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Travinfo Evaluation: Traveler Response Element Broad Area Study

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Phase 1 Results
Preliminary Analysis of Wave-1 Survey
Working Paper No.1

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ABSTRACT

TravInfo is part of the Federal Highway Administration (FHWA) Field Operational Test (FOT) program. It aims to develop a multi-modal traveler information system for the San Francisco Bay Area, combining public and private sector talents. This working paper presents the preliminary findings of the first wave Broad Area survey administered in November 1995. The purpose of the survey was to define baseline attitudes, opinions and travel behavior of Bay Area travelers for the assessment of the general impact of TravInfo. The survey questions were directed to the trip characteristics, the acquisition patterns of pre-trip and en route traffic information, the effects of traffic information on travel behavior and the demographic profiles of Bay Area travelers. The survey shows that three quarters of the participants listen to traffic reports at least on occasion and about one half of those who listen change travel habits as a result of traveler information. The benefits of getting traveler information include the ability to make informed travel decisions, save travel time, and reduce anxiety.

Keywords: TravInfo traveler information travel behavior

TABLE OF CONTENTS

LIST OF FIGURES Page

LIST OF TABLES

EXECUTIVE SUMMARY

This working paper presents the preliminary findings of the first wave of the Broad Area survey of San Francisco Bay Area residents. The survey was conducted in November 1995, six months prior to the (then) anticipated time that TravInfo was to become operational. Its purpose was to establish baseline travel data for the assessment of the general impact of TravInfo on the travel behavior of Bay Area travelers.

Computer-aided telephone interviews were conducted among San Francisco Bay Area households; 1,000 interviews were completed with a 52.9% response rate of those households contacted by random digit dialing according to telephone prefixes and area codes. The survey questions were developed for four traveler groups by trip purpose and mode; commuters who use personal vehicles, commuters who use mass transit, non-commuters who use personal vehicles, and non-commuters who use mass transit. The survey results presented here are primarily the distributional profiles of the sample, using frequency analysis and cross tabulation.

The key findings of the survey are:

- Nearly three quarters of the participants (74.1%) listen to traffic reports; regular and occasional listeners are evenly divided. Commuters tend to listen to traffic reports more often than do non-commuters.

- Commercial radio broadcast is the predominant means of receiving traffic information, both for pre-trip and en route; however, more people listen to radio traffic reports while driving

than before leaving home. Among the currently and potentially available media, radio broadcasts are still the most preferred medium for receiving traveler information.

- The quality of traffic reports is rated high when judged on clarity, usefulness and reliability. Over 70% of those who listen to traffic reports rated radio, television, and telephone information as excellent or good. The most-valued information improvements for drivers are those which would identify the best alternate routes to avoid traffic congestion. Real-time traffic information and fastest route information via an in-vehicle navigation device are seen as highly desirable. Real-time transit information is most valued by transit users followed by the best alternate transit route information.

- Approximately one third (38.2%) of the total participants (1,000) or one half (51.6%) of the traffic report listeners (741) change their travel habits in the past as a result of obtaining travel information. 17.7% of respondents reported both pre-trip and en route travel changes, while 11.0% reported only pre-trip changes, and 9.5% reported only en route changes. Travel behavior is closely associated with the user group. The more frequently information is acquired, the more changes are made in travel decisions. The majority of the respondents who regularly listen to traffic reports made both pre-trip and en route travel changes.

- Pre-trip traveler information has a greater impact on route choice than it does on mode shift; more people (76.3% of the total respondents who changed their travel habits) chose to take an alternate route than take mass transit. None of the drive-alone respondents changed their mode choice to mass transit. Of the 12 transit users who changed their mode, nine drove alone, two carpooled, and one took a bus from a streetcar. The majority of people who made en route travel changes diverted to surface streets.

- When asked about their travels over the past month, about one half (46.4%) of the drivers reported that they experienced a delay, with an average delay of 23 minutes. About two-thirds (67.1%) of them listened to traffic reports when they encountered a traffic problem but most did nothing to avoid the congestion. Only 23.7% took an alternate route and 19.4% believed that traffic reports helped them save travel time.

- The benefits of traffic information are perceived to be in the area of trip planning (45.4%), including trip cancellation, as well as in travel time savings (25.9%) and reduced anxiety (20.7%).

The most significant findings of the survey are that a large number of travelers rely on radio traffic reports, with the dominant effect on travel behavior being on route choice. Virtually no effect was seen on mode choice, particularly from personal vehicle (drive-alone) to mass transit. With its multi-modal information service, a working hypothesis of TravInfo is that improved information features from value added resellers (VARs) and travel advisory telephone services (TATS) will not only influence demand for traveler information but will also affect travel behavior, in particular the mode shift to mass transit from drive-alone. Changes in travel behavior with respect to departure time, route choice, and mode shift will be measured by direct comparison between the pre- and post-TravInfo survey results. The post-TravInfo survey will be conducted in November 1997.

1. INTRODUCTION

TravInfo is a Field Operational Test (FOT) sponsored by the Federal Highway Administration (FHWA) of the US Department of Transportation (DOT) and the California DOT (Caltrans). Over its three-year lifetime, it aims to develop a multi-modal traveler information system for the San Francisco Bay Area, combining public and private sector talents. Its objective is not only to provide benefits to Bay Area travelers, but also to stimulate the deployment of privately offered traveler information products and services. The FHWA intends to make the results of this test accessible to others across the nation who may wish to engage in similar enterprises. To achieve this aim, California PATH was commissioned to perform an independent evaluation of the test (Hall, et al, 1995; Yim, et al, 1995).

