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16. Abstract

Texas is one of the fastest growing states in the nation, and its growth is expected to continue, supported by diversity in its economy, geography, and population. The challenge of prioritizing limited resources in this environment requires a proactive approach to travel demand management. This project provides guidance for TxDOT in its planning and mobility efforts and in understanding the viability of various alternative mobility programs.

This report describes research of best practices and lessons learned from mobility programs. The research describes executive interviews, focus groups, and surveys to obtain details and document perspectives of the varying stakeholder groups. The research produced a guidebook that will aid TxDOT in determining how to best identify and implement alternative mobility programs in a given region as part of its planning and mobility efforts.

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# DYNAMIC RIDE-SHARE, CAR-SHARE, AND BIKE-SHARE AND STATE–LEVEL MOBILITY: RESEARCH TO SUPPORT ASSESSING, ATTRACTING AND MANAGING SHARED MOBILITY PROGRAMS – FINAL REPORT

by

Kristi Miller
Associate Transportation Researcher
Texas A&M Transportation Institute

Tina Geiselbrecht
Research Scientist
Texas A&M Transportation Institute

Maarit Moran
Associate Transportation Researcher
Texas A&M Transportation Institute

And

M.A. Miller
Assistant Research Scientist
Texas A&M Transportation Institute

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and the
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TEXAS A&M TRANSPORTATION INSTITUTE
College Station, Texas 77843-3135

# DISCLAIMER

This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation.

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# CHAPTER 1: INTRODUCTION

As one of the fastest growing states in the nation, the challenge of prioritizing limited resources has led to increased interest in developing proactive approaches to better manage travel demand on Texas roadways. The purpose of this project is to provide guidance to TxDOT and its partners and stakeholders in planning and mobility efforts, specifically through a better understanding of the viability of three specific shared mobility travel options: dynamic ride-share, car-share, and bike-share.

Shared mobility programs offer flexible transportation options that vary based on cost, travel time, travel distance, and other trip needs of travelers. However, there is not a one-size-fits-all approach to implementing shared mobility programs at the state level or within a given region. Shared mobility programs offer a set of adaptable, scalable transportation options that have the potential to serve a range of needs in various contexts. Existing programs range in scale and scope, often operating in multiple regions, to provide creative solutions and to increase travel options. New technology and changing travel trends have spurred the development and uptake of these new models of transportation, which expand the set of available travel options and have the potential to provide social, economic, and environmental benefits.

These travel options are referred to as "shared mobility programs" because, by design, they are shared among users (*1*). For the purposes of this research, the alternative travel modes are defined as follows:

- **Dynamic ride-share**: A service that gives drivers and passengers the ability to make ride matches close to their departure time with the convenience and flexibility to be used on a daily basis. This project's focus is on dynamic or "real-time" ride sharing, not on formal programs that are static and set/scheduled in advance or routine (as in the sense of formal carpools or vanpools).
- **Car-share**: A service that provides vehicles for rent on an "as needed" basis allowing users access to a vehicle without the fixed costs and responsibilities of private vehicle ownership.
- **Bike-share**: A service that makes bicycles available for shared use and rental on an "as needed" basis, allowing users access to a bicycle without the fixed costs and responsibilities of private bicycle ownership.

Shared mobility programs are developing at a time when technological capability is shifting rapidly, individual and governmental economies are both uncertain, and transportation systems are functioning at or beyond capacity. The changes in these interdependent influences create a dynamic landscape that is best viewed from several perspectives. This report provides those perspectives, bringing together user needs and perceptions with implementer experience. Together, they give insight into the issues that are important for TxDOT to understand in order to support these programs.

The purpose of this report is to document the research that identifies and defines the key factors in shared mobility program, including the agencies involved, the regulations that impact the programs, regional travel behavior characteristics and vendor criteria necessary for implementation. The report documents stakeholder input gathered during the research through

interviews, focus groups, and a statewide survey. The research supported development of a guidebook to aid TxDOT and its partners and stakeholders in how to best identify and implement these mobility programs (can be accessed at http://tti.tamu.edu/documents/0-6818-P1.pdf).

This report is organized as follows:

- Chapter 1 briefly introduces the research project and defines the shared mobility programs discussed in this research report.
- Chapter 2 provides a review of the literature and supporting research for each of the three shared mobility programs. It establishes the foundation for the guidebook on how to approach and implement, as appropriate, dynamic ride-share, car-share, and bike-share programs in Texas through a detailed review of each of these mobility programs.
- Chapter 3 summarizes the data collection and findings from focus groups, a statewide web survey, and executive interviews conducted with various stakeholders.
- Chapter 4 describes the development process and information presented in the guidebook.
- Chapter 5 summarizes the main objectives and key factors from the research project.

A series of appendices provide additional supporting research for this report:

- Appendix A: Ride-Share Program Information
- Appendix B: Car-Share Program Information
- Appendix C: Bike-Share Program Information
- Appendix D: Stakeholder Input
- Appendix E: Statewide Travel Options Survey
- Appendix F: El Paso Workshop Information

# CHAPTER 2: LITERATURE REVIEW AND SUPPORTING RESEARCH

This chapter provides a summary of the three shared mobility programs and the current state of each program in the United States and in Texas as of this report's publication. This includes a brief summary of each program type including the definitions, operations, and purposes for ride-share, car-share, and bike-share programs in the United States. Appendices A, B, and C expand on the major features and considerations of each mobility program.

The research summarized in this chapter is constantly evolving, with relevant shared mobility program details changing almost daily. The research is current **as of September 2015** and includes as much information about each program as is publically available.

## RIDE-SHARE

The following section describes research related to ride-share programs, including the definition used for this research project, a brief history of the mobility program, user demographics and traveler behavior, how ride-share works, and the benefits of using ride-share programs. More detailed research on ride-share programs can be found in Appendix A.

### Definition of Ride-Share

This study focuses on dynamic ride-share, defined for this project as a service giving drivers and passengers the ability to make ride matches close to their departure time, with convenience and flexibility to be used on a daily basis. The focus of this project is on dynamic or "real time" ride-share, not formal programs that are static and set/scheduled in advance or routine (as in the sense of formal carpools or vanpools). This definition is similar to that put forth by FHWA as "a strategy that involves travelers using advanced technologies, such as smart phones and social networks, to arrange a short-notice, one-time, shared ride. These real-time tools facilitate a dynamic carpooling activity aimed at helping to reduce the number of auto trips and vehicles trying to use already congested roadways" (*2*).

Of the shared mobility programs evaluated in this report, the area of dynamic ride-share has the most changes taking place, from regulation to definition, even to its name with recent research referring to "ride-sourcing" rather than "ride-sharing."

Dynamic ride-share programs are most commonly operated by private companies and nonprofits. Transportation network companies (TNCs) are generally private companies, while ride-share programs that facilitate casual, interpersonal arrangements are often nonprofit organizations (Table 1). TNCs typically offer a service more akin to taxi service than carpooling. Existing programs exhibit a range of program types and business models.

**Table 1. Dynamic Ride-Share Categories.**

| Type | Who Provides It | Properties |
|---|---|---|
| **For-Profit TNC Model** | Uber®<br>Lyft®<br>Sidecar® | • Provides a real-time online marketplace to match passengers and drivers.<br>• Uses some of the traditional taxi service regulatory considerations that include insurance, background checks on drivers, and city permits for operation. |
| **Casual Interpersonal Arrangements** | Carma Carpool®<br>eRideshare® | • Has the goal of decreasing the number of single occupant vehicles and associated vehicle-miles of travel (VMT).<br>• Limits its payment (if any) to drivers of the privately-owned vehicle at the reimbursement rate authorized by the Internal Revenue Service (IRS) and includes a small transaction fee. |

Dynamic ride-share is distinct from carpools or vanpools that are static and scheduled in advance. These traditional programs coordinate long-term, prescheduled, and pre-organized carpools focused on the daily commute. New technology has enabled ride-share models to focus on travelers who want to arrange short-notice, one-time, shared trips with one another regardless of the trip purpose.

**Brief History of Dynamic Ride-share**

In 2009, the Washington State Department of Transportation (WSDOT) provided a $400,000 grant to support the development of a pilot ride-share project in the Seattle region. The pilot program incorporated the latest smartphone technology to arrange carpools at any time (i.e., real-time ride-share). As opposed to casual carpooling, real-time ride-share allowed riders and drivers to arrange convenient pick-up locations anywhere along the driver's route.

In 2010, Avego® (a global provider of software, hardware, and professional services for the efficiency of passenger transportation) was selected by WSDOT to conduct the pilot project (*3*). The *go520* pilot utilized the *Avego Driver* smartphone application, which was available free of charge for Windows® and iOS® phones (*4*). Drivers earned $1.00 for each pick-up plus $0.20 per mile (minus a 15 percent transaction fee). All of the transactions were handled by the Avego system that automatically credited the driver's account (*5*).

The pilot project tested the feasibility of real-time ride-share using Global Positioning System (GPS)-enabled smartphones throughout State Route (SR) 520, a 14-mile freeway corridor from Redmond, Washington, to downtown Seattle. The pilot was formally launched in January 2011 with an outreach campaign to attract and register 1,000 participants (more specifically 250 drivers and 750 riders). The project was promoted as *go520* across local television, radio, dedicated website, and other sites (e.g., *The New York Times*). Furthermore, to increase the number of participants, Avego offered incentives including gas cards and rider credits. The goal of 1,000 participants was reached in April 2011 (*6*).

After the outreach campaign, Avego documented the *go520* pilot key findings and observations to include the following:

- Channels and media were effective in maximizing awareness of the pilot.
- Outreach conducted through the major employers and campuses (e.g., Microsoft® and the University of Washington) was by far the most successful.
- It is ideal to incorporate an element of joint marketing across trusted channels to attract more people.
- Meet-up events designed to personally introduce the program to participants were successful.

Strict qualification criteria were a significant problem when enrolling participants into the pilot program. Riders and drivers were required to provide their social security number and date of birth for a background check. Drivers needed to provide proof of auto insurance, driving record, and certify to the best of their knowledge that proper maintenance was provided to the vehicle (*7*). As a result of the strict registration requirements, participants lost interest on the pilot program. Of 962 individuals that signed up to participate, only 279 provided their social security numbers. Further, of those 279 individuals, only 89 riders and 9 drivers passed through the strict screening process.

During March, April, and May 2011, a survey was emailed to 127 people who initially expressed interest but never completed the registration process. The survey was answered by 33 people (26 percent response rate). The most notable observations were (*8*):

- Forty-nine percent of respondents decided not to complete the registration process because of the social security number requirement.
- Fifty-eight percent of respondents found out about go520 by an email from their employer and 9 percent from newspaper, radio, or television.
- The most influential factors in deciding to participate were to save time and money at 58 percent and 42 percent, respectively.

Ride-share services are not structured to require pre-arrangement between the driver and the passenger to establish a shared trip. Participants are able to request a ride anytime through the web, an automated telephone system, or through a smartphone application and the system sends a ride request to all nearby drivers who fit the rider's previously established criteria (e.g., male or female, smoking or non-smoking vehicle). Drivers then have the option to accept or reject the rider's request. Ride-share services rely heavily on mobile phone technologies given the technology's growing market share, ease of use, and capabilities such as GPS integration and online network connectivity.

Privately held ride-share service providers have customized iOS and Android® applications that allow drivers and passengers to arrange shared rides in real-time. Such platforms take advantage of current cell phone technology to offer a better and more secure trip sharing experience because of features such as (*9*):

- User-friendly interface.
- GPS tracking functionality.

- Ride-matching algorithm.
- User profiles.
- Social network integration.
- User rating system.
- Cashless transactions.
- Real-time maps showing nearest driver(s).

Interested users can download each ride-share provider's free mobile application and start requesting rides right away. Users who register as drivers are required to provide additional information (e.g., proof of registered vehicle, driver's license, age) to comply with the requirements established by each ride-share provider. Once the drivers are approved, they can start accepting ride matches from nearby passengers. Figure 1 shows the basic structure of how current dynamic ride-share models operate.

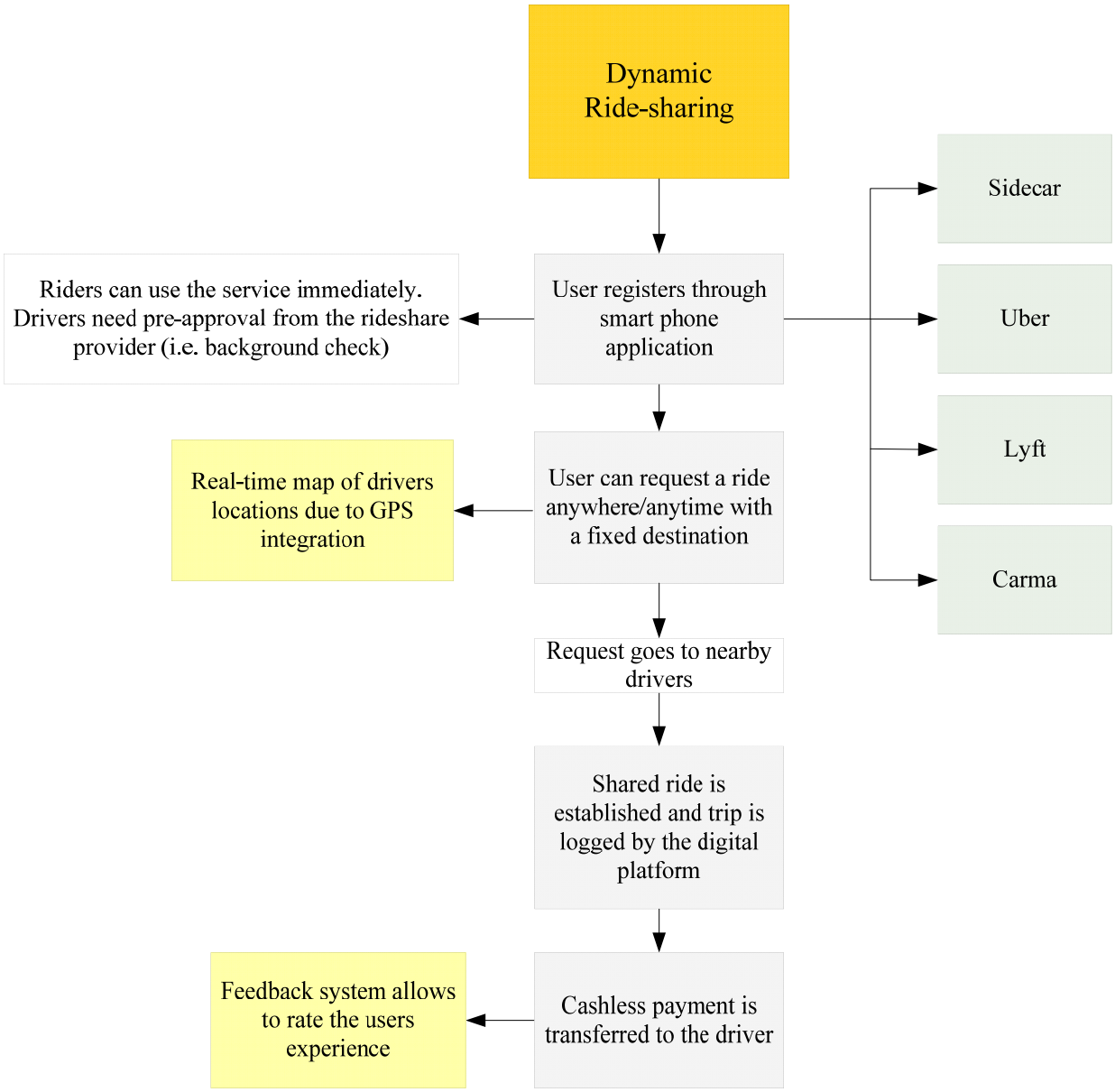



**Figure 1. Basic Structure of Current Dynamic Ridesharing Models.**

## User Demographics and Traveler Behavior

According to a recent study by Tahmesseby et al., the following factors influence participation in the dynamic ride-share market (*10*):

- Socio-demographic factors, such as age, gender, income, marital status, and occupation.
- Situational factors, such as reliability, sustainability concern, weather information, and activity pattern for the day.
- Psychological/attitudinal/behavioral factors, such as privacy, trust, previous ride-share experience with acquaintances, desire for socializing, and previous experiences.
- Spatial factor, such as residential location and employment location (*11*).

- Temporal factors, such as hours of work, schedule flexibility, and journey regularity.
- Transportation system factors, such as traffic congestion, public transit availability, and transit quality.

### Using Ride-Share

Ride-share programs rely heavily on smartphone technologies and customized iOS® and Android® applications (apps). Interested users can download a ride-share provider's free mobile application, register with a valid credit card, and start requesting rides right away.

Ride-share works by:

1. **Request**: A passenger requests a ride through an app (via computer, tablet, or smartphone).

2. **Connect**: The software sends the ride request to all nearby drivers who fit the rider's previously established preferences and route (Figure 2).

3. **Pick up**: A driver then has the option to accept or reject the rider's request. Upon acceptance, the driver navigates to the passenger's designated location using global positioning system technology that shares the vehicle's progress with both parties.

**Figure 2. Ride-Share App Alerts a Nearby Driver.**

4. **Pay**: Cashless transactions are facilitated automatically by the app or service. The TNC's charges are calculated based on distance and/or time, like taxis. Ride-share programs like Carma Carpool® and iCarpool® reimburse drivers according to the reimbursement rate authorized by the Internal Revenue Service plus a small transaction fee. This is the cost to the rider.

## CAR-SHARE

The following section describes research related to car-share programs, including the definition used for this research project, a brief history of the mobility program, user demographics, how car-share programs work, and the benefits of using car-share programs. More detailed research on car-share programs can be found in Appendix B.

### Definition of Car-Share

Car-share is a service that provides vehicles for rent on an "as needed" basis allowing users access of a vehicle without the fixed costs and responsibilities of private vehicle ownership and a more streamlined and flexible system than traditional rental contracts.. These programs are generally membership-based, providing short-term vehicle access for individual or business members. Typically, members are provided access to a fleet of vehicles that are geographically

distributed and pay a fee on a per-minute, per-hour, or daily basis. Gas, insurance, and maintenance are usually included in the rental cost. Vehicle storage is generally bundled with the service as well, although parking arrangements vary with different operational models (*12*,*13*,*14*).

Not all car-share programs are organized or operate alike; rather, they fall along a spectrum as shown in Figure 3. The most common design for car-share services in the United States are programs whose vehicles must start and end at designated parking spots. Emerging models include floating fleets without designated parking that allow one-way trips and programs in which individual's share their personal vehicles with others. These business and operational models are discussed in detail below.

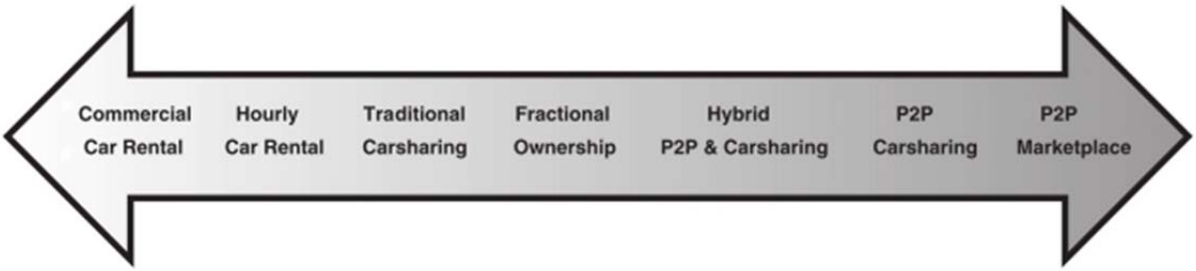



**Figure 3. Spectrum of Shared-Used Vehicle Services (*15*).**

Car-share business models in the United States can be for-profit, nonprofit, cooperative, or public-private partnerships. Several traditional car rental companies and car manufacturers are involved in car-share programs.

The most common design for car-share services in the United States involves programs that provide fleets of shared vehicles at designated parking spots where each trip must start and end. However, the spots are distributed throughout a geographic area and not concentrated at one specific location, as with a rental car agency.

Another car-share model uses floating vehicle fleets that allow point-to-point one-way trips within a certain geographic area. A virtual barrier monitors a vehicle's locations using GPS and ensures that the vehicle is parked at a legal parking spot within the operating geography. Figure 4 illustrates the home geography of the point-to-point program operated by Car2Go® in Austin, Texas.


**Figure 4. Designated Home Area for Car2Go Vehicles in Austin, Texas (*16*).**

Peer-to-peer (P2P) car-share programs facilitate exchanges in which individuals share their personal vehicles with others. In contrast to the fleet-based services, peer-to-peer car-sharing, or personal vehicle sharing, facilitates the sharing of privately-owned vehicles. A fleet of cars exists in a community, in which the marketplace allows owners of available cars to be matched to other drivers to rent. Program operators generally provide the organizational resources to negotiate transactions between car owners and renters. Other aspects of the programs such as use of internet-based reservation systems and hourly/daily/weekly rental periods are similar to fleet-based car-sharing programs. The operators serve mainly as matchmakers but provide the support services that ensure a simple and secure transaction between two strangers. The services enforce safety standards of vehicles, pre-screen members, and provide car owners with independent insurance and drivers with 24-hour roadside support. There were 33 personal vehicle sharing operators worldwide, with 10 in North America as of May 2012 (*17*).

## Brief History of Car-Share

The first experiments with car-share were in Europe. One of the earliest examples of a long-running car-share program was Zurich, Switzerland's Sefage cooperative that ran from 1948 to 2007 (*18*). Two demonstration programs were run in the United States in the 1980s, but both ended by 1986 (*19*). The first North American model, CommunAuto, was launched in 1994 in Quebec, Canada. By 1998, two cooperative car-share programs had launched in the United States – Boulder CarShare in Colorado and the Dancing Rabbit Vehicle Cooperative in Rutledge, Missouri. The for-profit CarSharing Portland (later Flexcar Portland) opened in Portland, Oregon, in 1998 (*20*).

Since 1994, 75 car-share programs have been launched in North America and 46 are operational. Twenty-five of these operational programs are in the United States (*21*). As noted above, CarSharing Portland was the first for-profit car-share company launched in the United States in 1998, followed by Flexcar in Seattle, Washington, and Zipcar in Boston, Massachusetts. This for-profit fleet-based model continues to lead the car-share market in the United States. In 2007, Zipcar absorbed Flexcar, maintaining its position as the largest car-share organization in the world. In 2013, the three largest providers in the United States represent 88 percent of total membership.

The car-share industry continues to expand and evolve. New models, advanced technologies, and the participation of automakers and rental car brands are shaping the future of car-share today. One-way rentals (such as Car2Go) and peer-to-peer sharing programs (such as Getaround, Relayrides) are expanding in the market. Traditional car rental companies—including Hertz, Enterprise and Avis—are blurring the lines between car rentals and car-share through acquisition of car-share operations, changes to traditional car rental operations, and the exploration of new features such as insurance and age policies (*21*).

Functionally, car-share programs generally provide a fleet of shared vehicles that are spread throughout a particular region and can be concentrated around activity, employment, or transit centers. Typically, car-share members will pick-up a vehicle at a parking spot, accessing the vehicle with a technologically-enabled card or key, and take off. The car is then returned to the same spot at the end of the reservation. Reservations can be made in advance, although these can take place shortly before the rental as long as there is availability (or without a reservation in the case of Car2Go). Reservations and vehicle access are generally available 24 hours a day, 7 days a week, 365 days a year (*22*).

**User Demographics and Traveler Behavior**

In general, attributes of car-share members include (*23*):

- Residents of dense urban areas.
- Highly concerned about environmental and social issues.
- Highly educated.
- Middle to upper income, but still cost-sensitive.
- Low-mileage drivers.
- Considered to be innovators.
- From smaller households (two persons or less).
- More concerned with what a vehicle can be used for, less concerned with how it looks or its brand name attributes.
- Generally in their 30s or 40s (although this can vary greatly by specific location and other service attributes).

In a 2012 report, Buffalo CarShare found that 61 percent of its member households did not own a vehicle (*24*). An international survey found that peer-to-peer car-share users are typically young, urban dwellers with an average age of 35 years. Users are twice as likely to own smartphones as the average population (*25*).

Convenience, followed by affordability, has been identified as the most important motivations for using car-share (*26*). Additional strong predictors of car-share membership in early implementations include the desire to save money, environmental concern, and the convenience of not owning a car (*23*). There has been an observed shift in motivation in which ecological and social values have given way to financial and pragmatic motivations.

An analysis of the motivational patterns of car-share users found the most common motives were value-seeking, convenience, lifestyle, and environmental (*27*). These motives can help identify the important features or aspects of car-share for different market segments. For example, users with an environmental motive may be best served by fuel-efficient vehicles and designated or accessible parking will appeal to those motivated by convenience (*28*). Figure 5 summarizes the literature on motivations for car-share membership, as of 2005.

| Motivations | Relative Importance |
|---|---|
| Desire to save money | High to very high |
| Concern about environmental issues | High to very high |
| Convenience – not dealing with maintenance, etc | High to very high |
| Changes in one's personal life situation | Moderate to high |
| Positive attributes of the car-sharing experience | Moderate |
| Work-related conditions | Moderate to low |

**Figure 5. Summary of Literature Regarding Motivations of Typical Car-Share Members (*23*).**

In addition to categorical motivations, some research has identified the importance of trigger points, such as personal events or life changes that stimulate the adjustment in travel behavior (*28*). A study of car-share members in Montreal, Quebec, revealed that most trips were for non-work purposes, averaged more trip chaining (number of trips per chain; a chain being defined as the reservation start and end), and trips were shorter than the typical trips made by Montrealers. The authors suggest that the differences in behavior are due to car-share users' aim to maximize the use of the cars (*29*).

Car-share is seen as an effective complement for areas that boast a set of transportation options comprised of transit, biking, and walking rather than settings that are more automobile-dependent. Thus, is it most commonly found in metropolitan areas. Higher growth for car-share is expected in areas with more one-person households, lower levels of drive-alone commuters, and lower vehicle ownership rates (*23*) as evidenced by the emergence of options on university campuses and in mixed-use or higher density residential development.

A review of studies found that the success of car-share is supported by the following common neighborhood attributes:

- Parking pressures.
- Ability to live without a car.
- High density.
- Mix of uses.
- Low vehicle ownership rates (*23*).

The peer-to-peer market has contributed to making car-share more common outside of dense, urban areas. These programs require less up-front capital investment in infrastructure by taking advantage of the fact that cars are typically idle for long periods of time (*30*).

### Using Car-Share

Car-share vehicles are typically spread throughout a region and concentrated in proximity to residential, employment, and activity centers. Smartphone apps can be used to streamline the process. Typically, the car-share process is:

1. **Reserve:** Reservations can be made in advance or at the time of the rental as long as there is availability. Reservations and vehicle access are generally available 24 hours a day/7 days a week.

2. **Pick up:** Members pick up a vehicle at a parking spot, using a membership card or other device that is embedded with a radio frequency identification (RFID) tag that unlocks the vehicle.

3. **Return:** In the case of fixed parking programs, the car is then returned to the same spot at the end of the reservation. In point-to-point programs, the vehicles are picked up and dropped off at any parking spot in a designated operating zone.

4. **Pay:** Members pay a usage fee on a per-minute, per-hour, or daily basis. Gas, insurance, maintenance, and vehicle storage are usually included in the rental cost. Parking arrangements vary with different operational models (*12*,*13*,*14*).

## BIKE-SHARE

The following section describes research related to bike-share programs, including the definition used for this research project, a brief history of the mobility program, user demographics, how bike-share works, and the benefits of using bike-share programs. More detailed research on bike-share programs can be found in Appendix C.

### Definition of Bike-Share

Public bike-share is an innovative mobility strategy that has emerged over the last decade in increasing numbers of North American cities. In *Bike Sharing in the United States: State of the Practice and Guide to Implementation*, FHWA defines bike-share as "a non-motorized transportation service, typically structured to provide users point-to-point transportation for short distance trips (0.5 to 3 miles). It provides users the ability to pick up a bicycle at any self-serve bike-share station in the network and return it to any other bike-share station (including the origin)" (*14*). Bike-share programs provide access to a network of bicycles for shared use, offering users point-to-point transportation for short trips without the costs and responsibilities of bicycle ownership.

University of California at Berkeley researchers provide more detail about these programs. Typically, bike-share systems position bicycles throughout an urban environment, within a network of docking stations, for immediate access by users. The programs operate with bicycle

docking stations that are usually unattended. Unlike most car-share systems, bicycles are accessible instantaneously without reservation. Trips can be either one-way or round trip with the user dropping off a bicycle at any station with an available dock, locking the bike, and ending the session. For most systems, trips made in less than 30 minutes are free. Users can sign up with bike-share systems on an annual, monthly, daily, or per trip basis. Programs allow users to access bicycles with the swipe of a credit card, a membership card, or through the use of a mobile phone (*14*).

The primary intention of bike-share programs is to address the storage, maintenance, and parking aspects of bicycle ownership and thus encourage cycling among users that may not use bicycles in the course of their travels. The availability of a large number of bicycles in multiple, dense, and nearby locations creates a network effect, that is, to further encourage cycling and, more specifically, the use of bike-share for regular trips (e.g., commuting, errands) (*14*).

Typically, bike-share systems position bicycles throughout an urban environment, served by self-service docking stations for immediate access. Users pick up a bicycle at a station and return it to any other station (including the origin) in the network (*31*). The emerging model in the United States is a scalable, automated operation characterized by real-time bicycle location information, instant rental with a credit card, and physical docking stations for drop off and pick up.

Most bike-share programs in the United States run as nonprofits with a private operator, for-profit companies, or public agencies that partner with a private operator. Every program has a unique organizational arrangement of owner, operator, partners, sponsors, and vendors. As a result, funding sources vary across advertising, user fees, grants, loans, sponsorships, and government funds, among others. Agencies involved in bike-share programs report that the programs help to solve the first and last mile problems of commuters trying to connect from existing public transportation infrastructure to their final destination.

**Brief History of Bike-Share**

The first attempt at bike-share was conducted as an experiment in Amsterdam in 1965. It consisted of making old, restored bicycles available for people to use freely around city streets. The trial soon failed as a result of opposition from authorities and vandalism. However, the concept was not invalidated. Similar attempts were made since in other cities (Cambridge, England; Tucson, Arizona; La Chaux-de-Fonds, Switzerland), but these so-called first generation services were plagued by the same problems as Amsterdam: bicycles were damaged, stolen, or destroyed (*32*).

The second generation of bike-share systems was characterized by a very low level of technology. They restricted access to bicycles by ensuring a human presence and issuing tokens for their use. Two programs are considered the best examples of second generation bike-share: the yellow bicycles in La Rochelle, France, set up by the local authority in 1974 and still in operation today, and the *Bycyklen* of Copenhagen, Denmark, organized and managed by an association that was partly funded by advertising on the bicycles. It closed at the end of 2012 (*14*).

The current increase in bike-share systems came through technological developments that make it possible to automate and track cycle availability. These third generation programs were initiated primarily in France (Rennes and Lyon) but migrated throughout the world and are the types of programs Texas citizens would see today. Third generation programs incorporate information technologies (IT) for bicycle reservations, pick-up, drop-off, and information tracking. Bike-share services with a basis in IT began to emerge in North America approximately five years ago. These programs have four main components:

- Program bicycles are distinguished by special designs or advertising displays on the bikes.
- Docking stations are used. The majority of bike-share programs use fixed stations, which are designated stations with multiple bicycle docks and a kiosk. Flex stations use mobile phone technology and street furniture for bicycle pick-up and drop-off. Users of flex stations receive a code on their mobile phone to unlock bicycles. They leave bikes at major intersections and inform the program where the bicycle is locked. This approach increases bicycle availability and minimizes the amount of infrastructure needed to operate a program.
- User interface is necessary for check-ins and check-outs at the kiosks.
- Use of advanced technology (e.g., mobile phones, magnetic stripe cards, and smartcards) allows users to locate, reserve, and access bicycles (*32*).

Figure 6 shows the three generations of bike-share programs implemented and an envisioned fourth generation program. Figure 7 provides current numbers for North American bike-share programs.

| | |
|---|---|
| First generation:<br>"Free bikes"<br>  | Bicycles are typically painted one color, left unlocked, and placed randomly throughout an area for free use. First-generation systems do not use docking ports. In some of the systems, the bikes are locked; users must get a key from a participating local business and may also need to leave a credit card deposit, but actual bike use is free. Many first-generation systems eventually ceased operations due to theft and bicycle vandalism, but some are still operating as community-based initiatives. |
| Second generation:<br>"Coin-deposit systems"<br>  | Bicycles have designated docking stations/parking locations where they are locked, borrowed, and returned. A deposit, generally not more than $4, is required to unlock a bike. While coin-deposit systems helped reduce theft and vandalism, the problem was not eliminated, in part because of user anonymity. Many second-generation systems are still in operation. |
| Third generation:<br>"IT-based systems"<br>  | IT-based systems use electronic and wireless communications for bicycle pickup, drop-off, and tracking. User accountability has been improved through the use of credit or debit cards. Third-generation bikesharing includes docking stations, kiosks, or user interface technology for check-in and check-out, and advanced technology (e.g., magnetic-stripe cards, smartcards, smart keys). Although these systems are more expensive than first- or second-generation systems, information technology enables public bikesharing programs to track bicycles and access user information, improves system management, and deters bike theft. IT-based systems are responsible for public bikesharing's recent expansion in both locations and scale. |
| Fourth generation:<br>"Demand-responsive/ multimodal systems" (*1*)<br>  | Demand-responsive, multimodal systems build upon the technology of third-generation systems by implementing enhanced features, such as flexible, clean docking stations or "dockless" bicycles; demand-responsive bicycle redistribution innovations to facilitate system rebalancing; value pricing to encourage self-rebalancing; multimodal access; billing integration (e.g., sharing smartcards with public transit and carsharing); real-time transit integration and system data dashboards; and global positioning system (GPS) tracking. Fourth-generation bikesharing is an evolving concept that has yet to be fully deployed. |

**Figure 6. Bike-Share Program Evolution (*33*).**

| | United States | Canada | Mexico | North American Total |
|---|---|---|---|---|
| Number of programs | 22 | 4 | 2 | **28** |
| Total Number of users | 1,191,442 | 197,419* | 71,611 | **1,460,472** |
| Number of members | 44,695 | 53,707 | 71,611 | **170,013** |
| Number of casual users, 1-30 Day | 1,146,747 | 143,312 | 0 | **1,290,059** |
| Number of bicycles | 7,549 | 6,115 | 3,680 | **17,344** |
| Number of kiosks | 800 | 492 | 307 | **1,599** |
| Number of docks | 12,955 | 10,506 | 7,487 | **30,948** |

**Figure 7. Current Statistics for North American Bike-Share Programs (*33*).**
**Note: BIXI Montreal had an additional 400 occasional users. Occasional users maintain a key and are billed a 24-hour membership when the key is used.*

### User Demographics and Traveler Behavior

Shaheen notes that compared to the general population of a metropolitan region, bike-share users tend to be (*33*):

- Wealthier.
- More educated.
- Younger.
- Caucasian.
- Male.

B-Cycle provided the demographic breakdown of San Antonio Bike Share (SABS) members in a 2013 report. Members were asked a series of questions about their demographics, employment, income, and household composition. About half (53 percent) of the respondents were male, 26 percent were 50–59 years old, 18 percent were under the age of 29, and 11 percent were 60 or older (Figure 8). Compared to the general population of San Antonio, the survey results suggested that the 50–59 year olds are somewhat overrepresented in the B-cycle membership relative to the general San Antonio population, while the youngest (18–24 year olds) and oldest (60+) segments are under-represented. Figure 9 is a chart from the B-Cycle report showing the race/ethnicity of bike-share program members.

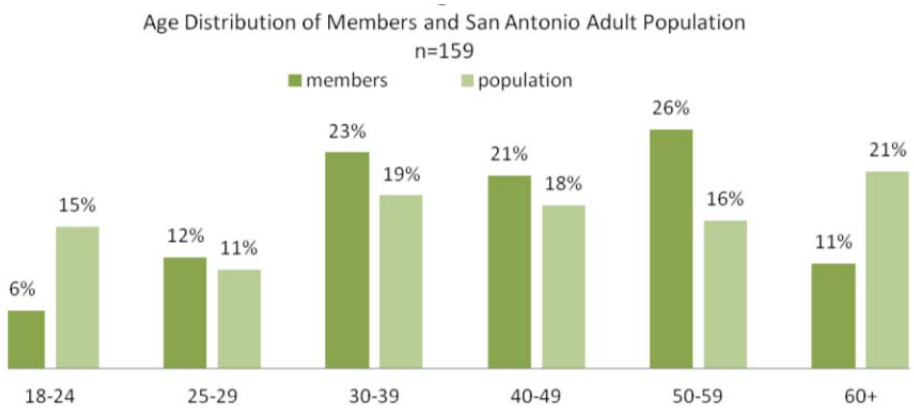



**Figure 8. San Antonio Bike Share Membership Age Distribution (*34*).**

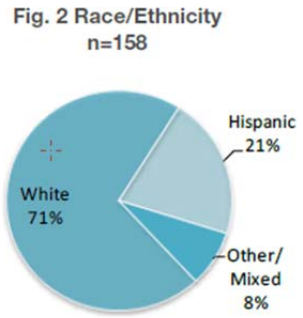



**Figure 9. San Antonio Bike Share Member Race/Ethnicity (*34*).**

In terms of travel behavior, the year before joining SABS, 27 percent had not biked for any purpose, and 49 percent biked weekly. After joining, 83 percent biked weekly, a statistically significant increase over pre-join levels. Higher income members were significantly more likely to cycle in the year prior to joining than were lower income members. No difference in the proportion of weekly cyclists in higher and lower income groups existed after joining. A larger proportion of lower income members compared to higher income members used B-cycle once per week, and a smaller proportion owned their own bike (*34*).

Researchers noted that in North America public bike-share tends to be highly dependent on casual or short-term users for its revenues. Short-term use is defined as users with passes ranging from 1 to 7 days. Initial findings suggested that casual/short-term usage accounts for between 85–90 percent of North American public bike-share users. However, additional study is needed to determine how many of these short-term users are return customers (*35*).

Virginia Tech researchers conducted a survey of users on Capital Bikeshare (CaBi) in Washington, D.C., comparing them to regular area cyclists. The analysis compared gender, race/ethnicity, age, student status, and socio-economic status. The comparison also included trip purpose, helmet usage, and travel modes for trips that were replaced by bike-share. Profiles of CaBi and area cyclists differed on many demographic and socioeconomic characteristics. Compared to area cyclists, CaBi short-term users and annual members:

- Are more likely female.
- Are younger.
- Have lower household incomes.
- Own fewer cars and fewer bicycles.
- Are more likely to cycle for utilitarian trip purposes.

Furthermore, CaBi trips mainly replace public transport and walk trips. CaBi short-term users and members show similar characteristics, but short-term users are more likely to ride for recreational trip purposes and less likely to wear a helmet. The study results indicated that bike-share can encourage new segments of society to cycle and can help increase overall bicycling mode share (*36*).

People are more likely to use bike-share under good weather conditions, which is understood intuitively. During the weekends, bike-share usage reduces. However, Friday and Saturday nights are positively related to arrival and departure rates suggesting restaurant and/or event districts attracting riders. Bicycle trip volumes are expected to decrease when farther from a central business district (CBD) (*37*).

### Using Bike-Share

Shared bicycles are typically scattered throughout a region, with concentrations near residential areas, employment hubs, activity centers, and recreational or tourist sites. Users must join bike-share programs on an annual, monthly, daily, or per-trip basis and can access bicycles at the docking station with a credit card, a membership card, or a smartphone app. Unlike car-share programs, bike-share programs do not typically allow advanced reservations. The process typically involves:

1. **Pick up**: Users can pick up any bike at any station in the system and return it to any other (or the same) station in the system.

2. **Return**: Users drop off a bicycle at any station with an available dock and lock the bike, ending the session.

3. **Pay:** For most systems, preregistration with a paid membership entitles users to trips made in less than 30 minutes without additional cost. Incremental charges incurred after that are charged to the user. Non-members can usually prepay with a credit card at pickup.

## CURRENT STATE OF SHARED MOBILITY PROGRAMS IN THE UNITED STATES

Shared mobility programs have functioned at some level in the United States for decades. Alternative modes of transportation appeal to travelers for convenience, financial considerations, and environmental conservation. In recent years, individual carpool arrangements and grassroots bicycle cooperatives have grown into public and private programs and initiatives, meeting the needs of many growing, urban markets.

Figure 10 shows the location of ride-share, car-share, and bike-share programs across the United States. The icons represent the presence of at least one program documented in that location. Although shared mobility programs are concentrated in urban areas and along transportation corridors, the demand for these programs is growing and includes locations in smaller urban areas and university towns. Forty-seven states and the District of Columbia have at least one type of shared mobility program as of 2015.

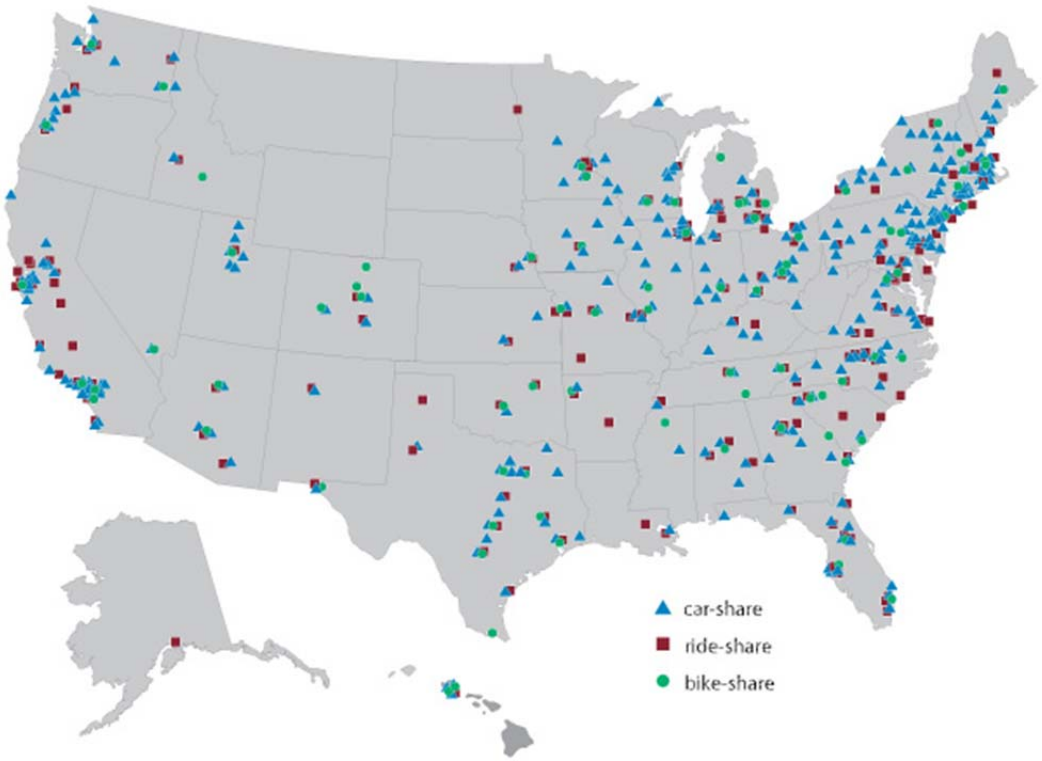



**Figure 10. Shared Mobility Programs across the United States as of October 2015.**

Note: Icons represent the presence of one or more programs in a particular region, but not how many exist.

## Ride-Share by the Numbers

In 2014, there were 27 ride-share programs in the United States with over 165,000 registered users. Programs operating in the United States include Uber, Lyft, Carma Carpool, ZimRide, and iCarpool. More recently, platforms for long-distance ride coordination, such as eRideShare, Ridester®, Carpool World®, and RidePost®, have led to increased privatization of ride-share and a less formal approach to ride-share. These companies use digital platforms that can be accessed from any smart mobile device to connect drivers and passengers in real-time. These real-time ride-share programs have found resistance in many cities from the taxicab industry and officials. As noted earlier, the details surrounding these programs change almost as dynamically as the ride-share they support.

Capturing the actual number of ride-share users in the United States is difficult because:

- Online coordination systems provide the opportunity for individuals to organize their own shared rides independent of the public programs.
- Private providers are hesitant to disclose proprietary information.

### Car-Share by the Numbers

As of January 2013, there were 46 car-share operators, over 1 million members, and over 15,000 shared vehicles in North America. The United States was home to nearly 900,000 of those members sharing over 12,000 vehicles from 25 operators (*21*).

Major programs operating in the United States include Enterprise Carshare®, Car2Go, Flexcar®, and Zipcar®. In 2013, three large providers in the United States represented 88 percent of total membership (*21*). Program funding for car-share has included private-sector investment, public start-up funding, and/or federal grants. In some cases, local governments may not provide direct financial support but instead support car-share through parking provision, marketing, or subsidized memberships for employees or partner organizations.

Car-share tends to succeed in areas with high density, low vehicle ownership rates, parking pressure and neighborhood design that allows residents to live without a car (*29*). Both convenience and affordability have been cited as the main reasons people use car-share services, in part because they can mitigate the financial pressures of car ownership or they live in neighborhoods with limited parking.

### Bike-Share by the Numbers

In 2014, there were 81 bike-share programs operating in the United States, including large-scale operations from companies such as B-Cycle™ and Motivate® (formerly Alta Bike Share [*38*]) in multiple cities.

## CURRENT STATE OF SHARED MOBILITY PROGRAMS IN TEXAS

Shared mobility programs are active in Texas. Figure 11 shows the locations of shared mobility programs in Texas. The icons represent the presence of at least one program documented in that location.

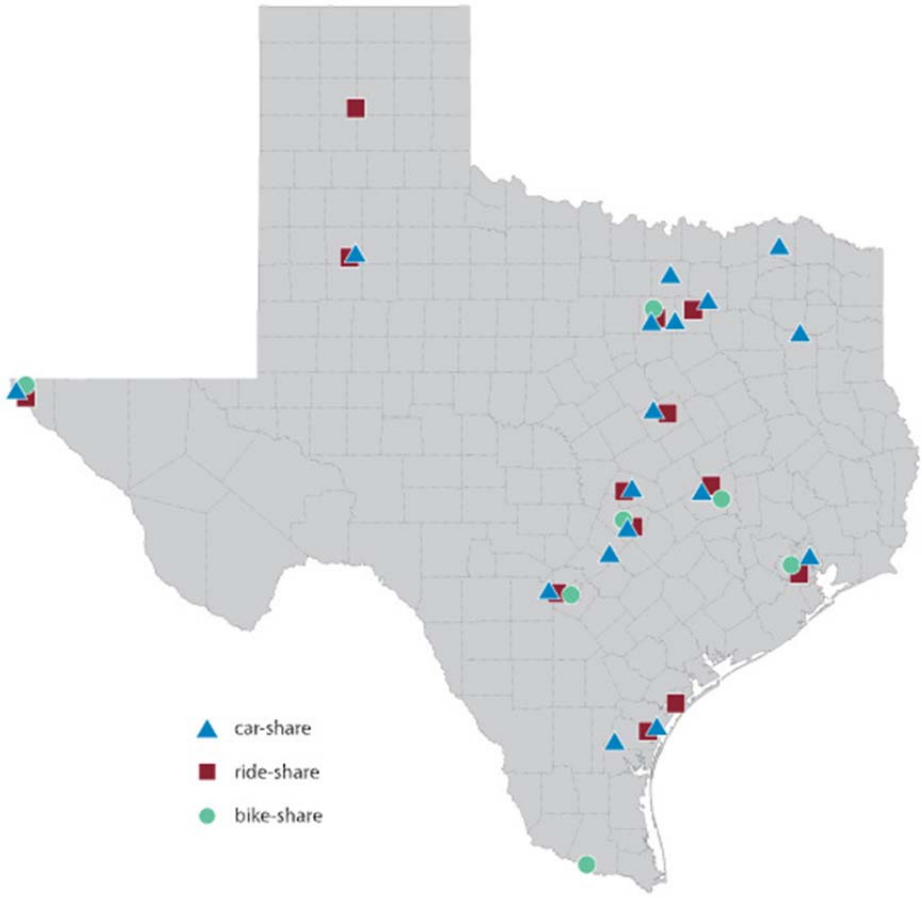



**Figure 11. Mobility Program Locations across Texas as of October 2015.**

One car-share program, RelayRides, is not fully represented on this map because the location of vehicles is not constant or consistent. Private vehicle owners anywhere can add (or remove) their vehicles at any time, therefore making it difficult to capture the number and location of available car-shares with this program.

