidize service for low-income communities; conduct targeted outreach and education in low-income and minority communities; offer assistance for people without smartphones or bank accounts
On-demand rideshare	↔	↔	↔	Pilot projects to subsidize rides for users in low-income communities; conduct targeted outreach and education in low-income and minority communities; develop concierge services for people without smartphones; ensure that accessible vehicles and drivers trained to assist people with mobility issues are available
Active transportation				
Bike racks	↑		↓	
Bike lockers	↔		↓	Consider payment options for low-income individuals
Bike lanes/paths	↑	↑	↓	
Improved pedestrian facilities	↑	↑	↑	
Support services				
Universal transportation accounts	↔		↔	Offer assistance for people without smartphones or bank accounts
Key				
↑	This feature will likely benefit this disadvantaged population group.			
↔	This feature may benefit this disadvantaged population group if best practices are implemented.			
↓	This feature is unlikely to benefit this disadvantaged population group.			
[blank]	No applicable research found.			

A. Driving

Mobility hubs are centered on transit stations and include many features designed to enable car-free travel throughout the region. Nevertheless, driving remains an important way for people to access transit stations, particularly in suburban areas. Features such as Park & Ride stations and smart parking make it more convenient for drivers to access transit, while providing EV charging stations helps to promote the use of zero-emission vehicles.

Average costs

Purchasing a car can be expensive. The average used car costs roughly \$18,000,⁶ while a new car costs between \$15,000 and \$36,000.⁷ According to the American Automobile Association, the average cost of driving is \$0.49-\$0.74 per mile.⁸ Many EVs have higher purchase prices than their conventional vehicle equivalents, but EV buyers often can buy a vehicle at reduced cost by taking advantage of state-level incentives, federal tax credits, or special leasing arrangements offered by manufacturers. EVs also cost less to drive and maintain.

Barriers

Driving is significantly more expensive than transit or active transportation on a per-trip basis, and it can be more expensive than shared mobility services once the costs of owning a car are factored in. Twenty percent of people at or below the federal poverty line do not have access to a car, and car ownership rates are even lower for low-income minorities.⁹ Older adults may have to give up driving due to visual impairment or other physical issues. As a result, mobility hub features that focus on driving may not provide proportional benefits to disadvantaged populations. Even though the price premium for EVs is not as high as sticker prices would suggest due to incentives and leasing arrangements, the cost remains a barrier for some low-income households. Another barrier to driving for disadvantaged populations is related to smart parking, which relies significantly on the use of smartphones. Low-income people and seniors make up a disproportionate number of those who do not have smartphones or bank access. Consequently, these groups may not be able to take advantage of some smart parking features.

⁶ Sullivan, B., "Why 2016 Could Be a Great Year to Buy a Used Car," Time, March 28, 2016, <http://time.com/money/4273696/buying-a-used-car/>.

⁷ Press Release, "New-Car Transaction Prices Up 2 Percent In March 2016, Along With Increases In Incentive Spend, According To Kelley Blue Book," Kelley Blue Book, April 1, 2016, <http://mediaroom.kbb.com/new-car-transaction-prices-up-2-percent-march-2016>.

⁸ AAA Association Communication, "Your Driving Costs: How much are you really paying to drive?" (2017 Edition), American Automobile Association, <http://newsroom.aaa.com/auto/your-driving-costs/>.

⁹ DeGood, K. and Schwartz, A., "Can New Transportation Technologies Improve Equity and Access to Opportunity?" Center for American Progress, April 2016, <https://cdn.americanprogress.org/wpcontent/uploads/2016/04/20121438/TransportEquity1.pdf>.

Benefits

Driving is more expensive than other modes of transportation, but it remains such an important option that the majority of low-income households still own at least one vehicle. Transit coverage and operating hours are limited, shared mobility services are not available in all areas of the San Diego region, and active transportation alone is typically not a viable option for longer-distance trips. Consequently, a private vehicle is the only mode of transportation that can guarantee reasonable access to any destination in the region. In areas with little transit service, private vehicles also are critical for connecting low-income travelers to jobs.¹⁰ Private vehicles also can be the most convenient mode of transportation for some people with disabilities, although in other cases disabilities can prevent people from driving.

Best practices

The majority of recent best practices related to equity and driving are focused on extending the benefits of EVs to low-income communities. There are several initiatives to support EV ownership in low-income communities that could be deployed in conjunction with EV charging at mobility hubs. These include the Greenlining Institute's Equity Toolkit¹¹ and pilot programs that help low-income households purchase EVs.¹² There also are pilot efforts to offer EV access to disadvantaged communities through subsidized carshare programs. For example, the City of Los Angeles is currently running an EV carsharing pilot program focused on low-income communities.¹³ The five-year pilot program is funded by the California Air Resources Board and the City of Los Angeles.

