

Carsharing Parking Policy

Review of North American Practices and San Francisco, California, Bay Area Case Study

Susan A. Shaheen, Adam P. Cohen, and Elliot Martin

Carsharing provides users access to a shared vehicle fleet for short-term use throughout the day, reducing the need for private vehicles. The provision of on-street and public off-street parking dedicated to carsharing is an important policy area confronting public agencies. As of July 2009, approximately 377,600 individuals were carsharing members in North America in about 57 metropolitan areas. Seventeen jurisdictions, one state (California), and eight public transit operators in North America have formal and informal carsharing parking policies, pilot projects, and proposed legislation. These policies, projects, and proposals are reviewed in this paper, along with a framework for carsharing parking policy that reflects three levels of government support. In addition, the authors examine carsharing parking policies in three jurisdictions in the San Francisco Bay Area in California that account for an estimated 50,000 carsharing members and 1,100 shared-use vehicles. Supporting this examination is an intercept survey on carsharing parking ($n = 425$) conducted in the Bay Area. Most people supported the conversion of some type of spaces for carsharing use, and 48% thought that carsharing organizations should compensate the city for on-street spaces. At the same time, converting most types of spaces was opposed by at least 20% of respondents. Neighborhood residents were generally more in favor of parking conversion for carsharing than people visiting the area for work or errands. Finally, a majority (61%) thought that nonprofits should have priority over for-profit organizations for carsharing spaces and should pay less than for-profit organizations.

In recent years, public policy has increasingly focused on improving vehicle fleet efficiency and reducing energy consumption and carbon emissions. Public agencies have aggressively pursued climate action planning and carbon reduction strategies. This focus has coincided with a number of recent policy proposals, including cap and trade and a plan to implement enhanced corporate average fuel economy standards of 35.5 mi/gal by 2016 (1, 2).

Over the past decade, the transportation sector has been the largest end-use contributor of carbon dioxide (CO₂) emissions (3). According to the U.S. Department of Energy, petrol-based transportation CO₂ emissions generally coincide with vehicle miles or kilometers traveled (VMT or VKT). Public policies that support the reduction of VMT-VKT are one way that public agencies can achieve carbon

reduction goals. Short-term auto use or carsharing is one transportation strategy that local governments and public agencies can employ in their efforts toward reducing VMT-VKT and supporting carbon mitigation efforts. Some public agencies (local governments, public transit operators, and parking authorities) have allocated parking to carsharing organizations because of transportation, environmental, land use, and social impacts (4). Eighteen studies from 1986 to 2009 have documented carsharing's impacts in these four areas.

The concept of carsharing is simple: individuals and businesses gain access to private vehicle use without the expense and responsibilities of auto ownership. Carsharing members have access to a fleet of vehicles in a network of locations and typically pay per use. One major impact of carsharing on the transportation system is reduced vehicle ownership. According to nine North American studies, a carsharing vehicle reduces the need for 4.6 to 20 privately owned cars (4-6). Thirteen of these studies also document 15% to 32% of carsharing participants selling a vehicle after joining a carsharing program, and 25% to 71% delaying or forgoing a vehicle purchase (4, 5). Ten North American impact studies also indicate an average reduction in VMT-VKT of 44% among carsharing members after having joined carsharing (4, 5). In addition to reduced vehicle ownership and VMT-VKT, carsharing is associated with lower greenhouse gases and CO₂ emissions, because members typically shift trips to public transit, bicycling, and walking. Many carsharing organizations also include lower-emission vehicles in their fleets, such as gasoline-electric hybrid and plug-in hybrid cars. Finally, carsharing demonstrates beneficial social impacts (e.g., increased mobility for lower-income segments). Recent North American studies (2009) have documented that carsharing results in an average net reduction of at least 0.58 metric tons of CO₂ per year per member and that each carsharing vehicle likely removes between 9 and 12 private cars off the road (6, 7).

Changing dynamics in the economy appear to be causing carsharing to gain popularity because of the cost savings associated with this service (8-10). In May 2009, U.S. and Canadian unemployment reached 9.4% and 8.4%, respectively (11, 12). Five of these impact studies suggest that carsharing can be more affordable than private vehicle ownership because it enables households to gain or maintain vehicle access without bearing the full ownership costs. Because carsharing is typically an all-inclusive, pay-as-you-go service, many carsharing members driving less than 16,000 km annually report lower transportation expenses using carsharing than with private vehicle ownership. These member surveys indicate an estimated monthly savings ranging from \$154 to \$600 in the United States and a savings of \$392 to \$583 in Canada (4, 13, 14). Carsharing offers a pay-as-you-go alternative for individuals and families who may not require daily auto access. Furthermore, municipalities and public agencies are employing carsharing to reduce fleet management costs

Transportation Sustainability Research Center, University of California, Berkeley, 1301 South 46th Street, Building 190, Richmond, CA 94804-4648. Corresponding author: S. Shaheen, sashaheen@tsrc.berkeley.edu.

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(15, 16). In 2004, Berkeley, California, and Philadelphia, Pennsylvania, were the first local governments to replace their municipal fleets with carsharing, saving taxpayers an estimated \$400,000 and \$5 million, respectively (17, 18).

This paper has five main sections. First, the authors provide a methodological discussion of the approaches employed in this study. Next, a carsharing parking overview is presented. This overview includes a discussion of international and North American carsharing parking policies and approaches, as well as a suggested policy framework. Third, the authors present a San Francisco, California, Bay Area case study, which highlights the policies and approaches of three jurisdictions: San Francisco, Berkeley, and the Bay Area Rapid Transit (BART) District. Finally, the authors present a San Francisco Bay Area public perception survey on carsharing followed by a conclusion.

