University of California Transportation Center
UCTC FR-2011-01

Markets for Dynamic Ridesharing?
Case of Berkeley, California

Elizabeth Deakin, Karen Trapenberg Frick,
and Kevin M. Shively
University of California, Berkeley
February 2011

Markets for Dynamic Ridesharing?

Case of Berkeley, California

Elizabeth Deakin, Karen Trapenberg Frick, and Kevin M. Shively

Ridesharing programs are widespread across the United States. Dynamic ridesharing is a newer way to share rides on the fly or up to several days in advance using cell phone or computer messaging to make arrangements. This paper describes research conducted to assess the potential for dynamic ridesharing for travel to downtown Berkeley, California, and the University of California, Berkeley, campus. The study provides insights about the opportunities and challenges presented by this travel option. Data were collected from statistical and geographic analysis of the downtown and campus travel markets, and surveys and focus groups were administered to employees and graduate students. The study found that about one-fifth of commuters who drive alone to the campus would be interested in using dynamic ridesharing at least occasionally and live in areas where matches could be found. They would prefer to arrange a shared ride at least the night before rather than immediately before the trip is made. Many of these travelers were unaware of current rideshare services, and some would be willing to find a regular carpool partner. Finally, if parking charges are fairly high and parking supply is limited and regulated, financial incentives and carpool parking subsidies greatly increase interest in dynamic ridesharing.

Ridesharing programs are in widespread use across the United States both as ways to provide affordable transport services quickly and at low cost and as strategies to reduce traffic congestion and the other negative transport impacts. Ongoing round-trip carpools and vanpools, some formed from households and others through matching programs, are the most common forms of ridesharing. Casual carpooling has arisen in some areas, where drivers offer rides to individuals who wait for such rides at formal or informal pickup points, usually to take advantage of high-occupancy vehicle lanes and toll exemptions.

Dynamic ridesharing is a newer way to share rides, with matches made on the fly or up to several days in advance, using cell phone or computer messaging to make arrangements. Travelers submit a ride offer or ride request and a ridematching service automatically scans a database to identify other ride offers and requests placed for trips with similar origins, destinations, and arrival times. If a satisfactory match is found, the driver and riders are notified to confirm the trip plans. As with casual carpooling, travelers who carpool together for one trip need not do so for the next.

Researchers at the University of California (UC) recently conducted a feasibility study to assess the potential for a dynamic ridesharing program in Berkeley. The study focused on commuters to UC Berkeley's central campus and downtown Berkeley, which together form a major activity center that attracts more than 55,000 daily commute trips. Although the area is well served by transit from a number of locations, and walking, biking, and transit use together account for the majority of the trips to the area, some 12,000 commuters drive alone, using local streets and arterials to reach their destinations (which are 2 to 3 mi from the nearest major highways). Because both the city and the university wish to reduce congestion, promote sustainable transport, and manage parking, dynamic ridesharing is of interest if it is able to attract some of those currently driving each day.

The study addressed the following questions:

1. What is the market for dynamic ridesharing services, considering the demographics of potential users and residential location?
2. Are there enough potential users in the same corridors for dynamic ridesharing to be a viable and sustainable form of travel?
3. When and how might commuters use a dynamic ridematching service?
4. What program features and incentives are necessary to sustain a critical mass of users?
5. Would a dynamic ridesharing program attract commuters who are currently driving alone or also draw them from other modes, including biking, walking, and transit?

After reviewing lessons learned from previous trials of dynamic ridesharing, the research team carried out a statistical and geographic analysis of the UC–downtown Berkeley travel market, using available data from the San Francisco, California, Bay Area Metropolitan Transportation Commission (MTC) travel surveys plus detailed travel and parking surveys of UC Berkeley students, faculty, and staff conducted by the campus in 2005 and 2006. The addresses of survey respondents were mapped to identify clusters of drive-alone commuters to the UC–downtown Berkeley area. The research team then held a series of focus group discussions with commuters to downtown Berkeley and the UC campus to identify issues with participants' current commutes and to assess interest in dynamic ridesharing. Participants were regular commuters to campus and downtown for school or employment. A total of 58 people, including 34 UC Berkeley employees, 13 downtown Berkeley employees, and 11 graduate students, participated in the focus groups.

On the basis of insights from the focus groups, the research team designed and administered surveys of potential users designed to determine their current travel choices and preferences, their interest in dynamic ridesharing, their views of a variety of program options

E. Deakin, City and Regional Planning Department, University of California, Berkeley, 228 Wurster Hall, Berkeley, CA 94720-1782. K. Trapenberg Frick, University of California Transportation Center and California Partners for Advanced Transit and Highways, 2614 Dwight Way, Berkeley, CA 94720. K. M. Shively, Nelson–Nygaard Consulting Associates, 785 Market Street, San Francisco, CA 94103. Corresponding author: K. Trapenberg Frick, kfrick@berkeley.edu.