### Ride-Share in Texas

There are currently three dynamic ride-share programs actively operating in Texas: Carma, Uber, and Lyft.

Founded in 2007, Carma uses real-time carpooling technology and offers services in Austin, Texas. Carma is participating in a dynamic ride-share pilot project with the Central Texas Regional Mobility Authority (CTRMA) that began in late 2013 and provides toll reimbursements for users on 183A and Manor Expressway in Austin.

Uber and Lyft began operating in Texas in late 2013. They have more recently developed ride-share services called UberPOOL and Lyft Line that facilitate ride-share, rather than just a single

rider hailing a driver. These private companies operate in 11 Texas cities. Houston and Austin have recently approved Uber and Lyft to operate legally under new regulations (*39*).

*Dallas Ride-Share Ordinances*

Dallas, Texas, developed regulations that serve as a compromise between ride-share companies, traditional taxicabs, and public safety. The ordinance accommodates ride-share into its existing vehicle-for-hire ordinance. According to one report, TNC representatives applauded Dallas for its ability to balance public safety concerns and open-market entry (*40*). City officials believe the new rules will set the stage for officials to pursue a regional car-for-hire policy and plan to continue working with the North Central Texas Council of Governments to craft such a policy. The new ordinance states that:

- Hail-able vehicles, such as taxis, will have maximum rates, while other ride-share fares will be unregulated.
- All drivers must undergo a background check.
- Vehicles must now undergo a 31-point inspection.
- There will be two tiers of commercial insurance: one for when an operator is available to accept riders and another for when he or she is picking up or carrying riders.

*San Antonio Ride-Share Ordinances*

San Antonio, Texas, passed a highly restrictive ordinance regulating TNCs in December 2014. After weeks of public protest, both Uber and Lyft announced they would cease operations in San Antonio after April 1, 2015, due to the strict ordinance imposed by the city (*41*). The ordinance requires drivers for ride-share companies to have:

- A city-conducted 10-fingerprint background check, in addition to the background check required by the TNC.
- A drug test.
- A review of their driving record.
- An initial and yearly vehicle inspection (including random checks).
- Proof of personal insurance.
- Documentation of these requirements.
- A driver and vehicle permit, issued at a cost of $175.

The City Council was able to come to an agreement with TNCs in August 2015 that gives drivers the option to volunteer to undergo the city's background check in addition to the background check already required by TNCs. As of October 13, 2015, Uber has resumed operations in San Antonio, and Lyft has yet to announce an official start date (*41*).

**Car-Share in Texas**

Car-share in Texas started in 2006 with the nonprofit CarShare Austin, which later closed. In 2010, Car2Go launched its first North American program in Austin. Car2Go began with a pilot program operated through a public-private partnership with the City of Austin, offering reserved parking and shared vehicles for city employees to use during business hours. Today, Car2Go has over 300 vehicles available to share in Austin, and membership is open to the public.

There are six other car-share programs operating in Texas: U-Haul Carshare®, Enterprise Carshare, Zipcar, Hertz on Demand®, RelayRides, and Getaround. These programs are active in Austin, Dallas, Houston, San Antonio, and other locations around the state. Among P2P models, Getaround is currently available only in Austin, while RelayRides has an active program in more than 70 locations across Texas.

Users must become members to use the shared vehicles and are able to reserve a car via web or telephone request. The pricing structure of these programs varies depending on the needs of each customer. For example, Zipcar offers different monthly driving plans that include a set amount of pre-paid driving hours, whereas Car2Go offers pricing rates by the minute, hour, or day. Typically, these companies will install several stations across each city to provide the user with flexible locations to pick-up and drop-off a vehicle (*16*,*42*). RelayRides and Getaround operate on a peer-to-peer model (*43*,*44*). These companies offer comprehensive insurance policies to protect both the vehicle owners and renters.

### Bike-Share in Texas

The first bike-share program in Texas began in 2011 in San Antonio through a public-private partnership between local governmental agencies and operator B-Cycle (*45*). As of August 2015, there are bike-share programs operating in Austin, College Station, Dallas, El Paso, Fort Worth, Houston, McAllen, and San Antonio. Details on these programs include:

- B-Cycle in San Antonio, operated by San Antonio BikeShare, is the largest bike-share fleet in the state with 450 bicycles and 53 docking stations.
- B-Cycle also operates in Austin with 276 bicycles at 43 stations, in Houston with 194 bicycles at 28 stations, and in Fort Worth with 300 bicycles at 35 stations (*45*).
- MaroonBikeShare at the Texas A&M University campus in College Station has 250 bicycles at nine docking stations around campus.
- McAllen is B-Cycle's newest bike-share program in Texas, with 80 bicycles at 8 stations (*46*).

The bike-share programs in Texas are operated by both private companies and nonprofit organizations. Funding for bike-share programs in Texas is provided from various sources such as federal grants, local stakeholders, donations, usage fees, and sponsorship opportunities.

## POTENTIAL BENEFITS OF SHARED MOBILITY

Shared mobility programs have the potential to offer multiple benefits to the communities and regions where they are implemented. However, research on the benefits of these programs is somewhat limited at this time due to limited operations and a lack of publicly available data. This section summarizes existing research findings on the benefits of ride-share, car-share, and bike-share.

### Ride-Share Benefits

Many traditional ride-share programs began as part of a larger effort to mitigate air quality concerns and congestion. Similarly, some dynamic ride-share programs have explicit goals to

decrease the number of single-occupant vehicles and associated vehicle miles of travel. Several TNCs are experimenting with allowing drivers to add additional passengers who then split the cost of the ride.

Dynamic ride-share programs have the potential to achieve those goals but currently appeal to many users for cost savings and convenience. The congestion relief and accessibility benefits sometimes suggested are not yet proven; additional evaluation and research should be done to quantify potential benefits.

Benefits of ride-share technology to users include:

- Smartphone integration.
- User-friendly interface.
- GPS tracking functionality.
- Ride-matching algorithm.
- User profiles.
- Social network integration.
- Driver and user rating system.
- Cashless transactions.
- Real-time maps showing nearest driver(s) (*9*).

The success of ride-share programs across the United States suggests that they provide a service that may be filling a gap in the existing set of transportation services. Currently, ride-share programs operate in larger urban areas, offering a new user experience for point-to-point travel. The use of new technology enabling real-time and dynamic ride-matching has the potential to increase the use of ride-share.

The technological and operational aspects offered by TNCs such as Uber suggest that their business model could be replicable in small towns or rural areas where car and vanpool programs have previously demonstrated success, but there is no research at this time to confirm that notion.

*Cost Savings*

A 2010 Virginia Tech study exploring the benefits of ride-share found that the main factor attracting survey participants to ride-share is cost. In that survey, 82 percent of the 125 participants said they would consider ride-share to save travel costs (*47*). A comparison of Uber and taxi trip costs found that Uber trips are less expensive than taxi trips in 20 out of 21 U.S. cities, including Dallas and Houston (*48*).

*Vehicle Trip Reduction*

Existing evidence suggests that the extent to which ride-share reduces vehicle trips varies by program design. For instance, Carma is designed specifically to combine several drive-alone trips into one ride-share trip.

However, TNC programs have less potential to generate traffic or environmental benefits. Table 2 presents the results of a survey in San Francisco on how a ride-sourced/ride-share trip would

have been made otherwise. The results show that few trips would have been made with a personal vehicle, and some would have been made by low-impact modes such as walking or biking (Table 2).

**Table 2. Survey Results on Travel Mode Replaced by TNC Ride-Share.**

| Survey Question: How would you have made this trip if UberX/Lyft/Sidecar were not available? | | | |
|---|---|---|---|
| | All Respondents | Do you have a car at home? | |
| | | Yes | No |
| Taxi | 39% | 41% | 35% |
| Bus | 24% | 17% | 33% |
| Rail (BART, streetcar, Caltrain) | 9% | 7% | 10% |
| Walk | 8% | 9% | 6% |
| Bike | 2% | 2% | 3% |
| Drive my own car | 6% | 10% | 0% |
| Get a ride with friend/family | 1% | 1% | 2% |
| Other* | 11% | 12% | 10% |
| **Total** | **100%** | **100%** | **100%** |
| N** | 302 | 175 | 124 |

*Other includes several responses indicating the respondent would have used another ridesourcing service, even though they were instructed not to.
**N = the number of respondents.

*Emissions Reductions*

Carma is an example of a ride-share program that is designed to achieve social goals. Carma's Austin, Texas, operations are documented to have reduced car trips and avoided 160,600 pounds of $CO_2$ emissions as of October 2014. The program generated over $2,500 in toll refunds to travelers using toll roads, in addition to $3,600 in commuting costs shared and 8,200 gallons of gas saved (*49*).

*Equity*

According to another study led by MIT, a successful ride-share program could provide commuters with major benefits including travel time and cost savings (fuel and parking). The

study also stated that a ride-share program could promote greater equity in the transportation sector by ensuring that mobility is maintained for lower-income travelers (*9*).

**Car-Share Benefits**

Car-share programs provide users access to a vehicle, on the fly or with a reservation, when they need to use it. One car-share vehicle can serve multiple users, reducing the time it spends sitting idle, and allows users to pay only for the time they use the vehicle (*50*).

Car-share has been described as a missing link for travelers who mainly rely on transit or other alternative travel modes but sometimes need a car. Car-share can provide an option for the first- and last-mile journeys that face travelers trying to connect from existing public transportation infrastructure to their final destination. Companies or agencies that face parking constraints might join car-share programs so that their employees have alternatives to driving private vehicles for work trips.

Car-share programs currently operate mainly in areas with high density, low vehicle ownership rates, parking pressure, and transit service (*29*).

The findings of multiple studies indicate that car-share may contribute to less congestion, increased use of active transportation and associated health benefits, lower development costs, and reduced parking demand.

Some of the benefits attributed to car-share have been well documented in literature (especially in neighborhood-residential markets), while other aspects are either difficult to quantify or have not been well studied.

Four well-documented benefits attributed to car-share, mainly focused on neighborhood-residential markets, include:

- Lower individual transportation costs.
- Reduced vehicle ownership.
- Reduced VMT.
- Lower greenhouse gas emissions.

*Cost Savings*

Studies have reported that 25 percent of North American car-share members have sold a vehicle and an additional 25 percent have forgone a vehicle purchase, which eliminates household expenses on car payments, maintenance, insurance, parking, and fuel.

Shifting vehicle use to a system operating on a variable cost structure may lead to behavioral shifts. The per-use charges are thought to make users more aware of trip costs and the need to weigh the costs and benefits of all available travel options.

*Vehicle Ownership Reductions*

For individuals and households, car-share can be a low-cost alternative to owning a car, depending on how often and how far a person normally drives. These savings may depend on the enabling role of transit accessibility for car-share.

Car-share programs are not designed to replace a frequent driving commute. Households with the ability to commute by transit are more likely to be able to replace a personal vehicle with a car-share membership.

*VMT Reductions*

Surveys and academic studies have indicated that:

- On average, each residential car-share household experiences a 44 percent reduction in VMT (*51*).
- Between 12 and 54 percent of car-share members walk more often, 13 to 54 percent take public transit more frequently, and 10 percent bike more often (*51*).
- PhillyCarShare™ reported increased use of non-automotive transportation options among members who gave up a car. Forty percent of members who gave up a car reported that they walked more, while 34 percent reported an increased use of public transportation, 18 percent reported more frequent bicycling, and 13 percent reported taking more taxis (*52*).

A car-share trip that replaces a public transit trip may contribute to more VMT, $CO_2$ emissions, and roadway congestion. However, in another scenario, if a local resident joins a car-share organization and, as a result, foregoes the purchase of a second car, this could redistribute that car's trips among car-share, ride-share, transit, and non-motorized modes to decrease overall household VMT.

*Emissions Reductions*

Various studies have reported reductions in emissions:

- Household gasoline consumption declined by 34 percent in a survey of over 2,000 car-share members in North America (*14*).
- On average, each household that adopts car-share reduces carbon emissions by 0.84 tons per year (*53*).
- A 2013 study of over 2,000 car-share members surveyed in North America found that car-share led to a 27 percent reduction in carbon dioxide emissions. If the avoided emissions of forgone vehicle purchases are also considered, the North American estimate increases to a 56 percent reduction in emissions by car-share members. European studies indicate similar reductions of between 39 percent and 54 percent (*14*).

**Bike-Share Benefits**

Biking is a healthy travel option that can take travelers off other congested travel routes. Bike-share programs provide a low-cost, flexible, and convenient biking option. Bike-share programs help address the first- and last-mile commute that faces travelers trying to connect

from existing public transportation infrastructure to their final destination. Programs also provide a transportation option that can serve short trips, tourist activity, and recreational activity. Programs operate in cities in Texas and across the United States that vary in population, urban form, and culture. Despite the fact that the outcomes vary with location and system design, consistent benefits have been identified.

Some purposes for bike-share programs include:

- Increase the health of communities by encouraging active transportation.
- Connect bikes with transit networks that have long distances between stations (first/last-mile considerations).
- Induce efforts to develop bicycle and pedestrian plans.
- Improve safety for bicyclists and pedestrians.
- Encourage tourism by providing a fun, dynamic mode to move about cities.

*Cost Savings*

A bike-share membership provides a low-cost transportation option: A bike-share membership typically costs between $50 and $115. In contrast, the average annual combined fixed and variable cost of vehicle ownership was approximately $9,000 in 2013 (*54*), and the cost of operating and owning a bike is about $308 per year (*55*).

The marginal cost of each bike-share trip is often free for short trips, which incentivizes marginal bicycle trips and keeps costs low for individual users. Like car-share programs, bike-share members are not responsible for the additional costs of maintenance, storage, or theft.

Bike-share members may replace vehicle trips with bicycle trips, but bike-share is generally viewed as one element of multimodal travel rather than a direct replacement for a personal vehicle.

*Emissions Reductions*

As a non-motorized form of travel, biking produces less $CO_2$ and pollutants than any motorized form of travel. Additionally, most bike docking systems are solar powered. Solar docks do not require a connection to the power grid and thus can reduce installation costs and offer a higher level of flexibility in station relocation.

*Health Benefits*

Bike-share has been found to increase cycling mode share between 1.0 and 1.5 percent in cities with existing low cycling use (*56*). The International Bicycling Fund suggests that the average person can lose 13 pounds in one year by switching to commuting by bicycle (*57*).

In a survey of Texans, the most important reasons that respondents gave for possibly using bike-share included that bike-share is fun and a way to get exercise. Similarly, bike-share users in New York City reported bike-share is appealing for exercise, recreation, and fun (*58*).

*Transit Integration*

Some programs have located bike-share stations to meet the goal of providing first- or last-mile connections to transit service. Evidence has shown that bike-share trips sometimes replace trips that would have been made on transit, such as in a busy, congested downtown area, but bike-share trips are used to complement transit when coupled with remote transit nodes as a last-mile connection.

*Local Economic Activity Boost*

Survey results suggest that bike-share programs can have a positive impact on the local economy. More than 8 in 10 respondents of the Capital Bikeshare survey said they were either much more likely (31 percent) or somewhat more likely (52 percent) to patronize an establishment that was accessible by Capital Bikeshare (*59*). A 2011 study looking at 58 separate projects found that $1 million invested in bicycle infrastructure produced 11.4 jobs, compared to 7.8 jobs for road-only projects (*60*). Researchers in Minneapolis, Minnesota, reported that Nice Ride users spent, on average, an extra $1.29 per week on new trips because of Nice Ride. When that total was projected out for the overall survey sample, it amounted to more than $900 per week in new economic activity, or about $29,000 over the Nice Ride season (April through November) (*61*).

## EMERGING TRENDS

Shared mobility programs are evolving rapidly. Many programs are embracing technology to enhance functionality and ease the user experience.

### Transportation System Integration

Shared mobility programs offer new opportunities for accessibility and the potential to reduce strain on existing transportation networks**.** While some efforts have been made to integrate ride-share, car-share, and bike-share individually with existing public transportation systems, shared mobility services can be most effective if integrated with multiple elements of existing systems. Each shared mobility strategy fits within specific roles for users within the larger transportation system.

While car-share can eliminate the need for a second household vehicle by providing access for sporadic usage, bike-share can aid transit in closing the first- and last-mile connections, allowing transit service to become door-to-door competitive. Ride-share has the ability to provide non-daily or emergency travel for individuals relying on alternative transportation for commute trips within the system.

Many programs are already working toward multimodal platforms and integrating shared mobility into existing systems.

*Universal Transit Cards*

Universal transit cards or passes are uncommon in the United States but are found in locations around the world (*62*). In the United States, the most common universal pass system is provided

through contractual agreements between transit agencies and universities. Every student is given universal access to transit services, and that access is verified or linked to their school ID and paid for by student activity fees collected by the university (*63*). Regional transit cards are also common, such as the Clipper Card in the Bay Area, and allow for seamless payment integration in regions with several transit service providers (*64*).

*On-Demand Public Transit*

The mobile technologies that have enabled the popularity of shared mobility programs have the potential to improve public transit service. Data collected from current transit riders could feed advanced algorithms that eventually allow transit vehicles to follow demand-responsive routes. Transit providers could provide real-time pick-up and drop-off locations, wait time, and travel time via smartphone apps, like Uber and Lyft currently do for their programs. Some niche shared mobility programs offer this type of dynamic bus travel in select U.S. cities (*65*).

The City of Helsinki, Finland, is exploring the idea of a mobility-on-demand system that uses a single subscription to let travelers access and pay for public transit and multiple shared services (*66*).

The premise behind this action is to reduce the necessity of auto ownership within the city by allowing users to price their trip by mile, by trip, or as a monthly fee. Initiated through government agencies, the vision is to open all data to the private market, allowing for competitive trip planning marketplaces to emerge.

The first steps toward this goal were initiated in 2012, when Kutsuplus (Finnish for "call plus") was initiated. Essentially a flex bus system, Kutsuplus allows users to call an automated microbus service, with price depending on time of day and willingness to carpool. The service costs more than public transport but less than a taxi, and is viewed as a tool in last-mile transit connectivity (*67*).

*Universal Mobility Apps*

Mobile technology and transportation data availability have enabled the development of universal mobile applications that provide real-time travel information. Building upon existing travel information services (mapped directions, travel time, and travel cost estimates), the innovation is to combine all transportation options into a single interface that allows a user to directly compare multiple attributes (e.g., wait times, travel times, traffic, costs, calories burned) of public transportation, ride-share services, car-share availability, bike-share availability, biking, walking, or driving a personal automobile (*68*). The end goal is a universal mobility app that incorporates personal preferences of its members and helps users find their best ride given the specific trip and their personal preferences.

RideScout and City Mapper are examples of a transportation integration platform that allow for a real-time comparison of all transportation options. On June 5, 2014, RideScout won the USDOT's Data Innovation Challenge award (*69*). As of 2015, RideScout is in operation in 69 cities across the United States. City Mapper is available in 30 cities worldwide as of October 2015 (*70*).

*Cross-City Integration*

Several shared mobility programs allow customers to use the services in cities other than the one in which they joined. Ride-share TNCs like Uber can be used in any city where it operates. Car2Go and Zipcar memberships are valid in other U.S. cities where the programs operate. B-cycle, a bike-share operator contracted in dozens of cities, markets a B-connected campaign. This integrated B-cycle system allows annual members to easily use systems outside of their home city.

*Competition Apps*

NuRide (Figure 12) is a mobility app that encourages alternative transportation through gamification and competition (e.g., Fitbit, Foursquare, smartypig). Currently funded by participating state and local governments, NuRide allows users to earn points for each recorded non-automotive trip (carpool, transit, bike, walk, telecommute, etc.) with the potential to earn up to $300 a year worth of discounts and coupons from participating partners. Currently, NuRide is only available in participating localities, including San Antonio and Houston, Texas (*71*).


**Figure 12. NuRide Logo (*71*).**

**Transportation Demand Management Program Integration**

Transportation demand management (TDM) is the term given to efforts to redistribute system demand through the use of alternative modes or travel during non-peak hours. This is achievable through multiple strategies and programs that fall into the TDM toolbox. These tools can be established individually or, as in most cases, implemented in concert to provide larger system impacts than can be achieved alone. Traditional TDM techniques include encouraging businesses to enact flex hours or offer subsidized transit passes for employers. Employing dynamic pricing on roadways and implementing intelligent transportation systems helps optimize congestion-prone zones.

Much of what shared mobility programs are able to accomplish occurs in conjunction with existing TDM programs. An employer's ability to offer car-share opportunities can allow workers the flexibility to use transit for commuting, with access to an automobile in an emergency. Bike-share can play a role as a last-mile link between transit stations and a traveler's final destination. Ride-share offers smartphone-based carpooling opportunities that reduce existing logistical barriers in traditional car-share strategies.

*Denver, Colorado*

In 2014, the Denver Regional Council of Governments created Multimodal Toolkits, a program targeted at improving non-automobile transportation for low-income residents. Based on a unique partnership between Boulder Housing Partners (BHP), eGo CarShare, and Boulder B-cycle, the program received a $100,000 CMAQ grant that will fund the program for two years.

The program includes a discounted cost for transit passes (often free), free membership to the regional bike-share, and discounted (50 percent) car-share rentals. Results have shown that 78 percent of the initial 280 BHP residents in the program have used at least one alternative mode (*72*).

*GreenTrip*

GreenTrip is a certification program of TransForm, a mobility advocacy group in the San Francisco Bay Area. GreenTrip is a traffic reduction and innovative parking certification program that allows developers to reduce parking requirements in exchange for viable shared mobility strategies including locating bike-share and car-share parking on site, decoupling rent and parking costs, and offering free or discounted transit and/or car-share memberships that are linked to each unit at a 40-year time frame (*73*).

## Program Trends

Ride-share, car-share, and bike-share programs are experimenting with new strategies and tools that are specific to the modes. These program trends are summarized in Table 3 and discussed in more detail in the rest of this section.

**Table 3. Emerging Trends for Shared Mobility Programs.**

| Ride-Share | Car-Share | Bike-Share |
|---|---|---|
| ▪ Handicapped accessibility.<br>▪ Long-distance ride-share.<br>▪ Autonomous vehicles. | ▪ Handicapped accessibility.<br>▪ Long-distance car-share.<br>▪ Alternative fuels. | ▪ Cargo bicycles for large loads.<br>▪ Electric-assist for children.<br>▪ Bike-share for children.<br>▪ Smart bikes. |

*Ride-Share Trends*

There are several emerging trends in the ride-share industry, including long-distance ride-share, handicapped-accessible rides, and autonomous vehicles.

### Long-Distance Ride-Share

While not prevalent in the United States, long-distance ride-share programs are common in Europe. One online ride-share marketplace (BlaBlaCar.com) has experienced rapid growth in long-distance ride-share in recent years. Drivers post planned trips and the number of available seats for their journey, along with personal and vehicle information tied directly to social media accounts.

Users, also through social media accounts, can use the website to search for city-to-city trips at prices capped at cost saving levels. This means drivers will not make a profit on their trip (they reduce their costs) and riders are guaranteed cheap intra-city travel (*74*).

### Handicapped-Accessible Rides

One issue that is raising concern with the growth of TNCs such as Uber and Lyft is the lack of handicapped accessibility when compared to the traditional taxi services with which they directly compete. Potential regulations to require TNCs to offer accessible services are being explored currently by the San Francisco Metropolitan Transit Authority (*75*).

### Autonomous Vehicles

Autonomous and connected vehicle technologies are being developed, and some predict these advancements could be applied to ride-share models. Both Google and Uber have expressed interest in developing driverless taxis and are in preliminary research and development phases (*76*). Uber is partnering with Carnegie Mellon University to develop autonomy technology (*77*).

## *Car-Share Trends*

Emerging trends in car-share programs include handicapped accessibility, long-distance car-share, and alternatively fueled car-share vehicles.

### Handicapped Accessibility

City CarShare in San Francisco created the first wheelchair-accessible car-share vehicle in 2008, called AccessMobile. The program offers minivans that accommodate two people using wheelchairs along with three other passengers and a driver.

### Long-Distance Car-Share

Several car-share providers are exploring long-distance or city-to-city car-share services, rather than the current focus on travel within a single city or region. This type of service continues to blur the line between car-share and traditional car rental programs but reflects the provision of flexibility and choice that defines many of the shared mobility programs.

### Alternative Fuels

Gasoline- and diesel-fuel vehicles are the most common, but many programs are incorporating low-emission vehicles, hybrids, and electric vehicles into their fleets. Car2Go's fleet comprises

entirely smart, two-door, two-passenger vehicles. Electric vehicles have been incorporated into the fleets of Zipcar, Car2Go, City CarShare, and others.

*Bike-Share Trends*

Bike-share programs are evolving to include cargo bicycles, electric-assist bicycles, bike-share for children, and smart bicycles.

### Cargo Bicycles for Large Loads

B-Cycle Madison, Wisconsin, initiated a cargo tricycle pilot program in 2013 with specialized stations and tricycles in addition to traditional bike-share. The program aims to increase total bike-share accessibility by providing tricycles for trips requiring larger carrying capacity (*78*).

### Electric-Assist Bicycles

An electric-assist bicycle (Figure 13) is a standard bicycle augmented with an electric motor to assist with pedaling and up-hill travel. Madrid, Spain, was the first European city to launch a fully electric bike-share system in 2014 (*79*). An electric assist can enable more people to travel by bike and expand the bike-share system to a wider geographic audience. Electric-assist bicycles have the potential to turn bike-share into a regional system, instead of one limited to a downtown or tourist area.

**Figure 13. Electric-Assist Bicycle.**

### Bike-Share for Children

Vélib', the world's third largest bike-share program, located in Paris, France, expanded to the toddler market in 2014 (*80*). P'tit Vélib' has 300 children's bicycles in four different sizes for kids 2 to 10 years old. It also provides child helmets. The bikes are available at five different locations around the city—strategically placed near public parks and pedestrian-only areas. These bikes must be returned to the same station as pick up.

**Smart Bikes**

Smart, or dockless, bikes are embedded with bike-share technologies so that the bike dock infrastructure is not required. The GRID bike-share program in Phoenix, Arizona, uses smart bikes that are equipped with solar-powered, GPS-enabled locks and can be parked at either the official stations or traditional public bike racks within the service district. An additional $2 charge for district parking encourages official station usage, and a $1 credit for returning a district park bike to a station incentivizes system balancing (*81*). These bikes can decrease the capital costs associated with docking stations, offering a lower-cost option to pilot a bike-share program.

# CHAPTER 3: STAKEHOLDER INPUT

Researchers used a combination of quantitative and qualitative research methods to gather stakeholder input about these shared mobility programs and their connection to statewide mobility. Focus groups were used to capture detailed impressions of uses and potential users of any of the programs. A web-based survey used information gathered in the focus groups to further understand travelers' decision-making about using the programs. Finally, interviews were conducted with "implementers" of shared mobility programs. In this context, "implementers" refers to cities or agencies that have established or are considering establishing such programs, and the private-sector providers who enable the programs. Researchers interviewed several people with knowledge of these programs, either as implementers, researchers, or program representatives.

This chapter summarizes key topics that surfaced during the focus group discussions, web survey, and executive interviews. For full details on stakeholder input gathered for this research project, please refer to Appendix D.

## FOCUS GROUPS

Researchers with the Texas A&M Transportation Institute (TTI) conducted a series of focus groups to capture the public's perceptions and understanding of the three shared mobility programs. The focus groups evaluated initial awareness of these modes and determined what features or benefits are most impactful for participants to use one of these modes. The focus groups also identified the largest obstacles to potential use of these modes.

The focus groups were held in large urban areas in Texas—Austin, Dallas, Houston and San Antonio. With input from the TxDOT project advisors, these cities were chosen because large urban areas either currently offer one or more of these travel options already, or are likely to in the future.

Focus group sessions were advertised through social media, and information about the focus group opportunity was sent to previous TTI focus group participants via email. Advertisements for each session were posted at least two weeks before the session, and respondents were directed to a website where they provided various socio-demographic data, such as gender, age, race, education and income. The research team used the data provided to select participants so that each session would have a broad representation of the population. Each session lasted approximately two hours, and participants were compensated $50 each for their time.

Focus groups are, by their nature, qualitative. The results of these sessions cannot be extrapolated to the general population of Texas. Not only was the sample not statistically significant, but the composition of the groups was not socio-demographically representative of the entire state in all sessions. In other words, most or a majority of participants agreeing or disagreeing with something presented in the session does not necessarily extrapolate to the general public's support or opposition. Focus groups do, however, allow researchers to understand the why behind a particular opinion.

The following is summary of key topics revealed in the focus group discussions:

- **Convenience.** The convenience factor that shared mobility services provide a user was important, and technology enables this.
- **Safety and Security.** Several aspects of safety and security were important to the participants, including maintenance of the vehicles and bicycles, and safety as a passenger riding with a stranger. The lack of dedicated bicycle infrastructure was also a safety concern for participants when discussing the bike-share programs.
- **Cost**. Though not all participants understood how costs are structured and fares calculated for some of these services, nevertheless they were of concern to participants and influenced decision making.
- **Education.** The public needs (and wants) to be educated about these services and the rules and regulations by which they are governed. According to the focus group participants, more education could result in more use.
- **Usage**. Most participants agreed that these shared mobility services were useful on many occasions, but viewed them as a supplement to, not a replacement of, a personal vehicle.

## FOCUS GROUP CONCLUSIONS

The following are conclusions drawn from the four focus group sessions with regard to public perception and understanding of shared mobility programs:

- Though it seemed that shared mobility programs could be useful on many occasions, participants viewed them as a supplement to, not a replacement of, a personal vehicle. However, people seemed unaware of the total cost of vehicle ownership, although they were not asked about this directly.
- Although mindsets do not change overnight, many indicated they would use these services more often if more education, advertising, public information and promotions were readily available.
- The convenience of these services was very appealing to the focus group participants.
- Safety and security are key aspects to these services, and it should be the responsibility of the vendor to properly select drivers.
- Transparency is important to encourage more use.
- Participants did not think these options could improve overall mobility in a region by removing cars from congested roadways.

## STATEWIDE WEB SURVEY

Researchers conducted an online survey with a focus on participants in larger Texas cities, including Austin, Houston, Dallas, Fort Worth, El Paso and San Antonio. The questions for the survey were designed based on literature review findings (Chapter 2, Appendix A, B, C) and focused on the objective of the research: to determine the impact of these modes on travel. The survey covered various topics, including the respondents':

- Current travel behavior.
- Awareness of dynamic ride-sharing, car-sharing, and bike-sharing.

- Initial impressions of the new travel options.
- Factors affecting their decision to choose or not to choose dynamic ride-sharing, car-sharing, and bike-sharing.
- Understanding of the role of dynamic ride-sharing or car-sharing on auto ownership.
- Socio-economic and demographic information of the respondent.

After many internal tests, the survey was launched for public input on January 16, 2015, and closed to input on February 16, 2015. The survey administration and monitoring was performed using the LimeSurvey™ website. The online version was made available to the public through the TravelSurveys.org website. It was distributed to residents all over Texas to gather their opinions on dynamic ride-share, car-share and bike-share programs and their potential uses. The type of survey promotion used resulted in a choice or non-random sample. Several methods were used to advertise and promote the web survey, including emails sent to TTI's past participant database, a press release targeted toward transportation media and efforts made through social media.

Just over 500 survey respondents provided information on their current and potential use of these modes, plus what features were most critical in their using or not using the modes. Overall, there was support for the modes, with significant percentages of people who had used the modes previously (32 percent used dynamic ride-share, 28 percent used car-share and 33 percent used bike-share) and would have used one of the modes if it had been available for their recent trip (15 percent to 30 percent of respondents). There were more than 10 percent of respondents who indicated that the availability of these modes would allow them to reduce the number of vehicles owned in their household. Therefore, according to survey respondents, these modes are likely to have an impact on future travel behavior and travel demand.

Based on these results there is clearly a great deal of interest in using these modes. However, the survey sample size is small, non-random and likely biased toward travelers interested in these modes. Therefore, the percentage of travelers indicating definite or likely use of these modes cannot be used for planning purposes. However, these results indicate that Texans are open to these new modes of travel, and future travel demand surveys by metropolitan planning organizations (MPOs) may need to incorporate the new modes. Based on these results, it is clear that these new modes have good support and are likely to impact future travel in Texas—at least in larger cities. Therefore, TxDOT should continue to investigate these modes and how they can be used to improve travel for Texans. This includes rules and laws surrounding the use of these modes and possible inclusion of these modes in urban transportation planning models and forecasts.

## INTERVIEWS

TTI researchers conducted structured interviews with representatives from ride-share, car-share, and bike-share programs, as well as government, consultant, and academic interests involved in the field of dynamic shared mobility programs. Table 4 provides a list of the organizations interviewed and topic areas covered.

**Table 4. Interview List.**

| Type | Organization | Ride-share | Car-share | Bike-share |
|---|---|---|---|---|
| Academic | Transportation Sustainability Research Center, University of California (UC) at Berkeley | x | x | x |
| Private | Uber | x | | |
| Private | Carma | x | | |
| Private | Alta Bike Share | | | x |
| Private | Enterprise CarShare | | x | |
| Government | Northern Virginia Regional Commission | x | | |
| Government | City of Austin, City Parking | | x | |
| Government | City of Austin; Former Council Member | x | x | x |
| Government | Washington, D.C., District Department of Transportation | | x | x |
| Nonprofit | Bike Chattanooga | | | x |
| Nonprofit | Denver Bike Sharing | | | x |
| Nonprofit | CarSharing Association | | x | |

Researchers asked interviewees about the different factors that influence the development of a shared mobility program. Other questions dealt with the decision to expand services to new markets, regulations and insurance requirements, data sharing activities and overall perspective on the services provided. Based on the interview responses, some of the factors influencing the development of shared mobility programs involved:

- Efforts to use auction slot bidding for car-share parking spaces on city streets (*82*).
- Issues with regard to sharing proprietary information.
- Considerations for the development of an integrator role to be undertaken by city and regional governments to coordinate the shared mobility services provided.

These interviews show that dynamic ride-share, car-share and bike-share programs have the potential to provide benefits and impose costs to a region. Ride-share, car-share, and bike-share programs may potentially benefit transportation planning efforts in that they all rely on a platform of technology that provides potential access to data on use rates, ridership, and origin/destination pairs. These services provide last-mile connections and improve access for users. Though more research is needed to confirm, based on the interviews, bike-share systems either can lead to street-level safety improvements such as bicycle lanes and the development of complete street policies.

There are also potential costs and negative externalities that are associated with shared mobility programs. Bike-share programs that do not consider the mix of membership riders and walk-up users when they balance network size and pricing may risk bankruptcy. Car-share programs that expand unplanned across a city use on-street parking or disappear into off-street garages and may

end up with a lower frequency of use, which limits its ability to reduce single occupant vehicle (SOV) use. Based on the ride-share interview findings, ride-share programs may lead to induced travel and may take trips from public transit, as well.

The main finding from the interviews is that, in the end, the balance of regulations may affect the level of benefits these shared mobility programs provide. Some regulations may reduce the benefits these programs can provide. Other regulations may give these programs too much room to operate, which may lead to them not providing the benefits they purport.

The stakeholder input activities of this project reveal a high level of public interest in these programs, regardless of prior familiarity with or use of any of them. Though not necessarily statistically valid samples, both the survey and the focus group indicated that public interest is, at the very least, piqued and that people want to know more about the programs and how they might improve personal travel. Implementer interviews provide important information about what market conditions make it possible for programs to operate in a region, and the obstacles that must be overcome in order to serve those markets.

# CHAPTER 4: DEVELOPMENT OF THE GUIDEBOOK

Using a combination of best practices and lessons learned, executive interviews, focus groups, and a general survey, the research team developed a guidebook that provides a thorough understanding of three shared mobility programs.

The guidebook aids planning and mobility practitioners in how to best identify**,** assess, attract**,** and manage shared mobility programs. It also highlights key factors that contribute to the development and success of a shared mobility program. These factors include the role of agencies involved, regulations in force, regional travel behavior characteristics, and vendor criteria for program implementation.

## GUIDEBOOK ORGANIZATION

The guidebook is organized into the following chapters:

1. **Introduction**: a discussion of how and why to use the guidebook.

2. **Shared Mobility Programs**: a short introduction to each program type—ride-share, car-share, and bike-share—and an overview of the three programs at the national and state level.

3. **Assessment**: steps for assessing a region to identify which program(s) best match regional characteristics and goals. This chapter outlines four steps to understand these key feasibility factors:

    - Conduct a Market Analysis—who are the residents, users, and businesses in the region that may use a shared mobility program?
    - Perform a Stakeholder Analysis—who are the individuals and groups that may be impacted by a shared mobility program?
    - Review the Regulatory Environment—how does the local regulatory environment impact a shared mobility program?
    - Establish Program Goals—what goals does the region want to accomplish with a shared mobility program?

4. **Attraction**: key components to attracting shared mobility programs, including the political and regulatory environment, policy considerations, funding and revenue streams, outreach and marketing, and business model factors. There are several key steps to attracting shared mobility programs to a city or region, including:
    - Communicate public support.
    - Integrate with planning and policy.
    - Align regulations.
    - Identify funding sources.
    - Educate and provide outreach to the public and partners on shared mobility.

5. **Management and Operations**: critical factors in successfully managing a shared mobility program, such as the business model type, agencies involved, regulations in force, program costs, and program expansion and evaluation. There is not a one-size-fits-all management approach for these types of programs at the local, regional, and state level. Generally, successful management of shared mobility means:
   - Oversee the business operations.
   - Build and leverage partnerships.
   - Control program costs and revenues.
   - Expand to new markets.
   - Continue ongoing evaluation.

6. **Emerging Trends**: new trends and innovations in shared mobility management and programs that an agency can investigate after the guidebook is published.

## PRACTICAL USE FOR THE GUIDEBOOK

As part of the research process, the content and structure of the guidebook was vetted with members of the TxDOT Project Management Committee and at a workshop with stakeholders in El Paso, Texas, in June 2015.

TTI invited staff from various agencies and local elected officials in the El Paso region to participate in a workshop to review the guidebook and discuss the information contained in it and the usefulness and applicability.

In this half-day workshop, members of the TTI research team presented the guidebook to participants in a series of lessons to gather feedback on the content, practicality, and functionality of the guide. The slide presentation given at the workshop, along with other workshop materials, is located in Appendix F.

Researchers used feedback gathered during this workshop and feedback from the TxDOT Project Management Committee to finalize the guidebook.

# CHAPTER 5: CONCLUSIONS

Shared mobility programs have existed in some form or fashion for decades in the U.S. Technology has allowed the programs to morph to meet the needs of travelers today. The objectives of the programs are also varied depending on your perspective as a user, operator, implementer, or regulator. These objectives may include:

- Reducing SOV travel.
- Improving air quality.
- Reducing congestion.
- Providing use of alternative modes.
- Reducing car ownership.
- Enhancing tourist activities.
- Generating revenue.

It is clear that these programs have a place in today's mobility and can serve to increase access to transportation options. This research provides an important step in understanding the programs and identifying how they may be integrated into a community to enhance transportation options. The guidance provided as part of this research and documented in the guidebook allows TxDOT and its transportation planning partners to gain a better understanding of the mobility programs.

Recognizing there is not a one-size-fits-all approach, the key factors for assessing program viability include the:

- Agencies involved.
- Regulations in place.
- Regional travel characteristics.
- Preference of the population.

This research documented the evolving and growing presence of shared mobility programs. It used best practices and lessons learned to explore the factors important in determining how, when, where, and why programs succeed. Stakeholder and public input identified the issues that should be addressed going forward. Finally, this information was synthesized to create a guidebook that provides TxDOT and its partners with guidance in how to identify, attract, implement, and monitor shared mobility programs.

# APPENDIX A: RIDE-SHARE MOBILITY PROGRAMS

This appendix provides the detailed research and literature review on ride-share programs completed by staff at TTI, including ride-share providers, business models, funding sources, target audience, regulatory considerations, and performance measures.

## DESIGN OF RIDE-SHARE PROGRAMS

### Providers

In this section, a brief introduction to the three main Texas providers for ride-share programs is provided. The purpose of these details is to provide both an understanding of the private sector business approach as well as to show how the approaches vary across providers. It is based on information released to the general public.

*Lyft*

Launched in mid-2012 as a service of Zimride, Lyft facilitates ride-share by allowing passengers to request a ride from available Lyft drivers through their smart phones. Lyft is available in 63 cities around the United States. In order to provide Lyft users a safe and trusted program, Lyft offers a $1 million insurance protection plan. It also requires driving record and background checks for all drivers as well as a vehicle inspection.

Lyft offers three different services: Lyft, Lyft Line, and Lyft Plus. These services give users the option to choose their ride based on their needs with respect to cost and vehicle space. Lyft Line offers rides to interested carpoolers that travel similar routes toward their destination, offering savings of up to 60 percent of an original Lyft ride. Lyft Line is currently available in San Francisco and Los Angeles only (*83*). Lyft Plus offers rides to larger groups of six passengers or more. Lyft's features and services are illustrated in more detail in Figure 14 (*84*).

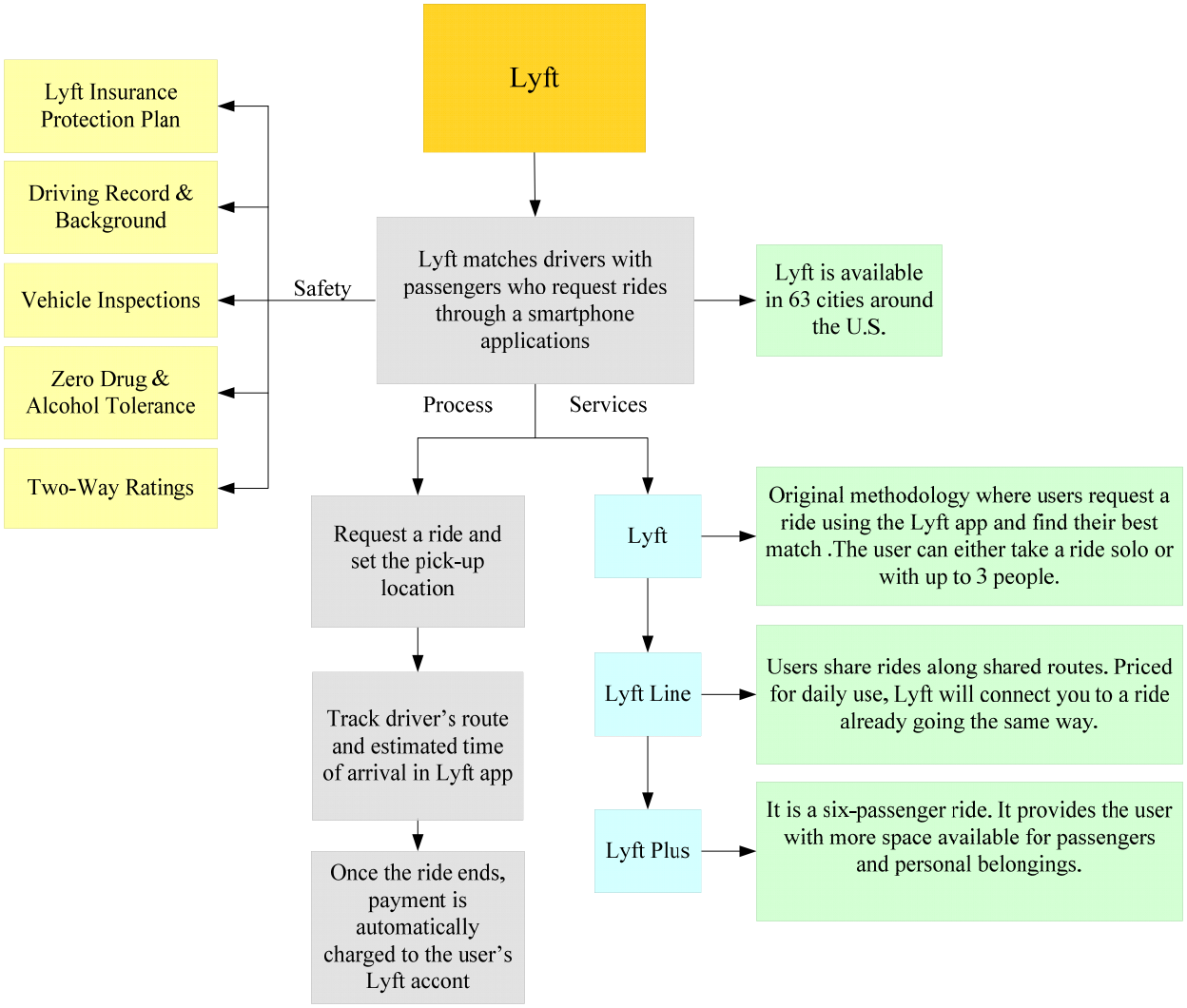



**Figure 14. Lyft Ride-Share System.**

*Uber*

Founded as "UberCab" in 2009, Uber is a ride-share service that connects passengers with drivers through a smartphone application. It is available in 45 countries and more than 210 cities around the world, including 112 cities in the United States. Uber not only offers users the opportunity to share or ask for a ride, it also lets the user indicate the desired type of vehicle and service. Uber currently offers six different services (*85*). UberX, Uberpool, Taxi, Black, SUV, and LUX (*86*):

- UberX is the service designed for everyday use and offers lower rates than its other services.
- Uberpool allows riders to share a ride and split the cost with another person requesting a ride along a similar corridor. The Uber app locates a ride match and notifies each rider.
- Taxi service is similar to regular cab service except the user schedules the pick-up and there is no cash required.

- Black, the company's main service, uses full-size luxury sedans or SUVs. This service is more expensive than UberX as it offers a higher quality of service with a licensed chauffeur.
- The SUV service provides the users with more space, seating up to six people.
- LUX allows users to choose from a selection of luxury vehicles, and is the most expensive service Uber offers.

Figure 15 shows the overall service structure of Uber.

