

# DRIVING SMART: CAR2GO IN AUSTIN AND BEYOND

K. Kortum

Department of Civil, Architectural, and Environmental Engineering,  
University of Texas, Austin, Texas, USA  
kkortum@gmail.com

## ABSTRACT

Carsharing is a specific type of car rental allowing individuals or businesses to rent vehicles by the hour or minute. This service draws users who only need a car occasionally, allowing these individuals the benefits of private vehicle access without the demands of car ownership. Such organizations have shown that they have the potential to have a significant impact on transportation patterns and, once firmly established, land use patterns as well. Daimler Auto Group entered this market with Car2Go, a carsharing organization with a fleet composed entirely of Smart Fortwo vehicles. It began with a pilot program in Austin, Texas, providing several carsharing innovations. First, Car2Go allows one-way rentals, whereas other carsharing programs require that the vehicle be brought back to the place of rental. The flexibility and spontaneity Car2Go provides increase its appeal and will result in significantly different usage patterns than other existing carsharing programs. Car2Go also charges users by the minute instead of by the hour as other carsharing organizations do, meaning that short trips are very economically efficient. This analysis began before Car2Go launched to determine the likelihood of success for the program and it also looks at Car2Go's pilot program and public operation.

## 1. INTRODUCTION

### 1.1 Background and Motivation for Research

Much of the low-density urban development that has occurred in the United States over the last several decades has been enabled by and designed around the automobile. The resultant automobile dependency has led to a variety of environmental and social problems, including air and noise pollution [1], greenhouse gas emissions [2], traffic congestion [3], and a dependence on foreign oil [4]. Additionally, vehicle ownership carries a significant financial burden, with the average vehicle costing its owner \$9,519 per year [5], despite its being used for only about one hour per day [6]. Most efforts to reduce automobile usage have focused on public transit, but carsharing may help to fill the space that remains between public transit and private vehicle ownership.

Carsharing is a specific type of car rental that allows individuals or businesses to rent vehicles by the hour or minute, as opposed to traditional car rentals that are based on day- or week-long rentals. Most carsharing organizations charge a membership fee, a deposit that is refundable upon leaving the organization, hourly fees, and mileage after a certain number of free miles [7]. The carsharing service handles all costs of ownership, including purchasing, maintaining, insuring, and fueling the vehicle. This type of service draws users who only need a car on an occasional basis, allowing these individuals the benefits of private vehicle access without the demands of car ownership. In combination with public transit availability, walking, bicycling, and carpooling, carsharing allows an individual a variety of transportation alternatives beyond private vehicle use. Carsharing also tends to reduce car ownership over time [8]; Zipcar estimates that for every three members, a new car goes unsold [9].

The first formal carsharing operations were begun in Germany and Switzerland in the 1980s, and the first commercial U.S. operation was in Portland, Oregon, in 1998 [10]. Today, carsharing is available in more than 1,000 cities around the world [11]. In certain metropolitan areas where carsharing has established a strong foothold, these organizations are beginning to have an effect on parking policies; cities are reducing parking requirements due to residents' easy access to carshare vehicles [12][13]. As of July 2008, most existing U.S. carshare organizations (61%) were nonprofits based in a single metropolitan area, and these include PhillyCarShare, San Francisco's City CarShare, and HOURCAR in Minneapolis and St. Paul [7]. The city of Austin, Texas, was previously home to the non-profit Austin CarShare (ACS). Founded in 2006, this carshare organization managed a fleet of seven vehicles for about 300 members. However, as of July 2010, the ACS has ceased operations [14]. For-profit operations include ZipCar, the world's largest carsharing program with almost half of all carsharers worldwide [15]. ZipCar has locations in twenty-eight states, primarily along both coasts, and has developed relationships with more than 120 colleges and universities [16]. ZipCar is also taking steps to make their carsharing process even easier to use; the company has recently partnered with Apple to develop a ZipCar application for the iPhone [17]. Other smaller for-profit organizations exist as well. For-profit operators make up only 29% of all carshare operators, but they account for 74% of all carshare members [7], largely due to the dominance of ZipCar. Traditional vehicle rental operations, including Enterprise, Hertz, and U-Haul, have also begun to experiment with offering hourly rentals and strategic placement of cars around cities, effectively acting as carshare organizations themselves [18][19][20].

Differences in the two types of carsharing operations (non-profit and for-profit) can be seen in their primary objectives. Whereas nonprofits have the flexibility to focus on their mission – in this case, improving transportation options for their members and the metropolitan area – for-profit operations are constrained by their need to produce a profit. Carsharing operations have traditionally not been profitable, although this is likely to change in the future, as carsharing grows in acceptance and use. Non-profits have the ability to concentrate on affordability and reliability [21], thus including a wider variety of incomes in their market, and they can also develop close relationships with public agencies and community-based organizations more easily than for-profit organizations [22]. On the other hand, for-profit organizations are likely to have better potential for obtaining financing, holding assets, and raising capital [23].

Carsharing programs, both non-profit and for-profit, have also developed close relationships with universities around the country. As of July 2008, 130 college campuses in the U.S. were served by eleven carsharing organizations, representing approximately 9% of the total carsharing market [7], and this segment of the market is one of the fastest-growing. College students are proving to be a successful demographic for carsharing organizations, and the parking challenges present at many universities further encourage students to consider carsharing instead of car ownership [24].

In the fall of 2009, Daimler joined the ranks of existing carshare operations in the U.S. with its first American pilot program. Based on a successful pilot program in Ulm, Germany, Daimler is operating a fleet of its Smart ForTwo vehicles in Austin, Texas, in an operation called Car2Go. The Smart ForTwo vehicle has a very distinctive appearance, commonly described as "cute," which will help the vehicle to stand out from other carshare vehicles, and its uniqueness may also draw increased interest from potential Car2Go members. Initial plans call for concentrations of Car2Go vehicles in two primary locations: the central

business district (CBD) of Austin and the University of Texas at Austin (UT). According to its promotional literature, Daimler suggests that Car2Go would be an appropriate service for those who primarily drive alone, who occasionally need a car for short trips, and who would like the car to be “ideally, right around the corner” [25].