B. Transit

By definition, mobility hubs are focused on enhancing access to transit because they integrate other modes of transportation that make it easier for riders to travel to and from stations. A number of mobility hub features are focused exclusively on improving the transit experience as opposed to making it easier for people to reach a transit stop. These features include smart intersections with traffic signals that give priority to transit vehicles, availability of real-time travel information, and more comfortable waiting areas.

¹⁰ Onésimo Sandoval, J.S., Cervero, R., and Landis, J., "The transition from welfare-to-work: How cars and human capital facilitate employment for welfare recipients," *Applied Geography* 31 (2011): 352-362, <http://www.pacific-gateway.org/the%20transition%20from%20welfare-to-work%20how%20cars%20and%20human%20capital%20facilitate%20employment%20for%20welfare%20recipients.pdf>.

¹¹ *Electric Vehicles for All: An Equity Toolkit*, The Greenlining Institute, August 3, 2016, <http://greenlining.org/publications/online-resources/2016/electric-vehicles-equity-toolkit/>.

¹² *Making the Cleanest Cars Affordable*, Air Resources Board, California Environmental Protection Agency, Revised June 23, 2015, https://www.arb.ca.gov/newsrel/efmp_plus_up.pdf.

¹³ Lee, P., "LA is bringing 100 electric carsharing vehicles to its poorest neighborhoods," *Curbed Los Angeles*, December 21, 2016, <https://la.curbed.com/2016/12/21/14046080/electric-carsharing-los-angeles-bluecalifornia>.

Average costs

Transit involves no upfront costs, and the average transit trip in the San Diego region costs between \$0.41 and 0.45 per mile.¹⁴ One-way fares for Metropolitan Transit System (MTS) bus and trolley rides are \$2.25 or \$2.50 for most routes, and \$1.10 or \$1.25 for seniors and disabled riders.

Barriers

Transit is affordable and operators have a mandate to accommodate all users, so it is an important mode of transportation for many disadvantaged groups. It can be challenging, however, to provide good transit service in suburban areas; plans for transit often focus on increasing ridership along major transportation corridors at the expense of reaching low-density, low-demand areas.¹⁵ Providing shared mobility options that help connect people to transit, such as bikeshare stations or pick-up/drop-off spaces for on-demand ridesourcing services, may better benefit disadvantaged populations in suburban areas where space is limited.

Benefits

Transit is likely the mode of transportation that people most associate with equity. Public transit is more affordable than other long-distance modes of travel, and low-income households are generally more likely to rely on transit.¹⁶ As public agencies, transit operators must provide reasonable accommodations for users of all ages and abilities. Transit vehicles and facilities also are required to be accessible to people with disabilities and to offer information in multiple languages.

Best practices

All transit features, particularly information that is given in real time, will need to address potential language barriers. This is especially important in communities with concentrated groups of people who speak a language not widely spoken throughout a service area. Transit agencies such as the Tri-County Metropolitan Transportation District of Oregon and Bay Area Rapid Transit have developed practices to meet the needs of riders with limited English proficiency (LEP). These include translating materials, using universal icons where possible, and establishing partnerships with community organizations that serve LEP populations.^{17, 18}

¹⁴ Based on full-price fares for most MTS bus and train service (\$2.25-\$2.50, <https://www.sdmts.com/fares-passes>) divided by average transit trip length (5.5 miles, <http://www.apta.com/resources/statistics/Documents/FactBook/2015-APTA-Fact-Book.pdf>). Seniors/disabled people are eligible for half-price fares on most MTS services, and some rural/express services are significantly more expensive.

¹⁵ Walker, J., *Human Transit: How Clearer Thinking about Public Transit Can Enrich Our Communities and Our Lives*, Island Press, 3rd Edition, Dec. 22, 2011, <https://www.amazon.com/Human-Transit-Clearer-Thinking-Communities/dp/1597269727>.

¹⁶ *Why Creating and Preserving Affordable Homes Near Transit is a Highly Effective Climate Protection Strategy*, Transform and California Housing Partnership Corporation, May 2014, <http://www.transformca.org/sites/default/files/CHPC%20TF%20Affordable%20TOD%20Climate%20Strategy%20BOOKLET%20FORMAT.pdf>.

