

Role of Site Amenities as Transportation Demand Management Measures

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Employee use of corporate services related to trip-making and the reduction of vehicle miles of travel (VMT) were observed. An activity diary was distributed at two major suburban worksites during the summer of 1993. The participants provided 5-day records of the activities they performed on the work site and related the impact of their site activity to their trip-making behavior. The total sample traveled 24 408 km (15,255 mi) during their respective survey weeks but recorded a total reduction of 1 008 km (630 mi) and elimination of 4 020 km (2,513 mi) for a total of 5 014 avoided km (3,134 mi) as a result of on-site amenity use. Had the amenities not been available, the total VMT would have been 20 percent higher. The study concludes that microlevel land use changes, in the form of amenities, offer transportation planners an effective transportation management tool. Amenity enrichment can contribute significant reductions in VMT, air pollution, and energy consumption that are not predicated on changing travel mode choice. The results add to the understanding of suburban travel behavior and provide insight regarding the mix of on-site services that will be required to reduce employee dependence on a private vehicle during the work day.

This study examined the impact of corporate amenities on transportation demand management. Amenity use at two corporate work sites was evaluated for its impact on the reduction of vehicle miles traveled (VMT), ability to rideshare, employee productivity, and employee job satisfaction. The data presented in this paper are part of a larger study for FTA on trip chaining and on-site amenities.

TRIP CHAINING

Before a description of the study findings, the relationship of trip chaining and corporate amenities is briefly discussed to put the study into context. The complex relationship between land use and employee travel behavior creates obstacles for successfully changing employee commuting behavior. Commuters drive alone to work because access to a vehicle before, during, and after work is necessary to perform basic activities. When workers are dependent on their cars to fulfill their basic need for everyday services, they can be expected to be reluctant to make commuting arrangements that limit their freedom of mobility. Trip chaining occurs during the process of filling the need for services. It is the act of linking one or more trips onto the morning or evening commute trip.

Trip Chain Trends

Trip chaining data collected as part of larger studies of employee commuting habits in Brentwood, Tennessee; Orlando, Florida; and Overland Park, Kansas, were compared for trends and relationships.

Travel pattern data from these communities revealed that employees relied heavily on their vehicles to gain access to everyday services. The data defined a full work trip as including stops for meals, shopping, and daycare. To commuters with these essential needs, the idea of ridesharing and giving up one's vehicle will appear irrational. The studies showed that employees were twice as likely to make stops on their way home from work as on the way to work with stops for purposes such as going to the bank and the dry cleaners and to eat and to shop.

The review revealed a great consistency between suburban data sets as well as urban and suburban data sets so that certain trip chaining characteristics, such as gender and occupation, appear to be homogeneous across geographical locations. For instance, clerical workers in suburban Brentwood, Tennessee, and urban Orlando, Florida, were more likely than any other occupational group to stop for general shopping and did so at identical frequencies (32 percent).

Working women made more frequent stops than men in both the morning and evening periods for a variety of purposes. Women were significantly more involved with child-related transportation than their male co-workers. They made more frequent stops than men in both the morning and evening periods for every purpose, with the exception of entertainment. Significantly, the data showed women to be more likely than men to trip chain, regardless of their income or occupational group. This implies that ridesharing may be more difficult to implement for working women, particularly for those with young children. The overall significance of trip chaining is the strong and rational deterrent that it poses to rideshare and transit arrangements.

Corporate Amenities

There are two methods for addressing the trip chain problem. One is to deliver services to the site, and the other is to enrich the site or adjacent land use with a mixture of amenities, services, and facilities. Corporately provided amenities are one way to substitute land use for transportation. On-site amenities are defined as support services, facilities, or incentives that employers make available to employees either immediately at the work site or within walking distance to the site. They encompass a broad range of options including cafeterias, day care, sport facilities, banking, and dry cleaning, etc. Although site services have the potential to balance the inconvenience of ridesharing/transit by making it more competitive with driving alone, transportation planners need a better understanding of their effectiveness in reducing single occupant trips to have confidence in them as transportation measures.

