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CALIFORNIA PATH PROGRAM  
INSTITUTE OF TRANSPORTATION STUDIES  
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# **TravInfo Field Operational Test Evaluation Plan**

**Randolph Hall, Y.B. Yim, Asad Khattak,  
Mark Miller, Stein Weissenberger**

**California PATH Working Paper  
UCB-ITS-PWP-95-4**

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# **TravInfo Field Operational Test Evaluation Plan**

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**Prepared for  
Federal Highway Administration**

**November 1994**

## **ABSTRACT**

TravInfo is a Field Operational Test (FOT) sponsored by the Federal Highway Administration (FHWA) of the US Department of Transportation. Over its three-year lifetime, TravInfo's goal is to implement a centralized traveler information center to collect, integrate, and broadly disseminate timely and accurate traveler information in the San Francisco Bay Area through a public/private partnership. California PATH was commissioned to perform a formal evaluation of the test. The TravInfo Evaluation Plan describes the scope, methods, and procedures to measure the effectiveness of the project. The TravInfo evaluation will contain four elements: institutional evaluation, technology evaluation, traveler response evaluation, and network performance evaluation.

## **EXECUTIVE SUMMARY**

The Bay Area is developing an Advanced Traveler Information System (ATIS) project, called TravInfo, that will provide travelers with easy access to timely and accurate information on all travel modes. TravInfo will help determine whether dissemination of up to date information on transit and traffic conditions results in a decrease in both auto use and congestion as travelers adjust their mode, route, and departure time to avoid delay. TravInfo, a federally funded Field Operational Test (FOT), will be implemented through a partnership of public agencies and private firms. California PATH was commissioned to perform a formal evaluation of the test. This report describes the plan that California PATH will use in this evaluation.

The test location is the entire San Francisco Bay Area, encompassing nine counties and a population of over 6,000,000 people. The Bay Area has a diverse, multi-modal transportation system that includes carpools, vanpools, bus transit, Bay Area Rapid Transit (BART), rail services, cable cars, and ferries. A unique aspect of TravInfo will be its open-access database that allows companies to retrieve the data and re-package it for ultimate dissemination to travelers. Hence, an important aspect of the evaluation is to determine whether private organizations utilize the TravInfo data base within their products and services, and whether these products and services lead to an improvement in transportation conditions in the Bay Area.

The focus of the evaluation is on measuring the effectiveness of the project relative to the project's goals; therefore, the evaluation will be performed independently, from the perspective of an outside observer. The TravInfo evaluation will contain four major elements: (1) Institutional Evaluation, (2) Technology Evaluation, (3) Traveler Response Evaluation, and (4) Network Performance Evaluation.

The ***institutional evaluation*** has two coordinated studies, one covering perceptions and attitudes of core participants (management board and steering committee) and the other covering perceptions and attitudes of peripheral participants (advisory committee). The thrust of the institutional element is entirely toward the goal of developing an effective public/private partnership. This is the only element addressing this goal and, to a degree, it stands independently of the others. The institutional element is interview oriented, supplemented by observations and review of documents.

The ***technology response evaluation*** has two coordinated studies, the traveler information center (TIC) study and the value-added-reseller (VAR) study. Within the technology element, the thrust of the TIC study is toward the quality of information and the ability to collect and integrate information. In essence, it will answer the question of whether the TIC functions as intended, but not whether the TIC is effective in solving transportation problems. The TIC study is measurement oriented and thus will largely rely on summarizing and plotting performance statistics. The thrust of the VAR study is toward the ability to stimulate the sale of services and devices. The VAR study is interview oriented. Semi-structured interviews will be conducted with product managers either in person or by phone.

The ***traveler evaluation*** has four coordinated studies: (1) broad area, (2) target, (3) VAR customer, and (4) traveler advisory telephone system (TATS). In a general sense, the traveler-element studies address the goals of information quality and benefits, as perceived by individual travelers. These studies are concerned with traveler perception and awareness of information and what travelers do with information. Data will be collected through four major surveys: broad area survey, target survey, VAR customer survey and TATS survey. The traveler response element is entirely survey oriented, focusing on individual travelers.

Finally, the thrust of the ***network performance evaluation*** is entirely toward measuring benefits resulting from TravInfo, measured objectively rather than by perceptions. The network performance element is measurement oriented and the analysis will utilize traffic simulations in addition to simple statistical analysis. Direct measurement of network performance will be used during incidents to develop case studies, accompanied by Target Area surveys.

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## **1. INTRODUCTION**

### ***1.1 Evaluation Background***

TravInfo is a Field Operational Test (FOT) sponsored by the Federal Highway Administration (FHWA) of the US Department of Transportation. Over its three-year lifetime, TravInfo's goals are to:

- Implement a system to collect, integrate, and broadly disseminate timely and accurate traveler information throughout the Bay Area.
  - Stimulate and support the deployment of a wide variety of Advanced Traveler Information Systems (ATIS) products and systems creating a competitive market with products providing a range of prices and capabilities.
  - Evaluate the effects of TravInfo on a broad array of issues, including entrepreneurial response to improved travel information, changes in individual travel behavior, and the impact on overall transportation system performance.
  - Test the value and effectiveness of a public/private partnership. (1)
- 

The FHWA intends to make the results of this test easily available to others across the nation who may wish to engage in similar enterprises. To achieve this aim, California PATH (Partners for Advanced Transit and Highways) has been commissioned to perform a formal evaluation of the test. This report describes the plan that California PATH will use in this evaluation.

The major elements and information flows of TravInfo are shown in Figure 1.1. TravInfo is designing and deploying the Traveler Information Center (TIC), which will receive data from a range of sources, including Caltrans, the California Highway Patrol (CHP), and various local sources. The TIC will integrate these data and distribute it by various mechanisms to travelers, public and private.

A unique aspect of TravInfo will be its open-access data-base that allows companies to retrieve the data and re-package it for ultimate dissemination to travelers (both through broadcast means, and via products developed by “Value-Added-Resellers” [VARs]). Hence, an important aspect of the evaluation is determining whether private organizations utilize the TravInfo database within their products and services, and whether these products and services lead to an improvement in transportation conditions in the Bay Area.

### **Figure 1.1. Major Elements & Information Flows of Baseline TravInfo**

*Source: TRW/ESL(3)*

*Legend:*

*TATS*    *Traveler Advisory Telephone System*

*LDS*    *Landline Data System*

*DBS*    *Data Broadcast System*

The evaluation of TravInfo will consist of four major elements:

- Institutional Evaluation
- Technology Evaluation
- Traveler Response Evaluation
- Network Performance Evaluation

This evaluation plan outlines each of these elements and provides an overall framework for the coordination of evaluation activities. The plan is prepared in accordance with the Guidelines for ITS (Intelligent Transportation Systems) Operational Test Evaluation Plans for Advanced Traveler Information Systems and Advanced Traffic Management Systems prepared by MITRE (2).

### **1.1.1 Test Location**

The test location is the entire San Francisco Bay Area, encompassing nine counties and a population of over 6,000,000 people. The site is described in detail in the TravInfo proposal to FHWA. (1)

The San Francisco Bay Area is the nation's fourth largest metropolitan area and includes the San Francisco-Oakland and San Jose urbanized areas. The region has a diverse economy that includes corporate headquarters and international finance in San Francisco,

high tech corporations located in Silicon Valley, and major transportation and tourist industries. Major educational and research institutions include U.C. Berkeley, Stanford University, SRI, and Lawrence Livermore National Laboratory.

The Bay Area's transportation system is constrained by its geography. The narrow band of flatland between the San Francisco Bay and adjacent hills resulted in older urban growth that hugs the bay. The urban core is served by a limited number of north-south freeways and rail lines. Major east-west facilities are concentrated in the passes through the hills in the East Bay and Peninsula.

One of the Bay Area's unique features is its diverse, multi-modal transportation system. In addition to the usual choice of cars, vans and diesel buses, Bay Area travelers have access to electric trolley buses, light rail systems, commuter rail services, BART, ferries, and cable cars.

### **1.1.2 Conditions, Assumptions and Constraints**

TravInfo is an unusual FOT in several respects. First, a unique public-private partnership is central to its purpose. This partnership is reflected in the organizational structure shown in Figure 1.2. Major public agencies (the "Partners") are represented on a management board, while varied public and private sector interests participate through an advisory committee and other groups. Since the success of TravInfo will depend in part on the success of this unique organization, substantial attention will be given to describing how the organization functions, and to assessing its strengths and weaknesses. Particular attention will be given to management and policy decisions: what they are, how they are made (and how various parties influence them), their timeliness and effectiveness, and the clarity and usefulness of lines of authority and responsibility.

**Figure 1.2. TravInfo Organizational Structure**

The public-private partnership also must rely on external agencies, organizations and systems for data collection. For example, the Caltrans District 4 Transportation Management Center (TMC) will provide critical data to TravInfo, yet it is being developed independently of TravInfo. Hence, delays in the TMC project and in other areas may affect the success of TravInfo. This may pose an obstacle to the project's success.

Another unique feature of TravInfo is that the information delivery to travelers is partially dependent on VARs, who may or may not develop products and services that tap into the database, and who may or may not be successful in marketing these products and services. In contrast to TravTek (4) and Advance (5), neither the particular technologies nor the particular services and certainly not the corresponding market penetrations can be known in advance.

