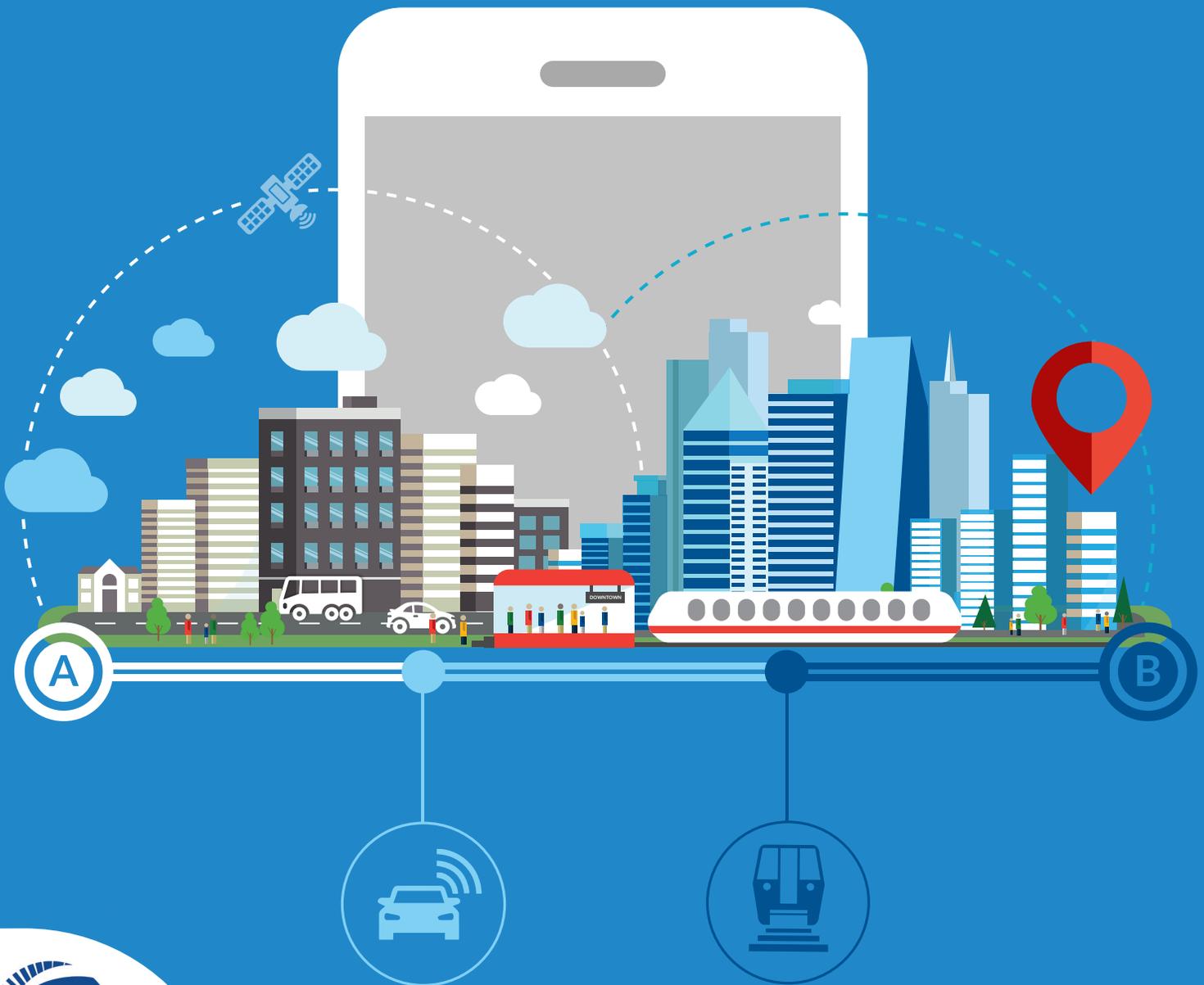


SHARED MOBILITY AND THE TRANSFORMATION OF PUBLIC TRANSIT



RESEARCH ANALYSIS
MARCH 2016

TCRP J-11/TASK 21

SHARED MOBILITY AND THE TRANSFORMATION OF PUBLIC TRANSIT

RESEARCH ANALYSIS

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SUBMITTED TO:

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Transportation Research Board
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Disclaimer

The opinions and conclusions expressed or implied are those of the research agency that performed the research and are not necessarily those of the Transportation Research Board or its sponsoring agencies. This report has not been reviewed or accepted by the Transportation Research Board Executive Committee or the Governing Board of the National Research Council.

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EXECUTIVE SUMMARY

Technology is transforming transportation. The ability to conveniently request, track, and pay for trips via mobile devices is changing the way people get around and interact with cities. This report examines the relationship of public transportation to shared modes, including bikesharing, carsharing, and ridesourcing services provided by companies such as Uber and Lyft. The research included participation by seven cities: Austin, Boston, Chicago, Los Angeles, San Francisco, Seattle and Washington, DC.

Some have predicted that, by creating a robust network of mobility options, these new modes will help reduce car ownership and increase use of public transit, which will continue to function as the backbone of an integrated, multimodal transportation system.

The objective of this research analysis, which is distilled from a larger forthcoming study on the same topic, is to examine these issues and explore opportunities and challenges for public transportation as they relate to technology-enabled mobility services, including suggesting ways that public transit can learn from, build upon, and interface with these new modes.

To accomplish this task, the study draws from several sources, including in-depth interviews with transportation officials, a survey of shared mobility users, and analysis of transit and ridesourcing capacity and demand. Together, these elements provide a snapshot of a rapidly widening mobility ecosystem at an early moment in its evolution.

KEY FINDINGS

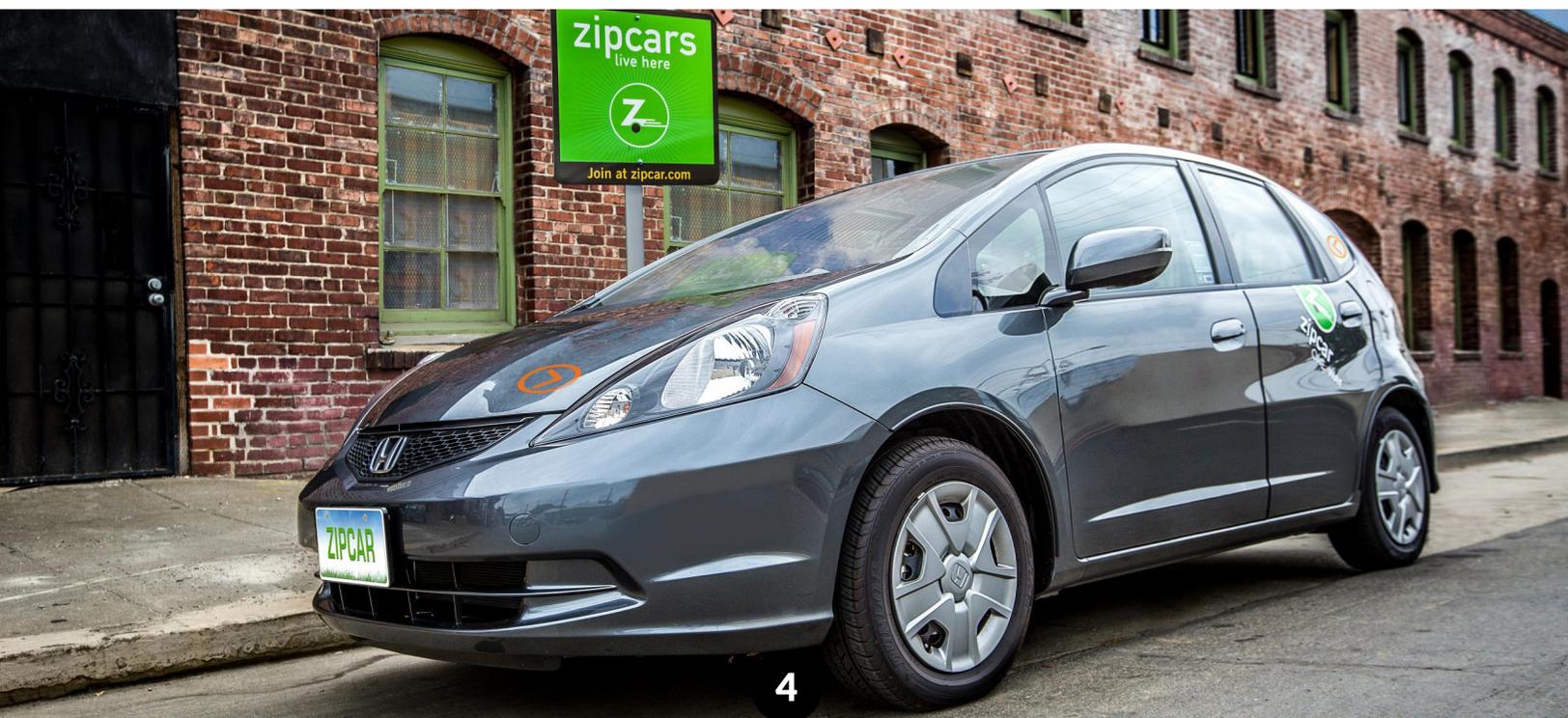
- 1. The more people use shared modes, the more likely they are to use public transit, own fewer cars, and spend less on transportation overall.** “Supersharers”—people who routinely use several shared modes, such as bikesharing, carsharing (e.g. car2go or Zipcar), and ridesourcing (e.g. Lyft or Uber)—save the most money and own half as many

household cars as people who use public transit alone.

- 2. Shared modes complement public transit, enhancing urban mobility.** Ridesourcing services are most frequently used for social trips between 10pm and 4am, times when public transit runs infrequently or is not available. Shared modes substitute more for automobile trips than public transit trips.
- 3. Shared modes will continue to grow in significance, and public entities should identify opportunities to engage with them to ensure that benefits are widely and equitably shared.** Public transit agencies should seize opportunities to improve urban mobility for all users through collaboration and public-private partnerships, including greater integration of service, information and payment methods.
- 4. The public sector and private operators are eager to collaborate to improve paratransit service using emerging approaches and technology.** While a number of regulatory and institutional hurdles complicate partnerships in this area, technology and business models from the shared mobility industry can help drive down costs, increase service availability and improve rider experience.

RECOMMENDATIONS

This report concludes by presenting recommended actions that public entities—public transit agencies, transportation departments, and other local and regional agencies—can take to promote useful cooperation between public and private mobility providers. It also suggests regulatory enhancements, institutional realignments, and forms of public-private engagement that would allow innovation to flourish while still providing mobility as safely, broadly, and equitably as possible.





KEY FINDING 1

THE MORE PEOPLE USE SHARED MODES, THE MORE LIKELY THEY ARE TO USE PUBLIC TRANSIT, OWN FEWER CARS, AND SPEND LESS ON TRANSPORTATION OVERALL.

“Supersharers”—people who routinely use several shared modes, such as bikesharing, carsharing, and ridesourcing—save the most money and own half as many cars as people who use public transit alone.