To a developer, amenities are the features that "go beyond" building basics and design. They are the aspects that respond to the marketing of comfort, aesthetics, and convenience. Comfort is provided

through zoned heating, temperature control, lighting, and furnishings. Aesthetics are cosmetic enhancements like artwork, atriums, landscaping, expensive exterior treatments, unique design, and other features. Convenience relates to the proximity of shops, restaurants, and services within the building. Fitness facilities, child care, and shuttle services are usually listed as "other" amenities. A fourth group of amenities is rapidly developing that are "technologically" oriented, such as electronic message centers, advanced telecommunications, video conferencing, and smart buildings.

STUDY METHODOLOGY

The on-site amenity study consisted of site interviews with senior management knowledgeable about the employees and the on-site services, distribution of an activity diary to collect employee data, and, data analysis.

Activity Diary

Attitudinal data regarding the relationship of amenities to workplace factors and actual activity were collected using an activity-based diary. Researchers developed a diary booklet that would collect activities for a 1-week period in a conveniently sized (5- by 7-in.) format. The diary booklet provided spaces for the recording of on-site activities for a 5-day period. A 2-page section was provided for each day of the week. Respondents were asked to identify all of their daily on-site activities, the mode of travel that would have been used to access each service had it not been available on-site, and their estimated miles of travel to perform each activity off-site. In addition, the booklet contained socioeconomic questions, which were to be completed only once, and a cover page, which presented easy-to-follow instructions.

Two difficulties can arise out of using the diary method. One is that diary keepers may complete an unequal number of diary days for the analysis. For example, some respondents completed the full 5 diary days, but others completed only 3 or 4 days, yet standard regression applications assume an equal number of "trials." Also the response rate was low, although researchers attempted to increase the participation rate by holding drawings, and top management encouraged participation. Fifty completed diaries were returned by Comdata Corporation employees in July 1993 for a 5 percent return rate. Service Merchandise Company (SMC) employees returned 127 diaries for a 15 percent response rate in August, 1993. On the other hand, the combined sets of employee diaries represented 885 work days. Employees at both these companies are asked to participate in many surveys, and the length of the survey time period may have discouraged participation. Future researchers may want to limit the study to a 1-day period, randomly selecting which day of the week each participant is to complete.

Management Interviews

The influence of a corporate culture on the organizational behavior of the workforce can be assessed through focus groups, interviews with selected informants, a review of corporate literature, and corporate language. The purpose of the management interview was to identify the type of amenities located on the site and to get an understanding of the corporate philosophy concerning their installation of

the amenities and the role that amenities played on the life of the business. In addition to the corporate interview, company publications such as newsletters, annual reports, and advertising were also reviewed to identify the corporate culture. Senior management who had been involved in the selection of the various amenities during the relocation or expansion phase were interviewed. During the interviews, the values, corporate objectives, strategies, type of workforce, and the reasons for incorporating various facilities or amenities were explored. The descriptions of the study sites incorporate the results of the management interviews.

Comdata Corporation

Comdata is a 20-year-old company with headquarters in the city of Brentwood in northern Williamson County. It is a leading supplier of funds transfer, cash advances, permits, and telecommunications services to the transportation, leisure, and retail industries. A primary program is the provision of transactions for fuel, phone, and cash services for an estimated 7,000 trucking companies. The multisite company constructed an 11 970-m² (133,000-ft²) headquarters building on 9 acres in 1989 on land zoned for office uses. Adjacent land uses include other corporate offices and a Kindercare child care center. Comdata operates 24 hr a day with three shifts. Amenities have been installed to create a comfortable site for all workers. Flexible work hours are available for Voice Center employees, and telework policies are being implemented. The city of Brentwood allowed Comdata to install 156 parking spaces over the code in return for commitments to implement transportation demand management (TDM) programs. Management perceives the site amenities to be part of their commitment to promote TDM. Comdata is also an active TMA member through which ridematching assistance and guaranteed ride home services are provided. Amenities available on the premises include a 150-seat, full service cafeteria, which is open from 7:00 a.m. to 3:30 p.m.; a break room with microwave, icemaker, and vending machine; an automated teller machine (ATM); a fitness center open 24 hr a day; direct payroll deposit; college-level classes; a company store with logo merchandise; and dry cleaning pick-up.

