

***WHERE DOES CAR-SHARING WORK?
USING GIS TO ASSESS MARKET
POTENTIAL***

by

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ABSTRACT

This paper examines and applies a tool to assess the market potential for new car-sharing operations in urban communities. The research reported in this paper is based the analysis conducted for *TCRP Report 108: Car-Sharing: Where and How it Succeeds*.

The paper analyzes geographic market segments in urban areas. A GIS-based analysis of 13 US regions finds that neighborhood and transportation characteristics are more important indicators for car-sharing success than individual demographics of car-sharing members. The results indicate that vehicle ownership has the strongest, most consistent correlation to the amount of car-sharing service in a neighborhood. Based on the results from this analysis, thresholds are outlined for low service, where car-sharing may be viable but where limited growth can be expected; and high service, where car-sharing is likely to flourish.

This tool to identify neighborhoods that can support car-sharing is applied to a new community seeking to establish a car-sharing program: Austin, Texas. The analysis finds that several neighborhoods in Austin have the characteristics to support car-sharing, such as low vehicle ownership rates and high percentages of one-person households. However, there are few Austin neighborhoods that could support a high level of car-sharing service.

INTRODUCTION

One of the newest additions to the transportation toolbox, car-sharing has attracted considerable excitement from communities seeking ways to reduce their dependence on the private automobile. Car-sharing programs are already established in more than 35 communities in North America, and car-sharing operators report frequent calls from city staff and community activists anxious to start up a local program.

Planning for car-sharing has been hampered, however, by uncertainties over the types of neighborhoods that can support an economically viable car-sharing operation. Until now, there has been no quantitative data to identify the core characteristics of neighborhoods that support car-sharing.

Instead, car-sharing planning has often taken place through trial and error. Programs in some communities – notably metropolitan cores such as Montreal, Boston, Seattle and San Francisco – have grown rapidly, while others have stagnated or have been forced to close through lack of usage. Suburban and small-city programs have met with mixed success: those in Palo Alto, California and Halifax, Nova Scotia were discontinued. Other communities such as San Juan, Puerto Rico, have sought to attract a car-sharing operator, but have had little independent gauge of market potential.

In contrast, transportation planners have a far better understanding of the geographic characteristics that indicate viability for other modes. As early as the mid-1970s, Pushkarev and Zupan tied the feasibility of transit service to density; their matrix outlining residential density thresholds for different levels of transit services is still used today (Table 1). Transit agencies such as AC Transit in the San Francisco Bay Area use density criteria to help determine service frequencies (1), while recent research has honed in on the precise physical characteristics of a transit-supportive community (2).

The paper presents a descriptive model that can help to analyze the market potential for car-sharing. It is based on an analysis of all 13 US regions that had significant car-sharing operations at the time of data collection in Fall 2004. The tool is then applied to one community considering starting a car-sharing program: Austin, Texas.

The analysis presented in this paper is a *supply* model of car-sharing, rather than a *demand* model. In other words, it analyzes where car-sharing operators provide vehicles. In most instances, however, it is reasonable to assume that supply is closely tied to demand, as car-sharing operators tend to add vehicles based on utilization. Supply in some instances is influenced by non-demand factors, such as government agencies seeking to extend service to new neighborhoods. However, even this support often serves only as a catalyst for car-sharing expansion; government funding can serve as a short-term revenue guarantee, but is usually not intended to sustain car-sharing service in the long-term in the absence of sufficient demand (3, 4).

One major limitation of this model is that neighborhood characteristics are just one, albeit critical, factor that determines the success of car-sharing. The support of partner organizations, subsidies and other factors are also important (4). Also, many car-sharing programs have been established in different market niches, particularly grassroots-based, volunteer-run programs (4, 5), and others may be able to exploit new markets such as resort communities. Technology, marketing and service developments such as one-way trips and instant reservations may also be able to extend the reach of car-sharing. The objective of this paper, therefore, is not to preclude new markets, but rather to describe where demand is concentrated for existing operators.

TABLE 1 Density Recommendations for Transit Service

Service	Frequency	Coverage	Dwelling Units per Acre
Rapid Transit (Rail)	5 min peak headway	100-150 sq mi corridor	12
Light Rail	5 min peak headways	25-100 sq mi corridor	9
Bus – Frequent Service	120 buses/day	1/2 mi between routes	15
Bus- Intermediate Service	40 buses/day	1/2 mi between routes	7
Bus- Minimum Service	20 buses/day	1/2 mi between routes	4

Source: Pushkarev, B. S., Zupan, J. M. and R.S. Cumella. (1982) Urban Rail in America – An Exploration of Criteria for Fixed-Guideway Transit. Bloomington: Indiana University Press.

CAR-SHARING MARKET SEGMENTS

Market segments for car-sharing can be usefully divided into two categories:

- **Demographic markets** – the demographic groups that are most likely to join a car-sharing program
- **Geographic markets** – the neighborhoods where car-sharing vehicles can be placed to best effect

Obviously, these factors are interrelated as the geographic markets will be influenced by the demographic characteristics of residents. However, demographic markets refer to the “micro” characteristics of car-sharing users, while geographic markets – the subject of this paper – refer to the “macro” characteristics of the neighborhood as a whole (4).