For these reasons, the effects of TravInfo on large numbers of Bay Area travelers is highly uncertain. Therefore, in order to carry out a cost-effective evaluation, the evaluation will take place at multiple levels: institutional, technology, traveler response, and network performance. While we can be fairly certain of providing definitive results on TravInfo's effectiveness in the institutional and technology area, and can likely provide definitive results in the traveler response evaluation, it is unclear whether the network performance evaluation will be definitive, owing to a variety of factors that may confound the analysis. The evaluation will adopt a strategy of flexibility to enable it to capture those aspects of Bay Area travel most impacted by TravInfo. Thus, we will evaluate traveler behavior through both broad regional surveys and "target" surveys to capture more detailed traveler response, especially under major incidents where TravInfo is likely to have the greatest impact.

## 1.2 Overall Evaluation Framework

This TravInfo evaluation will contain four major elements: (1) Institutional Evaluation, (2) Technology Evaluation, (3) Traveler Response Evaluation, and (4) Network Performance Evaluation. This section provides an overview of these elements, focusing on the goals addressed and the methodologies employed.

### 1.2.1 Terminology

Prior to discussing goals and methods, this section defines the terminology used in this evaluation plan.

**Evaluation Element** – The TravInfo Evaluation is split into four elements: institutional, technology, traveler response and network performance. Each element includes a set of activities that are similar (though not identical) with respect to the TravInfo goals addressed and methodologies employed.

**Field Operational Test** – TravInfo as a whole defines the field operational test (FOT) or, simply, the “test.” The test has two parts: the TravInfo Project and the TravInfo Evaluation. The **Project** includes all activities associated with the implementation of TravInfo, including architecture, design, installation, and operation. The **Evaluation** includes all of the activities described in this document.

**Goal** – These are the highest level objectives for TravInfo, as outlined in the TravInfo proposal, and in Section 1 of this document. Goals are not measurable in and of themselves.

**Measure of Effectiveness (MOE)** – These are the measurable effects of TravInfo. Measures of Effectiveness are associated with individual goals of TravInfo, and reflect the degree to which TravInfo achieves its goals.

**Study** – Each element is split into one or more studies (for example, the traveler response element is split into four studies: broad area survey, target survey, VAR survey, and Traveler Advisory Telephone System (TATS) survey). Each study uses a single evaluation methodology.

**Study Type** – Studies will be split into three types. **Surveys** will entail data collection from large groups of individual travelers, either by phone or in writing. **Interviews** will entail data collection from small groups (up to 75) of individuals and/or organizations involved in operating or managing TravInfo, or in utilizing or supplying TravInfo data. Interviews will either be conducted in person or by phone. **Measurements** will entail direct data collection from the TIC or TMC (e.g., traffic counts, system waiting times, etc.)

**TATS** – Traveler Advisory Telephone System. TATS is one of the three mechanisms through which the TravInfo/TIC system will disseminate information. It is an interactive telephone

system which will provide access to the TravInfo/TIC database content in traffic and transit information. TATS access will be structured for widespread use, especially by the general public, and its service will be accessible through any Public Switched Telephone Network (PSTN). The overall TATS system will operate as an audiotext system. (3)

**TIC** – Traveler Information Center. TravInfo is a centralized database which will function as Traveler Information Center where data will be collected, integrated, and broadly disseminated throughout the Bay Area. In other documents TIC is often referred to as TravInfo/TIC (3).

**VAR** – Value Added Resellers. VARs are expected to add information and offer products and services that will enhance the TIC data. The TIC will provide them with the design, interface, on-line services, and development information necessary to perform their activities. The TIC will provide an open-architecture system to encourage the widespread use of TravInfo including VARs and will apply appropriate standards whenever possible, but will not include any proprietary component unless there is a need for such a component (3).

**Wave** – Most studies entail data collection at multiple times over the course of TravInfo development and operation. Each execution will be referred to as a data collection wave. If the study includes repeated surveys from a common group of individuals, the study will be referred to as a **panel survey**.

### 1.2.2 Evaluation Elements

Three of the evaluation elements are split into multiple studies, and one contains a single study, as described below:

#### **Institutional**

**MB/SC** (Management Board and Steering Committee) **interviews** conducted in person or by phone by PATH employees, with core project participants (MB and SC members, as well as project personnel, consultants and advisors).

**AC** (Advisory Committee) **interviews** conducted by phone with peripheral project participants.

#### **Technology**

**VAR Interviews**, semi-structured interviews, conducted either in person or by phone by PATH employees, with product managers.

**TIC** evaluation using direct measurement of TIC performance through automatic data collection.

#### **Traveler Response**

**Broad Area surveys** administered by random digit dialing to households throughout the Bay Area, before and 18 months after TravInfo begins operation.

**Target surveys** administered by phone immediately after major incidents in the Highway 101 corridor, one before and the other after TravInfo begins operation. This will be closely coordinated with the network performance element.

**VAR Customer surveys** administered by mail to purchasers of ATIS devices.

**TATS surveys** administered by intercepting phone calls made to the Traveler Advisory Telephone System.

### **Network Performance**

Direct measurement of network performance during incidents to develop case studies, accompanied by simulations.

### **1.2.3 Evaluation Goals**

Table 1.1. shows the TravInfo goals addressed by the four evaluation elements and the individual studies. These goals are taken from the TravInfo proposal (Proposal for an IVHS Field Operational Test, 1992).<sup>(1)</sup> For the purpose of coordinating the project goals with evaluation objectives, the TravInfo goals were rephrased as follows:

#### **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 travel 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 purpose of the *institutional element* is entirely toward the goal of evaluating the development of an effective public/private partnership. This is the only element addressing this goal and, to a degree, it stands independently of the others.

Within the *technology element*, the thrust of the TIC study is toward the assessment of the quality of information and the ability to collect and integrate information. In essence, it will answer the

question of whether the TIC functions as intended, but not whether the TIC is effective in solving transportation problems. The focus of the VAR interviews is toward the ability to stimulate the sale of services and devices.

In a general sense, the *traveler response element* addresses the goals of information quality and benefits, as perceived by individual travelers. The VAR customer survey in addition addresses the ability of TravInfo to stimulate sale of products, based on individuals' assessments of these products.

Finally, the thrust of the *network performance element* is more toward measuring benefits resulting from TravInfo, measured objectively rather than by perceptions.

### **Table 1.1. TravInfo Goals and Evaluation Elements**

#### **1.2.4 Methods**

The basic methods of data collection employed in the evaluation will be surveys, interviews, and measurements. The institutional element is interview oriented (supplemented by observations and review of documents). The technology element's TIC study is measurement oriented, and its VAR study is interview oriented. The traveler response element is entirely survey oriented, focusing on individual travelers. Finally, the network performance element is measurement oriented.

Analysis methods vary in complexity across the elements. Due to its abstract nature, the institutional element will not quantify effectiveness, and will instead rely on summaries of comments and observations. The technology element's TIC study will largely rely on summarizing and plotting performance statistics. The VAR interview study will be similar to the institutional element, largely relying on summaries. The traveler response element will use more sophisticated techniques, including multi-variate analysis, in addition to simple frequency analysis. Finally, the network performance analysis will utilize traffic simulations in addition to averaging and simple statistical analysis.

Table 1.2 summarizes the methods of data collection, along with the planned sample sizes for each of the studies.

### **Table 1.2. Evaluation Elements and Data Collection Methods**

### ***1.3 Relationship of Evaluation Goals to Project Goals***

It should be kept in mind that the goals of the evaluation, referred to as evaluation objectives in this plan, are not identical to the goals of the project. The focus of the evaluation is on measuring the effectiveness of the project relative to the *project's* goals, and not on achieving the project's goals. Hence, the evaluation will be performed independently, from the perspective of an outside observer. However, some of the evaluation activities are necessarily intertwined with the project, especially when it comes to data collection. The evaluators will rely on the project to provide key data elements, as described below.

### ***1.4 Evaluation Responsibility***

PATH is responsible for independently evaluating the TravInfo FOT. Y.B. Yim of PATH will serve as overall manager for the evaluation tasks to be performed by PATH researchers. Yim will report to Stein Weissenberger, who will be responsible for coordination with PATH's overall research and testing program in Advanced Traveler Information Systems. The PATH researchers, Asad Khattak and Mark Miller, will be responsible for various evaluation tasks. Randolph Hall, of the University of Southern California, will serve as technical advisor to the team, and perform portions of the institutional and network performance evaluations.

An Evaluation Oversight Team (EOT) will provide technical advice to the Evaluator, with the goal of ensuring satisfaction of the evaluation needs of the FHWA, Caltrans, and other project partners. The chair of the EOT is Shara Lynn Kelsey of the Caltrans Division of New Technology. The EOT consists of members of the Steering Committee, Management Board, a technical advisor, and five members of a peer review panel. The charter of the EOT is contained in Appendix A.

The TravInfo partners will be responsible for providing data that is necessary to the evaluation. These responsibilities include:

Caltrans	Providing loop detector data before, during, and after two major incidents.
CHP	Providing computer-aided-dispatch records before, during, and after two major incidents. Allowing officers to be interviewed after these incidents.
MB/SC	Management board and steering committee members participating in interviews.
TIC	Providing system performance data on a continuing basis. Supporting interviews with TATS callers.
VARs	Participating in interviews, providing product information, and paying all costs for printing and mailing surveys.

## ***1.5 Master Schedule and Test Duration***

This section provides the master schedule for execution of all data collection. More detailed schedules, including study design and data analysis, can be found in Sections 2-5, which describe the evaluation elements in detail.

The schedule for the TravInfo evaluation is dependent on the schedule for the TravInfo project. As a result, the master schedule presented here is conditioned to the time when TravInfo becomes operational (i.e., the “start-up date”). As of November 30, 1994, TravInfo is scheduled to be operational in August 1995. The schedules for the technology, traveler response, and network performance elements are conditioned to this benchmark date, which will simply be referred to as “TravInfo.” Any delays to the TravInfo project will necessarily affect the evaluation, and may require re-scoping or re-budgeting the evaluation project. Figure 1.3. shows the master schedule for all data collection activities.