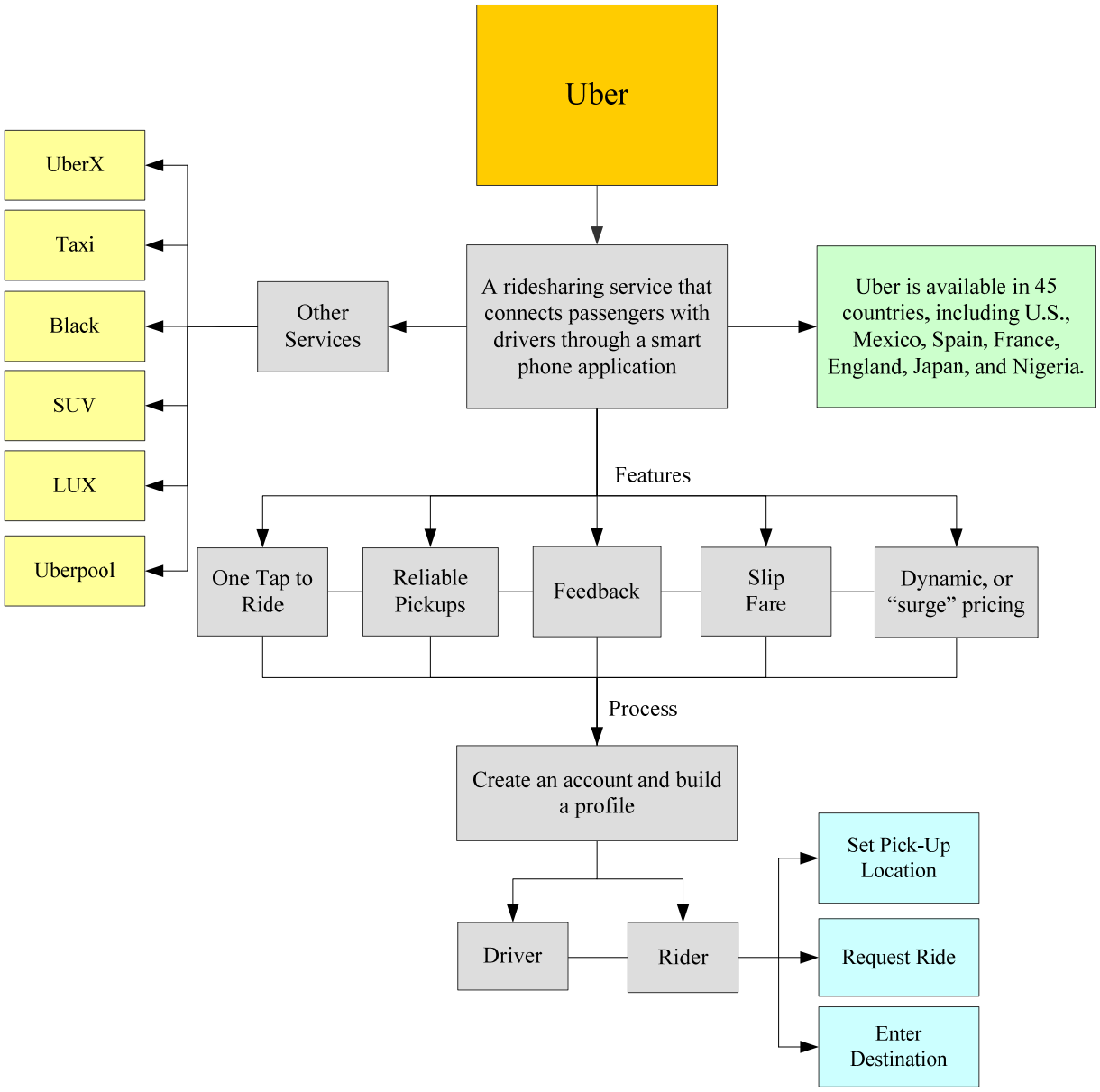



**Figure 15. Uber Ride-Share System.**

*Carma*

Carma was founded in 2007 as a leading company in real-time carpooling technology and offers services in Austin and San Francisco as well as Ireland and Norway. Carma's ridesharing system in Austin operates as a federally-funded pilot program in a partnership with CTRMA. The ride-share pilot program offers exclusive toll reimbursements to Carma users. "Carmapoolers" can get between 50 percent and 100 percent toll reimbursement depending on the vehicle occupancy while traveling along the 183A toll road or Manor Expressway (*87*). To receive this incentive, users must register their TxTag (a toll tag administered by the Texas Department of Transportation) and license plate information. Toll reimbursements are made monthly by CTRMA and credited directly to the user's TxTag account.

In San Francisco, Carma offers a reward system to users as an incentive to invite more people to join the program. There, Carma gives new users a $5 Carma credit for signing up, $10 for inviting someone to join the program, and a $25 Amazon gift card for those users who complete their 25th carpool. The process and features of the Carma application are illustrated in Figure 16 (*6*).

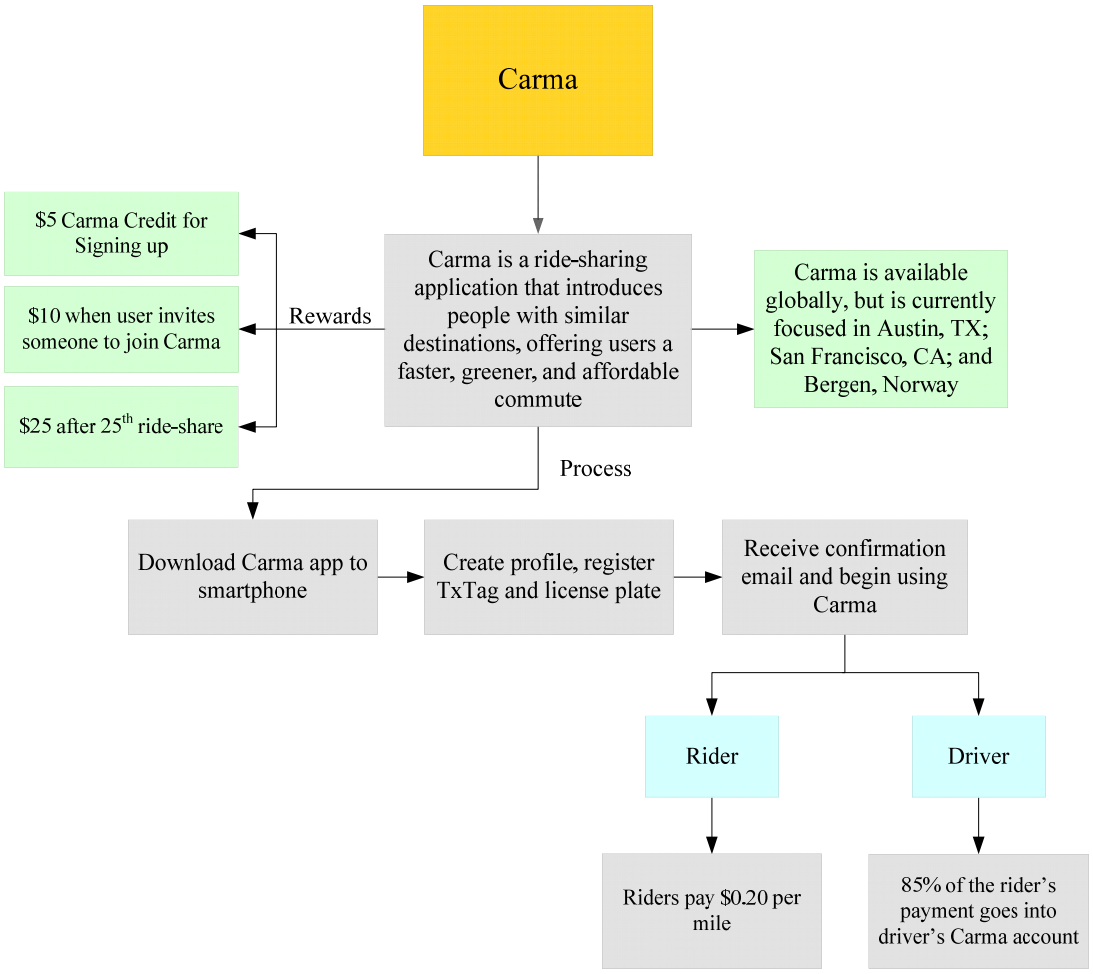



**Figure 16. Carma Ride-Share System.**

**Business Models of Dynamic Ride-share**

As noted above, real-time ride-share providers or facilitators offer free smartphone applications to facilitate matches between drivers and riders. In exchange for acting as an intermediary (or broker), these providers charge a fee for every payment transaction between the driver and passenger. These fees cover business expenses related to platform development, customer support, licensing, and communication costs (*88*). The following list describes the fare split used by dynamic ride-share companies:

- Lyft and Sidecar drivers receive 80 percent of the payment from the passenger(s) while the other 20 percent goes to the ride-share provider (*8*,*89*).
- In the case of Uber, drivers who sign up for UberX in San Francisco on or after September 2, 2014, will receive 75 percent of the payment (*90*).
- Carma carpooling employs a similar model where riders get 85 percent of the total transaction between the driver and the passenger.

Pricing structures typically consist of at least one of the following: base fixed fee per transaction, a minimum trip cost, per mile or per minute cost, and trip cancellation charges. All fees and per mile/minute costs vary depending on the city where the service is being requested.

Table 5 shows an example of the rates for Uber in Austin, Texas (as of September 2014), for both a small vehicle (UberX) and a sport utility vehicle (UberXL) (*85*). Uber's dynamic pricing model includes rate increases during peak hours, specific holidays (e.g., New Year's Eve or Halloween), and bad weather conditions. These times of higher rates are advertised using splash screens within the app (appearing before the rider confirms the ride request). The dynamic pricing model allows Uber to keep drivers available during high demand periods (*83*).

**Table 5. Uber Rate Structure Example for Austin, Texas.**

| Ride Rates ($) | UberX | UberXL |
|---|---|---|
| Base fare | $1.50 | $2.90 |
| Cost per minute | $0.30 | $0.45 |
| Cost per mile | $1.90 | $2.80 |
| Safe rides fee(*91*) | $1.00 | $1.00 |
| Cancellation fee | $5.00 | $5.00 |

Table 6 shows Houston rates according to Lyft's price structure for both small (Lyft) and large vehicles (Lyft Plus) (*92*).

**Table 6. Lyft Structure Example for Houston, Texas.**

| Ride Rates ($) | Lyft | Lyft Plus |
|---|---|---|
| Trust and service fee (*93*) | $1.00 | $1.00 |
| Base charge | $1.13 | $1.69 |
| Cancel penalty | $5.00 | $5.00 |
| Cost minimum | $5.00 | $7.00 |
| Cost per mile | $1.10 | $1.65 |
| Cost per minute | $0.17 | $0.25 |

Carma riders pay $0.20 per mile as part of the Austin pilot program, but drivers have the option to not charge any fee to riders.

**Funding Sources**

The funding for each program varies by provider:

- During summer 2014, **Uber** raised $1.2 billion in funding from a group of mutual fund managers and venture investors. Overall, the company has raised $1.5 billion since it was founded in 2010(*94*).
- In 2014, **Lyft** leveraged venture financing to expand its ride-share service to different cities around the United States. Lyft has raised more than $330 million from external funding since it started in 2007 (*95*).
- **Sidecar** has raised over $35 million to date from investors. Sidecar plans to use these funds to support a nationwide expansion of the company (*96*).
- As of the time of this report, **Carma** focuses recruitment for its service in two cities: Austin and San Francisco.
  - The ride-share program established in Austin, Texas, receives its funds from the FHWA value-pricing program, as administered by TxDOT and CTRMA.
  - In 2011, the Metropolitan Transportation Commission awarded approximately $2 million in 2012 to start the pilot program. Carma in San Francisco works in close partnership with Contra Costa Transportation Authority, Sonoma County Transportation Authority, and with the Transportation Authority of Marin County (*97*).

**Role of Technology**

Technology plays a crucial role in the provision of real-time ride-share services. As noted above, every ride-share provider uses smart technology to connect riders with drivers. With today's technology, ride-share applications can identify the users' current location to find available car services in the area. These applications allow the user to track its driver, while the driver makes its way to the rider. Also, the use of these technologies enables a secure cashless method (payments are made through the application) and access to the driver's profile (*98*).

**Marketing and Target Audience**

As the demand for the ride-share services continues to expand, so do strategies to attract new users. Facebook®, Twitter®, Instagram®, and Google+® are some of the most common media used to advertise services.

According to Travis Kalanick, Uber co-founder and Chief Executive Officer (CEO), the company has been experimenting with unusual marketing campaigns and promotions using Uber's on-demand feature. This feature offers various services that can be requested through the mobile app in select cities and delivered to the specified location. These on-demand campaigns and promotions have included:

- Uber ice cream.
- Roses for Valentine's Day.
- Barbecue in Texas.
- Cuddling with kittens (*99*).

The purpose of these campaigns are to create customer engagement, create an impression on potential ride-share users, and in the case of on-demand kitten, to raise money for animal shelters (*100*).

Lyft has taken a different approach to marketing by launching digital and outdoor ads. In August 2014, Lyft started running a campaign combining both online and offline advertising. The marketing campaign will run for three months in San Diego, California, and Denver, Colorado (*101*). As illustrated in Figure 17, the promotions show actual Lyft drivers and highlight what each driver does for a living besides sharing a ride (*84*).

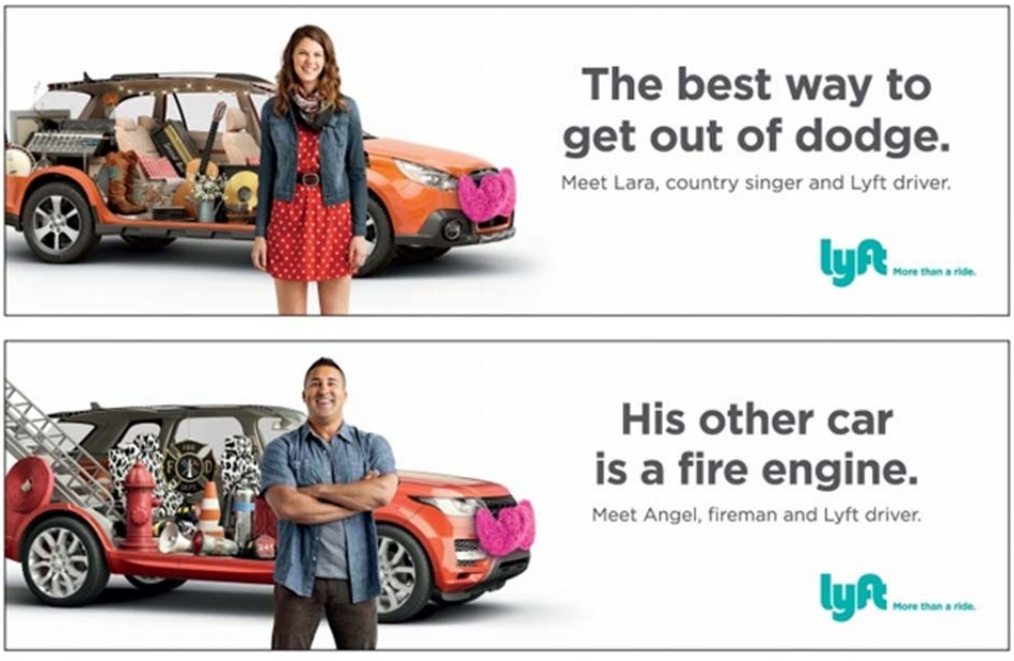



**Figure 17. Lyft Promotional Ads.**

**Partners**

Ride-share providers have established various partnerships to stay competitive in the market. These partnerships often include specific private businesses located in the same area as the transportation providers. Table 7 summarizes some of Lyft's recent partners.

**Table 7. Lyft Partnerships.**

| Date of Partnership | Partner | Partnership Details |
|---|---|---|
| September 2014 | Rock the Vote | Help increase the registration and participation in the 2014 elections. |
| June 2014 | Freelancers Union | Offers Lyft drivers access to high-quality health insurance, retirement plans, and other benefits. |
| June 2014 | AnyPerk | Offer discounts on a variety of perks (e.g., travel, entertainment, telecom) to Lyft drivers. |
| June 2014 | Hawaiian Airlines | Free Lyft rides to new users with the input of a particular promotional code. |
| May 2014 | MetLife Auto & Home | Improve safety by developing insurance solutions to further protect Lyft's drivers and passengers. |

In addition, Lyft has also acquired other businesses to keep improving their service. In March 2013, Lyft acquired *Cherry Mobile Auto Detail & Wash* (*102*). Cherry founder and CEO Travis VanderZander joined Lyft as Chief Operating Officer (COO). In September of 2014, Lyft acquired *Hitch (103)* to include Hitch's ride-share platform that connects multiple passengers traveling along similar routes in Lyft's expansion to new cities across the country (*104*).

Sidecar has created various partnerships in the past two years. Table 8 illustrates the most recent and notable partners (*105*). Sidecar has also established other agreements to offer discounts or free credit when users specify their destination (or origin) as being one of the eligible locations or special events. For example, in July 2013, Sidecar users save on a shared ride toward the Capitol Hill block party in Seattle. Also, in August 2014 Sidecar users could get $5 off each way when they used Sidecar to travel to or from San Francisco-area Whole Foods, Target, or Safeway locations.

**Table 8. Sidecar Partnerships.**

| Date of Partnership | Partner | Partnership Details |
|---|---|---|
| September 2014 | SherpaShare | Provide riders with an analytics platform to track income, costs, and opportunities. |
| August 2014 | Jiffy Lube | Sidecar users are eligible for discounts on basic vehicle services (e.g., oil change, inspection, tire rotation) by showing their driver smartphone application. |
| April 2014 | RideScout | Market exposure. RideScout free smartphone application aggregates transportation options. |
| March 2014 | Waze | Offer free ride credit to ride-share users on St. Patrick's Day to prevent driving under the influence. |
| March 2014 | The Bold Italic | Offer free ride credit to users who attend certain San Francisco events using their service. |

Uber has also aggressively expanded their horizons by establishing partnerships with various businesses such as Microsoft. Uber is the only ride-share service that is currently available for Windows operating system. Recent Uber partners are shown in Table 9 (*106*).

**Table 9. Uber Partnerships.**

| Date of Partnership | Partner | Partnership Details |
|---|---|---|
| September 25, 2014 | Sacramento Kings | Attract prospect users to get Uber app and provide them with transportation to Kings games. |
| July 29, 2014 | Concur | Provides Uber users an alternative for travel and expense management creating an expense report. |
| July 23, 2014 | Microsoft | Optimize accessibility of Uber app to Windows Phone users. |
| July 8, 2014 | American Red Cross | Deliver disaster relief services to those in need and help communities in relevant states of emergencies. |
| June 9, 2014 | American Express | Market exposure. Promote a membership rewards program where users can use points for eligible rides. |
| May 28, 2014 | AT&T | Provide Uber rapid access to AT&T customers. Support a wireless service to drivers on the Uber platform in the United States. |

Carma carpooling service has partnered with public agencies in both Austin, Texas, and San Francisco, California. The pilot project in Austin was launched in partnership with the CTRMA (*107*, *108*). In San Francisco, Carma partnered with Contra Costa Transportation Authority, Sonoma County Transportation Authority, and the Transportation Authority of Marin in San Francisco. The support from these public agencies has made it possible for Carma to provide a ride-share network in both cities. Carma has also recently partnered with *RideScout (68)* to add

their service as one of their mobility options displayed in RideScout's proprietary platform (*68*,*109*).

## REGULATORY CONSIDERATIONS

Of the three mobility programs, the dynamic ride-share market has received considerable press regarding surrounding regulations. Between taxi companies protesting that Uber drivers operate without proper licensing and city councils outlawing the services, the regulatory considerations for ride-share programs are undergoing rapid transformation. In lieu of providing an outdated section, the team monitored activities throughout the course of this research project to provide an updated listing of relevant statutory considerations (and how to keep abreast of rapidly emerging decisions) as part of the draft and final versions of the guidebook.

## IMPACTS OF DYNAMIC RIDE-SHARE

The aforementioned ride-share systems are thought to benefit commuters, transportation agencies, and the environment. The effective use of empty car seats is an opportunity to increase occupancy rates, which in turn can reduce congestion and lower vehicle emissions (*110*). Furthermore, it provides households with alternative transportation without sacrificing convenience and could lead to reduced vehicle expenses such as insurance rates and parking costs (*111*). As to be expected, usage rates are most important in determining the impact of each program as it provides an opportunity to increase vehicle occupancy rates (*112*).

### Measures of Success

Given the degree of private investment in these ride-share providers, limited information is available regarding the economic status of each company. Lyft and Uber are considered the leading ride-share companies in the United States based on the wide variety of services they offer to their users, as well as their availability in numerous cities around the country. Lyft is valued at approximately $700 million, while Uber is estimated to be worth $18.2 billion. According to Future Advisor, an online investment management site, more than 96,000 customers spent a combined $28.6 million on the two services between June 2013 and May 2014. During that period, approximately 82,000 people made a request for Uber service, while 14,200 used Lyft (*113*).

According to raw data and revenue dashboards provided by John Zimmer, Lyft co-founder, Lyft has a revenue growth rate of six percent every week, and more than $100 million gross run rate (*114*). Uber, on the other hand, stated that revenue growth rates change drastically depending on the seasons. During 2013, Travis Kalanick, Uber CEO, stated that the company maintained a 20 percent month-over-month growth. Uber has a $1 billion gross revenue run rate. Again, the remarkable differences in values between Uber and Lyft are because Uber offers multiple services, which provides the users with more products to choose from.

### Economic

Most commuters choose their mode of travel based on different factors, with the benefits of various factors varying for each participant. A recent study in Dallas and Houston examined

people's travel mode choices based on specific aspects such as travel time savings, cost sharing with questions about travel mode choices, and trip-related questions. According to the survey results, sharing vehicle costs, one of the highest overall rated factors, had a bipolar distribution. About 31 percent of the respondents rated this decision factor as not important, however, 36 percent rated very important (*115*).

The same Virginia Tech study explored the major benefits of ride-share among its survey participants. According to the study, the major factor that attracts people to ride-share is cost. Out of the 125 participants, 82 percent said they would consider ride-share to save in travel costs (*47*). According to a study led by the Massachusetts Institute of Technology (MIT), a successful ride-share system could provide commuters with major benefits including travel time and cost savings (fuel and parking). The study also stated that a ride-share program could promote greater equity in the transportation sector by ensuring that mobility is maintained for lower income travelers (*9*).

**Social**

One of the deciding factors for most people with respect to ride-share with strangers is safety. Social networks and user registration have become a means of establishing trust with users. The idea of registering a user helps alleviate safety concerns as it provides other users with a name, gender, age, and other basic profile information (*98*). Even then, a study at University of California (UC) Berkley found that students would still prefer securing rides with other students, staff, or faculty (*116*). Since some people only feel comfortable sharing a ride with someone they know, social networking is an important tool in promoting ride-share programs (*110*). With the increase of technology, it is also easier to track drivers who need to keep GPS location services on while transporting riders. This is another key aspect in reducing the "stranger danger" concerns of ride-share. On the other hand, GPS trip tracking can be seen as an invasion of privacy (*117*).

**Technology**

A study conducted by the University of California's Transportation Sustainability Research Center states that technology plays a critical role in the future of ride-share. Technological advancements have helped overcome earlier ride-share shortcomings. To meet user demands, ride-share provider services have evolved from dial-a-ride to ride-matching and now real-time (dynamic) ride-share such as Avego (now known as Carma), Carticipate, eRide-share.com, Flinc, Hover, iCarpool, NuRide, and Zimride (*118*). Though most of these companies have adapted to using GPS and social networks to pair riders, very few have the capability to assist riders in finding the best routes to save money and fuel (*119*).

Ride-share software has been advancing exponentially over the past few years, but one barrier yet to be overcome is the integration of multimodal transportation. The future of ride-share is a multimodal platform that routes the rider to the driver with neither going significantly out of their way (*118*). Aktalita, a project being developed in Guadalajara, Mexico, aims at such an integrated ride-share system (*110*).

The greatest limitation of ride-share programs is the lack of riders. Providers are actively pursuing business partnerships, incentives, and social marketing (*120*). They also must address the issues of safety, security, and multimodal integration.

### Performance Measures

Most of the app-based ride-share providers are privately held and do not share data with respect to revenue, number of registered members, or the level of service provided. This makes it difficult to measure performance. One public metric is the success of dedicated social media such as Facebook, Twitter, Google+, and Instagram. Table 10 shows the social network market for each provider. Since Uber is currently operating in more than 45 countries and has a wide variety of services available for its users, it is no surprise that Uber leads the number of followers in any social network.

**Table 10. Social Media Demand.**

| Transportation Network Company | Twitter | Facebook | Instagram | Google+ | LinkedIn |
|---|---|---|---|---|---|
| Uber | 178,000 | 705,845 | N/A | 834,478 | 84,926 |
| Lyft | 71,500 | 222,473 | 11,216 | N/A | N/A |
| Sidecar | 11,900 | 14,096 | N/A | N/A | N/A |
| Carma | 2,172 | 11,233 | N/A | 32,918 | N/A |

Carma is the only ride-share program that is partnered with government agencies and as such, offers some insights into the performance of the Austin pilot. As of May 2014, Carma reached 1,000 users in Austin. According to the Carma Carpooling website, despite the small pilot, Carma members have foregone 1,250 car trips, saved themselves over 800 gallons of gas, and prevented over 15,700 pounds of carbon dioxide ($CO_2$) emissions (*121*).

### Impaired Driving

One often-cited potential impact of shared mobility is the ability to aid in reducing driving impaired incidents. This section documents the results from a review of existing literature on potential relationships between Transportation Network Companies (TNC), such as Uber, Lyft, and Sidecar, and reductions in driving impaired incidents.

A 2015 paper published through the Social Science Research Network looks into the potential correlation between Uber's introduction to California in 2009 and a reduction in total alcohol-related deaths across 540 townships including both Uber and non-Uber markets (*122*). It splits the data between Uber Black, a premium town car service, and Uber X, the discount personal vehicle service. This controlled study found that while the premium Uber Black service has had no impact on reducing alcohol-related deaths in California, Uber X correlated with a damping of alcohol-related deaths by 3.6–5.6 percent per quarter in the state of California. Greenwood and Wattal extrapolate that if Uber X was implemented statewide a potential 500 lives and 1.3 billion in tax payer money could be saved annually. The paper goes on to cite limitations in its research tied to data availability, the need to further research the subject for

possible alternative correlated variables, and the inability to further parse the data by population or sub-populations groups.

The joint report published by Uber and Mothers Against Drunk Driving (MADD) relies on Uber's proprietary data to show how their presence in cities accounts for a deduction in impaired driving (*123*). They use pair select data types with specific cities to support their claims. These case studies include:

- Time of day usage numbers in Miami, showing a correlation between Requested Uber Trips and Alcohol-Related Crash Fatalities.
- Time of day usage numbers in Pittsburgh, showing a correlation of ridership at 2 a.m. when bars close.
- By relating Uber requests to liquor license businesses within 50 meters the report shows how in Chicago requests from liquor serving businesses peak at 45.8% during the 10 p.m. to 3 a.m., when compared to 28.9 percent at non-peak times.
- An analysis of Austin shows a decrease in taxi rides (supply) while requests for both taxi service and Uber peak at midnight. The report argues this shows a lack of supply at peak drunk driving times.
- A controlled monthly analysis of alcohol-related crashes in California shows a 6.5 percent reduction among drivers under 30, between the time Uber X launched (2012) and now.
- This is compared to non-Uber markets in California, where the reduction is not present.

The report also included some results from a survey conducted on Uber's behalf by the Benenson Group. Reported results include:

- 88 percent of respondents over 21 agree with the statement "Uber has made it easier for me to avoid driving home when I've had too much to drink."
- 78 percent of respondents say that since Uber launched their friends are less likely to drive after drinking.
- 57 percent agreed with the statement, "Without Uber, I'd probably end up driving more after drinking at a bar or restaurant."

Most articles/blogs looking into these claims look to compare reductions in Driving Under the Influence (DUI) charges to populations under 30 in relation to the introduction of TNCs to specific city markets including Pittsburgh, San Francisco, and San Antonio (*124*,*125*,*126*). While these individual comparisons appear to show a correlation they fail to consider alternative variables or to compare the decline to non-TNC markets meaning the fall in DUI charges may simply be a return to pre-2005 levels.

The findings of the preliminary research discussed here suggest a need for more research into this topic. As more TNC data becomes available to government agencies or the general public through ordinances and TNC agreements the research on the impact ridesharing has on impaired driving should grow in turn. Efforts toward this data access have been moving forward in recent months as Uber agreed to allow the city of Boston access to limited proprietary data for planning purposes (*127*). In Austin, Texas, city staff is currently recommending any TNC ordnance renewal contain data exchanges as a key aspect (*128*).

## RIDE-SHARE PROGRAMS IN THE UNITED STATES

The following table lists some of the ride-share programs in the United States as of September 2015.

**Table 11. Selected Ride-Share Programs in the United States.**

| Name | City | State | Link | Launched |
|---|---|---|---|---|
| Commute Smart | Birmingham | Alabama | http://commutesmart.org/ | 1999 |
| Share The Ride | Phoenix | Arizona | https://www.sharetheride.com/Public/Home.aspx | 2012 |
| ArkRide | Little Rock | Arkansas | https://www.arkride.com/public/Home.aspx | 2008 |
| Lyft Line | Los Angeles | California | https://www.lyft.com/line | 2015 |
| UberPool | Los Angeles | California | https://get.uber.com/cl/uberpool/ | 2015 |
| Lyft Line | San Francisco | California | https://www.lyft.com/line | 2015 |
| UberPool | San Francisco | California | https://get.uber.com/cl/uberpool/ | 2015 |
| 511 SF Bay | San Francsiso (Bay Area) | California | http://rideshare.511.org/ | 2012 |
| CTRides | Rocky Hill | Connecticut | http://ctrides.com/ | 2005 |
| Commuter Connections | Washington, D.C. | D.C. | https://tdm.commuterconnections.org/mwcog/ | 1974 |
| Lyft Line | Washington, D.C. | D.C. | https://www.lyft.com/line | 2015 |
| UberPool | Washington, D.C. | D.C. | https://get.uber.com/cl/uberpool/ | 2015 |
| RideShare Delaware | Fort Lauderdale | Delaware | http://ridesharedelaware.org/ | 1997 |
| South Florida Commuter Services | Fort Lauderdale | Florida | http://www.1800234ride.com/carpooling | 1988 |
| ReThink | Orlando | Florida | http://www.rethinkyourcommute.com/about-us/ | 2010 |
| Hawaii RideShare | Kapolei | Hawaii | http://hidot.hawaii.gov/highways/rideshare/match/ | |
| Lyft Line | Chicago | Illinois | https://www.lyft.com/line | 2015 |
| Pace Rideshare | Chicago | Illinois | https://www.pacerideshare.com/ | 2006 |
| Go Maine | (statewide) | Maine | https://www.rideproweb.com/GoMaine35/Trip/Search | 2002 |
| Commuter Choice | (statewide) | Maryland | http://www.commuterchoicemaryland.com/ridesharing.htm | |
| MassRides | (statewide) | Massachusetts | http://www.commute.com/ | 2010 |
| Lyft Line | Boston | Massachusetts | https://www.lyft.com/line | 2015 |
| iShareARide | Ann Arbor | Michigan | https://www.ishareride.org/ | 2013 |
| Mi Rideshare | Detroit | Michigan | https://mirideshare.org/en-US/ | 1980 |
| West Michigan RideShare | Grand Rapids | Michigan | http://therapid.greenride.com/ | 2006 |
| Rideshare Connection | Kansas City | Missouri | https://www.ridesharekc.org/Public/SingleMatchSummary3.aspx | 1980 |
| Ozarks Commute | Springfield | Missouri | https://www.ozarkscommute.com/public/Home.aspx | 2009 |
| Ride Finders | St. Louis | Missouri | http://ridematch.ridefinders.org/mct/service.asp?Authenticated=False | 1994 |

| Name | City | State | Link | Launched |
|---|---|---|---|---|
| Rideshare MT | (statewide) | Montana | http://www.ridesharemt.com/ | 2012 |
| Lyft Line | New York | New York | https://www.lyft.com/line | 2015 |
| UberPool | New York | New York | https://get.uber.com/cl/uberpool/ | 2015 |
| Share the Ride NC | (statewide) | North Carolina | https://www.sharetheridenc.org/public/home.aspx | |
| Ohio RideShare | Akron | Ohio | http://ohiorideshare.com/ | 1981 |
| Share-a-Ride | Philadelphia | Pennsylvania | http://www.dvrpc.org/SAR/ | 2011 |
| Rhode Island - NuRide | Providence | Rhode Island | https://www.facebook.com/nuride.ri/info | 2014 |
| We Go Military (exclusive) | Arlington | Virginia | http://wegomil.com/ | |
| TRAFFIX | Norfolk | Virginia | http://www.traffixonline.org/ | 2006 |
| Uber | Worldwide | Worldwide | https://www.uber.com/ | 2009 |
| Uber | Abilene, Amarillo, Austin, College Station, Corpus Christi, Dallas, El Paso, Fort Worth, Houston, Killeen, Lubbock, Midland, San Antonio, Waco | Texas | https://www.uber.com/ | 2009 |
| Carma Carpool | Austin | Texas | https://carmacarpool.com/austin/ | 2013 |
| Lyft | Arlington, Austin, Corpus Christi, Dallas, Denton, Ft. Worth, Garland, Mesquite, Plano, Rockport, Round Rock, San Antonio, San Marcos | Texas | https://www.lyft.com/ | 2012 |
| Lyft Line | Austin | Texas | https://www.lyft.com/line | 2015 |

# APPENDIX B: CAR-SHARE MOBILITY PROGRAMS

This appendix provides the detailed research and literature review on car-share programs completed by staff at TTI, including business models, funding sources, target audience, regulatory considerations, performance measures, and lessons learned.

## DESIGN OF CAR-SHARE PROGRAMS

### Business Organizational Structure

In January 2013, there were 46 car-share operators in North America, with 25 programs in the United States. Half of these US programs were for-profit programs encompassing 95 percent of members and 93 percent of vehicles (*21*). While these statistics reveal the current success of for-profit business models, several organizational structures exist in car-share programs, including:

- **For-Profit.** Measured in terms of number of vehicles and memberships, the dominant car-share operators in North America are privately held, for-profit companies. Examples include Flexcar, Zipcar, and Communauto (which was originally founded as a cooperative, Auto-Com).
- **Non-Profit**. These operators are incorporated as tax-exempt 501(c)(3) organizations. It is often a local organization, community, or co-op that facilitates car-share with the goal of changing driving habits over making a profit. Examples include City CarShare in San Francisco, PhillyCarShare in Philadelphia, and I-GO in Chicago.
- **Cooperative**. Operators such as the Cooperative Auto Network in Vancouver, British Columbia, are run by members who join by purchasing a share in the organization. In practice, this share acts in a similar way to the refundable deposits charged by for-profit and non-profit operations. Cooperatives are also likely to have social or environmental goals.
- **Other structures**. Research pilots by universities or governments have been developed in select examples. The Roaring Fork Valley in Aspen, Colorado, is served by a car-share program, called Car2Go, sponsored by the City of Aspen. Universities have also launched independent campus-level car-share programs although the for-profit sector is growing rapidly into this market in recent years.

As car-share finds success, several programs have grown through acquisitions or expansion into multi-city and multinational markets. Car manufacturers and rental companies, who previously may have been considered rival industries, have bought or initiated car-share programs, for example:

- Zipcar was acquired by Avis Budget Group in 2013.
- I-GO and Philly CarShare were purchased by Enterprise to be rebranded as part of its Enterprise CarShare program.
- Hertz began building its own on-demand car rental program in 2008. The company is pursuing a model that blurs the line between its traditional car rental service and a new car-share program.

## Operational Structure

Several operational models of car-share have been implemented in the United States and internationally. While there are many small differences and unique features of individual operators, three operational models that are distinguishable in terms of fleet ownership and vehicle storage/parking reflect most car-share operations.

*Fleet-Based Fixed Parking*

Fleet-Based Fixed Parking is by far the most common design for car-share programs. In this system, vehicles are geographically distributed in designated parking spots. Reservations are exclusively round-trip such that the vehicle must be returned to its original parking spot to end the rental. A prominent example of this traditional car-share model is Zipcar.

The CarSharing Association (CSA), a member-based organization including at least 26 car-share operators worldwide, defines car-share according to this more narrow structure. The definition given in the CSA's Code of Ethics defines car-share as a service that:

- "Car-share is a membership based service available to all qualified drivers in a community.
- No separate written agreement is required each time a member reserves and uses a vehicle.
- All Car-share organizations offer members access to a dispersed network of shared vehicles 24-hours, 7 days a week at unattended self-service locations.
- Car usage is provided without restriction at affordable hourly and/or 'per mile or kilometer' rates that include fuel, insurance, and maintenance" (*13*).

The CSA definition does not encompass all forms of vehicle sharing that exist on the market. It also includes a social responsibility element, stating that "car-share is defined by its environmental and social purpose, rather than business and financial objectives" (*139*).

*Fleet-Based One-Way/Point-to-Point*

One-way car-share allows for open-ending reservations and one-way trips. Traditional round-trip car-share is not conducive to certain types of trips, such as one-way trips, short-distance, long-duration trips, or out-of-town trips (*23*). This alternative car-share model serves to address some of these needs through a different operational model than traditional car-share.

Daimler's Car2Go program is a predominant one-way car-share program in the market. Started in Ulm, Germany, in 2008 and launched in Austin, Texas, in 2010, Car2Go operates in 29 cities in Europe and North America (Figure 18). This operating model provides access to vehicles without fixed locations; the vehicles can be parking in any legal street parking spots within a designated home zone. This system is enabled by geo-fencing technology, where the GPS in each vehicle communicates to a server to know whether it is within the allotted parking area to complete a trip. If a driver attempts to park outside this area, the system will not allow the transaction to be completed, and in-vehicle instructions are offered to move the vehicle to a spot in the designated home area. Another innovation is a fee system based on per-minute charges, so the user only has to pay for the time spent in the car. This approach arguably provides different

benefits and challenges for users, as well as requiring greater interaction with local jurisdictions regarding parking allocation.


**Figure 18. Designated Home Area for Car2Go Vehicles in Austin, Texas (*42*).**

*Peer-to-Peer Car-Share*

In contrast to the fleet-based services, peer-to-peer car-share, or personal vehicle sharing, facilitates the sharing of privately-owned vehicles. A fleet of cars exists in a community, in which the marketplace allows owners of available cars to be matched to other drivers to rent. Program operators generally provide the organizational resources to negotiate transactions between car owners and renters. Other aspects of the programs such as use of internet-based reservation systems and hourly/daily/weekly rental periods are similar to fleet-based car-share programs. The operators serve mainly as matchmakers but provide the support services that ensure a simple and secure transaction between two strangers. The services enforce safety standards of vehicles, pre-screen members, and provide car owners with independent insurance and drivers with 24-hour roadside support. There were 33 personal vehicle sharing operators worldwide, with 10 in North America as of May 2012 (*18*).

*Other Related Models*

Some other niche models of car-share that have proliferated across the world include business, government and institutional fleets; transit-based; and college and university-based. Many of these are variations on the operations and organizational structures are described here, but with a focus on a particular market. Car-share operations today have absorbed these trip-specific needs into a broad system that aims to serve many users with one system.

For example, station cars are an operational model that differs from car-share in that they serve a particular type of trip, namely the link between a transit station and the home or workplace. Several early examples of car-share services in the United States were in the station car model (*22*). This service provides a car at the home end or first mile of a commute trip, between home and the transit station. An arriving transit passenger can then use the same vehicle to travel the last mile from the station to their work location, returning the car at the end of the workday. Some models expanded the system to include mid-day users as well. Station cars were more common than car-share until the late 1990s, but only two remained in 2003 (*23*).

**Costs and Funding Sources**

The major costs for a car-share program can be summarized in the following list of fixed and variable costs (*23)*:

**Fixed Costs**

- Salary and benefits.
- Rent.
- Technology.
- Marketing and Public Relations.

**Variable Costs**

- Vehicles.
- Insurance.
- Parking.
- Gasoline.
- Cleaning and maintenance.

A 2002 study found that 60 percent of surveyed U.S. car-share operators received public money for start-up costs and 30 percent received some sort of continued funding after the first year (*23*). It has not been common for local governments to provide direct funding, but other options include risk-sharing and internal or external grant awards. Local agencies, as well as other partners looking to support car-share, can also offer subsidized memberships to employees or to certain user groups in an effort to address intersecting goals such as equity or environment.

Car-share business models in the United States can be for-profit, non-profit, or cooperative, and as a result, funding comes from private sector investment and public start-up funding and federal grants. The for-profit fleet-based model continues to lead the car-share market in the United States. In 2013, the three largest providers in United States represented 88 percent of total membership. In some cases, local governments may not provide direct support but instead collaborate on parking allowances, marketing, or subsidized memberships for employees or partner organizations. Car-share can also support fleet or trip reduction policies of public and private employers, as well as help connect transit riders as they travel from the existing public transit infrastructure to their final destination. Table 12 provides examples of funding sources for car-share programs in the United States.

**Table 12. Examples of Funding Sources for Car-share Programs in the United States.**

| Potential Funding Sources | Agency | Examples of Recipients |
|---|---|---|
| Congestion Mitigation Air Quality Improvement (CMAQ) | FHWA/ FTA | I-GO, trip reduction programs broadly |
| Value Pricing Program | FHWA | City CarShare (San Francisco) |
| National Planning and Research | FTA | HourCar (Minn-St. Paul) |
| Job Access and Reverse Commute (JARQ) | FTA | City CarShare (SF), Flexcar (Seattle) |
| Clean Air Transportation Communities | EPA | FlexCar (Seattle, Vancouver) |
| Surface Transportation Program | FHWA | |

Note: FHWA = Federal Highway Administration; FTA = Federal Transit Administration; EPA = Environmental Protection Agency

In addition, with the growth of for-profit car-share programs, industries that have shown interest in the car-share industry include (*129*):

- Auto manufacturers (examples: Daimler [Car2Go], Peugot, BMW).
- Rental companies (examples: Hertz, Enterprise, WeCar).
- Car-share brands (examples: Zipcar, StattAuto, GoGet).

## CAR-SHARE TARGET MARKETS

Car-share programs have evolved to serve the needs of different markets in different geographies, employing variations on the ownership and operational models discussed in the previous sections. The most common markets for car-share found in North America are neighborhood residential, business, and college/university markets (*15*). In 2005, neighborhood/residential markets generated an estimated 82 percent of car-share activity in the United States, with 12 percent and 5 percent generated by business and university markets, respectively. The same study found that existing car-share organizations expected university and business markets to increase their proportion of activity in the future. Other niche markets include commuter and low-income markets (*129*).

Several major car-share operators in the United States have distinct programs that are designed to serve different markets. This includes programs specifically for individuals, businesses, and universities (*120*).

- The Neighborhood/Residential Market is the most common market served by car-share programs in the United States. Most programs have located vehicles in dense, residential areas within urban areas because households in these locations are expected to offer a strong potential market.
- A 2010 survey of car-share experts reported that the college/university market is the most prevalent and profitable market in the United States (*143*). Hundreds of universities are home to one or more car-share programs on campus. According to Zipcar, the program provides a solution for campus congestion, offers students a way to "express their concern for environmental initiatives," and helps the school address transportation and

parking issues cost-effectively (*144*). The car-share programs have overlapped well with university sustainability and demand management programs, and the centralized nature of university management can ease the implementation process.

- Businesses can benefit from car-share. The needs of business customers that can be served by car-share programs include (*29*):
  - "Alternative to owning a fleet (or underutilized vehicles in a fleet).
  - Alternative to reimbursing employees for driving their own vehicles.
  - As an additional incentive to participate in a subsidized transit pass/Commute Trip Reduction program or when subsidized employee parking is reduced, by providing access to a car for personal trips during the middle of the day.
  - To substitute for, or at least partially replace, rental cars for trips shorter than a day."

  Several car-share programs highlight their services specifically to replace company fleets or problematical reservation and reimbursement programs, often offering turn-key systems that can be customized for an organization. Zipcar for Business is an example of a for-profit operator offering a system that includes direct or individual billing, discounted weekday driving rates, access to a fleet that can serve different needs, and a "7-to-7" rate that grants access to Zipcars from 7:00 a.m to 7:00 p.m., Monday through Friday (*130*). Zipcar highlights on the website existing business members that include an advertising company, a coffee roaster, a legal services company, a non-profit health care provider, and an architectural firm (*131*).

- Some other niche models of car-share that have developed across the world include government and institutional fleets, transit-based fleets, and rural fleets. Many of these are variations on the operations and organizational structures described above but with a focus on a particular market. In addition, car-share can be a lower cost alternative to personal vehicle ownership and a travel option for individuals without the ability to access a car. As such, it has the potential to serve low-income or low-mobility populations.

### Car-Share Partners

Partner organizations can be defined as "those organizations that see a benefit from car-share and take actions to help it succeed" (*23*, p. 5–1). Partners in car-share services include, but are not limited to, cities, counties, state and regional agencies, ride-share agencies, universities, developers and property managers, employers and businesses, transit agencies, consultants, community advocates, and community organizations. Partner organizations can be any entity that can play a role in supporting or introducing a car-share program in a community.

A Transit Cooperative Research Program (TCRP) report published in 2005 summarized the results of a web-based survey of car-share organizations. The survey revealed that the common types of assistance offered by partner organization include (*23*):

- Marketing.
- Administration.
- Parking.
- Financial contributions.

- Memberships.
- Planning, policy, and tax issues.
- Transit integration.

The survey also found that 41 percent of partnerships were initiated by the car-share operator, 30 percent of partnerships were initiated by a staff member at a partner organization, 11 percent a staff member from another organization, and 11 percent from community/advocacy/other groups (37 organizations responded to the survey question) (*23,* p. 147). Even for-profit corporate car-share programs need to foster relationships with partners, especially local governments. In one example, U-Haul CarShare encourages potential city or university partners to work with them to initiate car-share with no costs or guarantees except to "provide a parking space and co-marketing support" (*132*).

*Local Governments*

Local governments are a common partner for car-share because they control issues, such as parking, that are critical to car-share operations and because they may have overlapping goals. The provision of parking is one common and tangible form of support due to the local control of most parking. While some smaller programs may operate within a single complex or campus, city-wide programs are likely to require city-managed street parking. One-way programs such as Car2Go must negotiate for an access plan that allows parking in an entire region of a city. Other regulatory or taxation issues may fall under the jurisdiction of the local government as well.

Local government support can include marketing through government websites, regional trip planning services, or through the provision of on-street parking that offers visibility. Car-share can also fit well into campaigns for larger active demand management programs. Administrative support can be provided in the form of access to office or conference space, staff time for marketing or parking management, research or insight on planning and policy development or assistance in resolving internal barriers and building internal support for car-share. For example, District Department of Transportation in Washington, D.C., intervened to help resolve zoning issues technically under the jurisdiction of other departments because of their interest in car-share (*23*).

A government partner can also help an organization secure external funding. An early success occurred in Chicago when the Center for Neighborhood Technology recruited the City of Chicago to partner as the sponsoring government agent for CMAQ funds for the non-profit I-GO car-share venture. A CMAQ grant awarded the city $250,000 to start I-GO and a second grant in 2005 to expand the program. Although the City had concerns about taking on responsibility for performance of the non-profit, it secured the funding and remained involved in monitoring and reporting to the FTA (*23*).

Local governments may also institute policy initiatives that support car-share. These can include fleet reduction efforts and risk sharing arrangements. Risk sharing can be achieved when a partner organization purchase a block of memberships or guarantees vehicle use, offers vehicle subsidies, or pays the difference between costs and revenue of a vehicle placement. Through fleet-reduction efforts, agencies replace all or part of their municipal fleets with car-share services. As of 2005, at least three US cities had replaced their fleets with car-share services

(*20*). Many of the major car-share organizations today offer customized services to government agencies and private businesses to set up a car-share fleet program.