Urban Neighborhoods

Several neighborhood characteristics necessary for car-sharing to succeed have been identified in previous studies (6,7,8,9,10,11), including the following:

- **Parking pressures.** Car ownership is more expensive and less convenient in places where parking is scarce, making car-sharing a more attractive option.
- **Ability to live without a car.** Car-sharing is not designed to meet a household’s entire mobility needs, but to work in concert with other modes such as transit.

- **High density.** Higher densities bring a larger customer base within walking distance of each car-sharing location. Doubling the density will double the number of potential customers for a given car-sharing location. These potential customers will also have a higher propensity to join, since dense neighborhoods have lower rates of vehicle ownership and travel.
- **Mix of uses.** Business uses during the working day can be paired with residential uses in the evenings and on weekends to increase utilization.

While there is a relatively strong consensus in the literature regarding these supportive characteristics, there is almost no research on how to apply this information to evaluate the potential of car-sharing locations. However, researchers and car-sharing operators have often looked to census data to inform site-selection for new locations.

For example, Zipcar, one of the two main for-profit car-sharing operators in the US, used a minimum density threshold of 10,000 people per square mile. Zipcar's Mark Chase notes that the dense cores of cities, which are transit, bike, and pedestrian friendly, are important to car-sharing success (12).

Another example comes from Madison, WI, where a car-sharing feasibility study used census data to determine which neighborhoods to take forward for a market study (13). Researchers analyzed four variables at the census tract level based on a literature review:

- Percentage of workers commuting by non-auto modes
- Average vehicles per household
- Residential density
- Percentage of population aged 16-24

Initially, the 12 tracts with the highest percentages of workers commuting by non-auto modes were selected. All 12 tracts also had low vehicle ownership rates. Three were eliminated at the next stage, because they were located near the university campus and many younger residents would not be eligible for the service. While two of the remaining tracts were low density on average, they were retained since they incorporated high-density areas (13).

There is little information available, however, on how successful these tools have been in predicting the economic viability of car-sharing, at least partly for proprietary reasons. Density appears to have been the primary variable used to evaluate car-sharing potential – an intuitive choice, particularly given the volume of research linking density to transit viability and reduced car ownership (14, 15), but it has been unclear whether the same relationship holds for car-sharing.

Other Geographic Market Types

This paper focuses on urban neighborhoods where car-sharing has the best chances to succeed on a large scale, and make the greatest contributions to environmental and social objectives. However, it should be noted that there are other types of market settings

where car-sharing may be viable in some circumstances: university campuses, apartment buildings and small towns, for example. The preconditions for success in these environments are likely to be very different from those discussed in this paper. In less urban areas, for example, car-sharing is characterized by a high degree of member involvement, and programs are often volunteer-run. According to studies in Britain, the presence of a strong local champion is the most important ingredient for success, outweighing factors such as good public transportation (11).

ANALYSIS OF EXISTING LOCATIONS IN URBAN AREAS

A GIS-based analysis was undertaken to quantify the relationship between existing car-sharing supply (and by extension, demand) and neighborhood characteristics. The goal of this analysis was to develop a tool, including a set of guideline thresholds, to evaluate potential new car-sharing markets.

To begin to explain variations in car-sharing service, the amount of car-sharing – the level of service – that different neighborhoods can support was analyzed. The level of service concept is often used with other modes, such as automobiles and transit (16). For this study, a “car-sharing level of service” indicates the total amount of service – i.e., the number of car-sharing vehicles – in a given neighborhood.

Both the 1/4- and 1/2-mile radii were initially analyzed, and results were found to be similar. The 1/2-mile radius is typical for other transportation planning applications as a typical maximum walking distance for access to rail transit (2, 16), and is therefore used here. Car-sharing level of service is consequently defined as the number of car-sharing vehicles (regardless of operator) within a half-mile radius. In the example shown in Figure 1, the level of service for the location in the center of the circle is 10 because there are a total of 10 vehicles within one-half mile. Vehicle locations were obtained directly from car-sharing operators or from their websites in Fall 2004.

A range of variables from the US Census were considered as potential independent variables. Census data were analyzed for all 13 regions that had significant car-sharing operations at the time of data collection – Aspen, Boston, Chicago, Denver-Boulder, Los Angeles, Madison, New York, Philadelphia, Portland, San Diego, San Francisco, Seattle, and Washington DC. TCRP Report 108 recommends the following definition of car-sharing: “A membership program intended to offer an alternative to car ownership under which persons or entities that become members are permitted to use vehicles from a fleet on an hourly basis.” (4). The analysis in this paper uses this definition, with the caveat that it only includes programs open to the general public where information on vehicle locations is available via car-sharing operators’ websites.

FIGURE 1 Level of Service Calculation



Census data were obtained at the block group level for 16 variables (shown in Table 2) considered to have a potential influence on car-sharing viability, most of which are self-explanatory. The percentage of housing built before 1940 is an indicator of the age of the neighborhood, which often has implications for parking availability and street connectivity. Intersection density – the number of intersections per acre – is a function of block size, and is often used as an indicator of pedestrian friendliness (17).