METHODOLOGICAL APPROACH

From January to May 2008, the authors surveyed 28 North American carsharing operators about parking. Sixteen of 18 U.S. operators and all 13 Canadian operators participated (Zipcar counts as one service provider in each nation). Respondents provided quantitative data on parking metrics, including the number and composition of on- and off-street parking spaces, and qualitative data on how carsharing parking works in their service areas.

Additionally, the authors conducted 34 interviews with public officials and government agencies with experience in the development, implementation, and administration of carsharing parking policies in North America. Experts were interviewed from all local jurisdictions with existing carsharing parking policies, with the exception of Brookline, Massachusetts; Chicago, Illinois; and Salt Lake City, Utah, in the United States and Duncan, British Columbia; Montreal, Quebec; Toronto, Ontario; and Vancouver, British Columbia, in Canada. The authors attempted interviews with these jurisdictions, but did not receive a response. Carsharing organizations with current operations in these cities provided supplemental information on carsharing parking policies in these jurisdictions.

In September 2008, researchers also administered a public intercept survey at four locations in the San Francisco Bay Area to gain

insights into perceptions and opinions regarding on- and off-street carsharing parking provision; 425 clipboard surveys were collected in San Francisco, Oakland, and Berkeley.

Operator survey data, expert interviews, and intercept survey results were supplemented with a literature review. The authors draw upon these data to provide a review of carsharing parking policies in North America as well as to develop the San Francisco Bay Area case study in this paper.

CARSHARING PARKING POLICY

In this section, the authors provide an overview of carsharing parking policy based on their literature review, expert interviews, and carsharing operator surveys. After a brief introduction to worldwide practices, the authors focus on North America, providing an overview of key carsharing parking policy elements, a carsharing parking supply analysis, and an overview of carsharing parking policies. Overall, the discussion is focused on the allocation of on-street and public off-street parking (e.g., municipal garages) for carsharing vehicles and how various jurisdictions approach it. Finally, the authors outline a framework for carsharing parking policy development.

Although on-street parking for carsharing is common in North America, it is not practiced in some countries, such as Japan, Singapore, Switzerland, Spain, and France. But overall, the majority of carsharing nations worldwide do have access to on-street parking. Indeed, carsharing operators in many European nations, Australia, and North America often have access to free or reduced cost parking that is frequently provided as a form of nonmonetary support. Not surprisingly, supportive parking policies are considered integral to carsharing’s success in many regions (19). Table 1 presents a synopsis of worldwide parking policies for carsharing.

Key Parking Policy Elements

The authors determined from the literature review and expert interviews in North America that a number of agencies either have or are developing a combination of formal and informal carsharing parking

TABLE 1 Overview of Carsharing Parking Around the World (19)

	On-Street Parking	Cost	Dedicated Parking Zones	Parking as Nonmonetary Support
Asia				
Japan	No			No
Singapore	No			No
Australia	Yes	Free	Yes	Yes
Europe				
Austria	Yes		Yes	No
Belgium	Yes		Yes	Yes
France	No			No
Germany	Yes	Free and reduced		Yes
Italy	Yes	Free	Yes	Yes
Netherlands	Yes	Free and reduced		Yes
Spain	No			
Sweden	Yes	Free and reduced		Yes
Switzerland	No			Yes
United Kingdom	Yes	Free and reduced	Yes	Yes
North America				
Canada	Yes	Free		Yes
United States	Yes	Free and reduced	Yes	Yes

policies. Many of these policies cover (a) how carsharing is defined, (b) if and how carsharing parking should be allocated, (c) whether there should be a policy differentiation between for-profit and non-profit carsharing providers, (d) how to manage demand for parking among multiple carsharing operators, (e) determining the monetary value of parking spaces, and (f) how to address administrative issues such as permits, street cleaning, parking enforcement, and signage for carsharing vehicles.

Some municipal parking policies include (a) provisions for on-street parking, (b) exemptions to parking time limits, (c) creation of carsharing parking zones, (d) free or reduced cost parking spaces or parking permits, (e) universal parking permits (i.e., carsharing vehicles can be returned to any on-street location), and (f) formalized processes for assigning on-street parking spaces. From this research, the authors identified seven key elements among North American parking policies for carsharing. They are summarized in Table 2.

Parking Supply for Carsharing in North America

The authors' survey of carsharing operators was conducted between January and May 2008; it included 28 North American operators. This survey found that 69% of U.S. carsharing operators and 62% of Canadian carsharing operators had access to on-street parking. U.S. and Canadian carsharing providers claimed 415 and 27 on-street parking

spaces, respectively. At this time, on-street parking accounted for an estimated 8% and 2% of carsharing parking in the United States and Canada, respectively.

Carsharing operators indicated that the remainder of their parking included a combination of public and private off-street parking lots and garages. Although North American carsharing operators were unable to provide the exact number of public and private off-street parking, 11 North American operators (seven in the United States and four in Canada) indicated a 2:1 ratio between private sector and public off-street parking when estimating their off-street parking supply.

North American Carsharing Parking Policy Status

The authors also conducted 34 expert interviews with public officials in government agencies involved in developing and administering carsharing and parking policies in the United States. In Canada, several carsharing organizations provided information from their interactions with government agencies. The authors identified 17 local jurisdictions out of 57 (four cities in Canada and 13 cities in the United States) and one state (California) with formal and informal policies, pilot projects, and proposed legislation focused on on-street and public off-street carsharing parking. Eight North American public transit operators provide carsharing parking at their facilities (one