The evaluation project as a whole includes four test elements: institutional, technology, traveler response and network performance. The traveler response element, of which this working paper is a part, investigates the effectiveness of TravInfo on travel decisions to avoid traffic congestion. The traveler response evaluation has four coordinated studies, all of which employ a survey methodology. The impact on the entire Bay Area traveler population will be assessed from the Broad Area study. The site-specific impacts on a selected corridor, during incidents, will be assessed from the Target study. The impacts on the travelers with ATIS (Advanced Traveler Information System) devices will be assessed from the VAR (Value Added Resellers) Customer study. Finally, the impacts on travelers who directly access TravInfo by telephone will be assessed through the TATS (Travel Advisory Telephone System) study. The Broad Area study involves a comparative analysis of before and after TravInfo. Other traveler response studies are only concerned with the effects of TravInfo after it becomes operational.

This working paper presents the preliminary findings of the pre-TravInfo Broad Area study. The first wave of the Broad Area survey was administered in November 1995, six months prior to the (then) anticipated time the TravInfo project was scheduled to go on line. Its

purpose was to establish a baseline in reference to trip characteristics of San Francisco Bay Area households for the assessment of the general impact of TravInfo on individual travel behavior. The second wave of the Broad Area survey will be administered in November 1997.

The objectives of the wave 1 Broad Area survey are to:

1) Identify trip attributes associated with the acquisition of traveler information.
2) Assess perceptions of the quality of traveler information.
3) Document opinions on the benefits of traveler information.
4) Identify stated preferences for information content and delivery.
5) Describe the trip characteristics and profiles of Bay Area households

The paper begins with the methodology used for survey design and administration, followed by the findings of the survey.

2. METHODOLOGY

2.1 Survey Design and Administration

The wave-1 Broad Area survey was conducted between November 11 and 22, 1995. GLS Research, a market research consultant, administered the survey using the computer aided telephone interview (CATI) technique. The sample was drawn from households in all nine Bay Area counties by random digit dialing according to telephone prefixes and area codes. The random digit dialing method was used mainly because it can ensure that all households which have a telephone are included in the sampling pool, regardless of whether or not their telephone numbers are listed. Since over 95% of Bay Area households have a telephone, the exclusion of non-telephone households from the sampling pool should not pose a serious problem for the representativeness of the resulting sample.

One thousand telephone interviews were completed. This sample size was determined based on the expectation that there should be enough respondents from commuters and non-commuter groups to develop statistically reliable profiles of each group's travel behavior.

Other important subgroups for sampling were defined by mode. Their relative occurrence in the commuter population, according to the 1990 census data, is: 68.2% drive alone, 13% rideshare, 11.2% take public transit and 7.6% choose another transportation mode. We estimated that sufficient numbers will be obtained in the drive-alone category but the rideshare and public transit categories are unlikely to be sufficient to draw statistically significant conclusions. Oversampling of transit users was considered but was rejected because of the relatively high cost associated with sampling an additional 200 transit users via random digit dialing. To increase the sample size, although not by random, a separate mail-back survey of transit users was conducted in parallel with the Broad Area survey. The results of the transit user survey will be documented in a separate working paper.

To prevent any response bias by gender, an interviewing quota of no more than 52% female respondents was imposed. It has been well documented that women tend to respond more readily to surveys than do men. By imposing a gender quota we were able to ensure that the resulting sample population was representative of the total adult population of the Bay Area with respect to gender. Multiple contact attempts and refusal conversion procedures were employed to minimize non-response bias. Interviews were conducted with those who met the predetermined criteria; only individuals who were at least 18 years old were considered eligible for interviewing; non-residents and those who had language barriers were excluded in the survey; if the primary mode was walking or bicycling, the interview was also terminated.

Repeated calls were made up to five times and, with 13,502 total attempts, 1,000 interviews were completed with a 52.9% response rate of those households which answered the call. The

response rate was computed based on the ratio between the number of households which were willing to respond to the interview (those who completed the interview, 1,000, plus the people asked to call back, 486) and the number of households which refused to participate (1,323). Call records are shown in Table 2.1.

Table 2.1 Call Records of the Broad Area Wave-1 Survey

	1st*	2nd	3rd	4th	5th	Total
Complete	639	249	84	23	5	1,002
Call back	270	136	51	16	13	486
Refusal	852	289	121	45	16	1,323
Disqualified						
Language problem	88	28	9	2	0	127
Sex/zip quota full	11	13	7	0	1	32
Under 18	89	31	9	7	0	136
Resident	50	24	6	0	0	80
Walk or bike	17	7	2	2	1	29
Business/Got	643	168	46	17	4	878
Disconnect	1,462	196	37	7	3	1,705
No answer	2,391	1,243	518	159	58	4,369
Busy	372	208	104	50	26	760
Answering machine	1,348	664	257	89	24	2,382
Interviewer rejected	46	8	0	1	0	55
Qualification terminated	89	34	11	2	4	140
Total calls	8,367	3,298	1,262	420	155	13,504

***** 1st attempt to reach a household.

2.2 Sampling

The sample was supplied by Scientific Telephone Samples (STS), a company specializing in scientific sampling. The sampling frame is based on a database of all working residential

telephone exchanges and working blocks (sampling areas such as county or zipcode). The sample is pulled using a *pure unweighted methodology* from nine counties based on household density in each county (Table 2.2). Each possible telephone number within each county had an equal chance of being selected. Using this sampling method, completed interviews from the pulled sample, if dialed exhaustively, are highly representative of the population under study.

Table 2.2 The Sample and Bay Area Households per County

County	Households in % N=2.3 million	Sample in % n=1,000
Alameda	20.9	19.3
Contra Costa	13.8	15.2
Marin	4.3	5.4
Napa	1.7	3.0
San Francisco	13.2	11.9
San Mateo	11.0	9.4
Santa Clara	22.9	21.4
Solano	5.4	4.9
Sonoma	6.8	0.5

N= number of Bay Area households in 1995
n= total observation of the sample

2.3 Survey Content

The survey questions were directed to six subject areas, concerning:

1. General trip characteristics of commuters and non-commuters by mode, frequency, origin and destination, and specific routes people normally take.
2. Acquisition of pre-trip and en route traffic information in terms of frequency and the selected medium.
3. The effects of pre-trip traffic information on departure time, route and mode choice, and trip cancellation, and the effects of en route information on route diversion.