¹⁷ *Environmental Justice and Transit Equity*, TriMet, October 2010, <https://trimet.org/pdfs/publications/transit-equity.pdf>.

¹⁸ Appendix F, BART's Language Assistance Services, BART Public Participation Plan, 2011, https://www.bart.gov/sites/default/files/docs/Appendices_D-G.pdf.

Transit agencies also can consider new technology to help patrons better access transit services. For example, information “beacons” are being tested by various agencies. These beacons send transit information wirelessly to users who have Bluetooth-enabled smartphones and can target notifications to patrons from disadvantaged groups. Agencies such as LA Metro,¹⁹ TriMet,²⁰ Massachusetts Bay Transportation Authority,²¹ and Santa Clara Valley Transportation Authority have partnered with various technology companies to provide turn-by-turn wayfinding instructions, real-time transit service updates at stations and stops, and other services. One could envision these beacons providing messages in various languages via phone, providing directions to wheelchair-accessible facilities at a station, and providing assistance for patrons with cognitive disabilities.²² It has been proposed that people could wear devices such as wristbands or glasses that could interact with the beacons, enabling individuals to obtain localized information without holding a smartphone.²³ However, the deployment of beacons could raise privacy concerns, especially in cases in which public agencies partner with private companies to pair information about transit with marketing.

Real-time transit information can be provided through smartphone apps and cell phones, but it also should be displayed at transit waiting areas. An ever-increasing number of people have cell phones and smartphones, but low-income transit riders are less likely to have them and as a result be disproportionately unable to access the information. The best practice for providing information equitably is to provide “real-time information through at least two dissemination media and in both audio and visual formats.”²⁴

¹⁹ Nelson, L., “Beacon technology to target Union Station visitors with help, commerce,” Los Angeles Times, Feb 3, 2015, <http://www.latimes.com/local/california/la-me-california-commute-20150203-story.html>.

²⁰ TriMet News, “TriMet to provide riders with another way to access real-time transit information,” Mar 9, 2015, <http://news.trimet.org/2015/03/trimet-to-provide-riders-with-another-way-to-access-real-time-transit-information/>.

²¹ PRNewswire, “Intersection Pilots Beacon Technology in Select MBTA Rail Stations,” Intersection, Sep 25, 2015, <http://www.prnewswire.com/news-releases/intersection-pilots-beacon-technology-in-select-mbta-rail-stations-300149057.html>.

²² Poon, L., “How a ‘Smart’ Public Transit System Can Better Serve Riders With Disabilities,” CityLab, Sep 23, 2016, <http://www.citylab.com/commute/2016/09/rewiring-public-transit-to-better-serve-riders-with-disabilities-nsf-ibeacons/501065/>.

²³ *Wearables and Beacons: Using Contextually-Aware Technology to Improve Navigation of Public Transportation Spaces for Customers with Visual, Language, and Aging Challenges*, TRB IDEA Project Proposal: “Wearables and Beacons for Public Transportation,” Control Group, Sachs Insights, Cubic Transportation Systems, New York Metropolitan Transportation Authority, 2014, <http://www.ecologyit.net/blog/wp-content/uploads/2014/05/IDEAProposal-Wearables-final.pdf>.

²⁴ Schweiger, C., *Transit Cooperative Research Program (TRCP) Synthesis 91: Use and Deployment of Mobile Device Technology for Real-Time Transit Information*, Transportation Research Board of The National Academies, 2011, <http://www.trb.org/Publications/Blurbs/166249.aspx>.

C. Shared Mobility Services

Shared mobility services involve a range of modes of transportation such as cars, scooters, and bikes. They also involve a variety of operational models, including carshare and bikeshare, which make fleets of vehicles available to users, and peer-to-peer ridesourcing, in which drivers pick up passengers on demand. These services vary widely, but they all offer the ability to conveniently request, track, and pay for trips with mobile devices. Shared mobility services are growing in popularity as smartphone technology continues to improve. However, because shared mobility services rely increasingly on mobile technology, social equity is a concern.

Average costs

The cost of shared mobility services varies by transportation mode and operational model, and a given service can offer several different payment plans. Table 3 summarizes costs for carshare, bikeshare, and ridesourcing based on services offered in the San Diego region.