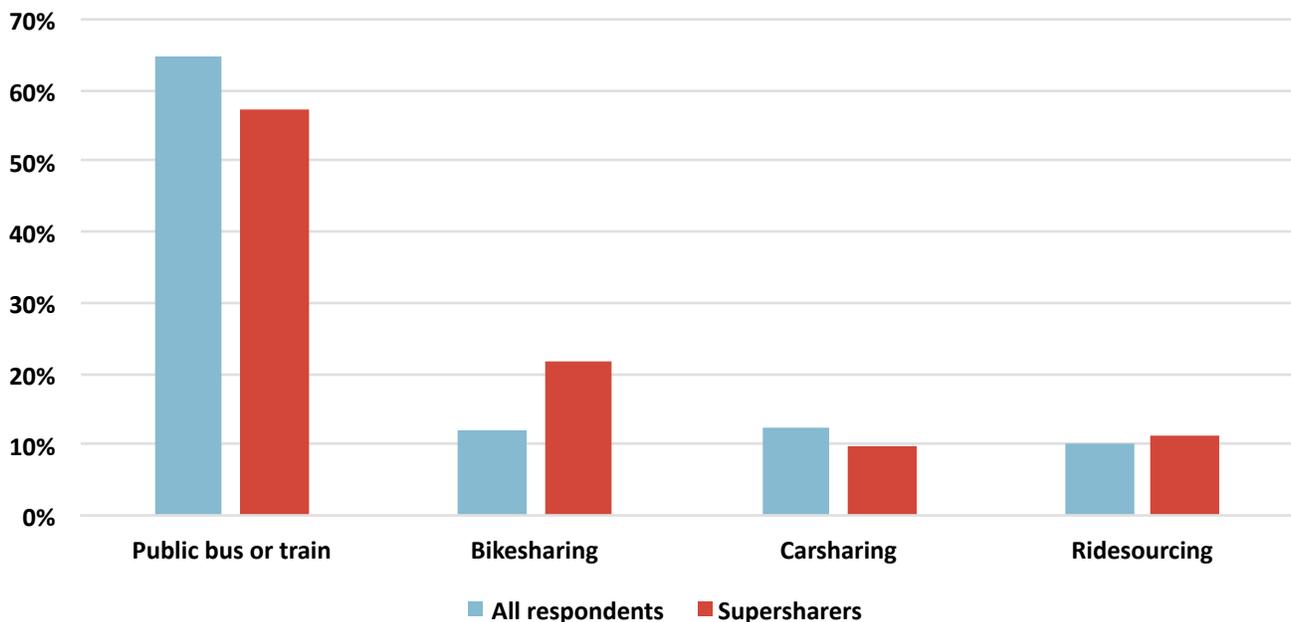
A survey of more than 4,500 shared mobility users in the seven study cities showed that rail and bus transit were the most commonly used shared modes, followed by bikesharing, carsharing, and ridesourcing (Figure 1).

Nearly 10 percent of respondents could be classified as “supersharers”—people who said they had used some combination of the non-transit shared modes (bikesharing, carsharing, or ridesourcing) across all three trip types (commutes, errands, and recreation) within the last three months.

PUBLIC TRANSIT IS BY FAR THE TOP SHARED MODE FOR ALL SHARED MOBILITY USERS, INCLUDING SUPERSHARERS

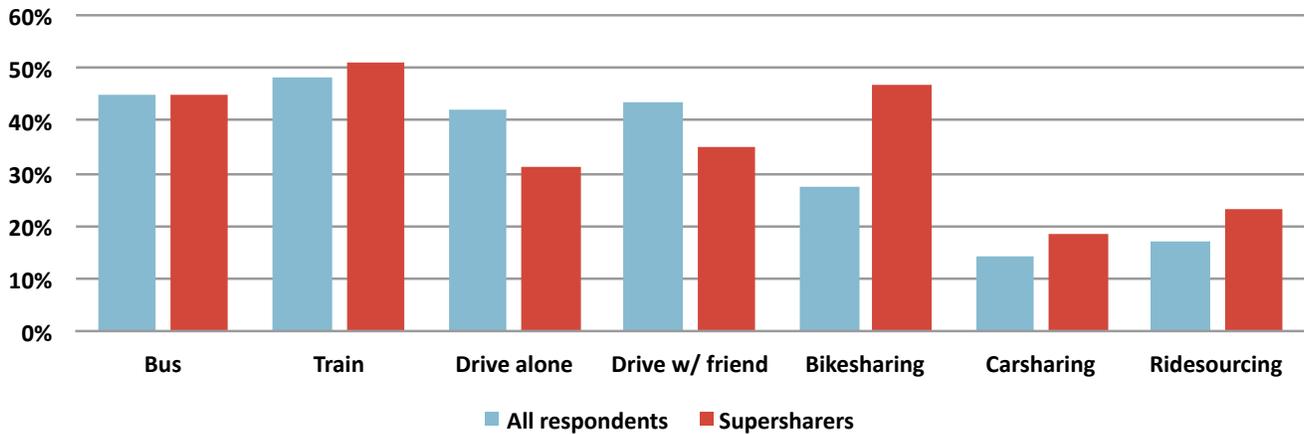
Approximately 57 percent of supersharers said public bus or train was the single shared mode they use most often, followed by bikesharing, ridesourcing, and carsharing (Figure 1). Supersharers also reported driving alone or with family or friends about 10 percent less than other respondents, and they use all of the other shared-use modes with more frequency (Figure 2).

Figure 1:
Single shared mode used most often—supersharers v. all respondents¹



¹ Q4: “Which shared-use service do you use most often?” Crosstabbed on Q9: “In the past 3 months, which of the following forms of transportation have you used for each type of trip?”

Figure 2:
Frequent use (once or more per week) by mode—supersharers v. all respondents²

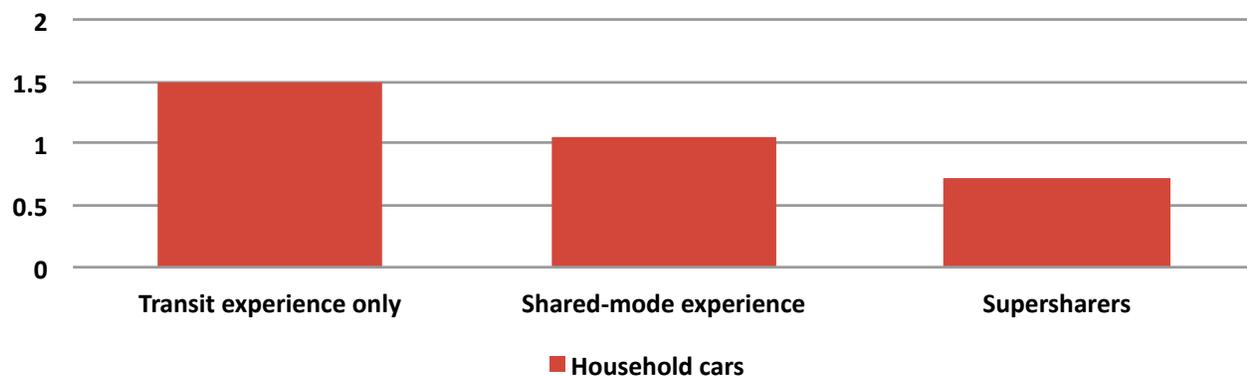


PEOPLE WHO USE PUBLIC TRANSIT AND OTHER SHARED MODES DRIVE LESS, WALK MORE, AND SAVE ON TRANSPORTATION COSTS

People who take greater advantage of shared modes report lower household vehicle ownership and decreased spending on transportation.

Compared to people who haven't used any shared modes beyond public transit, respondents who are experienced with new forms of shared mobility own nearly half a car less—1.5 versus 1.05 cars per household (Figure 3). Vehicle ownership is even lower among supersharers, who own only 0.72 cars per household.

Figure 3:
Household vehicle ownership, by shared-mode experience³

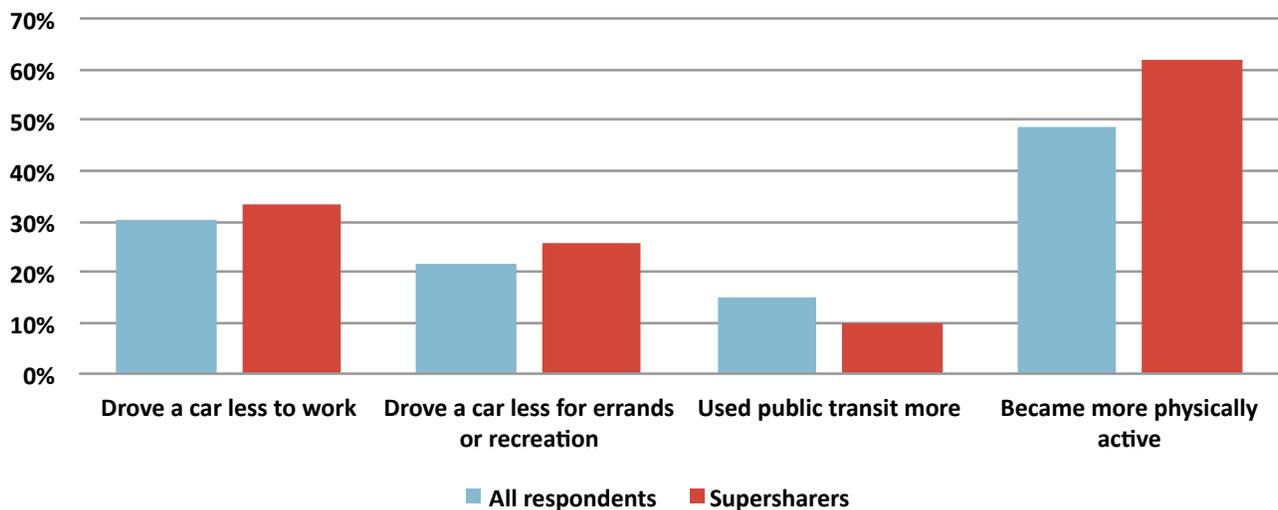


² Q7: "How often do you travel in each of these ways?" Crosstabbed on Q9: "In the past 3 months, which of the following forms of transportation have you used for each type of trip?"



Lifestyle changes that occur once people begin to use shared-use modes are notable across both groups: 30 percent of general shared mobility users and 34 percent of supersharers drove a car to work less often; 22 percent and 26 percent, respectively, drove less for errands and recreation; and 15 percent and 10 percent said they used public transit more (Figure 4, all percentages net). Almost half of all respondents and nearly two-thirds of supersharers also say they're more physically active since they began using shared mobility options.

Figure 4:
Lifestyle changes since starting to use shared modes (net change)
 —supersharers v. all respondents⁴

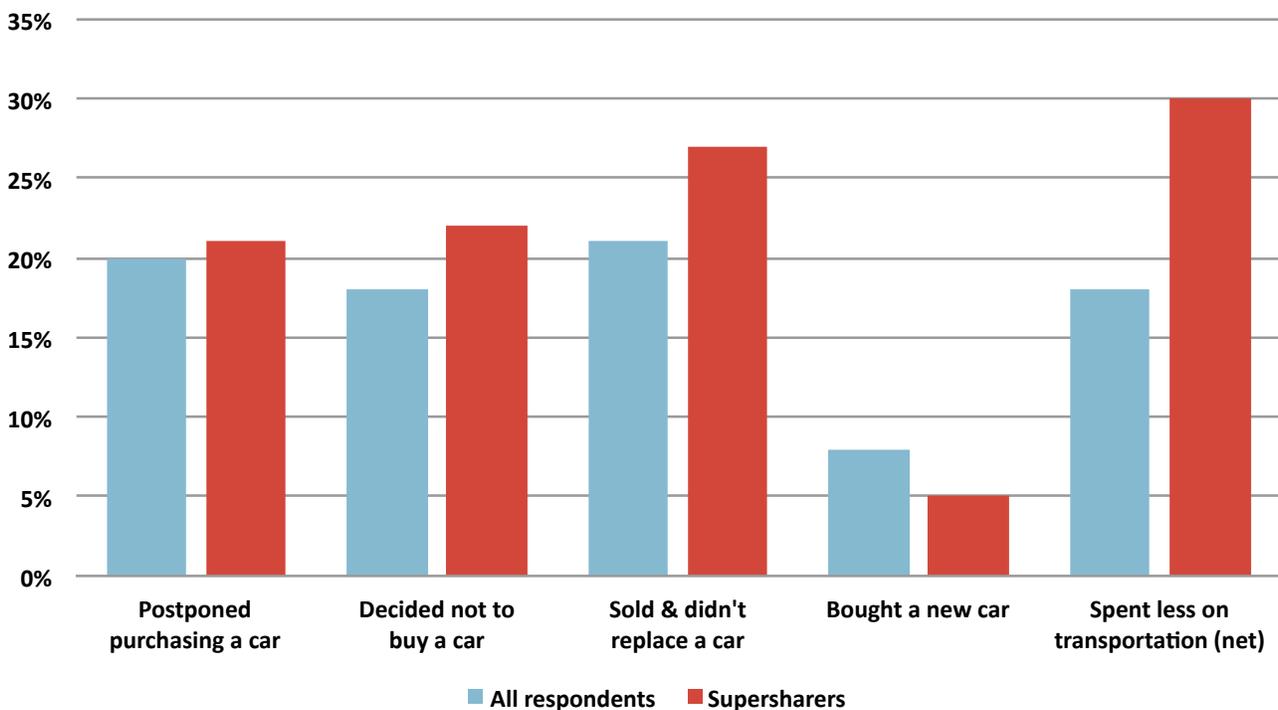


³ Q19: “How many cars does your household own or lease?” Crosstabbed on Q1: “Have you ever used a shared form of transportation like bike-sharing, car-sharing, or a ridesharing service like Uber or Lyft?” and Q9: “In the past 3 months, which of the following forms of transportation have you used for each type of trip?”