TravInfo fiscal year is defined as follows:

Fiscal Year One (FY1) is from July 1, 1993 - June 30, 1994;  
Fiscal Year Two (FY2) is from July 1, 1994 - June 30, 1995;  
Fiscal Year Three (FY3) is from July 1, 1995 - June 30, 1996;  
Fiscal Year Four (FY4) is from July 1, 1996 - June 30, 1997.

### **1.5.1 Institutional**

The schedule for the institutional interviews is independent of the TravInfo project schedule. Three waves will take place in the summers of 1994, 1995, and 1996. Each wave will include both an MB/SC survey and an AC survey.

### **1.5.2 Technology**

The TIC study will take place once TravInfo is operational. Data on system performance will be collected automatically, on a continuous basis. This data collection effort will conclude after 18 months. The TIC evaluation will also include periodic interviews of TIC operators. These will take place at 6 month intervals, beginning 6 months after TravInfo.

The technology evaluation also includes vendor interviews. These will be coordinated with the

institutional evaluation, and take place in the summers of 1995 and 1996.

**Figure 1.3.**

### **1.5.3 Traveler Response**

Figure 1.3 provides the schedule for administration of all surveys falling within the Traveler Response element of the evaluation. These surveys are summarized below:

<b><u>Study Name</u></b>	<b><u>When Executed</u></b>
<b>Broad Area Survey</b>	3 months prior to TravInfo 18 months after TravInfo
<b>Target Survey</b>	One wave prior to TravInfo One wave after TravInfo (dates may depend on occurrence of major incidents)
<b>VAR Customer Survey</b>	One wave immediately prior to TravInfo Continuing waves during TravInfo, as new products are introduced and sold. One follow-up wave 18 months after TravInfo
<b>TATS Survey</b>	Three waves, spaced at 6 month intervals, beginning 6 months after TravInfo

### **1.5.4 Network Performance**

The network performance evaluation will be coordinated with the target surveys. Immediately following the major incidents, Caltrans will be contacted to obtain loop detector data for the day of the incident, the days immediately preceding the incident, and the days immediately following

the incident. These data will be the basis for network simulations and analyses.

## ***1.6 Organization of the Plan***

The evaluation plan is split into five parts. In Section 1, the TravInfo evaluation framework is presented. Section 2 describes the institutional element, Section 3 describes the technology element, Section 4 describes the traveler response element, and Section 5 describes the network performance element. Appendix A provides the TravInfo EOT charter, and Appendix B provides supplementary information on security, safety, privacy, and impacts on the operational system. References are provided prior to Appendix A.

Sections 2-5 are organized according to a common format. First, an overview is provided, including background and motivation. Second, the goals addressed by the element are stated. Third, the specific measures of effectiveness used within the evaluation are described. Fourth, the experimental design is provided, covering data collection and data analysis. Fifth, resources required for the evaluation are listed. Sixth, a schedule is provided. Last, deliverables are stated.

## **2. INSTITUTIONAL**

### ***2.1 Background***

The TravInfo organization is diagrammed in Figure 1.2. TravInfo is directed by the Management Board (MB) composed of three members, representing the Metropolitan Transportation Commission (MTC), Caltrans District 4, and the California Highway Patrol (CHP). Caltrans New Technology Division, the Federal Highway Administration, the Federal Transit Administration, the California PATH Program, and the Chair of the Steering Committee are represented by *ex-officio* members of the Management Board.

The Management Board has created a TravInfo Advisory Committee (AC), with membership open to any firm or agency that wishes to participate. Within the Advisory Committee, the Steering Committee (SC) was formed with 14 individuals selected by the Management Board (15 are allowed). The Steering Committee includes both private sector and public sector members, with the majority currently from the private sector. Within the Steering Committee, Working Groups are created to address various aspects of the TravInfo system, such as system architecture and design, and drafting of participation agreements. The group leaders are from the Steering Committee, but anyone can join a Working Group.

The Management Board is the policy-setting body for all TravInfo test activities, responsible for

reviewing and approving procedures for the conduct of tests, and for setting access restrictions to databases. The Management Board has the ultimate authority for approval of TravInfo expenditures and consultants' work. The Advisory and Steering Committees have no direct authority for setting policies or procedures for the FOT, but advise the Management Board on all relevant issues. The full-time project manager retained by the Management Board is responsible for the day-to-day activities of the project, including supervision of consultants, liaison to the Advisory Committee, and progress reports to the Management Board.

The TravInfo Field Operational Test has been implemented through a public/private partnership. The premise is that the success of the TravInfo project depends on the active participation of public, private, and academic partners. Unlike other IVHS public/private partnerships, the TravInfo Advisory Committee will have open membership and will promote open access to encourage all ATIS vendors to compete in the Bay Area market.

The purpose of the Advisory Committee is to capture a wide range of knowledge from the broader ATIS community, thus enabling a more effective deployment of ATIS technology. The TravInfo management plan is intended to exploit the unique experience and share the knowledge of both the private and public sectors, while giving primary managerial responsibility to the public sector. The experience gained from the new institutional approach is expected to be invaluable to communities in other parts of the country as they deal with the need to form partnerships with a broad array of government agencies and private organizations.

The execution of TravInfo also entails a public/private partnership. The public sector's primary role is to develop a multi-modal Traveler Information Center (TIC) that will integrate and disseminate real-time and accurate transportation information to users via both public and private mechanisms. TravInfo will utilize an open-access architecture for all aspects of the information systems. Functionality and interface requirements will be specified based on the advice of the AC, so that users of TravInfo can easily interface their system with the TravInfo database.

The private sector is expected to respond to TravInfo by developing and deploying a variety of new ATIS products and services. TravInfo will work with private firms to assure open access to the TIC's data through a variety of media, including modem access and data broadcasts. TravInfo will also encourage development and deployment of ATIS products and services ranging from inexpensive hand-held and in-vehicle devices to sophisticated computer-based devices that provide dynamic route guidance linked to business listings similar to the Yellow Pages.

Because of the unique organizational structure, the institutional evaluation will be prominent in the overall evaluation of TravInfo. To a strong degree, the success of the entire project depends on the success of this organization, and its ability to attract private sector participation.

## ***2.2 TravInfo Goals and Evaluation Objectives***

The institutional elements will be evaluated with respect to Goal 4a) to test the value of the public/private partnership in the design, data integration, and widespread dissemination of real-time information on transportation conditions and travel options.

The objectives of the institutional evaluation are to:

- Assess the effectiveness of the organizational structure and the management approach in meeting project goals and schedules;
- Measure the extent to which the TravInfo organizational structure facilitates active involvement and cooperation among public agencies and between public and private institutions;

Secondly, the objective is to:

- Document the effects of TravInfo on the ATIS industry, including new business opportunities, changes in organizational philosophy, and ability to develop products along common interface standards.

### ***2.3 Measures of Effectiveness (MOE)***

By its nature, the institutional element does not lend itself to quantitative measures of effectiveness. Instead, the focus will be on documenting the institutional history of the project, covering problems encountered, methods of resolving problems, changes in the organizational structure and so on. The institutional history will be developed through a combination of periodic interviews, direct observation at meetings, and review of project documentation.

The areas of emphasis will be the following:

<b>TravInfo Goals</b>	Perceptions of project participants as to TravInfo goals, and whether TravInfo is working toward the proper goals.
<b>Organizational Structure</b>	Attitudes toward the effectiveness of the organizational structure, processes for resolving problems, and overall strengths and weaknesses.
<b>Performance of Partners</b>	Effectiveness of the advisory committee, steering committee, and management board; composition of these boards, and possible changes.
<b>Roles of Public and Private Sectors</b>	Attitudes toward the proper roles of the public and private sector in TravInfo operation and implementation.

<b>Barriers</b>	Perceptions of possible obstacles to TravInfo operation, covering institutional, technical and legal issues.
<b>General Perceptions</b>	Perception of whether TravInfo would improve the Bay Area transportation system, have an effect on its organization, and have an effect on other organizations.

## ***2.4 Experimental Design***

The institutional element includes two coordinated studies, one covering perceptions and attitudes of core participants (members of the MB and SC, project management, technical advisor, and consultant), and the other covering perceptions and attitudes of peripheral participants (AC members who are not in the core group). The first study will be referred to as “MB/SC” and the second study will be referred to as AC. (Each of these studies will be executed in three waves.) These interviews will be supplemented by direct observations at meetings, and review of project documentation.

### **2.4.1 Data Collection and Sample Size**

**MB/SC Study.** Semi-structured interviews will be conducted with core TravInfo participants, either in person or by phone. Interviews will be administered by PATH researchers and by Randolph Hall. All interviewers will be familiar with project details.

Interviews will be organized according to the MOEs specified in Section 2.3. For each MOE, interviewees will be asked a series of pre-selected, mostly open-ended questions. Interviewers will have discretion to ask probe questions as needed. Total interview length will be on the order of 45-90 minutes.

Interviews will be administered to all core members, unless circumstances prevent participation. The sample size will be 25-40 persons. Interviews will be administered in three waves, in the summers of 1994, 1995 and 1996. Because the core membership should not fluctuate greatly, the study constitutes a series of panel interviews, allowing comparison of individual responses between data collection waves.

**AC Study.** The AC study will be administered in the form of telephone interviews. The format will be more structured than the MB/SC study, though most questions will still be open-ended. Interviews will be administered by PATH employees, but not necessarily by people who are familiar with project details.

Interviews will be organized according to the MOEs specified in Section 2.3. For each MOE, interviewees will be asked a series of pre-selected questions. All probe questions will be pre-selected.