TABLE 2 Key Elements of North American Carsharing Parking Policies

Parking Policy Element	Description
Parking allocation	Carsharing parking is typically allocated through a combination of formal and informal processes. Some municipalities have established "option zones" that designate on-street carsharing parking. Other cities have allocated parking stalls for carsharing as a vehicle class rather than dedicating parking spaces to specific carsharing operators. Other local agencies allocate parking through permits that allow exclusive use of parking within a specific parking zone or district or use of a particular parking spot. Formal processes: Formal processes include established policies that may be written, codified by local ordinances and zoning provisions, or negotiated through a formal request for proposal process. Informal processes: An informal allocation process includes approving on-street and off-street carsharing parking through variances, special permits, and case-by-case approvals either from administrative staff or an elected council.
Parking caps	Caps limit the number or locations of on-street parking spaces used for carsharing. A public agency may limit the number of carsharing parking spaces in a category (e.g., on- or off-street), the number of parking spaces per operator, the number of parking spaces in a particular location, or parking stalls per given membership level (e.g., one parking stall per 100 members served).
Fees and permits	Some public agencies charge carsharing operators for parking to recover lost parking revenue from the conversion of parking from general use to carsharing-only spaces. Methods for determining the amount an operator may be assessed for a parking space include: (a) residential parking permit cost; (b) foregone meter revenue; (c) cost of providing parking (e.g., operations, administrative costs, overhead, and maintenance); or (d) the market cost for private or public off-street parking in a given parking district or municipal jurisdiction. Other public agencies have opted to allow free parking for carsharing operators. Table 3 provides a list of local jurisdictions and public agencies that require a parking permit or fee to park a carsharing vehicle.
Signage, installation, and maintenance	Almost all public agencies allocating on-street and off-street parking to carsharing operators allow special signage to denote carsharing spaces. Some public agencies regulate signage so they conform to local requirements. Many public agencies formally negotiate requirements for maintenance either through real estate lease agreements or informally with an operator as needed.
Parking enforcement	Enforcement is critical to ensure that carsharing vehicles are parked in their designated locations and that noncarsharing vehicles do not occupy a carsharing-only parking space. Some public agencies have created provisions for unique license plates and ticketing-towing authority. Many state-provincial vehicle codes do not define carsharing as a vehicle class, and therefore, many jurisdictions lack the authority to tow, boot, or ticket noncarsharing vehicles parked in a carsharing-only parking space.
Impact studies	A few public agencies have required carsharing operators to conduct impact studies documenting the transportation, social, and environmental impacts of carsharing both when considering carsharing parking policy and at regular intervals after a carsharing parking policy has been implemented. At present, most public agencies requiring impact studies do not release the results and infrequently link policy decisions to the outcome of such studies. Table 3 lists local jurisdictions and public agencies that require carsharing impact data or impact studies from carsharing providers at regular intervals.
Public involvement	Some public agencies require that carsharing operators work with local neighborhoods and community groups to gain approval for the location of carsharing parking spaces before installation.

in Canada and seven in the United States). Of the 17 North American locations with carsharing parking policies, three have adopted carsharing parking policies as part of pilot programs: Arlington County, Virginia; Austin, Texas; and Los Angeles, California. Finally, California has ratified a bill amending the state's vehicle code that enables city and county governments to designate areas exclusively for carsharing parking (20).

The authors categorized local jurisdictions and transit agencies as having a carsharing parking policy if one or more of the following conditions were met. The jurisdiction or agency (a) provides on-street carsharing parking in the public right-of-way or off-street carsharing parking in a public municipal or transit agency parking garage, (b) maintains an official ordinance or codified policy for approving and allocating carsharing parking or has delegated this authority to a public authority, (c) approves and allocates carsharing parking on a case-by-case basis (e.g., council resolutions and zoning variances), or (d) negotiates a real estate agreement or other formal contract between the local jurisdiction or public agency and the carsharing operator for the lease or use of carsharing parking.

In some areas, these policies are formalized through written regulations, local ordinances, or user agreements or contracts that provide special parking use to carsharing organizations. In other areas, the policies are more informal and are typically determined by agency staff or on a case-by-case approval basis. The policy provisions and fees associated with these on-street and public off-street parking spaces vary by location. Some of the municipal parking policies include (a) provisions for on-street parking, (b) exemption from parking time limits, (c) creation of carsharing parking zones, (d) free or reduced cost parking spaces or parking permits, (e) universal parking permits (i.e., carsharing vehicles can be returned to any on-street location), and (f) formalized processes for assigning on-street parking spaces. A summary of the North American policies is provided in Table 3. This table is divided into on-street carsharing parking and off-street carsharing parking. The table highlights the seven key elements of North American carsharing parking policy.

Framework for Carsharing Parking Policy

On the basis of this North American carsharing parking policy research, the authors have developed three approaches that local governments and public transit operators might use in formulating carsharing parking policies. These policy approaches include a sample or suggested policy framework for the following elements: allocation; caps; fees or permits; signage, installation, and maintenance; enforcement; impact studies; and public involvement. The elements reflect varying degrees of government support. The first framework, carsharing as an environmental benefit, is an example of maximum government support. The second, carsharing as a sustainable business, provides moderate carsharing support. The final framework, carsharing as a business, provides a minimum level of support. Many local governments and public agencies that were early adopters of carsharing parking policy developed parking policies that emphasized the environmental and sustainability aspects of carsharing, thereby providing moderate to maximum government support in their policies. For example, Portland, Oregon; the District of Columbia; and the BART District created formal policies, adopted parking caps, and required impact studies. Two of these jurisdictions also adopted a fee structure and implemented a procedure for incorporating public involvement. Although existing carsharing parking policies could be

classified into this model, this framework is primarily designed to assist in new policy development. The details of these frameworks are described in Table 4.

Public involvement is a notable aspect of carsharing parking allocation and should be incorporated into the process, if possible. Public involvement can reduce opposition to the conversion of pre-existing parking stalls and provide both jurisdictions and operators with valuable information on the locations with highest demand and highest potential use. The public involvement methods employed should reflect the unique institutions and policy procedures established by each jurisdiction. Examples of public involvement include endorsement by neighborhood councils (as in Washington, D.C.); a public comment, hearing, and approval process for the allocation of parking spaces; or an appointed or elected body to comment or approve parking requests. Some jurisdictions have provided city councils and parking authorities with varying degrees of authority over carsharing parking, which can include regular public meetings and public comment periods. In the next section, the authors present findings from their Bay Area carsharing parking case study and results from a public perception survey regarding the provision of on-street carsharing parking.