4. Perception of traveler information with regard to its quality and benefits to travelers.
5. Stated preference for traveler information in terms of the content and the means of receiving information.
6. Demographic profiles of survey participants

In the interest of keeping the interviews within 15 minutes, separate interview instruments were used for four traveler groups: 1) commuter driver, 2) commuter transit user, 3) non-commuter driver, and 4) non-commuter transit user. Drivers as defined in this paper are the users of personal vehicles who either drive alone, carpool, or ride a motorcycle. Travelers who use both a personal vehicle and transit (park and ride) are treated as transit users because their primary mode is transit. Descriptive statistical methods are used to determine distributional profiles of the sample. In some cases, bivariate statistical methods are used to compare means and proportions of responses. In the follow-up data analysis, models will be used to explore interdependencies and interaction effects among explanatory variables. The explanatory variables include demographic and trip characteristics and the dependent variables include information acquisition and attitudes toward traveler information.

3. DESCRIPTION OF THE SAMPLE

This section describes the sample and its characteristics. The sample and the 1995 Bay Area census were compared to determine whether the sample represents the relative occurrence in the population with respect to commuter and non-commuter attributes, modal split and demographic profiles.

3.1 Commuter and Non-Commuter Split:

The sample was composed of 67.1% commuters and 32.9% non-commuters who either work at home or do not have regular employment. Commuters were defined by the frequency of weekly

trips, i.e., those respondents who made three or more trips to work or school.. The sample reflects 1995 Bay Area working and non-working household profiles with an average of 1.4 workers per working household. The split between the commuters and non-commuters is 65/35 based on the 1995 census of Bay Area working and non-working households.

3.2. Modal Split:

The survey showed that 86.4% of the sample drive alone or carpool and 13.6% take transit to work or to their most frequent destination. The relative frequencies of respondents' primary transportation modes to work or most frequent destinations are shown in Table 3.1. The 1995 census report on the Bay Area modal split was not available at the time of the Broad Area survey data analysis. However, the data were compared with the 1990 Census and surveys recently conducted by Rides (Rides, 1995) and the San Francisco Chronicle (Table 3.2). The comparison shows that transit riders may be somewhat over represented and rideshare may be under-represented in the Broad Area survey.

Table 3.1 Modal Split between Commuters and Non-commuters

Mode	Commuters n=671		Non-commuters n=329		Total responses N=1000	
	n	%	n	%	n	%
Personal Vehicle Users:	575	85.7	289	87.8	864	86.4
Drive alone	533	79.4	277	84.2	810	81.0
Motorcycle	8	1.2	0	0	8	8.0
Carpool	34	5.1	12	3.7	46	4.6
Transit Users:	96	14.3	40	12.2	136	13.6
Transit	55	8.2	26	7.9	81	8.1
Combination (Park & ride)	41	6.1	14	4.3	55	5.5

N=total number of responses n=number of responses by subgroups

Table 3.2 Commuter Modal Split Comparison

Mode	1990 Census	1995 PATH N=671	1996 RIDES N=3,450	1996 SF Chronicle N=800
Personal Vehicle Users:	86.8%	85.7%	87.0%	87.9%
Drive alone	73.8	79.4	69.3	78.0

Motorcycle Rideshare	- 13.0	1.2 5.1	- 17.7	- 9.9
Transit Users:	12.1%	14.3%	13.0%	12.1%

3.3 Demographic Characteristics

Demographic profiles of the sample serves two purposes: to test the representativeness of the actual population and to identify the relationships between the population and its travel behavior characteristics. In looking at the household income characteristics of the sample, it appears that the upper income group over $100,000 is over-represented and the lower income group, less than $25,000, is under-represented, as shown in Table 3.3. Correspondingly, the age group between 18 and 34 is somewhat under-represented while the age group over 35 is somewhat over-represented (Table 3.4).

In order to correct response biases, the survey data will be weighted (sample balancing) according to the census demographic profiles of the Bay Area population. The P-STAT algorithm will be used in the subsequent step of the data analysis even though we expect sample balancing will not significantly affect the overall conclusions presented in this paper. The findings presented in this paper are based on unweighted data. When the data were weighted by Bay Area household income, the distribution was similar to the distribution using unweighted data. Sample balancing may be necessary, however, for before and after comparison of the TravInfo project.

Table 3.3 Household Income Distribution of the Sample and Bay Area Residents

Household income	Sample households responded in % n=746	1995 census households in % N=2.3 million
<25K	14.1	25.5
25-50K	22.5	31.6
50-100K	39.0	32.2
>100K	24.4	10.7

	100	100

254 people did not respond to the question about their household income.

Table 3.4 Age Distribution of the Sample and Bay Area Population

Age group	Sample in % n= 787	1995 census in % N=4,173,570
18-24	8.8	11.5
25-34	17.2	23.1
35-44	25.9	23.6
45-54	19.9	16.7
55-64	11,1	10.3
65+	17.1	14.8
	100	100

213 people did not respond to the question about their age.

4 PRELIMINARY FINDINGS OF THE FIRST BROAD AREA SURVEY

This section of the paper describes responses to survey questions pertaining to: 1) the acquisition of traffic information, 2) the traveler response to information, 3) the perception of the information quality and the perceived benefits, and 4) the preference for information content and delivery.

4.1 Acquisition of Traffic Information

To estimate the 1995 level of traveler information user characteristics among Bay Area travelers, the survey was concerned with: 1) how many people listen to traffic reports, 2) how frequently they listen, 3) when they normally listen to information and 4) what source of information they generally use.