The survey will be administered to members, or former members, of the AC. Up to three attempts will be made to contact each AC member. If the AC member proves to be unfamiliar with TravInfo, the interview will be terminated. Interviews will be administered in three waves in coordination with the MB/SC study, in the summers of 1994, 1995 and 1996. Because AC membership is expected to fluctuate, this will not be treated as a panel interview.

**Observations/Documentation Review.** The major sources of data will be meeting notes taken by the evaluator, and memoranda prepared by participating agencies. These data will provide a source of questions for interviews, and allow the evaluator to create an institutional history of TravInfo. In addition, information provided by VARs under the TravInfo participation agreement will be reviewed, to assess impacts of TravInfo on private organizations.

#### **2.4.2 Data Reduction and Analysis**

Because the primary data sources are open-ended questions, observations, and documentation, the “data” is somewhat anecdotal in nature, and difficult to analyze. In place of conventional analysis, the evaluation will simply summarize the essence of the interview responses, emphasizing recur

heard from multiple interviewees. These responses will be organized according to the MOE in Section 2.3. In addition, the specific roles played by individuals and agencies will be defined, reviewed, and traced over the life of the project. It is likely that the participating agencies hold different expectations regarding TravInfo. Conflicts arising among participating agencies will be described. Critical issues on which the success of the project depends will be identified and the ways in which these critical issues are resolved will be described.

## **2.5 Resources**

Institutional evaluation will be performed by PATH researchers and other researchers. Time allocation of each evaluator for this element is shown below in percent of full-time effort per fiscal year.

	FY2	FY3	FY4
Researcher A	10%	10%	5%
Researcher B	25	25	5
Researcher C	20	20	0

## **2.6 Evaluation Tasks and Test Schedule**

The key evaluation tasks are listed below. A schedule is provided in Figure 2.1.

### **2.6.1 Pre-Test Activities**

- a) Develop institutional evaluation plan as part of TravInfo evaluation plan;
- b) Design MB/SC and AC studies: develop interview instrument, identify names of people to interview; (repeated three times, once per wave);
- c) Develop plan for collecting data at meetings: create format for note-taking, identify meetings to attend, develop format for summarizing observations.

## Insert Figure 2.1

### 2.6.2 Evaluation Test Activities

#### A. MB/SC Study and AC Study

- a) Conduct initial wave of interviews in Summer, 1994;
- b) Conduct second wave of interviews in Summer, 1995;
- c) Conduct final wave of interviews in Summer, 1996.

#### B. Observations and Documentation Review

- a) Attend Management Board, Advisory Committee, and Steering Committee meetings as an observer throughout the project;
- b) Obtain and retain all project documentation as it is created; ensure that evaluator is on all appropriate distribution lists.

### 2.6.3 Post-Test Activities

- a) For the first and second data collection waves, summarize interview responses, and document in two working papers; Working Paper 1 will report on the first wave data analysis and Working Paper 2 will report on the second wave data analysis. Analyze changes in attitudes and perceptions from prior wave. Within these working papers, provide an update of the institutional history of the project. Prepare chronological analyses of committee activities and major decisions made at meetings;
- b) For final data collection wave, include all information contained in working papers, plus provide an overall institutional assessment of the project.

## 2.7 Deliverables

Working papers, as described above, will be delivered in October of 1994 and 1995. The final report will be delivered in October, 1996.

### **3. TECHNOLOGY**

#### ***3.1 Background***

TravInfo will implement a comprehensive regionwide system that integrates information from a variety of sources (see Figure 1.1), and disseminates the information through both public and private channels. The public sector component of TravInfo consists of the TIC that will integrate and disseminate transportation information to the general public, public agencies, and commercial vendors. Individual TIC components (i.e., hardware, software, communication processors and interfaces to the outside world) will be maintained by the public sector. The TravInfo project will allow vendors to test their systems in the real world and will generate valuable information on consumers' willingness to pay for specific capabilities and features. Industry trends, and the effect of TravInfo on these trends, will be documented and published so that all interested parties may have access to the results.

The technology element will include two studies, one measuring the performance of the TIC called "TIC study," and the other, accomplished through vendors, documenting effects of TravInfo on the Advanced Traveler Information System (ATIS) industry.

#### ***3.2 TravInfo Goals and Evaluation Objectives***

The objective of the technology element is to assess the performance of the Traveler Information Center (TIC study) and, to a limited degree, that of individual products and services using the system (VAR study). The TIC study will assess TravInfo's effectiveness with respect to the goals of: 1a) collecting and integrating transportation information, 1b) disseminating information throughout the Bay Area, and 1c) providing timely and accurate traveler information. The VAR study will assess TravInfo's effectiveness with respect to the goals of: 2a) stimulating and supporting the development of a wide variety of ATIS products and services, and 3a) evaluating entrepreneurial responses to improved travel information.

This technology element does not aim to determine whether the technologies result in benefits to travelers (which is addressed in traveler response and network performance). The focus is simply on the technical performance of the TIC, and on the functional performance of VAR products. The evaluation objective of the TIC study is to measure the effectiveness of the TIC performance. The evaluation objectives of the VAR study are: 1) to document the extent to which value added resellers are willing to use the TravInfo database and 2) to assess the effects of TravInfo on the ATIS industry, including the number of products developed to utilize TravInfo data, along with their features, and any long-term impact on the industry.

### ***3.3 Measures of Effectiveness***

This section separately identifies the measures of effectiveness for the TIC study and the vendor interviews. These two studies will, for the most part, be independent of each other.

#### **3.3.1 TIC Study MOE**

The TIC study will measure its effectiveness as TravInfo's hub for acquiring, processing (integration/fusion), and disseminating data for travelers, relative to such factors as timeliness, accuracy, reliability, operability, maintainability, availability, and adaptability. This investigation will be conducted from the following perspectives: (1) data input sources, (2) data output recipients, and (3) TIC hardware and software subsystems. Proposed measures of effectiveness categories to be investigated follow. Such categories, however, are broadly defined and consultation with TRW/ESL, the TIC developer, is currently underway to (1) produce the details that will completely specify all aspects of data requirements for the TIC evaluation, as well as (2) discover any problems with obtaining such data. These details will be provided in a subsequent document focusing on the TIC evaluation.

- (1) **Timeliness:**  
Response times to disseminate information disaggregated along the following dimensions:
  - temporal scope (time-of-day, day-of-week, time-of-year)
  - event type (recurrent, non-recurrent/planned, non-recurrent/unplanned)
  - TIC functional component (data acquisition, data processing, data dissemination)
- (2) **Accuracy:**  
Distribution of errors by type (e.g. minor, moderate, major), and along the above three dimensions to determine full error profile including:
  - when mistakes occurred
  - frequency
  - TIC functional component involved and event type during which it occurred
- (3) **Reliability, availability, and maintainability:**  
TIC downtime distributional profile disaggregated along the above three dimensions to determine:
  - when downtime occurred (date, time and duration)
  - its causes and remedy
  - frequency
  - TIC functional component involved and type of event during which it occurred
- (4) **Adaptability**

Response times to make necessary TIC changes to address changing or demanding conditions such as:

- unplanned event
- unanticipated peak period demand
- unanticipated growth in the number of VARs wanting access to TIC
- degree of success in addressing the above problems and percentage of problems resolved.

### **3.3.2 VAR Study MOE**

The VAR study will measure the effectiveness of the TravInfo project regarding development and distribution of new ATIS products and services and increased adaptation of TravInfo interface standards. The MOEs for the VAR study include:

- (1) Number of firms and public agencies who signed the TravInfo participation agreement
- (2) Number and type of new ATIS products developed using TravInfo database
- (3) Number of sales of ATIS devices and services using TravInfo database
- (4) Number of products designed for TravInfo interface standards
- (5) Market reception to ATIS products and services
- (6) Description of firms' marketing strategies for ATIS products and services.

## ***3.4 Experimental Design***

This section separately provides the experimental design for the TIC evaluation and the Vendor interviews. First, data collection and sample size are discussed (first for the TIC, and second for the Vendors), then data reduction and analysis are discussed (in the same order).

### **3.4.1 Data Collection and Sample Size**

**TIC Study:** The performance of the TIC will be measured using automatically TIC-generated data as well as through interviews. The automatically generated data will be provided from TIC to the evaluator on disks or by electronic means, according to the evaluator's specifications. Data will be recorded on a continuous basis. However, special attention will be paid to untimed or surprise events, such as accidents or lane-closures due to vehicle disablements or load spills. The collection of TIC performance data during such incidents will be coordinated with the Target Survey study and the Network Performance element, which will focus on these events. Since the TIC operators will play a major role in the TIC's overall operation, interviews of TIC operators will be conducted to ascertain information on TIC performance, especially after stressful and demanding times, such as during non-recurring events.

TIC operators will also be interviewed a six month intervals and after certain incidents to deter-

mine whether any special problems occurred and how they were resolved. Quantitative performance data will be supplemented by unstructured interviews, to measure satisfaction with the TIC's performance and to pinpoint possible areas of improvement. Interviews will be conducted with: 1) data input sources, such as event operators, Caltrans' Transportation Management Center (TMC), non-TMC agencies, transit operators, and weather agencies, and 2) data dissemination recipients, such as VARs. These interviews will not produce quantitative MOEs. The types of issues explored will cover how organizations interface with the TIC and problems encountered (for example, excessively long waiting times especially during periods of peak demand).

**VAR Study:** Semi-structured interviews, called **VAR interviews**, will be conducted with VARs that have signed the TravInfo participation agreement, as well as other prominent companies. Interviews will be conducted either in person or by phone by PATH evaluators. All interviewers will be familiar with project details. Through interviews with VARs, quantitative statistics will be obtained on the number and type of new ATIS products developed using TravInfo database and the number of sales of ATIS products and services using TravInfo. Qualitative measurement regarding success or failure of individual products or services will be done through interviews with vendors and service providers.