CARSHARING PARKING IN SAN FRANCISCO BAY AREA: CASE STUDY

Three jurisdictions were examined as part of the San Francisco Bay Area carsharing case study: San Francisco, Berkeley, and the BART District. This region was selected for the case study analysis because it has a long carsharing history, the authors reside in this region, and the public perception survey was conducted there. Furthermore, it illustrates the carsharing parking policy approaches of two cities and a public transit operator.

The San Francisco Bay Area is the 12th largest metropolitan region in the United States, with 7.2 million people. Private vehicles account for the greatest weekday modal share (80%), followed by walking (10.2%), public transit (6.2%), and bicycling (1.5%) (22). The remaining trips are made by other alternative modes. Some trends affecting carsharing services in the San Francisco Bay Area include a relatively higher income and cost of living and a greater percentage of individuals with a college or other advanced degree. Additionally, many areas in the region have limited on-street parking and expensive off-street parking. Of all the North American cities that allocate on-street carsharing parking, San Francisco has only two parking spaces that were approved on a one-time basis.

Carsharing first appeared in San Francisco from 1983 to 1985 with the short-term auto rental demonstration project. In 2001, carsharing services re-emerged in San Francisco with the launch of City CarShare, a nonprofit carsharing provider. In August and October 2005, two for-profit operators—Flexcar and Zipcar—also launched their services. They merged under the name Zipcar in October 2007. In 2007, for-profit U-Haul launched its U-CarShare service in the region. At present, most of U-CarShare's fleet of PT Cruisers is parked at U-Haul locations within Berkeley. As of July 2009, City CarShare, Zipcar, and U-CarShare served San Francisco, Oakland, and Berkeley with limited service at colleges and universities in the Peninsula and South Bay.

In July 2009, there were an estimated 50,000 carsharing members and 1,100 carsharing vehicles in the San Francisco metropolitan area. The Bay Area represents an estimated 16% of the U.S. carsharing

TABLE 3 Overview of North American Carsharing Parking Policies

	On-Street Parking						
	On-Street Parking Allocation	Parking Cap	Fees & Permits Required to Park	On-Street Signage	On-Street Parking Enforcement	Impact Studies Required	Public Involvement
Local Government							
Arlington County, Va.	X	X		X			X
Austin, Tex.	X			X			
Baltimore, Md.	X			X			
Bellingham, Wash.	X			X			
Brookline, Mass.	X		X	X			
Cambridge, Mass.	X			X			
Duncan, British Columbia, Canada							
Los Angeles, Calif.	X			X			
Montreal, Quebec, Canada	X		X	X			
Philadelphia, Pa.	X		X	X	X		X
Portland, Ore.	X	X	X	X	X	X	X
Salt Lake City, Utah	X		^a	X			
San Francisco, Calif.	X			X			
Seattle, Wash.	X			X			
Toronto, Ontario, Canada	X			X			
Vancouver, British Columbia, Canada	X			X			
Washington, D.C.	X	X		X	X	X	X
Public Transit Operator							
Bay Area Rapid Transit District, San Francisco							
Chicago Transit Authority, Chicago, Ill.							
Metropolitan Atlanta Rapid Transit Authority, Atlanta, Ga.							
Metropolitan Transportation Authority, New York							
New Jersey Transit, Newark, N.J.							
Translink Vancouver							
TriMet, Portland							
Washington (D.C.) Metropolitan Area Transit Authority (WMATA)							
State Government							
California	X						

^aCarsharing operator in Salt Lake City receives free metered parking under a municipal program that provides free parking for certain vehicles designated as clean by Utah and Environmental Protection Agency (21).

market measured by membership, and it accounts for approximately 18% of the U.S. carsharing vehicle fleet deployed. To date, the BART District has developed a carsharing parking policy, while San Francisco and Berkeley are in the process of formulating their policies. A summary of carsharing parking policies and approaches in these jurisdictions follows.

San Francisco

- San Francisco provides public off-street parking in municipal parking lots to City CarShare at a discounted carpool rate (approximately 50% of the full monthly rate) (Anita Daley, unpublished data).

- In March 2009, the Port of San Francisco began to consider whether to require carsharing parking and electric vehicle charging station allocations to be included in the lease renewals for off-street parking (23).

- City CarShare and Zipcar each have two on-street parking spaces, provided free-of-charge and approved on a one-time basis by the San Francisco board of supervisors. Both operators received additional spaces to showcase the mayor's plug-in hybrid-electric vehicle (PHEV) initiative (24).

- The San Francisco Municipal Transportation Agency plans to re-evaluate off-street and on-street carsharing policies in 2010 after they complete the San Francisco parking pilot project, SFpark, which employs demand-responsive parking methods to manage pricing and

Public Off-Street Parking					
Off-Street Parking Allocation	Parking Cap	Fees & Permits Required to Work	Off-Street Parking Enforcement	Impact Studies Required	Public Involvement
X	X				X
X					
X					
X					
X		X			
X	X	X	X	X	
X	X	X			
X		X			
X					
X		X			
X	X				

availability throughout the day in several of the city’s parking districts (Nita Rabe-Uyeno, unpublished data).

- San Francisco is paying to add electric charging infrastructure so that carsharing fleets can include PHEVs (25).

Berkeley

- In 2002, Berkeley’s city council allocated funding for City CarShare to install two on-street parking spaces (Anita Daley, unpublished data).
- Six spaces were designated informally for City CarShare fleet vehicles to park in municipal lots when Berkeley entered into a

fleet reduction contract with City CarShare in 2004 (Anita Daley, unpublished data).