The survey showed that the vast majority of travelers listen to traffic reports, at least when they expect a traffic problem. Over one third of Bay Area travelers listen to traffic reports regularly. Based on the survey responses, three types of travelers could be identified, those who: 1) use traffic information on a regular basis, 2) use information under special

circumstances and 3) never use information (Table 4.1). The relative distribution among the different user groups is: 35.7% regular users, 38.4% occasional users and 25.9% non-users. Regular users are defined as those who acquire information every time or most of the time when they travel. Occasional users are those who use information some of the time when they travel or only when they are expecting a traffic problem. (For consistency of terminology, those who commute to work in their personal vehicles are called "commuter drivers" and those who do not commute to work but use personal vehicles are called "non-commuter drivers.")

Table 4.1 Traveler category by acquisition of traffic information

Information user category	Commuter driver N=575	Non-commuter driver users N=289	Sig level	Commuter transit user N=96	Non-commuter transit user N=40	Sig level	sample N=1000
Regular users	225 39.1%	85 29.4%	0.996	40 41.7%	7 17.5%	0.998	357
Occasional users	229 39.8	107 37.0	0.577	30 31.3	18 45.0	0.864	384
Non-users	121 21.1	97 33.6	0.999	26 27.1	15 37.5	0.757	259

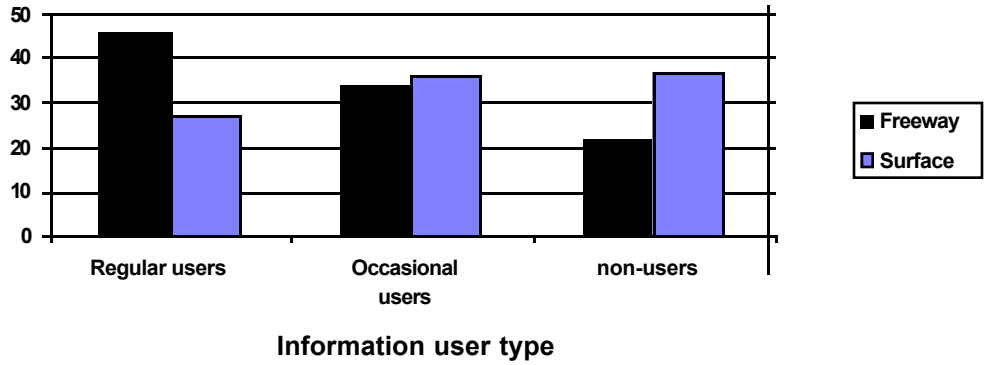
Two hypothesis were tested; first, commuters tend to acquire traffic information more frequently than non-commuters and second, personal vehicle users tend to rely on traffic information more often than transit users. The cross tabulation showed that commuters listen to traffic reports more frequently than do non-commuters (t-test of proportions, significant at the 95% significance level) for both transit and drivers, but no significant difference was found between personal vehicle users and transit users (t-test of proportions, significant at the 95% confidence level).

The survey results also indicate that more people tune into traffic reports en route than before leaving home. Commuter drivers who listen to *both* pre-trip and en route traffic reports are also more likely to change their commute habits than those who listen to traffic reports either pre-trip or en route only (t-test of means, significant at the 95% confidence level).

Another hypothesis tested was whether freeway drivers listened to traffic reports more frequently than those whose route is solely over surface streets. The cross-tabulation suggests that the acquisition of traffic information is closely associated with the primary travel route (t-test of means, significant at the 95% confidence level). Figure 4.1 shows the relationship between the use of information and freeway/surface streets. Nearly one half of those who normally use freeways listen to traffic reports regularly (45.7%) while about one fifth never listen to reports (21.4%). In contrast, less than one third (27.2%) of surface street users listen to reports regularly while nearly two fifths (36.9%) never listen to reports. As expected, more commuters use freeways (64.4%) than do non-commuters (45.7%).

Figure 4.1 Information Acquisition and Freeway/Surface Street Driving

Percent of respondents



4.2 Means for Acquiring Traffic Information

Currently, traveler information is available through commercial radio and television broadcasts, and over the telephone. Commercial radio broadcasting is by far the largest traffic information service in the San Francisco Bay Area; sixty-two radio stations broadcast the traffic conditions on Bay Area freeways at varying intervals each hour. By comparison, four television stations broadcast traffic reports every 20 minutes, during morning peak hours. Two commercial telephone sources, Fastline and Bay Line, are available for traffic and weather information. Fastline provides Bay Area traffic information at the subregional level, North Bay, East Bay, Peninsula, and South Bay. Fastline is connected to City Line, the free telephone information service for weather and Bay Area events. Bay Line, part of radio station KKSF, provides regionwide traffic coverage over the telephone, along with weather information. GTE Mobilnet and Cellular One offer traffic information service features over the cellular telephone. Transit telephone information is available through individual transit operators.

In the Bay Area, two private companies, Metro Networks and Shadow Broadcast Services, supply traffic information to nearly all the Bay Area broadcast stations. Although these companies produce and deliver traffic reports, the stations determine such parameters as the frequency, length, road/transit network, coverage area and style of the reports which they broadcast. In addition to their own aircraft surveillance, these companies use public data sources from the California Highway Patrol computer aided dispatch (CAD), police and fire reports, cellular calls, Caltrans' fax reports, beat calls and closed circuit television. Both companies are equipped with the necessary broadcasting equipment to produce live radio and television broadcasts at their own facilities.

At home, people can receive traffic information from three primary sources: radio broadcast, television broadcast, and the telephone. Traffic and transit information from fax machines and

on-line computers is also available through the employer transit use incentive program (initiated by the California Clean Air Act, Regulation 13). En route, travelers can acquire traffic reports mostly from in-vehicle radio broadcasts or the cellular telephone.

According to the survey, radio broadcast is the predominant means of receiving traffic information, both before leaving home and while driving. Of those travelers who acquire traffic information, about one fifth (19.7%) listen to television traffic broadcasts and about the same number of travelers (21.3%) get information by calling traffic information providers.