Interviews will be organized according to the MOEs specified in Section 3.3.2. For each MOE, interviewees will be asked a series of pre-selected, mostly open-ended, questions. Interviewers will have discretion to ask probe questions as needed. Total interview length will be on the order of 45 minutes.

Interviews will be administered to approximately 30 persons. Exact sample size will depend on the number of companies that have signed the participation agreement, as well as the state of the traveler information industry at the time of the interviews. Interviews will be administered in two waves, in the summers of 1995 and 1996.

In addition, the evaluator will have access to information provided to TravInfo under the participation agreement. The attachment to this agreement will provide a detailed description of the technology and how the information would be used. Prototype devices might also be available for inspection. VARs will also be encouraged to file a quarterly statement specifying the number of users. These reports will be used to create a history of products developed under TravInfo, their functionality and their intended market. (It should be borne in mind that obtaining product information from private companies may prove quite challenging, given the competitive nature of the industry. Obtaining product data may be especially difficult for VARs only utilizing dial-in data lines or wireless broadcasts, so that the actual users are not known to the VARs.)

### 3.4.2 Data Reduction and Analysis

**TIC Study:** TIC performance analysis will be based on data automatically collected by the TIC, as well as interviews. Bivariate statistical methods such as frequency analysis, cross-tabulation, and chi-square analysis will be used to determine distributional profiles and to examine differences for MOEs by time, event type, and TIC functional component (Section 3.3.1). Performance data will also be treated as a multi-variate time series, and plotted on weekly intervals over the course of the project. In addition, time of day and day of week patterns will be investigated through appropriate plots. Statistical testing will be employed to investigate changes in levels of performance (e.g., to determine whether the trend is toward improved performance, worsened performance or no difference). In addition, cause and effect relationships will be investigated as issues arise (for instance, to determine whether VAR complaints, if any, are supported by the data). The exact tests will be case specific.

**VAR Study:** Because interview data will largely be based on open-ended questions, the “data” is somewhat anecdotal, and difficult to analyze. In place of conventional analysis, the evaluation will simply summarize the essence of the interview responses, emphasizing recurrent themes heard from multiple interviewees. The response will also be used to formulate investigations of TIC performance (e.g., to investigate whether a complaint is supported by the data).

Vendor product data will also be analyzed by classifying products by the functions performed (e.g., dynamic vs. static, predictive vs. non-predictive, etc.), and by tabulating the number and variety of products available in each year.

### 3.5 Resources

Technology evaluation for the TIC and VAR studies will be performed by PATH researchers. Time allocation of each evaluator for this element is shown below in percent of full-time effort per fiscal year.

TIC Study:

	FY2	FY3	FY4
Researcher A	20%	15%	15%
Researcher B	0	20	20

VAR Study:

	FY2	FY3	FY4
Researcher C	10%	10%	5%

### ***3.6 Evaluation Tasks and Test Schedule***

The evaluation tasks and schedule are provided in Figure 3.1. These tasks are described below.

#### **3.6.1 Evaluation Pretest Activities**

- a) Develop technology evaluation plan as part of TravInfo evaluation plan;
- b) Develop detailed criteria for evaluation of TravInfo TIC performance. In cooperation with the project consultant, develop procedures for on-line recording of system performance to facilitate technology evaluation. Document the data collection plan in a working paper;
- c) Develop interview instrument for VAR study.

#### **3.6.2 Evaluation Test Activities**

##### **TIC Study**

- a) On a continuing basis, receive data from TIC, check for errors, and retain data in a format suitable for data analysis. Produce continuing plots of performance through Spring 1997;
- b) On a periodic basis (6 months), and after major incidents, interview TIC operators (estimated Spring or Fall 1996 and Spring 1997).

##### **VAR Study**

- a) Conduct the initial wave of the VAR interviews in Summer, 1995;
- b) Conduct the final wave of VAR interviews in Summer, 1996.

#### **3.6.3 Post-Test Activities**

- a) Provide working paper on TIC performance, based on first 9 months of operational experience including the second incident (Incident 2) evaluation for Target Survey Wave 2. Analyze trends in performance over these first nine months;
- b) Analyze results from initial wave of VAR interviews. Document products developed to interface with TravInfo. Document findings in working paper in October, 1995;
- c) Analyze results from second wave of VAR interviews. Document products developed to interface with TravInfo. Document findings in working paper in October, 1996;
- d) Write final report documenting technology assessment over the course of the project, including both the VAR interviews and the TIC performance .

*Figure 3.1.*

### **3.7 Deliverables**

- a) A TIC study working paper will be delivered 4 months after Incident 2 (in Spring of 1996) covering the TIC performance and operator interviews;
- b) VAR study working papers will be delivered in October 1995 and October 1996, based on VAR interviews and VAR products;
- c) A final report on technology performance will be delivered 20 months after TravInfo becomes operational (estimated, Spring 1997).

## **4. TRAVELER RESPONSE**

### **4.1 Background**

The traveler response element is aimed at measuring changes in individual travel patterns that result from the TravInfo project, and measuring traveler acceptance and preferences for the TravInfo technologies. Potential benefits include reduced travel time, enhanced mobility, increased awareness of travel options, and reduced travel costs. Surveys will be used to assess traveler response to, and perception of, the TravInfo project and the various information sources and devices made available to the public. Surveys will be conducted by phone to the general public, by mail to VAR purchasers, and by phone to people who call into the TATS.

Important considerations in survey design include:

- User benefits that accrue from TravInfo technologies can be tangible and intangible. The tangible benefits include travel time savings and delay reduction, increased vehicle occupancy, increased use of public transit, improved travel time reliability and reduced possibility of getting lost. The intangible benefits are relatively harder to measure and include reduced anxiety and stress, lower driver fatigue and increased awareness of travel options.
- The level of benefits depends on travelers' willingness to access, acquire, process, and use information. Therefore, a research issue is to explore the role of information and other factors

in travelers' decision making process.

- The travel time benefits from changes in travel decisions are most significant in incident situations.
- Given the current state of information technologies (e.g., traffic reports received through radios) and implementation of other measures meant to reduce travel and encourage transit use, a key operational test issue is whether there are significant *additional* benefits due to TravInfo.

Traveler decisions may be strongly influenced by the technology through which travelers receive the information, the type, content, format, and attributes of TravInfo information they receive—as well as the attributes of the alternatives, the individual and trip characteristics, the environmental conditions, and various situational factors. Thus, it is important to know the type and form of information best needed to support traveler decision making. The willingness to change behavior will affect the effort that an individual takes to obtain information.

Traveler Response is the largest single element of the TravInfo evaluation. It includes four studies, all of which employ a survey methodology, and all of which have two or more waves:

## ***4.2 TravInfo Goals and Evaluation Objectives***

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, and 3b) TravInfo's ability to transmit information that changes travel behavior and produces benefits. In addition, the Broad Area study within the traveler response element will investigate: 2a) whether TravInfo is effective in stimulating the sale of traveler information devices and services.

The evaluation objectives of the **Broad Area Study** are to: 1) measure changes in the acquisition of traveler information and information devices, 2) measure changes in the public perception of information quality, 3) assess the public awareness of the TravInfo information services, 4) document the public opinion of the benefits of TravInfo to individual mobility, and 5) define baseline attitudes, opinions and travel behavior with respect to TravInfo.

The evaluation objectives of the **Target Study** are to: 1) assess performance of TravInfo in the event of major incidents; 2) assess the benefits of TravInfo to individual travelers based on behavioral surveys, 3) determine the profile of individuals who access, acquire and use information available through TravInfo.

The evaluation objectives of the **VAR Customer Study** are 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.

The evaluation objectives of the **TATS Study** are to: 1) measure consumer response to TATS service and 2) determine the profile of individuals who access, acquire, and use information available through TATS.

### ***4.3 Measures of Effectiveness***

This section describes the MOEs associated with the four TravInfo goals investigated in the Traveler Response element, in the order in which the goals were presented in Section 4.2.

**Broad Area Study MOE**— General attitudes toward information and perceived benefits:

- 1) Percentage change in the acquisition of traveler information after TravInfo;
- 2) Percentage change in the public perception of information quality after TravInfo;
- 3) Percentage change in the awareness of improved traveler information services with TravInfo;
- 4) The perceived benefits of real-time traveler information to individual mobility in making travel decisions.

**Target Study MOE**— Responses to specific incidents and long-term changes in individual behavior:

- 1) Tangible benefits: travel time savings and delay reduction, vehicle occupancy, use of public transit, travel time reliability and possibility of getting lost;
- 2) Intangible benefits: anxiety and stress, driver fatigue and awareness of travel options.

**VAR Customer Study MOE** — Market responses to information devices, and preferences and attitudes toward product features:

- 1) Product satisfaction: satisfaction, rated on an ordinal scale, for specific product features, comparing those that are enabled by TravInfo (e.g., aspects of real-time information) vs. those that are not (e.g., maps and location determination). Comparison of satisfaction to alternative information sources, including radio broadcasts and message signs;
- 2) Consumer profile comparison: demographic characteristics (age, income, race, sex, auto-dependency) of device purchasers compared to demographics of the general population obtained from the Broad Area Surveys – specifically, assess ability to reach the general public through ATIS;
- 3) Product usage: frequency of product usage, frequency of feature usage, comparing features that are TravInfo-enabled to those that are not; length of ownership; conditions under which features are used (e.g., in the event of an incident);
- 4) Cost of information: amount paid for ATIS devices and information services.

