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Travinfo Field Operational Test: Work Plan For The Target, Network, And Value Added Reseller ( V A R ) Customer Studies

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CALIFORNIA PATH PROGRAM  
INSTITUTE OF TRANSPORTATION STUDIES  
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## **TravInfo Field Operational Test: Work Plan for the Target, Network, and Value Added Reseller (VAR) Customer Studies**

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Robert Tam, Stein Weissenberger**

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the Target, Network, and  
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**September 1996**

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## 1. Introduction

TravInfo is a Field Operational Test (FOT) of an open access traveler information system for the San Francisco Bay Area. Its purpose is to establish a centralized multi-modal traveler information system combining public and private sector talents through a partnership and to collect, integrate, and broadly disseminate timely and accurate traveler information in the San Francisco Bay Area. Its objective is not only to provide benefits to traffic operations and Bay Area travelers but also to stimulate the deployment of privately offered advanced traveler information products and services. The TravInfo FOT is sponsored by the Federal Highway Administration (FHWA) and Caltrans. The FHWA intends to make the results of this test accessible to others across the nation who may wish to engage in similar enterprises. California PATH is responsible for an independent evaluation of the TravInfo FOT.

The evaluation project as a whole includes four major test elements: (1) *institutional evaluation*, (2) *technology assessment*, (3) *traveler response* and (4) *network performance*. The institutional element tests the value of public/private partnerships and related issues. The technology element assesses the data collection, integration and dissemination at the Traveler Information Center (TIC). The traveler response portion investigates changes in individual travel patterns that result from TravInfo, and traveler acceptance of and preference for TravInfo technologies. The network performance evaluation investigates whether TravInfo causes measurable changes in network travel times and transportation conditions. Each evaluation element consists of individual studies and are classified as either core or additional tasks. The core tasks funded covered under original funding are:

### *Institutional evaluation*

- Management Board and Steering Committee study

- Advisory committee study

*Technology evaluation*

- Traveler Information Center (TIC) study
- Value Added Reseller (VAR) study

*Traveler response evaluation*

- Broad Area study
- Traveler Advisory Telephone System (TATS) study

Additional tasks covered under new funding are:

*Traveler response evaluation*

- Target (targeted geographical area) study
- VAR customer study

*Network performance evaluation*

The TravInfo evaluation plan (Hall et al, 1994) provides detailed work plan for the core tasks but only high-level plans for the additional tasks. This document contains detailed work plans for the additional evaluation tasks: ***the target and VAR customer studies*** and ***the network performance evaluation***. Detailed work plans for the *institutional* and *technology* elements and portions of the *traveler response* element, Broad Area and TATS studies were described in the evaluation plan. The target study focuses on a “high impact” Bay Area corridor to evaluate TravInfo impacts or benefits to Bay Area travelers. The network performance evaluation simulates the road conditions in that corridor to estimate TravInfo impacts at the aggregate level. The target study and the network performance element are designed to complement each other. Specifically, the network performance element has value only if it is executed with the target study.

The target and network performance studies are necessary in order to assess the site specific impact of the TravInfo project. These studies will allow cross-verification of



(traveler) reported and (instrument) measured travel conditions. They rely not only on travelers' recollections of incidents and their intentions but also on the construction of specific cases from field data sources.

The VAR customer study will provide information on those consumers who actually purchase and use ATIS devices and subscribe to TravInfo services. The VAR customer survey is the method by which ATIS user data can be collected most efficiently.

This work plan is organized in three parts: the Target study, the network performance evaluation, and the VAR customer study.

## **2. TravInfo Goals and Measures of Effectiveness**

The TravInfo evaluation is designed to measure the effectiveness of TravInfo in meeting its goals. The goals of TravInfo are (MTC, 1994):

### Goal 1

- a) Collect and integrate data
- b) Disseminate traveler information throughout the Bay Area
- c) Provide timely and accurate traveler information

### Goal 2

- a) Stimulate and support the deployment of a wide variety of ATIS products and services

### Goal 3

- a) Evaluate entrepreneurial responses to improved information
- b) Evaluate changes in travel behavior
- c) Evaluate the impact of overall transportation system performance

#### Goal 4

##### a) Test the value and effectiveness of a public/private partnership

The evaluation focuses on measuring the effectiveness of the project relative to the project's goals, and not on achieving the project's goals. Hence, the evaluation should be performed independently, from the perspective of an outside observer. However, some evaluation activities are intertwined with the project, especially when it comes to data collection. The evaluators will rely on the project to provide key data elements. The Target study will address Goals 1b, 1c, and 3c. The Network study will address Goal 3c. The VAR Customer study will address Goals 1b, 1c, 2a, and 3b. A detailed work plan for the Target study is described in Section 3, the Network performance evaluation in Section 4 and the VAR Customer study in Section 5.

### 3. Target Study Work Plan

The Target study evaluates changes in traveler behavior and assesses the impact of TravInfo on a “high impact” corridor in the presence of incident conditions under which TravInfo impacts/benefits are likely to be greatest. By repeatedly surveying a panel of travelers (three panel surveys are planned), it evaluates the *changes* in their responses to improved travel information provided by TravInfo; thus we can calculate the consequent benefits in terms of travel time savings and other performance measures. Traveler responses are then tied to the network performance evaluation. Specifically, network performance relies on the target survey and field measurements of traffic conditions in the selected corridor to simulate the effects of real-life incident occurrences. The simulations will provide aggregate delay estimates for various incidents after TravInfo. We believe that the target and network performance studies are necessary if we are to conduct in-depth evaluation of *direct* TravInfo impacts.