Table 3: Average costs of common shared mobility services

Shared Mobility Service	Upfront cost	Cost per mile
Carshare ²⁵	\$25 – \$95/year	\$1.05 – \$1.81
Bikeshare ²⁶	\$99 – \$199/year	\$0.07 – \$1.67
Ridesourcing ²⁷	None	\$1.24 – \$1.65

Barriers

The costs of shared mobility services vary widely, but such services are generally more expensive than transit, walking, biking, or even driving a car that is already paid off. Consequently, they are more likely to be used for occasional trips than for everyday travel. For example, people most frequently use ridesourcing for social trips during nighttime hours when many public transit services are not in operation.²⁸ People who regularly use shared mobility services in conjunction with transit and other options often do save money because they do not need a car. In theory, this could benefit low-income households, but in practice this has not been the case because shared mobility services are not widely available in low-income communities.

²⁵ Based on Zipcar rates for San Diego (<http://www.zipcar.com/check-rates/sandiego>). Annual costs are \$70/year for an occasional driving plan and a \$25 application fee. Hourly costs are \$8.55-\$10.50 per hour and assume two trips per hour of between 2.9 and 4.1 miles, based on trip lengths. From Cervero R., Golub, A., and Nee, B., "San Francisco City CarShare: Longer-Term Travel-Demand and Car Ownership Impacts," <http://iurd.berkeley.edu/wp/2006-07.pdf>.

²⁶ Based on Decobike rates (<http://www.decobike.com/sandiego/pricing>). Upper-end estimate assumes one three-mile trip for a single \$5 half-hour use; lower-end assumes 500 three-mile trips over the course of a \$99 annual membership.

²⁷ Based on Uber (<https://www.uber.com/ride/>) and Lyft (<https://www.lyft.com/fare-estimate>) costs for a sample trip from San Diego to Chula Vista. Costs reflect the range of services, from standard services to more affordable pooled services such as uberPOOL and Lyft Line during normal hours. Using the luxury services offered by these companies, or taking rides during times when surge pricing is in effect, will significantly increase costs above the amounts shown here.

²⁸ *Shared Mobility and the Transformation of Public Transit*, Shared Use Mobility Center, March 2016, <https://www.apta.com/resources/reportsandpublications/Documents/APTA-Shared-Mobility.pdf>.

Studies suggest that disadvantaged communities in cities that have bikeshare programs typically have less access to them.²⁹ The same studies also have identified cases in which carshare stations are concentrated in higher-income communities.³⁰

The technology and payment requirements associated with shared mobility services also are significant barriers for low-income people and seniors. Shared mobility services often require users to make reservations and payment using a smartphone. Some carshare services – none that currently operate in San Diego – also require a user to have a smartphone to unlock a reserved vehicle. Furthermore, most shared mobility services require a credit card or bank account for payment. Shared mobility services also may face significant cultural resistance from some disadvantaged communities simply because they are unfamiliar.

Minority communities also may face several barriers to using shared mobility services. First, these services simply may not be widely available in these communities. Second, linguistic and cultural barriers may make it difficult for people in minority communities to navigate apps and instructional materials used for shared mobility services. Even in moderate- to high-income neighborhoods, minority communities have lower access to carshare or bikeshare than non-minority communities in many cities, according to a 2016 analysis by the Shared Use Mobility Center.³¹ These disparities are particularly pronounced in San Diego: only about 40 percent of low-income minority communities have access to shared mobility services, while nearly 70 percent of low-income non-minority communities have access. Meanwhile, only about 10 percent of high-income minority communities have access to shared mobility services, while nearly 50 percent of high-income non-minority communities have access.

People with physical disabilities also face barriers to using shared mobility services, chiefly because privately-owned services are unlikely to spend money to accommodate them. Carshare services, for example, do not typically provide vehicles that can be used by disabled drivers. It is true, however, that some traditional car rental companies provide some accommodations. For on-demand ridesourcing, accessibility options have been increasing but are still limited. After initially resisting meeting ADA requirements, for example, ridesourcing services such as Uber and Lyft are now improving service for deaf and blind passengers, including passengers with guide dogs. A recent article, however, reported finding few if any drivers trained to help seniors or disabled passengers, or vehicles that can accommodate wheelchairs.³² Despite these challenges, many disabled passengers can ride as passengers in conventional vehicles. The Massachusetts Bay Transportation Authority has partnered with Uber and Lyft to offer ridesourcing as an option to on-demand paratransit users.³³

²⁹ Ursaki, J. and Aultman-Hall, L., "Quantifying the Equity of Bikeshare Access in U.S. Cities," Transportation Research Board, August 1 2015, http://chi.streetsblog.org/wp-content/uploads/sites/4/2016/03/Bikeshare_TRB_submission.pdf.