- Berkeley is developing a policy for allocating on-street car-sharing parking and planned to bring a formal policy proposal to the city council in 2009 (26).
- Berkeley is paying to add electric charging infrastructure so that carsharing can include PHEVs (25).

BART District

- In July 2002, the BART District and City CarShare entered into an official pilot program in which BART allocated up to 24

TABLE 4 Carsharing Parking Policy Approaches for Local Governments

	Carsharing as an Environmental Benefit: Maximum Governmental Support	Carsharing as a Sustainable Business: Moderate Governmental Support	Carsharing as a Business: Minimum Governmental Support
Parking allocation	Jurisdiction may allocate parking spaces on a case-by-case basis or through more informal processes, such as nonbinding council–board of director resolutions.	Jurisdiction that previously allocated parking spaces through an informal process formalizes this process.	Jurisdiction maintains a highly formalized and established process for carsharing parking space allocation, including a process for apportioning among multiple carsharing operators.
Parking caps (i.e., limit on number of carsharing spaces)	Does not impose any cap on the number of carsharing spaces or percentage of spaces that may be converted to carsharing.	May impose a cap on the number and location of carsharing spaces or the total percentage of spaces jurisdiction-wide that may be converted to carsharing.	Imposes a cap on the number and location of carsharing spaces or the total percentage of spaces jurisdiction-wide that may be converted to carsharing.
Fees and permits	Recognizing the social and environmental benefits of carsharing, parking is provided free of charge or significantly below market cost.	Fees may be based on cost recovery of parking provision (e.g. foregone meter revenue, administrative costs). Fees may be reduced to reflect environmental goals, such as charging a reduced carpool rate for carsharing parking.	Fees are based on a cost-recovery or profit-based methodology. This could include permit costs, lost meter revenue, and administrative expenses for program management.
Signage, installation, and maintenance	Jurisdiction pays for sign production and installation, striping and marking costs, and maintenance.	Jurisdiction pays for sign installation and striping and markings; operator pays for sign production and maintenance costs.	Requires carsharing operator to pay for the production and installation of signage, striping and marking, and maintenance costs.
Parking enforcement	Local police may maintain ticket authority. Citations for parking in carsharing stalls are greater than most other parking violations.	Local police may maintain ticket–citation authority.	Local police may have ticketing authority. Citations for parking in carsharing spaces are the same as most other parking violations.
Social and environmental impact studies	Requires that carsharing operators study and document local social and environmental benefits at regular intervals.	May require that carsharing operators study and document local social and environmental benefits on a one-time basis or at regular intervals.	Does not require any (or could require minimal) social and environmental impact carsharing reporting.
Public involvement	This is an informal process to elicit public input into the location and number of carsharing parking spaces allocated. It is led by the jurisdiction, and staff may determine this internally without public comment.	This is an informal process in which the jurisdiction and carsharing organization seek public input into the location and number of carsharing parking spaces through public notification, and staff manage possible public concerns.	This is a highly formalized process in which the carsharing organization is responsible for obtaining public input and approval on the location and number of carsharing parking spaces through neighborhood councils, commissions, or formal hearings.

parking spaces at various stations. Initially, two carsharing vehicles were placed per station free of charge at one of BART's San Francisco and two East Bay stations (Kevin Hagerty, unpublished data).

- In 2006, two additional for-profit companies, Flexcar and Zipcar, launched carsharing services in the Bay Area market. BART's board approved parking for Flexcar and Zipcar, allocating eight parking spaces to each operator. In 2007, when Flexcar and Zipcar merged, Zipcar acquired the Flexcar parking spaces at BART (Kevin Hagerty, unpublished data).

- BART has a policy of allowing a maximum of three parking spaces per operator at each station (Kevin Hagerty, unpublished data).

- BART charges the monthly permit fee of the respective station, ranging from \$63 to \$115 per month per space (27).

To summarize, both San Francisco and Berkeley provide parking spaces for PHEV carsharing vehicles at no charge and are in the process of further developing their policies (2009 to 2010 time frame).

City CarShare receives a reduced rate for off-street parking in San Francisco, as well as six free spaces as part of its role in Berkeley's fleet reduction program. BART has conducted a carsharing parking pilot program and adopted more formal policies regarding the number of carsharing parking spaces allocated per station and operator, as well as monthly permit fees, which do not reflect operator discounts. In the next section, the authors provide results from the Bay Area carsharing parking public perception survey.

CARSHARING PARKING IN SAN FRANCISCO BAY AREA: PUBLIC PERCEPTION SURVEY

In September 2008, the authors administered an intercept survey in the San Francisco Bay Area to understand the public's perceptions and opinions about the provision of on-street parking for carsharing. The objective was to gauge the public's reaction to the reassignment of public spaces to carsharing operators.

Several U.S. carsharing organizations participated in the pretesting of the questionnaire and provided comments on the design. Researchers selected intercept locations in urban areas with rail and bus transit, carsharing service, and on- or off-street carsharing parking. These areas are typical of those where carsharing parking is or might be located, and respondents in these areas were more likely to have exposure and knowledge of carsharing and public parking availability.

Researchers collected 425 clipboard surveys at four locations: downtown San Francisco near the civic center–city hall (19%), the Rockridge neighborhood and the nearby Rockridge BART station in Oakland (39%), downtown Oakland near the convention center (14%), and downtown Berkeley between the downtown Berkeley BART station and Berkeley city hall (28%). Because the survey was an intercept survey, the respondent pool is subject to some degree of self-selection. The survey was also administered in locations that had a high degree of transit accessibility via both rail and bus. In addition, all of the locations had limited parking supply because they were all urban locations. The Rockridge neighborhood was the least dense and most residential of the selected sites. This neighborhood is a high-traffic commercial main street that is a destination for many, as well as a key route to the University of California. Thus, the survey provides preliminary insight as to whether there are critical trends in support or opposition of carsharing parking. However, these results cannot necessarily characterize the balance of opinions in other regions of the country, which may be different. For similar regions, nevertheless, this survey can inform researchers of what to explore and perhaps enable improvements in future studies.