**TATS Study MOE** — Satisfaction with information service provided directly by TravInfo:

- 1) Service satisfaction: satisfaction, rated on an ordinal scale, for specific product features, comparing those that are enabled by TravInfo (e.g., aspects of real-time information) vs. those that are not (e.g., maps and location determination). Comparison of satisfaction to

- alternative information sources, including radio broadcasts and message signs;
- 2) Consumer profile comparison: demographic characteristics (age, income, race, sex, auto-dependency) of device purchasers compared to demographics of the general population obtained from the Broad Area Surveys – specifically, assess ability to reach the general public through ATIS;
  - 3) Usage: frequency of product usage, frequency of feature usage, comparing features that are TravInfo-enabled to those that are not; length of ownership; conditions under which features are used (e.g., in the event of an incident);
  - 4) Cost of information: the willingness to pay for TATS services if charged.
  - 5) Computed benefits based on behavioral changes using TATS, such as reduced travel time, ability to avoid traffic problem, and arriving at desired destination on time.

The MOE cited in this section will be the basis for the design of survey instruments. The exact structure of these instruments will be specified at a later date.

#### ***4.4 Experimental Design***

As already mentioned, the traveler response element is divided into four 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 devices will be assessed from the VAR Customer study. Finally, the impacts on travelers who directly access TravInfo by telephone will be assessed through the TATS study.

The following provides data collection and data analysis in separate sections. Within each section, the four studies are separately described. Bear in mind that the studies will, nevertheless, be closely coordinated, as described below.

##### **4.4.1 Data Collection and Sample Size**

**Broad Area Survey** To assess the general impacts of the TravInfo project, a “before and after” experimental design will be employed. The initial broad area survey, administered 3 months before TravInfo, will serve two purposes: to define baseline attitudes, opinions and travel behavior with respect to TravInfo, and to recruit individuals for a panel to assess changes in travel behavior under incident conditions. The second broad area survey will be conducted 18 months after TravInfo becomes operational. The objective of the second survey is to measure actual effects of TravInfo, and to compare before and after travel conditions.

The first broad area survey will have a sample size of 2,200. One thousand households will be selected at random, from areas other than the 101 Highway corridor. 1,200 households will be selected from the 101 corridor (these will be asked supplemental questions). These households

will also be the pool from which participants are recruited for the target survey (described later). The second broad area survey will have a sample size of 1,000 households, drawn at random from all 9 Bay Area counties. No additional sampling will take place in the 101 corridor in the second broad area survey.

Prior studies suggest that about one-half of the respondents to the initial survey will be commuters. With the split between commuters and non-commuters about 50/50, there should be enough respondents of each type (about 500) in these second broad area survey to develop statistically reliable profiles of their travel behavior. Other important subgroups are defined by mode. Their relative occurrence in the population, according to the 1990 census data, is: 68.2% drive alone, 13% rideshare, 11.2% public transit and 7.6% other transportation mode. We estimate that sufficient numbers will be obtained in the drive-alone category; the rideshare and public transit categories are unlikely to be sufficient to draw statistically significant conclusions. However, attaining a statistically significant sample is likely to be cost prohibitive.

The survey will be administered by a professional marketing firm by random digit dialing, covering households in the 9 Bay Area counties (determined by telephone prefixes). Random digit dialing ensures that all households who have a telephone are included in the sampling pool, regardless of whether or not their telephone number is listed. Since over 95% of Bay Area households have a telephone, the exclusion of non-telephone households from the sampling pool does not pose a serious problem for the representativeness of the resulting sample. However, transit users will likely be under-represented. (In the analysis step, this bias will be partially corrected by first disaggregating transit respondents from non-transit respondents, and adjusting to account for representativeness.)

Only individuals who are at least 18 years old will be considered eligible for interviewing. In order to account for any response bias by gender, an interviewing quota of no more than 51% female respondents will be imposed. It has been well documented that women tend to respond more readily to surveys than do men. By imposing a gender quota we can ensure that the resulting sample population is representative of the total adult population of the Bay Area with respect to gender. Multiple contact attempts and refusal conversion procedures will be employed to minimize non-response bias, and to obtain a response rate of at least 50%.

**Target Survey** The proposed experimental design focuses on a “high impact” corridor, characterized by (a) the presence of congestion and commuter traffic, (b) availability of alternate modes and routes, and (c) availability of aggregate traffic data. Focusing the behavioral study on a corridor will allow us to validate reported perceptions of delay with objective data on transportation network performance and information system performance (Section 5). What distinguishes our approach to evaluation from others is its emphasis on incident response, its control for various factors which influence travelers’ decisions and, importantly, its focus on asking travelers about their use of TravInfo in specific instances.

A panel will be used to study the behavioral impacts and benefits of TravInfo under incident conditions, when TravInfo is expected to provide the greatest benefits. The panel will be recruited from the 1,200 households surveyed in the US -101 corridor, within the Broad Area sur-

vey, which will also constitute an initial contact survey for the target surveys. Because TravInfo is a multimodal system, it is important to study mode choice changes. However, considering that mode choice is a long-term decision and changes due to TravInfo are likely to occur only under severe conditions, route and departure time changes will also be studied. Behavioral changes are more likely to occur in certain corridors, in particular, the 101 corridor south of San Francisco, because: (a) it offers strong transit alternatives, (b) data on traffic performance of US-101 corridor, especially incidents, can be obtained from Caltrans and other sources, (c) there are alternate routes in the corridor that can serve as relievers in case of incidents, and (d) improved real-time information will be available in the corridor. The study of the Golden Gate Bridge corridor showed that most transit services were affected by incidents, limiting the potential for mode diversion. (6)

As currently proposed (as of November 1994), two target panel waves will be conducted in response to major incidents, one before and another after TravInfo implementation. In each case, these will be administered within 2 days of the incident. The “before” wave will explore travelers’ experience with a pre-TravInfo major incident. The “after” wave will explore travelers’ experience with a post-TravInfo major incident within the same corridor. The possibility of incidents occurring during the evaluation period is quite high; also, in case there are no major incidents during the test period, adverse weather can be treated as an incident. The panel participants will be asked questions about the major incident (expected delay, time received information about the delay, etc.) and to provide details of their travel experience. (Normal travel patterns will also be available from the Broad Area survey.)

The incidents will be selected according to the following criteria:

- 1) Must have an effect lasting 2 or more hours (to ensure that a reasonable percentage of the population is affected).
- 2) Must have a significant effect on traffic conditions (blockage of 2 lanes on US-101, in a bottleneck, at a location and time where traffic normally is close to saturation).
- 3) Must not be unusually significant (e.g., cannot block entire freeway for an extended period).
- 4) The after incident must be comparable to the before incident, with respect to lanes blocked, duration, time of day, and traffic conditions.

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

**VAR Customer Survey** Respondents for the VAR customer surveys will be drawn from the

customer list of vendors. Participating vendors will be responsible for mail-out to their customers, or perhaps packaging surveys with their products, to ensure confidentiality for their customer list. Surveys would be returned to PATH anonymously. Each survey would be partially customized, to reflect a product's specific features. Many of the questions would be held common (e.g., demographic questions, and questions about general travel behavior and use of information).

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. Only those VARs desiring a direct connection with the TIC must sign a Registered Participant Agreement with MTC, which ensures a certain level of cooperation between the 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. Some service providers and VARs will be able to receive information from other VARs, without signing the participation agreement. Even for those VARs who have signed the agreement, further arrangements on survey details must be made with PATH. These arrangements will likely be developed case by case.

Surveys would be categorized by product type if appropriate: (1) one-way communication device such as radio and television, (2) two-way communication device such as cellular phones, and (3) sophisticated two-way communication device such as computerized in-vehicle monitors. Assuming 20% return rate for 2,000 completed surveys, a total of 10,000 survey forms will be distributed. At this time the number and type of VARs who will participate in the fully operational TravInfo as well as the size of their customer bases are unknown. The number of products sold, or number of participating vendors, may limit this value. Follow-up reminder mailings (mailed by the VARs) will be employed as necessary to increase the response rate.

Surveys will be distributed before TravInfo becomes operational (to capture pre-TravInfo devices such as cellular phones), and then continuously thereafter as new products are introduced and sold, over a 15 month duration. A final follow-up survey will be distributed by VARs to all of the persons originally surveyed (when feasible). 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.

**TATS Survey** Travelers will have direct access to the TIC via the Traveler Advisory Telephone System (TATS) which shall provide access to traffic and transit information.

At six month intervals after TravInfo becomes fully operational, telephone surveys of TATS patrons will be conducted in three survey waves. The administration of these surveys will be modeled after similar work on the SmarTraveler Project in the Boston area conducted between October 1992 and March 1994. Initially, incoming TATS calls will be randomly intercepted by PATH staff to learn which callers would be willing to participate in a follow-up call during which the survey will be conducted. The goal is to have 500 completed surveys for each of the three waves.

The initial intercept calls will create the pool of individuals who receive more extensive follow-

up calls. The intercept calls will retrieve the callers first name, phone number, and the best time for the follow-up calls to be made within 48 hours. Repeat interceptees will be rejected for the follow-up calls in order to prevent multiple surveys for the same individual. The follow-up calls will be made by a market research firm and three to five attempts will be made to establish contact with the participants to minimize non-response bias.

To obtain the 500 completed surveys will require intercepting considerably more than this number of TATS patrons initially. A percentage of callers intercepted would be willing to participate in the follow-up surveys and a percentage of those willing to participate will result in completed surveys. (The experience of the SmarTraveler project suggests 50% for both the above percentages, necessitating approximately 2,000 intercepted calls.) The TATS calling rate, daily or weekly, will help determine the duration of each wave.

