Los Angeles Smart Traveler Information Kiosks: A Preliminary Report

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Advanced Traveler Information Systems (ATISs), a key part of new technology applications in transportation, provide accurate and timely information that helps travelers select routes, times of travel, and travel modes. The potential for new technology applications in transportation is extensive, and substantial investments are being made to further this rapid technological development. Comprehensive, systematic testing and evaluation of new technology elements, therefore, is needed to ensure that the most promising and cost-effective technologies are pursued. To this end, several Field Operational Tests (FOTs) are being conducted throughout the United States. Preliminary results from an ongoing FOT evaluation, the Los Angeles Smart Traveler project, are presented. Usage patterns based on automated data and user surveys are examined for a sample of 41 kiosks throughout Los Angeles County. The data indicate that kiosks located in retail establishments are used more than those located in employment centers, and that that usage is related to the level of pedestrian activity at the site. Satisfaction with the kiosks is very high among users. The authors conclude that kiosks are used to obtain information more often for nonroutine or new trips than for the regular commute trip.

Choices travelers make regarding route, mode, time of departure, etc., are limited by the information available to them. Advanced Traveler Information Systems (ATISs), which seek to improve the accuracy and timeliness of this information, are being developed to improve traffic conditions and make transportation systems more efficient.

Advocates of pre-trip ATISs argue that access to information on ridesharing and transit is limited. Travelers must telephone the local rideshare or transit agency and request information. Because telephone lines are often busy, prospective transit riders must spend long periods of time on hold. Typical ridematching procedures take days or weeks, as match requests must be verified, potential partners identified, and results returned. Some argue that if such information were more accessible, transit use and ridesharing would increase.

THE LOS ANGELES SMART TRAVELER FIELD OPERATIONAL TEST

Smart Traveler is being implemented by the California Advanced Public Transportation Systems (CAPTS) Group, within California's Department of Transportation (Caltrans). Originally designed as a limited test within a confined freeway corridor (I-110), a reorientation and major expansion of the project was ordered after the Northridge earthquake to target affected areas of Los Angeles (Figure 1).

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The Smart Traveler Kiosks

The kiosks are a multimedia, personal computer-based system for accessing information on bus routes, carpools, and freeway congestion, and for viewing videos on various transportation topics. Designed and developed by IBM, the kiosks operate from a personal computer. Bus route, carpool, and freeway congestion data bases are accessed via modem. Videos are stored on a laser disk within the unit. The computer interface, for input and output, is a touch-screen monitor. Displays are in textual form, except for freeway congestion, which is displayed on a map. A 40-column printer allows users to print and take home bus route directions and carpool match lists. The kiosks are totally self-contained; only the touch-screen is visible to the user.

Kiosk usage is menu-driven. Progress through menu items is determined by user requests and responses. The first choice is language; all menu items are available in English and Spanish. The second choice is type of information (e.g., freeway conditions, bus routes, etc.). The number and extent of menu branches is determined by the complexity of the information requested. For example, only two commands are required to access the map of freeway conditions, whereas 10 or more commands may be required to obtain complete route information for a given trip.

The kiosks are linked and managed by a communications network. The system is depicted in Figure 2. The kiosks are connected to the IBM 3090 computer at the California Health and Welfare Agency Data Center (HWDC) in Sacramento. The HWDC mainframe is the central processing unit of the system. Its role is to obtain information from the three data bases (Caltrans for freeway conditions; Commuter Transportation Services, Inc. for carpool information; and the Los Angeles County Metropolitan Transportation Authority for transit information) in response to requests from kiosks and to process the information in a format that is compatible with the kiosk software.

Location and Distribution of Smart Traveler Kiosks

As noted previously, the incorporation of Smart Traveler for emergency response activities after the Northridge earthquake substantially changed the magnitude of the FOT. The change led to an increase in kiosks from 3 to 77, all within the earthquake impact area. Kiosks were installed during May, June, and July 1994. Sites were selected based on the density of foot traffic; hours of availability of the site to the public; security; and willingness of businesses in the area to take part in the project. Kiosk sites are diverse and include dense employment centers with high-rise offices; retail centers such as shopping malls, grocery stores, and multi-purpose high-volume retailers; transportation centers; hospitals; and public office buildings.