SURVEY RESULTS

The demographics of the respondents illustrate a working age population with a racial mix slightly tilted toward Caucasian and Asian in comparison with the general population. The survey respondents were split equally by gender. A little more than two-thirds were between the ages of 18 and 45 (68%), 17% were between the ages of 46 and 55, and 11% were between 56 and 65. Only 3% of the sample was older than 65. Most identified themselves as Caucasian (63%), followed by Asian (11%), then African-American and Latino (each at 9%); Native American and Pacific Islander races constituted 2% collectively.

Respondents were asked whether they were familiar with carsharing before the survey. Eighty-six percent of the sample indicated that they were familiar with it, while 10% also were members of a carsharing organization. The respondents were then asked a series of questions about their relationship to the neighborhood in which they were surveyed, their perception of local on-street parking, and relative support or opposition to allocating certain types of existing spaces to carsharing. The results show that respondents were generally more supportive of allocating parking to carsharing than they were against it. However, some key caveats should be noted.

Respondents had different relationships with the neighborhood in which they were surveyed. Some lived locally, others worked locally, and others were visiting for a variety of reasons. How these groups reacted to parking for carsharing was different. First, it is important to understand how they perceived parking supply within their neighborhood. Table 5 shows the respondents' perceptions of parking supply as defined by their location when taking the intercept survey and the reason they were in the region.

TABLE 5 Perception of Parking Supply by Location and by Purpose at Intercept Location

Response Category	Way Too Little Parking; I Wish There Was More (%) (n = 92)	It Would Be Nice to Have More Parking (%) (n = 122)	There Is Just Enough Parking (%) (n = 97)	There Is Too Much Parking; There Should Be Less (%) (n = 16)	Unsure (%) (n = 4)	No Opinion (%) (n = 25)	Other (%) (n = 45)	Total (respondents) (n = 401)
Within This Neighborhood, What Is Your Opinion of On-Street Parking Supply (or the amount of on-street parking)?								
San Francisco Civic Center	21	25	27	5	3	8	11	75
Rockridge BART station	17	32	32	3	1	6	8	161
Downtown Berkeley	35	30	13	4	0	5	14	111
Downtown Oakland	18	32	21	5	0	9	16	57
All together (%)	23	30	24	4	1	6	11	404
What Is the Primary Purpose of Your Trip Today?								
I work or attend school in the neighborhood	28	29	23	1	1	5	12	164
I am a resident and live in the neighborhood	17	32	32	6	1	5	7	95
I am visiting the neighborhood for shopping	29	40	14	0	0	6	11	35
I am visiting the neighborhood for dining	19	37	15	19	0	0	11	27
I am visiting the neighborhood to participate in recreational or social activities	21	14	28	5	0	19	14	43
Other	16	38	24	3	3	3	14	37

TABLE 6 Respondent Relationship with Neighborhood and Support for Carsharing Parking: What Is the Primary Purpose of Your Trip Today?

Relationship with Neighborhood	Location				Total (n = 421)
	San Francisco Civic Center (%) (n = 78)	Rockridge BART (%) (n = 166)	Downtown Berkeley (%) (n = 118)	Downtown Oakland (%) (n = 59)	
I work or attend school in the neighborhood	50	27	50	51	173
I am a resident and live in the neighborhood	13	32	20	19	98
I am visiting the neighborhood for shopping	6	13	5	3	35
I am visiting the neighborhood for dining	5	7	6	8	28
I am visiting the neighborhood to participate in recreational or social activities	12	10	14	7	46
Other	14	10	5	12	41

Table 5 shows that most respondents said that more parking is desired within the neighborhood. This was generally true regardless of the neighborhood and regardless of the reason the respondent was in the area. That is, both residents and visitors in each neighborhood generally thought that parking was not in oversupply, and this is important when considering their general support for allocating some of this limited parking supply to carsharing.

Table 6 shows the extent to which people at the survey sites supported carsharing parking in that location; the support is classified by the respondents' relationship with the neighborhood. Table 7 shows respondents' relative support or opposition for converting specific types of parking spaces within the respective neighborhood. The percents shown are the percent of respondents within

the neighborhood, as defined by the column in both sections of the table.

Table 6 shows that half of the people surveyed in the downtown locations were there for work or school. Rockridge was more atypical, with nearly a 30–30 split between workers and residents. Table 7 provides the percentage of people who supported or opposed the conversion of a specific type of space to a dedicated carsharing space. Respondents were allowed to pick more than one response, so the percentages do not sum to 100, but reflect the percentage of respondents electing each specific option among others. With a few exceptions, more people supported the conversion of spaces to carsharing than opposed them in each neighborhood because typical respondents supported the conversion of more spaces than they opposed. For exam-

TABLE 7 Respondent Relationship with Neighborhood and Support for Carsharing Parking: Which Types of Spaces Would You Oppose or Support Converting for Designated Carsharing Use Only?

Type of Space	Location								Total (n = 425)	
	San Francisco Civic Center (n = 79)		Rockridge BART (n = 167)		Downtown Berkeley (n = 119)		Downtown Oakland (n = 60)			
	Oppose (%)	Support (%)	Oppose (%)	Support (%)	Oppose (%)	Support (%)	Oppose (%)	Support (%)	Oppose	Support
Metered parking	37	39	24	56	29	47	35	53	124	213
Taxi zones	22	47	19	49	18	45	13	47	77	200
Truck loading zones	25	32	29	36	25	30	30	37	116	143
“No Parking” or “No Stopping” zones	19	39	20	43	22	39	15	53	83	182
On-street permitted parking	30	28	26	46	20	35	25	47	107	169
Reallocating existing parking spaces	18	44	17	46	13	45	17	43	67	191
Other	3	6	1	5	8	7	8	2	17	23
I would be fine with any of these spaces being converted	6	22	5	19	6	21	3	22	23	87

ple, roughly 70% of all respondents opposed the conversion of at least one type of space, whereas 93% of all respondents supported the conversion of at least one type of space. Thus, most respondents had opinions about the types of spaces that they would support and oppose for carsharing conversion. Table 8 shows this result in the context of the respondent’s relationship with the neighborhood.