Service Merchandise Company

SMC is a multisite corporation with 400 showrooms across the country. The national headquarters is located on 32 acres on the northwest quadrant of a major Interstate interchange. SMC consolidated offices from three buildings in Nashville to the Brentwood office building in 1989 by conducting a major renovation to add 21 600 m² (240,000 ft²) of gross floor area to the existing 9 180-m² (102,000-ft²) building while increasing the number of employees from 600 to 1,400. The company operates on a 24-hr basis with 1,200 people on an 8 a.m. to 5 p.m. schedule. As part of SMC's application to expand, the Brentwood Planning Commission required SMC to appoint an employee transportation coordinator, promote ridesharing, and report annually on progress by conducting vehicle occupancy counts. By 1994, SMC had assigned over 75 priority parking spaces for carpools and registered 250 employees in the TMA's guaranteed ride home program. The annual reports show an overall 14 percent decrease in single occupant vehicles from 94 percent in 1991 to 80 percent in 1993.

The following amenities are found at SMC: a full service cafeteria, break room with vending machines, company store that offers company logo items, automated order center for SMC catalogue

items, ATM, direct deposit, travel agency for personal use, newsstand, dry cleaning pick-up stall, post office area, and a first aid clinic.

AMENITIES FINDINGS

On-site amenity use and travel behavior revealed in the diaries are described following brief demographic profile of respondents.

Demographic Profile

Employee profiles at the two firms were homogeneous. About three-fourths of the total respondents were women; 58 percent were married; almost one-fourth of the households had preschool or elementary age children; two vehicles were available per household; and, the mean educational level was "some college." Respondents were most likely to be clerical workers (37 percent) or managers (21 percent). The majority of the respondents had 1 hr for lunch (57 percent). Men were likely to have 1-hr lunch periods (83 percent) than were women (48 percent). Managers were twice as likely (89 percent) to take an hour than were non-managers (44 percent). More than half of the total respondents drove alone to work every day of the week, whereas 80 percent used an HOV mode 1 day a week, 11 percent were HOV users 2 days a week, 5 percent rode a carpool or vanpool 3 days a week; 2 percent pooled 4 days a week; and 8 percent never drove alone.

User Attitudes Toward Amenities

On-site amenities perceived to be important to the general ability to ridesharing by the employees were direct deposit, child care, and the cafeteria. Car repair, stamps, and midday shuttles were moderate in importance, and educational classes, dry cleaning, and grocery pick-up were ranked low. Although the aggregate results identified educational classes as being among the least important amenities to ridesharing, two-thirds of the Comdata employees, who were heavy ridesharers and who had access to classes, cited it as being important.

Importance of On-Site Amenities to Productivity

The amenities that employees perceive as most contributing to productivity were direct deposit and a cafeteria. On-site child care ranked third compared with near-site child care ranking in eighth place. Fitness facilities consistently ranked high as contributing to productivity. The amenities least likely to be perceived to contribute

to productivity were the company store, grocery delivery, and shuttle services.

The availability of a cafeteria was perceived as boosting a productivity factor of all commuters, regardless of their pool status, although it appeared to be of greatest importance to non-poolers and heavy poolers. Women were more likely to perceive a cafeteria as being very important to their productivity (47 percent) than men (37 percent).

Perceived Importance of Amenities to Satisfaction

Employees indicated the importance of amenities on their job satisfaction. Direct deposit was very important to more than three-fourths of the sample. A cafeteria was very important to 61 percent of all respondents. Child care facilities were perceived as being very important to work satisfaction by 41 percent of the total respondents. This compares with only 23 percent of the total respondents who perceived a closely sited child-care facility as being very important to job satisfaction, indicating that on-site access is a salient factor. Having access to an ATM and a fitness center and the opportunity to purchase of stamps were very important to about half of the respondents. Table 1 shows that direct deposit, a cafeteria, and fitness facilities were perceived as the amenities most important to worker satisfaction. Stamp purchase, an ATM, and car repair also influence employee satisfaction. The amenities that were perceived as contributing least to satisfaction were the company store, grocery delivery and a shuttle.