Table 4.2 Means for Receiving Pre-Trip Traveler Information

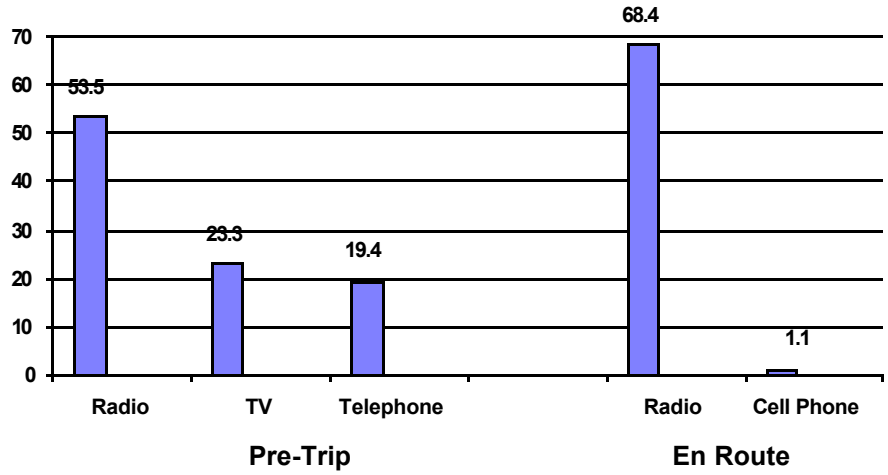
Source	Commuter driver N=454	Non commuter driver N=192	Source	Commuter transit user N=70	Non-commuter transit user N=25
Radio Television	358 89	170 38	Radio or Television	49	11
Telephone	47	69	Telephone	28	14

The numbers shown above are not mutually exclusive.

The survey also showed that among all drivers more people listen to radio reports en route than before leaving home (Figure 4.2). Of the 528 radio traffic listeners, 47.5% (251 respondents) acquire both pre-trip and en route information, 7.8% (41 respondents) acquire pre-trip information only and 44.7% (236 respondents) acquire en route information only.

Figure 4.2 Means of Receiving Pre-Trip and En Route Traffic Information by All Drivers

Percent of respondents.



Both GTE Mobilnet (Metro Traffic data) and Cellular One (Shadow Traffic data) offer traffic information. Metro Networks supplies information to GTE and Shadow Broadcast Services supplies information to Cellular One. The survey showed that few people acquire traffic information over the cellular phone, only 6.1% of the cellular subscribers (19% of the total participants who have cellular phones or 1.1% of all drivers) ever called the cellular traffic information source. In the Bay Area, cellular call volume for traffic information has been constant over the past five years (Yim, et al, 1992) although subscription has gone up significantly (from 3% to 19%). This is presumably due to the fact that drivers have to pay for the information, $1 a call, while the identical information can be obtained from commercial radio broadcasts. The SmarTraveler operational test in Boston however revealed that cellular call volume has increased dramatically when cellular traveler information has been offered free. Cellular phone users made up 45% of the total SmarTraveler callers and cellular calls comprised of 61% of the total calls (Multisystems, 1995).

4.3 Perceptions of Traffic Information

Evident in previous research is the close relationship between the acquisition of traveler information and the quality of the information. A widely accepted hypothesis is that the better the information quality, the more people use it (Peter Harris Research Group, 1994). To assess public perceptions of the quality of traffic reports currently available, the respondents were asked to rate the quality of traffic information in terms of its clarity, usefulness and reliability on a scale of 1 to 5, 1 being poor and 5 being excellent.

User satisfaction with current traffic reports is high according to the survey; a significant proportion of the respondents perceive the quality of information as excellent (36.7%) or good (33.9%) on each counts. Tables 4.3a and 4.3b illustrate the rating of traffic information delivered by different media among personal vehicle users and transit users. Personal vehicle users and transit users gave similar ratings.

Table 4.3a. Quality of Traffic Information Rated by Personal Vehicle Users

	Commuter Driver Rating	Non-Commuter Driver Rating
Radio		
Clarity	4.14	4.02
Usefulness	3.78	4.01
Reliability	3.77	4.12
Television		
Clarity	3.92	3.76
Usefulness	3.88	4.05
Reliability	3.91	4.10
Telephone		
Clarity	3.89	3.92
Usefulness	3.84	4.15
Reliability	3.97	4.19

Table 4.3b. Quality of Traffic Information Rated by Transit Users

	Commuter Transit User Rating	Non-Commuter Transit User Rating
Radio or Television	3.65	4.27
Clarity	3.57	4.36
Usefulness	3.86	4.10
Reliability		
Telephone	3.57	4.43
Clarity	3.59	4.35
Usefulness	3.54	4.29
Reliability		

4.4 Benefits of Traffic Information

Traffic reports may benefit travelers in a number of ways. In addition to travel time savings, the intangible benefits include reduced anxiety, increased knowledge of travel options, increased reliability (particularly in arrival at the destination and the accuracy of information), enhanced ability to avoid congestion, and reduced possibility of getting lost. The perceived benefits of traveler information will influence individual travelers' choices whether or not to acquire information and then modify their travel behavior.

The participants who use traffic information were asked to state the single biggest benefit that they received from getting traffic reports. 45.4% said the ability to make informed travel decisions, 25.9% said travel time savings, and 20.7% said reduction of anxiety. The latter two benefit categories are related to trip planning, the former covers broader benefit categories including decisions taken to avoid traffic congestion, such as trip cancellation.

4.5 Reasons for Not Acquiring Traffic Information

One quarter of the survey participants are classified in the non-user group. Among the key reasons cited for not listening to traffic reports are the unavailability of alternate routes and inadequate geographic coverage (Table 4.4). Other reasons include "not being able to understand traffic reports" and "not usually listen to the radio or television." Similar responses were cited by transit and personal vehicle users. The hypothesis is that when personalized traffic information services become available with TravInfo through Traveler Advisory Telephone System (TATS) and VARs, the expanded geographic coverage (including surface streets) and real time traffic information will attract those who currently do not acquire traffic information.