⁴ Q10: “Have you made or noticed any of these changes in your transportation habits since you started using shared forms of transportation?” Crosstabbed on Q9: “In the past 3 months, which of the following forms of transportation have you used for each type of trip?”

When asked about changes to their household and finances since starting to use shared modes, 20 percent of respondents reported they had postponed buying a car, 18 percent had decided not to purchase one, 21 percent sold one and didn't replace it, and 18 percent (net) spent less on transportation overall (Figure 5). Among supersharers, 21 percent postponed buying a car, 22 percent had decided not to buy, 27 percent had sold a car and didn't replace it, and 30 percent (net) spent less on transportation. While the savings were significant for shared mobility users in all these cases, the supersharers reaped the greatest benefits.

Figure 5:
Household and financial changes since starting to use shared modes—
supersharers v. all respondents⁵



⁵ Q11: "Have you or your household made any of these financial changes since you started using shared forms of transportation?" Crosstabbed on Q9: "In the past 3 months, which of the following forms of transportation have you used for each type of trip?"



KEY FINDING 2

SHARED MODES COMPLEMENT PUBLIC TRANSIT, ENHANCING URBAN MOBILITY.

Ridesourcing services (e.g., Lyft and Uber) are most frequently used for social trips between 10 pm and 4 am, times when public transit runs infrequently or is unavailable. Shared modes substitute more for automobile trips than public transit trips.

The research conducted for this study suggests that, instead of competing for the same riders, public transit and ridesourcing complement one another by serving different trip types. Public transit agencies tend to view new forms of shared mobility as largely complementary. Representatives of cities with robust public transit systems interviewed for the study had the least concern about the impact of these new modes on public transit services, and were often already engaged with bikesharing and carsharing. Public transit agencies with more dispersed ridership or a higher proportion of difficult-to-serve riders were interested in possibilities for new complementary mobility options and service models.

RIDESOURCING IS MOST COMMONLY USED FOR RECREATION AND SOCIAL TRIPS

Survey responses suggested that ridesourcing is a common part of the mobility menu for many people. However, it is used far more for socializing than for other kinds of trips. More than half of respondents (54 percent) indicated that they had used ridesourcing for a recreational or social trip within the last three months (Figure 6). Only 21 percent said they had used it to commute, and 16 percent reported using it for shopping or errands. In fact, for recreational and social trips, ridesourcing was the single top shared-use mode.

RIDESOURCING IS MOST COMMONLY USED LATE AT NIGHT, ESPECIALLY ON WEEKENDS, WHEN TRANSIT IS LEAST AVAILABLE

Asked about the hours of the day and times of week that they most commonly use various modes (Figure 7), survey respondents cited ridesourcing as the least frequent choice during the morning rush, evening rush, and mid-day, as well as weekdays overall. However, in the evening and late at night, ridesourcing was by far the top choice.

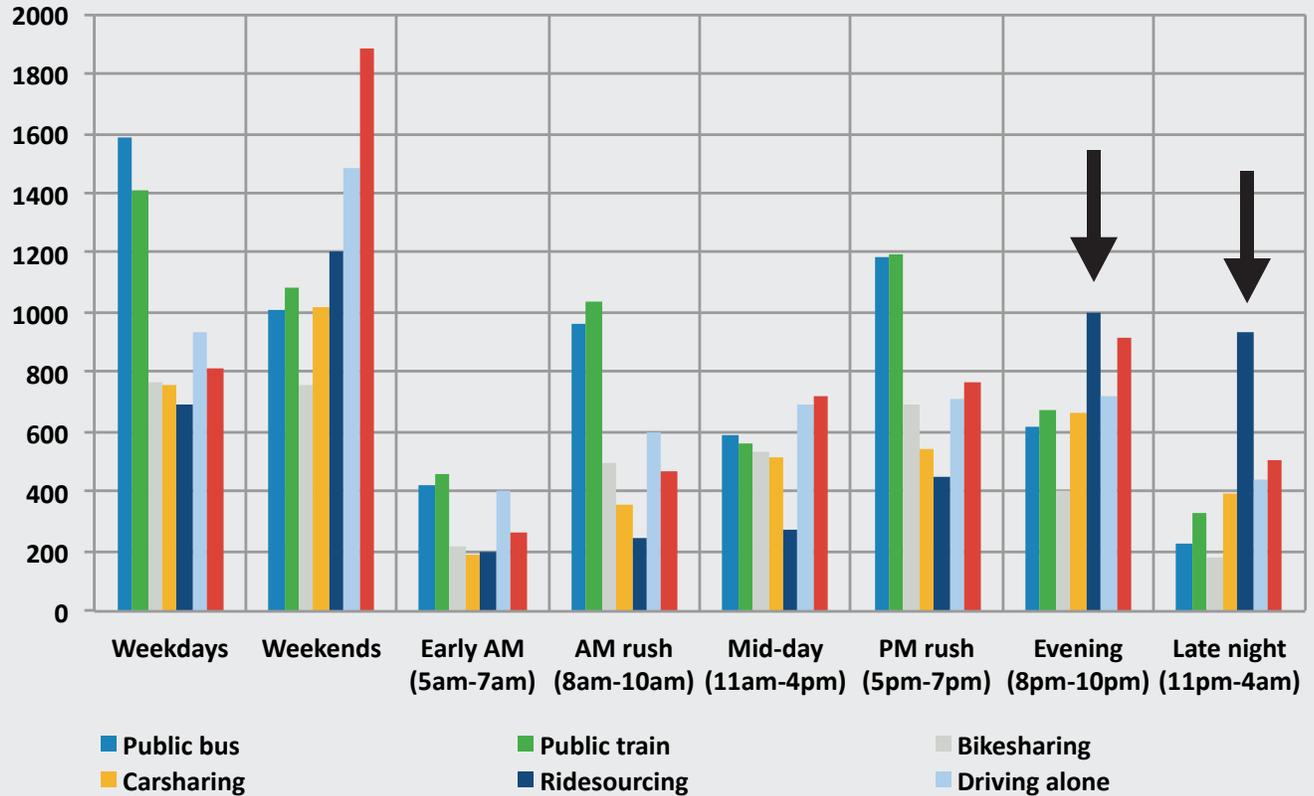
Figure 6:
Recent use of ridesourcing, by trip purpose⁶



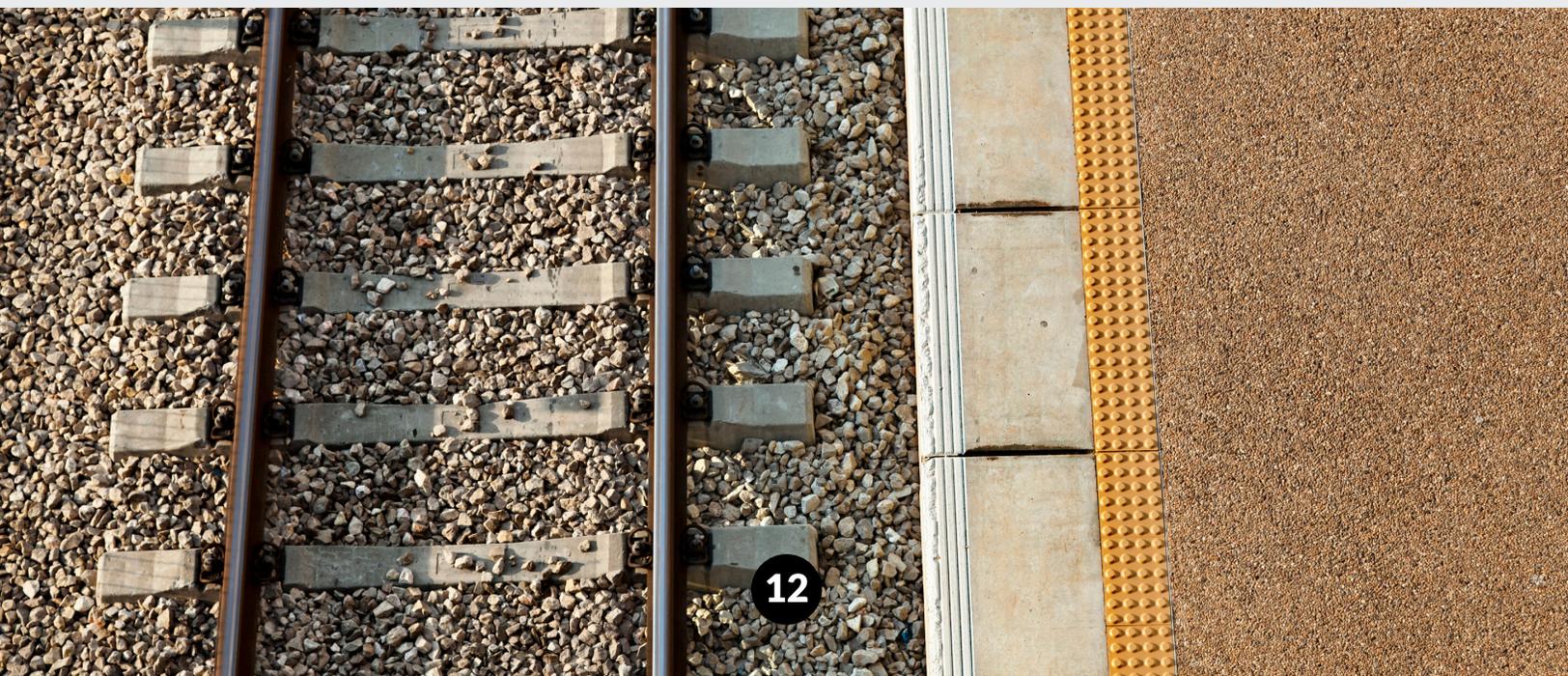
⁶ Q9: "In the past 3 months, which of the following forms of transportation have you used for each type of trip?"

Figure 7:

Mode preference by time of day and week. Ridesourcing is the most frequent choice in the Evening and Late Night periods, while it is the least frequent choice at all other times of day and on weekends. ⁷



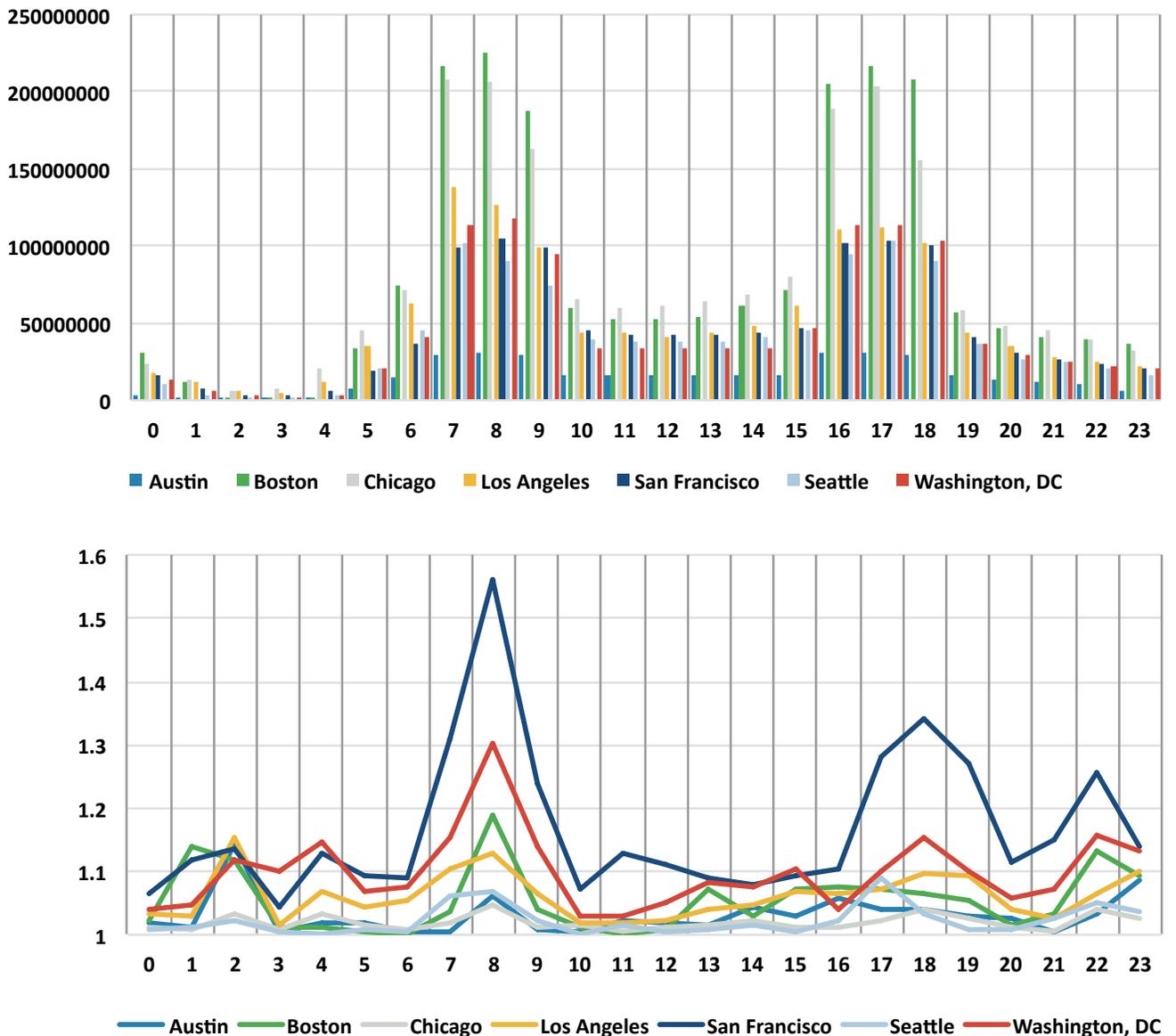
⁷ Q14: "At what hours of the day and week do you generally use each form of transportation?"