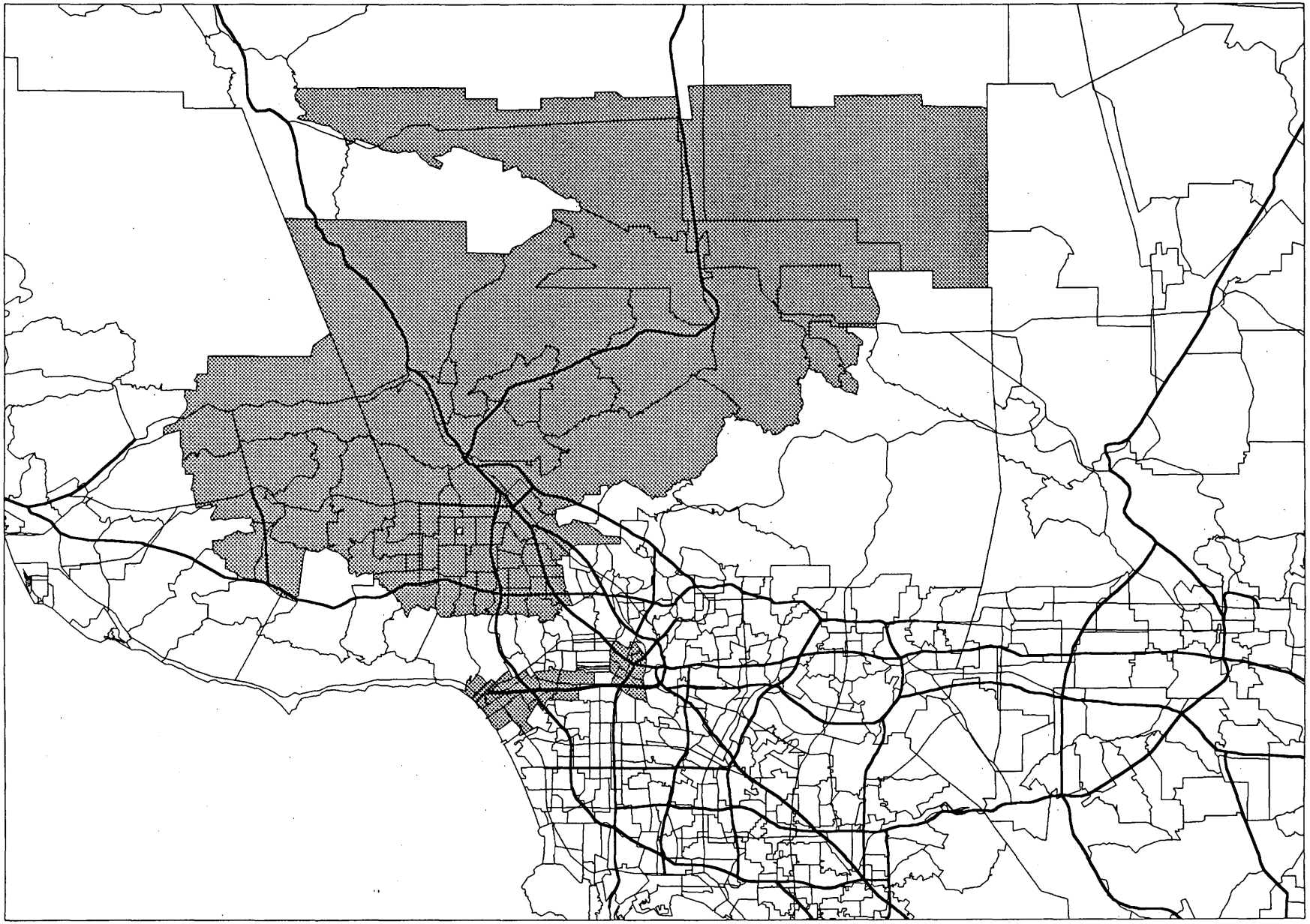

FIGURE 1 Smart Traveler emergency response target area.