#### 3.1 Target Study Objectives

The Target study will address traveler response to major incidents and long-term changes in individual travel behavior in terms of specific Measures of Effectiveness (MOEs) that are based on TravInfo project goals. The **objectives** of the Target study are to:

1. Assess the performance of TravInfo in the event of a major incident.
2. Assess the benefits of TravInfo to individual travelers, based on behavioral surveys.
3. Determine the profiles of those who acquire traveler information available through TravInfo in a targeted geographical area.

#### 3.2 Measures of Effectiveness

The Target study will measure the effectiveness of the TravInfo project in three areas with respect to the evaluation objectives:

#### MOE for Goal 1a

- Availability of TravInfo to those who are affected by major incidents, measured in terms of the number and frequency of the information items disseminated through conventional and new media.
- Awareness of TravInfo measured in terms of the number of travelers who have knowledge of TravInfo availability through various media.

#### MOE for Goal 1b

- Changes in the acquisition of TravInfo over the duration of the FOT measured in terms of the number of travelers who use it, frequency of usage and time (pre-trip or en route).
- Changes in travel behavior over time as a result of TravInfo measured in terms of the number of people who took an alternate route, changed their departure time, took public transit, or canceled their trip.

#### MOE for Goal 1c

- Tangible benefits of TravInfo measured in terms of travel time savings and overall delay reduction.
- Intangible benefits of TravInfo measured in reduced stress and awareness of travel options for trip planning.

#### MOE for Goal 3b

- Changes in travel behavior over time.

The target study is one of four traveler behavior evaluations, Broad Area, Target, VAR customer and the TATS studies, all of which employ a survey methodology. The site

specific impacts on a selected corridor, during incidents, will be assessed from the Target study. The impact on the entire Bay Area traveler population will be assessed from the

Broad Area study. The impact on travelers with ATIS devices will be assessed from the VAR customer study. Finally, the impact on travelers who acquire TravInfo information through the public telephone connection will be assessed through the TATS study. The purpose of the Target study is to assess the direct impacts, in specific instances of use, of traveler information on travel changes through two to three waves of panel surveys depending on the occurrence of major incidents between February 1, 1997 - June 30, 1998.

While the Broad Area study deals with travel changes in a representative sample of the Bay Area traveler population, the Target study involves travel changes over time at a selected corridor to assess the performance (and hence benefits) of TravInfo in the event of major incidents, and determine profiles of the individuals who acquire traveler information available through TravInfo. The motivation for the Target study is that TravInfo should have the greatest impact on the incident-induced congestion that forms 57% of the congestion problem in the Bay; the rest is recurrent congestion. One objective of TravInfo FOT is to reduce incident congestion through the provision of information. Finally, incidents provide the best opportunity to measure TravInfo effects on network performance; we can use incident responses to simulate travel time impacts of TravInfo on the selected link.

### **3.3 Experimental Design**

The experimental design focuses on a “high impact” corridor where individual benefits (travel time savings, reduced delay in reaching destinations) are observable and network performance can be measured and simulated. The Target study corridor should be

characterized by (a) the presence of congestion and commuter traffic, (b) availability of alternate modes and routes, and (c) availability of aggregate traffic data. It should also be expected to undergo a significant improvement in the quality of travel information (due to TravInfo). Because TravInfo is a multi-modal system, mode choice changes will be included in the study. Since mode choice is primarily a long-term decision and changes due to TravInfo are likely to occur only under the most severe conditions (which may not be captured in our Target events), route and departure time changes will also be studied. The selected corridor is a 20 mile segment of the US 101 corridor between the interchange of 101 and 92 to the south and the interchange of 101 and 280 to the north (Figure 1). This segment is selected because:

1. It offers strong transit alternatives, Caltrains and SamTran.
2. There are alternate routes in the corridor that can serve as relievers in case of incidents, US 280, and parallel arterials.
3. Updated traffic data will be available in the immediate future; Caltrans District 4 will complete installation of loop detectors by the end of December 1996.
4. This segment of the corridor is classified as one of the most congested and high accident corridors (JHK, 1990).
5. On and off ramps are easily identifiable for the network performance study.
6. The Target study can benefit from the on-going Bay Area O & D study (Systan, 1995).

### **Panel Surveys**

Based on discussions at the EOT meetings and subsequent discussions with the Federal Highway Administration and Booz-Allen Hamilton, Inc. officials, a panel survey methodology will be employed for the Target study. The major advantage of the panel survey is that behavioral changes due to TravInfo, in particular the response to incidents,

can be monitored over time. Panels will allow us to identify regular and occasional TravInfo users. Panel surveys can also address questions such as:

- Are travelers consistent in their use of TravInfo?
- Do they consistently change modes and routes (and obtain benefits) due to TravInfo?
- How, when and where they became aware of delay?
- How they responded after becoming aware?
- What are changes in travel time?
- Do they believe that they made the most beneficial decisions in terms of travel time savings?

**Figure 1. Selected Segment of the US 101 Corridor**



Panels also allow us to develop and use consistent behavioral models in network performance evaluation. That is, we can evaluate network performance impacts for the market penetration levels over the duration of the FOT with consistent behavioral models (that are sensitive to the quality of the information).