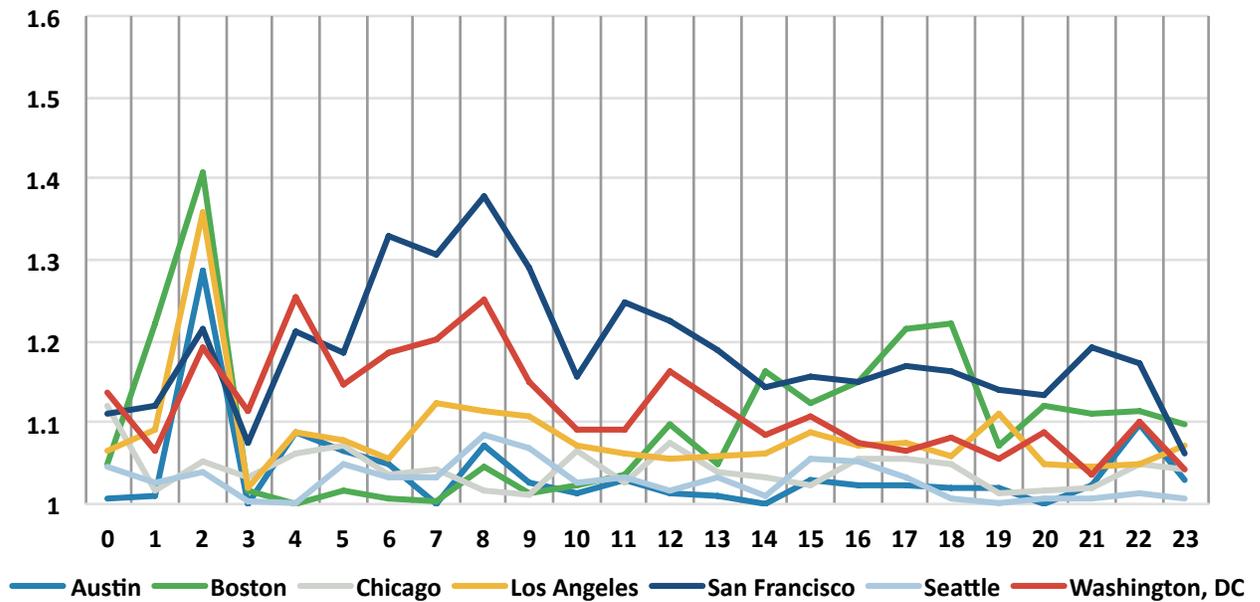
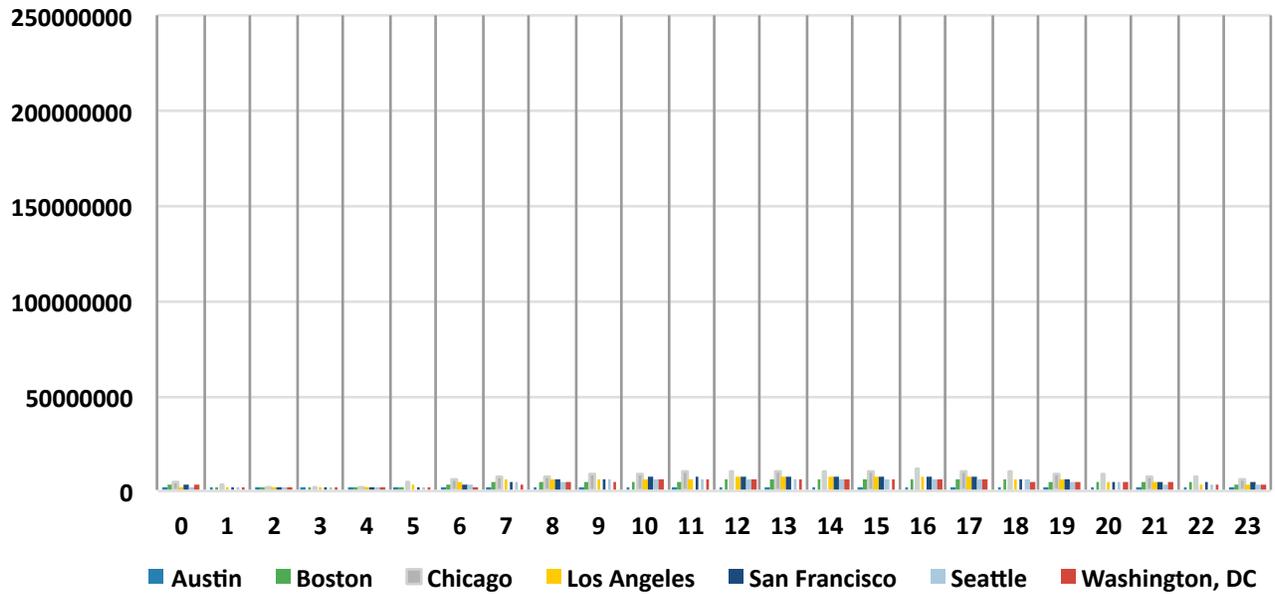


The survey’s findings were bolstered by an analysis of ridesourcing demand throughout the week and around the clock (Figure 8). In every study city, a clear peak in ridesourcing demand is visible between 10pm and 4am on weekends, and in the majority of cities this is the time of greatest demand overall. It is also the time of the day and week when scheduled public transit capacity is at its lowest point and average headways are longest.

Figure 8:

Scheduled public transit capacity (top graph of each set) and average ridesourcing demand (bottom graph of each set) by hour, for weekdays (first set) and weekends (second set). The x-axis corresponds to the local hour in a 24-hour day, and the y-axis shows the relevant metrics aggregated across the core county of each study region. Units for transit capacity are seat stops per hour, units for ridesourcing demand are mean surge multiplier.





PEOPLE TURN TO RIDESOURCING WHEN THEY'RE DRINKING

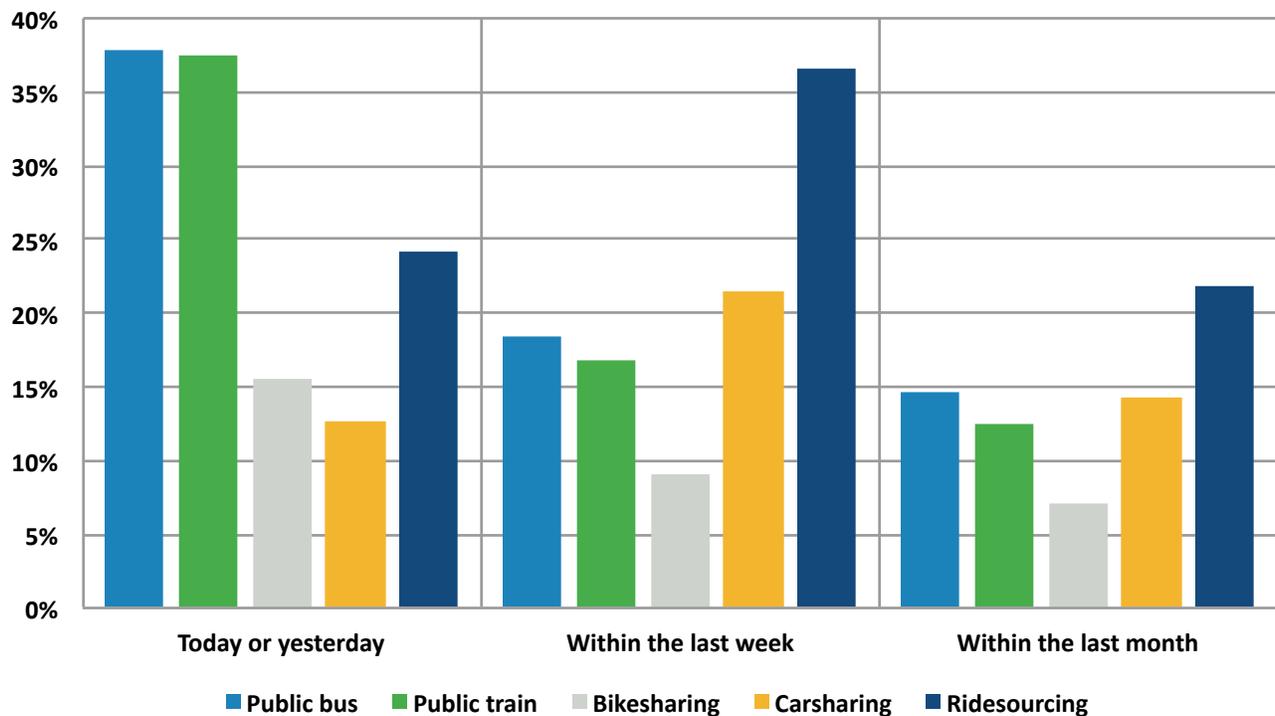
The survey had no questions specifically about alcohol use, but it did inquire into factors influencing transportation choices, allowing for open-ended answers. **Unprompted, more than 100 respondents volunteered that alcohol consumption was a major consideration in their mode choice for recreational trips, and a number named ridesourcing or a specific ridesourcing provider as their preferred choice in that case.** It is likely that if alcohol use had been among the explicit answer choices, the number would have been higher.

RELATIVELY FEW PEOPLE USE RIDESOURCING TO COMMUTE—AND THOSE WHO DO, DO SO OCCASIONALLY

Some people do use ridesourcing to get to and from work at least some of the time. Figure 8, which shows clear demand peaks during weekday rush hours, reflects this. However, it is not a major part of the mobility picture for most commuters who responded to the survey.

Among the 21 percent of respondents who did report using ridesourcing to commute (broken out in Figure 9), 38 percent said that their most recent ride on a bus or a train was today or yesterday, while about one-quarter of the group (or about 5 percent of total respondents) said they last used ridesourcing today or yesterday. The proportion declines to 18 percent for transit for trips within the last week, while increasing to 37 percent for ridesourcing. Together, this suggests that people use ridesourcing situationally, and not daily—as a mode that fills in gaps or works under specific circumstances rather than as the core of their commute. This is similarly reflected in the frequency of use: even among respondents who report ridesourcing as their top shared mode, only 7 percent say they use ridesourcing daily, while 43 percent say they use it 1-3 times per month.