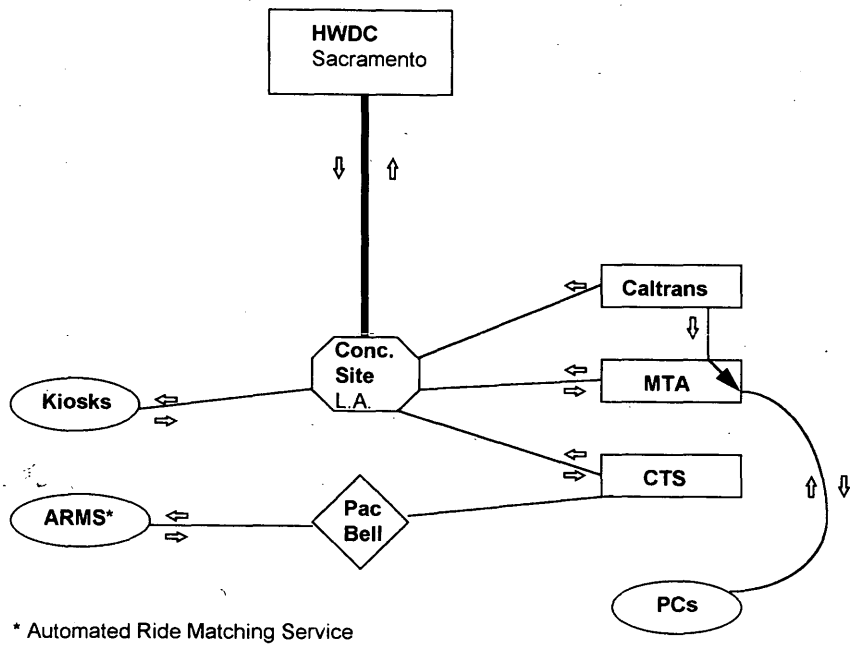

FIGURE 2 Smart Traveler system diagram.

USER RESPONSE

Data

User response is examined using the three data sources described in the following sections.

Automated Kiosk Data

Smart Traveler kiosks display a continuous video, called an "attract loop," when the machine is not being used. The attract loop is interrupted when the screen is touched, and a welcoming screen appears containing icons and text. The user can activate the menu options by touching the screen icons and text. Each touch is logged by task element and time by the kiosk computer software, creating a data log file. The data log file is stored on the kiosk's hard drive. The kiosk project design calls for an automated procedure for periodically polling each kiosk, transferring the files to the HWDC computer, and downloading them to tape or diskette. To date, this process has not been implemented, and the log files must be manually collected and downloaded.

In theory, the log files provide a complete record of use for each kiosk over the life of the project. Every use is tracked, making it possible to determine which menu items are accessed, in what order, and over what period of time. In practice, however, many problems have arisen in the collection and transfer of data files, thus limiting the analysis to a sample of data from 41 kiosks for which site field observations had been completed. The sample data spans August 17, 1994 through November 17, 1994; however, most sites do not have continuous data over the entire period. In addition, only basic measures of use are included. More comprehensive analysis will require additional programming and data file construction.

Site Field Observations of the Kiosks

Field observations were conducted to evaluate the kiosks based on their location. It was postulated that differences in levels of kiosk use can be expected to be a function of (a) the type of site where they are located; (b) the level of activity in the immediate vicinity of the kiosk; (c) the relative quality of the area where the kiosk stands; and (d) other factors, such as the maintenance and operating condition of the kiosk. It was anticipated that data collected at each site would help with the interpretation of the automated data and perhaps also help in clarifying the responses to the kiosk user surveys. The field observations were conducted in May, June, and July 1994, immediately after the installation of the kiosks.

Kiosk User Survey

The kiosk user surveys were conducted to determine user responses and perceptions of the kiosks. Because the survey was financed with funds from the Federal Emergency Management Agency (which must be used within 6 months), it had to be completed by July 17, 1994. To meet the deadline, surveys were distributed to users and observers of kiosks on site with pre-paid envelopes provided for survey returns. The kiosks had only recently been activated, and for many users this was their first opportunity to use Smart Traveler. It was therefore not possible to ask questions about repeated use or whether kiosk use had influenced travel decisions.

The following survey locations were selected based on relatively high estimated foot traffic:

1. An upscale food court serving two downtown high-rise office towers.
2. A high pedestrian traffic area in a large, up-scale suburban shopping mall.

3. A food court in a middle-market urban shopping mall.
4. A fourth location, a downtown plaza with a luxury hotel, multiple eating facilities, and a major anchor store, was added when the first location yielded a low response.

The range of locations selected for the distribution of the surveys helped increase the mix of survey respondents even though the method of distribution was non-random.

Analysis

Patterns of Kiosk Use

As noted previously, the kiosks selected for the preliminary analysis do not all have data for each of the 92 consecutive days. Explanations for missing data include:

1. Some kiosks are not available on weekends, and therefore no transactions were recorded;
2. Kiosks may not have been operating and were awaiting maintenance;
3. There were no users; and
4. The kiosk was used, but the data were not downloaded.

It was therefore necessary to correct for the number of days in which use was registered for each kiosk to calculate the average use per day.

A "use" is defined as each time the attract loop is interrupted and at least one menu item is selected. A "touch" is defined as each time the attract loop is interrupted. The attract loop is interrupted whenever the screen is touched, whether or not the kiosk is actually used. The number of touches is generally about 20 percent greater than the number of uses, indicating considerable touching of the screens without subsequent use. Table 1 gives the mean, standard deviation, and range for number of days, as well as average uses and touches per day for the 41 kiosks. The average number of days of data per kiosk is about 71, and the range is from 7 to the full 93 days.

