CARSHARING IN NORTH AMERICA:
MARKET GROWTH, CURRENT DEVELOPMENTS, AND FUTURE POTENTIAL

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ABSTRACT

Carsharing provides members access to a fleet of autos for short-term use throughout the day, reducing the need for one or more personal vehicles. Over ten years ago, carsharing operators began to appear in North America. Since 1994, a total of 40 programs have been deployed—28 are operating in 36 urban areas, and 12 are now defunct. Another four are planned to launch in the next year. This paper examines carsharing growth potential in North America, based on a survey of 26 existing organizations conducted from April to July 2005. Since the mid-1990s, the number of members and vehicles supported by carsharing in the U.S. and Canada continues to grow, despite program closures. The three largest providers in the U.S. and Canada both support 94% of the total carsharing membership. Growth potential in major metropolitan regions is estimated at 10% of individuals over the age of 21 in North America. While carsharing continues to gain popularity and market share, the authors conclude that increased carsharing education, impact evaluation, and supportive policy approaches, including mainstreaming carsharing as a transportation strategy, would aid the ongoing expansion and development of this alternative to private vehicle ownership.

KEYWORDS: Carsharing, markets, policy

INTRODUCTION

Auto ownership is widespread in North America. In 2001, 92.1% of U.S. and 78.2% of Canadian households owned at least one vehicle (*1, 2*). Over 60% of U.S. and 36% of Canadian households owned two or more vehicles (*3, 2*). Not surprisingly, transportation represents the second and third largest consumer expenditures in the U.S. (19.1%) and Canada (13.66%), respectively (*4, 5*). With auto ownership and fuel costs rising, individuals are seeking alternatives to private vehicle ownership. Short-term auto rentals or carsharing programs—through hourly rates and subscription-access plans—provide such an alternative, especially for individuals living in major urban areas, households with one or more vehicles, and those with access to other transportation modes, such as transit and carpooling.

The principle of carsharing is simple: Individuals gain the benefits of private vehicle use without the costs and responsibilities of ownership. Instead of owning one or more vehicles, a household or business accesses a fleet of shared-use autos on an as-needed basis. Individuals gain access to vehicles by joining an organization that maintains a fleet of cars and light trucks in a network of locations. Generally, participants pay a fee each time they use a vehicle (*6, 7*). Carsharing became popularized in Europe in the mid- to late-1980s. At present, nearly 300,000 individuals belong to carsharing organizations worldwide. Since 1994, a total of 40 programs have been deployed in North America—28 are operating in 36 urban regions, and 12 are now defunct. Another four are planned to launch in the next year.

Common goals among North American carsharing organizations, include: 1) reducing congestion and auto ownership; 2) providing cost savings since customers pay per use, sharing the costs of the vehicle lease, maintenance, repair, and insurance; 3) reducing emissions by lowering overall vehicle miles/kilometers traveled and employing clean fuel vehicles (e.g., gasoline electric-hybrid cars); 4) facilitating more efficient land use (e.g., carsharing reduces the number of parking spaces needed); and 5) increasing mobility options (e.g., low-income market segment) and connectivity among transportation modes.

This paper provides an overview of North American carsharing growth, market developments, and future potential. From April to July 2005, the authors surveyed 26 of 28 existing operational programs in North America to collect data on market developments. All 28 organizations provided current membership, vehicle, and technology use data for this paper. One hundred percent of U.S. carsharing organizations participated in our market development survey (n=17). Nine of 11 existing Canadian organizations participated, yielding an 81.8% response rate. Organizations were surveyed by a combination of mail questionnaires and telephone interviews. In addition, researchers also updated data from each organization's web site, when available. Many organizations did not complete all questions in the survey due to proprietary issues or uncertainty. We have supplemented the survey data with expert interviews and a literature/Internet review.

This paper includes five main sections. The first is an overview of carsharing impacts, with an emphasis on North American understanding. Second, the authors provide an overview of carsharing market growth in North America in which organizational dynamics, total membership and vehicle trends, and business models are explored. Third, the authors discuss current and future market developments, including demographic markets served, rate structures, insurance, and technology. Next, the authors provide a synopsis of carsharing policy approaches and conclude with a summary of key observations.

OVERVIEW OF CARSHARING IMPACTS

A number of social and environmental benefits are commonly associated with carsharing, supported by an increasing body of empirical evidence. However, differences in data collection and study methodology frequently produce inconsistent results, often with limited samples, which make it difficult to estimate carsharing effects. Thus, ongoing impact evaluation research is recommended.

The impacts of carsharing can be categorized into transportation, environmental, land-use, and social effects (*8, 9, 10*). A major impact of carsharing on the transportation system is a reduction in vehicle ownership. Canadian studies and member surveys suggest that between 15 to 29% of carsharing participants sold a vehicle after joining a carsharing program, while 25 to 61% delayed or had forgone a vehicle purchase (*11, 12, 13*). U.S. studies and surveys indicate that between 11 to 26% of carsharing participants sold a personal vehicle, and between 12 to 68% postponed or entirely avoided a car purchase (*14, 15, 16*). Furthermore, U.S and Canadian data reveal that each carsharing vehicle removes between 6 to 23 cars from the roads (*13, 14, 17, 18*). According to recent European studies, a carsharing vehicle reduces the need for 4 to 10 privately owned vehicles (*19*). Location-specific variations are likely to result in differences in this impact measure. A reduction in vehicle ownership, in turn, is likely to result in fewer vehicle miles or kilometers traveled (VMT/VKT), reduced traffic congestion and parking demand, and an increase in the use of public transportation and other transport modes (such as biking and walking) in lieu of car travel (*10, 20, 21*). VMT/VKT reduction data range from as little as 7.6% to as much as 80% of a member's total VMT/VKT in Canada and the U.S. Estimates differ substantially between members that gave up vehicles after joining a carsharing program and those that gained vehicle access through carsharing (*14, 17, 22, 23*). The authors calculate an average reduction of 44% in VMT/VKT per carsharing user across North American studies. European studies also indicate a large reduction in VKT, between 28 to 45%. Carsharing also induces lower VMT/VKT by emphasizing variable driving costs, such as per hour or mileage charges.

Furthermore, reduced vehicle ownership and VMT/VKT lower greenhouse gas (GHG) emissions, as trips are shifted to transit, biking, and walking. In Europe, carsharing is estimated to reduce the average user's carbon dioxide emissions by 40 to 50% *(19)*. In addition, many carsharing organizations include low-emission vehicles, such as gasoline-electric hybrid cars, in their fleets (*12, 23, 24*). Carsharing members also report a higher degree of environmental awareness after joining a carsharing program (*21*).