Figure 9:
Most recent use of each mode—respondents reporting ridesourcing commute⁸



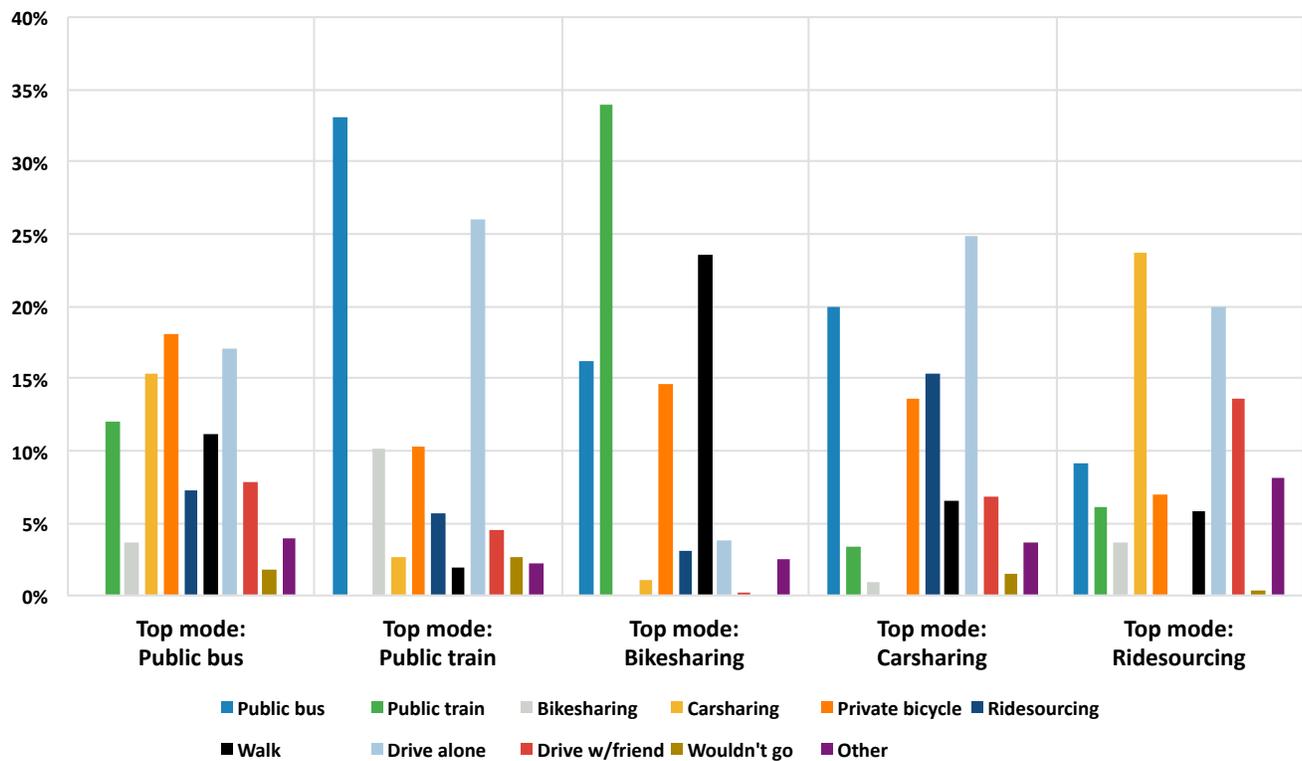
⁸ Q3: “When was the LAST time you used each form of transportation? (Please choose the most recent period when you used each type.)” Crosstabbed on Q9: “In the past 3 months, which of the following forms of transportation have you used for each type of trip?”

RIDESOURCING APPEARS MORE LIKELY TO SUBSTITUTE FOR AUTOMOBILE TRIPS THAN PUBLIC TRANSIT

In listing alternatives if their preferred mode was not available, survey respondents clustered into two groups: those with active, transit-centered lifestyles, and those with automobile-centered ones (Figure 10). Those who prefer ridesourcing tended to be more automobile-centered, with 34 percent reporting they would drive alone or with a friend if ridesourcing wasn't available, 24 percent saying they'd use carsharing, and only 14 percent saying they'd ride a bus or train instead. Some 8 percent of ridesourcing users selected the "other" option, and all but one of these open-ended responses mentioned using taxicabs.

This supports information gleaned through interviews with local transportation officials who are tracking the increase in ridesourcing trips: those who use ridesourcing are largely not substituting for public transit trips, but rather for private auto trips or taxi rides. Moreover, these users are more likely to have access to a personal car, and the availability of ridesourcing gives them a way to leave that car at home more often.

Figure 10:
Alternative for most frequent shared-mode trip if that service was not available—by top shared mode⁹



⁹ Q5: "Thinking about the service you selected in the prior question, how would you make your most frequent trip if that service was not available?" Crosstabbed on Q4: "Which shared-use service do you use most often?"



KEY FINDING 3

SHARED MODES WILL CONTINUE TO GROW IN SIGNIFICANCE, AND PUBLIC ENTITIES SHOULD IDENTIFY OPPORTUNITIES TO ENGAGE WITH THEM TO ENSURE THAT BENEFITS ARE WIDELY AND EQUITABLY SHARED.

Public transit agencies should seize opportunities to improve urban mobility for all users through collaboration and public-private partnerships, including greater integration of service, information and payment methods.

Everyone can benefit from a transportation system that provides more mobility options through seamless transfers, integrated fare payment methods, and improved information. However, such a system is only possible if public sector entities make a concerted effort to ensure that collaboration with private mobility providers results in services that work for people of all ages, incomes and mobility needs.

POTENTIAL FOR PARTNERSHIPS AND COLLABORATION

As the shared mobility industry continues to grow and evolve, many public sector representatives said in interviews they look forward to increased collaboration with the private sector. For instance:

- A number of transportation agencies are already partnering with new shared mobility providers; the earliest collaborations were with carsharing and bikesharing providers but partnerships increasingly include ridesourcing companies (although these types of partnerships are still in their infancy).
- Regulation of ridesourcing providers remains a contentious process. At the same time, public transit agencies recognize ridesourcing as part of the new urban fabric and an opportunity to extend and expand the use of public transit, such as through increased first/last mile connections.
- Public transit agencies are happy to let private providers lead in developing customer-facing technologies, and are widely committed to providing the open data that helps make this possible.

In reconciling collaborative opportunities with their mandates to serve the public, transit agencies and other public entities should recognize their role as conveners and gatekeepers to the public way. The same institutional heft that makes public transit agencies attractive partners for the private sector also allows them to set the terms of agreement to ensure all users have equitable access to information resources, streamlined payment options, and improved, integrated mobility services.

KEEPING TECH-ENABLED SERVICE INNOVATIONS FAIR AND ACCESSIBLE

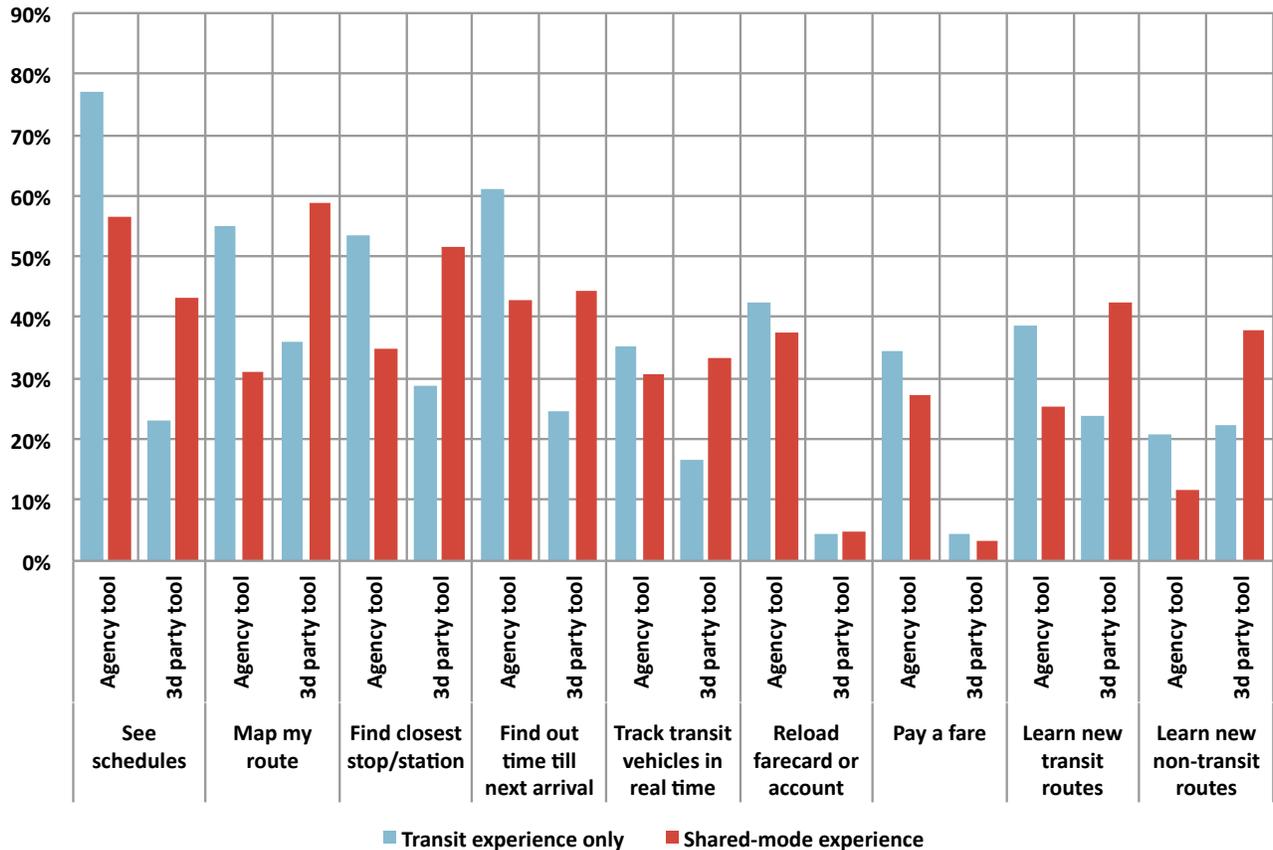
Because it's a precondition to using many shared mobility services, access to information technology has been proffered as a barrier to widespread adoption of new shared modes, especially among persons with lower incomes and those who are less comfortable using new technology.

The study found that—while there are some differences among the particular tools that various groups of respondents prefer for accessing information about public transit and other mobility options—transit information technologies are widely used across income and

experience levels. (These findings must be approached with the knowledge that the survey was administered online, so it is biased to an unknown degree toward users with some level of familiarity with the Internet.)

Comparing respondents who have only public transit experience to those who have used new shared modes (Figure 11) it is apparent that both groups are broadly similar in their familiarity with public transit-related information technologies. The most notable difference is in the provider of the tools—the transit-only group was much more likely to use transit-agency provided applications or websites, as opposed to the third-party tools preferred by respondents who have used other shared modes.