³⁰ Shellooe, S., "Wheels When *Who* Wants Them: Assessing Social Equity and Access Implications of Carsharing in NYC," May 2013, http://academiccommons.columbia.edu/download/fedora_content/download/ac:161981/CONTENT/Shellooe_Final_Thesis.pdf.

³¹ *Shared-Use Mobility Toolkit for Cities*, Shared Use Mobility Center, 2016, <http://sharedusemobilitycenter.org/wp-content/uploads/2016/07/SUMC-Toolkit-Final-Report.pdf>.

³² Kelly, H., "Uber's services for the disabled lack actual cars," CNN, May 3, 2016, <http://money.cnn.com/2016/05/02/technology/uber-access/>.

³³ Lazo, L., "Uber, Lyft partner with transportation authority to offer paratransit customers service in Boston," The Washington Post, September 16, 2016, <https://www.washingtonpost.com/news/dr-gridlock/wp/2016/09/16/uber-lyft-partner-with-city-to-offer-paratransit-customers-on-demand-service-in-boston/>.

Several cities are either testing adaptive bikeshare bicycles or are already providing citizens with a small number of them, but there is no single type of adaptive bike that can accommodate the different needs of all riders. These cities also have found it challenging for shared mobility services to accommodate equipment such as wheelchairs.³⁴

Benefits

Low-income people generally use shared mobility services less than more affluent people. Some studies have suggested that shared mobility services can save people money, suggesting that low-income people have much to gain from these services if they are expanded into disadvantaged communities. This will require a concentrated effort from public agencies, however. They will need to work with providers to bring services to disadvantaged communities, conduct outreach to residents, and potentially even subsidize the cost. Some best practices are discussed below.

Best practices

There are ways to help people who do not have a bank account and therefore access to a bank card to use shared mobility services. Agencies can work with shared-mode operators to ensure that non-card-based payment options are accepted or to take more comprehensive approaches, such as developing partnerships with local banks, credit unions, or nonprofit organizations to offer people prepaid cards or other payment options that do not require credit cards. An organization in Washington, District of Columbia, for example, created an escrow account to offer debit cards to people who did not have a bank account.³⁵ Public agencies and other organizations also can cover upfront costs for low-income users. For example, the bikeshare program in Chicago, managed by the Chicago Department of Transportation, subsidizes enrollment fees for low-income people through its Divvy for Everyone program. Qualified participants can go to a designated enrollment center and pay \$5 for a one-year membership (memberships normally cost \$75 annually). Usage fees can be paid in cash at participating 7-Eleven and Family Dollar Stores.^{36, 37}

Outreach and support also can help promote shared mobility services in disadvantaged communities. In addition to online media, outreach programs should use billboards, other out-of-home advertisements, and/or fliers. These programs also should ensure that all informational materials are provided in the languages used by targeted populations. Language and cultural barriers may be best overcome by partnering with community organizations to develop outreach campaigns, or by enlisting the help of local residents.³⁸

³⁴ Editor, "Can Bikesharing Serve Disabled Riders?" Shared-Use Mobility Center, August 1, 2016, <http://sharedusemobilitycenter.org/news/can-bikesharing-serve-disabled-riders/>.

³⁵ *Philadelphia Bike Share Strategic Business Plan*, Toole Design Group, Aug. 22, 2013, <http://www.bikesharephiladelphia.org/philastudy/completebusinessplan.pdf>.

³⁶ Press Release: "Mayor Emanuel Announces Divvy Expanding Access to Popular Bike Share System through Divvy for Everyone (D4e) Program," Office of the Mayor, City of Chicago, July 7, 2015, https://www.cityofchicago.org/city/en/depts/mayor/press_room/press_releases/2015/july/mayor-emanuel-announces-divvy-expanding-access-to-popular-bike-s.html.

³⁷ Divvy for Everyone (D4E) webpage, <https://www.divvybikes.com/pricing/d4e>.

³⁸ *Philadelphia Bike Share Strategic Business Plan*, Toole Design Group, Aug. 22, 2013, <http://www.bikesharephiladelphia.org/philastudy/completebusinessplan.pdf>.