Data for each block group were weighted based on the proportion of the area within the same 1/2-mile radius, using a standard script in the ArcGIS software. For full details on the methodology and analysis, see (4).

Regional Comparison of Household and Neighborhood Characteristics

Results indicate that car-sharing neighborhoods (i.e., the half-mile radius from a car-sharing location) in all 13 regions have distinctly different characteristics compared to their surrounding regions. Even the least dense car-sharing neighborhoods with the lowest transit usage still have higher densities and higher transit usage than the regional norm. Table 2 summarizes the results. Some of the main differences include:

- **Household size, composition and education.** One-person households are far more common in car-sharing neighborhoods. The presence of children is noticeably less

likely as well. Residents living in car-sharing neighborhoods are also far more likely to rent and hold a Bachelor's degree or higher.

- **Mode to work.** Residents in car-sharing neighborhoods are far more likely to take transit and walk to work, rather than drive, compared to their regional counterparts. The high mode share for walking is indicative of mixed-use development as well as a good pedestrian environment.
- **Vehicle ownership.** Residents of car-sharing neighborhoods own substantially fewer vehicles compared to the regional average, and are more likely to live without a car.
- **Neighborhood characteristics.** Car-sharing vehicles in most regions (Aspen, Chicago, Denver/Boulder, and Los Angeles are exceptions) tend to be located in older, historic neighborhoods, which are likely to be more walkable and have less off-street parking. Car-sharing neighborhoods also tend to have higher densities; in most regions they fall into the range of 7 to 25 units per acre.

Surprisingly, income was not a noticeable factor in the profiles of car-sharing neighborhoods in the 13 regions. On average, the percentage of high-income households within a car-sharing neighborhood is within 1% of the region-wide averages, but there are substantial variations between regions.

TABLE 2 Demographic and Neighborhood Characteristics

	Car-sharing Neighborhood Averages		Regional Average***	Difference
	<i>Vehicles Weighted Evenly*</i>	<i>Regions Weighted Evenly**</i>		
	1	2		
Demographics				
% 1-person households	51.8%	51.0%	27.2%	24.6%
% households with children	12.5%	12.5%	32.4%	-19.9%
% of rental households	71.5%	70.5%	39.6%	31.8%
% households earning > \$100,000	18.2%	16.7%	17.9%	0.3%
% with Bachelor's degree or higher	54.6%	52.4%	34.0%	20.6%
Commute Mode Share				
% drive alone to work	33.0%	39.3%	69.4%	-36.4%
% carpool to work	6.6%	6.7%	11.6%	-5.0%
% take transit to work	30.8%	23.7%	8.8%	22.0%
% bike to work	2.1%	3.1%	0.8%	1.3%
% walk to work	21.9%	21.1%	4.4%	17.5%
Vehicle Ownership				
% households with no vehicle	40.0%	34.7%	11.3%	28.7%
% households with 0 or 1 vehicle	82.0%	76.9%	46.0%	36.0%
Average vehicles per household	0.84	0.97	1.66	-0.83
Neighborhood Characteristics				
Housing units per acre	21.7	17.1	N/A	
Intersections per acre	0.37	0.34	N/A	
% units built before 1940	43.6%	34.9%	16.9%	26.7%

* Mean of data for all individual vehicles, meaning that car-sharing neighborhoods with more vehicles will be weighted more strongly.

** Mean of means for each car-sharing neighborhood

*** Mean of means for each region

Level of Service Correlation

A Pearson correlation analysis was performed with car-sharing level of service as the dependent variable, using the independent variables listed in Table 2. Table 3 summarizes the results. The analysis was conducted both for the data set as a whole, and for each region with a medium- to large-sized car-sharing operation (defined as 25 vehicles or more), giving a total population size of 940 vehicles. Almost all of the variables were found to correlate with level of service at a high level of statistical significance, although as expected given previous research (18) there are significant intercorrelations between the independent variables. Density, for example, correlates with nearly every other variable – negatively with variables such as drive-alone rates, and positively with variables such as one-person households and transit mode share.

For all the regions analyzed, level of service correlates negatively with drive alone to work and average vehicles per household – in other words, neighborhoods with lower drive-alone and vehicle ownership rates tend to have more car-sharing service. Level of service also correlated positively with households with zero to one vehicle and households with no vehicle. Other variables with consistent statistically significant correlations (negative or positive) with car-sharing level of service include the percentages of one-person households, households with children, and rental households; commute mode share for walking and carpooling; intersection density; and residential density.

As car-sharing level of service increases, so does the proportion of rental households, one-person households, households with low vehicle ownership, and transit and walking mode shares. Similarly, as level of service increases, the proportion of households with children, commuters who drive alone or carpool, and average vehicles per household decreases.