Table 8 also shows that support for converting some spaces to carsharing generally outweighs opposition. In particular, the difference between percentages of support and opposition are largest among those who are neighborhood residents. This result is important because it suggests that allocating parking for carsharing may receive less opposition from locals than from people commuting into the neighborhood. In addition, the data also show that opposition to converting some spaces within a neighborhood is not insignificant. That is, the conversion of any of the listed spaces was opposed by at least 20% of people living in a neighborhood. Hence, although support does outweigh opposition, there was no type of space that was universally endorsed for conversion to carsharing parking.

Finally, respondents were asked whether they thought carsharing organizations should compensate the city for on-street spaces. About half thought that they should (48%), approximately one-third thought they should not (33%), and the remaining were unsure. When respondents were asked whether a different policy should exist for granting on-street parking to for-profit versus nonprofit carsharing providers, about 61% agreed, 23% thought there should be no difference, and the rest were uncertain. More than half of the respondents (53%) indicated that carsharing operators should be required to obtain consent from neighboring residents and businesses before converting a parking space to carsharing. This

response emphasizes the importance of public involvement in carsharing parking policy development.

Overall, respondents, and particularly residents, offered more support than opposition to allocating parking to carsharing. Although the survey suggests support, it does not reflect a unanimous endorsement of parking for carsharing and finds that a large portion of the respondents think that carsharing organizations should compensate the city for spaces.

CONCLUSION

This paper examines North American carsharing parking policies, presents a model framework for carsharing parking development (ranging from maximum, moderate, and minimum government support), highlights three jurisdictions’ carsharing parking policies or approaches in the San Francisco Bay Area, and analyzes public reaction to carsharing parking policies in the Bay Area to help inform future carsharing parking development.

In North America, 17 local jurisdictions out of more than 57 localities have a combination of formal and informal policies, pilot projects, and proposed legislation focused on carsharing parking. Eight North American public transit operators provide carsharing parking in their facilities. Finally, California has ratified a bill amending the state’s vehicle code, allowing local governments to allocate exclusive-use on-street parking for carsharing.

The San Francisco Bay Area carsharing parking case study features some of the policy approaches undertaken by public entities to allocate on-street, off-street, and transit-based carsharing parking.

TABLE 8 Neighborhood Relationship and Carsharing Parking Support and Opposition

Type of Space	Purpose of Trip											
	I Work or Attend School in the Neighborhood (n = 173)		I Am a Resident and Live in the Neighborhood (n = 98)		I Am Visiting the Neighborhood for Shopping (n = 35)		I Am Visiting the Neighborhood for Dining (n = 28)		I Am Visiting the Neighborhood to Participate in Recreational or Social Activities (n = 46)		Other (n = 41)	
	Oppose (%)	Support (%)	Oppose (%)	Support (%)	Oppose (%)	Support (%)	Oppose (%)	Support (%)	Oppose (%)	Support (%)	Oppose (%)	Support (%)
Metered parking	36	46	19	66	31	40	25	46	22	48	34	49
Taxi zones	19	46	17	51	23	43	18	36	11	57	20	46
Truck loading zones	23	31	31	41	23	34	39	32	24	43	37	20
“No Parking” or “No Stopping” zones	22	40	19	45	17	40	18	43	20	50	15	46
On-street permitted parking	27	35	23	54	17	46	36	32	26	37	22	34
Reallocating existing parking spaces	13	43	19	51	20	40	25	46	11	54	12	34
Other	6	5	2	6	0	6	4	0	7	9	2	5
I would be fine with any of these spaces being converted	7	20	3	22	9	17	4	25	2	20	7	20

The authors' intercept survey in the Bay Area revealed that residents of a neighborhood are more inclined to support the conversion of spaces for carsharing use than oppose it. But no type of space was widely unopposed for the conversion to carsharing use. Each space had at least 20% opposing conversion. The fact that residents and not visitors were more supportive of carsharing parking is important, as it is typically residents who have the greatest influence on local parking policies. Furthermore, general support for allocating some parking to carsharing exists in an environment in which a large portion of the sample said that parking was in undersupply.

As carsharing continues to expand, public entities may find it beneficial to develop formal policies to equitably allocate carsharing parking among operators (both the number and space location). Additionally, they should incorporate public involvement into the process to ensure that stakeholder concerns are considered. Supportive parking policy approaches will likely play a critical role in fostering any expansion of carsharing and could aid local jurisdictions in achieving their congestion mitigation and environmental goals.