Kiosk usage varies. Average use is about 20 per day, but ranges from a high of 49 to a low of 4. The kiosk with the highest average daily use is in Union Station in downtown Los Angeles. The remaining four of the top five locations are all in shopping malls. Of the five least-used kiosks, three are in office locations, one is in a grocery store, and one is at the Port of Los Angeles. Figure 3 illustrates daily usage at three locations: Union Station (Kiosk 11), Fox Hills Mall (Kiosk 1), and Warner Center (Kiosk 22). Fox Hills Mall is a shopping center on the west side of Los Angeles. Warner Center is a large suburban employment center about 67 km (40 mi) northwest of central Los Angeles. Not only is there a great difference between the highest and lowest performing kiosks, but each pattern shows a lot of day-to-day variability. A difference between weekends and weekdays also is discernible. Differences in use by day of the week were further analyzed. The single highest day is Saturday, followed by Sunday and Friday; the differences, however, are not statistically significant. Figure 3 also shows that the level of use at each kiosk appears to be fairly consistent over the 3-month period. Whether this will remain true for the whole sample of kiosks over a longer period of time still must be tested.

Kiosk location, as expected, is an important explanatory factor for differences in use. Kiosk locations were categorized as follows: shopping centers, grocery stores, discount stores, office, and other. The "other" category includes transportation facilities, hospitals, libraries, and other hard-to-classify locations. An analysis of variance was conducted using the location categories and a dummy variable for weekday/weekend. All effects are significant (F-statistic = 32.92, sig. = 0.000, N = 284). Location type accounts for most of the explained variation in average usage; time of week is significant both independently and jointly.

These differences are further illustrated in Table 2, which gives average daily usage for each type of location, by weekday and weekend. As expected, usage is higher on weekends than weekdays at the retail locations, and lower on weekends than weekdays at office locations. However, even on weekdays the office locations have less use than any other type of location. Because the "other" category includes such a diverse set of locations, no conclusions should be drawn about the patterns observed for this group.

A dummy variable regression was conducted to determine the relative effect of location and time of week on average daily usage. Results are given in Table 3. All variables except the grocery dummy are significant. The value of the constant is close to the actual sample mean value, and the R^2 is reasonable. Because all the coefficients are effectively in the same units, they can be interpreted directly. The shopping center and discount stores have much higher average usage than the sample as a whole. The equation predicts a use rate of about 35 users per day for these types of locations, which is about 75 percent higher than the sample average. Office locations have significantly lower than average usage by comparison. Time of week has a relatively weaker effect.

The kiosk menus can be accessed in English or Spanish. Spanish accounts for 17 percent of the kiosk daily average. It ranges from a low of 3 percent to a high of 55 percent. The two kiosk locations where Spanish was the menu of choice were both discount stores, ranked 7 and 8, respectively, in terms of average daily usage. Figure 4 shows average daily usage, in English and Spanish, for the 41 kiosks in rank order. The figure shows that the higher usage kiosks generally also have a greater than average proportion of Spanish use.

Explaining Patterns of Kiosk Use

If kiosk use were equally attractive to all passers-by, the level of usage would simply be determined by the level of pedestrian traffic

TABLE 1 Average Kiosk Use: 41 Kiosks

Total Kiosks	Use Days	Touches Per Day	Uses Per Day
Average	71.4	25.7	20.3
Std. deviation	21.4	15.6	12.8
Range	7 - 93	5 - 56	4 - 49