For example, the San Mateo County Transit District (SamTrans) runs a Mobility Ambassador program, which trains volunteers to help seniors and people with disabilities to plan trips.³⁹ Portland, Chicago, and other cities market shared mobility options to targeted populations.⁴⁰ Agencies also can integrate phone support for shared mobility services with their main public transit support line.⁴²

A growing number of transportation stakeholders are experimenting with extending the benefits of shared mobility services to low-income communities and other disadvantaged populations. Motivate, which operates Bay Area Bike Share, is discounting its \$88 annual membership fee for riders who are eligible for their utility's low-income assistance program. Discounted memberships cost \$5 for the first year and \$60 thereafter.⁴³ The advocacy organization TransForm, also in the Bay Area, has been conducting extensive outreach to promote shared modes of transportation in low-income and minority communities and to collect feedback on how to make these modes work more equitably.⁴⁴ This effort is funded by Motivate and a grant from People for Bikes. The City of Los Angeles recently announced a pilot program, funded by the California Air Resources Board, to bring electric carsharing to low-income communities in Central Los Angeles. The program adds new vehicles and charging stations while recruiting new users.⁴⁵ This pilot project is the first step in implementing a policy described in the Shared Mobility Action Plan for Los Angeles County. The policy calls for extending public transit's focus on equity and accessibility to shared mobility.⁴⁶ Many cities are experimenting with partnerships with ridesourcing companies, in order to fund trips that connect to transit. Among them is Centennial, Colorado, a suburb of Denver, that partnered with Lyft to offer free rides to the city's light rail station. The goal is to help the city's growing number of seniors maintain their independence.⁴⁷ Centennial also runs a Mobility Ambassador Program, which developed a resource guide and trains seniors to lead hands-on seminars about how their peers can use modern transportation tools and services.⁴⁸ Pilot projects like this one could be models for establishing mobility hubs in suburban areas in a more equitable way.

³⁹ Senior Mobility Initiative, Mobility Ambassadors webpage, SamTrans, <http://www.seniormobility.org/ambassadors.html>.

⁴⁰ SmartTrips website, Portland Bureau of Transportation, <http://www.portlandoregon.gov/transportation/43801>.

⁴¹ Greenfield, J., "Go Pilsen TDM Program Encourages Walking, Biking and Transit Use," StreetsBlog Chicago, July 7, 2014, <http://chi.streetsblog.org/2014/07/07/go-pilsen-tdm-program-encourages-walking-biking-and-transit-use/>.

⁴² Espino, J. and Truong, V., *Electric Carsharing in Underserved Communities: Considerations for Program Success*, The Greenlining Institute, January 2015, <http://greenlining.org/wp-content/uploads/2015/01/Electric-Carsharing-in-Underserved-Communities-spreads.pdf>.

⁴³ Baldassari, E., "Bay Area Bike Share to offer cash payments, reduced fares to low-income cyclists," *East Bay Times*, October 19, 2016, <http://www.eastbaytimes.com/2016/10/19/bay-area-bike-share-to-offer-cash-payments-reduced-fares-to-low-income-cyclists/>.

⁴⁴ "New shared mobility choices shouldn't leave people behind," Shared Mobility website, TransForm, <http://www.transformca.org/landing-page/shared-mobility-all>.

⁴⁵ Editor, "SUMC to Help Lead \$1.6 Million Low-Income Carsharing Pilot in LA," Shared Use Mobility Center, July 24, 2015, <http://sharedusemobilitycenter.org/news/sumc-to-help-lead-1-6-million-low-income-carsharing-pilot-in-la/>.

⁴⁶ *Los Angeles County Shared Mobility Action Plan*, Shared-Use Mobility Center, September 2016, <https://assets.documentcloud.org/documents/3107597/LA-County-Shared-Mobility-Action-Plan.pdf>.

⁴⁷ Bliss, L., "A Denver Suburb Bets Big on Free Lyft Rides to Light Rail," CityLab, August 9, 2016, <http://www.citylab.com/commute/2016/08/centennial-lyft-transit-partnership/495080/>.

⁴⁸ City of Centennial Senior Commission website: <http://www.centennialco.gov/Government/senior-commission.aspx>.

D. Active Transportation

At some point, all transit users are pedestrians, whether they are walking from their home to a station or from a parked car to a station. Many people also ride their bike to transit stations. Mobility hubs could offer many features that make it safer and more convenient to embrace active transportation to get to and from a transit stop. These features could include bike racks or lockers at stations, bike lanes, protected bikeways, or improved pedestrian facilities leading to and from stations.