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REFERENCES

- Obama Announces New Fuel Economy Standards. Fox News, May 19, 2009. <http://www.foxnews.com/story/0,2933,520680,00.html>. Accessed June 24, 2009.
- Tankersley, J. Obama Sets Strict Rules on Carbon Emissions. *Chicago Tribune*, Feb. 27, 2009. <http://www.chicagotribune.com/news/nation/world/chi-cap-and-tradefeb27,0,5872133.story>. Accessed June 24, 2009.
- Emissions of Greenhouse Gases in the United States 2007*. Report DOE/EIA-0573(2007). Energy Information Administration, U.S. Department of Energy, 2008. [http://www.eia.doe.gov/oiaf/1605/ggrpt/pdf/0573\(2007\).pdf](http://www.eia.doe.gov/oiaf/1605/ggrpt/pdf/0573(2007).pdf). Accessed June 24, 2009.
- Shaheen, S. A., A. P. Cohen, and M. S. Chung. North American Carsharing: 10-Year Retrospective. In *Transportation Research Record: Journal of the Transportation Research Board, No. 2110*, Transportation Research Board of the National Academies, Washington, D.C., 2009, pp. 35–44.
- Shaheen, S. A., A. P. Cohen, and J. D. Roberts. Carsharing in North America: Market Growth, Current Developments, and Future Potential. In *Transportation Research Record: Journal of the Transportation Research Board, No. 1986*, Transportation Research Board of the National Academies, Washington, D.C., 2006, pp. 116–124.
- Martin, E., S. A. Shaheen, and J. Lidicker. Impact of Carsharing on Household Vehicle Holdings: Results from North American Shared-Use Vehicle Survey. In *Transportation Research Record: Journal of the Transportation Research Board, No. 2143*, Transportation Research Board of the National Academies, Washington, D.C., 2010, pp. 150–158.
- Martin, E., and S. A. Shaheen. Greenhouse Gas Emission Impacts of Carsharing in North America. Submitted to *IEEE Transactions*, 2009.
- Recession Lesson: Share and Swap Replaces Grab and Buy. *Washington Post*, July 17, 2009. http://www.washingtonpost.com/wpdyn/content/article/2009/07/16/AR2009071604201.html?nav=rss_business. Accessed July 17, 2009.
- In Wake of High Gas Prices and Low Car Sales, Zipcar Grows 100% During Past 12 Months. Zipcar, July 9, 2008. <http://zipcar.mediaroom.com/index.php?s=43&item=25>. Accessed July 6, 2009.
- Can You Give Up Your Car? New Auto-Sharing Services Bet That You Can. *Newsweek*, Aug. 4, 2009. <http://www.newsweek.com/id/150371>. Accessed July 6, 2009.
- Washington Unemployment Rate Jumps to 9.4 Percent. *Portland Business Journal*, June 16, 2009. <http://www.bizjournals.com/portland/stories/2009/06/15/daily20.html>. Accessed June 24, 2009.
- Canadian Unemployment Rate at 8.4%. *HRM Guide*, June 5, 2009. <http://www.hrmguide.net/canada/jobmarket/canadian-unemployment.htm>. Accessed June 24, 2009.
- Come to College—But Leave Your Car At Home. *Automotive.com*, Aug. 28, 2008. <http://www.automotive.com/auto-news/02/38388/index.html>. Accessed July 30, 2009.
- Victoria Carshare. Membership and Usage Costs. <http://victoriacarshare.ca/drupal-6.2/node/9>. Accessed July 12, 2009.
- City of Philadelphia Selects Zipcar to Provide Car-Sharing Services. June 11, 2008. <http://zipcar.mediaroom.com/index.php?s=43&item=28>. Accessed July 6, 2009.
- Philadelphia's Carsharing Benefits Drivers, City Governments. Oct. 30, 2007. <http://postcarboncities.net/philadelphias-carsharing-benefits-drivers-city-government>. Accessed July 6, 2009.
- Philadelphia Sustainability Awards. Nominees. www.philadelphia.sustainabilityawards.org/nominees/philly_carshare/. Accessed July 6, 2009.
- Bates, T. Berkeley Is Once Again a Progressive Leader. *Berkeley Daily Planet*, July 12, 2005. www.berkeleydailyplanet.com/issue/2005-07-12/article/21834?headline=Commentary-Berkeley-is-Once-Again—a-Progressive-Leader-By-Tom-Bates&status=301. Accessed July 6, 2009.
- Shaheen, S. A., and A. P. Cohen. Growth in Worldwide Carsharing: An International Comparison. In *Transportation Research Record: Journal of the Transportation Research Board, No. 1992*, Transportation Research Board of the National Academies, Washington, D.C., 2007, pp. 81–89.
- California Assembly Bill 2154. May 8, 2006. http://info.sen.ca.gov/pub/05-06/bill/asm/ab_2151-2200/ab_2154_cfa_20060616_155424_sen_comm.html. Accessed July 30, 2009.
- Salt Lake City. Free Metered Parking for “Green Vehicles.” <http://www.slccgov.com/Transportation/Parking/green.htm>. Accessed Nov. 9, 2009.
- Metropolitan Transportation Commission. Maps and Data. http://www.mtc.ca.gov/maps_and_data/datamart/survey/. Accessed July 30, 2009.
- Moyer, M. Parking Bid Resolution Memorandum. *City and County of San Francisco Port Commission*, March 5, 2009. <http://www.sfgov.org/site/uploadedfiles/port/meetings/supporting/2009/Item%209a%20Parking%20Bid%20Agenda%202009.pdf>. Accessed June 24, 2009.
- Mayor Newsom Unveils Electric Vehicle (EV) Charging Stations for San Francisco. City and County of San Francisco, Office of the Mayor, Press Release, Feb. 18, 2009. http://www.sfgov.org/site/mayor_index.asp?id=99135. Accessed June 24, 2009.
- Howland, L. Bay Area Leading Way in Green Automotive Trends. *PublicCEO*, June 9, 2009. http://www.publicceo.com/index.php?option=com_content&view=article&id=288:berkeley-leading-way-in-green-automotive-trends&catid=156:information-technologies-publicceo-exclusive&Itemid=39. Accessed June 24, 2009.
- Kamlarz, P. Contract No. 6475 Amendment: City CarShare for Fleet Vehicle Program. City of Berkeley, Office of the City Manager, June 9, 2009. http://www.ci.berkeley.ca.us/uploadedFiles/Clerk/Level_3_-_City_Council/2009/06Jun/2009-06-09_Item_20_Contract_No._6475_Amendment_City_CarShare_for_Fleet_Vehicle_Program.pdf. Accessed June 24, 2009.
- San Francisco Bay Area Rapid Transit District. Parking. <http://www.bart.gov/guide/parking/>. Accessed June 25, 2009.

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