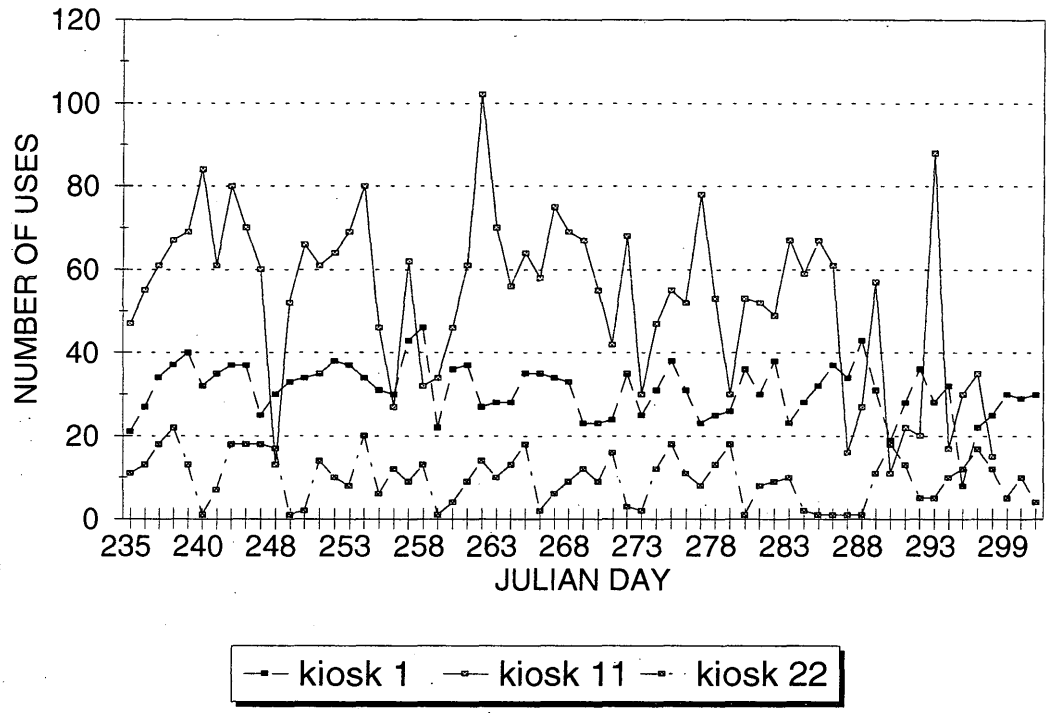

FIGURE 3 Total daily usage—high, average, and low examples.

in the area of the kiosk. Thus, one explanation for higher use at retail locations is that such locations get more pedestrian traffic. This hypothesis cannot be rigorously tested because average traffic per site is not known. However, the field site observations included a subjective assessment of activity levels both within the buildings where the kiosks are located (site area) and for the area within 15 to 20 ft of the kiosk (kiosk area). These subjective assessments are quite consistent with level of usage. Table 4 gives site and area activity ratings for the top five, middle five, and bottom five kiosk locations for which complete field information is available. Differences are found only among the bottom five locations, suggesting that other problems at these sites (for example frequent equipment breakdowns) may be deterring kiosk usage.

Total traffic is also a function of the number of hours per day that the kiosk is available. Retail locations have more hours per day of exposure than office complexes. The information on hours of operation was examined to determine whether it was possible to test directly for an effect. Hours of operation were found to be clearly established at retail sites and were found to have little variability within location categories; this was not the case at other sites. Many office complexes are open at night or on weekends, for example, yet little business activity takes place at these times. The conclusion is that the stated hours of operation are not a good indicator of pedestrian traffic at kiosk sites.

Another explanation for the patterns that were observed may be associated with the purposes for which the kiosks are being used. Traveler information systems are typically aimed at the work trip. The commuter is the stereotypical user (i.e., the motorist checks the freeway map before departure and the prospective transit user or carpooler searches for bus routes or carpool partners). Office locations thus seem appropriate. However, kiosk information may be more relevant and beneficial for non-routine trips (i.e., for tourists, for non-work destinations, or for new work trips). High usage at shopping centers and other retail locations suggests that kiosk use is more of a leisure time activity; travelers are gathering information about possible future trips, rather than for their current trip. Even for commuting, travelers may find it more convenient to learn about alternative modes during their off hours.

TABLE 2 Group Means, Average Daily Usage by Location and Time of Week

	Shopping Center	Grocery Store	Discount Store	Office	Other
Weekend	40.19 (20)	19.87 (14)	38.83 (8)	3.67 (19)	17.84 (18)
Weekday	30.8 (50)	14.27 (35)	29.07 (20)	10.87 (50)	16.98 (50)

( ) = number of observations in each group

TABLE 3 Regression Results, Dependent Variable = Average Daily Usage

Variable	Coeff	T-statistic	Sig. of T
Weekday	-2.77	2.032	.0431
Shopping Center	16.22	9.241	.000
Office	-8.34	4.737	.000
Discount Store	14.59	6.304	.000
Grocery Store	-1.39	.722	.471
Constant	19.24	12.004	.000
N = 284			
R^2 (adj) = .467			

Anecdotal evidence suggests that kiosks may not be a very convenient way to obtain real-time travel information. In a focus group discussion held at one of the office complexes, participants noted that while it would be helpful to access the freeway map to check on traffic conditions before leaving for home, it was not worth a trip to the kiosk to do so. Having access to the map in the office on their PC (another Smart Traveler element) was considered greatly superior.