Car2Go represents the first entry of a major car manufacturer into the carsharing market. Existing carsharing operations have not been vehicle-specific, instead purchasing a range of vehicle types and manufacturers. Daimler’s proposal is also unique among existing carsharing operations in that cars will not need to be returned to any particular location, whether it be their starting point or a designated Car2Go location. Instead, vehicles may be taken on one-way trips and left wherever is convenient for the user. Daimler’s business model is unclear, but is potentially based more on marketing of their brand, particularly the Smart ForTwo vehicle, than on management of a profitable operation. If marketing is indeed the focus, as it may well be in an era of falling new vehicle sales [26], the vehicular variety and potential cost of retrieving vehicles will be relatively unimportant. If, however, profitability is key to Daimler’s operation, analysis will need to be done in order to determine whether the principal tenet of their carsharing operation – the lack of specified locations for their vehicles – is too costly to sustain.

This paper looks at economic and demographic characteristics of members of existing carshare programs. Based on previous research as well as new data collected for this purpose, the analysis will determine whether or not UT and the Austin CBD are appropriate locations for Daimler’s Car2Go program. The remainder of Chapter 1 looks at previous research into carshare user characteristics. Chapter 2 considers the sociodemographic characteristics of the Austin metropolitan area, those associated with UT, and individuals living in Austin’s CBD. Chapter 3 explains the intent, structure, and distribution of the survey created for this analysis, and Chapter 4 reviews the results of the survey. Chapter 5 provides concluding remarks and suggests directions for future analyses and planning.

## 1.2 Literature Review

Physical characteristics of a neighborhood have significant impacts on the level of support that carsharing receives. Celsor and Millard-Ball [27] found that neighborhood and transit characteristics of an area are “more important indicators for carsharing success than the individual demographics of carsharing members.” Increased household densities lead to increased use of carshare [28]. Streets on which parking is limited or restricted show greater support for carsharing than streets that provide easy parking [29]. Another important predictor of carsharing usage is the distance to the nearest vehicle [10]; studies have shown that individuals are generally willing to walk up to 400m, but distances beyond this show a significant decline [29].

Low vehicle ownership is one of the most common characteristics of carshare members [30][31]. Celsor and Millard-Ball [27] found that low vehicle ownership in a neighborhood has the strongest correlation with the level of carsharing service in the neighborhood. In San Francisco, City CarShare members were more likely to use the service heavily if they lived in zero-car households [32]; in fact, most City CarShare users do not own cars but substituted a carshare vehicle for a walking or bicycling trip [33]. Additionally, Steininger et al. [34] found that more than half of European carshare members did not own a car prior to membership.

Personal characteristics of individuals using carshare are also important. Members of carsharing organizations tend to be relatively young. Many researchers have found that a

majority of members are in their late twenties to their early forties, with “thirty-somethings” being the most common users [34][35][36][37][38]. Studies have shown mixed results with regard to the gender split of carshare users. Loose et al. [39] and Cervero [8][28][32][33][37] found that women are the primary members, but Taylor[35] showed that, in Europe, membership is 66% male. In most organizations, carshare members are highly educated, generally having earned at least a bachelor’s degree[34] [35] [37] [38]. These high levels of education often lead to professional employment [40] and lower unemployment rates than the general population [34]. Correspondingly, studies have generally shown that typical carshare users have higher-than average incomes [40] [34] [30] [35]. However, interest in carsharing is also present among those with lower-than-average incomes [29] [35]. These individuals may consider a private vehicle too expensive to purchase and maintain, but are still in need of a car for occasional driving trips. Use of carshare vehicles by individuals is primarily for personal business, such as errands and doctors appointments, and for social and recreational trips [33]. Many of these trips are concentrated in evenings and weekends [41], resulting in reduced vehicle availability at those times. In areas with limited personal vehicle availability, the primary use of carsharing is local residential and neighborhood use [42].

Carshare users tend to share important unquantifiable characteristics. Burkhardt and Millard-Ball [43] have found that carshare users tend to “be considered to be social activists, environmental protectors, innovators, economizers, or practical travelers,” and Shaheen and Rodier [40] have shown that typical CarLink (San Francisco) members exhibit “sensitivity to congestion, willingness to try new experiences, and environmental concern.” Members often show “at least a vague interest” in environmental issues [35]. Generally, carshare users tend to be those who walk, bicycle, and use transit more than average members of their community [39]. Longer membership durations generally lead to more frequent use of shared cars [10]. Carsharing is not a concept that will appeal to the entire population of any metropolitan area, but certain subgroups have shown to be highly receptive to the idea. Generally, highly-educated and relatively young urban residents are the best prospects for a carsharing organization’s members. This analysis continues to examine the downtown Austin residential population and the UT daytime population to determine their sociodemographic characteristics and how closely these specific subgroups match the characteristics of existing carshare members in other cities.

## **2. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF AUSTIN AND UT**

As shown in previous literature, demographics may be an indicator of the likelihood that an individual will become a carshare member and user. Because of this, it is necessary to consider the demographics of the two primary groups that Daimler is targeting with its Car2Go program: those working or residing in Austin’s CBD and UT students, faculty, and staff. UT faculty and staff are expected to behave similarly to the metropolitan area population, but students have a unique set of demographics and travel behavior that require separate consideration.

While only about 6,000 people resided in downtown Austin as of 2008, the daytime population of Austin’s CBD itself is estimated to be 67,000 employees. 90,000 daytime employees are estimated to work within one mile of 6th Street and Congress, the intersection of two key streets in the CBD area [44]. These daytime numbers are comparable to those of UT, which has a student population of 50,000 [45] and staff and faculty population of 21,000 [46], for a total of 71,000. The residential population of Austin’s CBD is expected to increase in coming years, as several new condominium buildings are currently under development.

## 2.1 Income

As of 2007, the city of Austin has a median household income of \$48,227 and a median per capita income of \$28,000. These values are similar to national medians of \$50,007 and \$26,178, respectively [47]. Residents of Austin's CBD have higher incomes, however, with a median family income of approximately \$105,000 and per capita income of \$36,400. The typical member of an existing carshare organization has an above-average income, indicating that CBD residents may well be a successful market. According to results of a survey completed by ACS in 2009, a plurality of members (35%) reported yearly household earnings of \$45-65,000, but a significant number (15%) also reported household earnings of more than \$100,000. Because the membership profile of ACS is likely to be the best indicator of Car2Go members, Daimler can expect that their service, like others around the country, will appeal largely to those of higher-than-average incomes.