#### **4.4.2 Data Reduction and Analysis**

**Broad Area Survey** Results will be analyzed at multiple levels. Initially, the focus will be on tabulating frequencies of responses, separately broken down into a few basic categories (by location, mode of travel, commuter/non-commuter). Later, multivariate models will be developed, as described below. Finally, after the second broad area survey, a before/after comparison will be made. Differences between frequencies will be calculated in the before/after cases, relative to measures of information quality and awareness, and tested for statistical significance (likely with simple t-tests).

Multivariate models of behavior (*e.g.*, 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 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.

Discrete choice analysis will be used to quantify the effect of information and other factors on behavior. For example, the effect of several socio-economic, contextual and information variables on the diversion decisions will be examined by estimating (pooled and separate) diversion choice models based on respondents' reported experience of incident delays (for more details on discrete choice modeling see Ben-Akiva and Lerman (7)).

To analyze more complex data, structural equations will be used. 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). An example of the modeling structure is given in the figure below. It shows that information acquisition is a decision that depends on socioeconomic and contextual

factors and that preferences in turn depend on the same factors as well as the information acquired from various sources. Importantly, structural equations allow linkage of variables at two or more distinct points in time.

The following models will be specified. If there are  $p$  dependent variables (information and preference variables), then the equation system can be represented as follows:

$$y^* = By^* + Gx + z$$

where  $y^*$  is a  $(p \times 1)$  vector of dependent variables,  $B$  is a  $(p \times p)$  matrix of causal effects among the  $y^*$  variables (information and preference variables; note that the diagonal is zero because a variable cannot be causal to itself),  $G$  is a  $(p \times m)$  matrix of regression effects of the  $(m \times 1)$   $x$  independent variables (socioeconomic attributes and contextual factors), and  $z$  is a  $(p \times 1)$  vector of disturbance terms.

The product of analysis will be models of traveler behavior and associated benefits. They will indicate the preferences of travelers regarding changes in travel patterns due to TravInfo and other factors. (Notice that we are controlling 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 propensity to change. For example, we can evaluate whether the propensity of change to public transit increases when information is acquired through self-observation, radio or ATIS device. This will allow us to understand and predict behavioral changes due to improved information.

**Target Survey** The data from surveys will be used to relate behavior to attributes of alternatives, individuals and information. Initially, simple statistical techniques such as frequency analysis and cross tabulations will be used to analyze the data by testing traveler behavioral hypotheses and studying reported preferences. For example, in the case of response to an incident on a commuter's usual route, the travel time benefits from route diversion can be explored simply by looking at normal travel time and additional delays on both the usual and alternate route and the traveler's preference among the alternatives.

To elaborate, suppose that we are evaluating the benefits of mode diversion in incident conditions. The most tangible user benefits of a switch to public transportation is a reduction in travel time. 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 public transportation is used. We will analyze differences in the behavior of persons before and after the implementation of TravInfo.

To analyze traveler response, data will be collected on traveler behavior (choices such as destination, route diversion/return, and re-scheduling), perceptions regarding information received from various sources, situational factors and constraints at the time of the decision and socioeconomic characteristics. The responses will be analyzed through statistical methods to estimate traveler benefits attributable to TravInfo, as described in the prior section.

In addition, we will obtain data on transportation network performance (see Section 5, including

incident duration, queue lengths, free flow travel times on various routes, and incident location) to *validate* how perceptions of individuals (e.g., reported delays) differ from the objectively measured delays. This would provide insights into perceived and potential benefits. Finally, we will obtain data on information (information content and validity, etc.) disseminated through TravInfo. Overall, the analysis will allow the evaluation of TravInfo impacts on travel decisions, providing an assessment of the benefits, and insights into refinement of TravInfo design.

In addition to measuring effects of TravInfo during incidents, the panel nature of the survey will allow individual behavior to be tracked over the long-term. The impact of informational technologies on strategic decisions such as mode choice, route choice, departure time, auto ownership, and relocation of residence will be investigated.

**VAR Customer Survey** The data from the VAR customer surveys will be used to measure level of satisfaction with purchased product/service features, and to assess profiles of purchasers.

simple bivariate statistical techniques such as frequency analysis and cross-tabulations will be used to analyze the data, for example, by measuring, associations between individual products and product features with customer satisfaction. Multivariate models will also be considered for analysis to explore the inter-dependencies among explanatory variables and allow exploration of interaction effects.

Assuming that the surveys are representative of the VAR customer base, overall performance of a product or service associated with a particular VAR or VAR-type will be based on a statistical analysis of the survey responses' frequency distribution. For example, the percentage of survey respondents affirming satisfaction with a product, or its features, will be the measure of effectiveness. It cannot be known in advance how many VARs will exist, how many customers each will have, or what kind of access the evaluators will have to various kinds of customers. (In some cases, the VAR itself will not have direct access to ultimate customers of its products.) Hence, surveys will be subject to idiosyncrasies of specific VAR types and situations, and it will be impossible in advance to describe a single useful approach for all VARs.

**TATS Survey:** The TATS survey will be the simplest of the four surveys, focusing its questions on satisfaction with the information service, likelihood that the information will affect travel behavior, benefits based on behavioral changes such as reduced travel time, ability to avoid traffic problems, or ability to arrive at desired destination on time. A few demographic questions will also be asked to develop a consumer profile of TATS patrons compared to demographics of the general population. Initially, bivariate statistical methods such as frequency analysis, cross-tabulations, and Chi-square will be used to determine distributional profiles and to examine MOEs along demographic dimensions, such as gender, age, education, and income. Multiple regression analysis and discrete choice models will later be used to explore interdependencies and interaction effects among the explanatory variables, e.g. demographic information.

#### 4.5 Resources

Traveler Response evaluation for the Broad Area, Target, VAR Customer, and TATS studies will be performed by PATH researchers and telephone surveys will be conducted by market research consultant. Time allocation of each evaluator and consultant involvement for these Traveler Response evaluation elements are shown below in percent of full-time effort per fiscal year.

Broad Area Study:

	FY2	FY3	FY4
Researcher A	20%	10%	20%
Researcher B	20	0	20

Market research consultant to conduct telephone surveys for Wave 1 and Wave 2 surveys.

Wave 1: 1,000 completed surveys plus oversample of 1,200 completed surveys for recruiting

Target Survey participants at 50% return rate.

Wave 2: 1,000 completed surveys at 50% return rate.

Target Study:

	FY2	FY3	FY4
Researcher A	25%	25%	15%
Researcher B	30	30	30

Market research consultant to conduct telephone surveys for Wave1 and Wave 2 surveys.

Wave 1: 500 completed surveys

Wave 2: 500 completed surveys

VAR Customer Study:

	FY2	FY3	FY4
Researcher A	0	20%	20%
Researcher B	15%	15	15
Researcher C	0	30	40

TATS Study:

	FY2	FY3	FY4
Researcher A	5%	10%	10%
Researcher B	0	30	30

Market research consultant to conduct telephone surveys for Wave 1, Wave 2, and Wave 3 surveys.

Wave 1: 500 completed surveys

Wave 2: 500 completed surveys

Wave 3: 500 completed surveys

## ***4.6 Evaluation Tasks and Test Schedule***

Data collection will begin approximately three months before TravInfo installation and end 18 months after TravInfo. A detailed schedule is provided in Figure 4.1, for the tasks described below.

### **4.6.1 Pre-Test Activities**

- a) Develop Traveler Response component of TravInfo evaluation plan.
- b) For each study (broad area, target, VAR, TATS), design survey instrument, and develop detailed data collection plan
- c) Pre-test each survey, and revise as necessary.
- d) Contract with market survey firm to perform target surveys.

**Figure 4.1**

#### **4.6.2 Evaluation Test Activities**

- a) Broad Area Surveys:  
Execute initial broad area survey (Wave 1: Spring 1995);  
Execute final broad area survey (Wave 2: Spring 1997).
- b) Target Surveys:  
Execute initial target survey (Wave 1, Spring 1995 shortly before TravInfo becomes operational but after Broad Area Survey Wave 1);  
Execute second target survey (Wave 2, approximately Spring 1996).
- c) VAR Customer Surveys  
Execute initial survey immediately prior to TravInfo start-up;  
Execute VAR customer surveys on continuous basis, as TravInfo operates (distribute mail-back questionnaires through VARs through Spring 1997);  
Execute one follow-up survey 18 months after TravInfo start-up.
- d) TATS Surveys  
Execute TATS survey on a periodic basis, 6 months after TravInfo and at 6 month intervals.

#### **4.6.3 Post-Test Activities**

- a) Broad Area Study:  
Analyze initial broad area survey (Wave 1) results. Document in a working paper (WP1) 4 months after Wave 1 survey;  
Analyze final broad area survey (Wave 2) results. Document in the final Traveler Response Evaluation report.
- b) Target Study:  
Analyze initial target survey (Wave 1) results;  
Document in a working paper (WP1) 4 months after Wave 1 survey;  
Analyze second wave (Wave 2) of target survey;  
Document in working paper, comparing to initial wave (WP2) 4 months after Wave 2 survey.
- c) VAR Customer Study

Analyze VAR customer survey results, up to 9 months (Spring 1996) after TravInfo becomes operational;

Document in a working paper (WP1) 12 months after TravInfo becomes operational

Analyze final 9 months of VAR customer surveys, along with follow-up VAR customer survey;

Document in the final Traveler Response Evaluation report.

d) TATS Study

Analyze TATS survey (Wave 1) results;

Document in a working paper (WP1) 4 months after Wave 1 survey;

Analyze TATS survey (Wave 2) results;

Document in a working paper (WP2) 4 months after Wave 2 survey;

Analyze TATS survey (Wave 3) results;

Document in the final Traveler Response Evaluation report.

e) Final Traveler Response Evaluation Report

Write final report, summarizing all Traveler Response working papers, and including new results from second Broad Area survey, final 9 months of VAR results and follow-up VAR survey, and TATS survey.