Figure 11:
Experience with transit apps and information services, by shared-use mode experience¹⁰

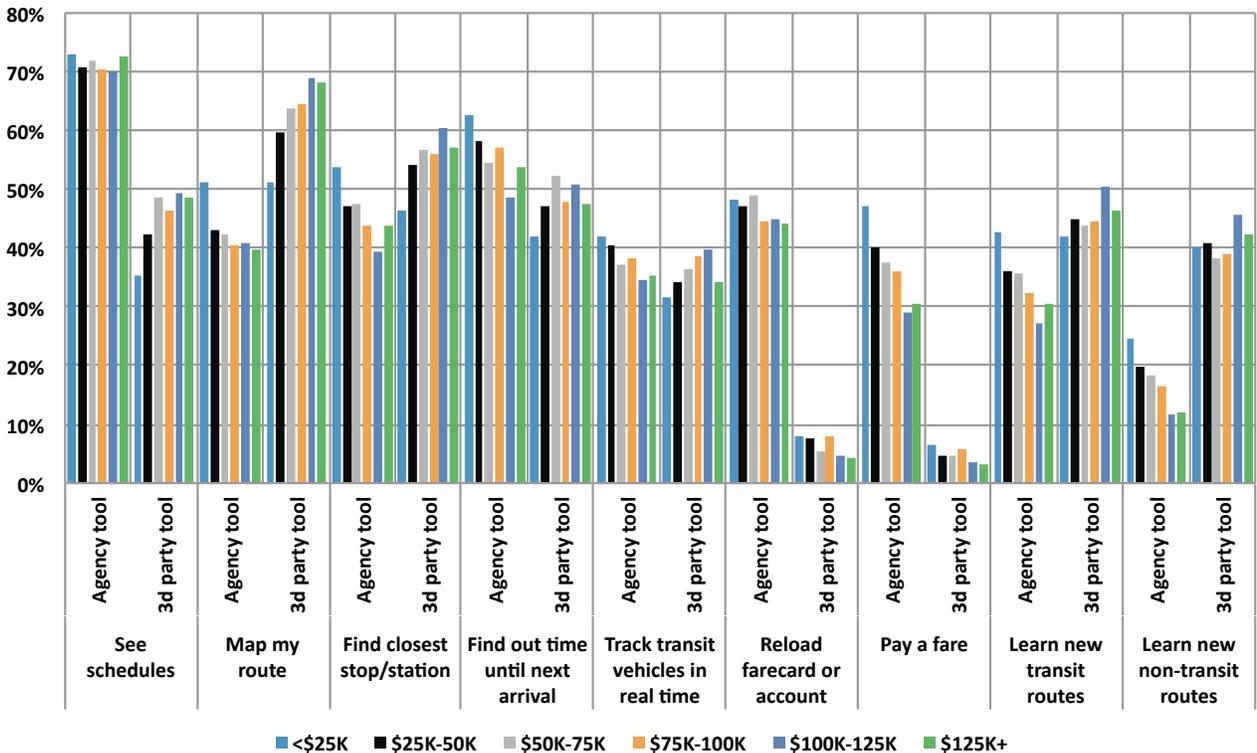


¹⁰ Q15: “Many websites or apps show information about public transit schedules and operations? Which of the following activities have you performed for trips in the metro area where you live?” Crosstabbed on Q1: “Have you ever used a shared form of transportation like bike-sharing, car-sharing, or a ride-sharing service like Uber or Lyft?”

Looking at differences across income levels (Figure 12), the survey showed little difference in overall access. There were nearly uniform levels of experience (around 70 percent) across income groups when it came to using public transit agency-provided apps or websites to view schedules, while use of third-party tools increased with income.

Even among the lowest income group, however, around half of respondents had used third-party informational apps, compared with around 70 percent among the highest-use groups. The difference in adoption rates of transit agency-provided tools vs. third-party tools points to the ongoing value of customer-facing technologies in which public transit agencies have invested, especially for users who might not have the latest hardware.

Figure 12:
Experience with transit apps and information services, by income level¹¹



Since many shared-use services involve using a proprietary app, it follows that use of third-party tools would grow with shared-mode usage in general. Taken together, these findings suggest that increasing access to shared-use mobility has the potential to improve the transportation picture for people with the fewest options—improving connections to public transit and access to the region as a whole. Lack of information may be a barrier, but lack of access to technology seems to be less of one.

¹¹ Q15: “Many websites or apps show information about public transit schedules and operations? Which of the following activities have you performed for trips in the metro area where you live?” Crosstabbed on Q22: “What was your total household income last year?”

EQUITY IMPLICATIONS OF FARE AND SERVICE INTEGRATION

Transit agencies across the country are working to migrate to new electronic fare payment systems. The integration of fare payment and service information is central to innovations in public transit, the emerging mobility models, and the trend toward app-based payment in general. Even if this involves no change to the actual fare structure, many public transit agencies will need to assess the impact of these changes on minority and low-income riders as part of their obligations under Title VI of the Civil Rights Act of 1964.

Based on the lessons of Title VI equity analyses performed during recent fare media transitions by the Chicago Transit Authority and Portland's TriMet, public transit agencies will need to maintain the ability for unbanked customers to purchase fares using cash or other means that do not require a bank account or credit card. Moreover, public transit agencies will need to assess whether proposed changes unduly burden disadvantaged communities in several other areas, including:

- New non-fare fee structures
- Fare loading levels
- Changes to the mix of retail outlets for fares and fare media, including purchase by mail
- Access for persons with limited English proficiency
- Registration requirements

Because they have lower Title VI reporting requirements, demand responsive services have more flexibility to change and experiment with new fare structures. As a result, this is an area where many innovations are likely to be initially located. The flipside of this flexibility is that reservations and fare payment for demand responsive service that is adjacent to a fixed route transit system (such as a microtransit or ridesourcing provider feeding a larger fixed-route system) might have to remain on a separate payment and reservation platform pending the main system's Title VI-compliant adoption of fare changes. So, while this flexibility can help encourage innovative new models in the demand responsive space (for fare payment, customer interaction, or actual delivery of mobility services), full fare integration will always be subject to Title VI obligations as it scales to the system level.

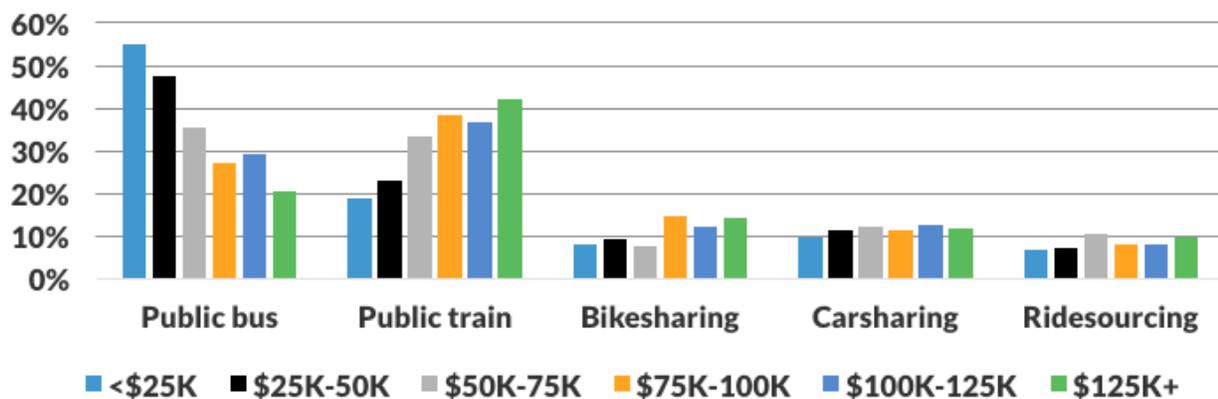


EXPANDING MOBILITY OPTIONS ACROSS THE INCOME SPECTRUM

PUBLIC TRANSIT IS THE MODE OF CHOICE FOR EVERY INCOME LEVEL

While the survey found differences in how households access the transportation system depending on their income, everybody had one thing in common: public transit is by far the top shared-use mode at every income level (Figure 13). The lowest income riders are most likely to take the bus, while riders are increasingly likely to use the train as income level rises. Among non-transit shared modes, carsharing is evenly popular across income levels, while bikesharing becomes more popular at higher household income levels.

Figure 13:
Top shared-use mode, by income level¹⁴



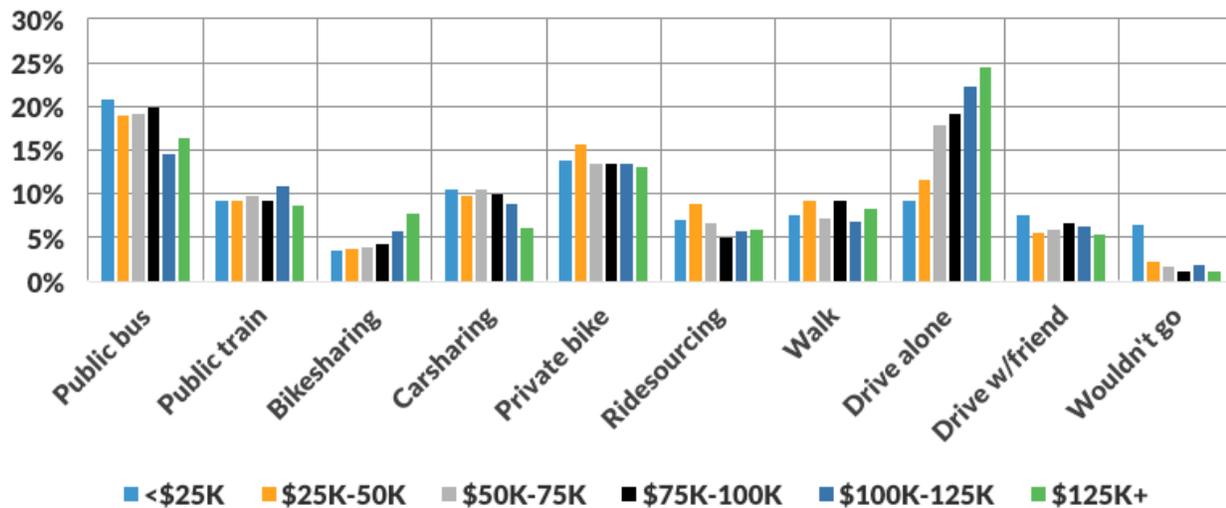
¹⁴ Q4: "Which shared-use service do you use most often?" Crosstabbed on Q22: "What was your total household income last year?"

LOWER-INCOME HOUSEHOLDS HAVE MUCH TO GAIN FROM WIDER AVAILABILITY OF SHARED-USE MODES

Shared-use modes expand options for lower income households. The option to drive rises with income, and at three times the rate of every other cohort, the lowest-income group reports that if their top mode was not available, they simply wouldn't go (Figure 14).

Among non-transit shared-use modes, carsharing was the top alternative mode for low- to moderate-income residents, with its use decreasing at higher incomes. Ridesourcing showed a similar trend line. This underscores the role these two modes play in helping people access destinations more easily reachable by car, while avoiding the costs of full-time car ownership.

Figure 14:
Alternative if top shared mode not available, by income level¹⁵



¹⁵ Q5: "Thinking about the service you selected in the prior question, how would you make your most frequent trip if that service was not available?" Crosstabbed on Q22: "What was your total household income last year?"





KEY FINDING 4

THE PUBLIC SECTOR AND PRIVATE MOBILITY OPERATORS ARE EAGER TO COLLABORATE TO IMPROVE PARATRANSIT SERVICE USING EMERGING APPROACHES AND TECHNOLOGY.

While a number of regulatory and institutional hurdles complicate partnerships in this area, technology and business models from the shared mobility industry can help drive down costs, increase service availability, and improve rider experience.

Paratransit and other community transportation services—which often take the form of subsidized door-to-door trips in wheelchair-accessible shuttles and taxis—play a vital role in serving older adults and persons whose disabilities prevent them from readily accessing traditional public transit. These services are highly regulated and expensive to operate, and both demand and costs are rising steeply. A recent FTA study found that between 1999 and 2012, the annual number of ADA paratransit trips increased from 68 million to 106 million, while the average cost increased from \$14 to \$33 per trip (a cost increase of 138 percent, compared with an increase in the unit cost of fixed-route bus service of 82 percent over that same period).¹⁶

Representatives from both public transit agencies and private operators interviewed for this study expressed a strong interest in finding ways to harness emerging shared-use models and technology to improve mobility, lower costs, and improve the rider experience associated with paratransit service. Slowing the growth of costs could have a major impact on public transit agencies' operational costs.

The technologies and business models of the new shared-use modes will likely find applicability to paratransit in two main ways:

First, individual technologies developed for new shared mobility services can be folded into existing paratransit operations as part of the ongoing technical evolution of the sector. Some applicable methods and technologies include:

- Interactive reservation, confirmation, schedule adjustment and cancellation systems;
- Dynamic dispatch and routing of vehicles;
- Route combination for riders with similar origins/destinations;
- App-based payment integrated into reservation systems;
- Ability to track vehicle arrival and share trip details, location, and estimated arrival time with caregivers or other third-parties; and
- Real-time customer feedback.

The second, and perhaps more revolutionary, application would be the direct provision of transportation services to persons with disabilities by new ridesourcing or microtransit providers. While this might seem like an extension of traditional taxi subsidies or dial-a-ride forms of demand response transportation, fundamental differences in the underlying business models make this more complicated—while offering the possibility for greater positive change if certain questions can be resolved.