Transportation Research Record: Journal of the Transportation Research Board, No. 2187, Transportation Research Board of the National Academies, Washington, D.C., 2010, pp. 131–137.
DOI: 10.3141/2187-17

and incentives, and their likely frequency of use of a dynamic ridesharing program. A link to an online survey was e-mailed to UC graduate students, UC faculty and staff, and selected downtown Berkeley employers for distribution to their employees. In addition, a version of the survey that could be returned by mail was distributed to other office and retail employees in downtown Berkeley. In total, 1,830 surveys were distributed and 444 surveys were completed, for a response rate of 24%. Using the findings of the focus groups and surveys and the residential location of survey respondents, the research team conducted simulations to estimate the daily use of a dynamic ridesharing program serving commuters to the UC–downtown Berkeley area.

This paper presents the results of the study and summarizes findings that may be of broader applicability.

BACKGROUND ON DYNAMIC RIDESHARING

Dynamic ridesharing may overcome some of the barriers that limit conventional ridesharing, whereby participants must schedule a round-trip ride in advance. The rigidity of conventional ridesharing arrangements, which generally require fixed travel times each day of the week, has been a barrier for many commuters. Dynamic ridesharing is considerably more flexible. It allows travelers to offer or request a ride just minutes before their desired departure time or to make scheduled appointments for one-time, one-way trips. This flexibility eliminates the need to commit in advance to a fixed commute schedule or to commit to travel with particular individuals on an ongoing basis. If a traveler needs a ride, or is willing to offer one, he or she only needs to send an electronic message by cell phone or computer to a web-based data service, and the service will provide an instant match if one is available. Advanced applications have been proposed that would use Global Positioning System (GPS) technology to assist drivers and passengers in finding each other during pickups.

In some applications, there is no charge for the service and no compensation for offering rides. In other applications, the service compensates the driver using billing and receiving account information provided by the participants.

The ability to schedule occasional rideshare appointments or to obtain nearly instant, on-demand ridesharing should expand the number of people willing to try the service and the number of potential matches. However, dynamic ridesharing is not without weaknesses. Drawbacks include concerns about safety and security (which may be reduced by membership approaches that register drivers and passengers, verify insurance and driving record, etc.) as well as concerns about riders getting stranded if they are unable to find a match on the return trip (which may be minimized by marketing the services only in areas of high demand, providing extra incentives to offer rides home, or providing a guaranteed ride home) (*1*). Additionally, program costs should be considered. These include start-up and ongoing operations and staffing costs, marketing, incentives to participants, related software and hardware for ridesharing matching, and program monitoring and evaluation.

Several dynamic ridesharing service models have been tried in North American cities. The first U.S. trials were publicly funded Smart Traveler programs in Los Angeles, California, and Bellevue and Seattle, Washington, in the mid-1990s (*2–4*). All failed to achieve the critical mass of users needed to sustain dynamic ridesharing. However, these trials may have come before their time; both cell phone and Internet use have increased substantially since then and many cell phones are now text, web, and GPS enabled, so it now would be far easier for most people to access the ridematching systems than it was a decade ago.

More recently, a dynamic ridesharing trial project was conducted as a means of access to and from the Dublin–Pleasanton Bay Area Rapid Transit (BART) rail station in the San Francisco Bay Area. The station is located in a suburban area surrounded by single-use residential and commercial developments. At the time of the trial project in 2005–2006, the station served approximately 6,500 riders per day, with about half arriving by car. Ample free parking was available at the station. As an incentive, participants in the dynamic ridesharing program were permitted to park in reserved spaces close to the station entrance.

The program never reached a critical mass of users and was suspended in 2006. According to the postprogram evaluation report, the readily available free parking at the station, together with problems in guaranteeing users the promised preferred parking spot near the station entrance, reduced the effectiveness of the parking incentive and thus undermined the success of the project (*1*). Program marketing also was limited and proved insufficient to generate a critical mass of users to sustain and grow the service. However, the report concluded that the project had "demonstrated that there is a demand for flexible and innovative carpooling options, establishing that dynamic ridesharing can provide a viable travel option for people who have complex commutes or who are not interested in traditional carpooling programs. . . ." (*1*).