The panel will consist of people who regularly use the (US-101) freeway segment during morning peak hours between 6 am - 10 am. As currently proposed, two to three panel waves will be conducted in response to major incidents, all during the operational phase of the TravInfo FOT (it became operational on August 29, 1996). The possibility of having a major incident within six months is high on the 101 corridor according to the Caltrans' TASAS data analysis for the past two years. In each incident case, Target surveys will be administered within 3 days of the incident. The panel participants will be asked questions about the incident (perceived delay, time that information was received about the delay, etc.) and to provide details of their travel experience. The panel survey results will be compared with travel patterns obtained through the Broad Area surveys.

A combination of a "true panel" where participants are asked the same questions repeatedly, and an "omnibus panel" where participants are asked different questions in successive waves will be used. The questions about perceptions of information and travel behavior will be repeated, whereas questions about impacts of specific incidents will vary. However, survey instruments will be prepared in advance of the incidents (with exception of a few case specific questions), to enable immediate response with the expectation that a few specifics will be filled in at the last minute.

### **Panel Selection**

A panel of northbound morning commuters or frequent travelers on the selected corridor will be recruited by Caltrans District 4 in September 1996. Systan, Inc., a survey research consultant, will conduct origin and destination surveys of eight Bay Area

corridors in the fall of 1996 for Caltrans District 4. On August 9, 1996, Caltrans District 4 agreed to conduct an O & D survey of the US-101 corridor for the Target study. The Caltrans' O & D survey will employ the video assisted (or license plate) method for creating an address file from the California Department of Motor Vehicles. Three video cameras will be placed over the Oyster Point Overpass (south of Candlestick Park) to record license plate numbers on the first, second, and third lanes northbound. The scheduled date for the license plate recording is September 19, 1996 from 6am - 10am. Using the address file, Caltrans will send out a two page mail-back survey questionnaire to approximately 10,000 households. Of these, we anticipate that approximately 10% will agree to participate in the Target study. If necessary, postcards will also be mailed to increase the initial number of Target study participants to 2,000. The proposed sample size of the first wave is 1,000, the second wave is 750 and the third wave is 500 considering the 25% drop out rate.

### **Incident Selection Criteria**

The incidents will be selected according to the following criteria:

1. Must have an effect lasting  $x$  or more hours to ensure that a reasonable percentage of the population using the corridor is affected.
2. Must have a significant effect on traffic conditions, blockage of  $y$  number of lanes on US-101 in a bottleneck, at a location and time where traffic normally is close to saturation.
3. Must not be "catastrophic," e.g., cannot block entire freeway for many hours.

The  $x$  (number of hours being affected) and  $y$  (number of lanes being closed) values will be determined based on the historical data analyses on the accident and incident rates.

This study is currently underway, and will be completed by December 1996. PATH evaluators will rely on TIC operators to identify major incidents and transmit information

to the surveyor. Specifications of major incidents will be provided by PATH to TIC operators.

### **3.3.1 Data Collection**

#### **Target Survey Administration**

GLS Research, a survey research firm, will conduct telephone interviews after each incident using the Computer Aided Telephone Interview (CATI) system. Upon notification of the major incident from TIC operators, GLS Research will conduct a telephone survey beginning that evening.

#### **Survey Instrument Design**

The Target study will use the information collected by the O & D survey (the Caltrans-SYSTAN's study) on the following questions:

##### **Trip characteristics:**

- How often do you usually use US 101 between 6-10 a.m. Monday through Friday?
- When you use the 101 corridor during these hours, where do you usually begin your trip?
- What time do you usually begin your trip?
- Where do you usually end your trip?
- If you drive, do you park for free at that location? If not, how much do you pay?
- How many miles is your trip one-way in miles?
- What time do you usually end your trip?
- Usually, what is the purpose of your trip?
- Do you usually make stops en route?
- What type of vehicle do you use?
- Including yourself, how many people are usually in your vehicle?

##### **Demographic profile**

- Sex

- Age
- How many cars are there in your household?
- Do you work regularly outside your home? Fixed or flexible working hours
- How many licensed drivers are there in your household?

### **Panel Survey Recruitment**

As part of this study, Caltrans will be sponsoring a few small group discussions and telephone interviews among drivers using the 101 corridor to elicit first-hand information regarding personal opinions, travel choices and traffic problems. Focus group meetings will last about 2 hours and a stipend of \$40 will be paid to those chosen to participate.

**Please provide us with your name and home phone number.**

- Both focus group and telephone interviews \_\_\_\_\_
- Telephone interviews only
- Focus group only

Name \_\_\_\_\_ Evening phone no. \_\_\_\_\_

The Target study will address the following questions:

### **True Panel Telephone Interview Questions for the Target study**

- Were you delayed this morning due to the [ *incident* ] near [ *location* ]?
- How did you first become aware of the *incident*?  
(before leaving home or while driving/ precode source: Radio, TV, saw it, etc.)
- What did you do in response to the congestion?  
(precode: nothing, took an alternate route, etc.)
- Approximately how many minutes were you delayed if you were delayed?
- Did you listen to a radio report after you encountered the congestion?
- Do you know of TravInfo that you can call the number to get up-to-the -minute traffic information and travel options?
- If yes, did you call TravInfo?
- Do you feel the traveler information saved you any time?
- How much time do you think you saved in minutes?
- What is the single biggest benefit you receive from getting traveler information either before or during your commute?
- About how long in minutes one-way is your commute on a typical day?