Average costs

Active transportation is very affordable. Walking costs virtually nothing, and while some bikes can cost \$1,300 or more (and a lock, helmet, and other supplies can add on to the cost),⁴⁹ many good commuter bicycles are available for well under \$500. Furthermore, bikes typically cost less than ten cents per mile to maintain.⁵⁰

Barriers

The main barrier to active transportation has less to do with equity and more to do with overall utility. Bicycling and walking are best suited for short-distance trips. The average length of a trip taken by walking (other than exercise) is 0.7 miles; for a bike trip, 2.26 miles. Many residents in urban areas are within walking distance of a transit station. Biking to transit, meanwhile, may be convenient in both urban and higher-density suburban areas. Nevertheless, getting to transit stations by active transportation may not be viable for people in less dense suburban areas.

Seniors and people with disabilities often have a more limited range of travel if they are walking or biking. This means that infrastructure geared toward active transportation is less likely to be useful in communities with many seniors.

Benefits

Infrastructure supporting bike and pedestrian activity generally provides benefits for all people, including those in disadvantaged communities. Researchers have found that disadvantaged populations rely on active transportation infrastructure more than other populations, and are often forced into unsafe trips because of unsafe or nonexistent bike and pedestrian lanes and paths.⁵¹ A study by the Centers for Disease Control and Prevention found that the fatality rates for Hispanic and African-American bicyclists were 23 percent and 30 percent higher than white bicyclists respectively, and that better infrastructure could help reduce these disparities.⁵²

⁴⁹ Assumes no cost for walking and up to \$1,000 for a commuter bike plus roughly \$300 in parts and accessories. (Roth, J.D., "The Costs and Savings of Bicycle Commuting," *Forbes*, June 15, 2011, <http://www.forbes.com/sites/moneybuilder/2011/06/15/the-costs-and-savings-of-bicycle-commuting/#3d0f8c02c1da>.)

⁵⁰ Lower end assumes no cost to walk; upper end assumes \$100/year in bike maintenance over 1,000 miles of riding per year.

⁵¹ Sandt, L., Combs, T., and Cohn, J., "Pursuing Equity in Pedestrian and Bicycle Planning," Federal Highway Administration, April 2016, https://www.fhwa.dot.gov/environment/bicycle_pedestrian/resources/equity_paper/.

⁵² *The New Majority: Pedaling Towards Equity*, The League of American Bicyclists and Sierra Club, 2013, http://www.bikeleague.org/sites/default/files/equity_report.pdf.

Both walking and biking have little to no entry costs compared to other modes and help keep people healthy and more social, particularly in areas with built-in safety features and little car traffic. Improved infrastructure for pedestrians and bicyclists – including improved crossings – can help make active transportation inexpensive and safe for low-income people, disabled people, and seniors who are making short trips or connecting to other modes of transportation. A study by the League of American Bicyclists found that women and minorities are more likely to try biking if there is improved infrastructure.⁵³

Best practices

The main challenge for connecting active transportation infrastructure to mobility hubs is knowing which investments to prioritize. This is especially true in cases where bicycle and pedestrian connectivity is poor. Some agencies, such as King County Metro in Washington State,⁵⁴ have conducted detailed connectivity analyses to prioritize active transportation projects near transit stations. While King County's analyses did not factor in equity populations, it would be feasible to consider them to give more weight to improvements that connect to low-income or minority neighborhoods.

One mobility feature, bike storage, may raise equity concerns if there are high usage costs or if payment requires going online or having a bank account.

IV. EQUITY IMPLEMENTATION PLAN

Our demographic analysis communicates which disadvantaged populations live near mobility hub prototype locations and what modes they are likely to use to travel to public transit. Our impact analysis identifies mobility hub features and best practices that will best promote equity. Table 4 considers both analyses in order to recommend key mobility hub features and best practices for equitable implementation at the design prototype sites. These recommendations provide guidance on what features to include at mobility hubs in different place-types – i.e., which features could most equitably serve a given population.

In addition to the location-specific strategies shown in Table 4, this review reveals several general best practices to implement mobility hubs that consider social equity:

- Partner with community-based organizations to conduct outreach on mobility hubs in disadvantaged communities, gather information about multimodal travel patterns and needs, and educate residents about different transportation services and opportunities.
- Establish regional policies to ensure the equitable provision of bicycle and pedestrian networks, shared mobility services, and other transportation modes that connect to mobility hubs.
- Prioritize pedestrian facilities and transit amenities at all mobility hub locations. These are affordable modes of transportation that low-income people, minorities, and seniors rely on.

⁵³ *The New Majority: Pedaling Towards Equity*, The League of American Bicyclists and Sierra Club, 2013, http://www.bikeleague.org/sites/default/files/equity_report.pdf.