Smart Traveler Kiosk Users

In this section, kiosk user survey results are discussed. Of the 1,785 surveys that were distributed to kiosk users and observers, 325 were returned, yielding a response rate of 18.2 percent. As noted previously, the kiosk user survey is not based on a random sample of kiosk users or potential kiosk users. In fact, there is no information on the population of kiosk users. The population of potential kiosk users is determined by the kiosk locations. Because few of the kiosks are located in areas that serve large numbers of lower income households, the authors did not expect to find many individuals from lower income households among the kiosk users. In addition, survey responses are generally correlated with education and income, and the surveys were written only in English, thus eliminating non-English speakers from the sample population.

It is therefore useful to compare characteristics of survey respondents with those of the Los Angeles County population. Table 5 gives gender, employment, education, and income level for survey

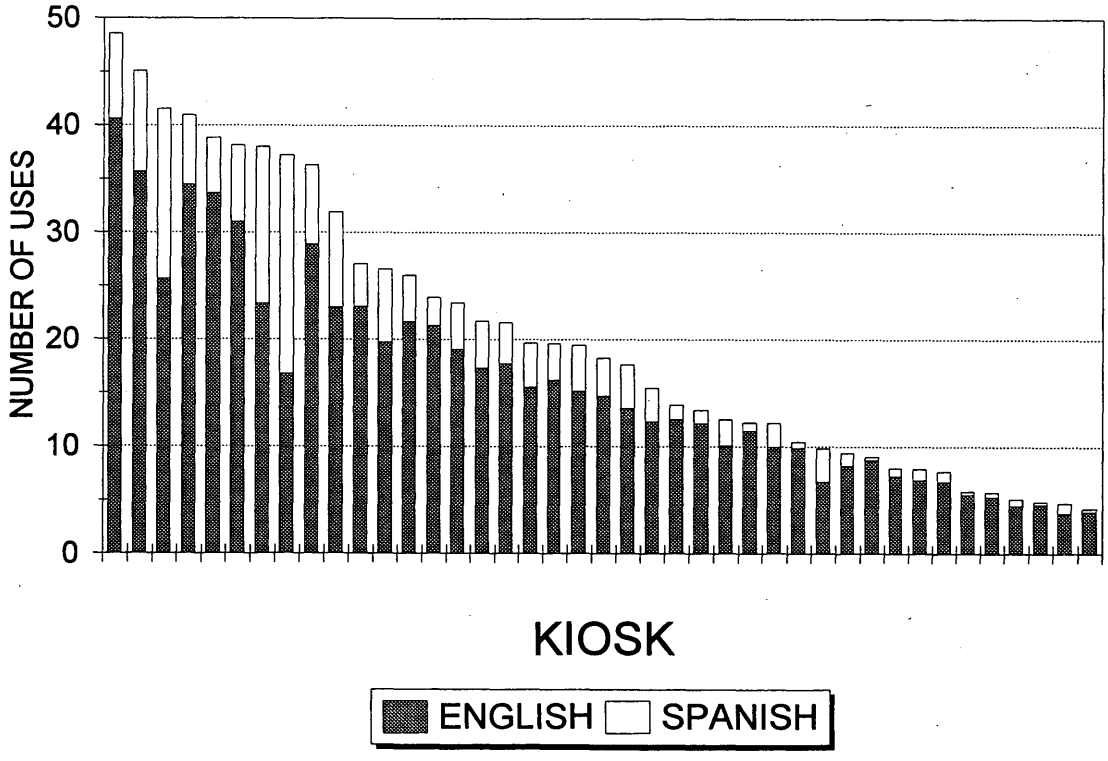

FIGURE 4 Kiosk average daily usage by language.

TABLE 4 Average Daily Usage, Site and Area Activity Level, Selected Kiosks

Category	Mean Use	Site Activity	Area Activity
High Usage			
Union Station	49	high	high
Shopping Mall	45	high	high
Shopping Mall	42	high	high
Shopping Mall	41	high	high
Shopping Mall	39	high	high
Moderate Usage			
Grocery store	20	high	high
Discount Store	19	high	high
Shopping Mall	18	medium	medium
Office building	18	medium	medium
Grocery store	15	medium	medium
Low Usage			
Hospital	6	high	low
Office complex	6	low	low
Office complex	5	medium	medium
Grocery store	5	low	low
Office complex	4	medium	medium

respondents and Los Angeles County population, taken from the 1990 Census. As expected, survey respondents differ from the general population. They are more likely to be employed, are more educated, and have higher household incomes. Although our survey respondents are not representative of the general population, they likely are representative of the potential users at the locations where the surveys were conducted.