Other programs have tested dynamic ridesharing for a variety of trip purposes and in a variety of formats, both in the United States and abroad (*5*). Proposed applications vary from straightforward bulletin board approaches to wearable software approaches. Some of these have been tried, with moderate success; others are still on the drawing boards. Two recent programs have been quite successful. In the St. Paul–Minneapolis, Minnesota, area, NuRide has been providing commuters with web-assisted dynamic ridematching services since March 2007. As of 2008, the service had 11,000 registered users, and approximately 2,200 people attempted to find or offer a ride each weekday morning. In the San Francisco Bay Area, Genentech has implemented the Goose Networks real-time dynamic ridesharing service, with automatic $4 per day parking cash-out payments to participants for each day they share a ride. As of January 2008, 1,000 of the company's 8,000 employees had registered to use the online ridematching service; 500 are active users who make an average two to four rideshare requests per week. The match rate for these 500 daily users (the share of all ride offers and requests that are successful in finding an acceptable geographic and temporal match) is 55%.

From these experiences, several lessons emerge:

1. Only a fraction of those who are identified as potential users of the system will want to use it. Reasons for not wanting to rideshare range from a strong preference for other means of travel, to concerns about safety, to the need to make stops en route to or from the work place.
2. Many travelers do not have sufficient incentive to rideshare; for them, cost or time savings don't outweigh the perceived benefits of driving alone, including flexibility, privacy, and ability to satisfy one's own audio and climate preferences.
3. Of those who do want to share a ride, some will prefer conventional ridesharing programs or transit rather than dynamic ridesharing.
4. Dynamic ridesharing is most likely to appeal to people who are comfortable with computer and cell phone messaging.

5. Registration and screening by the ridesharing service reduces concerns about safety and security, as does the ability to limit rideshare requests to co-workers, fellow students, members of other affiliation groups, or friends (e.g., potential rideshare partners screened using social networking applications).

6. Dynamic ridesharing appeals to people who are interested in saving time and money on their commutes but do not want to, or are not able to, commit to a regular ridesharing arrangement.

7. Dynamic ridesharing appeals to people who are willing to share a ride for environmental or social reasons, but are not able or willing to do so on a regular basis.

8. The number of participants must be high enough so that users have a good chance of finding a ridesharing match or they will not sign up for or continue to try the program.

The size of the market is the most critical issue, and for programs aimed at commuting, this means understanding commute trips on a detailed basis.

COMMUTING CHARACTERISTICS OF THE STUDY AREA

The City of Berkeley is centrally located in the San Francisco Bay Area and its downtown and the adjacent UC Berkeley campus are in the center of the city. The downtown–campus area has frequent and robust transit service, with a BART station and numerous bus lines operated by AC Transit.

Travelers in the downtown–campus area include more than 20,000 undergraduate students and 14,000 graduate students, nearly 12,000 UC faculty and staff members, and more than 7,500 employees of downtown Berkeley businesses, government, and nonprofit establishments. Downtown Berkeley also is home to more than 1,700 employed residents, many of whom commute to jobs outside of the area. In addition, some 1,400 students attend the Graduate Theological Union, located immediately to the north of UC, and nearly 4,000 employees work at the Lawrence Berkeley Laboratory to the east of the campus and in student-oriented shopping districts along the north and south edges of the campus. About 5,000 students attend Berkeley City College, located downtown.

Walking is the major mode of travel in the area, accounting for 35% of the commute trips and many of the other trips made during the day. The high pedestrian share of travel is because many students live close to campus, but it also reflects the ease of walking in the area. Transit also is heavily used, accounting for 27% of the commute trips to the area, and bicycles are a significant mode, with 9% of the commute trips. The remainder of the commute travel to the campus and downtown is made by car, with solo drivers accounting for just over 20% of the daily commutes and carpools accounting for 5%. Together, these trips amount to nearly 14,000 automobile trips a day.

About two-thirds of central Berkeley commuters arrive between 7:30 and 10:30 a.m. Arrivals and departures from campus are even more spread out; only 55% of drive-alone commuters leave campus between 4:30 and 7:30 p.m.

UC faculty and staff members have much more regular and peaked arrival and departure times than their student counterparts. About half of the students arrive during the morning peak period, whereas just one-quarter typically departs from the campus during the afternoon peak period. Student departures are spread out over a 9-h period. More than 10% of students depart in the early afternoon, between 1 and 3 p.m., whereas nearly 20% leave between 7:30 and 10 p.m.

About two-thirds of regular solo commuters to the central campus usually park in campus lots or structures in and around campus, with the balance parking on the street or in off-campus lots, structures, or garages. Notably, 10% of campus solo commuters report that they park without the appropriate permits in on-street residential permit parking zones in the surrounding neighborhoods, where they must move their cars every 2 h to avoid a ticket.