Finally, carsharing also shows evidence of beneficial social impacts. Households can gain or maintain vehicle access without bearing the full costs of car ownership (*10, 25*). Depending on location and organization, the maximum mileage up to which carsharing is cost-effective—in comparison to owning or leasing a personal vehicle—lies between 10,000 to 16,093 kilometers (*24, 25, 26*). Low-income households and college students can also benefit from participating in carsharing (*8*).

CARSHARING MARKET DYNAMICS: NORTH AMERICA

North America began to experiment with carsharing in the early 1980s through two demonstration programs: first, Mobility Enterprise, a Purdue University Research project; and second, the Short-Term Auto Rental (STAR) initiative in San Francisco. After the entry of these two programs in 1983, and their subsequent exit in 1985 and 1986, respectively, it was not until 1994 that carsharing reemerged with the launch of Auto-Com (later CommunAuto), followed in

1997 by Cooperative Auto Network and Victoria Carshare Coop in Canada and Dancing Rabbit Vehicle Cooperative in the U.S. (*6*). By 2001, the U.S. claimed 14 carsharing organizations and more than 5,000 members, and Canada claimed ten programs and nearly 3,800 members. Since then, this developing industry has continued to expand. This section of the paper examines the following developments: number of organizations, membership and vehicle trends, member-vehicle ratios, and business models.

Number of Organizations

There was a notable jump in the number of organizations in both the U.S. and Canada, which occurred between 1999 and 2001. Since 2001, the number of organizations in Canada and the U.S. has somewhat stabilized (See Figure 1, below).

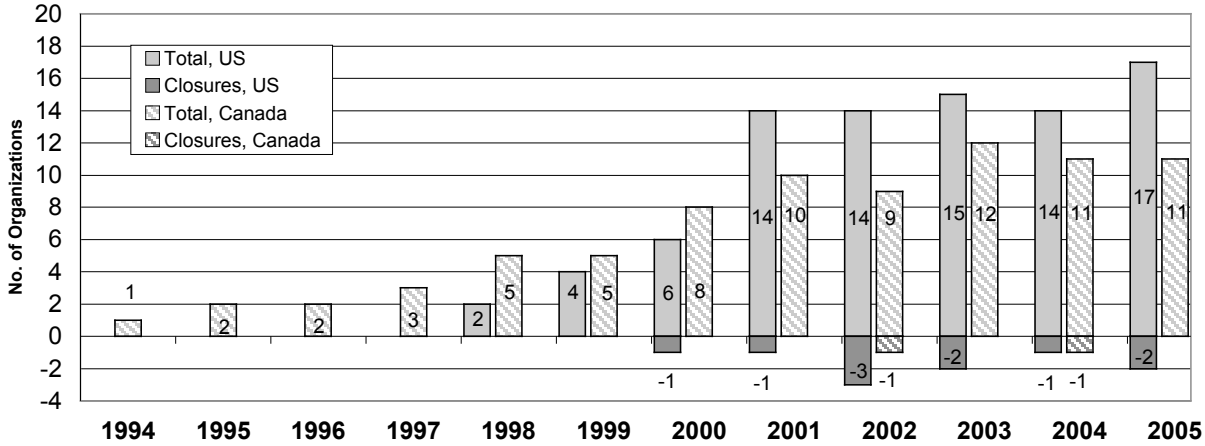

FIGURE 1 Total number of organizations & closures in U.S. and Canada.

Canada, which currently hosts 11 organizations, has experienced fewer closures than the U.S. The U.S. market, which now has 17 organizations, has experienced a greater total number of new entrants and closures. The sunset of six research and/or limited electric vehicle deployments explains over half of U.S. closures. The remaining closures reflect one merger in the U.S. and five closures (3 in the U.S. and 2 in Canada) among smaller organizations that lacked sufficient staff and users.

U.S. startup activity peaked in 2001, with nine programs. Since 2001, organizational launches in Canada and the U.S. have fluctuated between zero and five total each year. This likely reflects some barriers to entry for new entrants, including first-to-market advantages and economies-of-scale for existing programs (*8*). Not surprisingly, the capability of larger operators to expand to new regions may deter startups considering large urban markets, at least those pursuing more traditional carsharing markets, such as neighborhood residential, in the future.

More direct competition among operators—similar to the Washington, D.C. area where two programs now provide carsharing services—seems more likely in the near future in several geographic regions, including Portland, San Francisco, and Seattle. Indeed, one large American operator has announced plans to enter several major metropolitan markets, many of which are already served by other operators. This trend could ultimately lead to some program mergers, which has previously occurred in Europe.

Total Membership and Vehicle Trends

Between July 2004 to 2005, growth rates in membership and vehicles continued to slow in both the U.S. and Canada. See Figure 2, below. (Note that data in each figure reflect July of each year.) Membership in the U.S. rose by 46%, making 2005 the first year that the U.S. carsharing market has not at least doubled in membership size. Carsharing membership in Canada increased by 19.5%, down from 42.5% growth the previous year. In decline since 2001, U.S. vehicle growth was approximately 30% in 2005; Canadian vehicle growth dropped to 15%. It is important to note that the three largest operators in both Canada and the U.S. are responsible for the majority of growth (i.e., 94%). Furthermore, membership totals are likely to reflect double counting in some cases (e.g., a member who participates in business and personal carsharing may be counted twice in an organization's estimates).