Table 4.4. Reasons for Not Acquiring Traffic Information
Question: Why don't you get traffic or travel reports from radio, television, or over the telephone? (Asked as an open-ended question)

Reasons N=259	Commuter drivers n=121	Non-commuter drivers n=97	Commuter transit users n=26	Non-commuter transit users n=15
Do not usually listen to the radio or television	9.9 %	26.8%	19.2%	20.0%
Traffic reports rarely cover the routes I take	17.4	10.3	3.8	6.7
Traffic reports are not relevant to my trip	40.5	49.5	11.5	53.3
No alternate routes available	4.1	1.0	30.8	-
Traffic reports are unreliable	2.5	1.0	3.8	-
Cannot understand the traffic reports	0.8	1.0	7.7	13.3
Not sure/DK	0.8	7.2	15.4	6.7
Refused/NA	24.0	3.1	7.7	-

4.6. Changes in Travel Behavior

This section reports on the survey results with respect to changes in travel behavior as a result of obtaining pre-trip or en route traveler information. We are concerned with travelers'

specific decision whether to change departure time, shift mode, take an alternate route, or to cancel the trip altogether based on traffic information.

The survey showed that about half (51.6%) of the total sample population who listens to traffic reports (741 regular and occasional listeners) changed their travel habits as a result of obtaining traffic information. Figure 4.5a shows the distribution of travel changes among commuters and non-commuters. Proportionally more non-commuter drivers changed their travel habits than did commuter drivers (t-test of means, significant at the 95% confidence level); the reason may be that their schedules are more flexible. According to the survey, more non-commuter drivers tend to make travel decisions before leaving home than commuters; more commuter drivers seem to make their travel decisions en route than non-commuters. Table 4.5b shows the travel behavior changes among personal vehicle users. The study also suggests that people who listen to traffic reports *both* before leaving home and en route are more likely to change their travel habits than those who listen to only pre-trip or en route reports (Pearson Chi-Square test, significant at the 95% confidence level).

Table 4.5a Distribution of Travel Changes
Question: Do you ever change your commute or traveling in any way because of the traffic reports you hear?

	Commuter driver n=259	Non-commuter driver n=134	Commuter transit user n=70	Non-commuter transit user n=25
Yes	177 68.3%	110 82.1%	46 65.7%	12 48.0%
Once a week or more	20.9%	10.9%	15.2%	Not asked because of the small sample size
Once every 2 to 3 weeks	18.1	9.1	43.5	
Once a month	27.7	28.2	19.6	
Less than once a month	32.2	48.2	21.7	
	1.1	3.6	-	

Table 4.5b Travel Changes Based on Traffic Information among Drivers

	Commuter driver n=244	Non-commuter driver n=138

Pre-trip changes	24.2%	37.0%
En route changes	27.5	20.3
Both pre-trip & en route changes	48.3	42.7

To assess the behavioral characteristics of travelers, the participants were asked the last time they changed their travel because of a traffic report, how did they change with regards to departure time, route choice, mode shift, and trip cancellation. Of the total drivers (382) who changed their travel habits, 75.1% (287 drivers) made pre-trip decisions to alter their travel and 71.2% (272) made en route decisions to take an alternate route. Note that these percentages are not mutually exclusive: 46.3% of the 382 drivers changed both pre-trip and en route travel the last time they heard a traffic report. Table 4.6 shows the distribution of each travel category among personal vehicle users.

Table 4.6
Travel Changes Based on Pre-trip Traffic Information among Drivers

Travel category	%
Left earlier than originally planned and took an alternate route	25.4
Left earlier than originally planned but took the usual route	7.3
Left later than originally planned and took an alternate route	9.8
Left later than originally planned but took the usual route	4.2
Left at the usual time but took an alternate route	41.1
Left at the usual time but changed the mode	-
Left earlier than originally planned and changed the mode	1.2
Left later than originally planned and changed the mode	0.5
Canceled the trip altogether	10.5

The survey suggests that the greatest effects of travel information are on route choice. Three quarters (76.3%) of drivers including commuters and non-commuters who changed their travel habits said they took a different route the last time they heard of a traffic problem while only 1.7% said they changed their method of travel (commonly referred to as mode). Of 575 commuter drivers, 31.3% took an alternate route. This suggests that people are least likely to shift their method of travel from drive alone to transit (Figure 4.3). Of the three commuters who changed their travel method from drive alone, one carpooled, one bicycled, and one

motorcycled. Of the 12 transit users who changed their travel method, nine drove alone, two carpooled, and one took a bus from a streetcar. In making departure time choices, more people choose to leave early rather than late and more transit users in proportion seem to leave early than do personal vehicle users (Figure 4.4).

Figure 4.3 Travel Method and Route Changes Based on Traffic Information (combined pre-trip and en route)