PROGRAM DESIGN ISSUES

In this context, what role can dynamic ridesharing play? The 5% conventional carpooling rate to UC–downtown Berkeley is about half that of the Bay Area as a whole. However, this is less a matter of disinterest in shared modes than a matter of other modes being more attractive. The area has unusually high rates of walking, biking, and transit use, and the high percentages of travel by these modes push down the drive-alone and carpool shares. Berkeley's high walking, biking, and transit shares in turn reflect city and university policies. The campus is highly pedestrianized, and the city has invested in a network of bike boulevards and bike lanes and has emphasized pedestrian comfort throughout the downtown. Students get free transit passes, and both UC and many other employees in the area can participate in transit pass programs that offer deep discounts. Both UC and the city charge relatively high rates for parking; both have produced or helped facilitate more housing in the central area so that long commutes can be avoided. Further, vanpools and carpools get preferential locations and parking discounts at city and university garages.

From the perspective of city and university officials who cooperated with the research team in this study, a major question is whether dynamic ridesharing would reduce the number of persons driving in the city, or whether it would primarily move people from transit, biking, and walking to carpools. This question was tied to concerns about the reasons for spending resources on the program (i.e., both the city and the university wanted to reduce congestion and parking spillover into neighborhoods but not to reduce the use of transit, walking, and biking). Both had concerns about the costs of parking if carpools formed through dynamic ridesharing were to be given free or deeply discounted parking in preferred locations, just as conventional carpools enjoy. Although both university and city officials were willing to provide additional discount parking at convenient locations if it reduced driving, they were reluctant to provide such privileges to drivers who, for example, formerly took the bus to campus or picked up friends in Berkeley who otherwise would walk to work, because in these examples there would be either an increase in parking or no decrease.

At the same time, both city officials and campus staff expressed some optimism that a dynamic ridesharing program could succeed. For one thing, they believed that a strong marketing campaign would help. In a 2006 survey, UC Berkeley researchers found that nearly one-quarter of a sample of solo commuters to downtown Berkeley cited a lack of information about "who lives nearby" as their primary reason for not carpooling (C. Alvarado, R. Greene-Roesel, C. Lollini, M. Mittman, K. Shively, W. Tao, C. Way, and J. O. Yeamans, unpublished report, 2006). Better marketing might be able to entice some of these commuters to actually try ridesharing.

Staffers acknowledged that there are many other factors that work against carpooling to UC and downtown Berkeley. Conventional carpooling works best at work sites where large numbers of potential rideshare partners arrive and depart at the same times. In Berkeley,

many who might be open to carpooling may also be unable to do so because they do not work the same hours as their colleagues who live nearby. This is a problem not limited to Berkeley: In a recent survey of drivers in Houston and Dallas, Texas, "location" and "schedule limitation" were the most frequently mentioned reasons for not carpooling; the second most frequently mentioned reason was the need for "travel flexibility" (*6*). Because more than 45% of Berkeley faculty and staff members arrive on campus outside of the 6 to 9 a.m. peak period, it is likely to be more difficult than usual to find others who want to commute at the same time (*7*).

ASSESSING POTENTIAL MARKET FOR DYNAMIC RIDESHARING

With this foundation from the literature and past trials, and with the concerns of city and university and staff in mind, the research team conducted several studies to assess the feasibility of a dynamic ridesharing program for UC Berkeley and downtown: a series of focus groups to gauge attitudes toward dynamic ridesharing and to identify key issues from a commuter perspective, a commuter survey to provide improved estimates of willingness to use dynamic ridesharing, and a geographic analysis of commuter residential locations to estimate the market for such a program. The use of complimentary methods provided a fuller assessment of the challenges and benefits of dynamic ridesharing.

Focus Group Insights

To better understand how commuters would respond to dynamic ridesharing, the research team organized seven focus groups. Nearly 60 regular downtown and campus commuters participated. The participants were recruited to talk about commuting to campus and downtown, with no mention of specific modes or dynamic ridesharing in the recruitment materials. Their usual commute modes were roughly the same as the population of commuters as a whole for the study area. The research team supplemented the findings of these focus groups with those from a series of separate focus groups that had been carried out for a study of express buses and park-and-ride lots (*8*).

Only a handful of the participants had heard of dynamic ridesharing, though more knew about organized and casual carpooling. Of those who were drive-alone commuters, about half—primarily those traveling longer distances—were willing to try dynamic ridesharing, if it were easy to arrange and they did not have to commit to traveling home with the same person(s). Some of these commuters would be willing to offer rides every day; many said they would likely use the service occasionally (a few times a month). Although solo drivers were the most interested in the concept, many BART and bus riders said they would use dynamic ridesharing if it proved to be cheaper and more reliable than transit. In contrast, most pedestrians and cyclists were satisfied with their commutes and were not inclined to switch to carpooling.