Predictors of Attitudes Toward Amenities

In examining the existence of significant predictors of the importance of the amenities, multiple regression analysis revealed no clear trends with one exception: the number of children in the household was a marginal predictor of attitude toward childcare. Also not surprising, lower educational level proved to be a significant, but weak predictor of the perceived importance of on-site education. Both educational attainment and occupation were related to the importance of a cafeteria, with those in higher categories (college, post grad/managers, execs) regarding the cafeteria as a bit less important. Number of children was weakly related to the importance of a company store and direct deposit.

Relationship Among Factors

Overall, employees perceived the importance of amenities to worker satisfaction as being somewhat greater than their impor-

TABLE 1 Most Important Amenities

PRODUCTIVITY	SATISFACTION	RIDESHARE
1st Direct Deposit	Direct Deposit	Direct Deposit
2nd Cafeteria	Child Care	Cafeteria
3rd ChildCare	Cafeteria	Fitness
4th Fitness	Classes	ATM
5th Car Repair	Stamps	Stamps

tance to productivity. The perceived importance of amenities to worker satisfaction was far greater than any perceived relationship to ridesharing. A perceived relationship between amenities and job satisfaction emerged at both firms. The importance of financial services provided on-site was particularly evident with 80 percent of the total respondents rating direct deposit as important to job satisfaction and 54 percent likewise rating access to an ATM. While the relative degree of percentages differed, there was agreement in the rank order of the perceived importance of the various amenities. Direct deposit was the highest ranked amenity in all categories, followed by the cafeteria. Table 1 presents the importance of amenities to productivity, ability to rideshare, and satisfaction.

Relationship of Amenities to Vehicle Need

Respondents were asked to agree or disagree with a series of statements about the impact of having access to a variety of amenities on needing to have a car available at work. The questions elicited the workers' perception of the impact of services on behavior. The workers strongly agreed that an ATM, a cafeteria, and a stamp machine make it less necessary to have a personal car at work. There was strong agreement that the on-site amenities make it less necessary to have access to a car during the day. Overall, the ATM, cafeteria, and stamp machine were the top three amenities that respondents strongly agreed would lessen dependence on a car. For all amenities, non-poolers were less likely to agree that amenity availability would reduce the necessity for a car. Heavy poolers were in strongest agreement that a gym (60 percent), stamps (50 percent), and ATM (33 percent) make a car unnecessary.

On-Site Amenity Use

For the total respondents, direct deposit, company cafeterias and ATMs were the most frequently used amenities, followed by college classes and near-site childcare. Non-poolers were slightly more likely than poolers, particularly light poolers, to use on-site services. Non-poolers had a total weekly mean use of five, compared with four uses for heavy poolers and three for light poolers.

Relationship of Amenities to VMT

Two mutually exclusive categories resulted from employee use of amenities on the site in that vehicle miles of travel were reduced and eliminated. Respondents were first asked if they used a particular amenity and if they asked yes, were asked how they would have performed that activity if it had not been present and available on the site. If they would have used a single occupant vehicle to perform the activity, then they were asked to estimate the number of miles that the availability on site reduced or eliminated. None of the answers were doublecounted in the analysis.

Total Miles Reduced

The total respondents reduced 1 008 km (630 mi) of travel for an overall weekly VMT reduction of 5.12 km (3.2 mi). Comdata employees reduced 2 096 km (131 mi) and SMC workers reduced

798.4 km (499 mi). Men were more likely to reduce VMT than women. Comdata men had a mean weekly reduction of 5.92 km (3.7 mi) compared to 3.68 km (2.3 mi) for women, although the sum reductions for women (87) were twice those of the men (44). SMC men had a mean of 5.34 compared to that of women with 5.44 km (3.4 mi).

Managers tended to reduce VMT as a result of amenity use to a greater degree than non-managers. Comdata managers reduced twice as many mean miles (3.4), as non-managers (1.2).

Heavy poolers at Comdata were much more likely to have a higher mean of miles reduced (6.7) than light poolers (0) or non-poolers (2.3). SMC non-poolers (4.5) had a much higher mean than heavy poolers (1.6), quite the reverse of the case at Comdata.