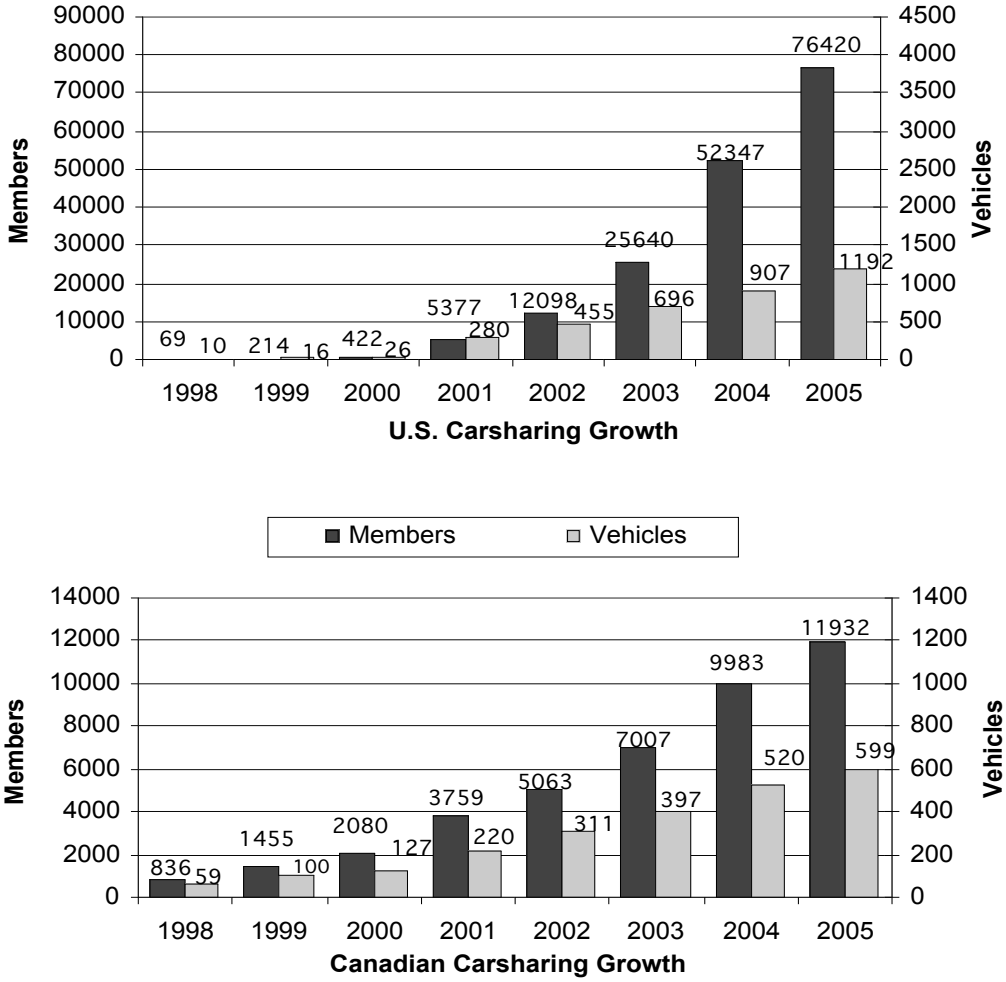

FIGURE 2 U.S. and Canadian carsharing growth, 1998-2005.

Member-Vehicle Ratios

The effect of vehicle growth rates slowing more than membership growth is higher member-vehicle ratios. Rather than an industry dynamic, this appears to be a business strategy (e.g., increasing vehicle use/profitability and attracting investors), particularly among the largest U.S. operators. As of July 2005, the member-vehicle ratio of the five largest U.S. organizations was 66:1, whereas the remaining U.S. carsharing programs had a member-vehicle ratio of 20:1. Due to the large membership of the five biggest programs, the overall average U.S. ratio was 64:1. The dynamic around member-vehicle ratios is noticeably different in Canada. The average member-vehicle ratio was 20:1 in July 2005, and even the three largest Canadian organizations had member-vehicle ratios that ranged from 19:1 to 24:1.

Higher U.S. member-vehicle ratios may be explained in part by more limited membership requirements (i.e., few organizations require deposits and only one third collect monthly dues). Fourteen of 17 U.S. programs, including the two largest, do not require deposits; deposits range from US$100 to $350 for the three operators that collect them. Nine of 17 U.S. programs have one-time membership fees (ranging from US$25 to $115, and US$400 for a one time buy-in/membership fee in the case of one program). Thirty-three percent of U.S. programs charge monthly fees, ranging from US$10 to $20. Three programs collect annual fees, ranging from US$35 to $100.

In contrast to the U.S., nine of 11 Canadian organizations, including the two largest, require deposits; deposits range from CA$300 to $500 per member and are typically higher than U.S. program deposits. Two Canadian programs charge one-time membership fees of CA$400 and $500. Presumably, high deposits require a greater commitment to join or subscribe to a carsharing program.

Forty-five percent of Canadian organizations charge monthly dues, typically ranging between CA$10 and $25. Thus, monthly dues are more frequent among Canadian programs. Higher membership costs, along with good transit access, may lead to more consistent and intensive vehicle use among members, generating more revenue for the organization and ultimately limiting the number of customers that can be served by a single vehicle. While monthly fees may not represent as great a commitment to carsharing membership as high deposits, these fees can also act as a screening mechanism to limit inactive members in both the U.S. and Canada. No Canadian program charges an annual membership fee.

Finally, vehicle ownership rates are higher in the U.S. than in Canada—over 60% of U.S., and 36% of Canadian households own two or more vehicles (*3, 2*). Thus, vehicle ownership may affect how carsharing is integrated into households in Canada and the U.S. For instance, carsharing may be more likely to serve as a household's primary vehicle (or supplement to a one-vehicle household) among Canadian members. Although carsharing has been shown to reduce vehicle ownership (*8*, *11, 14, 19*), particularly when coupled with good transit access, the proportion of households with one or more vehicles that subscribe to carsharing may be growing in the U.S. In this case, the U.S. market could be serving a greater number of households with higher auto ownership rates and ultimately more individuals per carsharing vehicle on average. In the future, high U.S. member-vehicle ratios may stabilize or become lower in key geographic markets, when coupled with greater vehicle penetration (i.e., a denser network of lots and more vehicles per lot). With increased saturation, members may gain confidence in vehicle availability and perceived convenience and ultimately increase use.

Business Models

There are two main carsharing business models: 1) for-profit and 2) non-profit, which include cooperatives. In the U.S., while only 29% of the organizations operate as for-profits (5 of 17), these organizations accounted for 90% of the membership and 83% of the fleets deployed. Similarly in Canada, while only 18% of the organizations are for-profit (2 of 11), these accounted for 78 and 76% of the membership and vehicles deployed, respectively. In summary, while there are many more non-profit carsharing operators in the U.S. and Canada, these operators account for a minority of the North American carsharing members and fleets deployed. Although for-profits account for the majority of carsharing members and vehicles, the more growth-oriented programs in Canada and the U.S. (i.e., the top four programs in each nation) are split between for-profit and non-profit models.

CURRENT AND FUTURE MARKET DEVELOPMENTS

Based on the authors' survey of existing North American organizations, carsharing membership growth potential in major metropolitan regions is estimated by respondents at 6.9% of individuals over the age of 21 in Canada (n=8) and 12.5% in the U.S. (n=13). Note that the minimum age requirement for most carsharing organizations in North America is between 21 and 25. Thus, growth potential could exceed these projections, if programs begin to serve individuals of 18 to 21 years of age (e.g., college market). This section of the paper examines existing and future demographic markets, profitable locations, rate structures, insurance, and technology. Note that survey respondents did not answer every question.