For commute trips, travelers would prefer to use dynamic ridematching to schedule ride offers and ride requests in advance of their desired travel date and time (e.g., the night before) or to place standing requests for a rideshare partner at regular times each week. They were concerned that last-minute offers and requests would be a hassle or would simply not work. They were more interested in the ability to find matches on a part-time or occasional basis than in doing so instantly.

Those making very short commute trips (e.g., Berkeley Hills to downtown Berkeley) were less likely than others to want to participate because they expected it would not be worth the time required to arrange a ride. Even those with longer trips did not want to have to wait or divert from their route by more than a few minutes. Most preferred relatively anonymous pickup and drop-off points (e.g., parking lots, major intersections) to pickup and drop off at specific home or work addresses.

Prospective participants would be motivated to share rides primarily to save time, money, or both, and secondarily to reduce the climate and environmental impacts of driving. To save time, most would prefer a service that matches riders and drivers automatically, on the basis of stated criteria, rather than one that gives the participant a list of contacts and expects them to follow up.

Participants were split on whether they would expect a rider to pay for a share of the cost of a trip, including parking. Some saw it as fair and others saw it as uncomfortable and a potential hassle. Some prospective riders expressed a willingness to pay the equivalent of a transit fare to share a ride as a passenger. Drivers preferred another incentive, however. They suggested that the employer or city provide free or deeply discounted carpool parking to participants, with price discounts increasing with the number of passengers.

A number of participants expressed concerns that that dynamic ridesharing, especially the pickup process, would be too complicated, time-consuming, and unreliable for commute trips. A number of participants said they would be more inclined to use instant ridematching for spontaneous, discretionary noncommute trips to and from the UC–downtown Berkeley area, partly because they would be less concerned about the timing and less upset if there were occasional delays or missed rides. For the commute trip, some participants were especially concerned that they would not get a ride home and that this would make them anxious and unwilling to use the system regularly. Others said that they would simply take transit home, and a few said they would call a friend or family member and ask to be picked up.

Dynamic ridesharing raised some concerns about safety and security. Most commuters saw a safety–security benefit to having all users register with the ridematching service provider, or the sponsoring organization, before arranging rides. Commuters also wanted the option to set their own criteria for rideshare partners, pickup locations, how long to wait, and the like to enhance their own comfort (e.g., some women wanted to ride only with other women). Some UC staff and students expressed a willingness to share rides with downtown Berkeley commuters if it would increase their chances of finding a ride, but others would be reluctant to do so. However, even with participant registration and self-designated criteria for the ride, many UC Berkeley staff and students commented that they would feel more secure sharing rides only with other members of the UC community, whom they assume are safe and trustworthy. Display of a UC employee or student ID card would be sufficient identification in this case. Status was not an issue; UC staff said they would be willing to travel with employees in all job categories and with students and vice versa. In contrast, commuters bound for downtown Berkeley were for the most part comfortable sharing rides with commuters from other employers, including UC employees and students.

Survey Findings

The research team used the focus group findings to design a survey that was administered on campus and downtown. The total number of respondents was 444 and was evenly distributed between graduate students, UC employees, and downtown Berkeley employees.

Many respondents had little knowledge of existing ridesharing services. Over 40% of the UC Berkeley graduate students and employees surveyed had never heard of or used the carpool ridematching function at www.511.org, or by dialing 511. Two-thirds had never heard of, nor used, the guaranteed ride home program (sponsored by the Alameda County Congestion Management Agency and available to all UC commuters who regularly use transportation alternatives).

The survey results show that UC Berkeley employees are more likely to try (46%) and regularly use (at least one time per week: 26%) a dynamic ridesharing service than UC graduate students (39%, 21%), or commuters to downtown Berkeley (34%, 25%). In terms of current mode of transport, carpool commuters are the most likely to try, and to regularly use, a dynamic ridesharing service. Drive-alone commuters are also more willing to use a dynamic ridesharing service than commuters who use transit, or nonautomobile modes, such as bicycling and walking. Current bicycle and pedestrian commuters are less likely to try or to regularly use a dynamic ridesharing service than commuters who use other modes of transportation. These findings are similar to those of the focus groups.

Also similar to the focus groups, survey respondents were most likely to use dynamic ridesharing for scheduling trips a day or more in advance (34%). They also would use a service to find a regular carpool partner with the same schedule (26%) or to place a standing offer or request for ride on the same days and at the same times each week (17%). In contrast to the focus groups, however, almost one-quarter of survey respondents said they would use a dynamic ridesharing service to seek a ride or rider a few hours or minutes before departing (22%).

Of the respondents willing to try dynamic ridesharing, nearly three-quarters would be willing to either ride or drive, whereas 10% would prefer to always drive, and 14% would prefer to always ride as a passenger.