¹⁶ FTA Report No. 0081: Accessible Transit Services for All (2014), p. 13

¹⁷ TCRP Report 121: Toolkit for Integrating Non-Dedicated Vehicles in Paratransit Service (2007), pp. 7-8

¹⁸ Final rule at 49 CFR 655 (2013). Testing is required for organizations funded under Secs. 5307, 5309, and 5311, the major public transportation funding programs. Section 5310 organizations (which provide services specifically for the elderly and people with disabilities) are exempt from the testing requirements only if they do not provide any services for an agency funded under the other programs.

COMPLEXITIES OF DIRECT PARATRANSIT PROVISION BY RIDESOURCING COMPANIES

Much of the complexity regarding the role of current ridesourcing business models as they relate to public transportation springs from the nature of drivers' relationships with the ridesourcing companies (i.e., whether they are employees or independent contractors), which is currently being litigated in several jurisdictions. As long as drivers are considered independent contractors who can be provided with incentives, but cannot be subject to employment conditions, several hurdles make it difficult for ridesourcing companies to begin providing contracted paratransit services using federal monies. Those include:

- FTA-required drug and alcohol testing, which applies to any party contracted to provide transportation services for a public transit agency.¹⁷ Testing is required for operators, dispatchers, and maintenance personnel for transit agencies or contractors receiving FTA funding, including taxi companies in a contractor (rather than vendor/ voucher) relationship.¹⁸
- Liability and occupational safety relating to transfers and loading/unloading of non-ambulatory riders. There is potential for injury for both drivers and passengers if drivers are not properly trained to help people with impaired mobility to load, unload and secure their wheelchairs.
- Requirements for accepting accessible rides and for accommodating wheelchairs or service animals. Ridesourcing companies have had inconsistent results in this area.



- Heightened vehicle safety and inspection requirements and insurance costs associated with ADA provision and the transportation of fragile individuals. This goes beyond already fraught questions about the applicability of non-commercial insurance in ridesourcing provision.

Even if the employment question is resolved, other considerations remain if ridesourcing or microtransit companies move into direct paratransit provision, such as:

- Fleet-level accessibility requirements. Unlike fixed-route transit fleets, which must be 100 percent accessible, demand-responsive transit service can be delivered with a fleet that is a mix of accessibility levels, as long as the level of access provided to riders with disabilities is equivalent to the level of service it provides to riders without disabilities.¹⁹
- Buy America provisions. Most federally funded rolling stock procurements above \$100,000 are subject to the requirement that vehicles and components be substantially manufactured and assembled in the United States. While there is some flexibility in the application of these requirements and waivers are available, the auditing requirements can add significantly to the unit cost of the kinds of smaller vehicles used for paratransit or other demand-responsive services.²⁰

The clearest way to address the first set of questions in the immediate term is for existing paratransit providers to license portions of these new ridesourcing technologies and deploy them using employees who are trained to work with riders who have with disabilities. In the long term, public agencies can perhaps reform or create new classes of regulation for emerging models to encourage greater innovation from the private sector to help improve paratransit provision.

PUBLIC TRANSIT AGENCIES CAN BUILD ON THE INNOVATIONS OF SHARED-USE MODES FOR PARATRANSIT

A close reading of the regulations and a survey of the policies and practices of paratransit systems across the country indicate that there are a number of applications for emerging shared-use models and associated technologies in serving ADA rides. These include:

Bringing reservation systems into the 21st century

The paratransit sector is ripe for change in the area of reservations. For instance, the FTA found in 2014 that fewer than 15 percent of paratransit systems used voice-interactive or web-based applications for reservations, with electronic fare collection similarly slow

¹⁹ 49 CFR 37.77(b)

²⁰ National Cooperative Highway Research Program Research Results Digest 319: “Buy America Issues Associated with Procurement of Paratransit Vehicles Using FTA Funds” (2007)

²¹ FTA Report No. 0081 (2014), p. 8

to be taken up.²¹ Telephone reservations will always need to remain available for reasons of accessibility, but considerable staff costs could be saved by the wider use of electronic customer interfaces. A number of public transit agencies, including Capital Metro in Austin, have opened app- or web-based reservation systems for customers who are able to use those options, while also preserving their live telephone reservation systems.

Use of “concierge services”

In several cities, shared mobility providers are piloting services that act as a human front-end to an electronic service interface for customers who want to access these services but either don’t have a smartphone or can’t use the default interface. Since it ultimately delivers the request to a ridesourcing provider, this is at present outside the realm of paratransit. But paratransit providers who move to dynamic reservation systems could use this option. Together with automated scheduling and rapid improvements in routing software (which are being quickly taken up by paratransit agencies), this could reduce reservation staff requirements.

Provision of same-day paratransit rides

Paratransit provision is governed by rules requiring advance reservation periods. These requirements generally end the calendar day before a ride, resulting in a customer experience marked by inflexibility and foreclosing the possibility of spontaneous choices. However, FTA guidelines rules do not actually prohibit same-day service. Instead, it would be considered “premium service” and not governed by the usual rules regarding complementary paratransit, including restrictions on service areas, fares, and permissibility of limiting riders based on purpose. A number of paratransit agencies are already providing such services to ADA-eligible passengers.



Make greater use of feeder paratransit

Feeder paratransit service (rides to and from transit, rather than door-to-door service) is fairly rare now, likely because of expense and the additional trip time caused by transfers. More efficient linkages arising from the kinds of opportunities described above could make it a more useful format, and make more efficient use of existing transit infrastructure.

PRIVATE SECTOR PROVIDERS CAN IMPROVE AND INNOVATE ADA SERVICES

At present, new technology-enabled services for passengers with disabilities might not necessarily be provided within a strictly paratransit context, but they could still serve many of the same customers and do so with greater flexibility and better customer service.

Niche services

Service models are beginning to emerge that recognize the different needs of passengers with disabilities, and the higher standards required of the drivers who work with them. Services like SilverRide (which is focused on older adults who can no longer drive, or prefer not to) hire and train drivers to accommodate the specific needs of their customers, including training in first aid, safe lifting and transfers, and improved communication. Companies like Shuddle and HopSkipDrive (which are essentially ridesourcing for children, with extra training and outside certification of drivers) provide examples of how the shared mobility industry is creating new models to accommodate populations with specific needs and vulnerabilities. They are doing so in an area that could be bolstered by improved federal guidance. However, the role of such services in relation to formal paratransit provision with federal funds involved is still evolving.

Incentives to drivers for taking accessible rides and using accessible vehicles

Many of the most innovative features of new shared-use modes, and ridesourcing in particular, are based on the idea of using incentives to produce desired outcomes. To better serve riders with disabilities, companies could provide a way to request drivers willing to accommodate specific needs, and offer incentives for drivers to provide the needed services. Such a system would work best if there are clear regulations that encourage companies to provide universally accessible service.

Make accessible interfaces standard

Riders might not necessarily want to use paratransit, but in many places it is the only option for people who can't drive themselves. By making sure that accessible interfaces are available (i.e. interfaces that can easily be used with a screen-reader, and don't require dropping a pin or dragging a map), shared mobility providers could make their services useful for a wider range of customers.



RECOMMENDATIONS

RECOMMENDATIONS TO PUBLIC TRANSIT AGENCIES FOR BUILDING ON INNOVATION AND COLLABORATING WITH SHARED MODES

This research points to actions that public transit agencies (and other public-sector entities) can take to build on the mobility innovations of technology-enabled shared use modes. It identifies opportunities for cooperation and also suggests regulatory enhancements, institutional realignments, and forms of public-private engagement that would allow innovation to flourish, while still providing mobility as safely, broadly, and equitably as possible.

MAKE MOBILITY THE GOAL AND CHANGE PERFORMANCE METRICS

- Take a big picture approach to metrics that drive performance. Current metrics that are focused solely on operational measures such as route ridership, unlinked trips, or passenger revenue miles are not sufficient. These metrics should take into account the whole mobility picture, including reductions in solo car trips and increases in linked, multimodal trips.

LAY THE GROUNDWORK FOR STRONG PUBLIC-PRIVATE PARTNERSHIPS AND TARGETED INVESTMENTS IN THE MOBILITY SYSTEM, INCLUDING PUBLIC TRANSIT AND SHARED MODES

- Explore opportunities and challenges for public transportation as they relate to technology-enabled mobility services, including suggesting ways that public transit can learn from, build upon, and interface with these new modes.
- Ensure that, early in the process of pursuing public-private ventures, both sides know what the other needs, can supply, and is prepared to do. Use requests for information (RFIs) to get an accurate sense of private operators' capacities and needs before issuing requests for qualifications or proposals.
- Map local mobility assets, deficits, and other local needs to make sure policies and investments are directed to where they'll have the greatest impact.
- Hold information-sharing sessions to introduce regional stakeholders to one another and to private industry representatives. Especially when previously unknown business models are entering a region for the first time, much of the groundwork has to do with establishing relationships and trust among players and making sure everyone's goals are on the table.

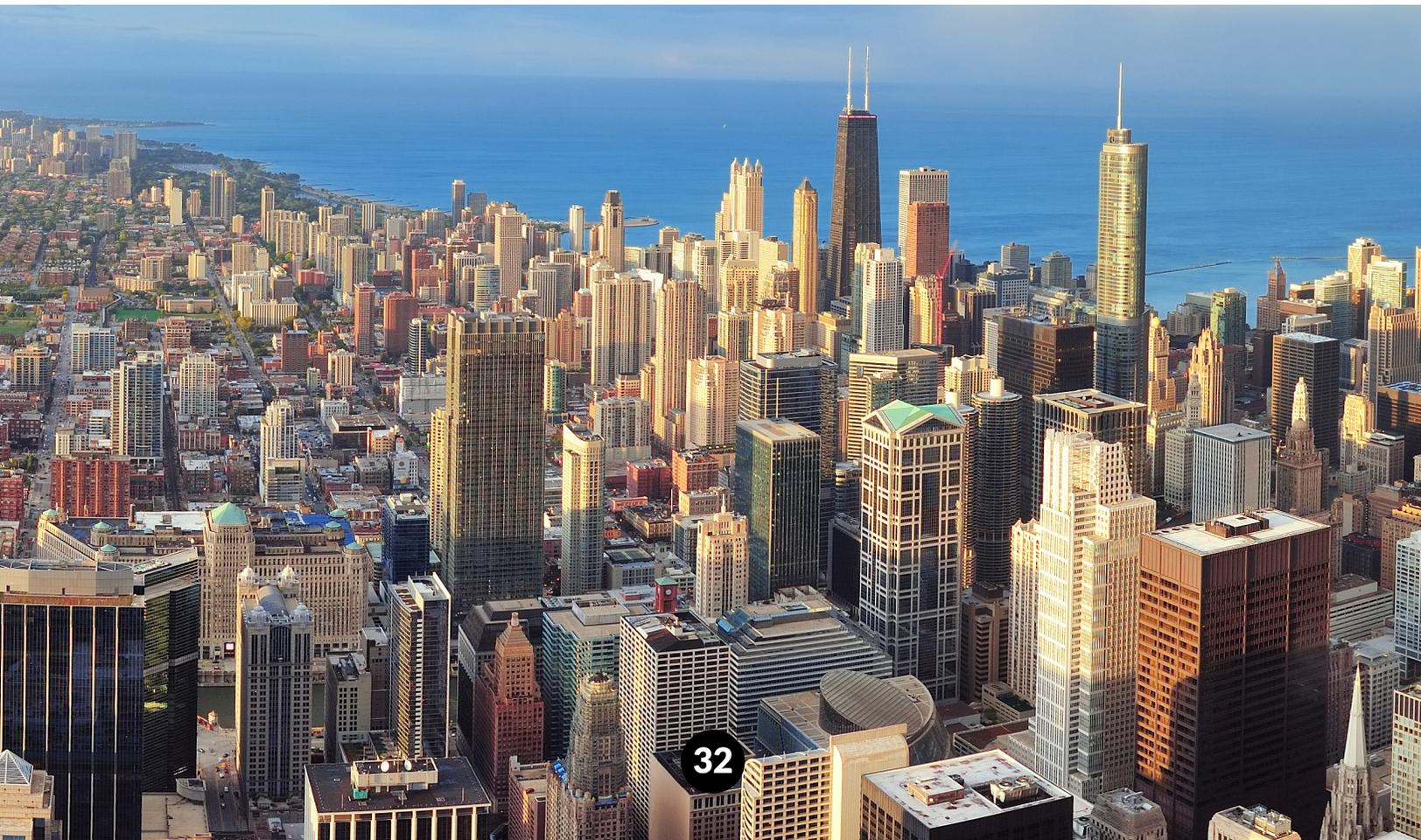
MAINTAIN ACCESSIBILITY AND EQUITY AS CENTRAL MANDATES FOR URBAN AND REGIONAL MOBILITY, ESPECIALLY WITH AN EVOLVING MIX OF PUBLIC AND PRIVATE ENTITIES

- Address inequities in access to information, which is the currency of the new mobility system. The capacity to readily use tools for information, schedules, booking, and payment must be ensured for those who face barriers related to cost, technology, technical knowledge or disability.
- Evaluate the use of new modes such as microtransit and one-way carsharing to increase transit access in outlying communities, and conduct targeted outreach to educate residents about first/last mile solutions. The suburbanization of poverty has resulted in longer commutes, poorer job access, and greater reliance on car ownership

for many who can least afford it. People without bank accounts may need accommodations related to cost and payment options.