Given that most variables have a high degree of correlation, it is interesting to look at which do *not* correlate – either for the data set as a whole, or for certain regions. These variables include transit commute mode share, which correlated positively in most regions but not in Boston, New York, and Philadelphia. Income, education, bicycle commute mode share, and the percentage of units built before 1940 were other variables that did not have a consistent correlation with car-sharing level of service.

Of the different factors analyzed and found to have correlations with car-sharing level of service, vehicle ownership appears to have the strongest, most consistent relationship. Figure 2 is a scatter plot that shows the strong relationship between percent of households with zero to one vehicle and car-sharing success, with each region having a statistically significant correlation at the 1% confidence level. Each square represents one car-sharing location and each color represents a different region (New York is not included in this plot because it is a case unto itself with very low vehicle ownership rates).

Through multiple regression analysis, several models were tested for their ability to predict the level of car-sharing service for a neighborhood. (New York data were

excluded given extremely high densities and low vehicle ownership levels.) For the other twelve regions, the best model was found to use vehicle ownership rates combined with walk mode share.

$$\text{Level of service} = 11.305 - 6.564(\text{Vehicles}) + 0.00213(\text{Walk})$$

Where: “level of service” is the number of car-sharing vehicles with a half-mile circle; “vehicles” is average vehicles per household within the half-mile radius; and “walk” is the number of commuters who walk to work within the half-mile radius. Note that the “walk” variable is the absolute number (not a percentage) and thus subsumes some density effects.

For example, in San Francisco’s Hayes Valley, a pedestrian-oriented neighborhood commercial and residential district¹, average vehicle ownership is 0.68 vehicles/household and 4376 persons walk to work in the ½ mile radius. Predicted LOS is therefore $11.305 - 4.464 + 9.322 = 16$ vehicles – a healthy market for car-sharing, and about the same number existing as of Fall 2006.

The R squared value is 0.477. The relatively low predictive power may indicate that car-sharing is still a new concept, and has yet to reach market saturation in many neighborhoods. In Figure 2, for example, it can be seen that an exponential equation is likely to be the best-fitting form. There are many neighborhoods below the predicted potential (indicating scope to expand), but almost none above the predicted potential.

¹ The block group used here is Tract 162, Block Group 3. The number of people walking to work in the ½ mile radius is given by the number of people walking to work in the block group * $0.5^2\pi$, divided by the area of the block group.