The incentives and service features most favored by survey respondents were free or discount parking, access to preferred parking lots (including those located nearest to one's destination), and a guaranteed free ride home by taxi in case of emergency or if a carpool is not available for the ride home. Least favored by respondents was the option of collecting restaurant or retail discount coupons for every shared ride. All groups were far more likely to use a dynamic ridesharing service if their preferred incentive or service features were offered. With favored incentives, willingness to use the service one or more days a week rose to about half of the respondents and 70% of the drive-alone commuters.

The survey also sought to better understand why travelers would not use dynamic ridesharing. The most frequently cited reason for not using such a service is a concern that the trip is "too short for ridesharing to be convenient." This reason was followed closely by related concerns about time needed to wait for rides, time needed to pick up and drop off passengers, and time needed to arrange shared rides. Safety concerns and "preference for driving alone" were less frequently cited reasons.

Geographic Analysis and Market for Dynamic Ridesharing

To assess the potential market for dynamic ridesharing, the research team also conducted a geographic analysis of UC–downtown Berkeley commuter travel using data from surveys of UC Berkeley students (2005) and faculty and staff (2006), which reported both home address and commute data, supplemented with survey information on the commute patterns of downtown Berkeley workers taken from MTC and Alameda County estimates and previous UC studies. The findings from the focus groups and surveys informed the analysis.

The research team determined the potential size of the market for dynamic ridesharing as follows. First, using campus travel survey data, the team identified the home location of all solo drivers to the campus who had reported that their preferred alternative to driving alone would be carpooling or a shuttle from remote parking. This group, numbering about 1,850 commuters, was the first sample of possible participants. The team then simulated whether the driver could find a rideshare match at least 60% of the time with no more than 10 additional minutes required to match schedules or travel for pickup or drop off. The 60% successful match threshold was derived from responses to a separate survey the team had conducted as part of this study, and the maximum of 10 min additional time was based on the literature and experiences with the campus rideshare program.

Matches were simulated by using the survey responses to estimate the likelihood that each traveler in the sample of potential participants would offer or seek a ride on a particular day, and to determine the time of day of the offer (within a time slot of 15 min). Then, for offers within the same time slot, the research team used the addresses and mapping software to estimate the total extra time required to make the match. If a match could be made within the 10-min time limit, it was counted as a potential success. Approximately 850 such potential successes were found for the typical weekday (Tuesday, Wednesday, Thursday), with 10% fewer successes on Monday and 20% fewer on Friday.

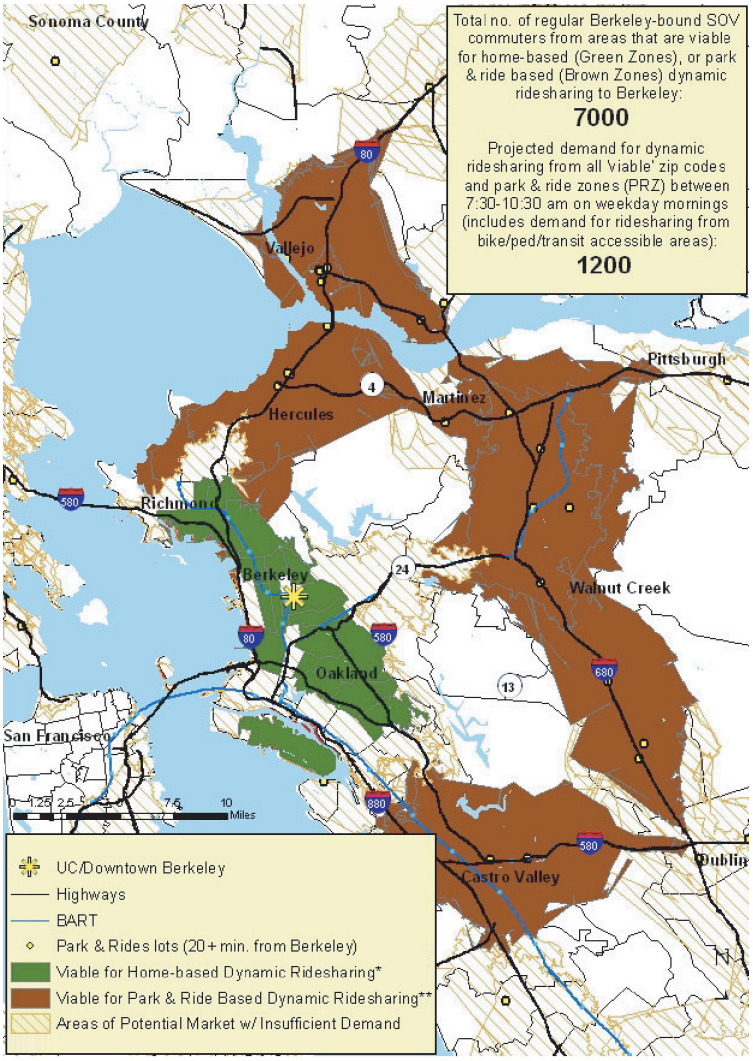
For travelers who commuted along a route that passed a park-and-ride lot, the research team also determined whether matches could be made at the lot with no more than 10 min added travel time. In some areas, travelers could match rides either at the park-and-ride lot or locally, and the team counted these options only once in determining the total market. In other areas, the density of requests was too low for local matches, but park-and-ride matches were possible at sufficient frequencies to support continued participation. The use of the park-and-ride option added approximately 325 potential successes to the participant pool.