Existing and Future Demographic Markets

Demographic markets are defined as the primary groups or markets served by carsharing, including neighborhood, business, college, low income, and commuter. Over 82% of U.S. and 100% of Canadian carsharing survey respondents provided estimates of their existing demographic markets based on membership. Researchers supplemented these data for the remaining organizations (n=6) by consulting program websites and industry experts. All program market-segment estimates were weighted by number of members per organization for the entire North American market. Neighborhood residential was the staple demographic market in the U.S. and Canada, accounting for 81.7 and 96% of their existing membership, respectively. (See Figure 3, below.) Other existing segments tended to represent a greater share of the total U.S. market than in Canada, including: 12.3% business, 4.6% college (age 21 and over), 1.3% low income, and 0.1% commuter.

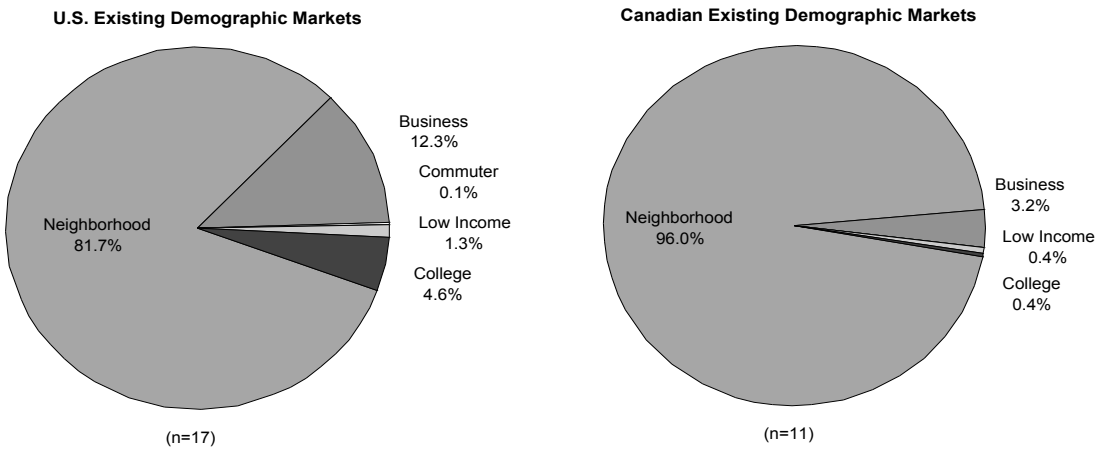

FIGURE 3 U.S. and Canadian demographic markets.

Respondents were also asked to project into the future. Sixty-five percent of U.S. (n=11) and 73% of Canadian survey respondents (n=8) provided future estimates. Responses were treated as market opportunity opinions and averaged across organizations. In five years, U.S. and Canadian organizations forecast that the majority of their demographic markets will still consist of neighborhood residential, but this segment will represent a smaller proportion of the total market due to greater diversification (e.g., business customer growth in the U.S. and Canada). In the U.S., business and college markets are projected to increase in market share to an estimated 22 and 23%, respectively. U.S. organizations also forecast small but growing low-income, commuter, and older adult community markets.

In Canada, neighborhood residential is expected to decrease in market share to 80%. Most of the remaining share will be captured by growth in the business market, which is expected to expand to between 10 to 15% of the total market.

Rate Structures

Approximately 83% of North American survey respondents (n=23) stated that either profit or cost recovery was a principal factor in selecting their current rate structure. As part of their pricing, Canadian operators much more frequently emphasize mileage as the primary cost basis, whereas this is practiced less frequently in the U.S. For instance, ZipCar, I-Go, and Community Car all provide varying amounts of free mileage either per reservation or hourly usage. Flexcar now provides an unlimited number of miles in the hourly charge of its vehicles.

This analysis includes membership dues, rates, and mileage for all rate plans of 25 North American organizations, not including two U.S. university research programs and one organization, which currently provides free service. Since deposits represent a potential barrier to membership rather than actual usage fees, they were excluded from this analysis. Data were obtained from the Internet or through personal communication with organizations. Rates have been adjusted to U.S. dollars, using a 1.24603 exchange rate.

As Figure 4 (below) indicates, the average rates for equivalent distance and time of use in the U.S. and Canada differ significantly. Carsharing charges in the U.S. increase substantially over the time a vehicle is used. This echoes a key difference between U.S. and Canadian rates:

the U.S. tends to charge higher hourly rates, sometimes bundled with "free miles," whereas Canada has a tendency to charge lower hourly rates with little or no "free miles."

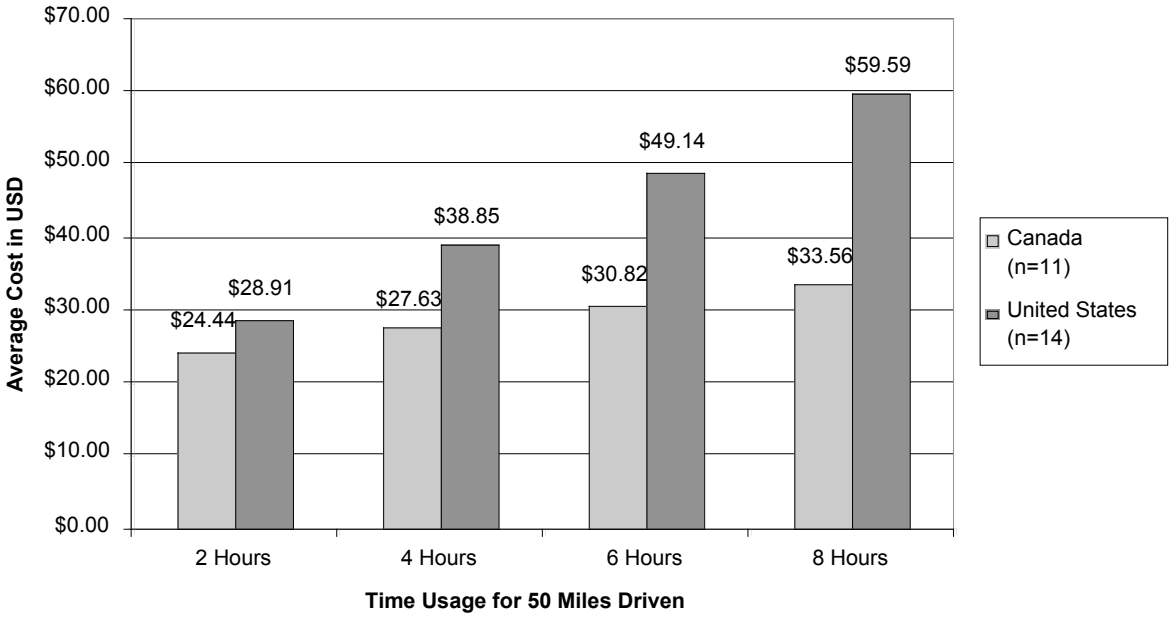

FIGURE 4 How changing time of vehicle use affects U.S. and Canadian rates.