TABLE 3 Pearson Correlation with Car-Sharing Level of Service

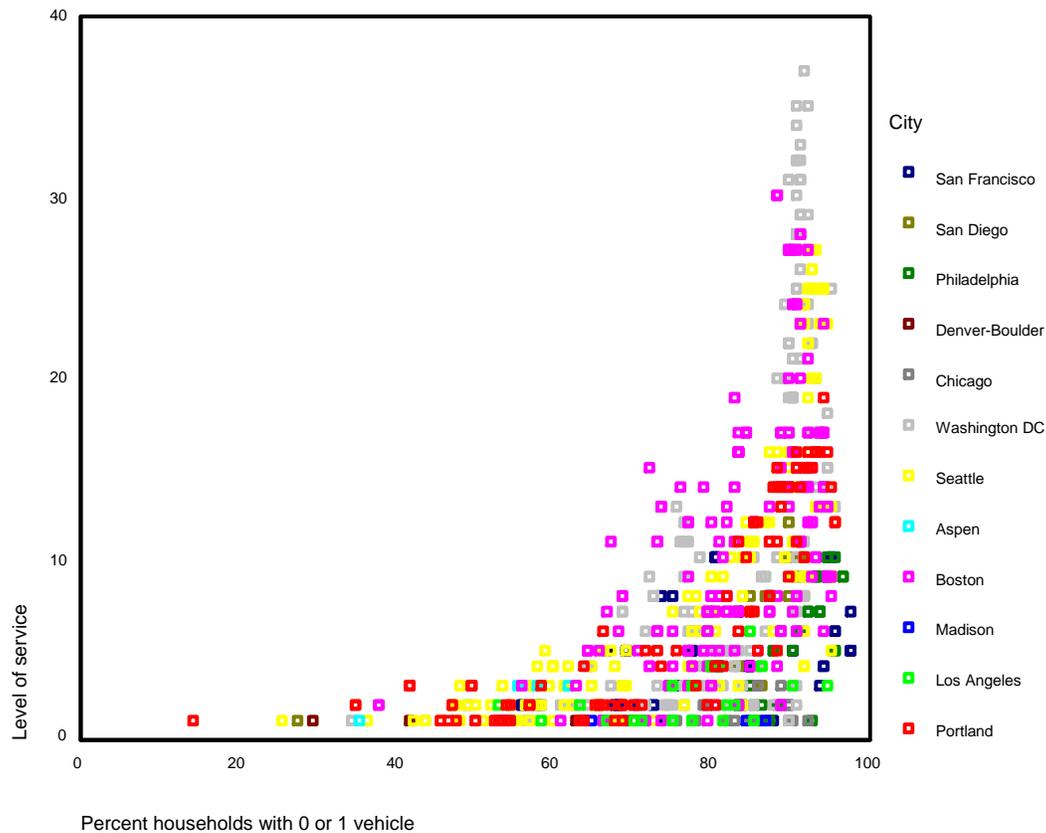
	Boston	Los Angeles	New York	P'delphia	Portland	San Francisco	Seattle	Wash. DC	All Regions
<i>Population size (no. of vehicles)</i>	201	28	118	30	91	72	134	219	940
% 1-person households	.619(**)	0.124	.699(**)	.679(**)	.822(**)	.236(*)	.758(**)	.441(**)	.478(**)
% households with children	-.548(**)	0.106	-.593(**)	-.627(**)	-.729(**)	-.552(**)	-.646(**)	-.303(**)	-.412(**)
% of rental households	.198(**)	0.317	.230(*)	.404(*)	.760(**)	.317(**)	.653(**)	.383(**)	.301(**)
% households earning > \$100,000	.356(**)	-0.15	0.148	0.145	-.308(**)	0.037	-.425(**)	-.308(**)	-.066(*)
% with Bachelor's degree or higher	.210(**)	-.483(**)	.381(**)	.573(**)	-0.028	-0.055	-.472(**)	-0.04	0.063
% drive alone to work	-.441(**)	-.620(**)	-.406(**)	-.627(**)	-.851(**)	-.480(**)	-.758(**)	-.653(**)	-.431(**)
% carpool to work	-.503(**)	0.338	-.414(**)	-.596(**)	-.715(**)	-.608(**)	-.708(**)	-.340(**)	-.363(**)
% take transit to work	0.033	.492(**)	0.043	-.626(**)	.607(**)	.477(**)	.277(**)	.198(**)	.104(**)
% bike to work	-.149(*)	-.425(*)	.202(*)	0.109	0.005	-0.046	-.318(**)	.688(**)	-0.003
% walk to work	.374(**)	0.337	.376(**)	.718(**)	.915(**)	.281(*)	.850(**)	.538(**)	.512(**)
% households with no vehicle	.427(**)	.661(**)	.551(**)	.667(**)	.902(**)	.361(**)	.832(**)	.681(**)	.399(**)
% households with 0 or 1 vehicle	.522(**)	.485(**)	.400(**)	.735(**)	.793(**)	.422(**)	.770(**)	.633(**)	.488(**)
Average vehicles per household	-.495(**)	-.620(**)	-.497(**)	-.722(**)	-.839(**)	-.405(**)	-.819(**)	-.680(**)	-.458(**)
Housing units per acre	.751(**)	-.445(*)	.379(**)	.843(**)	.636(**)	.656(**)	.671(**)	.890(**)	.174(**)
Intersections per acre	.374(**)	0.114	-.259(**)	.577(**)	.710(**)	.475(**)	.642(**)	.519(**)	.290(**)
% units built before 1940	.311(**)	-0.024	-.208(*)	-0.26	0.144	.583(**)	0.142	.475(**)	.223(**)

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Note: All Regions includes data for small regions not listed in the table: Aspen (4 vehicles); Chicago (18); Denver/Boulder (7); Madison (4); and San Diego (14).

FIGURE 2 Vehicle Ownership and Car-Sharing Level of Service



Key Indicators and Car-Sharing Thresholds

The results indicate that neighborhood and transportation characteristics are more important indicators for car-sharing success than neighborhood demographics. While car-sharing members tend to be highly educated (4), they may not live in neighborhoods where the population as a whole shares these attributes. Variables such as education and income might have explanatory power in some regions, but they do not consistently apply elsewhere.

On the other hand, variables such as commute mode split, household composition, and – in particular – vehicle ownership seem to be the best proxies for the types of neighborhoods where car-sharing succeeds. They indicate places where transit and walking are realistic alternatives, and where a car is not needed for everyday travel.

How can a current or would-be car-sharing operator, or a transit agency or other partner organization assess the types of neighborhoods where car-sharing may be viable? Some guidelines, based on the results presented above and additional regression plots, are shown in Table 4. The table shows two sets of services: low service, where car-sharing may be viable but where limited growth can be expected; and high service, where car-sharing is likely to flourish. These thresholds are not intended to be precise requirements

but rather guidelines to show approximate neighborhood characteristics that must be coupled with other considerations. There are certainly examples of successful car-sharing operations that do not meet these thresholds. However, together with other considerations such as support from partner organizations, the guidelines can help determine the likelihood of success.

TABLE 4 Thresholds for Car-Sharing Level of Service

	Level of Service	
	Low	High
Demographics		
% 1-person households	30%	40%-50%
Commute Mode Share		
% drive alone to work	55%	35%-40%
% walk to work	5%	15%-20%
Vehicle Ownership		
% households with no vehicle	10%-15%	35%-40%
% households with 0 or 1 vehicle	60%	70-80%
Neighborhood Characteristics		
Housing units per acre	5	5

Role of Density

The results of this analysis provide some conflicting suggestions about the overall importance of residential density. This variable is clearly important in some manner for car-sharing. It is an indication of the potential customer base for a car-sharing location and it also serves as a good proxy for the auto-orientation of a neighborhood. Holtzclaw et al. (18), for example, found that residential density served as the best predictor of vehicle travel, explaining 63-86% of the variation in vehicle miles traveled in San Francisco, Los Angeles, and Chicago.