*Transit Agencies*

Transit agencies may benefit from car-share operations as a means to provide station access, increase ridership, and improve overall mobility. Car-share offers a strategy to expand station access and thus expand the market for transit. By creating new last-mile options, transit agencies may absorb more riders who might otherwise chose to drive the entire trip. Both partners can increase mobility and choice for their customers through car-share collaboration. On the other hand, there is the risk that car-share trips will replace transit trips and reduce overall ridership. Transit agencies have collaborated differently in different settings based on their needs and how they define their role in mobility.

As partners, transit agencies can assist with marketing, provide parking and fare discounts, or allow fare integration. They can offer marketing support through a website, trip planners, or demand management programs. Parking in park-and-ride lots can be an important tool for car-share operators but it can hold conflicts for transit agencies. The decision of what to charge for parking varies by the agencies involved. Discounts are found in several US examples but fare integration is nearly non-existent. Fare integration has progressed much further in Europe, where several cities have single cards that can pay for both car-share and transit services.

Zipcar has arrangements with several transportation organization in the United States to bridge the last mile of transit trips, including San Francisco's Bay Area Rapid Transit District, Chicago Transit Authority, King County Metro Transit in Seattle, Massachusetts Bay Transit Authority, New Jersey Transit, New York's Metropolitan Transit Authority (MTA), Washington Area Metro Transit Authority, and Metropolitan Atlanta Rapid Transit Authority (*133*).

*Developers*

As a growing partner in North America, developers value car-share programs as an amenity to offer tenants, a contribution to sustainability/corporate responsibility, and a tool for parking mitigation to reduce parking requirements and as a money-saving opportunity in some cases (*23)*. Car-share can have value to both residential and commercial developers, and are becoming common in new housing and mixed-use developments.

Parking can be provided by developers and property managers. The provision of free parking spaces in a complex may be offset by a reduced parking space requirement for the developer. Subsidized membership can also be a form of support provided by a developer to car-share organizations or tenants. Sometimes they are temporary, subsidized, or linked in perpetuity to individual units. Marketing can be a mutually beneficial effort as developers can incorporate the service into the amenities package (*23*).

Partnerships with developers can also have challenges. One example is the issue of granting access to car-share members who do not necessarily live or work in the development where a vehicle is located. With new technology, this can often be resolved with passkeys or codes (*23*).

*Universities*

Universities proved to be a viable partnership for car-share programs for several reasons: parking is often limited, academic funds cannot usually be used for parking and transportation, as self-contained organizations implementation can be easier, there is an existing communications network, they represent a unified destination, and academic populations are more likely to be environmentally aware. They are also likely to already focus on traffic and parking demand, and car-share can be integrated easily into a larger travel demand management program or sustainability program (*23*).

Differences in the geography of a campus may impact the form of a program. Urban campuses like MIT in Cambridge and University of Texas in Austin are integrated with the surrounding Zipcar network. On the other hand, Stanford University and University of North Carolina Chapel Hill initiated their own stand-alone projects given their more suburban setting (*23*).

*Airports*

Airports represent another organization that has developed partnerships with car-share organizations. In March 2013, Zipcars were located at New York City airports for hourly and daily rates. Car2Go has a partnership with The Parking Spot, a "leading near-airport parking company," to provide parking spots near the airports in Austin, Texas, and Columbus, Ohio. Members can drop off a vehicle at a designated spot or pick one up after landing in the airports and drive it to any legal parking spot in the designated home zone (*134*).

## Development Scenarios for Car-Share Programs

There are several scenarios by which car-share programs can be initiated. These scenarios vary based on the business model, operational structure, partner organizations, and local markets that define a car-share venture as described in the previous sections. The operations and initial markets for car-share programs will also depend on the goals and objectives of the initiating organizations and its major partners. Table 13 outlines some of the scenarios through which car-share can develop.

**Table 13. Scenarios for Car-Share Development 2005 (*23*).**

| Model | Main Considerations | Initiated by | Operator | Key Partners | Initial Markets |
|---|---|---|---|---|---|
| **Business venture** | Primarily depends on operators' business and expansion plans, and their perceptions of the strength of the market. Partners may be able to influence operators' priorities through provision of support. | For profit operator, car rental firm | For-profit operator, car rental firm | Less dependent on partners, but local municipalities are important for parking/land use factors | Higher income, well-educated people in dense neighborhoods |
| **Strong public-private partnership** | Operators' interest will depend on the depth of support that is offered, coupled with the inherent desirability of the market. | Public agency or for-profit operator | For-profit operator, possibly non-profit or cooperative | Local government support is critical, transit agencies and other partners | Same as above, but additional emphasis on transit riders and varied income levels |
| **Municipal lead** | Requires strong, ongoing commitment from local government, and full operational responsibilities. | City-led initiative | May be non-profit sponsored by city, or partnership with a for-profit group | Local government | Same as above, but with emphasis on city staff |
| **Grassroots, community-based effort** | Feasibility depends on interest and organizational capacity of local groups, and the amount of support that can be offered by partners. | Community group | Non-profit or cooperative, could involve for-profit with similar ethos | Community groups, local government, transit agencies, other non-profits | May start with people with strong environmental awareness or other social cause; potential to diversify |
| **Special purpose/ research** | Limited wider applicability; conditioned by availability of demonstration/ research funds. | University or research institution | University | Auto manufacturers, research staff | Students, staff, faculty; potential to diversify |
| **Stand along development or campus** | Special niche; can be combined with any of the above scenarios. | Community group, developer, university | Non-profit, for-profit | Developer, campus manager, community group | Residents/staff/faculty of the particular development/campus |
| Adapted from TCRP 108 – Exhibit 8-2 and 8-4. (*23*) | | | | | |

## REGULATORY CONSIDERATIONS

The regulatory environment can have significant consequences for car-share programs, particularly in its effects on costs and location decisions. Regulations can be supportive, as in the case of trip reduction ordinances, or harmful, as with higher tax rates on car-share programs than other services. A survey of car-share industry experts worldwide revealed that 70 percent of

those surveyed expected "continued market diversification" in the next five to 10 years (2015 to 2020) that would depend heavily on public policy and multimodal integration (*143*). The findings of multiple studies indicate that car-share may contribute to less congestion, increased use of active transportation and associated health benefits, lower development costs, and reduced parking demand. These public benefits suggest that public policies should be designed to support or encourage car-share programs (*129*). Regulatory considerations include the following major issues.

### Parking

Parking policies are the most prevalent regulatory issue facing car-share organizations, as well as one that varies considerably in form. Common policies include (*20*):

- Provision of on-street parking.
- Provision of off-street parking.
- Exemptions from parking limits.
- Creating of car-share parking zones.
- Free or reduced cost parking spaces.
- Free or reduced cost parking permits.
- Universal parking permits (parking allowed in any on-street location).
- Formalized processes for assigned on-street parking spaces.
- Recommended use of parking meter revenue.

### Taxation/Tax Code

Tax codes can have an accommodating or limiting effect on car-share programs. Car-share organizations tend to be taxed by local and state governments in the same manner as traditional car rentals, often resulting in higher average taxes relative to typical sales tax. Nationally, the average tax on car-share services was 17.93 percent for 1-hour reservations and 14.08 percent for 24-hour reservations. Average sales tax was just over 8 percent. It has been estimated that these high taxes reduce car-share use and reduce the potential social benefits that can be achieved with car-share.

If local governments are interested in supporting the benefits of car-share programs, tax code adjustments can be a supporting effort (*30*). In a similar market, vanpool vehicles are not required to pay vehicle taxes in Virginia. Another example is the state of Oregon's 2001 legislation to allow tax credits for businesses enacting energy-saving activities, which included car-share operators. This program is administered by the Oregon Department of Energy. Washington State offered a tax credit to employers and property managers who provide financial incentives for commute trip reduction measures including car-share (*23*). Tax credits have also been given at municipal or state levels including local or state sales tax credits, exemptions from rental car taxes, and tax credits for employers and property managers.

### Insurance

Insurance for traditional and fleet-based car-share programs is a substantial cost but is no longer considered a major barrier. Car-share organizations in the United States typically have $1 million

liability insurance per accident per claim. Some have reduced this limit to $300,000, which is more similar to personal vehicle insurance than fleet insurance (*20*). Car-share is essentially the same as a traditional car rental, so the industry did not face the challenges of a completely new model as with ride-share. Unlike traditional car rentals, it is the industry standard to include insurance in car-share rental fees (*135*).

In 2005, car-share insurance was estimated to cost over $2,500 per vehicle per year in 2005 (*19*). A 2003 report found that shared-use vehicle organizations were spending between 20 to 48 percent of their organizations' total costs on insurance. Usage-based insurance may provide an alternative system for car-share service insurance, fitting well with the model of use-based fees 2003) (*136*). Unfortunately, more current research on car-share insurance costs is not available.

Today, car-share programs face insurance issues with regard to two particular market segments. Younger drivers, particularly on college campuses, represent a significant growth market for many large car-share operators. The second challenge is for the emerging peer-to-peer car-share industry, which gets tangled in traditional personal vehicle insurance regulations. Determining liability when a car-owner lends their car to an unaffiliated driver through a third-party facilitator is a concept less familiar in the insurance industry. Alternative insurance models, such as usage-based insurance, could prove to be a viable option that is well suited to the needs of car-share users and providers (*138*).

**Planning, Development, and Zoning**

Government agencies and jurisdictions are increasingly including car-share as a strategy in transportation and environmental planning documents (e.g., Montreal, Boston, Seattle). This can provide credibility for the programs and support car-share as a mainstream transportation option (*23*). In Washington, the Commute Trip Reduction ordinance required a program for employers over 100 employees, spurring success in the business market for car-share (*23*).

Linking car-share to planning and zoning decisions provides a foundation for long-term growth and can reduce the amount of parking or infrastructure that must be provided by a local jurisdiction. Car-share can be a mitigation measure during site planning (as demand management or for affordability) or a zoning stipulation in the development process. For an example of the latter, Berkeley, California, allowed variances to reduce a "one space per three residential units" parking requirement in its zoning ordinance to a developer because the project offered car-share (*23*, p. 168). Formal inclusion of car-share into zoning rights rather than a case-by-case basis provides certainty to developers and car-share operators but there are limited examples of this to date.

Several municipalities have policies that ease zoning regulations and encourage car-share in new developments. These polices generally take the following forms (*20*):

- Parking reduction (i.e., downgrading the required number of spaces in a new development).
- Parking substitution (i.e., substituting general use parking for car-share stalls).
- Trip reduction (i.e., reducing vehicle and single-occupant vehicle trips).
- Allowing greater floor area ratios (i.e., developers can build more densely on a site).

## IMPACTS OF CAR-SHARE

Supporters of car-share argue it provides a range of public benefits, and although empirical studies are somewhat limited, academic research has shown support for the claim. Four benefits have been well-documented in literature, mainly focused on neighborhood-residential market models, including:

- Reductions in vehicle ownership.
- Reductions in VMT.
- Lower greenhouse gas emissions.
- Lower individual transportation costs (*20*).

A survey of 49 partner organizations in the United States and Canada, conducted in 2004, documented the views of partner organizations on the benefits of car-share. The majority of respondents represented cities or counties. The most important benefits identified were the provision of mobility options and reduced vehicle travel. In addition, two-thirds of respondents felt reduced parking demand was a benefit to their organization. Figure 19 summarizes the survey results on perceived benefits of car-share. (*23*, p. 5–2)

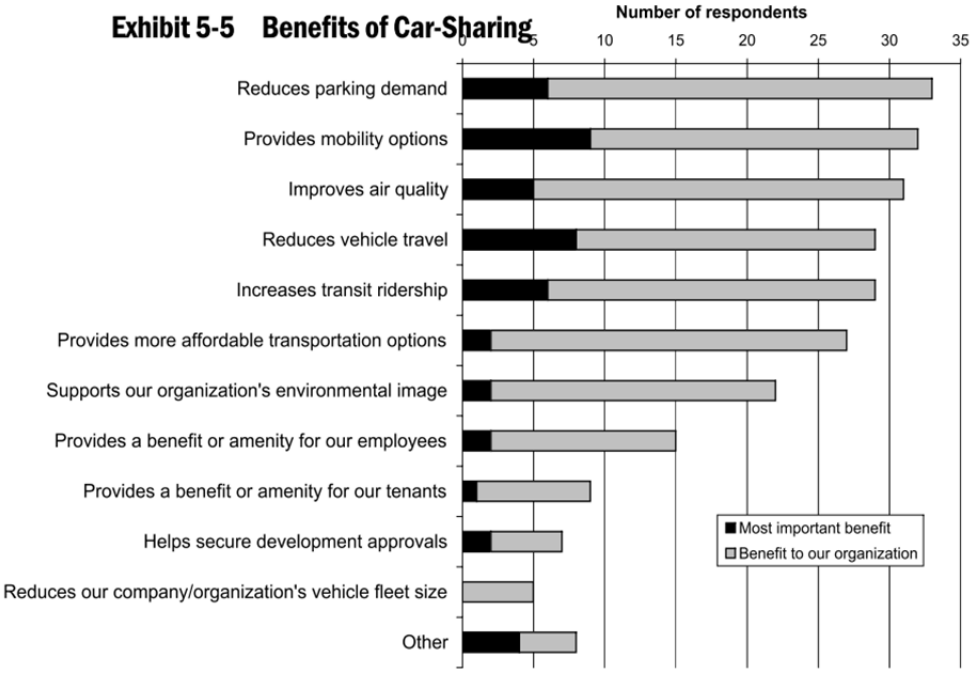



**Figure 19. Results of 2004 Car-Share Partners Survey (*23*).**

### Transportation

The high fixed-cost of driving can encourage vehicle-owning travelers to actually drive more. In contrast, car-sharing incentivizes less driving by charging drivers for only the actual miles or hours spent driving. Members are more likely to take cheap or free forms of transportation when applicable. Membership seems to also lead to decreased vehicle ownership (*26*). Studies have found that car-share in North America can replace between 9–13 privately-owned vehicles with

one shared vehicle. Zipcar claims that each Zipcar "takes 15 personally-owned vehicles off the road" and 90 percent of Zipcar members drive fewer miles after joining (*137*). A consulting firm study of car-share in 10 major cities estimated that between 2006 and 2013, 500,000 more new or used cars would have been purchased if car-share services were not present. Figure 20 presents a summary of transportation impacts as presented in academic literature as of 2012.

**Table 1**
North American carsharing impacts.

| North American studies (year) | Location | Sample size | Participants selling owned vehicle (%) | Participants avoiding vehicle purchase (%) | # of privately-owned vehicles removed per carsharing vehicle | Change in average VMT/VKT (%) |
|---|---|---|---|---|---|---|
| Martin and Shaheen (2010) | North America | N/A | 25 | 25 | 9–13 | N/A |
| Econsult (2010) | Philadelphia, PA | 300 | 25 | 7 | 15.3 | N/A |
| Cervero et al. (2007) | San Francisco, CA | N/A | 24.2 | N/A | N/A | −33 |
| Cervero et al. (2007) | San Francisco, CA | N/A | N/A | N/A | N/A | −67[c]/24[d] |
| Dallaire et al. 2007 | Quebec Province, Canada | N/A | 24 | 53 | 4.6 | N/A |
| Price et al. (2006) | Arlington, VA | 369 | 29[a] | 71[b] | N/A | −43 |
| Zipcar (2006) | United States | N/A | 32 | 39 | 20 | −79.8 |
| Millard-Ball et al. (2005) | North America | 1340 | 55.2[a] | 70.5[b] | 14.9 | −37 |
| Lane (2005) | Philadelphia, PA | 502 | 24.5 | 29.1 | 10.8[e] | −42 |
| Price and Hamilton (2005) | Arlington, VA | 403 | 25 | 68 | N/A | −40 |
| Cervero and Tsai (2004) | San Francisco, CA | 516 | 29.1 | 67.5 | 6.8 | −47[c]/−73[d] |
| Autoshare (2003) | Toronto, Canada | N/A | 15 | 25 | 6–8 | N/A |
| Katzev (2003) | Portland, OR | 64 | 26 | 53 | N/A | N/A |
| Cervero et al. (2002) | San Francisco, CA | 404 | 2.5 | 60 | N/A | −3[c]/−58[d] |
| Jensen (2001) | Quebec Province, Canada | N/A | 21–29 | 55–61 | 9.1 | N/A |
| Cooper et al. (2000) | Portland, OR | N/A | 23 | 25 | N/A | −7.6 |
| Katzev (1999) | Portland, OR | 110 | 26 | 53 | N/A | N/A |
| Walb and Loudon (1986) | San Francisco, CA | N/A | 15.4 | 43.1 | N/A | N/A |

Note: N/A denotes data not provided.
[a] Percentage that strongly agreed or agreed that they were able to sell one or more cars due to carsharing.
[b] Percentage that strongly agreed or agreed that they were able to postpone buying a car due to carsharing.
[c] Reflects existing members' reduction in VMT/VKT.
[d] Reflects only trial members' reduction in VMT/VKT.
[e] Reflects vehicles removed by members who gave up a car.

**Figure 20. A 2012 Review of North American Car-Share Transportation Impacts (*18*).**

## Environmental

A study of over 2,000 surveyed car-share members in North America found that car-share led to a reduction in carbon dioxide emissions by 27 percent. If the avoided emissions of forgone vehicle purchases are considered, the North American estimate increases to a 56 percent reduction in emissions by car-share members. European studies indicate reductions of between 39 percent and 54 percent (*15*). Zipcar reports that the reduction in member driving after joining reduces crude oil use by 32 million gallons per year. Zipcar also states that shared cars, by reducing the total amount of cars needed to serve the population, can allow for more green space by reducing the need for parking and vehicle storage (*137*).

## Economic

Studies have also reported that 25 percent of North American car-share members have sold a vehicle and an additional 25 percent have forgone a vehicle purchase, which eliminates household expenses on car payments, maintenance, insurance, parking, and fuel. Household gasoline consumption declined by 34 percent in a survey of over 2,000 car-share members in North America (*15*).

A common promotional talking point for many car-share programs is its cost saving potential for members. These savings depend on a customer's travel behavior and needs, and costs are based on more than simply VMT. Duncan estimated that 5 percent of Bay Area households could benefit financially from car-share in its existing presence, and this percentage could rise to

22 percent if vehicle locations were expanded (*138*). The study also reiterated the enabling role of transit accessibility for car-share. Car-share does not serve commute trips and non-work trips, and households with the ability to commute by transit are more likely to be able to replace a personal vehicle with car-share membership (*138*).

### Social

One potential social benefit of car-share is the impact of the pay-as-you-go on how individuals view driving. Car-share may encourage less driving with you only pay for what you use.

In the 2005 survey of car-share members, when asked whether car-share had not been available for a particular trip, the two groups most likely to report that they would not have traveled consisted of individuals with high school diplomas or less (the group with the least education) and people who earned $20,000 or less (the group with the lowest income), suggesting that the mobility of low-income households is improved by car-share (*23*, p. 3-14). Many proponents have argued for the social benefit of increased accessibility due to car-share. These benefits are most applicable in operations that actively court low-income users, often non-profit programs.

### Evaluation and Performance Measures

Performance and evaluation data can be invaluable tools for communicating the benefits of a relatively new concept to partners and users. This is especially useful for a new and rapidly expanding industry such as car-share. However, precisely because it is new, data can be limited, quickly become outdated, and present a poor reflection of current conditions (*23*).

Important data sets have been identified to include utilization data, financial data, and impacts evaluations. Figure 21 presents a list of performance measures that can be used to review the costs and benefits of car-share programs. Some are internal measures that may be proprietary information of the car-share organization while several outcomes measures can be collected from member surveys. The growing use of GPS or other in-vehicle technologies in car-share vehicles offer opportunities to collect more robust data.

| Measure | Definition | Significance | How Measured |
|---|---|---|---|
| **Output Measures (usually proprietary)** | | | |
| Number of members | Number of members. | Simple measure of size and penetration. | Member database |
| Active members | % members using service in a month. | Assesses whether members are active users, dormant or have signed up for "mobility insurance." | Reservations logs |
| Number of vehicles | Number of car-sharing vehicles in service. | Simple measure of size and penetration. | Fleet database |
| Low-emission vehicles | % vehicles that are hybrid, CNG or electric. | Assesses uptake of clean-fuel technology. | Fleet database |
| Car-sharing developments | Number of (i) approved and (ii) occupied developments that incorporate car-sharing. | Assesses uptake of car-sharing by developers. | Fleet database |
| **Outcome Measures** | | | |
| Vehicle travel | Net change in annual Vehicle Miles Traveled (VMT) in private vehicles. | Assesses impacts of car-sharing. | Member surveys or travel diaries |
| Vehicle ownership | Net change in number of vehicles owned. Where members report having avoided vehicle purchases, this should be reported separately. | Assesses impacts of car-sharing. | Member surveys |
| Emissions | Net change in $CO_2$, CO, NOx or other pollutants. Based on change in VMT and fleet composition. | Assesses impacts of car-sharing. | Fleet database and VMT change calculation, using factors adopted by local air quality regulators |
| Transit ridership | Number of new transit trips generated each year. | Assesses impacts of car-sharing. Includes ridership from transit access trips to car-sharing, as well as wider changes in travel behavior. | Member surveys |
| Parking spaces saved | Net reduction in parking provision in developments that incorporate car-sharing. | Assesses extent to which car-sharing changes the form and auto-orientation of new development. | Planning Department data. Difficult to quantify as parking variances are often granted for multiple reasons. |
| Mobility | Perception of increased mobility among members (e.g. ability to reach new destinations). | Assesses impacts of car-sharing. | Member surveys |
| Fleet savings | Annual change in cost of corporate vehicles (rental cars, | Assesses cost savings from car-sharing. | Requires "before" and "after" data |

**Figure 21. Performance Measures for Car-share Programs (*23*, p. 244, Exhibit 7-5).**

| Measure | Definition | Significance | How Measured |
|---|---|---|---|
| **Internal Measures (normally proprietary)** | | | |
| Utilization | Revenue hours per vehicle per month. | Core measure of demand and effectiveness, which helps to assess performance of individual vehicle locations. | Reservations and vehicle logs |
| Revenue per vehicle | Revenue (usage charges) per vehicle per month. | Similar measure to utilization, but helps control for reduced-rate nighttime trips. | Reservations and vehicle logs |
| Vehicle availability | % reservations denied. | Helps assess whether new capacity is needed. Can be separated into members whose first choice was denied, and those who could not reserve an acceptable time or vehicle location for that trip at all. Difficult to measure with modern web-based reservations, since members can choose another vehicle or time. | Manual reservations logs; difficult to measure with web-based systems |
| Employee overhead | Full-time employees per vehicle. | Measures the efficiency of staffing; ratio should fall as an organization grows. | From staffing and vehicle numbers |
| Member satisfaction | % "very satisfied" or "satisfied" with car-sharing service. | Simple satisfaction measure. A range of more sophisticated measures are available; see *TCRP Report 88* (Kittelson & Associates, 2003a). | Member surveys |
| Member retention | % of members leaving each year. | Customer satisfaction measure. Exit surveys can probe reasons for leaving. | Member database |
| Farebox recovery | Ratio of member fees to total expenses. | Progress towards financial self-sufficiency or profitability. Similar to standard transit industry measure. | Financial statements |

**Figure 22. Performance Measures for Car-share Programs (*23*, p. 244, Exhibit 7-5). (Continued).**

## LESSONS LEARNED – MAJOR FACTORS FOR CAR-SHARE PROGRAM SUCCESS

Current market trends demonstrate the success of for-profit business models, but there are still numerous car-share programs that have taken an alternative scenario. It has been argued that non-profit, cooperative, and other alternative organizational models can be more flexible than for-profit organizations in testing innovative and new procedures and initiatives. Based on the review provided in this report, several issues identified are critical to the development of any car-share program.

### Marketing and Market Diversification

Although still a small share of travel activity, car-share is growing in popularity and has become pervasive in common culture. Reaching new markets and expanding membership are important next steps for car-share programs. A growing market presents opportunities and challenges for car-share organizations who want to reach a diversifying customer base (*28*). Market characteristics provide information that can support decisions about fare structures, advertising strategies, and vehicle placement. It can also help assess the potential for car-share on a broader level and further quantify the public benefits.

While the dominant focus for car-share organizations remains the neighborhood residential market, business and university users are a major source of growth. Potential users for car-share include several categories and can vary depending on the goals of a particular service (Figure 23). Households with multiple cars living in transit-oriented and dense areas can be a primary target group, since they have high potential to reduce car ownership in these areas (*23*). Car-share may be targeted at households without a car to improve quality of life and access to basic needs or at households without good access to transit as a last-mile solution. Low-income, transit-dependent households have become a target group to broadly improve accessibility but are not presently a major user group (*23*).


**Figure 23. An Operator Demonstrates Marketing to Different Motivations of Potential Users.**

### Equity and Low-Income Markets

It is not uncommon for car-share organizations to cite an increase in social equity as a benefit of the operation. Car-share can be a lower cost alternative to personal vehicle ownership and a travel option for individuals without the ability to access a car. It has the potential to serve low-income or otherwise disadvantaged populations. For car-share organizations that aim to achieve social goals in addition to profit, as defined the Car Sharing Association's Code of Ethics, and for partner organizations with equity and accessibility goals, identifying best practices for including equitable access is an important consideration for the development of car-share programs.

In spite of the potential that car-share schemes hold for creating more equitable transportation environments, it may be difficult to serve disadvantaged groups due to the fact that culture, sparse population, the cost of insurance, and an inability to raise the required deposit may all act

as barriers to participation (*139*). Still, there are car-share organizations that aim to overcome those obstacles through concerted efforts to increase transportation access to all populations.

Several examples of programs to incorporate equity goals can be found in practice. In 2001, City CarShare was launched in the San Francisco Bay area as a non-profit with the mission of improving the environment and quality of life in local communities (*17*). City CarShare has a *Community***Share** program through which they offer subsidized membership fees and driving costs to low-to-moderate income individuals referred to the program through one of City CarShare's partner organizations (*17*). Partners include an economic development corporation, housing organizations, Project Access developments, and a community development organization (*17*). *Community***Share** discounts are also made available to applicants and recipients of San Francisco's Working Families Credit programs (*17*). City CarShare, as a nonprofit corporation, funds its *Community***Share** program by channeling 100 percent of the profits, donations, and grants that the organization receives back into City CarShare programs (*17*).

Buffalo CarShare cites social equity as one of the organization's primary goals (*25*, p. 1). Among the car-share benefits that the organization lists is the social benefit of providing access to those without a vehicle because "everyone should be able to get a job interview or drop their kids off at day care on a snow day" (*140*). Buffalo CarShare found that 75 percent of members have used the service in order to access medical care, 85 percent have traveled to the grocery store using Buffalo CarShare, and 46 percent have taken a shared car to a job interview on at least one occasion indicates that the car-share acts as an important resource for its users (*25*, p. 1). Two-thirds of Buffalo CarShare's members report household earnings of less than $35,000, with over 25 percent reporting incomes lower than $15,000; it appears as though the car-share organization is are improving equitable access to transportation within the Buffalo community (*25*, p. 2).

**Partnership Implementation**

Car-share may not fit neatly into the existing structures of agencies or organizations that could be potential partners. For instance, a transit agency that sees itself as a mobility manager is more likely to champion car-share as a core idea whereas another agency may see car-share as competition. Similarly, universities have made for great partnerships because of their commitment to travel demand management, parking management, environmental initiatives, and an understanding that car-share can help fulfill these needs.

The type of support, including funding, will depend on the views and objectives of the partner. For example, in Seattle the transit agency contributed public funds to a private car-share company to help "demonstrate the viability of car-share and…test the different markets" while Southeastern Pennsylvania Transportation Authority (SEPTA) in Philadelphia viewed car-share as a complement to public transportation and thus chose to partner with a non-profit operator. Their belief was that a non-profit would be less interested in the bottom line and not promote car-share as a substitute for transit use (*23*).

A workshop conducted among car-share operators in 2005 suggested three important questions to ask of potential partners (*23*):

1. Do they have a business plan and something tangible to offer or in-kind assistance?
2. Do they have commitments up front that make the venture less risky?
3. Do transit agencies and local government in the community embrace car-share with a willingness to provide institutional support?

Partnerships with car-share organizations can be a win-win opportunity for many groups and can have an influence on the success or failure of a program. Increasing awareness and visibility, integrating car-share into governmental policies and offering tax breaks or savings, and private endeavors that allow for car-share have the potential to lead to successful outcomes. Communicating and relating car-share to the goals of a potential partner who may not have a deep understanding of car-share programs operations and benefits is important.

**Evaluation and Performance Measures**

Car-share is a new and rapidly expanding industry that can benefit from the ability to clearly communicate its benefits to partners and users. A lack of understanding among consumers or potential partners can be overcome by providing good information, gathered from evaluation and monitoring programs. It can ensure that public and private resources are properly spent and build support for car-share in the long term.

Car-share programs and partner organizations can support the industry by supporting robust and up-to-date monitoring and evaluation. Performance data can be critical for communicating the benefits of a relatively new and rapidly expanding industry such as car-share. The growing use of GPS or other in-vehicle technologies in car-share vehicles offer opportunities to collect more robust data.

**Parking Considerations**

Parking availability and cost are critical elements to the operations of car-share programs and involve regulatory issues and partner organizations. Finding and financing parking spaces can also be a barrier to car-share expansion in both new and existing markets. Parking deals have become more common with the expansion of one-way car-share programs like Car2Go, where the fleet vehicles are not designated to a single parking space. Local government is such an important partner for car-share programs because they usually control both on- and off-street parking. Three issues that arise in relation to car-share parking and that often must be addressed with local government input are (*23*) cost of parking, parking locations, and interference with other regulations.

*Cost of Parking*

Solutions have ranged from offering free parking to a gradual increase from start-up parking to full market rates, to charging for spots. For a car-share operator, parking costs may have a significant influence on start-up and operating costs, it can have conflicting meanings for government or other agency organizations. For example, the New York metro area's rail operator Metro North felt free parking was equivalent to using public funds for a private venture and instead charged $75 per spot. In other instances, offering free parking has been a tool to support a car-share program without actual funding (*23*).

Car-share programs have come to different solutions with different local governments regarding parking allocations. In many cases, car-share programs are paying cities for parking access. In 2012, Car2Go paid the local government in Washington, D.C., $578,000 annually to enable its 200-car fleet to park in all permit and metered parking spaces. San Francisco and Los Angeles have agreements with car-share operators to allow access to individual parking spots for fees that range from $600 to $2,700 per spot. In many cases, car-share programs are paying more than what private car owners pay for curbside parking (*141*).

*Parking Locations – On- and Off-Street Parking*

On-street parking offers visibility and publicity/public education. It may also offer security for the operator (busy public streets) and amenities for the users (transit, street lights, and trash cans) (*23*). Off-street parking avoids conflicts with street-cleaning, emergency vehicles, etc. Off-street parking locations that are placed within developments may have to address issues of access by non-resident members. Furthermore, placement of parking within a city has implications for equity and operators must address the trade-off between granting more access to low-income or non-traditional users and the costs of servicing areas that may not generate revenue to cover those costs.

*Interference with Other Regulations*

Car-share parking allowances can also conflict with other city regulations such as snow removal and street cleaning. Washington, D.C., has Rush Hour Zones, which are parking lanes during off-peak travel periods converted to driving lanes during weekday rush hours. While Car2Go generally allows parking in any legal on-street parking, DC-specific rules indicate that parking Car2Go vehicles in these spaces is not allowed at any time and can result in hefty fines for users. Car-share programs should consider the local parking regulations and engage local partners to best address this issue.

**Technology and Innovation**

Technological development has shaped the design and proliferation of car-share programs. Early models relied on telephone reservations, self-reporting of mileage and fuel use, and lock-boxes or other non-automated key access. All of today's car-share programs rely heavily or exclusively on Internet and mobile technologies to make reservations, locate vehicles, track usage and billing, and access vehicles.

This is also seen in an evolving car-share vehicle fleet worldwide. Gasoline and diesel vehicles are the most common, but many programs are incorporating low-emission vehicles, hybrids, and electric vehicles into their fleets. Car2Go's fleet comprises entirely Smart, two-door, two-passenger vehicles. Electric vehicles have been incorporated into the fleets of Zipcar, Car2Go, CityCarShare, and others.

Technology continues to change and is likely to be an important element in improving the functionality and ease of using car-share programs. The City of Helsinki, Finland, is exploring the idea of a mobility-on-demand system that uses a single subscription to access and pay for public transit and multiple shared services (*142*). Car2Go is experimenting with city-to-city one-way car-share in Europe. It has also been argued that the integration of current technologies

helps to engage new users, particularly young, tech-savvy consumers. The ability to innovate is likely to help car-share programs improve their operations and continue to appeal to growing markets.

## CAR-SHARE PROGRAMS IN THE UNITED STATES

The following table lists some of the car-share programs in the United States as of September 2015.

**Table 14. Selected Car-Share Programs in the United States.**

| Name | City | State | Link | Launched |
|---|---|---|---|---|
| Uhaul Car Share | Glendale | Arizona | https://uhaulcarshare.com/glendale-az/ | |
| Uhaul Car Share | Phoenix | Arizona | https://uhaulcarshare.com/phoenix-az/ | |
| Uhaul Car Share | Belmont | California | https://uhaulcarshare.com/belmont-ca/ | |
| Uhaul Car Share | Oakland | California | https://uhaulcarshare.com/oakland-ca/ | |
| City Car Share | San Francsico (Bay Area) | California | https://citycarshare.org/ | 2011 |
| Car To Go | Aspen | Colorado | http://www.aspenpitkin.com/Departments/Transportation/Car-To-Go/ | 2009 |
| Uhaul Car Share | Colorado Springs | Colorado | https://uhaulcarshare.com/colorado-springs-co/ | |
| eGO Car Share | Denver | Colorado | http://carshare.org/ | 1997 |
| Uhaul Car Share | Boca Raton | Florida | https://uhaulcarshare.com/boca-raton-fl/ | |
| Uhaul Car Share | St. Petersberg | Florida | https://uhaulcarshare.com/st-petersberg-fl/ | |
| Uhaul Car Share | West Palm Beach | Florida | https://uhaulcarshare.com/west-palm-beach-fl/ | |
| Uhaul Car Share | Galesburg | Illinois | https://uhaulcarshare.com/rock-island-il/ | |
| Uhaul Car Share | Rock Island | Illinois | https://uhaulcarshare.com/rock-island-il/ | |
| Blue Indy | Indianapolis | Indiana | http://www.blue-indy.com/ | 2014 |
| Uhaul Car Share | Decorah | Iowa | https://uhaulcarshare.com/lamoni-ia/ | |
| Uhaul Car Share | Dubuque | Iowa | https://uhaulcarshare.com/lamoni-ia/ | |
| Uhaul Car Share | Indianola | Iowa | https://uhaulcarshare.com/lamoni-ia/ | |
| Uhaul Car Share | Waverly | Iowa | https://uhaulcarshare.com/lamoni-ia/ | |
| Uhaul Car Share | Portland | Maine | https://uhaulcarshare.com/portland-me/ | |
| Uhaul Car Share | Weston | Massachusetts | https://uhaulcarshare.com/weston-ma/ | |
| Uhaul Car Share | Midland | Michigan | https://uhaulcarshare.com/midland-mi/ | |
| Dancing Rabbit Vehicle Co-Op | Rutledge | Missouri | http://www.dancingrabbit.org/about-dancing-rabbit-ecovillage/social-change/function/co-ops/dancing-rabbit-vehicle-co-op/ | 1998 |
| Uhaul Car Share | Lincoln | Nebraska | https://uhaulcarshare.com/lincoln-ne/ | |
| EZ Ride | Wood Ridge | New Jersey | http://www.ezride.org/2-4-0-CarShare.asp | 2009 |
| Buffalo Car Share | Buffalo | New York | http://www.buffalocarshare.org/ | 2008 |
| Ithaca Car Share | Ithaca | New York | http://www.ithacacarshare.org/ | 2008 |
| Carpingo | New York | New York | http://www.carpingo.com/ | 2012 |
| Uhaul Car Share | Asheville | North Carolina | https://uhaulcarshare.com/asheville-nc/ | |
| Uhaul Car Share | Boone | North Carolina | https://uhaulcarshare.com/asheville-nc/ | |
| Uhaul Car Share | Gambier | Ohio | https://uhaulcarshare.com/gambier-oh/ | |

| Name | City | State | Link | Launched |
|---|---|---|---|---|
| Time Car | Marfa | OK | | |
| Uhaul Car Share | McMinnville | Oregon | https://uhaulcarshare.com/monmouth-or/ | |
| Uhaul Car Share | Monmouth | Oregon | https://uhaulcarshare.com/monmouth-or/ | |
| Getaround | Portland | Oregon | https://www.getaround.com/pdx | 2012 |
| Uhaul Car Share | Easton | Pennsylvania | https://uhaulcarshare.com/easton-pa/ | |
| Uhaul Car Share | Gwynedd Valley | Pennsylvania | https://uhaulcarshare.com/easton-pa/ | |
| Uhaul Car Share | Ogden | Utah | https://uhaulcarshare.com/salt-lake-city-ut/ | |
| Uhaul Car Share | Park City | UTAH | https://uhaulcarshare.com/salt-lake-city-ut/ | |
| Uhaul Car Share | Salt Lake City | Utah | https://uhaulcarshare.com/salt-lake-city-ut/ | |
| CarShare Vermont | Burlington | Vermont | http://www.carsharevt.org/ | 2009 |
| Uhaul Car Share | Marlboro | Vermont | https://uhaulcarshare.com/marlboro-vt/ | |
| Scoot | Bremerton | Washington | http://www.kitsaptransit.com/scoot | 2005 |
| Community Car | Madison | Wisconsin | http://www.communitycar.com/ | 2003 |
| Uhaul Car Share | Waukesha | Wisconsin | https://uhaulcarshare.com/waukesha-wi/ | |
| Zipcar | Arlington, Austin, College Station, Dallas, Fort Worth, Houston, Kingsville, Lubbock, Prairie View, San Antonio, San Marcos, Waco | Texas | http://www.zipcar.com/ | 2000 |
| Car2go | Austin | Texas | https://www.car2go.com/en/austin/ | 2010 |
| Relayrides | Statewide | Texas | https://relayrides.com/ | 2009 |
| Hertz on Demand | Arlington, Denton, College Station, San Antonio | Texas | https://www.hertz.com/rentacar/productservice/ | |

# APPENDIX C: BIKE-SHARE MOBILITY PROGRAMS

This appendix provides the detailed research and literature review on bike-share programs completed by staff at TTI, including business models, funding sources, target audience, regulatory considerations, and performance measures.

## DESIGN OF BIKE-SHARE PROGRAMS

This section describes the business models of bike-share programs, provides an economic overview, as well as information on funding sources, marketing, target audience, and private sector partners.

### Business Models of Bike-Share

The University of Montana conducted a feasibility study for a city bike-share program on behalf of the city of Bozeman, Montana. As part of the effort, researchers and staff outlined the primary considerations for program development. One of the first considerations for a prospective program is the type of business model to apply. A number of public bike-share business models have evolved with the advent of IT-based systems, including:

- Nonprofit.
- Privately owned and operated.
- Publicly owned and operated.
- Publicly owned and contractor operated.
- Street furniture contract (in Europe primarily).
- Third-party operated.
- Vendor operated.

Given variations in ownership, system administration, and operations, there can be overlap among these models (*143*).

The feasibility of a bicycle-share program in a given community is affected by multiple criteria, such as:

- Quality of *bicycling infrastructure* within the area the program is intended to reach. This includes signs and traffic laws, terrain, availability of bike racks, and the safety and connectivity of bike lanes, paths, and trails.
- *Cycling culture* in the region including current bike use and public attitudes toward biking. The opinion of possible users toward cycling is important because the expected use of the program can determine support by sponsors and stakeholders.
- *Demographics* including population, age cohorts, income, current commuter data, population densities, and location of heavily congested areas.
- *Startup and annual maintenance costs* of a bike-share program needs to be within a community's ability to pay or to find sponsors to support. User fees are usually minimal and may only cover some of the actual cost.

- *Stakeholder support* is essential to obtain public and/or private funding and sponsors for the program.
- *Current transportation options* and usage in the region (*143*).

**Economic Overview**

Annual operating and maintenance costs were found in some of the literature given per bike or per station. BIXI in Montreal and B-Cycle automated system startup costs average $4200–5400 per bike, including stations, kiosks, and all system components. Another program noted a capital cost of implementation of approximately $50,000–60,000 per station, depending upon size (number of docks) (*144*).

Average operating costs range from $150 to $200 per bike each month including bike and station maintenance and staff to rebalance bikes (*143*). One system noted annual operating costs of approximately $11 million. In some cases, maintenance costs were noted to be approximately $25,000 per station per year (*144*).

The four most common types of insurance coverage carried by U.S. and Canadian bike-share operators included general liability coverage, workers' compensation, commercial auto, and inland marine coverage. In general, commercial liability was the most common form of insurance. Except in cases in which bike-share programs were insured by a sponsor or local government entity, most of them carried some form of liability coverage. Although all North American programs required a liability waiver, many were required to carry liability insurance as a condition of permission to place kiosks on either public or private land. Most operators perceived liability insurance as a necessary protection against potential legal action because liability waivers served as protection only with respect to legal actions by users (and not by property owners or drivers of vehicles, who might encounter bike-share users) (*32*).

**Funding Sources**

Related to the increased diversification of business models noted above, public bike-share systems have generated an array of start-up and operational funding. Funding for current bike-share programs has been obtained through a combination of sources, including:

- Advertising.
- User fees.
- Grants.
- Loans.
- Sponsorships.
- Health care and tobacco settlement funds.
- Governmental funds for capital costs, operational costs, or both.

Most public bike-share start-ups have received some combination of local, state, or federal government funding. Operational costs typically are funded through a combination of user fees, advertising, and sponsorships (*143*).

There was no information found in the technical literature pertaining to the use of CMAQ funds and bike share programs. However, bike-share programs are a legitimate use of CMAQ funding. A search of the FHWA CMAQ project database yields the following (Table 15).

**Table 15. Bike-Share Projects in CMAQ Project Database.**

| CMAQ Project ID | State | MPO | NonAttainment Maintenance Area | Project Year | Project Title |
|---|---|---|---|---|---|
| TN20100015 | Tennessee | Chattanooga Hamilton County RPC | Chattanooga | 2010 | Bike Share Program |
| DC20110004 | District of Columbia | Metropolitan Washington COG | Washington DC-MD-VA | 2011 | Bike Share Program Phase II |
| VA20110070 | Virginia | Metropolitan Washington COG | Washington DC-MD-VA | 2011 | Northern Virginia - Arlington County - Purchase and installation of Bike Share S |
| IN20120041 | Indiana | Indianapolis MPO | Indianapolis | 2012 | Indianapolis Cultural Trail Bike Share Program |
| VA20110070 | Virginia | Metropolitan Washington COG | Washington DC-MD-VA | 2012 | Northern Virginia - Arlington County - Purchase and installation of Bike Share S |
| NV20130006 | Nevada | Regional Transportation Commission of Clark County | Las Vegas | 2013 | Regional Bike Share Program |
| MI20130030 | Michigan | Southeast Michigan COG | Detroit-Ann Arbor | 2013 | Ann Arbor Bikeshare Infrastructure |
| IL20130135 | Illinois | Chicago Area Transportation Study | Chicago-Gary-Lake County | 2013 | Bike Sharing Program |

### Station Location

With respect to docking stations, key considerations for prospective program start-ups include (143):

- Where to position stations?
- How much distance should exist between kiosks?
- How far stations must be placed from transit hubs to encourage multimodal cross flow between transit and bike-share?
- Whether to locate kiosks on public or private land?

In a survey, program operators indicated, in almost all cases, that use of the land for stations was free. In a few cases, sponsors paid operators to locate public bike-share on their property. In one instance, an operator had to pay to use a municipal property. Although operators in general did not pay to use the land, cases have occurred in which programs had to either move or install on-street furniture as part of their agreement. (*35*)

The preferred linear distance between docking stations for operators varies considerably. The research provides a range from 300 feet to greater than 4,000 feet between stations. The majority reported a preferred distance of 900–1,300 feet between stations. In terms of distance from public transportation, the research again indicated a wide range from a maximum of 82 feet up to 1,300 feet. Determination of optimal station placement includes consideration of numerous factors and constraints. Researchers concluded that the variation reflected the diversity of operator environments and the practical experience gained by the industry with respect to an understanding of station network design (*145*).

### Marketing and Target Audience

The Delaware Valley Regional Planning Commission in Philadelphia, Pennsylvania, conducted a more technical, two phase in-house market study. The first phase used a raster-based geographic information system (GIS) analysis to identify a primary geographic market area for a bike-share program. Phase 2 applied bike-share trip diversion rates observed in peer European cities to estimate daily bike-share trips in the primary market area.

In Phase 1, various demographic, land use, and infrastructure factors considered favorable for bike-share usage were spatially analyzed to define a primary market area—the portion of Philadelphia most likely to utilize a bike-share program. Planners conducted a weighted sum raster analysis using ArcGIS software. The input factors used to develop the bike-share weighted sum raster analysis were:

- Trip Origin Factors.
  - Population density at the census tract level for persons.
  - 17–64 years of age.
  - Non-institutionalized group quarter population density at the census tract level (includes dormitories and shelters, but not nursing homes or prisons).
- Trip Attraction Factors.
  - Job density at the traffic analysis zone (TAZ) level.
  - Retail job density at the TAZ level.
  - Locations of tourist attractors (cultural, entertainment, sports, and destination restaurants from Greater Philadelphia Tourism Marketing Corp. database).
  - Proximity to parks and recreation areas.
- Network and Facility Factors (500 meter buffer).
  - Proximity to rail station(s).
  - Proximity to bicycle-friendly streets, including streets with bicycle lanes (Philadelphia Streets Department data set).
  - Proximity to streets with bicycle lanes (Philadelphia Streets Department data set).
  - Locations of bus stops (includes surface trolley stops).

In the second phase, a sketch-planning method was developed to estimate the demand for bike-share in Philadelphia on the basis of the demand for existing modes and diversion rates extrapolated from bike-share systems in other cities. The method involved three steps:

1. Calculation of diversion rates for peer cities.
2. Calculation of demand for existing transportation modes in Philadelphia.
3. Application of the diversion rates to existing Philadelphia trips to estimate the demand for bike-share (*146*).

### Partners (Private Sector)

In Europe, third-generation bike-share programs tend to be large scale, operate through public-private partnerships and advertising models, and feature advanced technologies. It has become common for external operators, notably advertising firms, to work alongside city authorities in the implementation of a bike-share system. These operators have their own bike system models

that they sell to the city. While they differ in their visual design, these models have many similarities with regard to system characteristics, such as electronic docking stations, smartcards or key fobs. Among operators in European countries, JCDecaux and Clear Channel are the most prevalent. In both of these cases, the advertising company provides bike-share services in exchange for the right to advertise on city street furniture and billboards (144).

In North America, different financial and operating models are emerging. In 2012, North American programs emphasized sponsorships to support program costs rather than advertising agencies as program funders and operators. Non-profit organizations (e.g., BIXI Montreal, Nice Ride Minnesota) were the predominant business model, followed by publicly-owned/contractor operated models (e.g., Capital Bikeshare, Capital BIXI), and next for-profit vendor operated models (e.g., DecoBike, Bike Nation, SoBi) (*35*).