Overall, Canadian rates tend to be substantially lower than their U.S. counterparts, particularly after two hours of use. While the scenario in Figure 4 more accurately reflects typical carsharing use, the rate differential between the U.S. and Canada is somewhat smaller for the same hours of use and higher mileage (e.g., 200). This is likely attributable to a few factors, including lower insurance costs and more uniform compact fleets in Canada. While crude oil is cheaper in Canada, Canadian fuel taxes make the "pump" cost higher than that in the U.S. Given higher fuel costs and a strong motivation to reduce mileage and GHG emissions among numerous Canadian operators, it is not surprising that Canadian programs charge more per kilometer driven on average.

Insurance

Vehicle insurance continues to be a major industry obstacle in recent years. Following the terrorist attacks of 9/11, North American organizations were confronted with the challenge of higher insurance premiums (*10*). At present, insurance premiums remain high for numerous North American carsharing operators.

Only two out of nine U.S. survey respondents indicated that they had changed their insurance carriers within the last six months. (Two new U.S. organizations launched within the last six months.) Similarly, just one out of nine Canadian survey respondents had changed insurance carriers within the last six months. This organization indicated shifting from third-party to self-insurance as a method of reducing costs. North American organizations were also asked whether finding insurance was an ongoing problem. Answers differed sharply between the U.S. and Canada, with 53% of U.S. respondents (n=15) indicating that finding insurance was an ongoing problem in contrast to just 22% percent of Canadian organizations (n=9).

Carsharing insurance is estimated to cost over $2,500 per vehicle per year. There are several ways in which carsharing providers can reduce insurance costs: 1) lowering insurance liability limits by decreasing the maximum amount that an insurance carrier is required to pay in case of an accident; 2) self-insurance; 3) increasing the number of vehicles to enter a group insurance pool; 4) increasing deductibles; 5) covering fewer loss categories (e.g., theft); and 6) shifting more loss of risk to members.

In the carsharing industry, U.S. organizations typically carry $1 million in single limit (per accident per claim) liability insurance. Some organizations have reduced this limit to $300,000, an amount more typical of personal automobile rather than fleet insurance. Some organizations may confront higher coverage thresholds, however, due to partner regulations (e.g., a partner transit agency requires minimum liability coverage beyond that of a carsharing operator). Lowering insurance costs through self-insurance of vehicle damage was also observed among a number of U.S. organizations. Another strategy for reducing insurance costs is the formation of a carsharing affinity group—an insurance pool that provides coverage at a discounted rate to members (Dave Brook, unpublished data, July 2005).

Over 80% of 23 survey respondents indicated that they would consider group insurance with other carsharing providers. Only two organizations indicated that they would not consider group insurance, while two other respondents were uncertain (n=4). Two out of the four were larger U.S. and Canadian organizations that did not express difficulty finding an insurance carrier. Two of the four also indicated that some provinces, such as British Columbia, provide the option of public sector and self-insurance. The majority of U.S. and Canadian respondents have found it a challenge to identify affordable insurance for a growing younger driver market (i.e., individuals under the age of 21). Planned organizations eager to enter into the college market shared this sentiment. A few strategies have been designed to permit entry into the college student carsharing market. For example, Boulder CarShare self-insures younger drivers, charging $250 per each year a driver is under age 25. At Zipcar's Wesley College location, the college provides insurance to student drivers through their liability policy.

Another potential solution is for the insurance and carsharing industries to partner, providing a mechanism for students to maintain insurance coverage on their parents' policies. The latter method is similar to rental car insurance in that a rental company maintains state minimum liability insurance, but the renter must provide their own personal auto insurance or purchase additional liability insurance to rent a vehicle. In fact, one rental car company now offers hourly rentals to student drivers at Stanford University under the condition that they provide their own insurance coverage. This service, however, is priced at a rate significantly higher than typical carsharing charges (*20*).

Technology

Technology plays an important role in North American carsharing. Electronic and wireless technologies have been used to address the challenges of vehicle security, maintenance, and service quality. Increasingly, carsharing programs are purchasing technology (e.g., reservations/billing, vehicle-access systems) from specialized vendors or licensed products from Zipcar, Flexcar, or Cooperative Auto Network.

Researchers obtained technology information on all 28 carsharing programs through the Internet and expert interviews. Thirteen North American organizations now employ advanced operations (i.e., automated reservations, integrated billing, and advanced vehicle-access systems). Only 11.5% of North American programs continue to use manual operations, whereas three years ago 37.5% operated manually (*27*). Partially automated systems (i.e., automated

reservations via touch-tone telephone/Internet) are more predominant in Canada (73%), while advanced systems are more common in the U.S. (70%). North American organizations credit advanced technologies with lower costs, faster billing, and enhanced consumer experience.

Recent technology trends include: 1) instant reservation capabilities (i.e., a few minutes before a trip) and 2) "vehicle class reservations," which are also known as anonymous pods (i.e., when a user does not reserve a specific vehicle from a lot but rather a class of vehicle). In our survey, 55% of respondents (n=20) reported considering or offering instant reservations. Thirty percent of respondents (n=20) have considered or currently support vehicle class reservations.

To supplement our survey, the authors interviewed five major technology vendors (Metavera, INVERS, EngineGreen, Vetronix, and ETL) regarding future innovations. Most backend providers interviewed reported making advances that allow better software-hardware integration and greater ease-of-setup for carsharing (Metavera, EngineGreen, Vetronix, unpublished data, July 2005). In the near future, two vendors believe that carsharing operators are not likely to introduce innovative features (e.g., one-way rentals, ridesharing) due to added management complexities; nevertheless, providers interviewed do offer some technical support for the customization of novel carsharing features, such as pre-paid usage cards.

CARSHARING POLICY APPROACHES

In this section, the authors summarize the findings of a broad literature review, Internet investigation, and expert interviews on existing and proposed carsharing policy approaches. We identified an array of supportive carsharing policies that range from encouraging carsharing organizations to deploy/expand services in new or untested markets (risk sharing) to promoting the incorporation of carsharing in new and existing developments. (See Table 1, below.) These policies have also been augmented by a variety of U.S. federal funding sources, including the Federal Highway Administration, primarily Congestion Mitigation and Air Quality (CMAQ); the Federal Transit Authority, mainly Job Access Reverse Commute (JARC); and the Environmental Protection Agency. Municipal and non-profit funding has also been used to provide startup grants, loans, and lines of credit in the U.S. and Canada (*28, 29*). In addition to sales taxes, which are already paid by some carsharing members, 2005 marks the first year in which members of two carsharing programs are required to pay a municipal/state "user tax" (annual and usage) that classifies carsharing categorically with car rentals.