Total Miles Eliminated

More importantly, the total survey participants eliminated or totally avoided a sum total of 4 044.8 km (2,528 mi) of travel. The total mean miles eliminated by all survey participants was 14.3. Table 2 presents the data by company and amenity. The significance of the data is that vehicle mile eliminations were much higher at both Comdata (1,124) and Service Merchandise (1,404) than were the mere reduction of vehicle miles off an existing trip. Non-work trips were eliminated as a result of the on-site services.

The mean weekly miles eliminated per Comdata employee was about double (23) that of Service Merchandise employees (11). Comdata men eliminated over 50 percent more miles than women co-workers [mean of 49.6 km (31 mi) compared to 32 km (20 mi)]. The amenity utilization at SMC of men was similar (10.8) to that of the women (11.2), although women had three times the total VMT as men [587 km (367 mi) 1 659 km (1,037 mi)/587 km (367 mi)]. Managers had a 50 percent high mean elimination compared with non-managers.

VMT eliminations by commute status at Comdata showed non-poolers having the lowest mean elimination of VMT (18), followed by light poolers (29 VMT) and heavy poolers with the highest weekly mean VMT elimination of 73.6 km (46 mi). SMC heavy poolers experience the lowest VMT avoidance due to amenities (10.5), followed by non-poolers (10.9) and light poolers (13.4).

The primary amenity eliminators of VMT at Comdata were the cafeteria, education, the fitness facility, and the ATM. The Service Merchandise cafeteria was a top mile and trip eliminator with a total of 1 064 km (665 mi) or about 27 trips avoided per day. Other amenities at Service Merchandise responsible for avoided VMTs were the ATM (210), direct deposit (166), stamp machine (107), dry cleaning pick-up (93), and travel agency (82). The least influential amenities were the clinic, college classes, childcare, track, and company store.

Amenities proved to be a substitute for trip-making. They allowed non-poolers to contribute to trip reduction by removing weekly miles that non-poolers would have traveled as part of the home-based work trip, mid-day trip or a later home-based non-work trip. The most influential amenity on trip elimination at both work sites was the cafeteria.

ENVIRONMENTAL IMPACTS OF AMENITIES

The greenhouse gas (global warming) impacts of employee amenity use and resultant VMT were calculated. Data for vehicle speed,

TABLE 2 Total Miles Eliminated by Amenity and Company

	COMDATA	SMC	TOTAL
Cafeteria	350	665	1,015
Fitness	161	4	165
Company Store	0	2	2
ATM	85	208	293
Direct Deposit	51	135	186
College	248	41	289
Childcare	27	10	37
Nurse	na	30	30
Travel Agency	na	82	82
Stamp	na	107	107
Cleaners	na	93	93
Other	<u>205</u>	<u>27</u>	<u>232</u>
	1,124	1,404	528

average daily traffic vehicle occupancy, VMT, and link grade were collected as inputs for the MOBILE5 air emissions model. MOBILE5 is an air quality model developed by the Environmental Protection Agency (EPA). University of Tennessee researchers performed modeling work under contract to the TMA Group as part of a study of greenhouse gas impacts of Transportation Demand Management for the Tennessee Department of Economic and Community Development Energy Division. Masses of greenhouse gases per day were calculated for carbon dioxide, carbon monoxide, non-methane hydrocarbons, and methane (MHC) for each of the 30 links in the study area. Average values were developed by dividing the total pounds of emissions per day per gas by the total vehicle miles of the links. These average pollutant values were then applied to the miles reduced and eliminated by the various amenities with the following results:

- The analysis showed positive environmental impacts of site level amenities from both the reduction and the elimination of VMT. Employee use of on-site amenities at both sites for one week, where a trip was shortened as a result of the amenity use, resulted in a reduction of [101 kg (225 lb)] of greenhouse gases. The cafeteria was responsible for the largest reduction of carbon monoxide pollutants [31.5 kg (70 lb)] followed by the ATM [18.45 kg (41 lb)] and stamps [17.55 kg (39 lb)].

- Employee use of amenities resulted in the elimination of vehicle miles of travel and the removal of a total of almost 411.3 kg (914 lb) of weekly air pollutants from the air. The full service cafeterias, ATM and college classes resulted in the most significant air pollutant savings. Table 3 presents the total weekly pounds of pollutants saved due to the utilization of the various corporate amenities present at the two work sites.