For-profit vendors operate as businesses and do not require public support. With sponsorships, bike-share operators often obtain start-up and operational support from a combination of corporate sponsors and station sponsors, as well as government. Public and private entities can sponsor either an entire bike-share system or specific kiosk locations, generally in exchange for advertising on the bike-share system. In a sponsorship model, sponsor-based advertising is often used to support bike-share capital purchases rather than as a means to sell advertising as a business. Citibike in New York City started in May 2013 with more than 6000 bicycles. Citibank paid $41 million to be the programs lead sponsor, followed by MasterCard at $6.5 million. Citibike highlights an emerging trend emphasizing sponsorships in contrast to advertising in North America (144).

## REGULATORY CONSIDERATIONS

The *Urban Transportation Monitor* conducted a survey of staff of five bike-share programs in North America (144). One of the questions asked about regulatory or planning aspects in their region that helped develop the program. Their responses included:

- Complete streets ordinance.
- Pedestrian and bicycle master plans.
- District planning exercises.
- County operating budget includes funding.
- Bike infrastructure being addressed.
- Development review process used to provide opportunity for inclusion of bike-share stations in future developments, as appropriate (*144*).

## IMPACTS OF BIKE-SHARE

Shaheen noted that bike-share offers a number of environmental, social, and transportation-related benefits (*35*). It provides a quick and zero-emissions means to access public transportation or to make short-distance trips between docking stations. Potential bike-share benefits include:

- Increased mobility.
- Economic benefits, including cost savings from modal shifts and increased tourism.
- Lower implementation and operational costs (in contrast to shuttle services).
- Reduced traffic congestion.
- Reduced fuel use.
- Increased public transit use.
- Increased health benefits.
- Greater environmental awareness (*35*).

One study showed 16 percent of Capital Bikeshare riders in Washington, D.C., report making new trips because of Capital Bikeshare. Twenty-three percent of users reported spending more money because they used bike-share, perhaps enhancing local retail businesses. Twenty percent of businesses in the study sample reported a positive impact of bike-share on sales and 70 percent identified a positive impact on the neighborhood. In addition, 61 percent would have either a positive or neutral reaction to replacing car parking in front of their business with a bike-share station (*59*).

Another study of Capital Bikeshare found that the introduction of a bike-share program in Washington, D.C., is correlated with an increase in bicycle commutes and bicycle crashes. However, in Minneapolis, the start of Nice Ride did not have the same effects. This may be attributed to greater development in bicycle infrastructure by Minneapolis in conjunction with the bike-share program implementation. This suggested to researchers that the safety of participants in bike-share programs is enhanced by the addition of bike lanes and optimal station placement (*147*).

## LESSONS LEARNED AND BEST PRACTICES

General lessons about bike-share are:

- Bike-share is still growing rapidly in North America.
- Rebalancing remains a difficult and expensive issue for operators.
- Casual users generate the majority of revenue.
- Partnerships are key to program success.
- Members drive less as a result of bike-share.
- Bike-share functions as public transit for many commuters (37).

When determining the extent and spatial distribution of docking stations, system planners should consider the importance of a comprehensive network of potential destinations within biking proximity of each other. Proximity to a greater number of other bike-share stations exhibited a strong positive correlation with ridership in a variety of model specifications. Operators of existing bike-share systems may consider the relocation of underused, isolated stations to be closer to a central network of stations (*148*).

Restaurants, other commercial enterprises, and universities in the vicinity of a docking station significantly influence the arrival and departure rates of the station. Researchers observed that adding a station has a stronger impact on bicycle flows (arrivals/departures) compared to

increasing station capacity. It suggests that bike-share operators should consider reallocating capacity from large stations to multiple small size stations (59).

### Maintenance

Several levels of maintenance for bicycles and stations are needed. Minor maintenance can be carried out onsite, while more major work needs to be done in a specialist's workshop, which involves being able to handle the bicycles. The level of maintenance required is mainly dependent on the levels of vandalism and theft, which are difficult to predict. Vandalism has been a phenomenon that was poorly anticipated and has threatened the financial equilibrium of some programs, sometimes going as far as to force temporary closures of stations or even entire programs (36).

### Redistribution

There is a significant amount of research being conducted to develop models for rebalancing and redistributing bicycles within a station network in order to meet demand. Approximately 25–33 percent of the research reviewed pertained to this issue. Redistribution involves moving bicycles around the system to avoid having stations that are either empty or too full. The geographical and economic structure of the program network can result in unevenness both in spatial and temporal:

- Stations in areas at higher elevation tend to empty toward stations lower down (structural imbalance).
- Stations in residential areas experience a shortage of bicycles in the morning and are saturated in the evening, while the opposite applies to stations in areas with a high level of economic activity (such as within the central business district ).
- Imbalances in terms of time are seen near areas that generate a large number of trips, such as universities, railway stations, arts venues, and leisure facilities (36).

### User Data

One way of optimizing the use and operation of bike-share is to improve awareness of the program among users, particularly in terms of making it easier to borrow and return bicycles. In addition to real-time information on bicycle availability (at station terminals, the internet, and mobile phones), the information provided must allow the user to prepare and complete their journey and therefore include subscription conditions and terms of use, details of stations and routes, information on closed stations, and estimated journey times.

Creating a dedicated program website is essential, as is providing information throughout the city, especially paper maps of stations and plans made available to users in public areas, not just at stations. It is also important to enable users to provide feedback (positive and negative) to the service operator. Regular promotional campaigns such as at organized events, on blogs, or communication campaigns will boost the reputation and image of the program (36).

One study found that health, recreation, and transportation were the most frequently identified benefits of bicycling highlighted by focus group respondents, indicating that bike-share marketing might be most effective at attracting participants if it promoted these elements.

Suggesting bike-share use for situations in which participants were most likely to use a bike may prompt the choice to choose this transportation mode instead of an automobile. Recreational rides in parks appear to be popular and can be an ideal way to get comfortable on a bike before riding in traffic (*149*).

Worksite support will play a major role in the success of bike-share programs. Employees provided with additional physical and cultural support for active transportation are more likely to walk or bike. However, one study found practical limitations for users, including shower access and personal hygiene concerns, as barriers to bicycling during the day. Tangible worksite encouragement of active transportation by providing these types of amenities might ease these limitations. The perception that other coworkers use active transportation influences the likelihood of choosing walking or bicycling. Employees in workplaces that promote active travel are less likely to drive an automobile to work. Therefore, internal promotion of the bike-share system by employers and employees can encourage use (*150*).

Researchers found that the number of trips at Nice Ride stations in Minneapolis is positively and significantly associated with food-related destinations near the station and with job accessibility. However, it was not so with general retail establishments. This association with food-related destinations correlates with Denver B-Cycle's 2012 Survey of Users showing 55 percent of users made trips to restaurants, bars, or pubs and 45 percent using the service for commuting to work at some point (*151*).

**Barriers to Planning and Programming**

Introducing a bike-share program will always involve some risk for the local transportation agencies. Bike-share programs may run into difficulties and produce undesirable effects. Examples of these include:

- Excessive operating costs generated by damage/vandalism targeted at bicycles and stations or the necessity of redistributing bicycles around the system.
- Consumption of public space in a restricted environment.
- Undesirable modal shifts (for example, from walking or public transport to public bicycles on non-congested routes).
- Negative image in the event of problems: poor operation of the service, accidents involving public bicycles, limited use of the service, etc.
- Undesirable side effects: competition with commercial cycle-hire services.

Some negative or undesirable effects can be anticipated, avoided, or reduced when the program is designed. However, there will still be a level of uncertainty associated with external factors (vandalism, user reaction to the service, etc.). Complete failures are very rare though (36).

Safety issues can form a barrier to successful implementation of a bike-share program. Research surveys indicated that concerns regarding bicycling in traffic are apparent because of a lack of facilities (bike lanes) and a need for public education on safe motorist and bicyclist behavior.

Respondents identified the lack of, or insufficient, bicycling infrastructure and traffic safety as the most common reasons for not cycling to work. Unsafe road conditions, construction, debris,

and railroad tracks were also commonly identified as hazards. Bicyclists not following the rules were noted because of the negative impact this unpredictability has on motorists' behaviors and perceptions. A final concern was the presence of steep hills creating difficult riding conditions (*150*).

Helmet laws are perceived as an obstacle to use because of the inconvenience associated with the carrying of a helmet, the lack of its availability for last minute trips, and the operator challenges associated with the provision of sterile shared-use helmets (*145).* Fishman noted that bike-share users demonstrate a greater reluctance to wear helmets than private bicycle riders and helmets have acted as a deterrent in jurisdictions in which helmets are mandatory (*152*).There are 21 states, the District of Columbia, the Northern Mariana Islands and the Virgin Islands have a helmet law for bicyclists below a certain age, generally about 16. On the other hand, 29 states and Guam have no bicycle helmet law. Only the Virgin Islands require helmets for all bicyclists. (*153*)

### Current Developments in Bike-Share

Shaheen presents a list of current and future issues pertaining to bike-share in the United States (*33*). These issues are evolving rapidly, and will be monitoring over the course of the project as information, practice, or experiences are noted and recognized:

1. Occasional Members – a new membership type known as the Occasional Member is becoming more common.
2. Membership Reciprocity – B-cycle's B-connected campaign.
3. Community Involvement and Crowd-Sourced Funding – Online "Suggest-a-Station" platforms enabling additional public input and crowd-funded system expansions.
4. Equity Issues and Public Policy systems are increasingly looking at how to address social equity in bike-share.
5. Helmet Dispensing Options – Helmet kiosks launched in Boston.
6. Peer-to-Peer Bike-share – The sharing of private bicycles between individuals.
7. Flexible Docking and Geo-fencing Technologies – Allows for users to pick-up and drop-off bicycles anywhere within a geographic area.
8. Self-Rebalancing and Dynamic Pricing – Pricing mechanisms are used to encourage self-rebalancing of the bike-share fleet (e.g., Vélib, CapBi, London's Barclay's Cycle Hire).

## BIKE-SHARE PROGRAMS IN THE UNITED STATES

The following table lists some of the bike-share programs in the United States as of 2015.

**Table 16. Selected Bike-share programs in the United States.**

| Name | City | State | Link | Launched |
|---|---|---|---|---|
| Vallocycle | Montevallo | Alabama | http://www.vallocycle.com/about | 2011 |
| NAU Yellow Bikes | Flagstaff | Arizona | http://nau.edu/green-nau/yellow-bike-program/ | 2007 |
| GRID Bike Share | Phoenix | Arizona | http://gridbikeshare.com/ | 2014 |
| Razor BikeShare | Fayetteville | Arkansas | http://parking.uark.edu/320.php | 2013 |
| Zotwheels | Irvine | California | http://www.parking.uci.edu/zotwheels/about.cfm | 2009 |
| Bike Nation USA | Los Angeles | California | http://www.bikenationusa.com/ | 2009 |
| OCTA Bike Share | Orange | California | http://www.octa.net/Share-the-Ride/Bike/BikeShare/Overview/ | 2013 |
| Bay Area Bike Share | San Francsico (Bay Area) | California | http://www.bayareabikeshare.com/ | 2013 |
| We-Cycle | Aspen | Colorado | https://www.we-cycle.org/ | 2010 |
| Boulder B-Cycle | Boulder | Colorado | https://boulder.bcycle.com/home.aspx | 2011 |
| Denver B-Cycle | Denver | Colorado | https://denver.bcycle.com/home.aspx | 2007 |
| FC Bike Library | Fort Collins | Colorado | http://www.fcbikelibrary.org/ | 2008 |
| Simsbury Free Bike | Simsbury | Connecticut | http://www.bikewalksimsbury.org/simsbury-ct-free-bike.php | 2011 |
| Capital BikeShare | Washington, D.C. | D.C. | http://www.capitalbikeshare.com/ | 2008 |
| Orlando Bike Share | Orlando | Florida | http://orlandobikeshare.com/ | 2014 |
| Broward B-Cycle | Tampa | Florida | https://broward.bcycle.com/home.aspx | 2011 |
| Coast | Tampa | Florida | http://coastbikeshare.com/ | 2014 |
| Bike Emory | Atlanta | Georgia | http://bike.emory.edu/ride/bike-share | 2007 |
| Columbia County B-Cycle | Evans | Georgia | https://columbiacounty.bcycle.com/home/ | 2013 |
| Cat Bike | Savannah | Georgia | https://catbike.bcycle.com/home/ | 2013 |
| Hawaii B-Cycle | Kailua | Hawaii | https://hawaii.bcycle.com/home.aspx | 2014* |
| Boise GreenBike | Boise | Idaho | http://boise.greenbike.com/ | 2015 |
| 5B Bike Share | Ketchum | Idaho | http://5b.socialbicycles.com/ | 2012 |
| Divvy | Chicago | Illinois | https://www.divvybikes.com/ | 2013 |
| South Illinois U Bike Share | Edwardsville | Illinois | http://www.siue.edu/sustainability/bike-share.shtml | 2010 |
| StarBikes | Springfield | Illinois | http://www.uis.edu/campusrec/programareas/wellness/bikeshare/ | 2014 |
| Pacers Bike Share | Indianapolis | Indiana | https://www.pacersbikeshare.org/home | 2013 |
| Des Moines B-Cycle | Des Moines | Iowa | https://desmoines.bcycle.com/home.aspx | 2010 |
| Blue Bikes | Orono | Maine | http://umaine.edu/mainebound/bluebikes/ | 2011 |
| Umass Amherst Bike Share | Amherst | Massachusetts | http://umass-sga.com/bike-share/ | 2011 |
| Yellow Bike Program | Amherst | Massachusetts | http://bike.hampshire.edu/ | 1999 |
| Crimson Bikes | Boston | Massachusetts | http://crimsonbikes.org/about | 2009 |
| Hubway | Boston | Massachusetts | https://www.thehubway.com/ | 2011 |
| Tufts Bikes | Medford | Massachusetts | http://tuftsbikes.com/how-it-works/ | 2010 |
| Blue Bikes | Ann Arbor | Michigan | http://recsports.umich.edu/bluebikes | 2012 |
| MSU bikes | East Lansing | Michigan | http://msubikes.wordpress.com/rental-program/ | 2003 |
| Capital Community Bike Share | Lansing | Michigan | http://www.lansingmi.gov/CapitalCommunityBikeShare | 2013 |
| Bike Loan | Rochester | Michigan | http://www.oakland.edu/campusrec/bike | 2012 |
| TC Bike Library | Traverse City | Michigan | http://carterscompost.com/tc-bike-library/ | 2013 |
| Nice Ride MN | Minneapolis | Minnesota | https://www.niceridemn.org/about/ | 2010 |

| Name | City | State | Link | Launched |
|---|---|---|---|---|
| Green Bikes | Northfield | Minnesota | http://wp.stolaf.edu/sa/transportation/greenbikes/ | 2007 |
| Rebel Pedals | Oxford | Mississippi | http://bike.olemiss.edu/program.html | 2009 |
| Mizzou Bike Share | Columbia | Missouri | http://environmentalleadership.missouri.edu/mizzou-bike-share/ | 2012 |
| Kansas City B-Cycle | Kansas City | Missouri | https://kansascity.bcycle.com/home.aspx | 2012 |
| Heartland B-Cycle | Omaha | Nebraska | https://heartland.bcycle.com/home.aspx | 2011 |
| Original Yellow Bike Program | Omaha | Nebraska | http://www.unomaha.edu/bikeshare/ | 2009 |
| The Bike Library | Omaha | Nebraska | http://www.unomaha.edu/bikeshare/ | |
| Molasky Corporate Center | Las Vegas | Nevada | http://www.molaskyco.com/molasky-media-blog/2012/09/molasky-corporate-center-launches-las-vegas-first-private-bike-share-program/ | 2012 |
| Green Bikes | Keene | New Hampshire | http://www.keene.edu/sustain/initiatives.cfm | 2002 |
| Collingswood Bike Share | Collingswood | New Jersey | http://www.collingswood.com/bikeshare | 2008 |
| Citibike | Jersey City | New Jersey | https://www.citibikejc.com/ | 2015 |
| Buffalo Bike Share | Buffalo | New York | http://buffalo.socialbicycles.com/ | 2013 |
| Gilded Bicycles | Clinton | New York | http://www.hamilton.edu/transportation/gilded-bicycles | |
| Big Red Bikes | New York | New York | http://bigredbikes.cornell.edu/ | 2008 |
| Citi Bike | New York | New York | http://www.citibikenyc.com/ | 2013 |
| NYU Bike Share | New York | New York | http://www.nyu.edu/sustainability/campus.projects/bike.share/index.php | 2010 |
| Wolf Ride Bike Share | Stony Brook | New York | http://www.stonybrook.edu/sustainability/biking-at-stony-brook/wolf-ride-bike-share.shtml | 2013 |
| Tar Heel Bikes | Chapel Hill | North Carolina | http://rha.unc.edu/enhancements/tarheelbikes/ | 2012 |
| Charlotte B-Cycle | Charlotte | North Carolina | https://charlotte.bcycle.com/pricing.aspx | 2012 |
| Pirate Bikeshare/ Bike Rental Program | Greenville | North Carolina | http://www.ecu.edu/bikes/bikeshare.html | 2009/ 2012 |
| Great Rides Bike Share | Fargo | North Dakota | http://greatrides.bcycle.com/faqs | 2015 |
| BearCat Bike Share | Cinncinnati | Ohio | http://www.uc.edu/af/pdc/sustainability/campus_initiatives/transportation/bike_share.html | 2010 |
| CoGo | Columbus | Ohio | http://www.cogobikeshare.com/ | 2013 |
| Flash Fleet | Kent | Ohio | http://www2.kent.edu/flashfleet/index.cfm http://www.kent.edu/recservices/flashfleet | 2010 |
| Otterbike | Westerville | Ohio | http://www.otterbein.edu/public/About/Newsroom/Spotlights/Otterbike.aspx | 2009 |
| Spokies | Oklahoma City | Oklahoma | http://spokiesokc.com/ | 2012 |
| Tulsa Townies | Tulsa | Oklahoma | http://www.tulsa-townies.com/default.aspx | 2007 |
| UO Bike Share | Eugene | Oregon | http://outdoorprogram.uoregon.edu/bikes/share | has not started operation |
| UC Bike Share | Collegeville | Pennsylvania | http://www.ursinus.edu/netcommunity/page.aspx?pid=4296 | 2008 |
| Indego Bike Share | Philadephia | Pennsylvania | https://www.rideindego.com/ | 2015 |
| Healthy Ride | Pittsburgh | Pennsylvania | https://healthyridepgh.com/ | 2015 |

| Name | City | State | Link | Launched |
|---|---|---|---|---|
| Pittsburgh | | | | |
| Bike Pottstown/Schuylkill | Pottstown | Pennsylvania | http://bikeschuylkill.org/ | 2008 |
| Bike CofC | Charleston | South Carolina | http://bike.cofc.edu/bike-share-program/ | 2013 |
| Greenville B-Cycle | Greenville | South Carolina | https://greenville.bcycle.com/home.aspx | 2012 |
| Spartanburg B-Cycle | Spartanburg | South Carolina | https://spartanburg.bcycle.com/home.aspx | 2011 |
| Rapid City B-cycle | Rapid City | South Dakota | https://rapidcity.bcycle.com/ | |
| Chattanooga Bicycle Transit System | Chattanooga | Tennessee | http://www.bikechattanooga.com/ | 2012 |
| CycleUShare (electric) | Knoxville | Tennessee | http://cycleushare.utk.edu/cycleushare/E-Bike_Sharing_at_UTK.html | 2011 |
| Nashville Green Bikes | Nashville | Tennessee | http://www.nashvillebikeshare.org/ | 2010 |
| GreenBike SLC | Salt Lake City | Utah | https://www.greenbikeslc.org/home.aspx | 2011 |
| UVM Bike Share | Burlington | Vermont | http://www.uvm.edu/sustain/node/1190 | 2011 |
| Patriot Bike Share | Fairfax | Virginia | https://gmu.viacycle.com/ | 2012 |
| Green Bike | Pullman | Washington | http://urec.wsu.edu/green-bike | 2010 |
| Pronto! Cycle Share | Seattle | Washington | http://www.prontocycleshare.com/ | 2014 |
| Madison B-Cycle | Madison | Wisconsin | https://madison.bcycle.com/home.aspx | 2011 |
| Bublr Bikes | Milwaukee | Wisconsin | http://bublrbikes.com/about/ | 2014 |
| B-cycle | San Antonio | Texas | https://sanantonio.bcycle.com/home.aspx | 2011 |
| B-cycle | Austin | Texas | https://austin.bcycle.com/ | 2013 |
| B-cycle | Houston | Texas | https://houston.bcycle.com/ | 2012 |
| B-cycle | Fort Worth | Texas | http://fortworthbikesharing.org/ | 2012 |
| B-cycle | Dallas | Texas | https://fairparktx.bcycle.com/ | 2014 |
| B-cycle | McAllen | Texas | https://mcallen.bcycle.com/ | 2015 |
| Maroon Bike Share | College Station | Texas | http://maroonbikeshare.com/ | 2012 |

# APPENDIX D: STAKEHOLDER INPUT

This appendix reports on the detailed, subjective impressions, and quantitative responses that potential users have about these modes, which includes a detailed account of information gathered from focus groups, the statewide survey, and the executive interviews. This chapter also documents the challenges and opportunities that the "implementers" experience in establishing these programs.

## FOCUS GROUPS

In December 2014, researchers with the Texas A&M Transportation Institute (TTI) conducted a series of focus groups to capture the public's perceptions and understanding of three shared mobility programs: dynamic ride-share, car-share and bike-share.

The focus groups evaluated initial awareness of these modes and determined what features or benefits are most impactful for participants to use one of these modes. The focus groups also identified the largest obstacles to potential use of these modes.

### Focus Group Discussion

Using the same discussion guide in each session, the moderator asked participants to provide their perceptions and understanding of each mode choice, as well as implications for mode decision making. Figure 24 shows the portion of the discussion guide used to begin each focus group.

**Introduction (15 Minutes)**
Welcome to the focus group today. Thank you for taking time out of your busy schedules to talk with us. I'd like to begin by telling you about how the group will work and then we'll get down to the specifics of our topic for the day.

How many of you have participated in a focus group before?

The success of the group depends quite a bit on how willing you are to share with us what you think. So, I'm asking you right up front to be open and forthcoming, and not to worry about what I might think, or what others in the group might think about what you say, or even if you are giving a viewpoint that disagrees with someone else's. We're not really talking today about matters that would be considered very sensitive, but the topic is one that we would expect people to have differing opinions on, so I do want to encourage lots of dialogue.

We will be recording this session but only for note-taking purposes. We will keep the recording to ourselves and will destroy the file once our report is completed. Please let me assure you that we will always keep everything you say as anonymous.

Having said that, I want you to relax and enjoy the conversation. But I do have to ask that you talk one-at-a-time, that you not have any side conversations, and you speak loudly so that everyone can hear what each person has to say. I don't expect our discussion to last more than about an hour and a half. If you need to get more refreshments or use the facilities around the hall, please feel free to get up at any time.

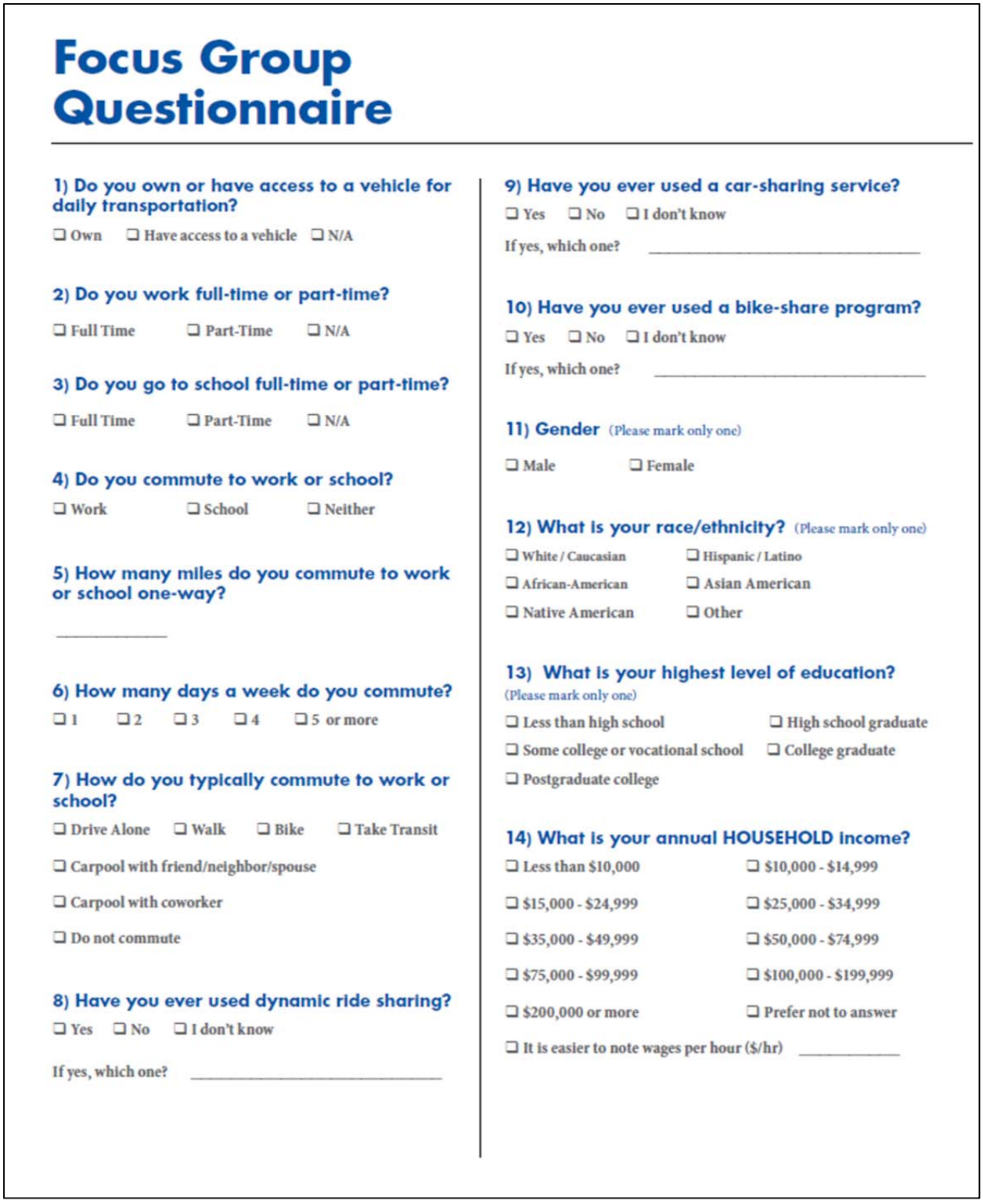
First, I'd like us to have some brief introductions. I'll start with us…

Now, let's go around the room and say your first name only (because we're keeping this anonymous), and a little bit about who you are, how long have you lived in the area and what you do for a living.
Before we get started with the discussion I want to give you a little questionnaire. *(pass out questionnaire; allow 5 minutes for completion)*

**Figure 24. Focus Group Discussion Guide – Introduction Section.**

*Questionnaire*

After initial introductions and a briefing on how the group would be conducted, participants were given a questionnaire (Figure 25) with questions about commute patterns and socio-demographic information. Researchers used this information to further understand daily travel needs and resources defining participants' decision making.



# Focus Group Questionnaire

**1) Do you own or have access to a vehicle for daily transportation?**

❑ Own ❑ Have access to a vehicle ❑ N/A

**2) Do you work full-time or part-time?**

❑ Full Time ❑ Part-Time ❑ N/A

**3) Do you go to school full-time or part-time?**

❑ Full Time ❑ Part-Time ❑ N/A

**4) Do you commute to work or school?**

❑ Work ❑ School ❑ Neither

**5) How many miles do you commute to work or school one-way?**

_____

**6) How many days a week do you commute?**

❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 or more

**7) How do you typically commute to work or school?**

❑ Drive Alone ❑ Walk ❑ Bike ❑ Take Transit

❑ Carpool with friend/neighbor/spouse

❑ Carpool with coworker

❑ Do not commute

**8) Have you ever used dynamic ride sharing?**

❑ Yes ❑ No ❑ I don't know

If yes, which one? _____

**9) Have you ever used a car-sharing service?**

❑ Yes ❑ No ❑ I don't know

If yes, which one? _____

**10) Have you ever used a bike-share program?**

❑ Yes ❑ No ❑ I don't know

If yes, which one? _____

**11) Gender** (Please mark only one)

❑ Male ❑ Female

**12) What is your race/ethnicity?** (Please mark only one)

❑ White / Caucasian ❑ Hispanic / Latino

❑ African-American ❑ Asian American

❑ Native American ❑ Other

**13) What is your highest level of education?**
(Please mark only one)

❑ Less than high school ❑ High school graduate

❑ Some college or vocational school ❑ College graduate

❑ Postgraduate college

**14) What is your annual HOUSEHOLD income?**

❑ Less than $10,000 ❑ $10,000 - $14,999

❑ $15,000 - $24,999 ❑ $25,000 - $34,999

❑ $35,000 - $49,999 ❑ $50,000 - $74,999

❑ $75,000 - $99,999 ❑ $100,000 - $199,999

❑ $200,000 or more ❑ Prefer not to answer

❑ It is easier to note wages per hour ($/hr) _____

**Figure 25. Focus Group Questionnaire.**

A total of 31 participants attended four focus groups and completed the questionnaire. The gender composition of the total focus group effort was 13 males and 18 females. A variety of races/ethnicities were represented in the focus groups: 13 White/Caucasian, nine

Hispanic/Latino, six African American, one Asian American and one person who identified a race/ethnicity other than those listed on the form. Two-thirds of the participants were college graduates, with several having post-graduate degrees. Participants reported a range of annual incomes from less than $10,000 to over $100,000.

With the exception of one person, all participants owned a vehicle used for daily transportation. The majority of participants worked full-time, while some worked part-time, and several either did not work or were retired. Three participants were students. Most commuted to work alone, five or more days per week, with the majority commuting 20 or more miles each day.

One-third of participants indicated they had used a shared mobility service prior to the focus group. Six had previously used bike-share services, four had used ride-share and two had used car-share.

*Preliminary Discussion*

The moderator initiated discussion with a series of questions oriented toward obtaining participants' initial awareness and knowledge of ride-share, car-share, and bike-share programs. The moderator began by asking, in turn, if participants had heard of the travel options. The conversation allowed participants to describe what they knew or had heard about each of the programs. The moderator did not offer any additional information nor correct any misinformation at this or any point of the discussion. Figure 26 shows the portion of the discussion guide used for the preliminary discussion.

**II. Preliminary Discussion (15 minutes)**
OK, now we're ready to get on with the topic at hand. TTI is conducting a research project for TxDOT that is aimed at studying transportation modes that may have an impact on statewide mobility or, more specifically, at the mobility for each of you individually. Specifically, we're looking at the availability of alternate modes and whether or not you use them or what would make you willing to use them. We want to gain a better understanding of how people feel about dynamic ride-sharing, car-sharing, and bike-sharing.

First, I want to find out what you know about different mobility programs.
- Have you heard of [dynamic] ride-sharing? What do you think it means?
- Have you heard of car-sharing programs? Can you name some examples? Where have you seen it? What do you think it means?
- Have you heard of bike-sharing programs? Can you name some examples? Where have you seen it? What do you think it means?

Let me share some information about each of the programs with you. *(pass out one-pagers, allow 5 minutes for review)*

**Figure 26. Focus Group Discussion Guide – Preliminary Discussion.**

Based on this initial discussion, some participants were able to generally describe ride-share and car-share services and had experience with both. However, some found it difficult to distinguish

a ride-share program from a car-share program. It seemed as though most participants knew what these travel options were, but they had not heard the terminology “ride-share” and “car-share” or were unclear on their definitions. Most participants were able to define and provide examples of bike-share programs, and several participants had experience using bike-share programs as well.

This information was used as a baseline for the in-depth with the main discussion to follow.

*Informational Material*

After the initial discussion, participants were given time to review three one-page documents, each with information about the travel options to be discussed during the session (see Figure 27–Figure 29). Using text and pictures, these documents provided participants with:

- A clear definition of each travel option.
- An explanation of how each program operates.
- Examples of service providers.

# RIDE SHARING

## WHAT IS RIDE-SHARING?

Dynamic, or real-time, ride-sharing is an approach to carpooling in which interested carpoolers can find others to share the ride on relatively short notice. Ride-sharing systems, generally owned and operated by private companies, run on advanced digital technologies, such as smart phones, iPads and social networks, enabling users to quickly arrange a shared ride.


## HOW DOES IT WORK?

Participants request a ride any time through the web, an automated telephone system, or a smart phone app, and the system provides a match with a driver and coordinates their meeting. No pre-arrangement between driver and passenger is necessary.

Registering for the service and downloading the app are usually free. Passengers pay drivers through a pre-registered credit card once the ride is completed. Different companies provide different levels of service, from no-frills carpooling with several travelers to single-rider trips in luxury vehicles stocked with snacks and beverages.

## WHO OPERATES IT?

Ride-sharing services are operated either by private Transportation Network Companies (TNCs), such as: Uber and Lyft, or as databases that help connect users, like Zimride and Carma. TNCs employ drivers, while others simply match private travelers willing to share rides. Most programs typically perform some level of background check and ongoing user evaluation of both drivers and riders. Those companies that actually employ drivers and cover vehicle maintenance costs are required to carry liability insurance.


**Figure 27. Ride-Share Informational Page.**

CAR SHARING

## WHAT IS CAR-SHARING?

Car-sharing services provide short-term auto access to users who want the benefits of a personal vehicle without the costs and responsibility of ownership. Most services are based on a membership model and offer both individual and business memberships. Fees are based on a per-minute, per-hour or daily basis.

Just drive off
and then park


## HOW DOES IT WORK?

Car-sharing programs provide fleets of shared vehicles spread throughout a particular region and concentrated around activity, employment or transit centers.

Typically, car-sharing members will pick-up a vehicle at a parking spot, accessing the vehicle with a technologically-enabled card or key, and drive away. The car is then returned to the same spot at the end of the reservation, in the case of fixed parking services, or left at a designated spot elsewhere in one-way, point-to-point services.

Reservations can be made in advance, although these can take place shortly before the rental as long as there is availability. Reservations and vehicle access are generally available at all times.

## WHO OPERATES IT?


Car-sharing programs are operated by private companies, co-operative organizations, and public-private partnerships. Major programs operating in North America include Car2Go, Flexcar, Zipcar, and Communauto.

Organizations suffering from parking constraints or aiming to reduce work trips often join car-sharing programs so that their employees have alternatives to driving private vehicles for work trips. Cities and transit agencies often partner with car-sharing companies to install stations near transit centers, providing transit-riders a way to travel the "last mile" from the transit stop to their destination.

**Figure 28. Car-Share Informational Page.**

# BIKE SHARING

## WHAT IS BIKE-SHARING?

Bike-sharing is the practice of short-term, bike rental from self-serve bike stations, designed to support point-to-point transportation for short distance trips (0.5 to 3 miles). Users can pick up a bike at one station, and return it to the original station after a round- trip, or return it to a different station after a one-way trip.


## HOW DOES IT WORK?

Bicycles in a bike-share program are accessible instantaneously and do not require a reservation to rent. Trips can be either one-way or round trip. Users may drop off a bicycle at any station with an available dock, lock the bike, and end the session.

For most systems, trips made in less than 30 minutes are free. Users can sign up with bike-sharing systems on an annual, monthly, daily, or per-trip basis, and access bicycles at the docking station with a credit card, a membership card, or through an app on a mobile phone.

## WHO OPERATES IT?

In the U.S., the largest bike-share providers are Alta and B-Cycle. For-profit vendors operate as businesses and might partner with advertising agencies by selling ad space on the bikes or docking stations. Alta runs the successful Capital Bikeshare program, and B-Cycle has set up its stations in places like Austin, Fort Worth, and San Antonio.

Other providers may partner with a city or other government entity who can provide access to government funding or to public real estate for docking stations.

**Figure 29. Bike-Share Informational Page.**

**Main Discussion**

After participants reviewed the informational material, the moderator initiated the main discussion, which was designed to elicit:

- Participant impression of these travel options.
- Whether participants find any of these modes attractive for at least some of their trips.
- Features/benefits that would be needed before the participants would try using these modes.
- Obstacles to overcome before participants would use the modes.

Figure 30 shows the portion of the discussion guide used for the main discussion in the focus groups.

**III. Discussion (45 Minutes)**
Now that you know a little bit more about each of the programs, what do you think? *(go through following questions for each program)*

- Have you ever used a program like this? If so, tell us about it. *(focus on trip purpose)*
    - If not, do you think you would ever use one of these options?
    - If yes, under what circumstances? *(for what kinds of trips)*
- If ride-sharing, would you use it as a driver or rider?
    - If no, why not? What would prevent you from using this? *(helmets, insurance, etc.)*
- Do you think these options are viable alternatives to the single-occupant vehicle?
    - What do you like about them?
    - What do you dislike about them?
- What would make these options more attractive for you to use? *(prompt for each program)*
- What's the biggest obstacle for using these options? *(prompt for each program)*
- How involved should agencies be in the regulation of these programs? (*prompt for each program)*
- Does "regulation" affect your decision to use a particular program? How so?

**IV. Thanks and Compensation**

**Figure 30. Focus Group Discussion Guide – Main Discussion.**

The following sections describe the key topics revealed in the focus group discussions.

*Convenience*

Convenience was a trend in the discussion about shared mobility programs during the focus groups. Ride-share users felt smart phone applications combined with the flexibility of vehicle type, real-time driver location information, reliability of the service and ability to pay through the mobile app made these services convenient and easy to use. Ultimately, these factors were the most important in choosing this mode. These participants often utilized ride-share services to act as their designated driver because they felt it was both convenient and safe. Participants also pointed out that ride-share services can save users time and money spent on parking, as well as

time driving during special events or in unknown areas. Some participants felt that ride-share services typically arrived faster than a taxi would and that the vehicles were cleaner.

Car sharing offers convenience and flexibility for users, as well. Participants noted that car sharing will enable someone to use transit or a traditional carpool to commute to work but have a car available for off-site meetings, running errands, or emergencies during the day. Car-share vehicles often have designated parking spaces, too, which eliminates the time typically spent searching for a space. Participants also felt that car sharing was more convenient than a traditional rental car and provided a good alternative for students living on college campuses where cars are not allowed, who may occasionally need a vehicle.

Bike sharing also provides convenience and flexibility during the work day. Some participants indicated they had used bike-share services for off-site meetings, lunch, or errands during the work day when driving was not necessary or too inconvenient.

Participants believed all three shared mobility programs would complement transit and be convenient for the last mile portion of transit trips.

There were some inconvenient aspects to the shared mobility programs, according to the focus groups. For example, ride-share and car-share options are not convenient for families with children or when a car seat is needed. Also, ride-share programs are not offered in all areas, such as far-reaching suburbs. Some participants felt that the limited coverage area and too few pick-up and drop-off locations made car sharing somewhat inconvenient. Also, car-share services are not widely available (or well-advertised) everywhere, even in some major cities. Bike sharing is also not available in all areas, which limits usage to the area near docking station locations. This aspect is considered inconvenient for commuters who live far from work or for those traveling with children.

The climate seemed to be a major factor in mode decision, especially in the case of bike sharing. Most participants agreed they would not use bike sharing in the Texas heat and humidity, but some said with the proper preparations bike sharing could still be a viable option. For those who walk or bike as part of their regular commute, car sharing could be a good option in the event of unpredictable, inclement weather.

*Safety*

Safety was an overarching theme among all four focus groups for all three shared mobility options. Participants were concerned with the safety and maintenance of the vehicles used in ride- and car-share programs, as well as bicycles used in bike-share programs. Some participants suggested that if service providers would make verified maintenance records available to the public, users might feel more comfortable using the service.

The driver's security background, for ride-share programs, was very important among all focus groups. Although all participants with experience using ride-share options (Uber and Lyft being the services most commonly discussed in the groups) shared their positive experiences and indicated they felt safe while riding, some others felt they would be unsafe or uncomfortable riding alone with a stranger. Many felt the background checks were not thorough enough to properly vet drivers, and driver recruitment efforts on sites like Craigslist were disconcerting. In

most instances, participants with experience using the service were informing the rest of the participants of what they thought were the rules and regulations. Some participants explained that, in the case of Uber, once a ride has been requested and accepted, both parties receive personal information about the other, including a headshot, vehicle type, license plate number, phone number, and email address. This information put some participants at ease with using the service in the future. One participant explained that both drivers and passengers can rate their experiences which, this person felt, added an extra element of safety. Others felt the word of mouth referral element of ride sharing indicated the service was safe to use. The ability to cancel/decline a ride if one party felt uncomfortable was appealing as well, although penalties for doing so were unknown. Participants agreed that more transparency from private companies on driver selection criteria and background checks was important and would put them at ease when using this service.

Not yet versed in the verifications in place for both drivers and riders, some participants questioned the security of the service itself. One person used Lyft's signature pink mustaches as an example. How would a person requesting a ride know if the driver was a verified Lyft driver or if the mustache had been stolen and the person was posing as a ride-share driver?

Most participants believed that ride-share services had some positive safety benefits, such as providing an alternative to driving for impaired drivers and allowing someone else to navigate in unknown areas or cities.

In addition to a concern about overall vehicle maintenance, some participants took issue with the size of cars typically used in car-share services, such as two-door Smart cars. These participants felt these vehicles were too small to be safe, discouraging them from using a car-share service.

Sharing the road with vehicles is the main safety concern for bike-share use among the focus groups. The lack of bicycle infrastructure, distracted drivers and the lack of education regarding the rules of the road were of great concern to participants. Helmets were also discussed, with mixed reviews. While many participants believed wearing a helmet was safer, they felt that the decision to wear one should be left up to the bicycle user. There were no participants willing to use a publicly provided helmet, and most would not carry their own.

*Cost*

The cost of shared mobility programs was an important topic of discussion during the focus groups, generating a great deal of confusion for most participants. The method by which a fare is calculated and the uncertainty of dynamic pricing (called "surge pricing" in the case of Uber) seemed to be major drawbacks for most participants. Many were familiar with news stories of extreme overcharging for trips and errors in fares, but some were then relieved to hear from other participants that the mobile application does alert users when the fare has changed or increased and provides a fare estimator before requesting a ride. Participants agreed that ride-share services are typically less expensive than a taxi and do not charge per person rates like a taxi, which were both important factors for those choosing to ride share. Some questioned whether ride-share drivers took the least expensive route or would be willing to accept route suggestions from passengers.

The cost structures of car sharing and bike sharing were similarly confusing to participants. There are different membership types and hourly/daily rates for different companies and in different cities. Some questioned how a membership worked for these services, and they were not aware that insurance and fuel are included in the hourly/daily rate. In the case of car sharing, many participants found the services to be too expensive and the cost of memberships was often cost-prohibitive, especially for low-income individuals. Others questioned the affordability of bike sharing as well.

Several people also pointed out that all three shared mobility programs save money on parking and wear on a personal vehicle. Others pointed out potential cost savings to employers who participate in car sharing rather than maintain their own fleet vehicles. In terms of ride-share services, one person said he was not loyal to a brand but made his choice strictly based on the most cost-effective option available.

*Education and Advertising*

Participants indicated that more education is necessary in order for all three shared mobility programs to gain users. The public, as indicated by the focus groups, needs more information about how these programs actually operate, including an explanation on safety and security measures, costs and fare structure, service areas and regulations. Educating both drivers and cyclists on the rules of the road was very important to everyone in the focus groups.

Many felt these services are only advertised by word of mouth, so more traditional advertising would be beneficial. Advertising should be developed to appeal to a broad spectrum of possible users. One person suggested that TxDOT include ride sharing in their annual campaign against drunk driving.

*Targeted Groups and Locations*

Focus group participants agreed that shared mobility programs are most applicable to younger, "tech-savvy" people and those living in downtown areas or densely populated areas. It is also believed that areas that are supported by transit, have limited or expensive parking, and/or are inconvenient to own a car are also vital considerations for these travel options. Many thought ride-share services would be useful in decreasing intoxicated driving in college towns.

Ride-share services rely almost exclusively on mobile apps for their services. Some participants believed that the technology requirement could be a potential road block for certain demographics. In particular, the elderly population was noted as a particular demographic group that could benefit from ride-share services but may be prevented by the challenges of technology from taking advantage of this option. The mobile app developers should be charged with developing a product that is useful for everyone. One person pointed out that the app is only as good as your cell phone coverage, which could be problematic at times.

Some felt that the bicycles used for bike sharing are too heavy and "clunky." Participants felt that bike-share services were used mostly by tourists and often located in areas located near tourist destinations. In fact, when participants were relating their experience using bike sharing, it was most often as a tourist in places such as Miami, Florida; Montreal, Canada; and Washington, D.C. Many people would like bike-share docking stations to be located in non-

tourist locations, for use predominately by local residents. Several people indicated that redistributing bicycles (known as rebalancing) did not happen often enough because, in their experience, bicycles usually ended up in one place in the same area. One participant said that car-share vehicles also piled up at the edge of service areas.

Many participants felt that Texas cities are too spread out for shared mobility to make a major impact or be practical for daily use but would feel comfortable using (or already use) these services while on vacation, while in an unknown or new location, for a special event, or for recreational activities.

*Enhanced Mobility*

One participant pointed out that more travel choices can lead to better quality of life. Everyone agreed that all three shared mobility programs complemented transit well and could help them to travel the last mile of their commute. Participants felt that ride-share and/or car-share could provide transportation to people without a personal vehicle the needed access to medical care and the ability to run errands when convenient for their schedule.

Most agreed that car sharing was the travel option best suited for day-to-day use. Participants said car sharing is designed for short trips and occasional use like the grocery store, medical appointments, or commuting to/from the airport. They also indicated that if they carpooled or used transit for their commute car sharing would be useful during the work day because the option to use a car during the day was available, if needed.

Most participants thought bike sharing was most appropriate for recreational use and would not replace most car trips or be useful for everyday tasks (e.g., grocery shopping). Many people had experienced using bike-share services in other cities like Montreal, Canada; Miami, Florida; Washington, D.C.; and Austin, Fort Worth, Houston, and San Antonio in Texas. Although it enables people to explore a larger area in a new city, most said they would feel more comfortable using bike-share options if they were more familiar with docking station locations. Some also mentioned enhancements on the bike, such as global positioning system, might make them more likely to use bike sharing.

Several participants said that incentives, whether from an employer or a vendor, to use shared mobility programs would encourage usage. Some participants felt that using shared mobility programs required a shift in transportation culture, and that such a shift would require a visible, vocal champion in a position of power or leadership to model and support these changes in travel behavior.

*Regulations*

Focus group participants concentrated the discussion on operational regulations on ride-share services, particularly Uber. Many participants understood that Uber was not operating under the same regulations as taxis and felt that Uber should be regulated for both safety and tax revenue generation purposes. Some were concerned that regulating ride-share services would affect fare prices. Some suggested that while taxis are over-regulated, there should be a common set of rules for both taxis and ride-share services to follow. Some said they would use Uber more often if

their drivers were regulated and had the same stamp of approval as taxi drivers, while others were not concerned at all.