However, the density levels for car-sharing neighborhoods are far below what might be expected from a review of other research. For example, 25% of car-sharing neighborhoods have a density of 8.5 households per acre or less. For comparison, single-family “sprawl” often clocks in at around three units to the acre, while San Francisco Bay Area data suggests that transit ridership increases noticeably at 10 households per residential acre (19). A threshold of 15-25 units per acre is often cited as a desirable minimum for transit-oriented development, while 4-6 units/acre appears to be the minimum for even basic hourly frequencies.

One explanation may be that many car-sharing locations are situated close to rail stations with large amounts of surface parking, which lowers gross densities, or are in mixed-use centers with lower residential densities but a large daytime population. Certainly, relatively high walking rates (22% on average for all car-sharing neighborhoods) suggests a predominance of mixed-use development. However, it is also possible that density is not as dominant in explaining car-sharing market settings as it is, for example, in the case of transit.

AUSTIN: ONE EXAMPLE OF HOW TO IDENTIFY NEIGHBORHOODS WHERE CAR-SHARING CAN SUCCEED

This section applies the methodology developed to assess the market potential for car-sharing to Austin, Texas, where Austin CarShare opened for business in 2006 (after completion, but independently, of this analysis). Austin also recently reduced its parking requirements in some neighborhoods for developments that incorporate car-sharing, as an incentive for car-sharing programs to set up in the city. The analysis in this section therefore provides both an example of how this methodology can be implemented in practice, and a “reality check” as to whether Austin is likely to provide a good market.

Census data for the six key variables were collected for all Census tracts in Austin. Each variable was tested to determine if it meets the threshold for minimum level of service and high level of service. Because vehicle ownership has a strong and consistent correlation with car-sharing level of service, special attention is given to the percent households with 0 or 1 vehicle.

Several neighborhoods in Austin meet the minimum thresholds for car-sharing service (see Figures 3 and 4). Downtown Austin, north of downtown near the University of Texas, and southeast Austin appear to be particular promising geographic markets for car-sharing, as they meet 5 or 6 of the criteria. These are older, dense neighborhoods that are well-served by transit, and thus intuitive candidates for car-sharing. Vehicle ownership rates are low (65-75% of households own 0 or 1 vehicle) in the downtown area and in a few neighborhoods in southeast Austin. Based on the guidelines established for low and high levels of service, car-sharing may be viable in these Austin neighborhoods. However, no census tract meets all of the criteria for high levels of service, largely because of relatively high vehicle ownership rates. Values for each variable for these tracts are listed in Table 5.

Interestingly, the University of Texas (tract 6.04) and Downtown (tract 11.00) were selected by Austin CarShare for its initial locations. The downtown tract meets all criteria except residential density (as might be expected by virtue of a downtown location), and the university tract all except (marginally) the drive alone commute mode share.

TABLE 5 Austin Census Tracts with Potential for Car-Sharing

Census Tract	% 1-person households	% drive alone to work	% walk to work	% households with no vehicle	% households with 0 or 1 vehicle	Housing units per acre
000500	52%	53%	19%	10%	64%	10
000601	61%	32%	49%	11%	65%	1
000603	53%	66%	16%	10%	62%	13
000604	48%	56%	24%	17%	67%	13
000700	54%	48%	21%	12%	74%	2
001100	63%	53%	10%	15%	73%	2
002304	32%	43%	1%	18%	70%	10

Numbers in **bold** meet thresholds for low level of service.