On the other hand, income for students at the University of Texas is more challenging to gauge. Faculty and staff incomes will be comparable to those of the city as a whole, but students have no general population with which they can be compared. While anonymous family income data could be obtained through the university, the student's actual disposable income may bear little correlation to the family's income. Given the wide variety of possible family situations, some students may be receiving plenty of spending money from their parents or other family members while others work to earn disposable income or simply do without. Additionally, car ownership, which is often used successfully as a surrogate for income, is not readily available for the student population, nor may it be as reliable an indicator as it is for the general population. Students often choose, either on their own or at the request of their parents, a residential location that is highly convenient to the campus as well as to necessary services, negating the need for a vehicle. Housemates may also choose to share a vehicle, perhaps because of limited parking availability, which may have little or nothing to do with the income situation of the individual students. As a result of these uncertain income dynamics, a general assumption was made that, while there may be great variation in student incomes, this demographic will generally be very sensitive to pricing.

## 2.2 Age

The median age of Austin residents is 32.2 years [48], which is slightly younger than the national median of 36.7 years [49]. With regard to those purchasing residential units in Austin's CBD, no median age is readily available, but similar age patterns exist; as of 2008, 27% of buyers were under 30 years old and another 35% were between 35 and 44 [44]. Based on the findings of previous studies, most American carshare users are under age 45, indicating that a majority (62%) of downtown residents will fall into this category. The youthful nature of carshare users also bodes well for the UT market. Only six percent of UT undergraduate students are 25 years or older, and the average age of an undergraduate is 21 years [50]. The ages of faculty and staff can be expected to be very similar to the ages of the overall Austin metropolitan area, which are generally younger than national averages.

## 2.3 Education

24% of downtown Austin residents hold a Master's degree or greater, as compared to only 15% of the metropolitan Austin population [51] and 7% of the national population [52]. Carshare members tend to be among the most highly-educated individuals in a region [8][28][33], suggesting that downtown residents may be a strong carsharing market. Students at UT can also be considered to be among the more highly-educated members

of society, as they are working toward, at minimum, a bachelor's degree. Staff likely have similar educational backgrounds as the Austin metropolitan area, which would mean that 84% of those over the age of 25 are high school graduates, and 43% have at least a bachelor's degree [47]. Faculty will be among the most highly-educated members of society and most will hold a doctorate. Overall, those affiliated with the University of Texas are very likely to have significantly higher levels of education than the general population. This is particularly true in comparison to the national population, in which only 27% has obtained at least a bachelor's degree [47].

## 2.4 Vehicle Ownership

Of occupied housing units in 2007, 7.3% had no vehicles available. 43.5% had one vehicle, and the remainder had at least two vehicles [47]. Home locations can have some effect on vehicle ownership rates; 30% of those buying condos in downtown Austin worked in Austin's CBD as of 2008 [44]. This urban lifestyle and proximity of home and work locations is reflected in vehicle ownership levels among CBD residents that are approximately half that of suburban residents [53].

Student vehicle ownership is more difficult to accurately gauge. A 2004 study by Harris Interactive revealed that 72% of college students aged 18 to 30 own or have access to a vehicle [54]. This value has likely held nearly steady since then, and may even be slightly higher among Texas students, since vehicle ownership in the state tends to be higher than the national average [55]. However, like many college campuses, parking is a serious challenge at UT. Many students are thus discouraged from attempting to bring a vehicle to campus, particularly if they live close enough that walking, bicycling, or transit are viable options. Student parking permits are sold to those who reside in on-campus housing but likely do not provide an accurate representation of overall vehicular ownership. Approximately 10,000 beds are available on campus, accounting for only a small fraction of the university's 50,000 students. Those who live off-campus are expected to have significantly different vehicle ownership rates than those who live on-campus, but it is not possible to accurately determine what these rates would be. Generally, however, it can be assumed that student vehicle ownership is markedly lower than vehicle ownership for the Austin metropolitan area.

## 2.5 Travel Behavior

More than 90% of Austin's commuting population traveled to work in private vehicles, both alone and in carpools [47]. At the same time, just over 2% of commuters used public transit to reach their workplace. These numbers are somewhat higher for workers in the CBD region, however; 45% of all bus routes run through the downtown area [56], and approximately 4% of downtown workers use transit to commute [57]. Transit commuters could be a strong market for Car2Go because of the lack of convenient transportation alternatives available once the individual has reached his or her workplace. If carsharing vehicles are readily available and easily accessible, transit users could run errands, make doctor visits, and otherwise make use of the carsharing service throughout the day.

While the daily population of the UT campus is approximately 71,000, there are only 14,109 parking spaces available on campus [58]. Clearly, a significant number (approximately 80%) of those traveling to campus do so by some means other than private vehicles. Additionally, 80% of UT students do not live on campus [50]. However, 68% of those who travel to UT on a regular basis (including students, faculty, and staff) live within five miles of the campus [59]. Many students use the UT Shuttle system, the largest university shuttle system in the country, to commute to campus: 7.5 million shuttle rides

are provided each year [60]. Because of this, even students who own a vehicle may not have access to it on campus throughout the day. Given that a large majority of the 71,000 people who travel to the UT campus on a daily basis are using public transportation, biking, or walking, this population may form a significant market for the short-term use vehicles available through Car2Go.

Many of the socio-demographic characteristics of the UT daytime population and downtown residents correspond with the findings of previous studies, indicating that these two markets may be a promising market for Car2Go. However, demographics alone may not tell the whole story; in order to determine actual attitudes toward carsharing, this analysis includes a survey that was provided to these groups. With more specific information about the individual opinions, the results of this analysis will provide a much greater level of accuracy.

### **3. SURVEY DESIGN AND PURPOSE**

In order to compare the attitudes and perceptions of Austin residents to those determined in previous literature, a survey was conducted. This internet-based survey, for which the questions asked are available in the Appendix, requested a variety of demographic information, focusing on that which had previously been found to be significant in an individual's decision to use a carsharing service. Additionally, the survey asked stated preference questions in an attempt to determine the respondent's likelihood of using carshare services in general and the Car2Go model in particular. Using these data in combination with the results of other studies, it may be possible to determine the likelihood of success of the Car2Go organization in Austin.