The majority of policy approaches were observed in the U.S. and in locations where carsharing has existed the longest and supports the largest memberships. There are a few instances in which supportive policies have preceded carsharing operations (e.g., Austin, Texas). In addition, the university market has mirrored many of the same policy trends, often incorporating a combination of approaches, including: free or discounted parking, membership subsidies, transit discounts, risk sharing, and fleet reduction.

While developer/zoning/building policies are increasingly popular in promoting carsharing partnerships, there is presently more activity with existing developments (i.e., property managers). This is not surprising as it often takes several years to establish a new development. Carsharing approaches with property managers can be characterized as follows: 1) open-door (i.e., when a vehicle is placed in an apartment complex or parking garage but is available for use by all carsharing members); and 2) closed-door (i.e., when a vehicle is placed in a limited-access location, such as a gated apartment complex, and is only available to members of those communities). While open-door carsharing has historically been more prevalent in new/existing developments in North America, the industry may support more closed-door

applications in the future, as property managers share risk in vehicle placement (e.g., the "subtraction model," see Table 1).

Looking to the future, carsharing is likely to be used increasingly as a fleet management tool for public agencies (e.g., *30*), although it is unclear whether this will replace entire fleets or maximize efficiency through managing peak motor pool demand. University applications are also likely to gain popularity, particularly if insurance can be cost-effectively obtained for younger drivers. As carsharing becomes more mainstream, existing policies may need to be reevaluated. For instance, on-street parking spaces may no longer be available to an organization for free. Additionally, as carsharing becomes more competitive in more locations, case-by-case approvals will likely be codified to ensure fair practices among competing enterprises.

TABLE 1 Carsharing Policy Approaches

Automakers In California, automakers are eligible for additional zero emission vehicle (ZEV) credits for placing qualifying low-emission vehicles into carsharing applications linked to transit (*31*).
Developers & Zoning Regulations In the U.S. and Canada, there are many policies aimed at easing zoning regulations and encouraging carsharing in new developments. Municipalities support the vast majority of these policies, with only a few at the county and state levels. These policies can be categorized as follows: 1) parking reduction (i.e., downgrading the required number of spaces in a new development) (*32*); 2) parking substitution (i.e., substituting general use parking for carsharing stalls) (*33*); 3) trip reduction (i.e., reducing vehicle and single-occupant vehicle trips) (*34*); and 4) allowing greater floor area ratios (FARs) (i.e., developers can build more densely on a site) (*20, 35*). While the majority of parking and trip reduction policies have been codified into municipal codes, there are instances where parking reductions and FAR bonuses have been granted through case-by-case variances (*20, 35*). Lastly, the U.S. Green Building Council is considering the inclusion of a carsharing credit in its revised Leadership in Energy and Environmental Design (LEED) rating system (*36*). LEED is a voluntary program in which U.S. and foreign architects/developers can meet sustainability benchmarks.
Fleet Reduction A number of policy initiatives have focused on fleet reduction requirements, predominantly by local governments. At least three U.S. cities have replaced their municipal fleets with carsharing services (Todd Boulanger, unpublished data, July 2005, *37, 38*), and another two U.S. cities are considering or planning such a switch (Steve Gutmann and Ron Szeto, unpublished data, July 2005). One county also uses carsharing services to supplement peak demand of their motor pool and to retire underutilized vehicles (Steve Gutmann, unpublished data, July 2005). Two states are in the process of evaluating carsharing use to improve the efficiency of their vehicle fleets (Steve Gutmann, unpublished data, July 2005, *30*).
Participant Subsidies The authors identified two types of participant subsidies in the U.S. to encourage use/membership: 1) those available to participants in a specific location (i.e., university, city), and 2) those geared towards the low-income market. At least one city, one property manager, and a university have provided participants with paid use or membership and application fee reimbursement (some restrictions apply) (Steve Gutmann, unpublished data, July 2005, *20, 39*). In a few other instances Job Access Reverse Commute (JARC) and Congestion Mitigation and Air Quality Improvement (CMAQ) funds have been used to subsidize low-income users (*40, 41, 42*). Additionally, one municipal transportation authority and a number of transit agencies have subsidized carsharing membership, use, or both (*20, 43*).
Parking Policies & Variances The authors found the greatest number of policies affecting parking. While these policies are the most prevalent, they vary considerably, including: 1) provisions for on-street parking (Marco Viviani, unpublished data, July 2005); 2) provisions for off-street parking, (Ron Szeto, unpublished data, July 2005); 3) exemption from parking limits (*20*); 4) creation of carsharing parking zones, (Dave Brook, unpublished data, July 2005); 5) free or reduced cost parking spaces (Ron Szeto, unpublished data, July 2005); 6) free or reduced cost parking permits (*35*); 7) universal parking permits (i.e., carsharing vehicles can be returned to any on-street location) (*35*); 8) formalized processes for assigning on-street parking spaces (*20*); and 9) recommended use of parking meter revenue to subsidize carsharing (Graham Hill, unpublished data, July 2005).
Risk Sharing Partnerships Partnership risk sharing is increasingly being used to support carsharing in the U.S. in new or potentially risky markets. Three proponents of risk sharing were identified: 1) local government, 2) a university, and 2) property management. Three ways in which this is done, include: 1) the partnering organization purchases a block of memberships and/or guarantees vehicle use (Charlie Simonson, unpublished data, July 2005); 2) vehicle subsidies (*20*); or 3) the "subtraction model" in which the carsharing organization values the monthly cost of vehicle placement and subtracts monthly revenue from that collected value and bills the shortfall to the risk partner (Dave Brook, unpublished data, July 2005).
Taxes There are several instances in which municipal and state governments have issued tax credits to carsharing members in the U.S., including: 1) local and state sales tax credits (*44*); 2) exemption from rental car taxes (Dave Brook, unpublished data, July 2005); and 3) tax credits to employers and property managers (*45, 46*). There have also been some legislative distinctions between non-profit and for-profit carsharing, whereby members of non-profit carsharing organizations may receive tax exemptions and credits (*47*). In addition to sales taxes, the authors identified two instances in the U.S. in which carsharing members are taxed as car rental users (*44, 48*).
Transit Discounts In Canada, at least one bus operator offers discounts to carsharing members (Marco Viviani, unpublished data, July 2005). In the U.S., transit discounts have been bundled with various "pass" programs that can include free or discounted carsharing membership or use (Steve Gutmann, unpublished data, July 2005).
Universities Carsharing is operating at approximately a dozen North American universities. Universities have supported and enticed operators onto campus by providing free or reduced cost parking (Charlie Simonson and Steve Gutmann, unpublished data, July 2005); subsidizing membership fees and use (Charlie Simonson and Steve Gutmann, unpublished data, July 2005); and adopting university fleet reduction measures (*49*).