## STATEWIDE WEB SURVEY

Researchers conducted an online survey with a focus on participants in larger Texas cities, including Austin, Houston, Dallas, Fort Worth, El Paso and San Antonio. Based on the literature review findings, dynamic ride-sharing, car-share and bike-share were assumed to have a larger impact on the mobility in these cities than in rural locations. The questions for the survey were designed based on those literature review findings. The questions focused on the objective of the research, which is to determine the impact of these modes on travel (see Appendix E for the complete survey instrument).

The first section of the survey investigated the current travel behavior of the respondents in relation to their most recent long (greater than three miles) and short (less than three miles) trips. This was accomplished by gathering data regarding origin and destination, mode of travel, time of travel, and frequency of the trip. Next, the respondents were asked if they had ever used dynamic ride sharing, car sharing or bike sharing. If they had, follow up questions regarding that trip were asked.

The survey continued with questions to garner the respondents' reaction to the alternate travel modes of dynamic ride sharing, car sharing and bike sharing. Respondents were asked to estimate their probability of choosing these modes for both their short and long trips. Respondents then ranked the reasons for choosing to use, or not use, a shared mode for those trips. Next, the survey examined the potential impact of dynamic ride sharing, car sharing or bike sharing on the number of trips taken, as well as on auto ownership. The last section of the survey collected demographic and socio-economic information on the respondents, including age, household type, education, income and number of vehicles owned.

As a part of the development of the survey, a draft survey was created based on the literature review, the research objectives and inputs from the TxDOT project monitors. The online version of the survey was created using LimeSurvey™, a free survey hosting website that allows the users to develop and publish online surveys and collect responses. After many internal tests, the survey was launched for public input on January 16, 2015, and closed to input on February 16, 2015.

### Survey Administration

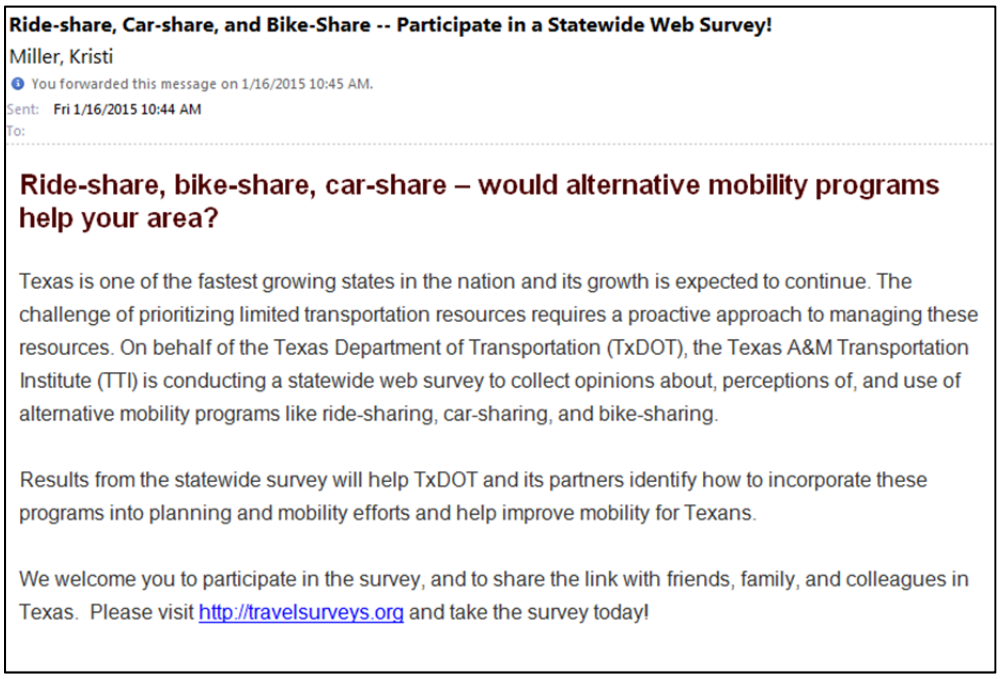
The survey administration and monitoring was performed using the LimeSurvey website. The online version was made available to the public through the TravelSurveys.org website. It was distributed to residents all over Texas to gather their opinions on dynamic ride-share, car-share and bike-share programs and their potential uses. The type of survey promotion used resulted in a choice or non-random sample.

## Advertising and Marketing for the Survey

Several methods were used to advertise and promote the web survey, including emails sent to TTI's past participant database, a press release targeted toward transportation media and efforts made through social media.

*Past Participants*

Information about this survey and the link to participate were sent to approximately 2000 email addresses. Two emails were sent to past research participants on January 15 and January 27, 2015, as shown in Figure 31 and Figure 32. Members of the TxDOT project committee and the TTI research team also circulated the email to their contacts.



**Ride-share, Car-share, and Bike-Share -- Participate in a Statewide Web Survey!**

Miller, Kristi

You forwarded this message on 1/16/2015 10:45 AM.

Sent: Fri 1/16/2015 10:44 AM

To:

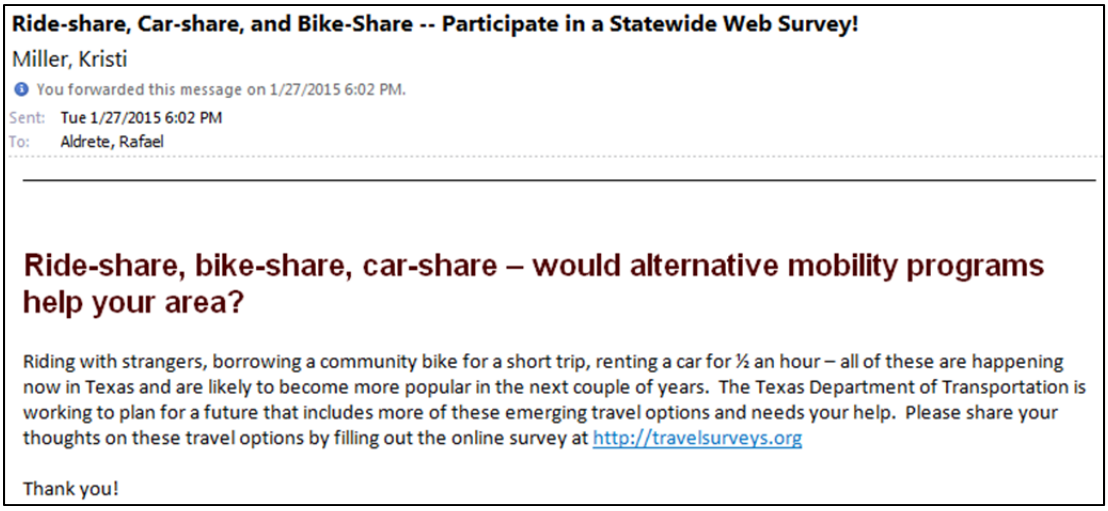
**Ride-share, bike-share, car-share – would alternative mobility programs help your area?**

Texas is one of the fastest growing states in the nation and its growth is expected to continue. The challenge of prioritizing limited transportation resources requires a proactive approach to managing these resources. On behalf of the Texas Department of Transportation (TxDOT), the Texas A&M Transportation Institute (TTI) is conducting a statewide web survey to collect opinions about, perceptions of, and use of alternative mobility programs like ride-sharing, car-sharing, and bike-sharing.

Results from the statewide survey will help TxDOT and its partners identify how to incorporate these programs into planning and mobility efforts and help improve mobility for Texans.

We welcome you to participate in the survey, and to share the link with friends, family, and colleagues in Texas. Please visit http://travelsurveys.org and take the survey today!

**Figure 31. First Email Promoting the Web Survey (Sent to Past Participants on Friday, January 16, 2015).**



**Ride-share, Car-share, and Bike-Share -- Participate in a Statewide Web Survey!**

Miller, Kristi

You forwarded this message on 1/27/2015 6:02 PM.

Sent: Tue 1/27/2015 6:02 PM

To: Aldrete, Rafael

**Ride-share, bike-share, car-share – would alternative mobility programs help your area?**

Riding with strangers, borrowing a community bike for a short trip, renting a car for ½ an hour – all of these are happening now in Texas and are likely to become more popular in the next couple of years. The Texas Department of Transportation is working to plan for a future that includes more of these emerging travel options and needs your help. Please share your thoughts on these travel options by filling out the online survey at http://travelsurveys.org

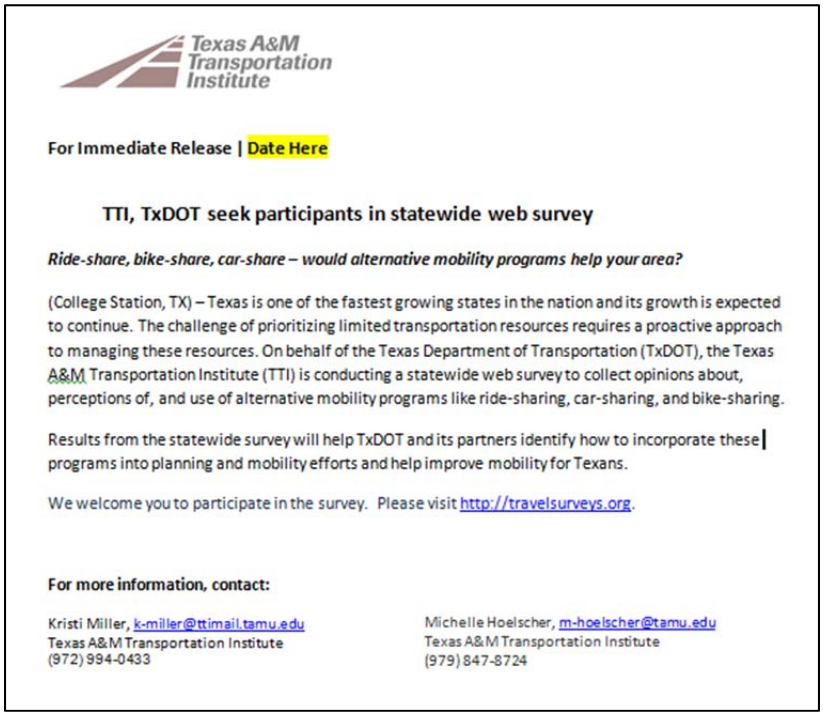
Thank you!

**Figure 32. Second Email Promoting the Web Survey (Sent to Past Participants on January 27, 2015).**

*It is important to note the wording was changed slightly for the second email.

*Press Release*

TTI Communications developed a press release targeted toward transportation media outlets across the state. This press release was sent to 132 media contacts, focused mainly on urban areas. Figure 33 shows the press release.



Texas A&M Transportation Institute

**For Immediate Release | Date Here**

**TTI, TxDOT seek participants in statewide web survey**

***Ride-share, bike-share, car-share – would alternative mobility programs help your area?***

(College Station, TX) – Texas is one of the fastest growing states in the nation and its growth is expected to continue. The challenge of prioritizing limited transportation resources requires a proactive approach to managing these resources. On behalf of the Texas Department of Transportation (TxDOT), the Texas A&M Transportation Institute (TTI) is conducting a statewide web survey to collect opinions about, perceptions of, and use of alternative mobility programs like ride-sharing, car-sharing, and bike-sharing.

Results from the statewide survey will help TxDOT and its partners identify how to incorporate these programs into planning and mobility efforts and help improve mobility for Texans.

We welcome you to participate in the survey. Please visit http://travelsurveys.org.

**For more information, contact:**

Kristi Miller, k-miller@ttimail.tamu.edu
Texas A&M Transportation Institute
(972) 994-0433

Michelle Hoelscher, m-hoelscher@tamu.edu
Texas A&M Transportation Institute
(979) 847-8724

**Figure 33. Press Release Announcing the Web Survey, Targeted to Transportation Media.**

*Social Media Efforts*

TTI currently has a presence on Facebook, Twitter, LinkedIn, Google+, and YouTube. In order to connect with our peers, TTI proactively seeks out Facebook friends and connects with them dynamically through our posts by sharing and tagging our partners. Social media has become a crucial part of transferring knowledge to targeted audiences—and as a tool to recruit survey and focus group participants. Survey response rate results have varied widely, based on the focus of the survey. This particular survey proved to be an interesting topic with a good share response from partners and stakeholders on social media.

The use of social media aided in achieving the target goal of more than 500 completed surveys for this research project. Social media efforts to publicize the survey included:

- Targeted tweets to more than 50 media and community groups and organizations through Twitter, such as local traffic anchors, transportation reporters, chambers of commerce, ride-share and bike-share groups, Metropolitan Planning Organizations (MPOs) and Councils of Governments (COGs).
- Facebook posts by TTI throughout the 30-day survey window. TxDOT and a number of other groups also posted the survey to their respective Facebook pages multiple times. The groups who most shared the survey were Houston B-Cycle, Austin B-Cycle, Bike Texas, Clean Air Action in Austin, Houston TranStar, City of San Antonio, and North Central Texas Council of Governments (NCTCOG).

*Advertising Results*

The survey was active from Friday, January 16, 2015, through Monday, February 16, 2015. A total of 507 surveys were completed. No advertising funds were used to "boost" social posts or place ads in area newspapers. The press release distributed to media did not yield any coverage so it is assumed all responses were generated through social media, the past participant emails, and contacts of the research team and TxDOT staff. Figure 34 shows response rate by date.

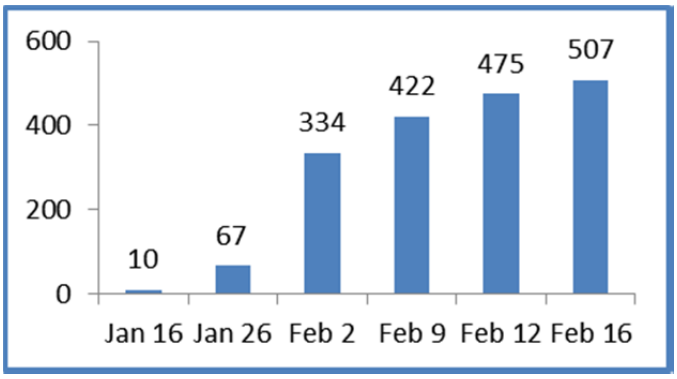



**Figure 34. Response Rates by Date.**

**Twitter's Reach**

Twitter provided a wide reach through retweets of tweets by @TTI and @TxDOT. Groups and individuals who retweeted the survey helped publicize the availability of the survey with a potential reach to more than 77,000 people using Twitter for news and information. Hash tags

used to promote the survey were #rideshare and #bikeshare. Examples of tweets and the retweet impact are shown in Figure 35 through Figure 38.


**Figure 35. Initial Tweet from TTI Promoting the Web Survey.**

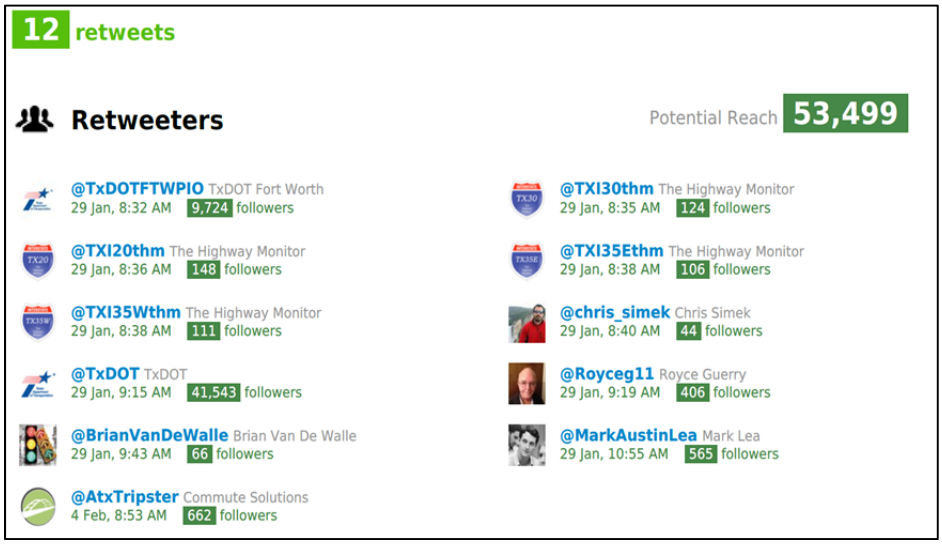



**Figure 36. Number of Retweets and Potential Reach from the Initial Tweet.**


**Figure 37. Initial Tweet from Local Partner, BikeHouston, Promoting the Web Survey.**

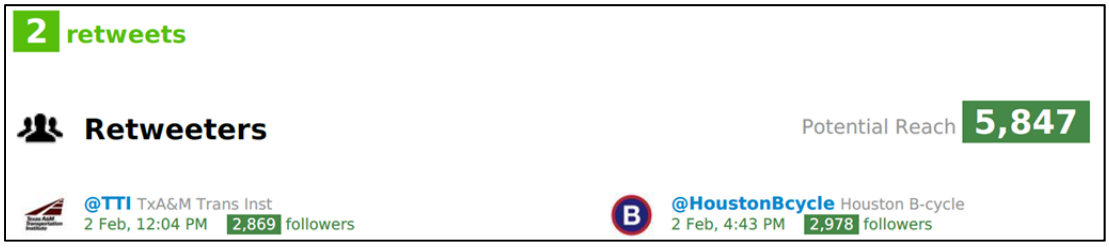



**Figure 38. Impact of the Initial Tweet from BikeHouston.**

### Facebook's Reach

The exact potential reach of Facebook is unknown; however, it can be estimated that more than 100,000 users could have seen the posts by TTI and TxDOT, along with other organizations actively posting and/or sharing the survey, such as Bike Texas, Houston B-Cycle, City of Austin Office of Sustainability, Houston TranStar, NCTCOG, and Austin Energy. Figure 39 through Figure 42 provide examples of screen grabs of TTI and TxDOT Facebook posts showing reach and shares.

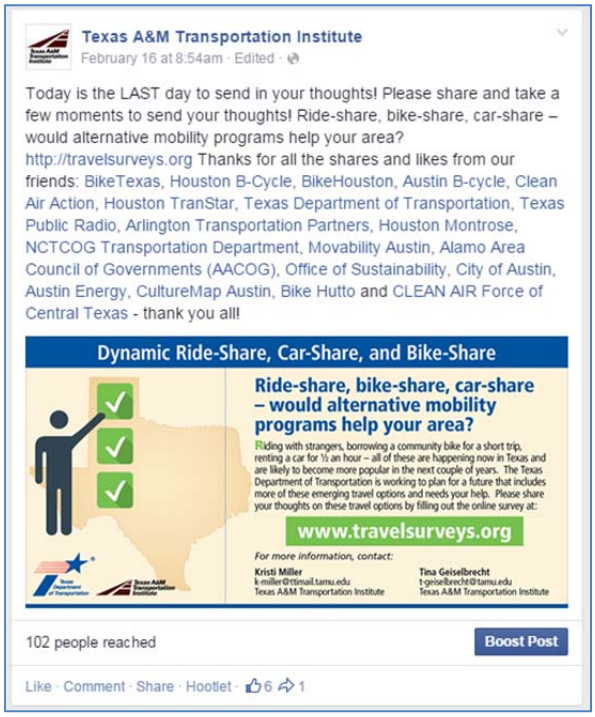



**Figure 39. Example of TTI Facebook Post Promoting the Web Survey (Reached 102 People, Liked by 6, and Shared by 1 at the Time of Screen Grab).**

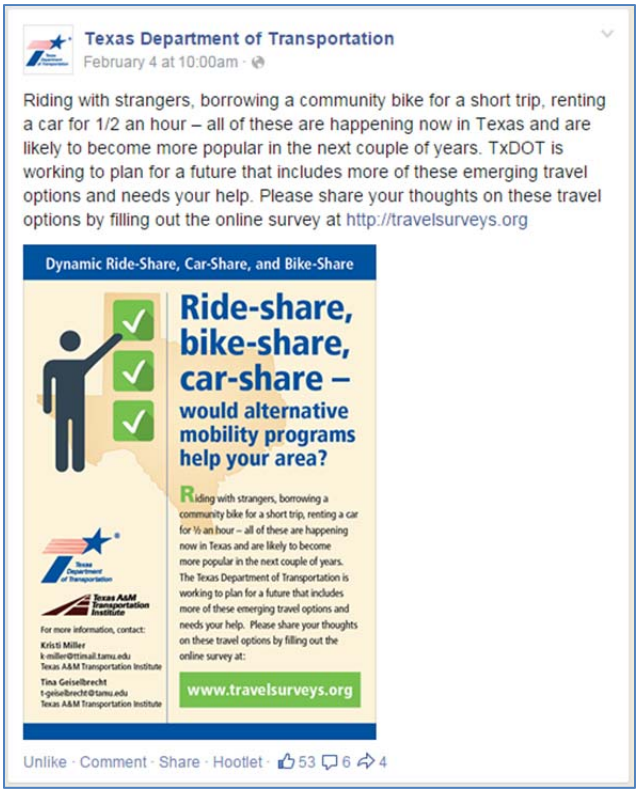



**Figure 40. Example of TxDOT Promoting the Web Survey via Facebook (Liked by 53 People, Shared by 4, and Commented on by 6 at the Time of Screen Grab).**

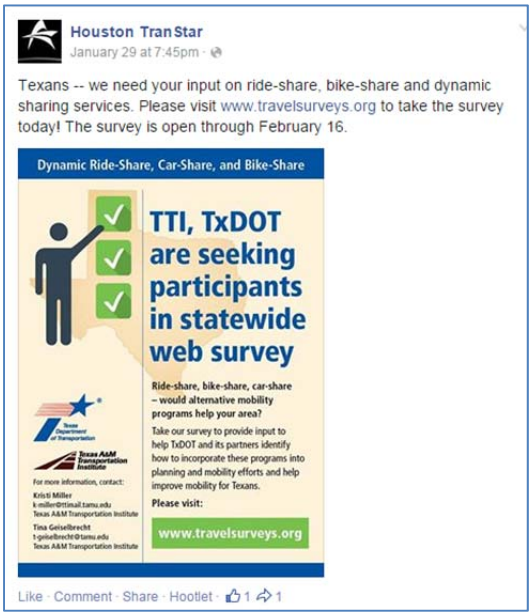



**Figure 41. Example of a Partner Organization, Houston TranStar, Promoting the Web Survey via Facebook.**

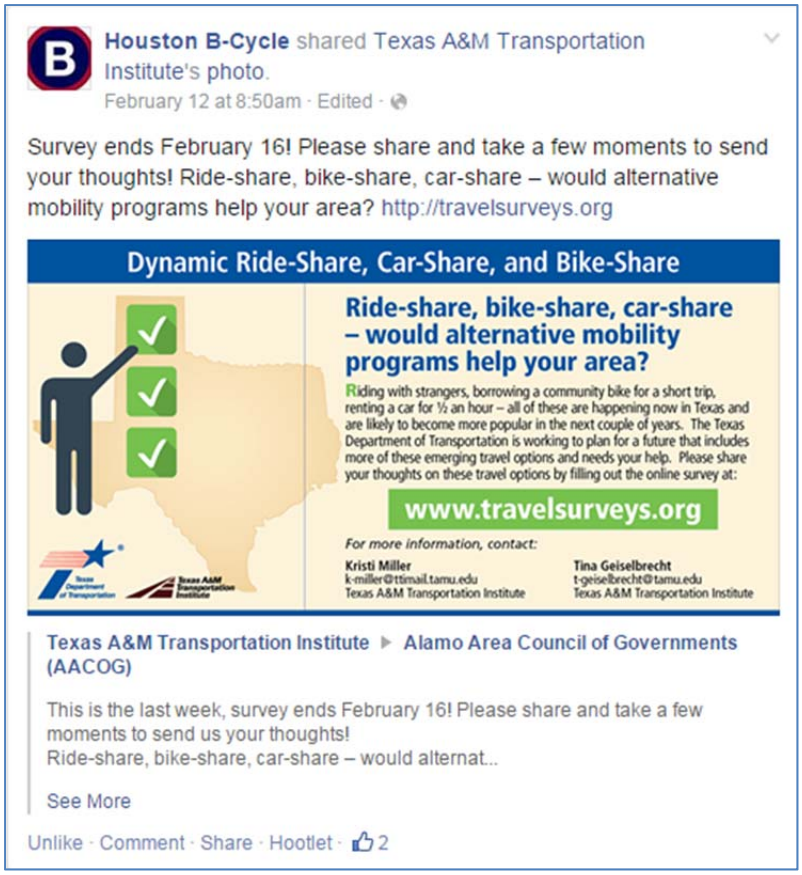



**Figure 42. Example of a Partner Organization, Houston Bike Share, Sharing TTI's Facebook Post to Promote the Web Survey.**

### Data Cleaning

Once the survey closed, LimeSurvey automatically placed responses into two categories and saved those responses in two separate files. The first category is completed surveys, meaning the respondent completed the survey and hit the submit button. The second category is incomplete responses, meaning the respondent did not hit the submit button at the end of the survey. Once all survey entries were categorized, there are several scenarios that require review and possible data cleaning, described here:

- Respondents who enter little data but hit the submit button, therefore counting it as a completed survey. Four surveys were like this and were removed from the final dataset.
- Respondents who enter erroneous data. No examples of this were evident.
- Respondents taking the survey multiple times. The IP addresses of the respondents were checked, and in a few cases there were multiple responses from the same IP address. This can occur if more than one individual at a residence responds to the survey or in cases of businesses or libraries that have the same IP address. In all of these cases the responses were different indicating the likely scenario of different individuals using the same computer/network; therefore, those responses were considered valid and kept in the database. All 507 remaining responses appeared to be legitimate responses from different individuals.

**Survey Results**

To begin the analysis, a simple examination of the percentage of responses to each question was undertaken. Only 4.9 percent of travelers did not regularly travel in one of the major metropolitan areas in Texas. Those travelers were then asked if they visited any of these cities and most did indicate they had at least visited one of these cities. As Figure 43 indicates, biking and walking had relatively high mode shares (24.6 and 11.8 percent, respectively) for short trips (those less than three miles). Longer trips were dominated by the automobile mode (75.3 percent), but 11.2 percent indicated they had used a bicycle for a long trip.

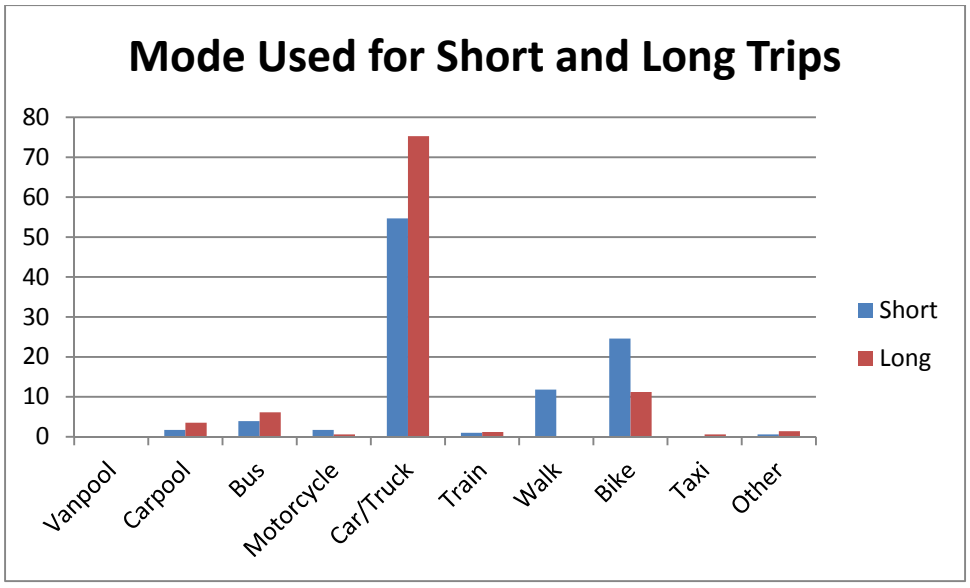



**Figure 43. Mode Used for Trips.**

Figure 44 illustrates that most short trips were for shopping or personal errands, while most long trips were commute trips to and from work and home.

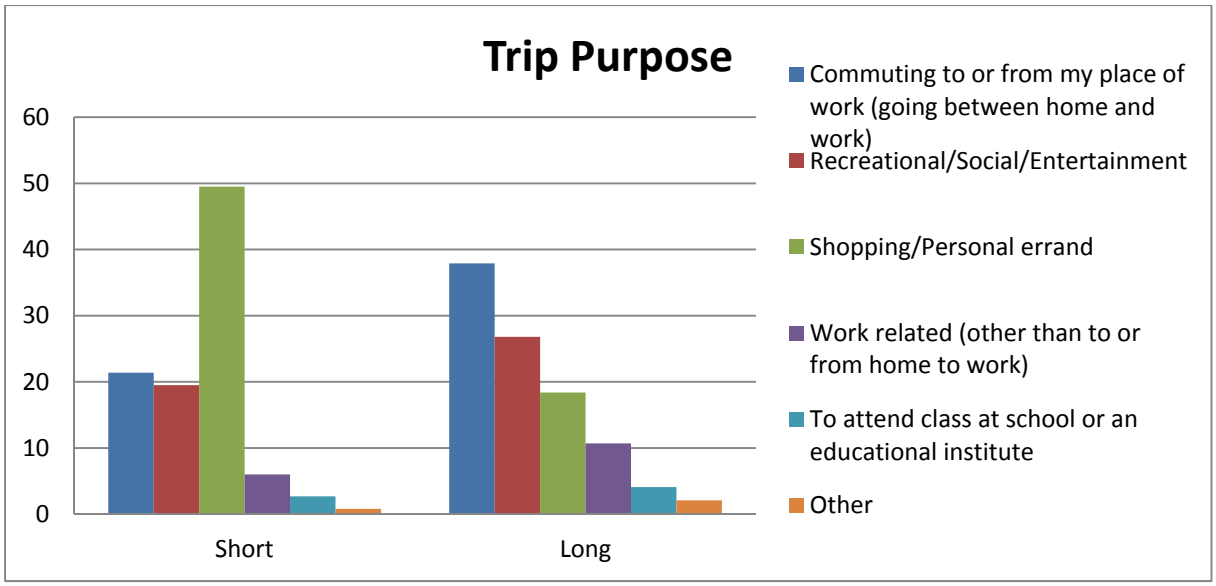



**Figure 44. Trip Purpose.**

*Dynamic Ride Sharing Survey Results*

The survey was divided into three sections to better predict the use of and, therefore, the impacts of the three shared mobility programs. This section describes the overall findings regarding potential use of dynamic ride-share and factors that might affect its use.

The majority (89.3 percent) of respondents had heard of dynamic ride sharing, and nearly one-third (32.1 percent) had used it. Thus, reasons given for using or not using the mode were mostly by people who had at least heard of the mode prior to this survey.

As Table 17 illustrates, the most important factors in using dynamic ride sharing were avoiding parking fees, no need to find parking and lower trip fares than traditional taxi cabs. The least important reason, by a large margin, was to meet new people.

**Table 17. How Important Are the Factors below in your Decision to Possibly Use Dynamic Ride-Sharing?**

| | Not Important | Probably Not Important | Somewhat Important | Probably Important | Very Important |
|---|---|---|---|---|---|
| Avoiding/reducing the costs of car ownership | 19.2 | 13.3 | 21.3 | 22.3 | 24.8 |
| Avoid parking fees | 14.6 | 9.6 | 17.0 | 21.0 | 37.8 |
| No need to find parking for car (save time) | 12.0 | 8.0 | 18.7 | 21.9 | 39.5 |
| Being able to schedule trips with my smartphone | 11.4 | 7.4 | 20.7 | 26.0 | 34.5 |
| Not having to exchange payment with driver | 12.6 | 9.1 | 24.6 | 23.0 | 30.8 |
| Not having to ride in a taxi cab | 26.8 | 11.6 | 22.2 | 14.3 | 25.1 |
| Lower trip fares than traditional taxi cab | 12.8 | 4.0 | 19.0 | 20.9 | 43.3 |
| Ride-sharing makes using transit more convenient | 14.1 | 7.1 | 29.0 | 24.9 | 24.9 |
| Meeting new people | 57.3 | 17.6 | 16.0 | 4.8 | 4.3 |
| Not having to drive myself | 19.8 | 7.4 | 21.7 | 17.5 | 33.6 |
| Not having to prearrange a carpool | 15.7 | 7.5 | 21.9 | 25.1 | 29.9 |

The survey also asked respondents to rank their most important reasons to **NOT** use dynamic ride sharing. The most important reasons to avoid using dynamic ride sharing were the uncertainty regarding the return trip and their trip being time sensitive. Personal safety concerns were ranked near the middle of the reasons for not using dynamic ride sharing. The least important reasons were not having a credit card or a smartphone, and the app being too complex. Respondents could enter their own reason for not ride sharing, and the most common one was the need to travel with small children who required a car seat. See Table 18 for detailed information.

**Table 18. How Important Are the Factors below in Your Decision to Probably Not Use Dynamic Ride-Sharing?**

| | Not Important | Probably Not Important | Somewhat Important | Probably Important | Very Important |
|---|---|---|---|---|---|
| Personal safety concerns | 26.3 | 12.7 | 18.3 | 14.6 | 28.2 |
| Financial safety concerns (must register credit card) | 39.4 | 12.6 | 15.4 | 12.6 | 20.0 |
| Privacy concerns (GPS location) | 42.5 | 13.9 | 17.2 | 9.5 | 16.9 |
| Ride-sharing would not work for the types of trip I take | 21.4 | 12.5 | 21.7 | 15.6 | 28.8 |
| It is too expensive | 20.6 | 13.2 | 21.5 | 16.0 | 28.6 |
| Using an app to get a ride is too complicated | 62.0 | 11.8 | 14.3 | 5.6 | 6.2 |
| I like to drive | 40.7 | 12.7 | 18.6 | 11.5 | 16.5 |
| I do not have a smartphone | 80.0 | 2.8 | 5.6 | 1.6 | 10.0 |
| I do not have a credit card | 89.2 | 3.8 | 3.5 | 0.3 | 3.2 |
| Uncertain reliability/availability of a ride home or to next destination | 17.5 | 5.7 | 15.7 | 18.1 | 42.9 |
| Trip home or to next destination is time sensitive | 17.3 | 6.8 | 22.5 | 16.1 | 37.4 |

Respondents were asked if they would have used dynamic ride sharing for their recent trips if it had been an option. For their recent short trip, 7.1 percent indicated they would and 8.3 percent probably would. For their recent long trip, 8.9 percent indicated they would and 14.1 percent said they probably would.

*Car Sharing Survey Results*

Respondents were introduced to car sharing and asked about their potential use of that mode. Over 83 percent had heard of car sharing and 28 percent had used it before. For those who indicated they would likely use car sharing, the most important reasons to use this mode were being able to reserve the vehicle with your smartphone and avoiding parking fees. Not being able to rent a car due to being less than 25 years old or not having insurance were not important to survey respondents. For those who indicated they would probably or definitely **NOT** use car sharing, the most important reason was that the car-share locations were not close to their origin or destination. Despite already being one of the available options, the most common reason to not use car sharing that respondents wrote in the "other reason" category was the lack of availability of car sharing near them. For their recent short trip, 18.4 percent indicated they would or probably would have use car sharing if it had been available. This increased to 26.2 percent for their recent long trip. More detailed data are illustrated in tabular form below.

Table 19 indicates factors that are important in possibly using car-share programs, and Table 20 shows which factors are important for **NOT** using car-share programs.

**Table 19. How Important Are the Factors below in Your Decision to Possibly Use Car-Sharing?**

| | Not Important | Probably Not Important | Somewhat Important | Probably Important | Very Important |
|---|---|---|---|---|---|
| Avoiding/reducing the cost of car ownership | 17.4 | 8.0 | 21.5 | 18.6 | 34.5 |
| I enjoy driving a different vehicle than my own | 59.3 | 15.9 | 13.5 | 6.6 | 4.8 |
| Being able to reserve vehicles with my smartphone | 13.1 | 5.0 | 19.8 | 22.7 | 39.4 |
| Avoiding parking fees | 17.0 | 7.0 | 15.3 | 21.7 | 39.0 |
| Car-sharing makes public transit more convenient | 16.1 | 10.1 | 26.2 | 22.6 | 25.0 |
| I cannot rent a car at a regular car rental place because I am younger than 25 years old | 90.4 | 1.8 | 2.7 | 1.5 | 3.6 |
| I cannot rent a car at a regular car rental place because I do not have car insurance | 83.4 | 5.4 | 3.9 | 2.7 | 4.5 |

**Table 20. How Important Are the Factors below in Your Decision to Probably Not Use Dynamic Car-Sharing?**

| | Not Important | Probably Not Important | Somewhat Important | Probably Important | Very Important |
|---|---|---|---|---|---|
| Financial safety concerns (must register credit card) | 56.6 | 11.5 | 11.2 | 6.8 | 13.9 |
| Privacy concerns (GPS location) | 56.5 | 14.0 | 10.6 | 5.1 | 13.7 |
| Car-sharing would not help for the types of trip I take | 29.4 | 8.2 | 17.8 | 16.0 | 28.7 |
| It is too expensive | 31.9 | 9.4 | 25.4 | 13.2 | 20.1 |
| Using an app for car-sharing is too complicated | 69.7 | 9.1 | 10.1 | 3.8 | 7.3 |
| I prefer to drive my own car | 30.0 | 8.7 | 17.7 | 11.3 | 32.3 |
| I do not have a credit card | 91.6 | 2.8 | 1.8 | 1.1 | 2.8 |
| Car-share stations are not located near my origin/destination | 16.5 | 3.3 | 13.5 | 13.9 | 52.8 |

*Bike Sharing Survey Results*

Finally, respondents were introduced to bike sharing and asked about their potential use of that mode. Over 86 percent had heard of bike sharing, and 33 percent had used it before. For those who indicated they would likely use bike sharing, the most important reasons to use this mode were getting exercise, ability to reach more destinations than walking, and no need to find parking for a car. For those who indicated they would probably or definitely **NOT** use bike sharing, the most important reasons were that they did not feel safe biking and it would not work for their trips. Other reasons for **NOT** using bike-share programs varied a great deal, but the most common was that they felt unsafe or they felt the route they would need to use was not safe for biking. For their recent short trip, 35.6 percent indicated they would or probably would have used bike sharing if it had been available. This dropped to 13.3 percent for their recent long trip. Table 21 and Table 22 provide the detailed percentages from respondents.

**Table 21. How Important Are the Factors below in Your Decision to Possibly Use Bike-Sharing?**

| | Not Important | Probably Not Important | Somewhat Important | Probably Important | Very Important |
|---|---|---|---|---|---|
| Avoiding/reducing the costs of car ownership | 27.1 | 12.3 | 14.5 | 31.3 | 14.8 |
| Avoiding/reducing the costs of bike ownership | 48.3 | 12.9 | 16.7 | 14.4 | 7.8 |
| Not worrying about getting bike to/from home | 12.2 | 4.3 | 18.8 | 42.9 | 21.9 |
| No need to find parking for car (save time) | 11.1 | 4.5 | 14.2 | 46.2 | 24.1 |
| Bike-sharing allows me to reach more destinations in close range than walking | 8.3 | 4.6 | 15.7 | 43.9 | 27.6 |
| Avoiding parking fees | 19.7 | 4.9 | 12.6 | 43.1 | 19.7 |
| Getting exercise | 5.9 | 4.0 | 17.0 | 47.2 | 26.0 |
| Bike-sharing makes transit more convenient | 9.9 | 5.4 | 20.7 | 36.9 | 27.0 |
| It's fun | 8.8 | 4.3 | 13.6 | 29.2 | 33.3 |

**Table 22. How Important Are the Following Factors in Your Decision to Probably Not Use Bike-Share Programs?**

| | Not Important | Probably Not Important | Somewhat Important | Probably Important | Very Important |
|---|---|---|---|---|---|
| Financial security concerns (must register credit card) | 59.9 | 12.1 | 11.4 | 6.9 | 9.7 |
| Bike-sharing would not work for the trips I take | 21.5 | 5.0 | 18.1 | 14.1 | 41.3 |
| It is too expensive | 54.7 | 13.2 | 13.6 | 7.7 | 10.8 |
| I prefer driving my car | 43.2 | 9.8 | 14.2 | 10.5 | 22.3 |
| I prefer walking | 53.5 | 16.4 | 19.2 | 5.6 | 5.2 |
| I do not like to bike | 68.4 | 8.5 | 9.5 | 4.4 | 9.2 |
| I do not have a credit card | 90.7 | 5.4 | 2.9 | 0.0 | 1.1 |
| I do not feel safe biking | 42.6 | 7.4 | 11.4 | 15.4 | 23.2 |

*Additional Survey Results*

There were some respondents who indicated the availability of these modes would allow them to reduce the number of automobiles they own. If bike sharing were available to them, 9.6 percent of respondents would or probably would reduce the number of cars owned by their household. Similarly, 16.1 percent and 35.8 percent of respondents indicated they would or probably would reduce the number of cars owned in their household if car sharing or ride sharing were available, respectively.

Researchers were also interested in specific characteristics of travelers who answered "Definitely Yes" or "Probably Yes" to the question: "If available, how likely would you be to use [dynamic ride-sharing/car-sharing/bike-sharing] for the [long/short] trip you previously described?" These respondents could be considered the likely adopters/users of these modes. These results are examined in Table 23.

It was surprising to see that the likely users of these modes were very similar. This was particularly surprising for bike sharing, as one might expect potential bicycle users to be, on average, younger and possibly have lower incomes than users of the two car-based mode choices. However, the percentage of respondents who were likely to use bike sharing for their recent short trip and were 34 years old or younger was within 3 percentage points of respondents who were likely to use dynamic ride share services and respondents who were likely to use car-share services, indicating very similar characteristics.

The final question on the survey asked respondents to "Please list any comments or suggestions you have regarding your travel needs and these new travel options." Many respondents did take this opportunity to provide a comment—notably more than usual for travel surveys that the authors have previously conducted in Texas. The comments and suggestions varied greatly but many fell into two broad categories: (1) respondents were supportive of these modes and happy to see TxDOT looking at these options—at least in cities—and (2) the impracticality of these modes in rural areas.

**Table 23. Statistics of Respondents Choosing to Use or Likely to Use a Shared Mobility Program.***

| Trip Characteristics | Options | Dynamic Ride-Sharing | | Car-Sharing | | Bike-Sharing | |
|---|---|---|---|---|---|---|---|
| | | Short Trip | Long Trip | Short Trip | Long Trip | Short Trip | Long Trip |
| **Traveler Location** | Austin | 37.2 | 48.3 | 43.9 | 47.8 | 64.1 | 51.2 |
| | Dallas | 18.0 | 12.1 | 13.3 | 19.4 | 8.7 | 12.2 |
| | El Paso | 3.9 | 3.5 | 3.3 | 3.0 | 3.3 | 3.8 |
| | Fort Worth | 2.6 | 3.5 | 3.9 | 4.5 | 1.1 | 1.5 |
| | Houston | 24.4 | 20.7 | 25.6 | 17.9 | 15.2 | 20.6 |
| | San Antonio | 9.0 | 6.9 | 5.0 | 3.0 | 5.4 | 5.3 |
| | I rarely travel in these cities | 5.1 | 5.2 | 5.0 | 4.5 | 2.2 | 5.3 |

| Trip Characteristics | Options | Dynamic Ride-Sharing | | Car-Sharing | | Bike-Sharing | |
|---|---|---|---|---|---|---|---|
| | | Short Trip | Long Trip | Short Trip | Long Trip | Short Trip | Long Trip |
| **Age of the respondent** | 16 to 24 | 6.4 | 6.9 | 6.7 | 6.0 | 7.6 | 6.1 |
| | 25 to 34 | 44.9 | 42.2 | 41.9 | 35.8 | 41.3 | 45.8 |
| | 35 to 44 | 20.5 | 19.0 | 20.1 | 26.9 | 21.7 | 17.6 |
| | 45 to 54 | 16.7 | 20.7 | 21.8 | 20.9 | 19.6 | 20.6 |
| | 55 to 64 | 7.7 | 7.8 | 7.3 | 9 | 7.6 | 6.9 |
| | 65 and over | 3.9 | 3.5 | 2.2 | 1.5 | 2.2 | 3.1 |
| **Gender** | Male | 50.7 | 48.2 | 53.9 | 51.6 | 52.8 | 53.1 |
| | Female | 49.3 | 51.8 | 46.1 | 48.4 | 47.2 | 46.9 |
| **Ethnicity** | White/Caucasian | 68.0 | 66.1 | 73.4 | 72.3 | 62.2 | 63.6 |
| | Hispanic/Latino | 21.8 | 20.0 | 17.5 | 18.5 | 24.4 | 21.7 |
| | African American | 2.6 | 2.6 | 1.1 | 1.5 | 1.1 | 3.9 |
| | Asian American | 1.3 | 2.6 | 1.7 | 1.5 | 1.1 | 1.5 |
| | Native American | 1.3 | 0.9 | 1.1 | 3.1 | 1.1 | 0.8 |
| | Other: | 5.1 | 7.8 | 5.1 | 3.1 | 10. | 8.5 |
| **Household Type** | Single Adult | 6.3 | 6.1 | 6.7 | 5.2 | 5.1 | 8.6 |
| | Unrelated adults (e.g., roommates) | 23.4 | 25.3 | 19.3 | 20.7 | 23.1 | 20.0 |
| | Married without child | 31.3 | 30.3 | 34.0 | 31.0 | 39.7 | 31.4 |
| | Married with child(ren) | 28.1 | 33.3 | 30.7 | 32.8 | 25.6 | 30.5 |
| | Single parent family | 3.1 | 3.0 | 4.0 | 5.2 | 2.6 | 3.8 |
| | Other: | 7.8 | 2.0 | 5.3 | 5.2 | 3.9 | 5.7 |
| **Occupation** | Professional/ Managerial | 66.2 | 56.5 | 55.0 | 42.4 | 61.5 | 58.9 |
| | Technical | 5.2 | 5.2 | 9.4 | 15.1 | 6.6 | 7 |
| | Sales | -- | 0.9 | 1.7 | 3.0 | -- | 1.5 |
| | Service Industry (restaurants, retail, etc.) | | 2.6 | 3.9 | 1.5 | 3.3 | 3.1 |
| | Administrative/ Clerical | 6.5 | 7.0 | 3.9 | 7.6 | 5.5 | 7.0 |
| | Manufacturing/ Construction | 3.9 | 3.5 | 4.4 | 6.1 | -- | 3.1 |
| | Stay-at-home parent/ homemaker | 1.3 | 2.6 | 2.2 | 1.5 | 2.2 | 1.5 |

| Trip Characteristics | Options | Dynamic Ride-Sharing | | Car-Sharing | | Bike-Sharing | |
|---|---|---|---|---|---|---|---|
| | | Short Trip | Long Trip | Short Trip | Long Trip | Short Trip | Long Trip |
| | Student | 10.4 | 12.2 | 10.6 | 13.6 | 12.1 | 10.1 |
| | Self employed | 1.3 | 4.3 | 5.0 | 4.5 | 5.5 | 5.4 |
| | Unemployed/ Seeking work | 1.3 | 0.9 | 1.1 | 1.5 | 1.1 | -- |
| | Retired | 3.9 | 4.3 | 2.8 | 3.0 | 2.2 | 2.3 |
| | Other: | -- | -- | -- | -- | -- | -- |
| **Education** | Less than high school | -- | -- | -- | -- | -- | -- |
| | High school graduate | 1.3 | 1.7 | -- | -- | 2.2 | 1.5 |
| | Some college/ Vocational | 10.3 | 7.8 | 11.8 | 14.9 | 6.6 | 8.5 |
| | College graduate | 39.7 | 50.4 | 47.7 | 47.8 | 54.9 | 46.9 |
| | Postgraduate degree | 48.7 | 40.0 | 40.5 | 37.3 | 36.3 | 43.1 |
| **Income** | Less than $10,000 | 3.8 | 3.5 | 2.2 | 3.0 | 1.1 | 1.5 |
| | $10,000 to $14,999 | 1.3 | 0.9 | 1.1 | 1.5 | 2.2 | 0.8 |
| | $15,000 to $24,999 | 1.3 | -- | 2.2 | -- | 2.2 | 1.5 |
| | $25,000 to $34,999 | 2.6 | 3.5 | 6.2 | 7.5 | 3.3 | 3.9 |
| | $35,000 to $49,999 | 11.5 | 12.2 | 8.4 | 7.5 | 12 | 10.1 |
| | $50,000 to $74,999 | 19.2 | 18.3 | 19.7 | 19.4 | 17.4 | 27.1 |
| | $75,000 to $99,999 | 9.0 | 9.6 | 10.7 | 9.0 | 9.8 | 7 |
| | $100,000 to $149,999 | 16.7 | 17.4 | 15.7 | 16.4 | 17.4 | 16.3 |
| | $150,000 to $199,999 | 10.6 | 12.2 | 10.7 | 11.9 | 15.2 | 13.2 |
| | $200,000 or more | 14.1 | 9.6 | 10.7 | 6.0 | 6.5 | 7.0 |
| | Prefer not to answer | 10.3 | 13.0 | 11.2 | 16.4 | 12 | 10.8 |

*All respondents who answered "Definitely Yes" or "Probably Yes" to the question: "If available, how likely would you be to use [dynamic ride-sharing/car-sharing/bike-sharing] for the [long/short] trip you previously described?"