SUMMARY

The data revealed that certain demographic groups, such as working women with young children, are more vulnerable than others, such as male executives, to the trip chaining phenomenon. Therefore, trip chain responsibilities fall hardest on the market segment who otherwise are most likely to rideshare or take transit. Trip chain data indicate that access to personal mobility to fulfill essential functions is a necessity, not simply a convenience. Traditional ridesharing and TDM strategies designed to equalize or increase the convenience of carpooling or transit do not present a strong enough incentive to penetrate the trip chain segment of the potential market. Enrichment at the site level must be added or integrated into the mix of tools.

The survey of amenity use showed that the major attractiveness of all the on-site amenities for employees—and correspondingly for management—was their importance to worker job satisfaction and work productivity. Employees perceived the on-site amenities as having greater impact on their productivity and job satisfaction than on their ridesharing. There was a high correlation between the amenities that were rated as important to productivity and satisfaction and their actual utilization by the employees.

Direct deposit ranked first in all areas of worker perception of its importance—ability to rideshare, enhancing satisfaction and increasing productivity was the most frequently used amenity. The second most important amenity, as it related to productivity, satisfaction and frequent use, was the cafeteria. The second most important amenity in regard to improved ability to ridesharing, however, was childcare while the cafeteria was ranked as being third in importance to ability to rideshare.

The presence of on-site amenities had a marked effect in reducing or eliminating total VMT by employees. However, VMT were

TABLE 3 Total Weekly Air Pollution Gases Eliminated by Amenities

AMENITY	CO ₂	CO	NO _x	NMHC	NC	TOTAL
Cafeteria	270.92	14.74	2.15	1.73	.42	289.96
ATM	114.71	6.24	.91	.73	.18	122.77
Educ.	113.14	6.16	.90	.72	.17	121.09
Direct Deposit	72.82	3.96	.58	.47	.11	77.94
Gym	64.60	3.51	.51	.41	.10	69.14
Stamps	41.89	2.28	.33	.27	.06	44.83
Cleaners	36.41	1.98	.29	.23	.06	38.97
Travel Agency	32.10	1.75	.25	.21	.05	34.36
Child Care	14.49	.79	.11	.09	.02	15.50
Clinic	11.75	.64	.09	.08	.02	12.57
Company Store	.78	.04	.01	.01	.00	.84
Other	<u>80.34</u>	<u>4.37</u>	<u>.64</u>	<u>.51</u>	<u>.12</u>	<u>85.98</u>
Total	853.94	46.46	6.76	5.45	1.31	913.93

more likely to be eliminated than reduced by the availability of on-site amenities. Commuters responsible for the "eliminated" miles through on-site amenity activity tended to be women with infants who carpoled two days a week. Heavy poolers were likely to report VMT elimination due to the utilization of on-site services. Solo drivers estimated that without the availability of the on-site amenities, an additional 3,017.6 km (1,886 mi) would have been traveled.

IMPROVING LIVABILITY OF ACTIVITY CENTERS

Recommendations regarding site amenities, land use, and delivery systems are presented below. The suggestions are aimed at improving the livability of existing suburban office centers, as opposed to creation of new residential/office mixed use centers.

Land Use and Development

Land use is the key component in achieving realistic solutions to suburban travel problems. Better analyses of customer/commuter demographics will develop an understanding of travel behavior and on-site needs so that an appropriate mix of amenities can be pursued. Land use becomes the playing board on which to encourage and distribute the office park amenities, facilities and services that will accommodate commuter needs and substitute for trip-making. Land use factors that relate to transportation include the density, scale, mix, design, and location. Infilling to increase the land use mix is attractive because small-scale adjustments in the land use/transportation relationship can be made incrementally and do

not incur great infrastructure costs for either the community or the developer.

Trip chaining data indicated the importance of integrating carpool/vanpool and transit services with supportive land use at the site level. The analysis of amenity use at two corporate sites provided direction as to the kind of micro-scale changes in the physical design and integration of land uses that will contribute to vehicle trip reductions. In particular, strategically locating food services, day care facilities, convenience retail, banking and fitness facilities in office centers would assist other TDM measures in the reduction or elimination of total vehicle miles of work trip travel.