EXTEND FARE INTEGRATION AND MOBILE PAYMENT TO GOALS BEYOND SMOOTHING FAREBOX INTERACTIONS, SUCH AS SUBSIDY ADMINISTRATION, MODE-SHIFT GOALS, AND GATHERING RIDERSHIP DATA

- Integrate fare payment systems to simplify the subsidy of linked rides, such as the Pinellas Suncoast Transit Agency’s pilot to partially subsidize transit-linked ridesourcing trips, or King County Metro Transit’s emergency ride home program. In-app payment could draw from a pool of voucher money established through agreement between the company and the transit agency that is reconciled on the back end.
- Make use of new technologies’ rich data gathering capabilities. As part of fare integration, public transit agencies can partner with aggregators and other mobility providers to more accurately measure both transit usage and cross-mode linked trips, since both are measures of trips that aren’t taking place in personal autos. Increases in linked trips, both within and across modes, should be a performance goal.
- Use Title VI equity analyses relating to fare medium changes to understand how to broadly distribute the benefits of integrated payment and information.



KEEP INFORMATION OPEN AND WIDELY AVAILABLE FOR THE BROADEST BENEFIT

- Use open data and APIs, continue improvement of feeds, and encourage private sector innovation. Making contracting more flexible for transit agencies will help ensure they are not locked into a single vendor’s proprietary software and hardware.
- Support the development and adoption of shared-mobility information standards. This is already happening with the general bikeshare feed specification, but something similar is needed for carshare, ridesourcing, microtransit, and other new modes.
- Build in accessibility from the ground up whenever information or payment solutions are pursued—this should be part of every payment or information system RFP.
- Continue to develop common standards for payment, storage of customer information, and privacy. Ideally, public authorities should actually own and maintain cross-modal data in an integrated system.
- Ensure data reciprocity from the private sector, which benefits greatly from open public data. A “walled garden” model will not work for ridesourcing companies and other private operators if they expect to take part in a wider mobility ecosystem. Public transit operators, planners, researchers need this data to understand how people are moving and where intervention may be needed.

TRANSFORM PUBLIC TRANSPORTATION AGENCIES INTO MOBILITY AGENCIES

- Coordinate public transit operations—along with regulation of bikesharing, carsharing, ridesourcing, shuttles, parking, and curb access—toward common mobility goals. The San Francisco Municipal Transportation Agency and several agencies in Seattle are transforming themselves into mobility managers, with responsibilities that go beyond a public utility model of transit provision or a streets department.
- Address mobility beyond direct provision of transportation services—especially through spreading awareness and training people how to use the full mobility menu to reduce the need for personal vehicles.
- Create a network of mobility managers at different levels (e.g., regions, municipalities, public transit agencies, and large employers) to communicate and coordinate mobility needs across departmental, jurisdictional and public/private lines.
- Create cross-agency working groups to get multiple entities—including public transit agencies, departments of transportation, business affairs divisions, consumer watchdogs, zoning departments, planners, and public safety agencies all in the same room to create policies that ensure they’re not working at cross-purposes in pursuit of similar goals.

APPENDIX

RESEARCH OBJECTIVES AND METHODOLOGY

RESEARCH OBJECTIVES

The objectives of this research were to:

- Improve understanding of new technology-enabled mobility services
- Find ways for public transit agencies to learn from new mobility services: present opportunities for agencies to learn from and build upon successes of these services, in service, marketing, customer satisfaction and convenience
- Identify opportunities and challenges, including potential for positive and negative outcomes for public transit agencies
- Present strategies and best practices for transit agencies to maximize public benefit
- Build on the experience of seven study cities: Austin, Boston, Chicago, Los Angeles, San Francisco, Seattle, Washington, DC

INTERVIEWS WITH PUBLIC AGENCY OFFICIALS AND PRIVATE MOBILITY OPERATORS

In order to understand the current relationship between and public transit services and shared-use modes the researchers interviewed more than 70 officials at 26 public agencies, along with representatives of 5 shared-use mobility operators. The public agencies included transit operators; local transportation departments; regional planning and transportation authorities; state transportation departments; regulatory compliance authorities at several levels of government; and the Federal Transit Administration.

SURVEY OF SHARED-USE MOBILITY CONSUMERS

The researchers conducted a survey of more than 4,500 shared-use mobility consumers in order to provide qualitative insights into travel behavior and any changes in their use of other modes, especially transit, since they've started using new forms of shared mobility.

The survey targeted a variety of shared-use mobility consumers and was distributed by public transit agencies and private shared mobility operators (carsharing and bikesharing) in the study cities. For the purposes of the survey we defined shared-use mobility as including transit as well as emerging modes like bikesharing, carsharing, ridesourcing, and ride-splitting.

Respondent Overview

The characteristics of the survey respondents are highlighted below:

- Male respondents slightly outweighed female, 1,863 (52 percent) to 1,726 (48 percent).
- The average household income of respondents was \$90,926, with an average age of 41.0 years, reflecting the relatively high cost of living in the study cities. However, the largest group of respondents (34 percent) were in the 25 to 34 year-old range, and 22 percent of respondents had household incomes under \$50,000. Several findings related to lower income consumers are explored below.
- 79 percent of respondents (3,581) indicated they had at least some experience with shared-use modes beyond transit. Around 21 percent (963) of respondents have only experienced transit.
- On average, the group without shared mode experience beyond transit was almost a decade older and had an average household income nearly \$15,000 lower than the shared mode-experienced group. This unusual grouping of greater age and lower income was more an artifact of the transit-only group. Looking at the respondents overall, younger people tended to have lower household incomes.

RIDESOURCING AND PUBLIC TRANSIT CAPACITY AND DEMAND ANALYSIS

While ridesourcing companies like Lyft and Uber are extremely protective of their trip data for both competitive and customer privacy reasons, the companies do provide a way for computer applications to get information about their services via a tool called an application protocol interface (API), a portal where two computers can pass specific information back and forth in a structured way. Queries from the Uber smartphone app use the API to request rides and interact with the customer account; Uber also provides limited access to the API to third-party software developers and researchers. Uber granted SUMC's researchers access to the API for 1000 requests per hour for each of price and wait time.

The API provides two key pieces of information as part of the response to queries for a theoretical ride between two locations: the wait time before a vehicle arrives at a requested location, and the estimated price, which includes a factor called the surge multiplier that reflects the relative demand for vehicles at that moment and location. Though it doesn't directly reflect the number of riders, the researchers made the assumption that changes in this factor act as a proxy for the changing level of demand over time.

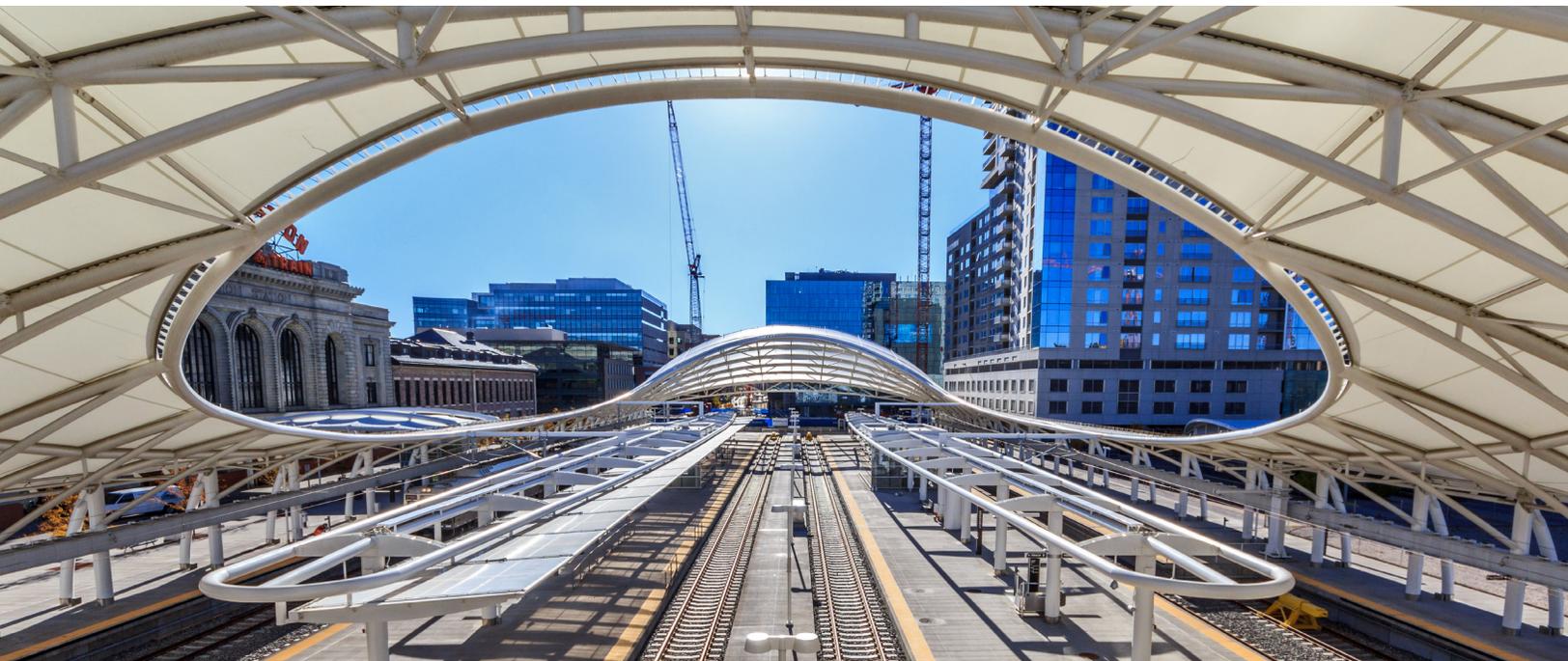
By systematically querying the API around the clock with origin/destination pairs from points providing coverage of the study cities, the researchers assembled a picture of how ridesourcing availability and demand varies across time and geography. All of the queries made were to a purely informational portion of the API, which did not generate actual ride requests or spoof calls for service. Combined, two rounds of collection over eight weeks produced some 1.07 million usable observations for the 7 study regions, which we aggregated to the zip code tabulation area (ZCTA) level for each hour and day.

Validation Of Surge Pricing As A Demand Indicator

Though Uber acknowledges that surge pricing is their system's way of signaling high demand to both drivers and customers, the researchers validated our interpretation of this indicator by comparing our own additional collection of these data for Brooklyn to publicly released trip data from the same area, finding a high degree of correlation between the number of actual rides actually originating in various locations at specific hours and days, and the patterns in surge pricing at those same hours and days.

Transit Capacity From Agency Schedule Data

To determine how Uber rides corresponded with transit trips, we compared the Uber API data with transit agencies' General Transit Feed Specification (GTFS) service information. For the transit capacity side of the comparison, we started from the assumption that the transit agencies schedule service in accordance with customer demand, and used the GTFS schedule data to build estimates of service capacity at the zip code level across the day and week. The researchers gathered the transit agencies' GTFS feeds and programmatically transformed them to hourly counts of trips, vehicles and vehicle types, and maximum wait times for each stop in the system (limited, like the ridesourcing data, to the core county of each region). Using standard load factors and agency-specific vehicle sizes to estimate capacity at each stop, we arrived at a measure of hourly seat-stops and headways for each stop. We then generated aggregate measures of seat stops per hour and average headways at the ZCTA level.





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