Most survey respondents are employed. Of those employed, 83 percent work 40 hours or more per week. Vehicle access and ownership is extensive among those employed; 66 percent report household ownership of two or more vehicles, and 82 percent report having a vehicle available to drive to work. An additional 10 percent report having a vehicle available to drive "sometimes." Only 4 percent report having no household vehicles, and 8 percent do not have a vehicle to drive to work.

Given the level of vehicle access, there is a higher than expected use of public transit for the trip to work, as shown in Table 6, where work trip mode shares for survey respondents and Los Angeles County workers are listed. The drive-alone share is close to the regional average, and the carpool share is slightly lower. Survey respondents also have longer trips to work. Reported mean travel time and distance are 36 min and 33 km (19.8 mi), with medians of 30 min and 25 km (15 mi), respectively. The Los Angeles County 1990 census data give a mean travel time of 26.5 min. An annual survey of Los Angeles metropolitan area commuters reports a mean distance of 27.5 km (16.5 mi) and a travel time of 31 min in its 1994 survey report (*1*).

Further examination of the survey data revealed that the downtown mixed-use plaza survey site generated a large proportion of transit users: 24 of the 64 commuters (37 percent) used bus or rail transit, compared with 9 percent for commuters surveyed at the downtown office site, 7 percent at the urban mall, and none at the suburban mall. The mixed-use plaza is adjacent to the Metro subway line and is one of the most "transit accessible" locations downtown.

Most of the survey respondents had used the kiosk. (Surveyors were instructed to distribute surveys to people near the kiosk). Respondents were asked whether they were aware of a Smart Traveler kiosk at the survey location, and, if so, whether they used the kiosk. Eighty-one percent of the 325 respondents were aware of the kiosk, and of this group 84 percent had used the kiosk. Given that the kiosks are a new technology, it is possible that willingness to use the kiosks and perceptions about the kiosks are related to individual characteristics such as education level or gender. For example, people with college degrees may have had more exposure to computers than high school graduates. Cross-tabulations were conducted of

TABLE 5 Comparison of Los Angeles County and Survey Respondent Characteristics

Characteristic	LA County (%)	Survey (%)
Gender		
Male (%)	49.4	56.8
Female (%)	51.6	43.2
Employment		
Employed (%)	62.0	81.5
Not employed (%)	38.0	18.5
Education		
No high school diploma	30.0	0.3
High school diploma	21.0	19.0
Some college	27.0	41.0
College degree	22.0	40.0
Household Income		
Up to $34,999	50.0	32.0
$35,000 to $49,999	17.0	20.0
$50,000 to $99,999	25.0	38.0
$100,000 or more	8.0	10.0

TABLE 6 Usual Mode of Travel to Work, Percent Shares, Survey and Los Angeles County

Mode of Travel to work	Survey (%)	LA County (%)
Drive Alone	70.3	72.1
Carpool with others	12.6	16.0
Bus or train	13.8	6.6
Vanpool	0.8	n/a
Walk or bike	1.6	4.0
Other	0.8	1.3
N	249	4,002,048

kiosk awareness and use with education level, income level, and gender. Only the results on gender and use were significant. While 83 percent of men and 79 percent of women were aware of the kiosk, 90 percent of men and 75 percent of women who were aware of the kiosks actually used them (chi-square = 11.30, df = 1, n = 262, sig. = 0.001). The greater propensity of men to use the kiosk may indicate a greater interest or willingness to try out the kiosk, or it may reflect joint use. When couples use the kiosk, the man may be more likely to navigate the menus.

Respondents who had used the kiosks also were asked whether they found them easy to use, whether they would use the kiosk again, and whether they would encourage others to use the kiosk. The results are quite positive, as shown in Table 7, and suggest that the kiosks have been well designed for their intended use. Users also were asked whether they would recommend any improvements to the kiosks. Recommendations for improvement were made by 62 percent of those who had used the kiosk. Of those responding to the question, the most frequently mentioned comment was a need to make the kiosk quicker (24 percent). Cross-tabulations were conducted to determine whether perceptions about using the kiosks were associated with individual characteristics; none were found to be significant. Apparently kiosk users are self-selected; those not favorably inclined to using the kiosks do not even try to use them.

Users of Smart Traveler kiosks were then asked about the particular menu items they had used, whether they found the given item easy to use, and whether they found the information obtained useful. Table 8 gives the frequency of menu items requested in rank order. The freeway conditions map is the most commonly requested menu item, followed by MTA bus and train routes. Rideshare or transit videos and carpool information are requested much less frequently. The vast majority of those who used a given menu item found the information useful and stated that they would use the kiosk again to obtain such information.