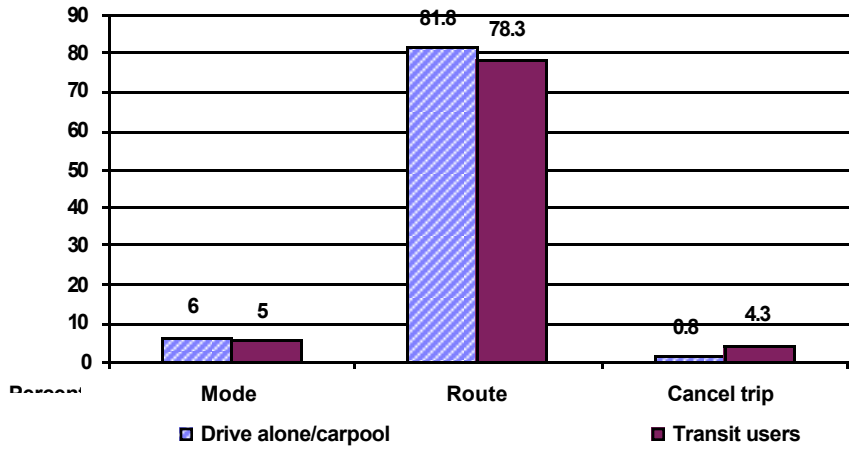
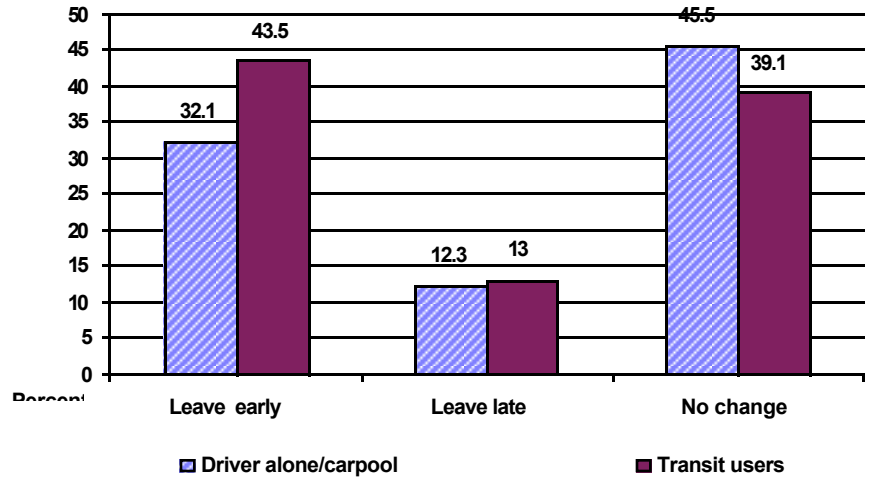


Figure 4.4 Departure Time Changes Based on Traffic Information (combined pre-trip and en route)



The respondents were also asked about their most recent experience in en route diversion as a result of the traffic reports that they heard while driving. When asked how they changed their

route after learning about a traffic problem, 43.9% of the commuters responded that they took surface streets, 23.9% took a different freeway, and 32.2% took a combination of different freeways and surface streets. Proportionally, more commuters tend to take an alternate route than do non-commuters.

4.7 Reasons for Not Changing Travel Habits

The respondents who acquired traffic information but did not change their travel cited that the primary reasons for them not changing the habits were the irrelevance of traffic information and unavailability of alternate routes. Among other reasons were "traffic usually clears" and "alternate routes take longer than the routes that they usually take." According to the survey, transit users were more afraid of getting lost than were the personal vehicle users (t-test at the 95% confidence level).

Table 4.7 Reasons for Not Changing Travel Habits based on Traffic Information
Question: What is the main reason you haven't changed your commute or travel as a result of traffic reports? (Asked as an open-ended question)

	Commuter driver n=82	Non-commuter driver n=24	Commuter transit user n=21	Non-commuter transit user n=12
Traffic usually clears	17.1%	29.2%	9.5%	8.3%
No good alternative routes	35.4	25.0	19.0	16.7
Alternative routes take longer	13.4	12.5	9.5	8.3
Information not relevant or useful	24.4	29.2	28.6	50.0
Afraid of getting lost	1.2	0	23.8	0
Not sure/DK	8.5	4.2	9.5	16.7

4.8 Preferred Means of Receiving Traveler Information

TravInfo is expected to provide more and better information through a variety of means, including cable television, commercial FM radio and in-vehicle devices specifically tailored for

those customers who desire personalized traveler information. To assess which medium is most favored by travelers for receiving travel information, the participants were asked to rate the currently and potentially available *media* on a scale of 1 to 5, 1 being not at all interested and 5 being very interested.

Across all user groups, radio broadcast is still the most favored medium to receive traffic information as compared to other media (Table 4.8a). Both commuter drivers and commuter transit users expressed a moderate interest in an in-vehicle device. The respondents showed little interest in receiving information through either fax machine or on-line computer. Commuter transit users rated on-line computer service somewhat higher than did other groups; the reason may be that they are more familiar with getting information through the employer transit information program. The percent of respondents who gave each medium the highest rating of 5 is shown in Table 4.8b, as an indication of the number of people who are strongly interested in getting information through each medium.

Table 4.8a. Desired Means for Receiving Traveler Information (a scale of 5)

Medium	Commuter driver n=554	Non-commuter driver n=192	Commuter transit user n=70	Non-commuter transit user n=25
Radio	3.55	3.91	3.94	2.96
Television	2.22	2.44	3.04	3.08
Telephone	1.73	2.18	2.29	2.28
Cellular phone	1.91	1.00	2.00	1.76
Fax machine	1.43	1.54	1.78	1.40
On-line computer	1.79	1.59	2.17	1.60
In-vehicle device	2.29	1.83	2.04	1.64

n= number of respondents

Table 4.8b. Percent of Respondents Who Gave the Highest Rating (a scale of 5)

Medium	Commuter driver n=554	Non-commuter driver n=192	Commuter transit user n=70	Non-commuter transit user n=25
Radio	40.3%	41.4%	49.0%	20.0%
Television	11.7	25.7	15.1	28.0

Telephone	7.2	14.3	14.6	12.0
Cellular phone	8.5	14.3	12.0	16.0
Fax machine	3.6	7.1	6.3	12.0
On-line computer	8.1	15.7	4.2	8.0
In-vehicle device	20.4	20.0	4.2	16.0

n= number of respondents

4.9 Desired Traveler Information

The survey participants were asked to rate types of *traveler information* as to whether they would like to receive it in the future and how important it is to them to make informed travel decisions on a scale of 1 to 5, 1 being not at all desirable and 5 being highly desirable. Moderate variations were found in the relative importance rating. People who normally drive were however most interested in getting alternate route information followed by real-time traffic conditions. To them the least desired information was real-time transit service. Table 4.9a shows the stated preference based on the desirability in a descending order of interest among drivers and Table 4.9b shows among transit users. As expected, transit users were most interested in getting information about real-time transit services followed by information about alternate routes. Traffic information through in-vehicle devices was least interesting to transit users. The percent of respondents who gave each information type a rating of 5 is shown below, as an indication of the number of people who are strongly interested in getting each type of information .