The overriding reality is that people like to live and work in the suburbs, so developers will continue to build there. Therefore the marketplace will continue to provide planners, developers and employers with numerous opportunities to retrofit a greater diversity and sense of place into existing suburban landscape.

The proximity of land use types to one another is equally or more important as density because it is the salient factor in actual employee use of facilities. If employees leave the front door of the building, they are lost to the parking lot. Therefore, a guiding principal in redevelopment should be to improve the proximity between uses. Design that incorporates enclosed walkways to tie buildings and uses together should be encouraged so that when amenities become available in adjacent buildings, neighboring workers can use them. Site design features, such as landscaping and enclosures, that keep workers from being enticed by the lure of the parking lot need to be applied with a certain discipline. Landscaping can be used to direct pedestrian flow between buildings with primary amenities.

TDM and transit professionals should be alert for opportunities to influence the development, adoption and proper application of

guidelines, regulations and incentives that promote enriched sites, mixed land use and connections between sites. Land use planners should be alert for logical opportunities to encourage amenities. Developers may be more receptive to retrofitting or including amenities during the expansion or relocation process so that amenities can be negotiated as TDM-oriented conditions of plan approval. Land that is waiting for development can be put into an interim use as jogging, walking and hiking trails. Desirable uses, such as educational facilities and child care centers, might be "recruited" by relaxing certain requirements, such as parking spaces. Or, projects that TDM supportive elements could receive expedited processing through approvals in a "fast tracked permit process."

Contrary to many other TDM measures, infilling does not rely on *changing* human behavior but appeals to the way people want to live and work. Successful infill strategy will result in an increase in mid-day walking activity, better internal traffic flow and more effective utilization of activity center road capacity as "trips not taken" create new capacity.

Service Delivery

In suburban settings with little redevelopment potential, the provision of services can be accomplished through concierge arrangements that bring services to the employee. A concierge could also sell transit passes, provide transit schedule information and coordinate Guaranteed Ride Home needs. Concierges can be managed by the development company, property manager or a transportation management association organization. TMAs and TMOs have developed nationwide to address congestion, air pollution regulations and mobility concerns. In performing their role as implementing agents for congestion management, TMAs have developed the characteristics that would make them effective deliverers of shared tenant services. These characteristics include flexibility, private-sector approach, established relationships with the development and employer communities, credibility with the commuting public and employers and in-depth understanding of the market area. The addition of tenant services would give TMAs a new, unique product that would also enable them to offer a new method of air quality compliance to their members.

Shuttle Service

Where shared ride services are not yet in place and it is not possible for employees to walk to access needed services, then local cir-

culator buses can be effective to give riders access to a broad range of services and stores. Service must be frequent enough for workers to return to work without abusing lunch hour limits. The private sector, transit authorities and local jurisdictions can pursue joint development of shuttle service and of childcare centers and retail at rail centers.

Technology has a still undefined role to play in the delivery of services to the site. Electronic super highways have the potential to revolutionize access to information. Electronic bill-paying and video conferencing are already fairly commonly accepted transactions that substitute for trip-making and on-line computer services are becoming commonplace in many households. Future consumers will use technology in ways to conduct business and perform essential transactions currently available only by personal automobile.

RECOMMENDATIONS FOR FUTURE RESEARCH

Travel diary data fills a gap that currently exists between the transportation planning profession's understanding of site impacts and the regional travel choice models. It provides more complete information on the total trip (before, during and after work). Additional, more widespread data gathering on the whole work trip is recommended. Doing so will aid in the construction of better models that are sensitive to consumer choice and behavior, particularly with respect to trip chaining as well as a better understanding of congestion-related household factors.

Trip elimination associated with site amenities has air pollution reduction benefits but a "trip not taken" is difficult to measure. Additional studies to document the VMT and greenhouse gas reduction achieved by the installation of amenities at employer sites are in order to give transportation planners confidence in their credibility as transportation control measurers.

In addition, new models need to be developed that are sensitive to the type of reductions that land use changes can make. New land use and air quality models should allow for the analysis of trip chaining as it impacts VMT and speed and for the calculation of emission reductions resulting from new services and facilities, particularly at large employer sites or transit stations.