FIGURE 3 Austin Neighborhoods Meeting Minimum Thresholds for Car-Sharing Service

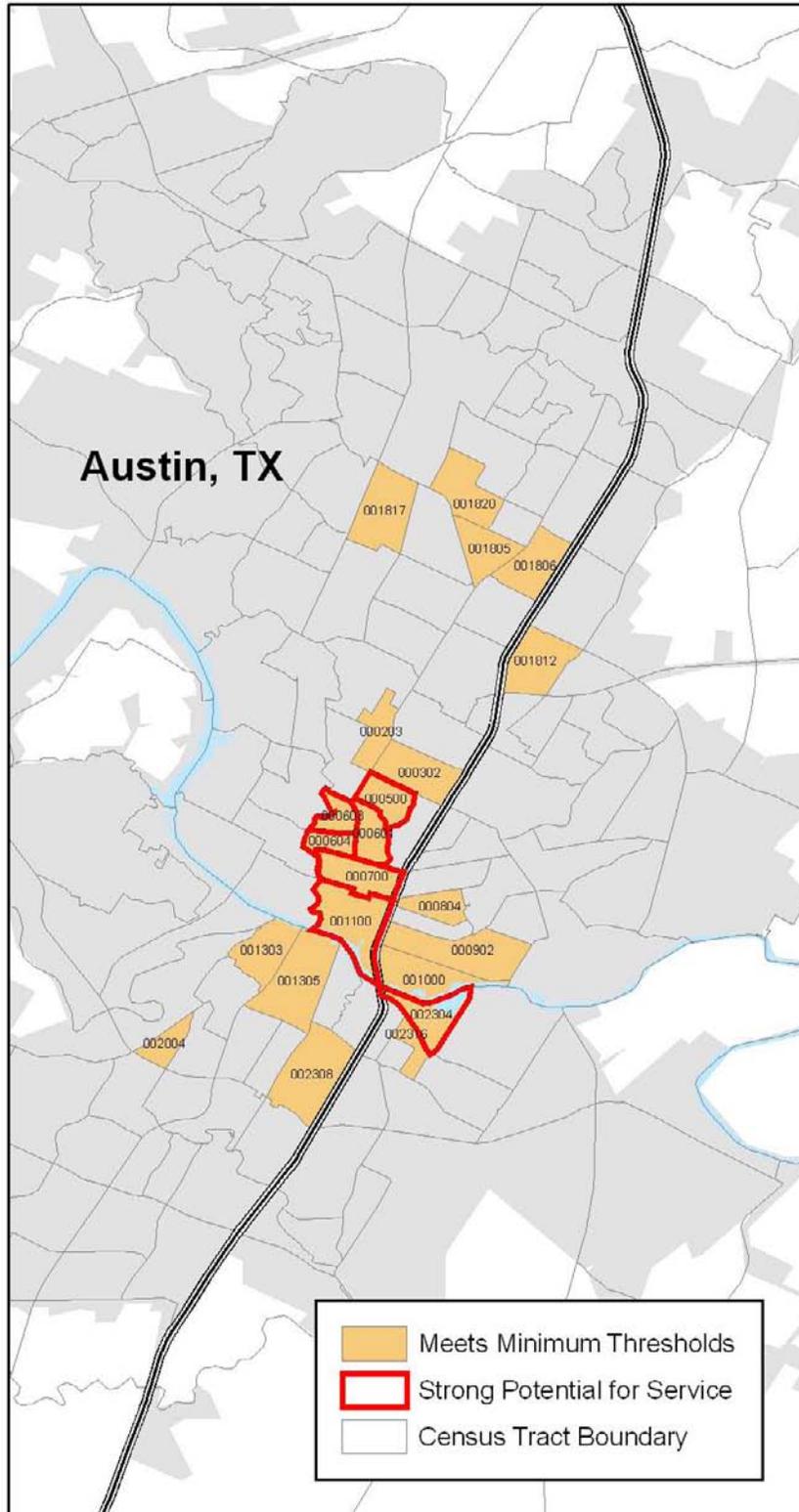
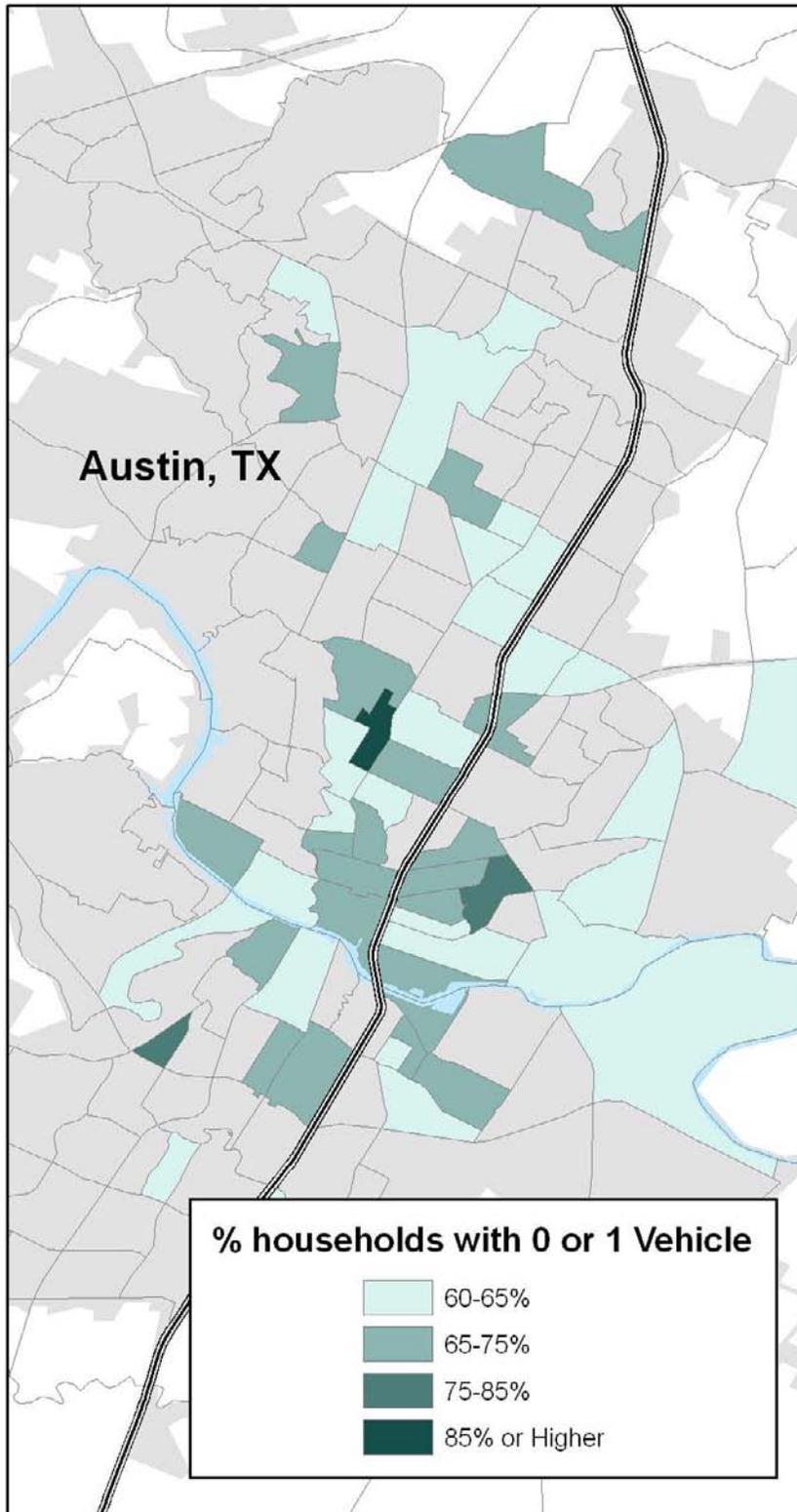