Using these two methods the team thus estimated that just under 1,200 potential participants lived in locations and traveled at times that would lend themselves to successful dynamic rideshare matches at least 60% of the time. Just under 700 of the potential participants were outside of walk–bike–transit zones, defined for walk and bike as within 2 mi of campus and for transit as within a quarter mile of a high-frequency bus route or a half mile from a BART station. Thus, the team estimated that the potential market for dynamic ridesharing to the campus was up to 1,200 if no restrictions were placed on participation and a more modest 700 if the program were limited to those who were outside of walk–bike–transit zones. On the day with lowest demand, probably Friday, participation would likely drop by 150 to 250.

Figure 1 shows all zip codes and park-and-ride zones where dynamic ridesharing could be a viable option for commuters to the UC–downtown Berkeley area using these criteria. Such a program would remove several hundred cars a day from the streets and parking facilities in the city and campus core.

INSIGHTS AND POLICY IMPLICATIONS

The study of dynamic ridesharing to downtown Berkeley and the UC Berkeley campus has provided a number of insights about the opportunities and challenges presented by this travel option. The study



* All ZIP codes within 20-minutes of Berkeley, with projected demand for at least 6 ridematch requests per hour between 4:30-7:30 pm
**All Park & Ride Zones more than 20-minutes from Berkeley w/ projected demand for at least 10 ridematch requests per hour between 4:30-7:30 pm.

FIGURE 1 Viable markets for dynamic ridesharing.

also demonstrates the use of a mix of methods, including focus groups, surveys, and geographic simulations that could be adapted for other local areas interested in such alternative transport strategies. Described here are some key findings and insights that would be useful for public agencies and others interested in considering dynamic ridesharing.

The case examined already has many of the elements that make ridesharing attractive: a major destination, priced and regulated parking (with discounted parking prices for conventional carpool commuters), employers willing to offer ridesharing incentives, other options for rides home should ridesharing not work for a particular trip. In this case, however, transit, walking, and biking are strong alternatives for those who do not want to drive alone, reducing the potential market for carpooling and raising questions about the advisability of facilitating ridesharing among users of these more sustainable modes. For these reasons, the estimates of participation rates must be considered case-specific. For the Berkeley case, the study found that dynamic ridesharing does have potential to attract new rideshare trips and reduce solo driving, even in an area with an already high use of collective and nonmotorized travel modes. However, regular transit passengers also may be interested in switching to carpools from their current mode. Decision makers will need to consider whether to open and market the program to all or to focus on solo drivers.

Second, a dynamic ridesharing program may be costly to implement and maintain. Program costs for dynamic ridesharing to consider would include start-up and ongoing staffing, marketing and advertising, incentives to participants, ridematching software and related hardware, and program evaluation. Other costs might include the number of existing nondrivers who switch to dynamic ridesharing. A cost–benefit analysis comparing dynamic ridesharing with other commute options, such as transit improvements, was beyond the scope of this study but would shed light on whether the dynamic ridesharing option is worthwhile to pursue, especially given scarce public resources. Some factors to compare modes might include the relative reductions in vehicle miles traveled and greenhouse gas emissions, potential for reduced automobile ownership, program and

out-of-pocket traveler costs, and perceived ease and frequency of use. In addition, if parking incentives are needed to make dynamic ridesharing work, such incentives could be quite costly in an urban environment where parking spaces cost $5 a day and up.

Third, despite the relatively high education levels and extensive commute offerings in the case study area, many travelers were unaware of current rideshare services, including some who would be willing to find a regular carpool partner. Indeed, some of the respondents were interested in the dynamic ridesharing program specifically to find a regular partner.