## EXECUTIVE INTERVIEWS

In fall 2014, TTI researchers conducted interviews with representatives from ride-share, car-share and bike-share programs, as well as government, consultant, and academic interests involved in the field of dynamic shared mobility programs.

### Summary Discussion

Austin, Houston, Dallas, San Antonio, and many other cities and towns in Texas have one or more dynamic shared mobility programs in operation, including Uber, a transportation network company (TNC), Carma, Car2Go, and B-Cycle. As a result of these services, policy questions arise regarding:

- What is the right balance of regulation and coordination for these services?
- What makes these Texas markets attractive to the service providers?
- What is the extent to which they contribute to public mobility, safety and environmental sustainability as a common good?

Shared mobility services impact the different needs of a region. Within the ride-share arena, ride-matching services address the traditional demand to coordinate regularly scheduled commuting and carpool activities. Dynamic ride-share programs consider casual, on-demand ride-share options, as well as the more formal, for-profit services offered by a TNC. Transportation network companies address the need for a dynamic, GPS-based, taxi-like network operating on real-time smartphone connectivity. According to the interviewees, the provision of for-profit, dynamic, ride-share services has led to a need for public oversight, especially where safety, environmental justice and access are perceived to be lacking.

According to the academic member interviewed, the impacts of shared mobility programs on regional performance measures such as vehicle miles traveled (VMT) or economic revitalization are also considerations when and where cities must plan for new developments and new transportation capacity based on such measures. For example, annual surveys of car-share and bike-share riders are typically undertaken by cities in order to establish whether downtowns are frequented more by tourists or if trips are being generated that would not have been taken otherwise, leading to induced demand and a subsequent increase in VMT. An examination of the issues involving shared mobility programs will help to leverage the positive contributions derived from these services while limiting some of their potentially negative externalities.

This section summarizes the results of these interviews and presents observations and conclusions. The following are some of the major findings from this effort.

*Efforts to regulate shared mobility programs and develop a regionally integrated shared mobility program ecosystem should consider market competition.*

- New programs are attempting to carve out roles as integrators of ride-share, car-share, bike-share and traditional transportation services.
  - One such vendor plans to integrate these shared services onto one smartphone-based platform that can help travelers build travel routes using multiple shared and traditional transportation programs.

    - The main problem is that aggregation requires platform integration from these other programs. Often transportation network companies and private car-share service providers refuse to allow traditional transportation programs to integrate with components of their platform.
- Cities that attempt to regulate shared mobility programs for safety purposes or revise parking rights to allow more competition are often embroiled in legal and public relations entanglements with the service providers, depending on the level of competition from market forces at play.

*Finance and revenue for shared mobility programs are hampered by perceived outdated rules and regulations.*

- The Carma representative advised that it preferred to locate in areas with policies supporting high-occupancy vehicle (HOV) usage, since their users could then accrue the benefits of HOV use as it enables increased ride-share activities among commuters.
- Many nonprofit and for-profit bike-share systems in the past have relied on state and federal funds to help purchase capital equipment. As explained by the Denver Bike Sharing representative, applying for these funds is based on bridges and roads forms; therefore, if these funds are used to install new bike stations, then that could trigger an automatic environmental review process.
- Federal commuter tax benefits reimburse employers who provide monthly funding to employees who use bike, transit and vanpool services to commute to work. As currently defined, ride sharing does not receive commuter tax benefits from the federal government. According to the Carma representative, this limited definition means three areas of loss: the ride-share users do not receive the benefit, Carma misses out on potential market growth, and the government misses out on potentially increased HOV use of roadways by carpoolers.

**Dynamic Ride-Share Programs**

Dynamic ride-share mobility programs are offered in a variety of formats but generally fall into two main categories. One is the profit-driven enhanced taxi service model, whereby GPS-connected smartphone applications serve as networking devices for passengers and drivers, and services are offered by TNCs. Uber and Lyft are examples of these companies. This model carries with it some of the traditional taxi service regulatory considerations that include insurance, background checks on drivers, and city permits for operation. The other is the dynamic ride-matching model, which focuses on being a commuter-oriented carpool service aimed at decreasing the number of single occupant vehicles (SOVs). Carma and vRide are examples of this variety. This model limits its payment to drivers to the rate for privately owned vehicle reimbursement authorized by the federal Internal Revenue Service plus a small transaction fee that is paid to the company.

Ride-share interviewees included representatives with University of California-Berkeley, Uber, Carma, the Northern Virginia Regional Commission, and the City of Austin City Council.

*Ride-Matching/Carpooling (Carma)*

**Benefits**

The primary focus of dynamic ride-share providers, according to the Carma ride-matching representative, is to achieve enough revenue to support the program, while also helping a region to reduce SOV usage and vehicle miles traveled. This approach focuses on commuter-oriented solutions, is policy-driven and functions like a public-private partnership (P3) in some situations. Ride-matching companies like vRide and Carma are primarily used for commuting purposes to and from work.

According to the ride-share representative, vanpooling and carpooling have been encouraged by the federal government for decades. Federal commuter tax benefits reimburse employers who provide monthly funding to employees for use of transit and vanpool services to commute to work. While vanpooling receives federal commuter tax benefits, traditional carpooling and the more recent move to dynamic ride sharing do not. Ride-matching services, like Carma, push for policy changes at the federal, state, and local level that incentivize carpooling.

At the federal level, as explained by the ride-share representative, the main priority for ride-share services like Carma is expanding the definition of eligibility for federal commuter tax benefits to carpoolers. At the state and local level, the priority for ride-share programs is free access to toll roads for HOV users, and for HOV access requirements to increase to three or more passengers. The ride-share representative advised that trip distances for Carma average 17 miles with three or more passengers in a vehicle. It limits the per-mile price for passengers to the federal reimbursement rate per mile (57 cents) and adds an administrative fee to cover expenses. The administrative fee is a 15 percent fee associated with any payment between driver and passenger, which goes back to Carma. One interesting finding, as advised by the ride-share representative, is that over time riders tend to form off-line relationships as the 15 percent fee becomes a disincentive to use the application when using the same driver repeatedly. At this point, the regularity of the ride sharing converts to a more traditional carpool situation.

Ride-share programs, per the Northern Virginia Regional Commission member, expanded into Northern Virginia initially in response to a P3 request by the Northern Virginia Regional Commission to assist with trip reduction policies aimed at the Base Closure and Realignment Commission (BRAC). The base closure and realignment resulted in the reassignment of 75,000 new service members to southeast Fairfax County. However, local roads and parking availability could not absorb this increase in SOVs. In Northern Virginia, Carma (then known as Avego) was contracted to help encourage carpooling to and from military bases through use of the ride-share service. The partnership between Carma and the Northern Virginia Regional Commission, according to the commission member, failed to achieve its objective. Two factors contributed to this failure. Carma was not able to encourage use of the smartphone application and ride sharing among a closed community of military base workers. Subsequently, the company sought to expand its use to the wider public, which ran counter to stringent information technology (IT) security requirements. These requirements prohibited the sharing of data through the application on the origins and destinations of military personnel on and off the base.

**Commuter-Orientation/Financial Sustainability**

Because ride-share services reimburse drivers at the standard federal mileage reimbursement rate, it does not make financial sense to use Carma on shorter trip distances. For Carma, a three-mile trip will only earn the driver $1.34; however, a Carma driver bringing a group of passengers 19 miles stands a far better chance of covering the cost of their trip by collecting $4.81 from each passenger and gaining free entrance to the toll road. In some ways this limits how much these services can contribute to commuter-oriented solutions. As explained by the Northern Virginia Regional Commission representative, another problem the BRAC project encountered, aside from the IT requirements, was the last mile connection to the Virginia Railway Express (VRE) and Maryland Area Regional Commuter (MARC) rail stations and Metrorail lines. Prior to the BRAC relocation, many employees relied on these rail and metro services to bring them to a station within walking distance of their offices in the Arlington and downtown Washington, D.C. area. The base location in southeast Fairfax County, where the BRAC project proposed to move their offices, was not located within a mile of these stations. As such, other ride-share services may have been a better fit for the short-distance trips in such a situation, as their trips average about 3.5 miles, compared to Carma, whose trips average 17 miles in length. The ride-share spokesman advised that the BRAC project did not succeed because the service could not provide instant route matching to users because the pool of drivers was too small. In other words, the ability to instantly match drivers and passengers is lost when the application is applied only to a closed community of users, such as a single military base, or a single employer or university.

Carma initially offered access to the application to civilian and military personnel driving to and from the military base, which was deemed acceptable. When the service did not gain traction, Carma sought to expand this application to a wider pool of users beyond the base, which violated military security IT restrictions. These restrictions prevented the display of the movement of civilian and military personnel working on the base to the public, which is what an application like Carma requires in order to be effective. Ultimately, this led the Northern Virginia Regional Commission to switch from Carma to vRide. VRide is a dynamic vanpool ride-matching service similar to Carma. According to the Northern Virginia Regional Commission representative, vRide replaced Carma as the dynamic shared service provider after Carma withdrew its service from the BRAC project.

Carma engages in outreach to multiple employers and city/regional governments to achieve financial sustainability through a mix of grants, public-private partnerships and user base expansion. In the San Francisco Bay area the Bay Area Rapid Transit (BART) transit strike was the event that led to Carma attaining a critical mass of users, per the ride-matching spokesman. As a result of the transit strike, Carma tracked an increase of around 15,000 new users who turned to Carma as an alternative commuter transportation method. Carma also provides commuter-oriented solutions beyond their ride-share application. In the Bay Area they won a $1.5 million dollar P3 to offer business development strategies to three counties in the San Francisco Bay area in order to encourage carpooling. Before this, Carma partnered with King County Metro Transit in Seattle, Washington, to operate their vanpools.

**Insurance, Background Checks and Safety Regulations**

One of the key issues is differentiating between ride-share and TNC companies. According to the Carma ride-share spokesman, many legislators attempt to pass legislation that places ride-share programs in the same regulatory structure as for-profit taxis and TNCs. These require background checks and have stringent insurance requirements. Carma's limitation on driver reimbursements creates a legal distinction between them as ride-sharers and TNCs as ride-share operators whose drivers are compensated employees. The ride-share spokesman indicated that this distinction means that Carma should not be subject to the same insurance, background check and safety regulations that TNCs are. Therefore, Carma does not provide insurance, vehicle inspections or background checks according to the ride-share spokesman. The reason is that since drivers are not able to be reimbursed beyond the federally allowed rate, they should not be subject to the same regulation as taxis and other TNC providers. Insurance is applied similarly to a typical driver operating as an HOV driving friends, family or neighbors and is based on personal liability insurance.

The ride-share representative advised that Carma works proactively with state insurance commissioners prior to launching their application to ensure they are operating within the bounds of the law. According to the ride-share spokesman, conducting background checks creates liability for the company when something goes wrong. Ride sharing by and among drivers who are not required to have background checks has been legal in most places for decades, and Carma sees itself as supporting, not changing, traditional carpooling activities. It is simply adding a dynamic component. There is also a rating system that Carma uses with the intent of keeping drivers and passengers on their best behaviors. When a rider or a driver enters a transaction through the Carma application, at the end of the experience they can rate each other. If there is a problem with either the rider or the driver, then there is the chance for a lower score rating. After multiple one-star ratings, a rider or a driver is removed from the system and prevented from using the Carma application. The intent of this rating system is to retain a method of keeping track and penalizing participants for poor quality service or inappropriate behaviors.

The ride-share spokesman stated that the programs in Seattle and in Northern Virginia did not work well as pilot efforts. Background checks and insurance requirements are what led the ride-share company to withdraw from the public-private partnership to provide dynamic ride-share services in Seattle. Eight different background checks were required, including social security checks, driver's license background checks and sex offender registry checks. Half of the driver applicants dropped out of the pilot based on the social security background check. Out of the 1,000 drivers that applied, eight drivers made it through the background check process. As in regional pilots like the BRAC relocation in Northern Virginia, limiting the service to employees from one military base location was also problematic. Ride-share programs find a more ideal operational setting when tied to P3s aimed at regional SOV and VMT reduction policies. The reason, as explained by the ride-share spokesman, is that P3s:

- Provide an injection of capital to ensure financial sustainability.
- Open the door to additional funding and grant applications.
- Offer more leverage with which to approach the local authorities to petition for changes in policy that reduce SOVs and VMT.

Another key piece of the insurance and safety regulatory setting with ride-share programs is the findings on use. As advised by the ride-share spokesman, exit surveys for riders found that, over time, riders stop using the application as they become more comfortable using a set of drivers. Unlike TNCs, Carma does not penalize drivers for establishing an arrangement outside of the application and anticipates this as a natural progression of use. So, the character of this program is really geared toward encouraging carpooling to the point where paying the 15 percent use charge acts as a disincentive and encourages offline, more traditional carpool arrangements. Conversely, TNCs only cover their drivers with insurance when the application is engaged, and if they find out that drivers are carrying passengers when the application is turned off, they will remove the driver from their system.

**Data Sharing**

As advised by the ride-share representative, Carma has been successful in securing funding from grants and P3 contracts for expansion into new regions and new commuter-oriented services. As part of these grants and P3 contracts, Carma provides data as evidence of their contribution to the reduction of SOV and VMT use. When the Carma application is downloaded, the origin address provided during the setup is set as the home of the traveler, whether it is actually the home or not. Data are gathered for trips taken from the origin location to destination locations. The origin and destination data and transactional data are scrubbed of personal identifiers.

Carma's efforts to develop business strategies in the San Francisco Bay area have led to the collection of other types of data outside of the ride-share application. Other data types are travel times and the daily number of carpoolers at park-and-ride facilities. Much of this is facilitated through data sharing agreements. The ride-share representative indicated that California Department of Transportation (Caltrans) operational changes as a result of a data sharing agreement along Interstate 80. Caltrans uses the carpool origin and destination data and the park-and-ride data to optimize the location of dynamic message signs and toll gantries in the corridor. With this park-and-ride HOV rider data, Caltrans can relocate dynamic message signs further upstream of the park-and-ride exit ramps to encourage SOV drivers to stop and pick up HOV riders at the park-and-rides. These data sharing requirements also show up in other projects, including the toll road rebate project with Central Texas Regional Mobility Authority (CTRMA) in Austin. In this project, Carma partners with CTRMA in order to provide HOV use data; in exchange, the driver gets a reimbursement on tolls.

The ride-share spokesman also advised that the data sharing agreements with governments and employers provide the ride-share service with data. These data are used to gather a detailed picture on where most trips originate and where commute times are the worst. Data are then used to track downloads of the application and origin trip addresses in order to target social media campaigns to certain neighborhoods with bad commute times and heightened interest in the application.

**Policy-Oriented Business Model**

According to the ride-share program spokesman, Carma seeks to reduce VMT and achieve financial sustainability through changes in HOV passenger requirement policies. Policies that define HOVs as 3+ passengers increase demand for Carma's application. As advised by the ride-share program spokesman, traditional carpools are usually two-person carpools. Carma uses

technology to match riders and drivers in real-time, allowing them access to 3+ HOV lanes. In turn, Carma receives the fee each time the application is used for a carpool.

Interviews with both government and ride-share program representatives revealed that ride-share programs are driven by SOV and VMT reduction policies. These policies originate at the federal, state, and local level in the form of grants, high-occupancy toll (HOT)/HOV lanes, P3s, and employer-based initiatives. What this means is that ride-share programs often begin their expansion into new regions by weighing partnership and grant opportunities with city transportation departments, toll authorities, and local federal transportation offices. They also must strive to separate themselves from TNC policy and regulatory considerations, given the similarity of the services, which use smartphone applications to seamlessly transport passengers from A to B. In this way, they seek to educate city councils and those responsible for crafting TNC regulations on the difference between ride-share and TNC services.

*Transportation Network Companies*

**How TNCs Identify and Expand into a Market**

Transportation network companies are for-profit ventures that are primarily used for short trips around town or as a connector to destinations when an automobile is unavailable or its use is undesirable. Examples of TNCs are Sidecar, Lyft, and Uber. TNCs facilitate ride sharing by allowing passengers to request a ride from an available pool of drivers through their smartphones. According to the academic member, originally Sidecar and Lyft were planned for use as a personally operated vehicle (POV) taxi service that could integrate with local transit service schedules to help passengers make connections to transit seamlessly. In 2012, Uber proposed a reduced transportation cost structure known as UberX that also expanded the service to any qualified driver with an acceptable vehicle. Prior to this, Uber offered only full-size luxury cars in their UberBlack service, which was offered at a higher rate. According to the academic member, UberX had the effect of heightening competition between TNCs and dampening efforts to integrate services with transit. The reduced cost structure of UberX changed the scope of the TNC industry toward operating more like a taxi service without attempts to integrate transit service schedules. Presently, TNC applications do not integrate transit schedules into their routing options. According to the academic member, because the demand remains for last-mile integration of transit schedules with TNC services, it is likely to be a future development.

The interviews revealed that TNCs expand into markets quite easily, usually as a result of market demand. Where services are just beginning to catch on, use is driven by users alone until a certain profit threshold is reached. At that point, a general manager is assigned as a city resource, followed by technical resources, marketing, and outreach resources. An example of a city at this stage is El Paso, Texas. When an office is built in a city, this typically indicates that the service is being used to a large extent. This then requires dedicated resources and staff to assist with background checks, user inquiries and general administration to support the company's local market. According to the Uber representative, these offices are often located in urban centers with larger populations.

As an example, when expanding to new markets, Uber focuses its outreach and coordination efforts with the city council, the public (through its users), and political leaders. These efforts are mainly oriented toward lobbying the city to provide beneficial operational settings and oversight regulations. Initially, Uber simply began operating in cities without any planned outreach. Lately, with the heightened awareness of some of the challenges they present, TNCs have taken on a more proactive stance. The TNC representative indicated that optimum operational settings for Uber are:

- Allowed use of self-insured policies of $1 million per vehicle.
- Internally conducted vehicle and background checks.
- Capability for virtually conducted safety inspections of vehicles using submitted images alongside the vehicle VIN number.
- Limited data sharing agreements that protect their proprietary information.
- Allowed use of surge pricing.

The TNC representative indicated that for Uber, city transportation offices are perceived to be there to carry out the regulations provided to them by political leaders. A TNC representative explained that often the most efficient way to affect changes to city policy is through city hall and the demand voiced by its users. However, there are cities where the city hall–centric approach to initiating the TNC service does not work as effectively. For example, cities such as San Antonio and Philadelphia have a more engrained taxi culture and, thus, more support at the political level. In New York City and Philadelphia, each city holds a financial stake in taxi services by providing paid license permits or medallions that allow the establishment or expansion of taxi services. The TNC advisor indicated that establishing service in the city of Philadelphia has been very contentious because TNC services are being blamed for reduced sales of taxi cab permit medallions.

According to the TNC representative, another issue is the difference in operating costs for traditional taxi drivers and TNC drivers. Cities place insurance requirements and operating costs on taxi cab companies that cab drivers must pay to the cab company. For TNCs, these costs are largely reduced because they are not subject to the same regulations as the taxi cab industry. The TNC application and renewal is a low-cost item, often in the range of $40 to $75 annually, and is paid for by the TNC driver. Moreover, completion of a background check and vehicle safety inspection is mostly done within the company. In some locations, like Houston, background checks and administrative fees are administered by the city government.

### Consideration of the TNC Business Model within a Traditional Taxi Cab-based Regulatory Environment

TNCs provide taxi-like services in a seamless digital environment by switching the mode of operation from analog dispatch to a digital dispatch in a data-rich environment. TNCs also bring along the capability to dynamically respond to surges in transportation demand by allowing drivers to charge higher rates in order to increase the active carrier pool at times of higher demand. This practice of charging higher prices in times of high demand is known as surge pricing. Transit long ago noted the uncertainty that went with the lack of real-time visibility of buses and trains en route to pick up passengers as a primary passenger complaint, and there have been many improvements since to improve the visibility of transit services along routes (*154*).

For the traditional taxi cab industry, some of the same uncertainty of arrival times applies, even though new services such as Flywheel, which matches taxi drivers and passengers similar to TNCs through an application-based interface, have the potential to provide a solution to this uncertainty. For TNCs, according to the ride-share spokesman, the digital visibility of the driver through use of GPS on a smartphone is a big benefit for customers. He also advised that TNC drivers are more likely to service high-crime areas of the cities where they operate because they do not carry cash and are covered by a high-dollar insurance policy and a data-web that tracks them as they operate.

What TNCs also showcase is that in cities where TNCs thrive, taxi services, in comparison, often operate in a highly regulated structure that places the financial burden on taxi drivers to pay large monthly sums to taxi cab companies to maintain their insurance policy. The regulatory policies placed on taxi companies might also be examined for further improvements.

*Shifting Regulatory Environments: Background Checks and Insurance*

While cities and states work to incorporate TNCs into local and regional transportation systems for which there are few or no existing regulations, TNCs invest considerable time and effort to influence policy on safety and background check regulations. In Austin, the city established a task group in early 2014 that included TNC representatives, taxi service operators, city council members, and city transportation department officials. The purpose of this task group was to work out an agreement setting forth operating conditions for TNCs. The city council member advised that since the group was unable to come to agreement, the city council passed a temporary measure allowing TNCs to operate legally for an interim period. As a result of the interim agreement, Uber is conducting driver background checks and vehicle safety inspections, and providing insurance to drivers. According to the TNC policy advisor, Uber will pay the city of Austin a flat fee to undertake all permitting activities on behalf of its drivers so that they can operate legally in the city. Also as part of the agreement, the city will have access to data on driver permit applications, as needed.

In Houston, permitting of TNC drivers is a function retained by the city government. As advised by the TNC representative, city council members voted to require that every driver working on behalf of TNCs have their own individual permit. This requires them to submit applications to the city for permitting with a $20 fee per application (*155*). To obtain a permit to operate as a driver for a TNC, individual drivers must:

- Obtain and complete a Fingerprint Applicant Services of Texas Packet.
- Provide finger prints and submit the packet at a cost of $41.45.
- Go to municipal courts to have a warrant check completed at a cost of $20.
- Complete the application as provided by the City of Houston with all pages notarized.
- Provide proof of insurance by having the insurance agent submit Acord 25 form directly to the offices responsible for the permitting function.
- Provide a company fee schedule.
- Submit a copy of the Doing Businesses As corporation papers from the Texas Secretary of State.
- Show proof of ownership of vehicle with one of three items as proof: bill of sale, title or vehicle registration.

- Show original Social Security card, Texas driver's license and work authorization/passport as part of the application.
- Bring the application to the permitting offices for submittal once all application materials are completed and gathered into one packet.
- Complete the vehicle inspection, which takes place at 8 a.m. at the same permitting offices building on the following business day after the application is accepted.

According to Uber, this city permit application is extensive and requires drivers to visit various offices for fingerprints, warrant checks, and the city permit offices to obtain a permit. Uber advised that this was perceived by Uber drivers as onerous in comparison to Uber's remote inspection and permitting process and resulted in a 75 percent reduction in typical applications for permits.

The academic interviewee advised that there also have been conflicts between state and city regulations, as well. In Michigan, state regulations allow TNCs to operate, while Detroit's own ordinances prevent their operation.

The TNC policy advisor indicated that when Uber drivers have engaged a passenger via the application and are en route to pick them up, Uber provides $1 million worth of insurance coverage. This insurance coverage is only provided when a driver is en route to pick up a passenger and while transporting the passenger. Taxi drivers, conversely, are required to provide insurance coverage the entire time they are on duty, regardless of whether or not they have a passenger. According to the TNC policy advisor, taxi providers in Houston wanted Uber drivers to be subject to the same around-the-clock insurance coverage requirements that taxis are required to hold. However, in Houston the agreement allows for Uber's $1 million insurance coverage to only cover their drivers while they are providing active service through the application and to cease once the driver is no longer actively listed as available for service on the application. This means that if Uber drivers transport anyone while their application is off, Uber's insurance is not covering the driver. In this case, taxi services argue that the personal insurance will not cover the driver, which exposes passengers and drivers off the clock to increased risk.

*Data Sharing Agreements and Proprietary Information*

Data sharing provisions are often part of the agreements, regulations, and ordinances enacted by city councils over private-sector ride-share activities. According to the policy advisor with the TNC, all TNCs operating in Austin must provide monthly data on a quarterly basis for the number of rides, use of surge pricing (when it is in effect and how much people pay), and provision of services such as UberWAV (wheelchair-accessible vehicles) for those with disabilities. The council member indicated that taxis also provide these data based on an agreement from years ago, but the quality of the taxi-provided data is not at the level of the TNCs since it is analog dispatch data, while TNCs maintain a GPS-based database. According to the policy advisor with the TNCs, regarding origin and destination data, TNCs provide the pickup and drop-off locations based on zip code areas and not the actual addresses, as this level of detail could provide advantages to competitors. Real-time data on locations of drivers are protected as proprietary information by TNC companies, as well. In January 2015, Uber elected to expand the Austin template for data sharing agreement nationwide in cities such as New York

City, Boston, and San Francisco. Sidecar and Lyft also have similar data sharing agreements in place.

*Effect of Ride Sharing on Vehicle-Miles-Traveled is Unknown*

It is difficult to gauge whether TNCs contribute to or reduce VMT in a city or region. The academic representative advised that, on the one hand, TNCs provide alternatives to taking a personally operated vehicle into the city or out to restaurants and entertainment, which could reduce VMT. On the other, TNCs enlist drivers out of their homes to accommodate peak demand for services over and above what traditional taxi driver pools provide, which increases VMT. A TNC policy advisor indicated that TNCs do not roam city streets looking for passengers, compared to traditional taxi drivers. They can remain stationed in one place and wait for riders to connect with them through the application before setting out on their next fare. A professor indicated that studies show that TNCs are used by customers who generally own fewer cars and travel with more companions, but also induce eight percent of the trips taken. This means that eight percent of all trips that normally would not have occurred without the TNC application now occur.

According to a city council member, another side of the VMT question is the dollar-per-mile fee users pay to use a TNC rather than operating their own personal vehicle. In consideration of allowing TNCs to operate, the council member noted that TNCs provide a new alternative to personal vehicle use that also attaches a cost on a per-mile basis. They anticipate that travelers may become more frugal with their transportation dollars after they consider total costs (including insurance, parking, annual fees, maintenance, etc.) to operate their own vehicles in comparison to what TNCs and transit services provide.

*TNCs May Help to Reduce Impaired Driving*

A city council member noted that the police department has become an unexpected champion of TNCs. As advised by the city council member in Austin, police were required to ticket all TNC drivers for a period of time while the city negotiated with the providers. At city hall meetings, police members supported the TNCs and expressed frustration over requirements to ticket sober TNC drivers who were bringing inebriated passengers safely to their homes. According to the TNC policy advisor, Uber conducted a study examining the benefit of TNCs on reducing impaired driving, which showed that in Seattle, driving under the influence (DUI) arrests declined by over 10 percent after the arrival of TNCs. One caveat to this study, according to the academic member, is that many other causal factors may be at play, such as population or demographic shifts.

## Car-Share Programs

Car-share companies undertake a balancing act between earning profits in a competitive industry while also providing governments proven results that they contribute to the reduction of VMT and SOV use on congested transportation networks. New smartphone or tablet applications allow users to reserve the vehicle, open a vehicle upon approach, obtain the key, and pay for the use of the car-share vehicle at the end. Previously, users accessed the car key from a lock box and noted hours and miles driven in a paper log. Now, a software application grants users access to the car and tracks miles and hours. According to the academic member, in California a shift in focus

from planning for new capacity to reducing VMT has also led to increased use of alternative modes such as car sharing to offer users alternatives to car ownership. Key considerations for effective integration of car-share companies into a local transportation network are data sharing agreements, competitive market pressures and resulting opportunities, cultural and geographic factors, and city-level arrangements.

Car-share interviewees included representatives with UC-Berkeley, the District Department of Transportation (DOT), Enterprise CarShare, the Car Sharing Association, and the City of Austin parking department.

*Documenting Whether Car Sharing Reduces Congestion by Providing an Alternative for Urban SOV Trips*

The Car Sharing Association representative advised that car sharing provides a transitional experience between car ownership and living car-free. Other organizations interviewed for this effort describe car sharing as developing from a need for congested cities to reduce vehicle ownership by connecting citizens with options to share vehicles from the same pool of vehicles. In Washington, D.C., the District DOT initially allowed two car-share service companies to operate on the city streets to develop a pool of vehicles that could show a positive impact on reducing SOV use. This initial deployment created a pool of 86 vehicles placed about the city, which were split between Zipcar and Car2Go. Policy goals of the car-share program in D.C. are: (1) reduction of personal vehicle use; (2) reduction of VMT; and (3) increased use of transit, bicycling and walking. These potential car-share program benefits are measured using annual surveys.

Recent changes to services in D.C. proposed by car-share companies include use of car-share rentals in suburban regions. The District DOT employees advised that this type of use may muddy the benefits of a shared carpool central to the city as it may encourage SOV drivers to bring more car-share vehicles to the city. New requests for parking spaces by new car-share companies also raise questions as to whether there is an optimal pool size of car-share spaces on city streets and whether a larger pool will negatively impact transit ridership and congestion on D.C. streets. In the case of the city of Austin, car sharing began as a one-year pilot with Car2Go to see what effects it had on reducing vehicle use and to test the smartphone application-based system.

Sometimes car-share service providers do not expand to cities and regions due to perceived lack of market opportunity. One method used by cities and regions to encourage car-share services in these locations, according to the Car Sharing Association representative, is leveraging employer-use guarantee agreements to encourage car-share companies to set up their business in and around these employer locations and close to neighborhoods where employees live. The Enterprise Car-Share representative explained how partnerships are formed with colleges, government agencies and anywhere there is a large community of potential users in close geographic proximity who might benefit from using a shared vehicle in place of full vehicle ownership. For example, in Houston an agreement was put in place between Enterprise Car-Share and the Energy Corridor District that allowed employees within the district lower rental rates during overnight hours to cover them if they need to use the car-share rental overnight.

Cities also use car-share programs in coordination with planned high-density developments to mitigate the impact of these developments on congestion. The City of Austin representative illustrated how they work with high-density developers to persuade them to decouple the cost of parking spaces from the total price of the development. In exchange, they helped establish a partnership whereby several car-share vehicles are placed at the facility for use by residents. While this effort is aimed at the reduction of vehicle ownership, the Car Share Association representative advised that these types of arrangements can see far fewer uses of the car-share vehicles posited at these garage locations due to their general lack of visibility by residents and casual users.

According to all organizations interviewed, strategies employed by car-share companies include working with employers, developers and city departments of transportation to establish parking and data sharing agreements, and guaranteed-use agreements, which guarantee a minimum level of car-share use and reimburse for any difference if the use should fall below the minimum. By participating in the placement of car-share units and encouraging their use among residents and employees, employers and developers can also influence the degree of success car-share companies provide in mitigating congestion and reducing SOV use and VMT. Issues that arise concern data sharing, the method for designation of public parking spaces and establishing the right mix of regulation and employer/developer agreements for a given locale. Another type of service within the car-share industry is the point-to-point service. For this service, the driver is allowed to rent a vehicle, and then park and leave the vehicle anywhere within a geographic area without any requirement to bring the vehicle back to its original location. Questions arose from the District DOT as to whether point-to-point car-share trips cut into transit and bike trips and add vehicles to streets during hours of peak demand.

*Data Sharing Agreements between Cities and Car-Share Providers*

District DOT representatives advised that they require annual user survey data from car-share companies as part of the agreement to allow vehicles to park on city streets. They also request quarterly data on monthly utilization rates, geographic distribution of membership, and D.C. membership growth rates. The annual survey gauges whether miles traveled by members increased; if walking/biking/transit trips increased, declined or remained the same; and how trips would be taken if a car-share vehicle were not available. According to District DOT representatives, these data can measure what effect car-share has on VMT and modal shifts. Core concerns were the extent to which car-share companies induced VMT and the extent to which trips were being taken away from transit and other modes. The City of Austin representative indicated that data sharing requirements accompany any new agreement to lease parking spaces with car-share companies. Presently Zipcar and Car2Go are both sharing data with the city parking department on new parking spaces associated with developer agreements. Utilization rates, growth rate, and types of trips taken are also collected. These data will be used to communicate some of the challenges and benefits of establishing a car-share agreement within or adjacent to a developer property.

From the industry and association perspective, careful attention needs to be paid to the types of data collected as part of regulations. For example, any data that require origin and destination locations for trips taken are considered proprietary, as they could provide an advantage to competitors. Mostly, cities want to ensure car-share companies do not adversely impact transit,

parking, and VMT reduction policies while retaining the benefit of reduced vehicles on the street by allowing citizens to drive cars from a shared pool of vehicles.

*Competitive Forces and Distribution of Parking Spaces*

New competition for parking spaces among car-share companies provides the opportunity for city government to use their authority to distribute parking spaces as leverage to obtain mutually beneficial data sharing agreements. Also, there is the opportunity to redesign the layout of the car-share network to ensure all areas of the city have first and last mile coverage and access to key destinations. According to the academic interviewee, a lottery process recently took place in San Francisco where 800 parking spaces were offered to car-share companies for a two-year pilot in exchange for data on benefits to VMT reduction and reduction of vehicle ownership in the city. The Car Sharing Association representative advised that, in the past, cities took a more supportive stance helping car-share companies get guaranteed user incentives and free parking in order to attract their services. Over the past three years, as more entrants came into the market, cities have begun to review whether car-share organizations actually reduce VMT and the minimal impacts on transit ridership that the car-share industry claims. Cities like Washington D.C., Boston, and Chicago are now revising the distribution of parking spaces, requiring data to measure the benefits and costs, and raising space rates to match new market demands. As part of this new demand, cities are also requiring coverage in parts of the city where demand may be low, but low-income communities stand to gain.

According to the Car Sharing Association representative, car-share companies prefer having their vehicles located on street-level parking because the use rates for these vehicles are far higher than those located in garages or private parking spaces. The Enterprise Car-Share representative advised that parking agreements with individual employers or universities are much more transparent and open to competition than many large city agreements. In comparison, many cities tend to favor earlier market entrants and come with requirements such as data sharing requirements and overly high minimum use requirements and penalties that threaten the viability of new ventures. The Denver car-share agreement was lauded by the Enterprise Car-Share representative as being openly competitive and transparent with approximately 30 on-street parking spaces per company allocated among four competitors. The Enterprise Car-Share representative advised that they are not making a profit in Denver and anticipate a three- to five-year time frame for most new markets to return a profit.

*Regional Characteristics: Climate, Culture, Transit and Density*

According to the Car Sharing Association representative, car sharing works best where entertainment, shopping and business destinations and high-density housing exist with shorter walks to the vehicle stations. The availability of public transit is cited as both a pro and a con, depending on the organization interviewed. The Enterprise Car-Share representative advised that rail transit with stations at every other corner tends to reduce car-share use rates, while rail transit stations separated by a half-mile or more makes use of car sharing more appealing. For round-trip car-share companies like Zipcar or Enterprise Car-Share, use of car-share rentals allows city dwellers access to commercial corridors outside of the denser urban core or to more rural areas.

The Car Sharing Association representative indicated that cities in temperate climates with a cultural disposition to sharing, eco-mindedness, and a larger percentage of high-tech workers

tend to have financially sustainable car-share environments. The City of Austin representative stated that there is a concerted effort to align car-share systems with new high-density developments so that maximum VMT reduction benefits may be realized. Because Capital Metro, the transit authority serving the city of Austin, is its own quasi-governmental entity and is not part of the City of Austin, there is currently no organizational effort to place car-share stations at transit stations or near park-and-rides. District DOT representatives advised that its transit agency, Washington, D.C. Metro, is cited as a benefit to car-share companies, with data to support the claim. Zipcar and Washington, D.C., Metro have a partnership where parking is provided at park-and-ride station lots.

**Bike-Share Programs**

Bike-share systems have the potential to provide a balanced consideration of safety and street-level improvements to accompany the increased use of bicycle and pedestrian modes in a city or region. Bike-share interviewees included representatives with the District DOT, Bike Chattanooga, Denver Bike Sharing, Alta Bike Share and the City of Austin City Council.

In Chattanooga, Tennessee, per the Chattanooga bike-share representative, the development of its bike-share system was instrumental in the development of a city department of transportation that oversees the integration of multiple modes of transportation, including the bicycle infrastructure. According to the Bike Chattanooga representative, one of the outcomes of this multimodal planning was the placement of new bicycle lanes in the downtown area to protect bicyclists. The multimodal planning also led to the formation of a new complete streets policy that aims to direct transportation planners and engineers to routinely design and operate the entire right of way to enable safe access for all users, regardless of age, ability, or mode of transportation.

Bike-share programs in New York City, Denver, Chattanooga and Washington, D.C., use a combination of nonprofit, private and government organizations in varying degrees to initiate, operate and maintain a system. On a yearly basis, bike-share providers look to grants, user revenue, advertising revenue and government support as funding sources that drive budgetary considerations. In some systems, like Denver, if advertising revenue does not materialize at the levels experienced in previous years, then operations and maintenance will receive fewer funds. In other programs, this exposure is reduced with increased government support, or public-private partnership contracts that place more of the financial burden and risk on the private industry.

*Different Bike-Share Programs Have Different Purposes*

Based on interview findings, bike-share systems are developed for various reasons. These include efforts to:

- Increase the health of communities by encouraging active modes of transportation.
- Connect bikes with transit networks that have large distances between stations (last mile considerations).
- Induce efforts to complete a bicycle and pedestrian plan.
- Improve safety for bicyclists and pedestrians.
- Encourage tourism by providing a fun, dynamic mode to move about cities.

According to the Bike Chattanooga representative, their bike-share program accompanied the development of bike-friendly policies and complete street designs so that Chattanooga could safely incorporate the resulting bicycle mode shift into the city. For example, their bike-share program launched as an independent system in July 2012. By July 2014, the city had taken up ownership of the bike-share program and developed a complete streets policy so that it could apply for federal funding to build bicycle lanes and add more bikes and bike docking stations to the network.

*Funding and Business Models*

The Denver Bike Sharing representative indicated that, in Denver, the bike-share program was initially funded with money left over from the 2008 Democratic National Convention and now remains an independent nonprofit system with support from advertising. Among other purposes and goals of the system, one goal was to facilitate the development of tourism and to make the downtown area more of a destination. Now, much of the effort is geared toward encouraging a bicycle-friendly city and equality of coverage and use, while also expanding to areas of high demand, such as mixed zoning residential developments. The focus is on keeping the system financially sustainable while also retaining the nonprofit status so that it may qualify for government grants and other similar types of support as they become available.

The strategy of bike-share programs typically involves forming a nonprofit partnership to secure private and public funding of capital assets. Agreements are made between the city or state and the bike-share program about station placement and public rights of way, and then a fine balance of network size and design are considered, as well as pricing the system. The bike-share company representative advised that the publically supported systems tend to have higher prices to cover an established level of service and in-house operation and maintenance costs. On the other hand, private systems tend to have lower prices to encourage a critical mass of users and achieve financial sustainability through increased use.

Another consideration advised by the bike-share company representative, is which city department is responsible for the bike-share program. In the opinion of the bike-share representative, if the program is run by a department primarily focused on road maintenance and road building, it is not in the right department. According to the bike-share company representative, active recreation groups at the parks and recreation departments are the best-case scenario for the bike-share company since those groups tend to prioritize safety improvements to streets and the creation of a bicycle-friendly city rather than the reduction of single occupancy vehicles. It was the perception of the bike-share company representative that, in general, the reduction of SOVs and VMT receives higher priority in the roads department in comparison to safety improvements.

Bike-share programs across the United States are born of a diverse patchwork of funding. As a result, a plethora of goals and requirements are attached to the use of these funds and ultimately shape the business structure. According to the Bike Chattanooga representative, their program did not have direct support from the mayor's office when it began. It was a grass roots effort in which a small group of people put together a roster of grants and supporting resources from various locations to get the project off the ground. A health fellowship was secured with the National Science Foundation (NSF) to conduct research on how the bike-share program might

work and the health benefits it might bring to a city or region. The NSF funding placed a need for good data on the Chattanooga bike-share program, which is why it was one of the first systems to acquire GPS-enabled bicycles. Following the NSF funding, $2 million in federal Congestion Mitigation and Air Quality Improvement (CMAQ) program funding was used to acquire all necessary capital assets and shaped the scale of the total system. Because Chattanooga is a smaller market and because there are not enough annual members to cover the operating costs, prices on the system remain high. The City now owns the equipment and contracts with Alta Bike Share to operate and maintain the program. The nonprofit Chattanooga bike-share now works to integrate the bike-share program with transit and other activities to promote healthy active lifestyles as per the original fellowship directive with the NSF.

The bike-share company representative stated that cities have different structures and interact with the bike-share company accordingly. In Washington, D.C., the program is heavy on the side of government ownership of capital investments with Alta Bike Share contracted as the operator. New York City chose to pursue a public-private partnership strategy with Citibank, whereby one major sponsor (Citibank) fronts the capital investment funding and contracts with Alta Bike Share to operate the program, placing the risk burden on Alta Bike Share to make the program financially sustainable. Cases in the middle are more like Chicago, where the capital equipment was funded by a federal grant and if the bike-share system loses money, it gets a subsidy from the city to cover the loss. Chicago has set up the contract to transition to Alta Bike Share, having more financial independence over time as performance improves. In Toronto, a flat fee is paid each year to Alta Bike Share to operate and maintain the system while the city retains ownership over the equipment. Toronto also manages the sponsors and ad revenue.

*Regulatory Considerations and Data Sharing*

Data sharing requirements that show use rates, types of users, revenue, trip patterns, and trip types are usually part of the initial agreement with the city. Regulations prevent the release of proprietary information, which includes personal data on origin and destination trips. These data, however, may be scrubbed of personal data and then put into use by the city or state for planning purposes or any other purpose, as needed. Generally, data sharing requirements are based on the founding circumstances and initial development of the bike-share program. According to the District DOT, Denver Bike Sharing, and the bike-share company representatives, data sharing provisions are generally part of the agreements put in place with the bike-share program operator to allow the system to go forward with deployment. In Denver, data collected from an annual user survey are provided to city planners. In New York City, trip behavior data are scrubbed of personal identifiers and then provided to the public and the City for planning purposes. Data on trip behavior may be collected from GPS units on some systems, while on other systems GPS data are inaccessible due to outdated or malfunctioning hardware and software.

According to the bike-share company representative, regulations vary by city and include prevailing wage regulations, Buy America regulations and minority business regulations. Capital purchases and subcontracts are influenced by these regulations, depending on the type of funding used to support the program. The Denver Bike Sharing representative advised that Buy America grant requirements apply when federal grants are used for capital purchases. An interesting note is that these grant requirements may change as federal-level funding changes. There is currently

a trend at the federal level away from providing funds for capital funding of bike-share programs.

*System Design and Pricing*

The City of Austin city council member advised that bike-share programs must consider the impact that smartphones can bring for future deployment considerations. The City of Austin is investing in intelligent transportation systems infrastructure to support complete streets and bicycle modes. New systems designed around smartphones apply the Car2Go point-to-point concept, allowing bikes from a bike-share program to be parked anywhere across a city without the need for a bike docking station. Providence, Rhode Island; Phoenix, Arizona; and Pittsburgh, Pennsylvania, are designing bike-share programs around this capability, according to the bike-share company representative.

Aside from new technologies, bike-share programs must balance system network size with anticipated use and cost to operate when designing a program. The Denver Bike Sharing representative stated when they considered the initial program they did not want it to be so small that it would not generate adequate revenue, but they did not want to oversaturate the city and make the costs to redistribute bikes too high. Seven years and 80 stations later, residential developers now drive station expansion considerations as they often request stations in conjunction with their development and are willing to help finance these stations. The Denver bike-share program also works with the city of Denver's Geographic Information System (GIS) team in order to align use data and trip behavior characteristics with land use patterns to make informed decisions about station placement.

Pricing also has an effect on use and financial sustainability. All bike-share organizations interviewed agreed that while offering a longer term subscription is vital to encourage higher overall use rates, pricing a system to attract walk-up or tourist users is absolutely vital to financial sustainability. If the system is priced too high, then there is a risk of losing annual riders. If the system is priced too low, there is the risk of overuse and inability to cover operational and maintenance costs, which was the case in the early stages of the New York City bike-share program.

According to the Denver Bike Sharing representative, station density and network development rely heavily on the type of riders. In Denver, annual memberships account for 60–80 percent of the bike-share use, but walk-up users account for the majority of the annual revenue since they are charged a premium rate. The Denver Bike Sharing representative stated that half of the $1.6 million dollar annual budget is poured into labor costs for operations and maintenance. So, if they see a reduced number of walk-up riders in a given year they may not be able to recoup their costs. Any additional stations must take into consideration anticipated walk-up and annual member use in comparison to these costs. As advised by the bike-share program representative, originally, the Denver bike-share program was launched with 50 stations, as this was the appropriate size for a city the size of Denver to ensure user interest. In 2013, 30 new stations were added. Key among considerations in the placement of these stations was whether they were frequented by tourists.

*Partnership Development: Transit, Housing Authorities and Private Sponsorships*

Partnerships are a critical piece to the puzzle of program design and financial sustainability. Some partnerships with transit open station locations on transit rights of way, as is the case with the Washington District DOT. The Bike Chattanooga representative advised that the regional transit agency, Chattanooga Area Regional Transportation Authority (CARTA), signed on as a partner during the initiation of the program. This partnership helped secure funding from the Federal Transit Administration (FTA), and the transit agency and the bike-share program are actively coordinating transit activities. According to its representative, the Denver bike-share program partnered with the Denver Housing Authority, which funded capital costs for new stations. In exchange, Denver Bike Sharing worked with the housing authority's property managers to open the program at a subsidized rate in city affordable housing developments. At the time of the interview, 162 low-income members had joined the Denver Bike Sharing program through two different housing authority properties.