Internet surveys are inherently biased towards younger, more educated and computer-literate individuals. In many surveys, this bias can lead to suspicion as to the accuracy of results. For this purpose, however, the individuals toward whom the survey is biased are those who are most likely to be involved in a carsharing organization. Carsharing organizations require moderately advanced levels of technology in order to manage the fleets, determine a car's location, unlock a vehicle with a user's personal identification card, and handle the charges accrued for each trip. Individuals who are most comfortable using technology to take an internet survey are likely to also be quite comfortable with the technology required to operate a carsharing organization.

The survey has three sections: one demographics section followed by two "what if" scenarios. One of the scenarios asks for stated preferences regarding general carsharing programs, and the second focuses on the same stated preferences for a carsharing program that uses exclusively Smart ForTwo vehicles. The demographics questions are based on results of previous literature, asking for the respondent's age, gender, education level, and income, as well as vehicle availability and driver's licensing status. Additionally, the respondent is given the option to provide the nearest cross streets to his or her home and workplace, which will help to determine the geographical location of those amenable to carsharing programs.

The two scenarios are designed to compare the interest in a Car2Go-type program (which focuses on Smart ForTwo vehicles) and a traditional carsharing organization with a wide range of vehicle types available. In both cases, the respondent is asked whether he or she would be likely to join such a program, how far he or she would be willing to walk to reach a carshare vehicle, the types of trips for which he or she would likely use a carshare vehicle, and whether he or she would like to have the option of a one-way rental. In

comparing the stated preferences of respondents under both scenarios, the viability of Car2Go can be compared to the viability of a standard carsharing service. This comparison may prove useful to Daimler as it determines its final business model.

The survey was distributed through a variety of channels, including University of Texas transportation distribution lists, the City of Austin bike forum users, and Austin CarShare members. Austin CarShare was particularly helpful in this regard, providing a list of their members who allowed their contact information to be shared. All of the survey outreach was conducted electronically, through email and online forums.

#### **4. SURVEY RESULTS**

There were 115 responses to the online survey. The sample population responded to the survey over the course of approximately one month, with the first response on June 11, 2009, and the last response and cutoff point on July 4, 2009. Existing carshare members (those belonging to ACS) account for 74% of the sample population, and students account for 30%.

##### **4.1 Socio-Demographics of Respondents**

The survey provided five categories for household income: \$0-5,000, \$5,000-24,999, \$25,000-69,999, \$70,000-149,000, and \$150,000 or more. Assuming a value of \$175,000 for the highest income category and using category midpoints for the other four, the sample population has a mean household income of \$68,438. This value is substantially higher than the mean Austin area household income of \$48,227. However, it is interesting to compare mean incomes for two subpopulations: those who responded that they are students and those who are not. Using the same calculation method as before, the mean household income among students is \$37,132, and the mean household income among non-students is \$80,696. (18% of those who responded that they are students also claim to work, which may account for a relatively high student income.) This difference in mean incomes is significant. There are no further questions related to money (i.e., membership fees, hourly costs, etc.) on the survey; without further information, one might reasonably assume that students, with a much lower disposable income, will be far more sensitive to pricing of a carshare service than will non-students.

All of those who responded to the question of age were between 18 and 65 and thus fit into a closed age category (that is, no individual was in the "65 years or more" open-ended age category). Because of this, it is possible to estimate the average age of the sample population using the midpoints of each age category. Using this method, the average age of the respondents is 34.5 years, slightly older than the Austin median age of 32.3 years and slightly younger than the national median of 36.7 years. With regard to age, the sample population is representative of the metropolitan area population. The sample population is also a highly educated group of people. 86% of respondents have earned at least a bachelor's degree, and 36% have earned a master's degree; both of these educational characteristics are much higher than national averages (27% and 7%, respectively) and Austin averages (43% and 15%, respectively).

Respondent households hold a mean of 0.8 vehicles each, with a median vehicle holding of one. This is significantly below the Austin area mean vehicle holding of 1.7 vehicles per household. Again, it is interesting to compare subgroups of the sample population. Student and non-student respondents hold nearly the same mean number of vehicles in each household (0.7 and 0.8, respectively). Members of ACS, however, hold a median value of



zero vehicles per household. 45 of the 85 ACS members' households do not have any vehicles available. Non-members hold a mean value of 1.2 vehicles per household; this value is still below the Austin area mean vehicle holding of 1.7, but is twice the ACS members' mean holding of 0.6 vehicles per household. These low vehicle ownership numbers are particularly interesting when considering that the entire sample population has a higher-than-average household income. In most situations, higher income leads to higher vehicle ownership, but this sample population does not follow the usual patterns; it is likely that these individuals with high incomes and low vehicle ownership rates will form a very strong market for carsharing.

Figure 1 shows the reported locations of the respondents' homes throughout the Austin metropolitan area.