CONCLUSION

In recent years, the total number of organizations and startup activity in North America has begun to stabilize; there are 28 programs in operation. The three largest providers in the U.S. and Canada both support 94% of total carsharing membership. In the future, it is likely that carsharing operators will face greater competition as larger organizations expand into existing markets. In addition, high U.S. member-vehicle ratios may level out or become lower (64:1 in July 2005), when coupled with greater vehicle penetration in key geographic locations. Average member-vehicle ratios are likely to remain higher in the U.S., given lower membership requirements (e.g., deposits, fees) and user patterns. Higher mileage costs are likely to prevail in Canada, given higher fuel costs, a greater commitment to reduce GHG emissions, and usage patterns. Several growth-oriented organizations will likely continue to account for the largest number of members and fleets deployed in North America.

Carsharing growth potential in major metropolitan regions is estimated at 10% of individuals over the age of 21 in North America. In the next five years, the carsharing industry will likely direct greater attention towards business markets in the U.S. and Canada (potentially representing as much as 22 and 15% market share, respectively). Fleet reduction strategies may accelerate government and business market penetration. U.S. operators will likely increase their presence in the college market (potentially representing 23% of U.S. market share), particularly among the younger student population, provided that the insurance impasse for drivers under 21 can be alleviated. Increased technological deployment, such as satellite radio and on-board concierge services (e.g., OnStar), may likely denote increasing competition among some carsharing operators.

While carsharing continues to gain popularity and market share in North America, the authors conclude that increased carsharing education, impact evaluation, and supportive policy approaches, including mainstreaming of carsharing into local, state/province, and federal legislation, will support the ongoing expansion and development of this transportation alternative. Partnerships between carsharing organizations and municipalities, universities, property managers, developers, and transit agencies can continue to augment the expansion of this transportation mode. Furthermore, strong relationships may help to reduce the risk of serving new and uncertain markets through a range of risk-sharing strategies (e.g., member subsidies, subtraction model). And, partnerships with developers will increasingly help to secure additional carsharing parking spaces in the future.

Supportive policy approaches and grants will likely continue to aid carsharing organizations in their future growth and location decisions. As carsharing markets develop and mature (e.g., government fleets, universities), policies will likely be codified and modified, as needed (e.g., due to high vehicle penetration and parking demand). While supportive policies directly aid carsharing in particular locations, they can also help to establish standards from which new markets can also model approaches. Such mechanisms, along with rising automobile ownership costs, will likely play a key role in driving the North American carsharing market into the future.

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REFERENCES

1. Hsu, P.S. and T.R. Reuscher. *Summary of Travel Trends: 2001 National Household Transportation Survey*. 2004. http://www.bts.gov/publications/highlights_of_the_2001_national_household_travel_survey/html/table_a04.html. Accessed July 31, 2005.

2. *Access to the 2001 National Household Travel Survey*. Ithaca: New Strategist Publications, Inc., Ithaca, 2004.

3. Canadian Statistics. Selected Dwelling Characteristics and Household (Household electronics and vehicles). 2003. http://www40.statcan.ca/l01/cst01/famil09c.htm. Accessed July 31, 2005.

4. U.S. Department of Labor. Consumer Expenditures in 2002 (Report 974). February, 2004. http://www.bls.gov/cex/csxann02.pdf. Accessed July 31, 2005.

5. Canadian Statistics. Average Household Expenditures by Provinces and Territories. http://www40.statcan.ca/l01/cst01/famil16a.htm. Accessed July 31, 2005.

6. Shaheen, S., D. Sperling, and C. Wagner. Carsharing in Europe and North America: Past Present and Future. *Transportation Quarterly*, Vol. 52, 1998, No. 3, pp. 35-52.

7. Shaheen, S. *Dynamics in Behavioral Adaptation to a Transportation Innovation: A Case Study of CarLink—A Smart Carsharing System*. UCD-ITS-RR-99-16. Davis: Institute of Transportation Studies, University of California, Davis, 1999.

8. Shaheen, S., A. Schwartz, and K. Wipyewski. Policy Considerations for Carsharing and Station Cars, *Transportation Research Record, No. 1887*, TRB, National Research Council, Washington, D.C., 2004, pp. 128-136.

9. Katzev, R. Car Sharing: A New Approach to Urban Transportation Problems. In *Analysis of Social Issues and Public Policy,* Vol. 3, No. 1, 2003, pp. 65-86. http://www.asap-spssi.org/pdf/katzev.pdf. Accessed July 31, 2005.

10. Shaheen, S., M. Meyn, and K. Wipyewski. U.S. Shared-Use Vehicle Findings on Carsharing and Station Car Growth, *Transportation Research Record*, *No. 1841*, TRB, National Research Council, Washington, D.C., 2003, pp. 90-98.

11. Robert, B. Potentiel de L'Auto-Partage Dans Le Cadre d'Une Politique de Gestion de La Demande en Transport. *Forum de L'AQTR, Gaz à Effet de Serre: Transport et Développement, Kyoto: Une Opportunité d'Affaires?* Montréal, 2000.

12. Jensen, N. The Co-operative Auto Network Social and Environmental Report 2000-2001. http://www.cooperativeauto.net/benefits/report.pdf. Accessed July 31, 2005.

13. Autoshare. News. http://www.autoshare.com/aboutus_news.html. Accessed July 31, 2005.

14. Lane, C. Philly CarShare: First-Year Social and Mobility Impacts of Car Sharing in Philadelphia. *Transportation Research Record,* TRB, National Research Council, Washington, D.C., Forthcoming 2005.

15. Price J. and C. Hamiliton. *Arlington Pilot Carshare Program. First-Year Report*. Arlington County Commuter Services, Division of Transportation. Department of Environmental Services. Arlington, VA, April, 2005.

16. Katzev, R. *Carsharing Portland: Review and Analysis of Its First Year.* Department of Environmental Quality, Portland, OR, 1999. http://www.publicpolicyresearch.net/documents/CSP_first_year_eval.PDF. Accessed July 31, 2005.