Because the survey was conducted shortly after the kiosks were installed, no information is available on whether kiosk users acted on the information they received. To get some indication of their willingness to use the information, respondents were asked whether they used the menu just to see how the kiosk works, or whether they actually requested information. Most users (90 percent or more, depending on the item) were experimenting, but the majority also requested and obtained transit (83 percent) or rideshare (67 percent) information. In the case of the freeway conditions map, 71 percent of those who used the map stated that they would use it before starting a trip.

CONCLUSIONS

The survey results show a very positive response to the Smart Traveler kiosks, yet the average usage of the kiosks is quite low. An average of 20 per day is equivalent to fewer than two uses per hour, indicating that the kiosks are idle most of the time. One explanation

TABLE 7 Perceptions of the Kiosks

Question	Easy	Neither	Difficult	N
How easy or difficult did you find the Smart Traveler Kiosk to use?	79%	16%	5%	217
	Yes	No		
Would you use the Smart Traveler Kiosk again?	85%	15%		219
Would you encourage other people to use Smart Traveler Kiosk services?	88%	12%		214

TABLE 8 Menu Items Requested

ITEM	YES	NO	N
Did you request freeway conditions map?	83%	17%	218
Did you request MTA bus and train routes?	56	44	220
Did you request rideshare or MTA bus and train videos?	28	72	217
Did you request the carpool service?	26	74	217

for this is that the kiosks were installed with minimal marketing effort. Although the kiosks are large and have a continuous moving light display across the top denoting them as Smart Traveler kiosks, there is no information at the site that describes what they do. Passers-by must be curious enough to investigate what the kiosks offer. Given this absence of descriptive information, kiosk location becomes more important. For example, the Union Station kiosk is adjacent to the MTA ticket office, whereas the kiosk in Fox Hill Malls is in the food court. It is likely that the function of the kiosk is more obvious in Union Station, where people are traveling, purchasing tickets, etc., than in a shopping mall food court.

A second explanation is that some of the kiosks have maintenance problems and are often out of service. In a location where repeated use might be expected (e.g., office locations), frequent breakdowns would lower kiosk use. Although an analysis of maintenance data has just begun, preliminary indications are that reported maintenance problems are not related to low kiosk usage. The relationship may in fact be the reverse: breakdowns should be a function of usage. This issue will be explored further in subsequent research.

How Kiosks Are Used

Preliminary evidence suggests that kiosks are used either for non-routine trip planning or for trips to be made at some future time. Most of the kiosk usage takes place in non-work environments where people apparently have the time available to explore travel options. Use for future trip planning seems logical. For transit and rideshare information, kiosks have a considerable advantage over telephone inquiries. Users can obtain transit information for more than one trip, and they can obtain printouts of specific trip itineraries. Given the size and complexity of transit services in the Los Angeles area, printouts are likely very helpful. Easily accessible transit information may be particularly valuable to tourists. In the case of rideshare information, the kiosks provide another alternative outside of one's place of work to obtain such information. If the usage patterns observed are supported in further analysis, they imply a kiosk deployment strategy oriented to train stations and other major transportation facilities, large hotel complexes, and shopping malls.

There is also evidence of high levels of use in locations that serve lower income households (e.g., discount stores in the central city area). These locations also show above average use of the Spanish menus suggesting that the kiosks are being used by those who are most likely to be transit dependent. Kiosks may prove an effective means of reaching such groups, and should be considered for social welfare and employment offices as well as major shopping areas.

Finally, the lack of use of the kiosks in office locations suggests that kiosks are not an effective way to provide more "real-time" travel information. On-line services delivering information directly to users at their desks are likely to be the preferred media interface. This is an element of the Smart Traveler Program that is still in development. (The Caltrans freeway traffic conditions map has just become available via the World Wide Web. This service is not part of Smart Traveler).

Further Kiosk Evaluation

The automated kiosk data are a rich source of information. Data for all 77 kiosks are still being processed. Subsequent analysis will examine usage across the different menus, as well as by location and over time. Such analysis should provide a deeper understanding of the extent to which the kiosks are being used for different purposes (e.g., planning of transit trips). It also should allow researchers to investigate use by time of day and test hypotheses about non-routine trip planning. The field site location data for the kiosks will be reviewed in detail to determine whether particular location characteristics (e.g., proximity to other machines, such as ATMs and lottery ticket dispensers) encourage or inhibit kiosk use. Finally, usage data will be supplemented with cost and maintenance data to establish how well the system has performed, and to make an overall assessment of the effectiveness of kiosks in providing traveler information.

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