## **4.7 Deliverables**

The deliverables are listed below:

a) Initial Broad Area study working paper (WP1) 4 months after Wave 1 survey;

b) Target survey working paper 1 (WP1) 4 months after Wave 1 survey and working paper 2 (WP2) 4 months after Wave 2 survey;

c) Initial VAR Customer study working paper (WP1) 12 months after TravInfo becomes operational;

d) TATS working papers 1 and 2 after surveys;

e) Final report, covering all studies (estimated September 1997).

## **5. NETWORK PERFORMANCE**

### **5.1 Background**

TravInfo will provide real-time transportation information to Bay Area travelers through VARs,

TATS, and possibly other means. The quality of the Bay Area transportation services will be influenced 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 element 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 in coordination with target surveys described in Section 4. The philosophy is to investigate two major incidents (one before, the other after), in depth, so that detailed *case studies* can be created, comparing incidents with TravInfo to incidents without. This in-depth approach will include a combination of target surveys, network measurements, and traffic simulations. The latter two are described in this section.

## ***5.2 TravInfo Goals and 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. Secondarily, the element will measure the speed at which information is transmitted, and the quality of the information transmitted. However, this will only apply to two incidents, one before and the other after TravInfo becomes operational.

## ***5.3 Measures of Effectiveness***

The MOEs for this study are highly influenced by available data sources (described in more detail in Section 5.4.1). These sources will likely be Caltrans loop-detectors, CHP Computer-Aided-Dispatch records, patronage records from Caltrain and Samtrans, TIC data, and tapes from traffic report broadcasts. These data sources will allow direct measurement of the following MOE:

- 1) Traffic counts, by time 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, by time and location, for the 101, 280 and 380 freeways, to assess changes in travel time.
- 4) Time between incident and public reporting of the incident; accuracy of reported information and information detail.

- 5) Number of follow-on collisions (if any), along with their causation, and a case-by-case assessment of whether traveler information affected these incidents.

In addition, these data will be used, in combination with a traffic simulation model, such as NetSim, as well as survey results, to estimate other MOEs, such as:

- 1) Changes in travel times and traffic levels on parallel arterials.
- 2) Changes in traffic volumes on parallel arterials.
- 3) Net changes in pollution, resulting from incident induced congestion.
- 4) Net changes in fuel consumption, resulting from incident induced congestion.

## ***5.4 Experimental Design***

The overall approach is to focus on two major incidents, one before TravInfo and the other after, within a pre-selected corridor. This corridor will be the area surrounding the US-101 Freeway in San Mateo County, for the reasons cited in Section 4. The experiment will be coordinated to take place at the same time as the target surveys.

### **5.4.1 Data Collection and Sample Size**

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

- |                    |  |
|--------------------|--|
| <b>Caltrans</b>    | Provision of magnetic tapes containing statistics on traffic flow, occupancy and speed, by location, for the US-101 corridor. These tapes will cover the day of the incident, and days immediately preceding and following the incident. |
| <b>CHP details</b> | Provision of Computer-Aided-Dispatch (CAD) records, providing all dispatching surrounding the incident.  |
| <b>TIC</b>         | As part of on-going supply of data, information on exactly what information was transmitted, and when, regarding the incident.   |

In addition, the evaluator will attempt to make arrangements with major traffic reporting services to obtain tapes of their broadcasts on the days of the incidents. Attempts will be made to obtain broadcast records from all of the registered participants.

The evaluators will also attempt to interview officers who were at the scene, to develop a detailed documentation of what happened during the incident, as well as in follow on collisions (if any). Participants in the accident will be interviewed, if feasible. Finally, personnel at the traffic reporting services will be interviewed, to assess how they handled the incident, and whether they handled it any differently because of TravInfo.

The sample size amounts to approximately 5 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 (exact duration defined by incident duration). For the TIC, the data will be part of what is routinely collected. Finally, for the traffic reporting tapes, the sample size amounts to several hours of data collection for each incident, for as many companies as are willing to participate.

#### **5.4.2 Data Reduction and Analysis**

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.

Follow-on accidents will be investigated through interviews with officers on the scene and by examination of accident records. Where possible, people involved in the accident will be interviewed to assess their awareness of the original accident, and the types of traveler information sources used. This will result in a case-study type description of the follow-on incidents.

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, under pre- and post- TravInfo.

Because of the small sample size, no attempt will be made statistically to test the magnitude of changes in performance resulting from TravInfo. Instead, the emphasis will be on describing what happened in the before and after cases in as much detail as possible, to enable a qualitative assessment of the effects of traveler information.

## 5.5 Resources

Network Performance evaluation will be performed by PATH researchers and other researchers. Time allocation of each evaluator and consultant involvement for these Traveler Response evaluation elements are shown below in percent per fiscal year.

	FY2	FY3	FY4
Researcher A	0	5%	10%
Researcher B	5%	10	10
Researcher C	0	30	30

## **5.6 Evaluation Tasks and Test Schedule**

The network performance element includes two major waves of data collection, one before TravInfo and the other after. Because incidents are inherently unpredictable, task times are inexact. The schedule in Figure 5.1 is approximate.

Insert Figure 5.1

### **5.6.1 Pre-Test Activities**

- a) Develop network performance element of evaluation plan;
- b) Work with Caltrans, CHP, TIC, and traffic reporting services; develop specific plan for obtaining data after incidents, ensuring no or minimal chance of lost data;.
- c) Select simulation model, and code with the 101-corridor network, to enable simulations.

### **5.6.2 Evaluation Test Activities**

- a) Collect data from CHP, Caltrans and TIC, for first incident;
- b) Interview officers who were at the scene, personnel at traffic reporting services, and participants in incident (if feasible), for first incident;
- c) Collect data from CHP, Caltrans and TIC, for second incident;
- d) Interview officers who were at the scene, personnel at traffic reporting services, and participants in incident (if feasible), for second incident.

### **5.6.3 Post-Test Activities**

- a) Create summary statistics for day of the first incident;
- b) Simulate network for the day of the first incident, to obtain network performance measures;  
Document first incident in a working paper, including simulation results and statistics, interview results, detailed time-line for incident, and results of target survey (see Section 4);
- c) Create summary statistics for day of the second incident;
- d) Simulate network for the day of the second incident, to obtain network performance measures;
- e) Document second incident alongside the first incident in a final report paper, including simulation results and statistics, interview results, detailed time-line for incident, and results of target survey.

## **5.7 Deliverables**

There will be one working paper covering the first incident and a final report covering the second incident (combined with the first).

## **REFERENCES**

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## **APPENDIX A. TravInfo Evaluation Oversight Team (EOT)**

### **A.1 EOT Charter**

The TravInfo project is an Intelligent Vehicle Highway Systems (IVHS) field operational test

(FOT) involving a partnership of public agencies and private concerns, which seeks to test and evaluate its effectiveness in providing high-quality traveler information to Bay Area residents. The FOT began in June of 1993 and is scheduled to be completed in 1997. The physical core of TravInfo, the Traveler Information Center (TIC), is presently scheduled to be operational in early 1995. The PATH program has been selected to perform the project evaluation.

The Federal Highway Administration (FHWA) and the California Department of Transportation (Caltrans) are sponsors of TravInfo, and one of their primary aims in this, as in all their IVHS projects, is to obtain a high-quality evaluation. Likewise, the other project partners – the Metropolitan Transportation Commission (MTC) and the California Highway Patrol (CHP) – are also key stakeholders in determining whether to commit further resources to TravInfo beyond the two-year test period.

In order to perform a credible evaluation, the project evaluator must retain considerable independence. However, this independence must be exercised in the context of also satisfying the evaluation needs of both FHWA, Caltrans, and the project partners. To ensure that these needs are satisfied, and that data and cooperation critical to the success of the evaluation are secured, the TravInfo Evaluation Oversight Team (EOT) has been formed.

The EOT is composed of members with specific backgrounds and expertise in project evaluation issues and an interest in the successful completion of the TravInfo evaluation. There are three categories of EOT membership: *active members*, who attend most EOT meetings and are most directly involved in providing support and guidance to PATH on the conduct of the evaluation; *auxiliary members*, who maintain an interest in and follow the design and results of the evaluation, as well as provide input and review comments, but do not regularly attend EOT meetings; and the *PATH evaluators*. A roster of current EOT members and their category of membership is appended.

New members may be added at any time at the discretion of the Chair with the general concurrence of the active members of the EOT, and with consultation of the PATH evaluators.

The purpose of the EOT is to oversee the project evaluation process and provide support and guidance to the PATH evaluators on the planning, design, and execution of the project evaluation. This advice and guidance is expected to be provided in a forum of regular meetings of the EOT where progress on the evaluation and potential problem areas are discussed, and review of any interim evaluation products is conducted (e.g., the detailed project evaluation plan and subsequent revisions, survey sampling plans and instrument design, field data collection plans, analysis methodologies, interpretations of results, working papers, etc.). Overall, the EOT will serve as a basic communications link between the PATH evaluators and the TravInfo project partners.

The EOT is not expected to be involved in the day-to-day management or direction of the evaluation. However, to the extent that concerns expressed by the EOT regarding the conduct of the evaluation reflect concerns of the project partners, the FHWA, and Caltrans, EOT input is expected to be given serious consideration by the PATH evaluators. Significant disputes between the EOT and PATH regarding evaluation issues, such as those involving interpretation of evaluation goals and objectives or selection of specific evaluation methods, will be mediated by the FHWA with the assistance of the FHWA evaluation support contractor.