- About how long in minutes one-way is your commute on a day when traffic congestion is unusually severe?

### 3.3.2 Data Reduction and Analysis

Panel members will provide detailed descriptions of the selected incidents, the traveler information received before, during and after the incident, their response to information and the perceived benefits due to information. The data from surveys will be used to relate behavior to attributes of alternatives, individuals and travel information disseminated by TravInfo. Initially, simple statistical techniques such as frequency analysis and cross-tabulations will be used to analyze the data by testing traveler behavior hypotheses and studying reported preferences. For example, the travel time benefits from mode/route diversion in incidents will be explored simply by examining normal travel time and additional delays on both the usual and alternate mode/route. To elaborate, suppose that we are evaluating the travel time benefits of mode/route diversion in incident conditions. The savings are simply the travel time on the usual route (to or from work), plus the expected length of delay, minus the travel time when using the alternate mode/route (including additional delays due to diversion of traffic to the alternate route). Information on the expected length of delay will be collected from the Network study. We will analyze differences in behavior of persons before and after the implementation of TravInfo. With better quality (TravInfo) information, the likelihood of switching in incident conditions may increase (all else being equal).

A more rigorous treatment that controls for exogenous factors will come from multivariate analysis. Specifically, multivariate models of behavior (mode, route and time diversion propensity) will be estimated to explore the effects of several variables simultaneously. The explanatory variables include socioeconomic characteristics, contextual factors and TravInfo information. The multivariate approach compensates for inter-dependencies among explanatory variables, controls for exogenous factors (such as changes in household structure and income levels) and allows the exploration of interaction effects. Two such methods are discussed below.

Models will be calibrated to quantify the effect of improved travel information due to TravInfo and other factors on behavior. For example, the effect of several socioeconomic, contextual and information variables on the diversion decisions will be examined by estimating (pooled and separate) diversion choice models based on the respondents' reported experience of incident delays. They can link more than one *dependent* variable, e.g., mode and route diversions. Also they will be used to model information variables (e.g., the type of information acquisition device) endogenously with preferences (e.g., route and mode changes).

The product of the analysis will be models of traveler behavior. They will indicate travelers change travel patterns due to TravInfo and other factors. (We will be controlling for as many factors as possible through survey design and multivariate analysis.) The estimated coefficients will provide insights on the relative importance of each source in determining the use of, and response to, information. For example, we can evaluate whether the propensity to use public transit increases when information is acquired through self-observation, radio traffic reports or special devices that are based on TravInfo. This will allow us to understand and predict behavioral changes due to improved information. Overall, panel analysis will allow us to obtain a deeper understanding of behavioral changes due to TravInfo; this understanding will complement what we learn from the non-panel broad-area survey.

### **3.4 Evaluation Tasks and Test Schedule (Figure 2)**

#### **Panel Sampling**

- Coordinate the video license plate study with SYSTAN for the Origin and Destination study by Caltrans District 4. (10/96 - 11/96)

- Obtain the address file of the Caltrans O & D study on the US 101 corridor. (10/96 - 11/96)
- Provide input to the O & D survey instrument in order to recruit Target survey participants. (10/96 - 11/96)
- Mail postcards to increase the panel sample size. (1/97 - 2/97)
- Establish criteria for selecting Target incidents (see page 11); establish reliable procedure for operationally selecting Target incidents and rapidly executing surveys.
- Develop data transfer procedures with cooperating agencies.

### **Target Survey Design**

- Examine literature on survey research conducted in other field operational tests (e.g., ADVANCE, TravTek). (10/96-11/96)
- Design the survey based on behavioral hypotheses; take into consideration comparability with and differences from the broad area survey. Develop the final target survey tool. (11/96-1/97)

### **Survey Administration**

- Pre-test recruitment survey and subsequent panels. (1/97)
- Administer two to three panel surveys using CATI (2/97-6/98)

### **Data Analysis and Documentation**

- Conduct preliminary data analysis (frequencies, cross tabulations). Model diversion behavior (mode change, departure time change, route change, etc.) to understand the effect of TravInfo along with other factors that influence behavior. (depending on incidents) (Data analysis of Wave 1 survey 7/97-10/97)  
Analyze survey data (7/97 - 9/98)



- Prepare draft working papers after each incident and final working papers for Target surveys (9/97 - 10/98)
- Prepare a final report documenting survey instrument, implementation methodology and analysis results. (9/98 - 12/98)

### **3.5 Deliverables**

- Draft and final working papers on the results of Target surveys
- Reports on the Target study in coordination with the Network study

## **4. Network Performance Evaluation Work Plan**

TravInfo will provide real-time transportation information to Bay Area travelers through VARs, TATS, and possibly other means. Bay Area transportation services will be enhanced by: 1) providing a range of travel options with real-time information for current and predicted travel conditions, 2) allowing effective pre-trip planning, and 3) providing real-time route selection opportunities.

The purpose of the network performance element is to investigate whether TravInfo results in measurable changes in network travel times and transportation conditions. To maximize the likelihood of measuring these changes, the evaluation will focus on conditions where TravInfo is likely to have the greatest effect: major incidents, in a congested location, and where travel alternatives exist. The measurements will take place on the selected US 101 corridor in coordination with the Target surveys described in Part I. Two experimental approaches will be employed for the Network study, the case study approach and simulation modeling. The case study approach will include a combination of target surveys, network measurements, and traffic simulations.