⁵⁴ *Non-Motorized Connectivity Study*, Prepared for King County Metro and Sound Transit by Fehr & Peers, September 2014, <http://metro.kingcounty.gov/programs-projects/nmcs/>.

Table 4: Key equity features and best practices for potential mobility hubs

Mobility hub prototype sites	Disadvantaged communities near the prototypes (and likely travel modes)	Key mobility hub features to promote equity	Implementation best practices
Barrio Logan	Low-income (bike and walk)	<ul style="list-style-type: none"> • Bike racks and lockers • Improved bike lanes/paths • Improved pedestrian facilities • Bikeshare • Enhanced transit waiting areas 	<ul style="list-style-type: none"> • Subsidize bikeshare service for low-income communities • Create payment options for people without smartphones/bank accounts • Conduct outreach and education to promote bikeshare in low-income communities
Brawley	Minority (walk, bike, drive) Senior (walk, bike, drive)	<ul style="list-style-type: none"> • Transit signal priority • Real-time travel information • Enhanced transit waiting areas • Shuttle service 	<ul style="list-style-type: none"> • Ensure that transit information is available in locally-spoken languages • Pilot beacon technology to target information on accessible features to seniors
City Heights/ State Route 15	Low-income (walk, bike) Minority (walk, bike)	<ul style="list-style-type: none"> • Transit signal priority • Dedicated transit lanes • Bike racks and lockers • Improved bike lanes/paths • Improved pedestrian facilities • Bikeshare • Shuttle service • On-demand rideshare • Enhanced transit waiting areas 	<ul style="list-style-type: none"> • Pilot projects to subsidize bikeshare and rideshare services for low-income communities • Pilot payment options for people without smartphones/bank accounts • Conduct targeted outreach and education to promote bikeshare and rideshare in minority communities • Provide free or subsidized shuttles or on-demand rideshare services for low-income communities
Grossmont	Senior (bike, drive)	<ul style="list-style-type: none"> • Enhanced transit waiting areas • Shuttle service • On-demand rideshare 	<ul style="list-style-type: none"> • Pilot concierge services for people without smartphones
Imperial Valley College	Minority (walk, bike, drive)	<ul style="list-style-type: none"> • Transit signal priority • Real-time travel information • Enhanced transit waiting areas • Bike lanes/paths • Improved pedestrian facilities 	<ul style="list-style-type: none"> • Provide transit information in locally-spoken languages
National City/ 8th Street	Low-income (bike, drive) Minority (drive)	<ul style="list-style-type: none"> • Enhanced transit waiting areas • Bikeshare • Shuttle service • Car/scooter/NEV share • On-demand rideshare • Bike racks and lockers • Improved bike lanes/paths 	<ul style="list-style-type: none"> • Subsidize shared mobility services for low-income communities • Pilot payment options for people without smartphones/bank accounts • Conduct targeted outreach and education to promote bikeshare and rideshare in low-income and minority communities • Provide free or low-cost shuttles

Mobility hub prototype sites	Disadvantaged communities near the prototypes (and likely travel modes)	Key mobility hub features to promote equity	Implementation best practices
Oceanside Transit Center	Low-income (drive)	<ul style="list-style-type: none"> • Shuttle service • Car/scooter/NEV share • On-demand rideshare • Enhanced transit waiting areas 	<ul style="list-style-type: none"> • Subsidize sharing services for low-income communities • Pilot payment options for people without smartphones/bank accounts • Conduct outreach and education to promote bikeshare and rideshare in minority communities • Provide free or low-cost shuttles
Otay Ranch	Minority (walk, bike, drive)	<ul style="list-style-type: none"> • Transit signal priority • Real-time travel information • Enhanced transit waiting areas • Bike lanes/paths • Improved pedestrian facilities • NEVs⁵⁵ 	<ul style="list-style-type: none"> • Provide transit information in locally-spoken languages • Provide infrastructure that accommodates NEVs as a lower-speed travel solution for seniors completing short trips
Sorrento	None		
Vista Transit Center	Low-income (walk) Minority (walk)	<ul style="list-style-type: none"> • Transit signal priority • Real-time travel information • Enhanced transit waiting areas • Improved pedestrian facilities 	<ul style="list-style-type: none"> • Provide transit information in locally-spoken languages

⁵⁵ Otay Ranch does not have a high concentration of seniors according to the thresholds that we are using for illustrative purposes, but the fact that it is a newer development that has also incorporated a NEV network into its general development plan makes it an opportune site for piloting NEVs to help seniors and other residents looking to complete short trips in other mobility hub locations.