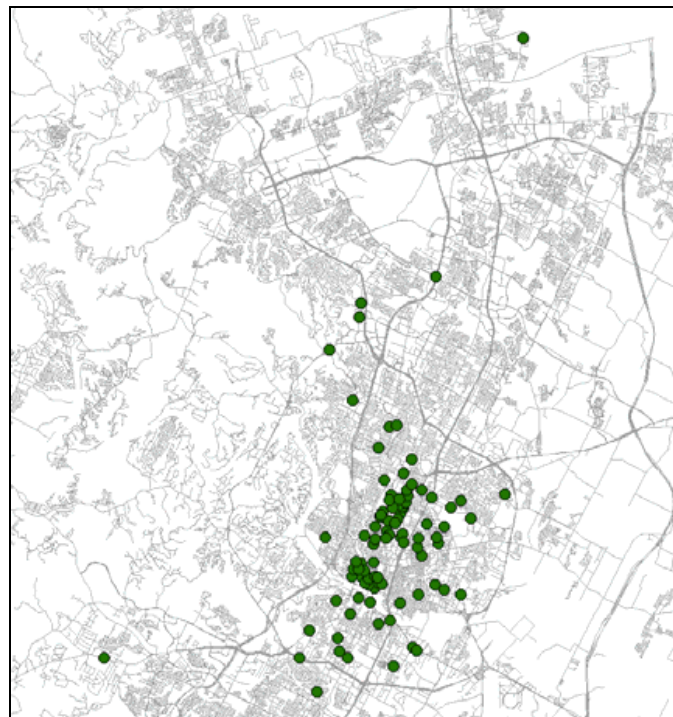


Figure 1 - Survey Respondents' Home Locations

A large proportion of the respondents live in downtown Austin and near the UT campus. Additionally, a significant number of respondents live in the area north of UT's campus known as Hyde Park. Not all respondents live in the central portion of the city, however; one respondent lives in Round Rock, a northern suburb of Austin, and another lives in far southwest Austin, as well as many who are scattered throughout the metropolitan area. Given that 74% of the respondents are ACS members, the residential locations of the sample population are not surprising. Individuals are unlikely to choose to become carshare members if the vehicles are not conveniently located for them; ACS provides cars in the downtown, UT, and Hyde Park areas of the city. Many of those who are not existing carshare members are students who choose to live near the UT campus for their own convenience. While there are many respondents who do not live in one of these three primary locations (downtown Austin, UT campus area, and Hyde Park), carsharing organizations would be most likely to locate their vehicles near the greatest concentrations of individuals' home locations. Figure 2 shows the reported locations of the respondents' work or school locations.



Figure 2 - Survey Respondents' Work/School Locations

Again, there are significant clusters of work or school locations. More than one-third of respondents (40) work or attend school within the UT campus boundaries. Another 21 respondents work within the CBD boundaries. Outside of these two locations, there are no clear clusters of employment locations; instead, employment is scattered somewhat evenly throughout the northern and southern sections of the city and is located almost exclusively along major arterials. Carsharing operators would likely look to concentrate their vehicles in the UT and CBD regions of Austin to provide easy access to the largest possible number of users.

#### 4.2 Discussion of Results

Overall, responses to both scenarios (traditional carsharing with a variety of vehicle types vs. carsharing with only Smart ForTwo vehicles) were generally similar, with respondents showing a slight but statistically insignificant preference for having access to a variety of vehicle types. Under both scenarios, a substantial majority (80%) wished to have one-way carsharing use available. This desire indicates that Car2Go may be able to attract users, possible even those who already belong to ACS, because of its one-way advantage.

Those who claimed no interest in joining a carshare program were entirely male. The sample population was skewed towards males (62%, while the actual population is evenly split), but the likelihood of all seven individuals who are not at all interested in carsharing randomly being male is only 4%. This suggests that a gender bias may be in effect and fits well with previous research by Cervero and Loose, who found that women make up the majority of American carshare members. It is possible that men are more attached to their own private vehicles, as befits the stereotype, or that women tend to have slightly more flexible schedules that lend themselves well to sharing a vehicle.

Those who are unsure of their interest in one carsharing program were very likely to be unsure of their interest in the other. 79% of the respondents who replied "possibly" to the question of joining under scenario one also replied "possibly" under scenario two. These individuals may require more information than was provided before they would be able to

make a final decision, as the scenarios provided were somewhat brief. The “possibly” group was evenly split between males and females, and mirrored the entire sample population in terms of education, age, and student status. This subpopulation did have a higher-than-average income of \$71,447, indicating that cost of a carsharing service may not be their primary concern.

Survey respondents were provided with six trip types for which they could possibly use a carshare vehicle (work, school, food shopping, non-food shopping, errands, and social activities) and asked which of these types they personally were likely to take. Under both scenarios, all respondents were most likely to use the vehicle for errands (89% with traditional carshare vehicle and 83% with Smart ForTwo vehicles) and least likely to use the vehicles for school or work. Non-food shopping was the second most popular reason to use a carsharing vehicle, with 55% of respondents opting to use either a traditional vehicle or a Smart ForTwo to accomplish this shopping. Frequencies of errand and non-food shopping trips are likely less and destinations are more varied than work or school trips. It is reasonable to assume that many people run errands alone or possibly with one other person, suggesting that a Smart ForTwo vehicle would be adequate for their needs. Non-food shopping may present challenges for the Smart ForTwo, however, depending on the precise type of shopping. Clothing and many other personal items are small and easily fit on an empty passenger seat or in the moderate cargo hold that the vehicle provides, but larger household items or furniture will generally not fit in the vehicle. This is a concern that Daimler will need to track as its operation commences to determine how many potential users are avoiding its carshare service because the vehicle will not suit their needs.

The sample population is generally willing to walk slightly further to reach a Smart ForTwo vehicle (0.57 miles) than to reach a traditional carshare vehicle (0.54 miles) ( $t=1.67$ ). The student subpopulation shows some differences in average distance they are willing to walk; students will walk 0.55 miles to reach both a traditional carshare vehicle ( $t=2.82$ ) and a Smart ForTwo vehicle ( $t=7.95$ ). These differences in the student subpopulation from the general population are statistically significant, but of little value practically. Using the rule of thumb that a block is about 400 feet long, these differences in walking distances represent only one-quarter of one block.

An interesting point of analysis is the connection between number of vehicles owned and whether or not an individual is a member of a carshare (ACS, in this case). Considering that the mean number of vehicles owned by a non-carshare member is approximately twice that of a carshare member, one might expect that such a correlation will exist. In fact, when the subpopulation of ACS members is compared with the general population, statistical analysis shows that fewer vehicles owned is indeed correlated with the likelihood that an individual is an ACS member ( $t=1.40$ ). Extrapolating this result further, it suggests that car-less individuals and households are likely a strong market for Car2Go. Since students and residents of Austin’s CBD have a lower vehicle ownership rate than the overall metropolitan area, the survey indicates that these are likely to be relatively good markets for Car2Go.

The mean educational level for members of ACS is higher than for non-members ( $t=4.68$ ). This fits well with previous research on carshare user demographics, and it can be assumed that the mean educational level for Car2Go members will also be higher than for non-members. Additionally, this finding suggests that the downtown residents and UT campus population will represent strong markets for Car2Go, as these are some of the highest concentrations of those with high education levels. Recall that 15% of the residents of downtown Austin have at least a master’s degree and that the campus

population (which includes faculty) is among the most educated group of individuals in the city.