Fourth, most who expressed interest in dynamic ridesharing would use it only occasionally. Whether such occasional use would be sufficient to keep commuters coming back to the service remains to be seen. Most users also would only be willing to go slightly out of their way or wait a short time to obtain or offer a ride, mostly because of the time entailed. Commuters who travel short distances of a mile or two are less interested in dynamic ridesharing than those who travel farther because for short distances, the time required to make the connection and accommodate a pickup and drop off is excessive. The 10 min added time for a match used in this analysis may be too high for many users and a shorter time, 3 to 5 min maximum, would cut matches down considerably. Sensitivity analyses to investigate this issue in more detail would be warranted before proceeding with a program.

Fifth, most users would prefer to arrange a commute trip at least the night before, not on the fly or shortly before the trip is made. The ability to carpool on an occasional basis is what motivated commuter interest in dynamic ridesharing, far more than the ability to make a match in real time (which was preferred for discretionary, noncommute trips).

Sixth, costs are a major reason for commuters being willing to consider dynamic ridesharing. However, cost sharing is seen by many as a hassle. Whether cost sharing is worth the effort is something that could be explicitly tested in a demonstration project. At least in the case considered here, improving the quality of the environment is also a strong consideration for ridesharing, and it would be worth exploring further whether information on greenhouse gases avoided each day would help provide an incentive to use the program.

Seventh, dynamic ridesharing need not be as a stand-alone service or option. Interested participants also could be provided with information about other ways to make the same trip, such as on transit. Combining dynamic ridesharing with a larger program of travel assistance could reduce program costs considerably.

Eighth, an important consideration is the technology used to provide enhanced rideshare matching. The past several years have seen major advancements in cell phone and GPS technology and use. Social networking and instant communication also has expanded rapidly through web tools such as Facebook and Twitter. The public sector's role may be simply to facilitate private-sector innovation without constraining it during the contracting and procurement process as may be the case in technology-related projects (*9*).

Finally, if a program is pursued, major institutional support and recognition is needed for key components, including development of an extensive marketing plan; parking management, especially if rideshare participants are given priority spaces; and a monitoring and evaluating program to consider short- and long-term outcomes. Several public entities and others will be involved, and close collaboration informed by market testing and travel analyses is critical.

The analyses presented in this paper are preliminary; the research was done on a very modest budget and used existing data and simple surveys and analysis methods accordingly. Should a dynamic ridesharing program be pursued, formal before–after studies would be of value not only to evaluate the case but also to inform others of the method's potential.

ACKNOWLEDGMENTS

This research is supported by the University of California Transportation Center, funded by the California Department of Transportation and the U.S. Department of Transportation. The authors appreciate the comments of five anonymous peer reviewers.

REFERENCES

1. Nelson\Nygaard Consulting Associates. *Ride Now! Evaluation Draft Final Report.* Alameda County Congestion Management Agency, Oakland, Calif., 2006.
2. Guiliano, G., R. W. Hall, and J. M. Golob. *Los Angeles Smart Traveler Field Operational Test Evaluation.* California PATH Research Report PRR-95-41. Institute of Transportation Studies, University of California, Berkeley, 1995.
3. Haselkorn M., J. Spryidakis, C. Blumenthal, S. Michalak, B. Goble, and M. Garner. *Bellevue Smart Traveler: Design, Demonstration, and Assessment.* Final technical report. Publication FTA-WA-0039-95-1. Washington State Department of Transportation, Olympia, 1995.
4. Dailey, D. J., D. Loseff, D. Meyers, and M. Haselkorn. Seattle Smart Traveler. Presented at 76th Annual Meeting of the Transportation Research Board, Washington, D.C., 1997.
5. http://www.dynamicridesharing.org. Accessed July 13, 2009.
6. Li, J., P. M. Embry, S. P. Mattingly, K. F. Sadabadi, I. Rasmidatta, and M. W. Burris. Who Chooses to Carpool and Why? Examination of Texas Carpoolers. In *Transportation Research Record: Journal of the Transportation Research Board, No. 2021,* Transportation Research Board of the National Academies, Washington, D.C., 2007, pp. 110–117.
7. Office of Student Research. *UC Faculty and Staff Housing and Transportation Survey.* Department of Physical and Environmental Planning, University of California, Berkeley, 2001.
8. Shirgaokar, M., and E. Deakin. Study of Park-and-Ride Facilities and Their Use in the San Francisco Bay Area of California. In *Transportation Research Record: Journal of the Transportation Research Board, No. 1927,* Transportation Research Board of the National Academies, Washington, D.C., 2005, pp. 46–54.
9. Deakin, E., K. T. Frick, and A. Skabardonis. Intelligent Transport Systems: Linking Technology and Transport Policy to Help Steer the Future. *Access,* No. 34, 2009.

The Transportation Demand Management Committee peer-reviewed this paper.