### **4.1 Network Performance Evaluation Objectives**

The network analysis element is primarily addressed at measuring the benefits to travelers and society, with respect to reduced congestion, reduced travel time, and mode shift, with respect to Goal 3c. Secondly, the element will measure the speed at which information is transmitted, and the quality of the information transmitted. This will apply to specific Target incidents only. The evaluation objectives are:

1. Measure the benefits to travelers and society with respect to reduced congestion, reduced travel time, and mode shift.
2. Measure the speed at which information is transmitted and the quality of the information transmitted under two to three incidents.

## **4.2 Measures of Effectiveness**

The MOEs for this study are highly influenced by available data sources (described in more detail in Part 1). These sources will be Caltrans loop-detectors, CHP Computer-Aided-Dispatch (CAD) records, patronage records from Caltrain and SamTran, and TATS recording of traffic reports using the Dictaphone system. These data sources will allow direct measurement of the following MOEs:

- 1) Traffic counts from loop detectors, by time, occupancy and location, for the 101, 280, and 380 freeways, to assess diversion to alternate routes and duration of queues.
- 2) Patronage on bus and train lines directly serving the corridor, for the day of the incident.
- 3) Speeds from loop detectors, by time and location, for the 101, 280 and 380 freeways, to assess changes in travel time for various alternative routes relevant to the specific incident.
- 4) Time between incident and public reporting of the incident; accuracy of reported information and information detail.
- 5) Number of follow-on accidents (if any) to the specific Target incident, along with their causation, and a case-by-case assessment of whether traveler information affected these incidents.

The above data will be compared with historical data. In addition, these data will be used, in combination with a traffic simulation model, such as FREQ and TRANSYT or WATSIM, as well as survey results, to estimate other MOEs, such as:

- 1) Changes in travel times and traffic levels on the selected corridor and parallel freeways and arterials.
- 2) Changes in traffic volumes on parallel arterials.
- 3) Net changes in pollution, resulting from incident induced congestion with and without traveler actions that depend on incident information.
- 4) Net changes in fuel consumption, resulting from incident induced congestion with and without traveler actions that depend on incident information.

### **4.3 Experimental Design**

The overall approach is to focus on two or three major incidents on the selected corridor. This corridor will be the area surrounding the US-101 Freeway in San Mateo and San Francisco counties, for the reasons cited in Part I (See Figure 1). The experiment will be coordinated to take place at the same time as the target surveys and the selected incidents will be the same as those for the Target surveys.

#### **4.3.1 Data Collection**

The evaluator will rely on the TravInfo partners for direct data collection. This will include the following:

**Caltrans** Provision of magnetic tapes containing statistics on traffic flow, occupancy and speed, by location, for the US 101 corridor (establish a communication link between Traffic Operations System (TOS) and PATH to receive data

directly from TOS. These tapes will cover the day of the incident, and the days immediately preceding and following the incident.

- CHP** Provision of Computer-Aided-Dispatch (CAD) records, providing all dispatching details surrounding the incident.
- TIC** As part of on-going supply of data, information on exactly what information was transmitted, and when, regarding the incident from both LDS and TATS.

**Transit Agencies (Caltrains, SamTrans)**

Provision of transit ridership records the day of the incident and the days immediately preceding and following the incident.

**Sample Size**

The sample size amounts to approximately 3 days of data collection for Caltrans, for each incident, covering all detectors in the selected corridor. For CHP, the sample size amounts to several hours of data collection for each incident. For the TIC, the data will be part of what is routinely collected and recorded for traffic data dissemination between 6am -10am. For transit agencies, the sample size amounts to several days of data collection for each incident.

**4.3.2 Data Reduction and Analysis**

The traffic data will be used for three purposes: 1) measurement of the average travel time during morning peak hours on the selected corridor, 2) cross-verification of (traveler) reported and (instrument) measured travel conditions on this corridor, and 3) provision of traffic flow data for network simulation modeling.

Traffic volumes on on- and off-ramps will be used to assess rates of diversion during the incident if feasible. Traffic volumes will be compared to normal days to determine when and where diversion takes place, and how many vehicles divert.

The first step of data analysis will entail simple averaging of the results, indicating average speeds, average traffic flows on the freeways, transit patronage, time to detect the incident, time to clear the incident, and time to clear the queues. Network analysis will be employed later to estimate travel times and traffic flows on primary and alternate routes, to estimate queuing delay by 5-minute time increment, and to infer measures of pollution and fuel consumption. Actual travel times, as determined from loop detector data, will also be compared against reported travel times and reported routes. This comparison will be used to determine whether travelers were able to find the best route based on traveler information.

Simulation models will be used for evaluating the network performance effects of TravInfo under incident conditions. Actual incident scenarios will be captured and the behavioral changes will be simulated with the historical data on the US-101 corridor. The evaluation will rely on aggregate performance measures such as reduced travel time in the network and route or mode shift.