One consideration is that students may be underrepresented in ACS due to the organization's fee structure. ACS charges an application fee of \$25, a refundable deposit of \$300, and either a monthly or yearly membership fee, depending on the plan chosen. As shown above, the difference in income of students and nonstudents is quite substantial, indicating that students are likely to be much more sensitive to pricing and fees than are non-students. Students may not be able or willing to pay the upfront fees required to be a member of ACS. Car2Go may be able to overcome this obstacle to student membership as it does not charge security deposits or monthly fees. Instead, the cost is based purely on minutes of vehicle use, with hourly and daily maximum charges. While there may be a small fee (around \$10) to cover the cost of the personal identification card that will act as the vehicles' key, the costs of membership of Car2Go are substantially lower than for ACS, which may lead to a much greater student membership.

Both the student population and those who live in Austin's CBD are, on average, highly educated. This alone indicates that these groups are likely to be a better market for Car2Go and other carsharing programs than the general Austin population. In comparison, most of those who work in Austin's CBD are not professionally employed but are instead in clerical, service, or support positions. Individuals holding these types of jobs, on average, are not as highly educated as UT students and those who reside in the CBD. As a result of this lower average level of education and the resultant lower salaries, the general CBD working population is likely to be a less-rich market for carsharing than are students and CBD residents.

The limited capacity of Smart ForTwo vehicles, for both humans and cargo, is a concern, as mentioned when discussing the potential trip types for which members will use the vehicles. Based on previous research (e.g. [30][39]), most carshare users tend to primarily use public transportation, walking, or biking for their trips, but will occasionally consider a private vehicle to be necessary or particularly convenient. In these situations, the limited capacity of Smart ForTwo vehicles may detract from their appeal as carshare vehicles. However, in San Francisco, whose City CarShare service is among the best-studied of all carshare programs, most members drive alone [32], which indicates that the Smart ForTwo's two-person capacity may not be a hindrance after all.

## **5. CONCLUSIONS**

Carsharing is increasing in popularity both domestically and internationally. Many individuals and businesses are finding that the option to use a private vehicle without the expenses of purchase, upkeep, fuel, and parking is a very attractive one. Additionally, carsharing has the potential to reduce congestion, as long-term studies have shown that carshare users reduce their driving and purchase fewer cars over time. If carshare users tend to use carsharing largely for non-work trip purposes, as indicated by the survey, they tend to use a mode other than single occupant vehicle for their work trip travel. The industry's growth in the United States, particularly in dense and congested urban areas, has been substantial since the 1990s, and the city of Austin is poised to reap the benefits of this growth. Starting in the fall of 2009, a for-profit carsharing organization will be entering the market. This organization, called Car2Go and operated by Daimler Automotive Group, will consist of a large fleet of Daimler's Smart ForTwo vehicles. Car2Go will be unique in that it allows users to charge their time by the minute, instead of the usual hour, and will allow one-way carshare use. Car2Go will also provide members with use of

one of the most uniquely-designed vehicles on American roads today, potentially increasing its appeal.

This paper considered the unique characteristics of Car2Go in combination with the socio-demographics of the two primary foci of Daimler's operation: Austin's CBD and the University of Texas. Using a survey to determine preferences of Austin residents, it was possible to compare the characteristics of this market to those markets which have previously been found to be highly successful, such as members of San Francisco's City CarShare and other popular carsharing services. The results of the survey confirmed some basic demographic information for Austin: namely, that the general population is younger and more highly-educated than national averages. Previous research has concluded that the young and highly-educated are precisely the groups who are most attracted to carsharing, suggesting that the city as a whole is a prime market for the service. However, the survey data goes further to show that specific subgroups, particularly those who live in downtown Austin and those who work and study at the University of Texas campus, are an even richer market for a carsharing operation. These groups are among the most highly-educated in the city and either earn or have the potential to earn far more than the average individual. Additionally, these subgroups tend to have high rates of public transit usage and lower rates of vehicle ownership, resulting in fewer difficulties in encouraging the use of a shared vehicle. Daimler's proposed focus on these two subgroups is likely to be their most successful possible focus and will bode well for the future of Car2Go in the Austin area.

Certainly, many analysts will be paying close attention to the Car2Go operation. Not only is it unique in its pricing structure and one-way allowance, but it also marks the first major entry of a car manufacturer into the carshare market. If Daimler finds success in carsharing, it is likely that other manufacturers will follow in its footsteps. These ventures, like Daimler, will have the option of attempting to earn a profit from the carsharing side of the business or simply using carsharing as a way to further market their vehicles. Either way, it is likely that carsharing organizations will continue to develop, expand, and generate new and innovative methods to attract additional users.

## REFERENCES

- [1] Kearney, A., and R. De Young. (1996) Changing Commuter Travel Behavior: Employer-Initiated Strategies. *Journal of Environmental Systems*, 24(4): 373-393.
- [2] Walsh, M. (1993) Highway Vehicle Activity Trends and Their Implications for Global Warming: The United States in an International Context. In *Transportation and Global Climate Change*. Edited by D.L. Greene and D.J. Santini. Washington, DC: American Council for an Energy-Efficient Economy.
- [3] Schrank, D., and T. Lomax. (2007) The 2007 Urban Mobility Report. Texas Transportation Institute, The Texas A&M University System. Available at [http://tti.tamu.edu/documents/mobility\\_report\\_2007\\_wappx.pdf](http://tti.tamu.edu/documents/mobility_report_2007_wappx.pdf).
- [4] Rutledge, I. (2006) *Addicted to Oil: America's Relentless Drive for Energy Security*. New York: I.B. Tauris.
- [5] American Automobile Association (AAA). (2010) *Your Driving Costs 2010*. Available at <http://www.aaaexchange.com/Assets/Files/201048935480.Driving%20Costs%202010.pdf>.
- [6] Shaheen, S.A., D. Sperling, and C. Wagner. (1998) Carsharing in Europe and North America: Past, Present, and Future. *Transportation Quarterly*, 52(3): 35-52.
- [7] Shaheen, S.A. (2008, October 20) The Look of Carsharing Today Across North America and Abroad. Presented at The Transportation – Land Use – Environment Connection Conference, Lake Arrowhead, CA. Available at [https://www3.uclaextension.edu/arrowhead/ppts\\_09/A16.ppt](https://www3.uclaextension.edu/arrowhead/ppts_09/A16.ppt).
- [8] Cervero, R., A. Golub, and B. Nee. (2007) City CarShare: Longer-Term Travel Demand and Car Ownership Impacts. *Transportation Research Record* 1992: 70-80.
- [9] Maynard, M. (2009, May 30) Industry Fears Americans May Quit New Car Habit. *The New York Times*. Available at [http://www.nytimes.com/2009/05/31/business/31car.html?\\_r=1](http://www.nytimes.com/2009/05/31/business/31car.html?_r=1).