17. Zipcar. Zipcar Customer Survey Shows Car-Sharing Leads to Car Shedding. http://www.zipcar.com/press/releases/press-21. Accessed July 31, 2005.

18. Flexcar. Impact. http://www.flexcar.com/vision/impact.asp. Accessed July 31, 2005.

19. Rydén, C. and E. Morin. *Mobility Services for Urban Sustainability. Environmental Assessment. Report WP 6.* Trivector Traffic AB. Stockholm, Sweden, January, 2005. http://213.170.188.3/moses/Downloads/reports/del_6.pdf. Accessed July 31, 2005.

20. Millard-Ball, A., G. Murray, J. Burkhardt, and J. ter Schure. *Car-Sharing: Where and How it Succeeds Final Report.* TCRP Project B-26. TRB, National Research Council, Washington D.C., Forthcoming 2005.

21. Lane, C. PhillyCarShare Press Release. PhillyCarShare Members Give Up Hundreds of Cars. Philadelphia, Pennsylvania, Jan. 07, 2004.

22. Cooper, G., D. Howes, and P. Mye. *The Missing Link: An Evaluation of CarSharing Portland Inc.* Oregon Department of Environmental Quality, Portland, 2000.

23. City CarShare. News. First-Ever Study of Car-Sharing. January 7, 2004. http://www.citycarshare.org/about/news/archives/000014.shtml. Accessed July 31, 2005.

24. Reynolds, E. and K. McLaughlin. Autoshare. The Smart Alternative to Owning a Car Brochure, 2001.

25. Litman, T. Evaluating Carsharing Benefits. In *Transportation Research Record: No. 1702*, TRB, National Research Council, Washington, D.C., 2000, pp. 31-35.

26. Calgary Alternative Transportation Cooperative. Carsharing. http://www.catco-op.org/carsharing.html. Accessed July 31, 2005.

27. Shaheen, S. and M. Meyn. Shared-Use Vehicle Services: A Survey of North American Market Developments. In *ITS World Congress 2002.* Chicago, Illinois, October 2002.

28. City of Toronto. Toronto Atmospheric Fund. http://www.toronto.ca/taf/grantsapproved.htm. Accessed July 30, 2005.

29. The People's Car. Project Funders. http://www.peoplescar.org/pages/projectfund.html. Accessed July 30, 2005.

30. Texas Building and Procurement Commission. State Vehicle Fleet Management Plan. http://www.tbpc.state.tx.us/fleet/VehicleFleetManagement.html. Accessed July 29, 2005.

31. Shaheen, S., J. Wright and D. Sperling. California's Zero-Emission Vehicle Mandate. In *Transportation Research Record 1791*, TRB, National Research Council, Washington, D.C., 2002, pp. 113-120.

32. City of Vancouver. Parking By-Laws (No. 6059). Sections 2-4. June 14, 2005. http://vancouver.ca/commsvcs/BYLAWS/parking/parking.htm. Accessed July 29, 2005.

33. City of Seattle. Parking Quantity Exceptions. Seattle Municipal Code Section 23.54.020. http://clerk.ci.seattle.wa.us/~scripts/nph-brs.exe?s1=23.54.020&s2=&S3=&Sect4=AND&l=20&Sect1=IMAGE&Sect3=PLURON&Sect5=CODE1&d=CODE&p=1&u=%2F%7Epublic%2Fcode1.htm&r=1&Sect6=HITOFF&f=G. Accessed July 29, 2005.

34. City of Cambridge. Parking and Transportation Demand Management Planning: Parking and Space Registration. Cambridge Municipal Code Section 10.18. http://bpc.iserver.net/codes/cbridge/_DATA/Title_10/18/index.html. Accessed July 29, 2005.

35. Enoch, M. Supporting Car Share Clubs: A Worldwide Review. *3rd Mobility Services for Urban Sustainability (MOSES) Meeting.* London, U.K., Feb. 2002.

36. United States Green Building Council. Green Building Rating System For New Construction & Major Renovations Version 2.2. December 2004. http://www.usgbc.org/Docs/LEEDdocs/NCCC%20v2%202%20MASTER_public_1_clean.pdf. Accessed July 29, 2005.

37. City of Berkeley. Berkeley and City Carshare to Make History – First Shared Municipal Fleet in the U.S. July 15, 2004. http://www.ci.berkeley.ca.us/mayor/PR/pressrelease2004-0715.htm. Accessed July 29, 2005.

38. City of Philadelphia. Car Share: Vehicle for Change. May 5, 2005. http://www.philly.com/mld/inquirer/news/opinion/local2/region/11565534.htm. Accessed July 29, 2005.

39. City of Alexandria. Alexandria Rideshare. http://www.alexride.org/carsharing.html. Accessed July 29, 2005.

40. Car Plus. Key Lessons Learned From A World Wide Car Club Tour. http://www.carclubs.org.uk/carclubs/N-Amer-tour.htm. Accessed July 29, 2005.

41. Metropolitan Planning Commission. Low Income Flexible Transportation Program (LIFT). http://www.mtc.ca.gov/planning/welfare_to_work/lift.htm. Accessed July 29, 2005.

42. Flexcar. Flexcar Extends Car-Sharing Program. March 28, 2005. http://www.flexcar.com/company/pr/pr032805.asp. Accessed July 29, 2005.

43. Portland State University. Alternative Transportation. https://www.aux.pdx.edu/transport/alternative.php#Employee_Passport. Accessed July 29, 2005.

44. Hourcar. Rates & Hubs. http://www.hourcar.org/rates_content.html. Accessed July 29, 2005.

45. Oregon Department of Energy. Business Energy Tax Credit Pass-through Option. http://www.energy.state.or.us/bus/tax/pass-through.htm. Accessed July 29, 2005.

46. Washington State Legislature. Transportation Demand Management. – Requirements for Counties and Cities RCW 70.94.527. http://www.leg.wa.gov/RCW/index.cfm?section=70.94.527&fuseaction=section. Accessed July 29, 2005.

47. Minnesota Senate. 2004 Omnibus Minnesota Tax Bill. http://www.revisor.leg.state.mn.us/bin/bldbill.php?billS2302.1&session=1s83. Accessed July 29, 2005.

48. Schwartz, S. Carsharing Gains Ground Among Drivers and Local Governments. April 19, 2005. http://jscms.jrn.columbia.edu/cns/2005-04-19/schwartzs-carsharing. Accessed July 29, 2005.

49. University of California Berkeley Parking and Transportation. City CarShare Is Now On Campus. http://pt.berkeley.edu/citycarshare.html. Accessed July 29, 2005.