#### **4.4 Evaluation Tasks and Test Schedule (Figure 2)**

The basic tasks are to select the appropriate simulation model, collect network data during incidents/run simulations, and analyze/explain simulation results, the design, implementation and analysis of network performance simulation. These are further elaborated below:

### **Simulation Model Selection**

- Examine literature on network performance research conducted in other field operational tests. (10-12/96)
- Select an appropriate corridor simulation model that can calibrate incident data from loop detectors and behavioral data from Target surveys. (2/97)

### **Experiment Design and Data Collection**

- Conduct statistical analyses of historical traffic data to understand the incident characteristics on US 101. We will use Caltran's TASAS, CHP's CAD, and TravInfo's loop and Freeway Service Patrol (FSP) data for the analyses. (9-12/96)
- Select the types of incidents to be analyzed. Develop an after TravInfo network evaluation design. (12/96 - 1/97)
- Collect data on the US-101 corridor in coordination with Target surveys (2/97 - 6/98). The simulation input data will include: target survey responses, traffic counts by time and location on US-101, patronage on bus and train lines directly serving the corridor for days of the selected incidents, speeds by time and location on US-101 to assess changes in travel times, time lag between incident and reporting of the incident, accuracy of the reported information, operations in the Traffic Management Center (TMC)/Traveler Information Center (TIC) at the time of the incidents and number of follow-on collisions (if any). See the TIC evaluation plan (Miller and Hall, 1995).

### **Data Analysis and Documentation**

- Compile results. This includes simple averaging of performance measures by time of the day, speed, occupancy, etc. (6/97-7/98)
- Conduct detailed analysis. Infer route travel times, arterial traffic volumes. (7/97-6/98). Compute net changes in fuel consumption and pollution, resulting from incident induced congestion.

- Prepare working papers on the results of the simulation and case studies three months after each incident (9/97-9/98)
- Prepare a final paper and deliver a properly documented simulation model, case study methodology and simulation results. (6/98-12/98)

#### **4.5 Deliverables**

- Draft and final working papers on the results of the simulation and case studies.
- Draft and final working papers on the comparative results of the Target and Network studies.



## **5. VAR Customer Study Work Plan**

TravInfo is a test of the effectiveness of a public-private partnership in providing enhanced and valued information to travelers. Public agencies have developed an open-access, real-time, regional transportation data base; in turn, private companies ("value-added resellers" or VARs) will access, repackage and enhance this data and sell it to travelers by means of particular devices and services. As end users of the TravInfo product, these travelers (the "VAR Customers") are an important source of information on the test's effectiveness. This part describes a plan for obtaining information on the purchases, experiences and reactions of these users.

The primary goals addressed in the traveler response element are: 1b) TravInfo's ability to transmit information throughout the Bay Area, 1c) TravInfo's ability to transmit timely and accurate information, 2a) stimulate and support the deployment of a wide variety of ATIS products and services, and 3b) TravInfo's ability to transmit information that change travel behavior and produces benefits.

### **5.1 VAR Customer Study Objectives**

The evaluation objectives of the VAR Customer Study are specifically to: 1) measure consumer response to value-added products and services using the TravInfo database; 2) determine the profile of individuals who access, acquire, and use information available through TravInfo technologies.

Customers of VARs will be important judges of the value of the TravInfo concept, of the effectiveness of its particular implementation in the San Francisco Bay Area, and more narrowly of the value of the specific products and information delivery services that they

are using. We hope to be able to obtain a variety of information from the choices and experiences of these customers, including help in answering the following important questions: Who is attracted to purchase these products and services? What are their demographic and travel characteristics and what are their expectations for these products? What are their actual experiences in the use of the products? How helpful are the products and the TravInfo information that they provide (especially as compared to the users' prior experiences), and in what ways have they led to changes in travel behavior? The remainder of this plan describes instruments for acquiring this information.

## **5.2 Measures of Effectiveness**

Basic measures of effectiveness for the VAR Customer Study are the following:

*For VARs:*

- Marketing strategies for products, including how TravInfo data is used.
- Reports of sales.
- Assessment of user experience and satisfaction.
- Evaluation of TravInfo product quality and usefulness.

*For End-Users:*

- Experience, functional use, frequency of use, resulting behavior change
- Increased functionality through product use, compared to prior experience
- Degree of satisfaction and product value, as compared to its cost
- User perception of product quality and usefulness, and user satisfaction
- Frequency of product usage and effectiveness in supporting travel decisions
- Willingness to pay for services

More specifically, *for product usage:*

Frequency of product usage, frequency of feature usage, comparison between TravInfo features (such as real-time information) and non-TravInfo features (such as maps etc.), increased functionality through product use.

*For product satisfaction:*

Satisfaction rated on an ordinal scale for specific product features, comparing TravInfo enabled features and those that are not. Comparison to satisfaction with alternative sources of information, such as radio broadcasts and message signs.

*For consumer profile comparison:*

Demographic characteristics (age, income, race, gender, auto-dependency, profession) of product purchasers compared to demographics of general population obtained from the Broad Area Surveys of the Traveler Response evaluation element. Specifically issue of ability to reach the general public through ATIS.

## **5.3 Experiment Design**

### **5.3.1 Data Collection**

There are presently 36 registered VAR participants. These VARs have been classified into six categories, representing the following types of products or services:

1. End-user product that contains a hardware component and user interface
2. Internet service providers
3. Wireless service providers
4. Information integrators and "wholesalers" with no direct contact to the end user.
5. Broadcasters.
6. Participating governmental agencies.

All VARs will be contacted to obtain basic information that describes their TravInfo related products and services, as indicated in the sample questionnaire in the appendix. The questionnaire covers product features, use of TravInfo data and marketing plans. Where possible, all VAR products and services will be tested to verify VAR provided information and to develop basic product and service comparisons.