- [10] Katzev, R. (2003) Car Sharing: A New Approach to Urban Transportation Problems. *Analyses of Social Issues and Public Policy*, 3(1): 65–86. [www.asapspssi.org/pdf/katzev.pdf](http://www.asapspssi.org/pdf/katzev.pdf).
- [11] World Carshare Cities Inventories. (2009) World Carshare Consortium. Available at <http://www.ecoplan.org/carshare/general/cities.htm>. Retrieved August 3, 2010.
- [12] Lorinc, J. (2009, June 2) "More Cities Encouraging Car-Sharing." *The New York Times*. Available at <http://greeninc.blogs.nytimes.com/2009/06/02/more-cities-encouragingcar-sharing/>.
- [13] McKeen, S. (2009, March 12) Does Car Sharing Make Sense for Urban Dwellers? *CanWest News Service*. Available at <http://www.canada.com/Cars/Does+sharing+make+sense+urban+dwellers/1378156/story.html>.
- [14] Gregor, K. (2010, July 30) So Long, Austin CarShare. *The Austin Chronicle*. Available at <http://www.austinchronicle.com/gyrobase/Issue/story?oid=oid%3A1063448>.
- [15] The Connected Car. (2009, June 4) *The Economist*. Available at [http://www.economist.com/science/tq/displaystory.cfm?story\\_id=13725743](http://www.economist.com/science/tq/displaystory.cfm?story_id=13725743)
- [16] Roth, D. (2009, June 24) Avoid Car Costs by Sharing. *Cable News Network (CNN)*. Available at <http://www.cnn.com/2009/LIVING/wayoflife/06/24/aa.car.sharing.not.owning/>.
- [17] Mack, B. (2009, June 10) Zipcar iPhone App Makes Car-Sharing a Breeze. *Wired.com*. Available at <http://www.wired.com/autopia/2009/06/zipcar-iphone/>.
- [18] Jones, J. (2008, July 12) Getting People into Cars, Despite the \$4 Gas. *New York Times*. Available at [http://www.nytimes.com/2008/07/12/business/12interviewweb.html?\\_r=1&oref=slogin](http://www.nytimes.com/2008/07/12/business/12interviewweb.html?_r=1&oref=slogin).
- [19] WeCar, Car Sharing by Enterprise Rent-A-Car, Launches in Downtown St. Louis. (2008, February 12) *Business Wire*. Available at <http://www.reuters.com/article/pressRelease/idUS164213+12-Feb-2008+BW20080212>.
- [20] U Car Share. (2009) U-Haul International, Inc. Available at <https://www.ucarshare.com/secure/Home.aspx>. Retrieved June 9, 2009.
- [21] Buffalo CarShare. (2009) Available at <http://www.buffalocarshare.org/index.html>. Retrieved June 11, 2009.
- [22] Sullivan, E., and L. Magid. (2005) Bringing Car-Sharing to Your Community. *City CarShare*. Available at [http://www.citycarshare.org/download/CCS\\_BCtYC\\_Long.pdf](http://www.citycarshare.org/download/CCS_BCtYC_Long.pdf).
- [23] Axelsson, T. (2000) For-Profit, Non-Profit, or Co-op? *The CarSharing Library*. Available at <http://www.carsharing.net/library/stories/cooporprofit.html>.
- [24] U. of Illinois Expands Zipcar Program. (2009, June 15). *Metro Magazine*. Available at <http://www.metro-magazine.com/News/Story/2009/06/U-of-Illinois-to-expand-Zipcar-program.aspx>.
- [25] Car2Go. (2009) Daimler AG. Available at <http://www.car2go.com/portal/page/home.faces>. Retrieved June 11, 2009.
- [26] Report Puts Brakes on Slipping Auto Sales. (2009, July 2). *Reuters*. Available at <http://www.reuters.com/article/bigMoney/idUS222534889720090702>.
- [27] Celsor, C., and A. Millard-Ball. (2007) Where Does Carsharing Work?: Using Geographic Information Systems to Assess Market Potential. *Transportation Research Record* 2007: 61-69.
- [28] Cervero, R., and Y. Tsai. (2004) City CarShare in San Francisco, California: Second-Year Travel Demand and Car Ownership Impacts. *Transportation Research Record* 1887:117-127.
- [29] Abraham, J. (1999) A Survey of Carsharing Preferences, University of Calgary, (<http://www.ucalgary.ca/~jabraham/WTPPCarshare.PDF>). *World Transport Policy & Practice*.
- [30] Millard-Ball, A., G. Murray, J.T. Schure, C. Fox, and J. Burkhardt. (2005) Car-Sharing: Where and How It Succeeds. *Transit Cooperative Research Program Report 108: Transportation Research Board, Washington, D.C.*
- [31] Zhou, B., K. Kockelman, and R. Gao. (2008) Opportunities for and Impacts of Carsharing: A Survey of the Austin, Texas Market. Paper #08-1639. Presented at the Transportation Research Board 2008 Annual Meeting, Washington, DC: January 13-17, 2008.
- [32] Cervero, R., N. Creedman, M. Pai, and M. Pohan. (2002b) City CarShare: Assessment of Short-Term Travel-Behavior Impacts. Working Paper 2002-01. Institute of Urban and Regional Development. University of California, Berkeley. Available at <http://repositories.cdlib.org/iurd/wps/WP-2002-01>.
- [33] Cervero, R. (2002a) City Carshare: First Year Travel Demand Impacts. *Transportation Research Record* 1839: 159-166.
- [34] Steininger, K., C. Vogl, and R. Zettl. (1996) Car-Sharing Organizations: The Size of the Market Segment and Revealed Change in Mobility Behavior. *Transport Policy*, 3(4): 177-185.
- [35] Taylor, J. (2003) Key Lessons Learned from a World Wide Car Club Tour. *Car Plus*, San Francisco. <http://www.carclubs.org.uk/carclubs/N-Amer-tour.htm>.
- [36] Cervero, R., N. Creedman, M. Pohan, M. Pai, and Y. Tsai. (2002c) City CarShare: Assessment of Intermediate-Term Travel-Behavior Impacts. Working Paper 2002-03 Institute of Urban and Regional Development. University of California, Berkeley.
- [37] Brook, D. (2004) Carsharing – Start Up Issues and New Operational Models. Presented at the Transportation Research Board 2004 Annual Meeting, Washington, DC: January 11-15, 2004.