FIGURE 4 Vehicle Ownership Rates in Austin



CONCLUSION

Until now, there has not been a good tool to assess the market potential for car-sharing in any given neighborhood. Car-sharing planning has largely taken place through trial and error, without the benefit of quantitative guidelines for neighborhood characteristics that help sustain car-sharing.

This paper has outlined a tool, developed based on an analysis of 13 US regions, that can help assess the economic viability of car-sharing in urban neighborhoods. By analyzing the neighborhood characteristics of existing car-sharing locations, it can help to assess the market potential for car-sharing in different neighborhoods, so that current or would-be car-sharing operators, transit agencies, or other partner organizations can use this as one factor in determining whether car-sharing is likely to flourish in the neighborhood.

This tool can also be of value in existing markets, through informing the negotiations between partner organizations and car-sharing operators. Transit agencies, for example, might want operators to place car-sharing vehicles at numerous suburban stations, which may or may not represent profitable markets. The analysis here can help them independently assess the potential for car-sharing, without having to solely rely on the judgment of the operator.

In several instances, car-sharing will expand to a new community with relatively little effort on the part of partner organizations. For example, HOURCAR launched in Minneapolis-St Paul in 2005 as a grassroots effort, and Flexcar opened for business in Atlanta in 2006. Flexcar and Zipcar have publicly stated their desire to expand in the coming years, having broken even in their core markets and attracted fresh injections of venture capital and investor funding. Most communities, however, will need to be more proactive if they are to achieve a desire to have car-sharing as a local transportation option.

In some instances, it may be appropriate to issue an RFP, particularly if it is tied to a significant amount of support from partner organizations. In other cases, it may be preferable to work directly with an operator or community group. The choice of model will often be dictated by practical concerns. The amount of support that can be offered, interest from private operators, and the capacity of local community organizations may determine whether car-sharing becomes a public-private partnership or a grassroots effort. However, some partners make a conscious choice in this regard. In Seattle, King County Metro wanted a for-profit provider to bring private capital to the table. SEPTA in Philadelphia, in contrast, was keen to see a non-profit operator that would be more likely to pursue goals directly aligned with those of the transit agency.

Certainly, car-sharing is a niche product, and has only been proven viable in a limited range of urban settings. The aspirations of partner organizations need to be tempered by realism, and Table 6 provides a simple checklist that can help in assessing the viability of a program.

TABLE 6 Establishing Car-Sharing – A Checklist

✓	Does the community have neighborhoods with the right characteristics to make car-sharing viable? Are there neighborhoods with low auto ownership and use, where walking and transit are viable transit options?
✓	Are there established Transportation Demand Management programs in which car-sharing can be inserted, or other ways to recruit business members?
✓	What is the depth of interest in car-sharing from different types of partners?
✓	Is there a high-level champion with a strong commitment to car-sharing?
✓	Are there community groups that have shown interest in starting a car-sharing program, and have the capacity to get a project off the ground?
✓	What incentives can partners provide for a commercial operator, such as start-up funding, marketing, zoning changes and parking provision?
✓	Is there an anchor member , such as a city or business that wishes to replace its vehicle fleet with car-sharing, that can provide guaranteed baseline usage?

The potential extent of car-sharing has yet to be fully explored. At the time of writing, car-sharing in the United States has been around for less than eight years, and programs are still expanding at a rapid pace. Car-sharing is here to stay, but little can be said with any confidence about its ultimate reach. Much learning will take place through experimentation by car-sharing operators and their partners, and through trial and error. This collective experience, in turn, will provide the only definitive answer to how and where car-sharing succeeds, and how it can help achieve a community’s environmental, social and economic goals.

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