Table 4.9a Importance of Traveler Information Type to Drivers

Rank	Information type	Commuter driver n=554	Non-commuter driver n=192	Average score N=746
1	Detailed information about alternate routes around congestion, including where to exit and what surface streets to take, with compared travel time	3.43 35.2%	3.52 38.0%	3.45
2	Current traffic conditions on radio or television that are updated every minute	3.25 33.6%	3.49 35.9%	3.31
3	An in-car navigational computer with a display showing highways and roads. The computer could show where congestion exists and map the fastest routes in terms of time around the congestion	3.18 37.0%	3.03 35.4%	3.14
4	Information about traffic conditions at specific locations, which they could request over the telephone or on-line through their computer	2.77 19.7%	2.70 20.3%	2.75
5	Detailed information about mass transit alternatives to avoid congestion includ-ing up-to-the-minute bus, ferry, and train schedules and where to take them	2.54 18.6%	2.41 17.2%	2.51

Table 4.9b Importance of Traveler Information Type to Transit Users

Rank	Information type	Commuter transit user n=70	Non-commuter transit user n=25	Average scores N=95
1	Detailed information about mass transit alternatives to avoid congestion including up-to-the-minute bus, ferry, and train schedules and where to take them	3.7.9 44.3%	2.84 20%	3.54
2	Detailed information about alternate routes around congestion, including where to exit and what surface streets to take, with compared travel time	3.60 40.0%	3.24 28%	3.5
3	Current traffic conditions on radio or television that are updated every minute	3.79 42.9%	2.56 16%	3.47
4	Information about traffic conditions at specific locations, which they could request	3.21	2.84	3.11

	over the telephone or on-line through their computer	28.6%	24%	
5	An in-car navigational computer with a display showing highways and roads. The computer could show where congestion exists and map the fastest routes in terms of time around the congestion	3.10 38.6%	2.80 36%	3.02

4.10 Experience with Incident Conditions

In this section, the study interest was to learn about traveler response to a delay under incident conditions. The driver participants were asked: 1) whether or not they had experienced an unexpected congestion in the previous month due to an incident, 2) how they became aware of it, 3) what the cause of the congestion was, 4) how long they were delayed, and 5) what they did in response to the delay. Transit users were excluded in this survey because en route decisions are made principally by transit operators. The survey showed that close to half of the drivers experienced a delay (49.0% of commuter drivers and 42.2% of non-commuter drivers). The average delay for commuters was 24 minutes and for non-commuters was 18 minutes.

Table 4.10. Travelers first become aware of the traffic congestion

Commuter drivers	%	Non-commuter drivers %
Just ran into congestion en route	78.7	90.2
Radio report en route	13.0	4.9
Radio report pre-trip	3.0	-
Television report pre-trip	1.7	-
Called Caltrans	1.7	0.8
From someone else	1.3	1.6
Other	0.4	1.6

A majority of those who experienced a delay said they became aware of it by *running into congestion while driving*; a small number of people said they learned of the problem from

traffic information sources (Table 4.10). About half of commuter drivers (52.2%) and one quarter of non-commuter drivers (27%) who ran into congestion subsequently tuned in to a radio traffic report to learn more about the problem.

Most of those who experienced a delay en route did nothing to avoid congestion; about 20% took an alternate route (Table 4.11). Four commuter drivers took transit when they learned of the problem before leaving home. The commuter drivers who took an alternate route thought traffic reports substantially saved travel time, with the average reported savings being 17 minutes.

Table 4.11. Traveler Response to Congestion

Commuter driver n= 230		Non-commuter driver n=122
Did nothing	72.6	86.9
Took an alternate route	22.6	10.8
Took mass transit	2.2	-
Changed departure time	0.9	0.8
Made an intermediate stop	1.3	0.8
Eliminated an intermediate stop	0.4	0.8

Accidents (commuter drivers 30.9%, non-commuter drivers 32.0%) were the primary cause of congestion, followed by roadway construction (commuter drivers 14.3%, non-commuter drivers 21.3%) and bad weather (commuter drivers 10.9%, non-commuter drivers 1.6%). More commuter drivers experienced a weather impact on congestion than non-commuter drivers (t-test of proportions, significant at the 95% confidence level).

5. CONCLUSIONS

The first wave Broad Area survey investigated the trip characteristics and travel behavior of Bay Area residents with traveler information. The key findings of the survey are that nearly 75% of Bay Area travelers surveyed acquire traveler information at least when they expect a

traffic problem; the vast majority of them listen to radio traffic reports, most frequently en route. Regular users and occasional users of traveler information are evenly divided. Approximately one half of those who listen to traffic reports (or one third of the total participants) changed their travel habits based on the traffic information they obtained. About an equal proportion of travelers changed their travel before leaving home and while driving. The most significant impact of traffic reports is on route choice; travel information had little effect on mode shift, especially to mass transit from drive alone.

Acquisition of traveler information is closely associated with freeway driving. A higher proportion of commuters drive on freeways than do non-commuters; the same proportion was found in the relative distribution of traffic information users. Freeway users acquire traffic information more often than those who use surface streets. This is due to the fact that traffic information covers mostly freeway driving conditions. The preferred means of receiving traveler information among the currently and potentially available media is still radio broadcast. Among commuters traveler information through an in-vehicle navigation device is seen as desirable.

The second wave Broad Area survey will be administered in November 1997. With the content and delivery of traveler information services under TravInfo, the usage of traveler information services is expected to increase both with respect to number of users and frequency of use. Furthermore, there may be an increase in the number of people who change their mode choice from drive alone to mass transit. The one-stop (one telephone number) TATS service will provide both real-time traffic information and multi-modal travel options. These hypotheses will be tested by comparing the survey results before and after TravInfo. The survey results reported in this paper will serve as the basis for the development of models by which the impacts of TravInfo will be evaluated.

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