- [38] Lane, C. (2005) PhillyCarShare: First-Year Social and Mobility Impacts of Car Sharing in Philadelphia. Presented at the Transportation Research Board 2005 Annual Meeting, Washington, DC: January 9-13, 2005.
- [39] Loose, W., M. Mohr, and C. Nobis. (2006) Assessment of the Future Development of Car Sharing in Germany and Related Opportunities. *Transport Reviews*. 26(3): 365-382.
- [40] Shaheen, S.A. and C.J. Rodier. (2005) Travel Effects of a Suburban Commuter Carsharing Service - CarLink Case Study. *Transportation Research Record* 1927: 182-188.
- [41] Hope, S. (2001). Monitoring and Evaluation of the Edinburgh City Car Club. Scottish Executive Central Research Unit. Available at: <http://www.scotland.gov.uk/Resource/Doc/156493/0042015.pdf>.
- [42] Barth, M.J., S.A. Shaheen, T. Fukuda, and A. Fukuda. (2006) Carsharing and Station Cars in Asia: Overview of Japan and Singapore. *Transportation Research Record* 1986: 106–115.
- [43] Burkhardt, J., and A. Millard-Ball. (2006) Who Is Attracted to Carsharing? *Transportation Research Record* 1986: 98-105.
- [44] Heimsath, C. (2008, April 2) Downtown Condominium Study: Report by Capital Market Research. Report prepared for Downtown Austin Alliance Economic Development. Available at [http://www.downtownaustin.com/downloads/DTAustin\\_CondoStudy\\_20080402.pdf](http://www.downtownaustin.com/downloads/DTAustin_CondoStudy_20080402.pdf).
- [45] Fall Enrollment at the University of Texas at Austin Reflects Continuing Trend Toward More Diverse Student Population. (2008, September 18) The University of Texas Office of Public Affairs. Available at [http://www.utexas.edu/news/2008/09/18/fall\\_enrollment/](http://www.utexas.edu/news/2008/09/18/fall_enrollment/).
- [46] University of Texas at Austin Facts: Overview. (2009) University of Texas. Available at <http://www.utexas.edu/opa/pubs/facts/overview.php>. Retrieved June 29, 2009.
- [47] Austin city, Texas. (2009) U.S. Census Bureau: City and State QuickFacts. Available at [http://factfinder.census.gov/servlet/ACSSAFFacts?\\_event=&ActiveGeoDiv=geoSelect&pctxt=fph&lang=en&\\_sse=on&geo\\_id=16000US4805000&\\_state=04000US48](http://factfinder.census.gov/servlet/ACSSAFFacts?_event=&ActiveGeoDiv=geoSelect&pctxt=fph&lang=en&_sse=on&geo_id=16000US4805000&_state=04000US48).
- [48] Austin Population. (2008) The Greater Austin Chamber of Commerce. Available at <http://www.austin-chamber.org/DoBusiness/GreaterAustinProfile/population.html>. Retrieved June 18, 2009.
- [49] CIA World Factbook. (2008) Central Intelligence Agency. Available at <https://www.cia.gov/library/publications/the-world-factbook/>.
- [50] The University of Texas at Austin. (2008) USA Today Education: College Toolkit. Available at [https://www.collegetoolkit.com/co/usatoday/colleges/studentprofile/the\\_university\\_of\\_texas\\_at\\_austin/228778.aspx](https://www.collegetoolkit.com/co/usatoday/colleges/studentprofile/the_university_of_texas_at_austin/228778.aspx). Retrieved July 2, 2009.
- [51] Downtown Austin: 2000 Census Residential Demographic Profile. (2000) City of Austin Downtown Redevelopment. Available at [http://www.ci.austin.tx.us/downtown/downloads/demographic\\_profile.pdf](http://www.ci.austin.tx.us/downtown/downloads/demographic_profile.pdf).
- [52] Educational Attainment in the United States: 2008. (2008) U.S. Census Bureau. Available at <http://www.census.gov/population/www/socdemo/education/cps2008.html>.
- [53] Bhat, C. (2004, September 22) Austin Commuter Survey: Findings and Recommendations. Available at [www.ce.utexas.edu/prof/bhat/REPORTS/Commuter\\_survey.ppt](http://www.ce.utexas.edu/prof/bhat/REPORTS/Commuter_survey.ppt).
- [54] College Students to Spend Nearly \$15 Billion on Cars in 2004. (2004, May 13) PRNewswire. Available at [http://www.advn.com/news\\_College-Students-to-Spend-Nearly-15-Billion-on-Cars-in-2004\\_7644637.html](http://www.advn.com/news_College-Students-to-Spend-Nearly-15-Billion-on-Cars-in-2004_7644637.html).
- [55] Texas QuickFacts. (2009) U.S. Census Bureau: City and State QuickFacts. Available at <http://quickfacts.census.gov/qfd/states/48000.html>.
- [56] Executive Summary: Downtown Austin Retail Market Strategy. (2005) Economics Research Associates and Downtown Austin Alliance. Available at [http://downtownaustin.com/downloads/DTAustin\\_Retail\\_ExecSumm.pdf](http://downtownaustin.com/downloads/DTAustin_Retail_ExecSumm.pdf).
- [57] Austin CBD, University, and Urban Area Commuting Profile. (2006) Urban Transport Fact Book. Available at <http://www.publicpurpose.com/ut-cprof-aus.htm>.
- [58] PTS: Frequently Asked Questions. (2008) University of Texas Parking and Transportation Services. Available at <http://www.utexas.edu/parking/utafaq2.html>.
- [59] University of Texas Bicycle Plan: Integrating Bikes into a Pedestrian Campus. (2007, August). Report prepared by Bowman-Melton/Alta Planning + Design. Available at [http://www.utexas.edu/parking/transportation/biking/UTBicycle\\_Plan.pdf](http://www.utexas.edu/parking/transportation/biking/UTBicycle_Plan.pdf).
- [60] PTS: Shuttles. (2008) University of Texas Parking and Transportation Services. Available at <http://www.utexas.edu/parking/transportation/shuttle/>.