Sponsorship also plays a critical role. According to the private bike-share company representative, different cities have different approaches to how sponsorship revenue is secured. In New York City, as the bike-share company prefers, the city allows the company the freedom to raise sponsors and advertising revenue. In Toronto and Boston, the cities manage the sponsors and associated revenue because the agencies want to be able to pick their own sponsors. In Denver, three core sponsors collectively cover the majority of sponsorship revenue, or about one-third of the total $1.6 million annual Denver bike-share program budget. According to the Denver Bike Sharing representative, sponsors are not concerned with obtaining a return on investment in their support of the program and so do not require advertising or marketing to be placed on their stations or bikes. The Denver Bike Sharing representative also advised that in Boulder, Colorado, their bike-share program pursues multiple smaller sponsorships and allows placement of ads on capital equipment, which is typically the case in smaller cities.

# APPENDIX E: STATEWIDE NEW TRAVEL OPTIONS SURVEY

This appendix provides screenshots of the Statewide Web Survey, available from January 16, 2015, to February 16, 2015.

New Travel Options Survey

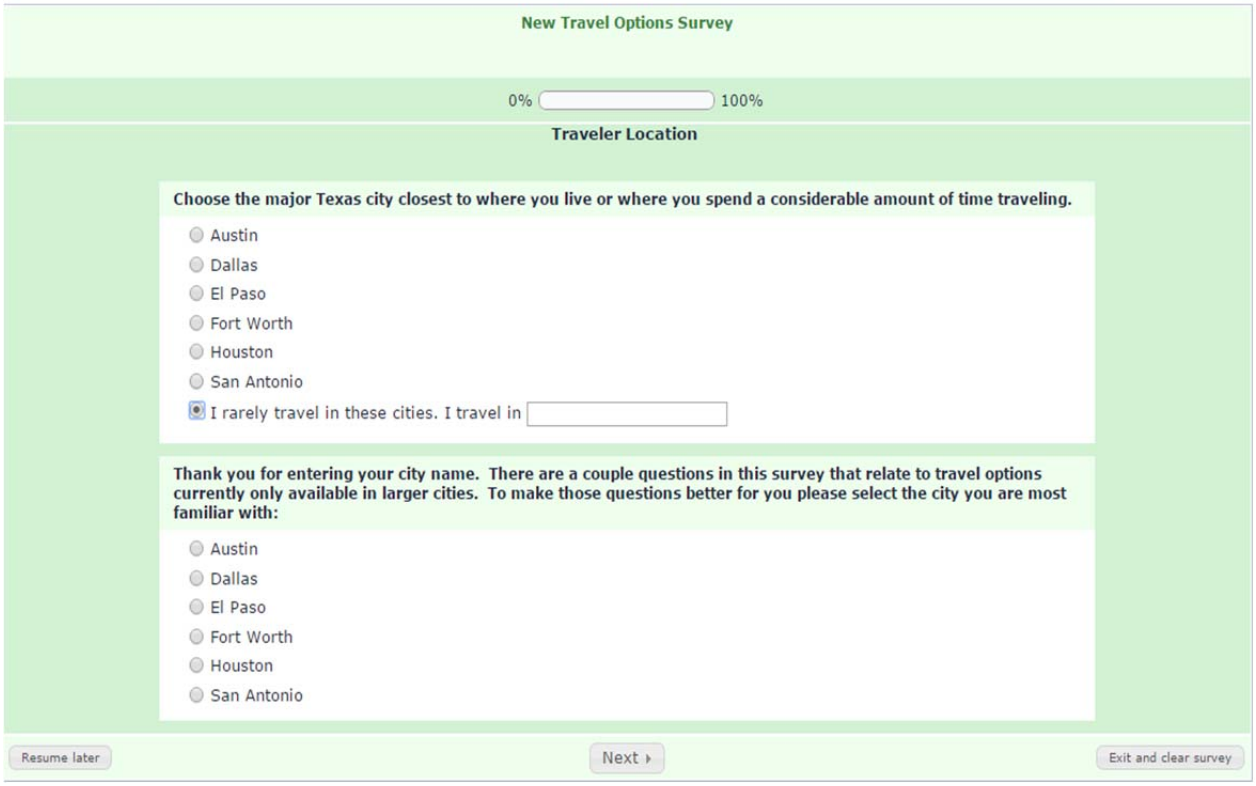
The Texas Department of Transportation is studying the use of new travel options and would like your input. Please help us improve travel conditions in Texas by responding to the following transportation related questions. The survey takes about 20 minutes to complete. You are not required to participate in this study however your responses are extremely valuable in our effort to improve travel across Texas. Your survey responses are confidential and will not be used to identify you in any way.

Sincerely,

Mark Burris, Ph.D.
mburris@tamu.edu

*This research has been reviewed by the Institutional Review Board at Texas A&M University.*
*TAMU IRB # 2014-751M – I*
*Approved 12/02/2014*
*For research-related problems or questions regarding your rights as a research participant, please contact their office at (979) 458-4067 or irb@tamu.edu.*

Load unfinished survey | Next ▸ | Exit and clear survey



New Travel Options Survey

0% 100%

**Traveler Location**

**Choose the major Texas city closest to where you live or where you spend a considerable amount of time traveling.**

- Austin
- Dallas
- El Paso
- Fort Worth
- Houston
- San Antonio
- I rarely travel in these cities. I travel in

**Thank you for entering your city name. There are a couple questions in this survey that relate to travel options currently only available in larger cities. To make those questions better for you please select the city you are most familiar with:**

- Austin
- Dallas
- El Paso
- Fort Worth
- Houston
- San Antonio

Resume later | Next ▸ | Exit and clear survey

**New Travel Options Survey**

0% 100%

**Section 1a: Current Travel Behavior-Short trip**
Please provide only one answer to each question below, unless otherwise indicated.

**Short Trip:**
For the following questions consider your most recent SHORT trip (3 miles or less). This could be any short trip such as visiting a neighbor, local convenience store, going to work, etc. by walking, biking, car, bus, etc.

☐ I cannot remember the last time I took a trip less than 3 miles

**What mode of travel did you use on that short trip?**

- ○ Vanpool
- ○ Carpool
- ○ Bus
- ○ Motorcycle
- ○ Car/Truck
- ○ Train
- ○ Walk
- ○ Bike
- ○ Taxi
- ○ Other: _____

**Near which major cross streets did that short trip start?**
*(for example: Commerce Street and Pinto Street)*

_____
and _____

**Near which major cross streets did that short trip end?**
*(for example: Highway 6 and Clay Road)*

and

**What was the purpose of that short trip?**

- Commuting to or from my place of work (going between home and work)
- Recreational/Social/Entertainment
- Shopping/Personal errand
- Work related (other than to or from home to work)
- To attend class at school or an educational institute
- Other(Type other reason here):

**What time of day did that short trip start?** (Example: 12:30 PM)

Please choose...

**What time of day did that short trip end?** (Example: 12:30 PM)

Please choose...

**How many people, including you, were there in the vehicle on that short trip?**

1 2 3 4 5+

**Did you have to pay a toll or fare on that short trip?**

- No
- Yes
- I do not know/I forgot

**Did you have to pay to park at your destination?**

- No
- Yes
- I do not know/I forgot

**How many of these types of short trips do you make during a full week (Monday to Sunday)?** *(Count each direction of travel as one trip. For example, traveling to work and returning home counts as 2 trips.)*

Trips

*These questions refer to the short trip (less than 3 miles) that you just described.*
*You carpooled/vanpooled with others.*

**How much extra time does it take you to pick up and drop off all passenger(s)?**

Minutes

**Who do you generally carpool/vanpool with? (Check all that apply)**

- Co-worker / person in the same or a nearby office building
- Neighbor
- Adult family member
- Child
- Other(Type the relationship of the person you travelled with:

Resume later Next Exit and clear survey

New Travel Options Survey

0% 100%

**Section 1b: Current Travel Behavior- Long Trip**

**Long Trip:**
For the following questions consider your most recent LONG trip (more than 3 miles). This could be any long trip such as visiting a neighbor, local convenience store, going to work, etc. by walking, biking, car, bus, etc.

☐ I cannot remember the last time I took a trip longer than 3 miles.

**What mode of travel did you use on that long trip?**

- ○ Vanpool
- ○ Carpool
- ○ Bus
- ○ Motorcycle
- ○ Car/Truck
- ○ Train
- ○ Walk
- ○ Bike
- ○ Taxi
- ○ Other: _____

**Near which major cross streets did that long trip start?**
*(for example: Highway 6 and Clay Road)*

_____
and _____

**Near which major cross streets did that long trip end?**
*(for example: Highway 6 and Clay Road)*

_____
and _____

**What was the purpose of that long trip?**

- Commuting to or from my place of work (going between home and work)
- Recreational/Social/Entertainment
- Shopping/Personal errand
- Work related (other than to or from home to work)
- To attend class at school or an educational institute
- Other(Type other reason here): [ ]

**What time of day did that long trip start?** (Example: 12:30 PM)

Please choose... ▾

**What time of day did that long trip end?** (Example: 12:30 PM)

Please choose... ▾

**How many people, including you, were there in the vehicle on that long trip?**

1 2 3 4 5+

**Did you have to pay a toll or fare on that long trip?**

- No
- Yes
- I do not know/I forgot

**Did you have to pay to park at your destination?**

- No
- Yes
- I do not know/I forgot

**How many of this type of long trip do you make during a full week (Monday to Sunday)?** *(Count each direction of travel as one trip. For example, traveling to work and returning home counts as 2 trips)*

[ ] Trips

*These questions refer to the long trip (more than 3 miles) that you just described.*
*You carpooled/vanpooled with others*

**How much extra time does it take you to pick up and drop off all passenger(s)?**

[ ] Minutes

**Who do you generally carpool/vanpool with? (Check all that apply)**

- ☐ Co-worker / person in the same or a nearby office building
- ☐ Neighbor
- ☐ Adult family member
- ☐ Child
- ☐ Tye the relationship of the person you travel with [ ]

Resume later Next › Exit and clear survey

New Travel Options Survey

0% 100%

**Section 2a: Introduction to a New Travel Option - Dynamic Ride-Sharing**

Dynamic ride-sharing is a one-time shared trip with another traveler on very short notice. Ride-sharing companies (such as Uber or Lyft) match contracted drivers with passengers through their smartphone applications and GPS navigation. Passengers are required to register credit cards, allowing all payment to be handled electronically through the smartphone application rather than with the driver at the end of a trip. Drivers and passengers are able to rate each other at the end of each ride and may view the rating of each other prior to scheduling the ride. Many ride-sharing companies and their users report lower trip fares than traditional taxicab companies.

**Have you ever heard of dynamic ride-sharing (such as Uber or Lyft) prior to this survey?**

- (•) Yes
- ( ) No

**Have you ever used a dynamic ride-sharing company (such as Uber or Lyft)?**

- ( ) Yes
- ( ) No

**If available, how likely would you be to use ride-sharing for the SHORT trip (less than 3 miles) you previously described?**

- ( ) 5 – Definitely Yes
- ( ) 4 – Probably Yes
- ( ) 3 – Maybe
- ( ) 2 – Probably Not
- ( ) 1 – Definitely Not
- ( ) I am not sure

**If available, how likely would you be to use ride-sharing for the LONG trip (more than 3 miles) you previously described?**

- ( ) 5 – Definitely Yes
- ( ) 4 – Probably Yes
- ( ) 3 – Maybe
- ( ) 2 – Probably Not
- ( ) 1 – Definitely Not
- ( ) I am not sure

**If you indicated you might use dynamic ride-sharing, then how important are the factors below in your decision to possibly use dynamic ride-sharing?**

| | Not Important | | Somewhat Important | | Very Important |
|---|---|---|---|---|---|
| Being able to schedule trips with my smartphone. | ○ | ○ | ○ | ○ | ○ |
| Avoiding/reducing the costs of car ownership | ○ | ○ | ○ | ○ | ○ |
| No need to find parking for car (save time). | ○ | ○ | ○ | ○ | ○ |
| Not having to drive myself | ○ | ○ | ○ | ○ | ○ |
| Not having to exchange payment with driver. | ○ | ○ | ○ | ○ | ○ |
| Lower trip fares than traditional taxi cabs. | ○ | ○ | ○ | ○ | ○ |
| Avoid parking fees | ○ | ○ | ○ | ○ | ○ |
| Meeting new people. | ○ | ○ | ○ | ○ | ○ |
| Not having to prearrange a carpool | ○ | ○ | ○ | ○ | ○ |
| Ride-sharing makes using transit more convenient. | ○ | ○ | ○ | ○ | ○ |
| Not having to ride in a taxi cab. | ○ | ○ | ○ | ○ | ○ |
| Other | ◉ | ○ | ○ | ○ | ○ |

**What are the other factor(s) ?**

**If you indicated you would probably not use dynamic ride-sharing, then how important are the factors below in your decision to probably not use dynamic ride-sharing?**

| | Not Important | | Somewhat Important | | Very Important |
|---|---|---|---|---|---|
| Uncertain reliability/availability of a ride home or to next destination | ○ | ○ | ○ | ○ | ○ |
| I do not have a credit card | ○ | ○ | ○ | ○ | ○ |
| Ride-sharing would not work for the trips I take *(Examples: you make frequent stops or you take short trips within walking distance)* | ○ | ○ | ○ | ○ | ○ |
| Financial safety concerns (must register credit card) | ○ | ○ | ○ | ○ | ○ |
| Trip home or to next destination is time sensitive | ○ | ○ | ○ | ○ | ○ |
| Using an app to get a ride is too complicated | ○ | ○ | ○ | ○ | ○ |
| Privacy concerns (GPS location) | ○ | ○ | ○ | ○ | ○ |
| It is too expensive. | ○ | ○ | ○ | ○ | ○ |
| Personal safety concerns | ○ | ○ | ○ | ○ | ○ |
| I like to drive. | ○ | ○ | ○ | ○ | ○ |
| I do not have a smartphone | ○ | ○ | ○ | ○ | ○ |
| Other | ◉ | ○ | ○ | ○ | ○ |

**What are the other factor(s) ?**

**What changes to dynamic ride-sharing would make you more likely to use it? (Explain below)**

**If dynamic ride-sharing were available do you think you would reduce the number of cars you or your family owns?**

- 5 – Yes. I would reduce the number of vehicles owned.
- 4 – Probably Yes
- 3 – Maybe
- 2 – Probably Not
- 1 – Definitely would not reduce the number of vehicles owned.
- Unsure

Resume later | Next ▸ | Exit and clear survey

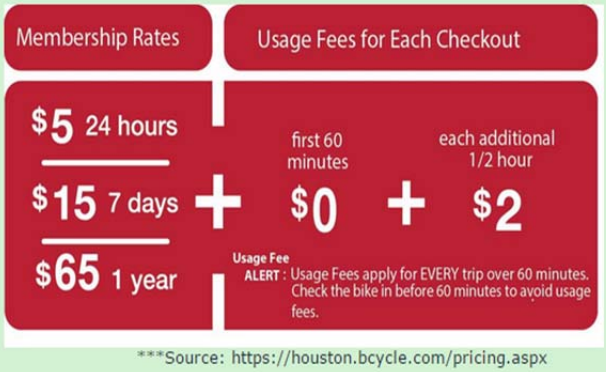
**New Travel Options Survey**

0% 100%

**Section 2b: Introduction to a New Travel Option - Bike Sharing**

Bike-sharing services offer an alternative to long walking trips and short vehicle trips by making bicycles available for short-term rental. Bicycles may picked-up at rental stations scattered throughout an urban area, and dropped-off at any rental station. Typically, the first hour of rental is very inexpensive to encourage short trips (such as, going to lunch, running errands or traveling to and from transit stations).

The City of Houston's bike-sharing program,B-cycle, has roughly 30 rental stations located in and around downtown Houston. B-cycle membership rates are below.




***Source: https://houston.bcycle.com/pricing.aspx

**Have you ever heard of bike-sharing programs (such as B-cycle)prior to this survey?**

- (•) Yes
- ( ) No

**Have you ever used a bike-sharing program (such as B-cycle)?**

- ( ) Yes
- ( ) No

**If available, how likely would you be to use bike-sharing for the SHORT trip (less than 3 miles) you previously described?**

- 5 – Definitely Yes
- 4 – Probably Yes
- 3 – Maybe
- 2 – Probably Not
- 1 – Definitely Not
- I am not sure

**If available, how likely would you be to use bike-sharing for the LONG trip (more than 3 miles) you previously described?**

- 5 – Definitely Yes
- 4 – Probably Yes
- 3 – Maybe
- 2 – Probably Not
- 1 – Definitely Not
- I am not sure

**If you indicated you might use bike-sharing, then how important are the factors below in your decision to possibly use bike-sharing?**

| | Not Important | | Somewhat Important | | Very Important |
|---|---|---|---|---|---|
| Bike-sharing makes transit more convenient. | ○ | ○ | ○ | ○ | ○ |
| Avoiding parking fees | ○ | ○ | ○ | ○ | ○ |
| Not worrying about getting bike to/from home as it is already where you need a bike | ○ | ○ | ○ | ○ | ○ |
| Getting exercise | ○ | ○ | ○ | ○ | ○ |
| No need to find parking for car (save time). | ○ | ○ | ○ | ○ | ○ |
| Avoiding/reducing the costs of car ownership | ○ | ○ | ○ | ○ | ○ |
| Bike-sharing allows me to reach more destinations in close range than walking. | ○ | ○ | ○ | ○ | ○ |
| It's fun | ○ | ○ | ○ | ○ | ○ |
| Avoiding/reducing the costs of bike ownership | ○ | ○ | ○ | ○ | ○ |
| Other | ◉ | ○ | ○ | ○ | ○ |

**What are the other factor(s) ?**

**If you indicated you would probably not use bike-sharing, then how important are the factors below in your decision to probably not use bike-sharing?**

| | Not Important | | Somewhat Important | | Very Important |
|---|---|---|---|---|---|
| I prefer walking. | ○ | ○ | ○ | ○ | ○ |
| It is too expensive. | ○ | ○ | ○ | ○ | ○ |
| I do not have a credit card. | ○ | ○ | ○ | ○ | ○ |
| Bike-sharing would not work for the trips I take. *(Example: you take long trips that require a car)* | ○ | ○ | ○ | ○ | ○ |
| I prefer driving my car. | ○ | ○ | ○ | ○ | ○ |
| I do not feel safe biking. | ○ | ○ | ○ | ○ | ○ |
| I do not like to bike. | ○ | ○ | ○ | ○ | ○ |
| Financial security concerns (must register credit card) | ○ | ○ | ○ | ○ | ○ |
| Other | ◉ | ○ | ○ | ○ | ○ |

**What are the other factor(s) ?**

**What changes to bike-sharing would make you more likely to use it? (Explain below)**

**If bike-sharing were available, how likely is bike-sharing to reduce the number of car/bus/motorcycle trips you take?**

- ○ 5 - Very Likely.
- ○ 4 - Likely/Probably
- ○ 3 - Maybe
- ○ 2 - Unlikely/Probably Not
- ○ 1 - Very Unlikely

**If bike-sharing were available do you think you would reduce the number of cars you or your family owns?**

- ○ 5 - Yes. I would reduce the number of vehicles owned.
- ○ 4 - Probably Yes
- ○ 3 - Maybe
- ○ 2 - Probably Not
- ○ 1 - Definitely would not reduce the number of vehicles owned.
- ○ Unsure

Resume later | Next ▸ | Exit and clear survey

**New Travel Options Survey**

0% 100%

**Section 2c: Introduction to a New Travel Option - Car Sharing**

Similar to bike-sharing programs, car-sharing services provide vehicle rentals for short time periods, often by the hour or minute. Car-sharing services are most often found in downtown areas, where travelers often commute by public transit, the cost of parking is high and most trips are short distance. In downtown settings, car-sharing (like bike-sharing) allows travelers to avoid long walking trips and avoid the cost of parking.

Car-sharing companies (such as Car-2-Go or ZipCar)allow travelers to view the location of available vehicles on a street map and reserve them using their smartphone. There are parking spaces designated for Car-2-go vehicles throughout downtown, however vehicles may be parked anywhere at no additional fee.

**Have you ever heard of car-sharing prior to this survey?**

- (•) Yes
- ( ) No

**Have you ever used car-sharing (such as Car-2-Go or Zip Car)?**

- ( ) Yes
- ( ) No

**If available, how likely would you be to use car-sharing for the SHORT trip (less than 3 miles) you previously described?**

- ( ) 5 – Definitely Yes
- ( ) 4 – Probably Yes
- ( ) 3 – Maybe
- ( ) 2 – Probably Not
- ( ) 1 – Definitely Not
- ( ) I am not sure

**If available, how likely would you be to use car-sharing for the LONG trip (more than 3 miles) you previously described?**

- ( ) 5 – Definitely Yes
- ( ) 4 – Probably Yes
- ( ) 3 – Maybe
- ( ) 2 – Probably Not
- ( ) 1 – Definitely Not
- ( ) I am not sure

**If you indicated you would probably not use car-sharing, then how important are the factors below in your decision to probably not use car-sharing?**

| | Not Important | | Somewhat Important | | Very Important |
|---|---|---|---|---|---|
| Financial security concerns (must register credit card) | ○ | ○ | ○ | ○ | ○ |
| Using an app for car sharing is too complicated | ○ | ○ | ○ | ○ | ○ |
| It is too expensive | ○ | ○ | ○ | ○ | ○ |
| Privacy concerns (GPS location) | ○ | ○ | ○ | ○ | ○ |
| Car-share stations are not located near my origin/destination | ○ | ○ | ○ | ○ | ○ |
| I do not have a credit card | ○ | ○ | ○ | ○ | ○ |
| I prefer driving my own car | ○ | ○ | ○ | ○ | ○ |
| Car-sharing would not help on the trips I take. *(Example: you take short trips within walking distance)* | ○ | ○ | ○ | ○ | ○ |
| Other | ◉ | ○ | ○ | ○ | ○ |

**What are the other factor(s) ?**

**What changes to car-sharing would make you more likely to use it? (Explain below)**

**If you indicated you might use car-sharing, then how important are the factors below in your decision to possibly use car-sharing?**

| | Not Important | | Somewhat Important | | Very Important |
|---|---|---|---|---|---|
| I enjoy driving a different vehicle than my own. | ○ | ○ | ○ | ○ | ○ |
| Avoiding parking fees | ○ | ○ | ○ | ○ | ○ |
| Being able to reserve vehicles with my smartphone. | ○ | ○ | ○ | ○ | ○ |
| I cannot rent a car at a regular car rental place because I am younger than 25 years old. | ○ | ○ | ○ | ○ | ○ |
| I cannot rent a car at a regular car rental place because I do not have car insurance. | ○ | ○ | ○ | ○ | ○ |
| Car-sharing makes public transit more convenient | ○ | ○ | ○ | ○ | ○ |
| Avoiding/reducing the cost of car ownership | ○ | ○ | ○ | ○ | ○ |
| Other | ◉ | ○ | ○ | ○ | ○ |

**What are the other factor(s) ?**

**If car sharing were available, do you think you would reduce the number of cars for you/your family?**

- 5 – Yes. I would reduce the number of vehicles owned.
- 4 – Probably Yes
- 3 – Maybe
- 2 – Probably Not
- 1 – Definitely would not reduce the number of vehicles owned.
- Unsure

Resume later | Next ▸ | Exit and clear survey

**New Travel Options Survey**

0% 100%

**Section 3: Traveler Information**

*The following questions will be used for statistical purposes only and answers will remain confidential. All of your answers are very important to us and in no way will they be used to identify you.*

**What is your age?**

- 16 to 24
- 25 to 34
- 35 to 44
- 45 to 54
- 55 to 64
- 65 and over

**What is your gender?**

- Male
- Female

**What is your ethinicity?**

- White/Caucasian
- Hispanic/Latino
- African American
- Asian American
- Native American
- Other: [ ]

**Including you , how many people live in your household?**

[ ] people

**Please describe your household type.**

- ○ Single Adult
- ○ Unrelated adults(e.g. room-mates)
- ○ Married without child
- ○ Married with child(ren)
- ○ Single parent family
- ○ Other: [ ]

**Altogether, how many motor vehicles (including cars, vans, trucks, and motorcycles) are available for use by members of your household?**

[ ] vehicles

**What category best describes your occupation?**

- ○ Professional / Managerial
- ○ Technical
- ○ Sales
- ○ Service Industry (restaurants, retail, etc.)
- ○ Administrative / Clerical
- ○ Manufacturing / Construction
- ○ Stay-at-home parent / homemaker
- ○ Student
- ○ Self employed
- ○ Unemployed / Seeking work
- ○ Retired
- ○ Other: [ ]

**What is the last year of school you have completed?**

- ○ Less than high school
- ○ High school graduate
- ○ Some college / Vocational
- ○ College graduate
- ○ Postgraduate degree

**What was your annual household income ?**

- ○ Less than $10,000
- ○ $10,000 to $14,999
- ○ $15,000 to $24,999
- ○ $25,000 to $34,999
- ○ $35,000 to $49,999
- ○ $50,000 to $74,999
- ○ $75,000 to $99,999
- ○ $100,000 to $149,999
- ○ $150,000 to $199,999
- ○ $200,000 or more
- ○ Prefer not to answer
- ○ It is easier to note wages per hour ($/hr) [ ]

**Please list any comments or suggestions you have regarding your travel needs and these new travel options**

[ ]

**That concludes the survey. Thanks again for your participation**

Resume later | Submit | Exit and clear survey

# APPENDIX F: EL PASO WORKSHOP INFORMATION

This appendix contains information used for the El Paso Workshop during the development of the Guidebook, including the invitation and the slide presentation.

## INVITATION

Figure 45 shows the invitation sent to potential participants in the guidebook workshop in El Paso, Texas. The invitation was sent via email.

**Workshop for TxDOT Project 6818:**
**Guidebook for Dynamic Ride Sharing, Car-Sharing, and Bike-Sharing in Texas**

**Wednesday, June 10th, 2015**
**1:30 p.m. – 4:30 p.m.**
**La Placita Conference Room**
**El Paso International Airport**

You are invited to participate in an informative workshop to provide input, gather feedback, and evaluate the proposed TxDOT guidebook on *Dynamic Ride Sharing, Car-Sharing, and Bike-Sharing in Texas.*

The guidebook is designed as a planning tool for local and regional transportation planning staff as they plan for shared mobility programs in their communities. During the workshop, you will learn about and discuss the three shared mobility programs presented in the guidebook: dynamic ride sharing, car-sharing, and bike-sharing. We will review the guidebook in detail, and also ask for your feedback (i.e., how useful it is, how can it be improved) to help improve its utility and presentation.

The workshop is intended for transportation planning staff in the El Paso region who plan, develop, and/or implement shared mobility programs in the region. Participants will receive an electronic copy of the proposed guidebook at least one week before the workshop for review. At the workshop, they will each receive a Participant Notebook containing the slides and materials.

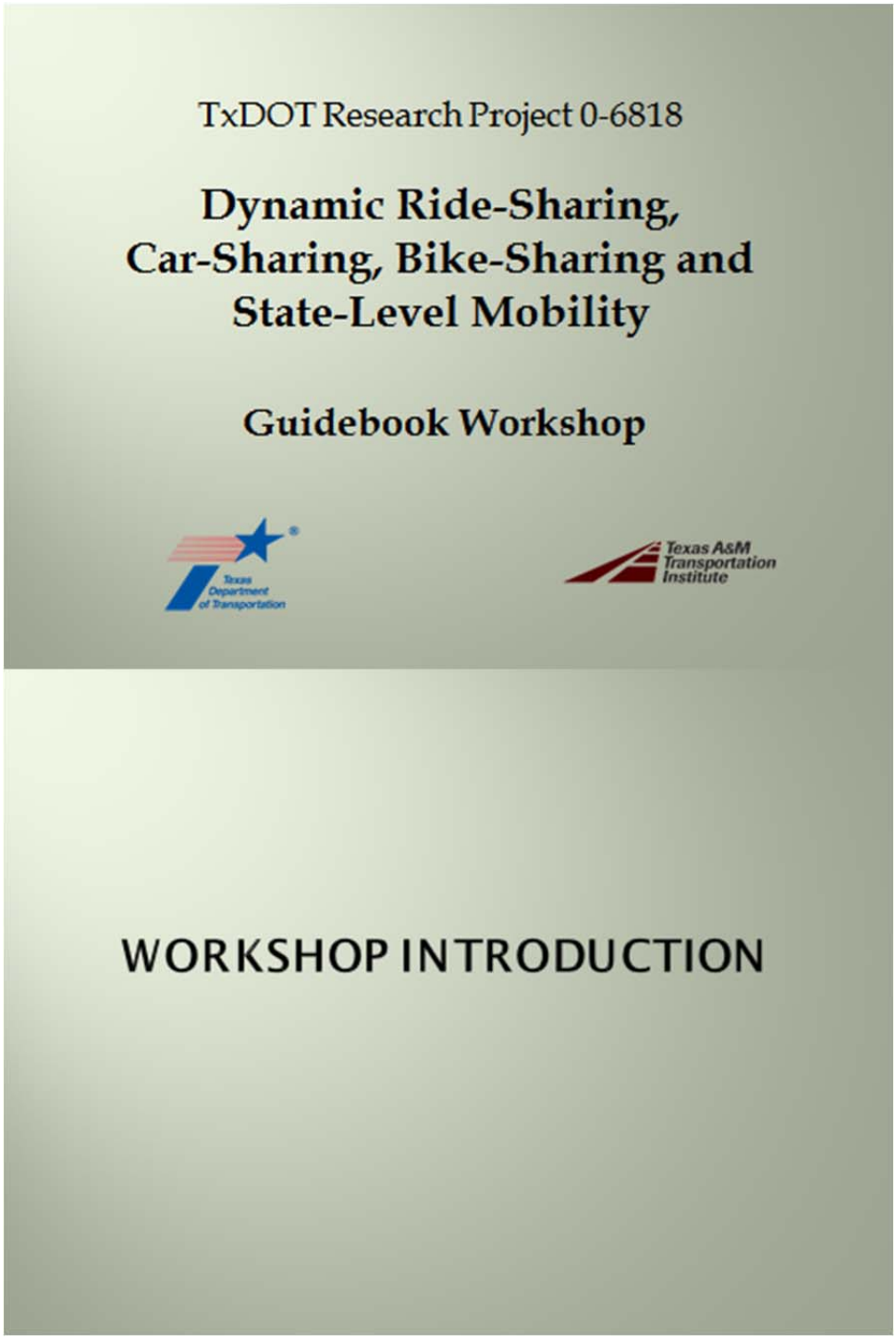
To register for the workshop, or for further information, please contact TTI researchers Tina Geiselbrecht at t-geiselbrecht@tamu.edu or Todd Carlson at tcarlson@tamu.edu. Space is limited so please register by June 8th. We look forward to you joining us for an engaging, informative afternoon!

This workshop has been developed by the Texas A&M Transportation Institute (TTI) for the Texas Department of Transportation (TxDOT). The proposed guidebook has been developed as part of TxDOT Research Project 0-6818: Dynamic Ride-sharing, Car-sharing, Bike-Sharing and State-level Mobility.

**Figure 45. The Invitation Sent to Potential Workshop Participants.**

**SLIDE PRESENTATION**

The following section shows the slide presentation given at the workshop in El Paso.



## Lesson 1

**Introduction to Dynamic Ride-Sharing, Car-Sharing, and Bike-Sharing**

## Ride-Sharing

- This guidebook focuses on ***dynamic*** or ***real-time ride-sharing***.
- Ride-sharing can be done casually or more formally in a business sense through services provided by transportation network companies (TNCs).

## Ride-Sharing

- Rely on smartphone technologies and applications.
  - Users download an app and start requesting rides.
  - Drivers are required to provide additional information to comply with the requirements established by each ride-sharing provider or TNC.

## Ride-Sharing

- Ride-share works by:
  1. Passengers request a ride through an app (via computer, tablet, or smartphone).
  2. The software sends the ride request to all nearby drivers who fit the rider's previously established criteria (e.g., male or female, smoking or non-smoking vehicle) and route.
  3. Drivers then have the option to accept or reject the rider's request.

## Car-Sharing

- Short-term vehicle access
- Traditional service programs - vehicles start and end at designated parking spots.
- New models - use floating fleets that allow one-way trips within a certain geographic area or markets in which individuals share their personal vehicles with others.

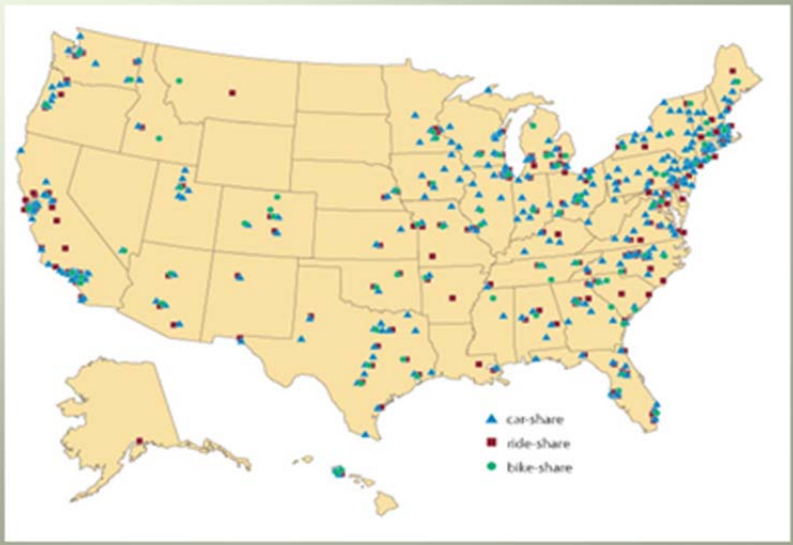
## Car-Sharing

- Typically, the car-sharing process is:
  - **Reserve:** Reservations and vehicle access are generally available 24-hours a day/7 days a week.
  - **Pick-Up:** Members access the vehicle with a key or a technologically-enabled card.
  - **Return:** The car is then returned to the same spot at the end of the reservation. In one-way, point-to-point programs the vehicles are picked up and dropped off at any parking spot in a designated operating zone.
  - **Pay:** Members pay a use fee on a per-minute, per-hour, or daily basis.

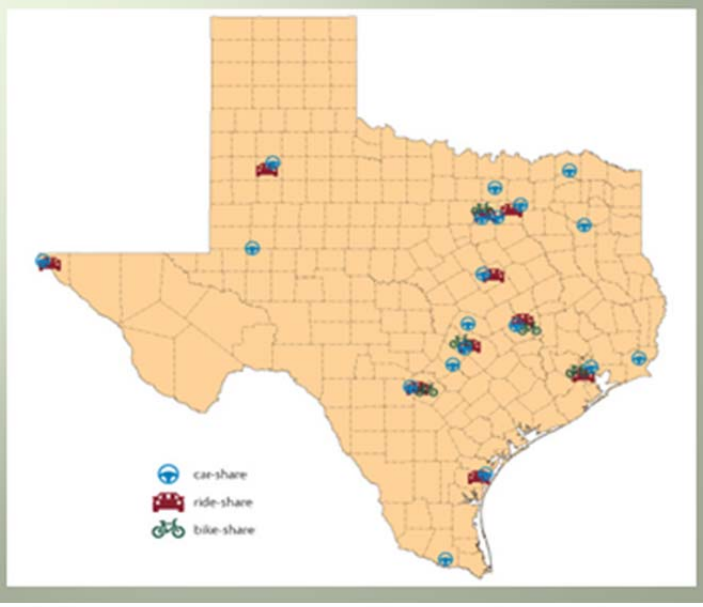
## Bike-Sharing

- Rent bicycles on an as-needed basis.
- Bicycles located throughout an urban environment served by self-service docking stations for immediate access.
- Users pick up a bicycle at a station and return it to any station in the network.

## Shared Mobility Programs in the United States



## Shared Mobility Programs in Texas




## Lesson 1 Review

- Have we described the programs well enough?
- Do you have additional questions about the programs that should be included in the Guidebook?
- Do you know of any of these programs in the El Paso area?

Lesson 2

**Overview of the Guidebook**

## Purpose of the Guidebook

- The ***Shared Mobility Programs - Guidebook for Agencies*** provides TxDOT staff and its stakeholders an understanding of the three shared mobility programs
- The guidebook helps to *identify, assess, attract, manage, and monitor* these mobility programs.

## Purpose of the Guidebook

- Key factors for program development and success.
  - the role of agencies involved,
  - the regulations in force,
  - regional travel behavior characteristics, and
  - vendor criteria for program implementation.
- The guidebook also contains a detailed case study on market analysis in the appendix.

## Development of the Guidebook

- Researchers used a combination of:
  - best practices and lessons learned,
  - executive interviews,
  - focus groups, and
  - a general survey.
- Information is current to February 2015.

## Guidebook Organization

- This guidebook is organized into the following sections:
  1. Introduction
  2. Shared Mobility Programs
  3. Assessment
  4. Attraction
  5. Management
  6. Emerging Trends
  7. Case Study on Market Analysis

## Lesson 2
## Review and Discussion

Lesson 3

**Assessment of Shared Mobility Programs**

# Assessment

- Assess, identify, and understand :
  - Desired goals/benefits of using shared mobility.
  - Physical and social context of their region.
  - Regional travel behavior characteristics.
  - Market demand.
  - Public perspective.
  - Agencies involved.
  - Regulatory context for program implementation.

## Assessment

- Five steps to assessing your region:
  - Perform a Market Analysis.
  - Perform a Stakeholder Analysis.
  - Assess the Political Environment.
  - Assess the Regulatory Context.
  - Establish Program Goals.

## Market Analysis

- A market analysis helps to answer basic questions:
  - **Users:** How do the demographic characteristics of this region compare to known shared mobility user characteristics?
  - **Neighborhoods:** What geographic characteristics of this region would support a shared mobility program?
  - **Trips:** What are the most likely trips made with a shared mobility program?
  - **Purposes:** For what purposes would the shared mobility program be used?

## Market Analysis

- These data are analyzed to:
  - Understand how much interest for shared mobility programs exists in a region.
  - Estimate the potential demand for a specific type of service.
  - Identify possible markets for starting a program.

## Stakeholder Analysis

- Stakeholders include all members of the public who are interested and/or impacted by the program. These include:
  - elected and other official representatives from communities,
  - local citizens,
  - community organizers, and
  - representatives of special interest groups.
- Public involvement professionals suggest engaging stakeholders EARLY and OFTEN.

## Stakeholder Analysis

- The steps that will lead to successful stakeholder involvement in any public project are:
  - Identify potential stakeholders.
    - Ask known stakeholders about others that may be unknown to you.
  - Engage with stakeholders.
  - Define the issues.
  - Identify potential partners.

## Potential Partners

- Program partners include, but are not limited to:
  - Cities
  - Counties
  - State and Regional Agencies
  - Ride-Share Agencies
  - Universities
  - Developers and Property Managers
  - Employers and Businesses
  - Transit Agencies
  - Consultants
  - Community Advocates
  - Community Organizations

## Political Environment

- A successful shared mobility program requires political buy-in and government support.
- An assessment should consider the leaders, agencies, and departments that may have a role in developing a successful shared mobility program.

## Political Environment

- Local governments and agencies can support shared mobility programs in several ways:
  - Providing administration, endorsements, outreach, co-promotions, and media events.
  - Including shared mobility programs in applications for grants, loans, and other incentives.
  - Providing access to public rights-of-way for parking, stations, and advertising.
  - Becoming shared mobility program customers.
  - Encouraging shared mobility programs in development projects.

# Public Agency Roles

| Agency or Department | Roles |
|---|---|
| City Planning and Zoning | Development and zoning |
| Public Works | Right-of-Way management |
| Traffic Enforcement | Ticketing, parking violations, parking locations |
| Economic Development | Station and parking location, impact on businesses |
| Environmental Protection | Ensure compliance with regulations, inform environmental goals and performance |
| Parks and Recreation | Parking or dock locations, connection to public spaces and activities |
| Policy | Ensure program fits with city or local policies and procedures |
| Public Relations | Media follows actions and announcements of a City; agencies can leverage this internal asset in program implementation |
| Historic Preservation | May be involved if vehicles or signage is to be placed in historic districts |

# Regulatory Context

- A review of regional plans and existing regulations is essential.
- Planning context
  - Does the existing city and regional planning framework and code support shared mobility programs?
- Local regulations
  - Parking.
  - Taxation.
  - Maintenance.
  - Advertising.
  - Development.
  - Right-of-way.
  - Environmental Legislation.
  - Traffic Enforcement.

## Setting Program Goals

- Determine your desired outcomes of the program.
- Compare the benefits of specific shared mobility programs to your desired outcomes.
- Establish performance metrics for monitoring those outcomes.
- Understand travel choices and behaviors of residents.

## Lesson 3
## Exercise and Review

Lesson 4

**Attracting Shared Mobility Programs**

## Attraction

- Key components include:
  - Communication between involved parties.
  - Regulatory environment.
  - Funding and revenue streams.
  - Outreach and marketing.

## Communication

- Open dialogue and transparency can be valuable in the design of programs and in negotiations with potential vendors.
- The primary way that a city or region communicates its vision and goals for a shared mobility program is through a Request for Proposals (RFP).
- The RFP should outline specific expectations about program design, location, operations, and monitoring.

## Regulatory Environment

- Political and regulatory support is key to attracting shared mobility programs to an area.
- The presence or absence of regulations is often a deciding factor in a vendor's ability to operate in an area.

## Revenue and Funding

- Knowledge that funding support exists and can be accessed is important when deciding to start or participate in a program.

- Examples:
  - User fees and membership costs.
  - Government funding.
  - Sponsorship and advertising.
  - Private investment.

Lesson 5

**Management of Shared Mobility Programs**

## Management and Operations

- There is no "one-size-fits-all" management approach for these types of programs.
- Generally, successful management of shared mobility means:
  - Selecting a business model,
  - Coordinating responsibilities,
  - Controlling program costs and revenues,
  - Considering and planning for regulations and policies.

## Business Model

- Several ways these types of programs can be structured and managed:
  - Nonprofit,
  - Privately owned and operated,
  - Publicly owned and operated,
  - Publicly owned and contractor operated,
  - Street furniture contract (in Europe primarily),
  - Third-party operated,
  - Vendor operated,
- There can be overlap among these models.

## Business Model Example

- The strategy of bike-share systems typically involves forming a non-profit partnership to secure private and public funding of capital assets.
- Agreements are made between the agency and provider about the station placement and public rights-of-way.
- In addition, a balance of network size, design, and pricing are considered.

## Coordinating Responsibilities

- The responsibilities of the shared mobility program can be divided among partners.
  - Assign Duties.
  - Address Risk-Sharing and Safety Issues.

## Assign Duties

| Partner Agencies | Local Governments |
|---|---|
| ▪ Marketing.<br>▪ Administration.<br>▪ Parking.<br>▪ Financial contributions.<br>▪ Memberships.<br>▪ Planning, policy, and tax issues.<br>▪ Transit integration | ▪ Access to office or conference space.<br>▪ Staff time for marketing or parking management.<br>▪ Research or insight on planning.<br>▪ Policy development or assistance in resolving internal barriers and building internal support for car-sharing.<br>▪ Marketing through government websites.<br>▪ Regional trip planning services.<br>▪ Provision of on-street parking that offers visibility.<br>▪ Secure external funding.<br>▪ Fleet reduction efforts.<br>▪ Risk-sharing arrangements. |

## Risk-Sharing and Safety Issues

- Introducing one of these programs will almost always involve some risk for local transportation agencies.
- However, research shows complete failures of shared mobility programs are very rare.
- Safety issues are primarily in bike-sharing programs, but the other two have concerns as well.

## Revenue and Funding Streams

- Key factors are:
  - **Startup and annual operating costs** of a program need to be within a community's ability to pay or to find sponsors to support.
  - **Stakeholder support** is essential to obtain public and/or private funding and sponsors for the program.
- When designing the system, shared mobility programs must balance the system network size with the anticipated use and cost to operate.

## Pricing

- If the system is priced too high, then there is a risk of losing annual riders.
- If the system is priced too low, there is the risk of overuse and inability to cover operational and maintenance costs.

## Program Costs

| Fixed Costs | Variable Costs |
|---|---|
| • Salary and Benefits<br>• Rent<br>• Technology<br>• Marketing and Public Relations | • Vehicles/Bicycles<br>• Insurance<br>• Parking<br>• Gasoline<br>• Cleaning and Maintenance |

- Operating costs will vary depending on the type of program and the size of the system.
- Costs will also vary as the program evolves and expands.

## Program Revenue

- Advertising
- User fees
- Grants
- Loans
- Sponsorships
- Health care and tobacco settlement funds
- Governmental funds for capital costs, operational costs, or both

## Regulations and Policies

- Regulations and policies that should be considered include:
  - Data Requirements and Agreements,
  - Insurance,
  - Planning, Development, and Zoning.

## *Data Requirements and Agreements*

- Public agency partners are more often including data-sharing agreements in contracts.
- Data sharing agreements can be valuable to cities trying to monitor and achieve particular goals…
- …but can be a challenge to the privacy expectations of private companies.
- Data requirements that show use rates, types of users, revenue, trip patterns, and trip types are usually part of the initial agreement with the city.
- Regulations prevent the release of proprietary information

## *Insurance*

- In general, commercial liability is the most common form of insurance in these programs.
- Many operators are required to carry liability insurance as a condition of permission to place kiosks on either public or private land.
- Insurance for car-sharing programs is a substantial cost but is no longer considered a major barrier.

## Planning, Development, and Zoning

- Pedestrian and bicycle master plans
- District planning exercises
- Program funding in city/county budgets
- Complete Streets ordinances
- Bike infrastructure addressed in the plan
- Trip reduction (i.e., reducing vehicle and single-occupant vehicle trips)

## Planning, Development, and Zoning

- More examples:
  - Development of review process used to provide opportunity for inclusion of bike-sharing stations in future developments, as appropriate.
  - Allowing greater floor area ratios (i.e., developers can build more densely on a site).
  - Parking reduction (i.e., downgrading the required number of spaces in a new development).
  - Parking substitution (i.e., substituting general use parking for car-sharing stalls).

## Lesson 5
## Exercise and Review

## Lesson 6

**Dynamic Ride Sharing, Car-Sharing, and Bike-Sharing in the El Paso Region**

## Ride-Sharing in El Paso

- Assessment
  - Guidebook appendix – El Paso market analysis
- Attraction
  - Are activities in place to attract these programs, if desired?
- Management
  - Can the local agencies effectively manage and partner with these companies?

## Car-Sharing in El Paso

- Assessment
  - Guidebook appendix – El Paso market analysis
- Attraction
  - Are activities in place to attract these programs, if desired?
- Management
  - Can the local agencies effectively manage and/or partner with these companies?

## Bike-Sharing in El Paso

- Assessment
  - Guidebook appendix – El Paso market analysis
- Attraction
  - Are activities in place to attract these programs and promote use?
- Management
  - Are the local agencies effectively managing and/or partnering with bike-sharing agencies?

## Lesson 7

Providing a Useful Planning Tool to the Region

## *Guidebook Discussion*

- Can this help you better address shared mobility programs in your region?
- What do you like?
  - Format
  - Look and feel
  - Organization
  - Content
- What do you <u>not</u> like?

## *Further Comment*

- Stacey Bricka, TTI, at s-bricka@tamu.edu
- Kristi Miller, TTI, at k-miller@tamu.edu

## Thank you!

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