Only VAR types 1 to 3 are candidates for surveys of VAR customers. Information integrators do not have direct contact to end users and do not provide a ready mechanism for customer surveys. Information broadcasters provide a direct service to end users, but offer no mechanism to contact their listeners. Their customers can only be surveyed through general surveys, such as the TravInfo broad-area survey. Lastly, governmental agencies fall outside the scope of the VAR customer survey, which is oriented toward commercial products.

Because VARs are developing unique products and services, it will be impossible to develop a single survey instrument that can be used in all instances. The following discusses some of the possibilities. Exact details will be resolved through one-on-one discussions with VARs

### **End-User Products**

Based on preliminary discussions, some end-user products will be available for purchase by the general public, whereas others will only be available to a closed group of known test participants. In the case of products for sale, some VARs will know their customers' identities whereas others will not (e.g., if product is sold through retailers). Each product type invites a somewhat different survey mechanism, as discussed below:

Packaged Surveys: A mail-back survey is packaged inside or on the product. An incentive may be provided to increase response rate. This may be the only survey mechanism when customer identity is unknown.

Mail-out/Mail-back Survey: When customer address is known, a survey may be mailed to the customer, and mailed back upon completion. An incentive may be provided to increase response rate.

Telephone Survey: When customer phone number is known, the survey may be completed by telephone.

Interview: In the case of test participants, it may be effective to conduct one-on-one interviews to explore product attributes in depth.

Focus Group: In the case of test participants, it may be effective to conduct a limited number of group sessions to discuss product attributes in depth.

Product Tests: The general public may be invited to participate in product tests, either on a one-time or ongoing basis. Participants would record their experience using the product and participate in surveys to assess their satisfaction with the product.

As an incentive to encourage VAR participation in the study, surveys will be designed to meet both the needs of the evaluation and the needs for VAR market research. Hence, each survey will be customized to include a combination of questions developed by PATH and questions developed by VARs. Survey results (from both VAR and Evaluator-provided questions) would be shared by both PATH and the VARs. The sharing of responses from evaluator-contributed questions on the part of VARs is essential. PATH, however, might in some instances agree beforehand not to access or use information resulting from VAR questions.

The survey distribution mechanism will also be customized. In some cases, to protect confidential customer lists, the VAR may mail out or receive customer surveys, and in some cases PATH developed questions will be integrated within the VAR's usual surveys. To the extent possible, PATH developed questions will be uniform across VARs, to allow cross comparisons, but some questions will be customized to reflect specific product features.

### **Internet Service**

In the case of internet services, it is unlikely that customer addresses or phone numbers will be known, to either the VAR or PATH. However, it may be possible to incorporate a short survey within the service, either prior to or after receiving information. Simple questions, such as whether the user is requesting information for a specific trip and whether the information resulted in a change in plans, could be posed. However, only limited information is obtainable. It may also be possible to request an electronic mail address from the user, which will result in automatically forwarding a follow-up survey (perhaps the next day). The e-mail survey could be more detailed than one that is integrated into the service.

### **Wireless Services**

Wireless service providers are unlikely to have direct contact with end-users, but may partner with second-tier VARs that do have end-user contact. These second-tier VARs may or may not be registered participants. Working through the wireless service provider and its partners, PATH may be able to access additional end-users, who could be surveyed via the mechanisms outlined for end-user product VARs.

While PATH will make every effort to gain cooperation from VARs, it should be borne in mind that some might refuse to participate in the VAR survey. The signing of the Participant Agreement insures a certain level of cooperation between VARs and PATH. The agreement states: “Participants are expected to participate to the fullest extent possible with the FOT’s evaluators in determining the TravInfo system’s ability to meet its performance goals.” This language is open to interpretation and arrangements with VARs will likely be made on a case by case basis.

VAR customer surveys will be administered through as many registered VARs as feasible, given their willingness to participate and their success in delivering testable products and services. The exact level of participation, and the potential population of VAR customers, will be determined through individual meetings with VARs. Hypothetically, assuming 2,000 completed surveys with a 20% response rate, a total of 10,000 evaluator customer surveys will need to be distributed.

The customer surveys will be administered continuously during TravInfo operations as new products are introduced and sold throughout the FOT period. A final follow-up survey will be administered to all of the persons originally surveyed (assuming their identity is known). This will take place 18 months after TravInfo becomes operational. The purpose of the follow-up survey will be to assess long-term usage of products, and compare this long-term usage to individuals’ initial expectations (Yim et al, 1994).

### **Evaluator User Survey Questions**

The exact content of customer surveys will be determined after VARs are contacted. The following describes the types of questions that may be asked.

- 1 Background questions on demographics, travel practice, etc., drawn from Broad Area Survey (Yim, 1996).

#### Product use questions

- How often do you use the product?
- When and where do you use the product?
- What specific benefits (travel time, stress, security, etc.) have you attained as a result of product use? (rank on a scale of value from 1 to 10)
- Has use of the product changed your travel behavior? (and how often)
- Do you feel you are traveling more or less or about the same with this product?
- What is your overall level of satisfaction with this product? (on a scale of 1 to 10)
- Have you found problems in using this product? (ease of use, reliability, functionality cost)

### **5.3.2 Data Reduction and Analysis**

Data analysis techniques will be selected as appropriate to the data type, number of VARs/Users, variability in data formats, and the purposes of the analysis. Simple tabulations will be performed at a minimum. Case study reporting will be done in cases where data is particularly sparse.

The data from the VAR customer surveys will be used to relate travel behavior, travel experiences, and level of satisfaction with purchased products/services features. Simple bivariate statistical techniques such as frequency analysis and cross-tabulations will be used to analyze the data. An example would be measuring associations between individual



products and product features with customer satisfaction. Models will also be considered to explore inter-dependencies among explanatory variables and interaction effects.

Assuming that the surveys are representative of the VAR customer base, overall performance of a product or service associated with a VAR type will be based on statistical analysis of the distribution of survey responses. However, it might be difficult to develop a single useful approach to all VARs for the assessment of products or services given: the different types of VARs and uncertainties concerning the number of VARs, the customer base, and the access the evaluators will have to customers.

### **Correlation with Other Evaluation Elements**

Correlations will be made with results from the Broad Area Survey and the Telephone Survey for consumer profile comparisons. The data will also be correlated with results from the TIC analysis to help explain (and confirm) reported deficiencies of TravInfo data by the VARs. Coordination of specific user evaluations with the Target Surveys may also be possible (Weissenberger, 1996). The VAR Customer Study also ties into the VAR study by helping to evaluate the actual deployment and quality of ATIS products and services.

## **5.4 Evaluation Tasks and Test Schedule (Figure 2)**

### **VAR Product Survey**

- Interviews with VARs to assess their willingness to participate in the VAR customer study (10/96 - 11/96)
- Coordinate with VARs for the design of VAR product surveys (10/96 - 6/98)
- Provide input to VARs for the design of survey instrument (10/96 - 6/98)

### **VAR Customer Survey**

- Design a survey instrument for the VAR customer study (10/96-3/97)
- Execute initial survey (12/96-3/97)
- Execute VAR customer surveys on continuous basis, as TravInfo operates (distribute mail back questionnaires through VARs, 3/97 - 6/98)
- Execute one follow-up survey 18 months after TravInfo start-up (6/98)

### **Data Analysis and Documentation**

- Analyze VAR customer survey results, up to 9 months (6/97) after TravInfo start-up
- Document in a working paper 12 months after TravInfo start-up (9/97)
- Analyze final 9 months of VAR customer surveys, along with follow-up VAR customer survey (3/98)
- Prepare draft and final working papers on the two VAR Customer survey data analyses. (6/98 - 12/98)
- Prepare a draft and final working paper on the results of the follow-up survey 18 months after TravInfo (3/98 - 9/98)

### **4.5 Deliverables**

- VAR Customer Study working paper, 12 months after TravInfo start-up
- Final report on the VAR Customer Study.

**APPENDIX A. TravInfo VAR Product/Service Information**

Product/Service Name:

Company Name: \_\_\_\_\_

Company Location (city/state): \_\_\_\_\_

Point of Contact (name/phone number): \_\_\_\_\_

Type: In-Vehicle Device | | Other Portable Device | | Software | | Internet Service | |  
Wireless Service | | Faxing | | Paging | | Kiosk | | Cellular | |  
Other (describe) | |

Describe functions performed by the product or service.

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How will the product use TravInfo data?

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What other types of dynamic travel information will be available from product/service?

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If product provides non-travel related features, describe these features:

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Required add-ons to make product functional (describe all that apply)

Hardware: \_\_\_\_\_

Software: \_\_\_\_\_

Communication/Data Services: \_\_\_\_\_

Optional add-ons (describe all that apply)

Hardware: \_\_\_\_\_

Software: \_\_\_\_\_

Communication/Data Services: \_\_\_\_\_

Product Features (answer as they apply):

How will information be displayed to the consumer (describe format and hardware)

\_\_\_\_\_  
\_\_\_\_\_

How will the consumer enter information (e.g., keyboard, touch-screen, etc.)

\_\_\_\_\_  
\_\_\_\_\_

What is the primary communication medium (e.g., modem, FM-subcarrier, etc.)

\_\_\_\_\_  
\_\_\_\_\_

Power Supply: \_\_\_\_\_

Describe product support

Documentation/manuals \_\_\_\_\_

Customer service phone lines \_\_\_\_\_

Repair \_\_\_\_\_

Product upgrades \_\_\_\_\_

Warranty period \_\_\_\_\_

Describe target market for product or service:

Demographics/user description: \_\_\_\_\_

\_\_\_\_\_

Locations where product will be released: \_\_\_\_\_

\_\_\_\_\_

Plans to market product (describe all that apply)

Via OEMs or Product Bundling \_\_\_\_\_

\_\_\_\_\_

Sale through retail electronics outlets \_\_\_\_\_

Sale through automobile dealerships or parts stores \_\_\_\_\_

Retail sale through other channels \_\_\_\_\_

Mail-order sale \_\_\_\_\_

Direct sale to customers \_\_\_\_\_

Other for-sale or fee \_\_\_\_\_

Please describe plans to advertise product or service

Medium (radio, print, electronic, etc.)

Co-operative advertising with retailer, OEM, etc.

\_\_\_\_\_

\_\_\_\_\_

Plans to test product with users

Through closed group of known participants \_\_\_\_\_

Other types of groups \_\_\_\_\_

Planned testing methods \_\_\_\_\_

\_\_\_\_\_

Units of product currently in use: Bay Area \_\_\_\_\_ Worldwide \_\_\_\_\_

Production target for 1997: Bay Area \_\_\_\_\_ Worldwide \_\_\_\_\_

Current Price: \_\_\_\_\_ Price target for 12/97 \_\_\_\_\_

Describe consumer experience with product to date

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Sale through automobile dealerships or parts stores \_\_\_\_\_



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