

CALIFORNIA PATH PROGRAM
INSTITUTE OF TRANSPORTATION STUDIES
UNIVERSITY OF CALIFORNIA, BERKELEY

Revenue Models for Advanced Traveler Information Systems

Y.B. Youngbin Yim

**California PATH Research Report
UCB-ITS-PRR-2001-3**

This work was performed as part of the California PATH Program of the University of California, in cooperation with the State of California Business, Transportation, and Housing Agency, Department of Transportation; and the United States Department of Transportation, Federal Highway Administration.

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California. This report does not constitute a standard, specification, or regulation.

Report for MOU 364

February 2001

ISSN 1055-1425

RevenueFin.doc

Revenue Models for Advanced Traveler Information Systems

Y.B. Youngbin Yim

June 1999

MOU364

ABSTRACT

The paper describes current trends in the traveler information supply system and the prospect for potential markets for advanced traveler information in the United States and Europe. Alternative revenue models are identified that may be able to support the operation of the newly created traveler information centers in the post-field operational test phase. In the past, public agencies have been reluctant to share traffic management responsibilities with the private sector.

However, this study found that the current trend is toward a public-private partnership in the form of a franchised or revenue sharing program. In the United States and Europe, many private entrepreneurs are currently involved in beta testing their products and in assessing the business viability of advanced traveler information services. In Japan, several types of in-vehicle devices are already commercially available to the consumer. The market potential for privately offered advanced traveler information services in the United States and Europe is; however, yet to be determined since consumer purchase behavior for traveler information is largely unknown.

The study investigated alternative revenue models that could support the operation of the newly created Traveler Information Centers in the post-field operational test phase. The interest was to explore the Traveler Information financing mechanisms for short- and long-term viability in Traveler Information Center operation.

Keywords: Revenue Model, Market, Advanced Traveler Information System

TABLE OF CONTENTS

| | Page |
|---|-----------|
| Abstract | i |
| Executive Summary | iv |
| 1. Introduction | 1 |
| 2. Methodology | 4 |
| 3. Assessment of the ATIS Market | 6 |
| National Market | 6 |
| Market penetration of traveler information devices | 7 |
| 4. Models of Traffic Data Collection and Dissemination | 8 |
| Exclusively public | 9 |
| Exclusively private | 10 |
| Public-private partnership | 12 |
| 5. Revenue Models of Traveler Information Center | 15 |
| 6. Business Opportunities | 19 |
| Privatization of TIC..... | 20 |
| Emerging trend | 20 |
| The ATIS consumer market | 22 |
| Business opportunities for the private sector | 24 |
| 7. Existing Models in the U.S. | 26 |
| Smart Traveler Model | 26 |
| SmartRoute Model | 28 |
| Etak-Metro Networks Model | 28 |
| 8. Implementation Issues and Potential Barriers | 30 |
| Uncertainty of the market for ATIS deployment..... | 31 |
| Lack of national standards | 32 |
| Equitable sharing of revenues | 33 |
| Claiming intellectual property | 33 |
| Exclusivity of public information | 33 |
| Procurement and contracting regulations..... | 34 |
| 9. Conclusions | 34 |
| References | 35 |

LIST OF FIGURE

| | Page |
|---|------|
| 1. Exclusively public | 8 |
| 2. Exclusively private | 8 |
| 3. Public-private partnership | 9 |
| 4. Tax-based revenue model | 16 |
| 5. User-fee based revenue model | 17 |
| 6. Third-party sponsorship based model | 18 |
| 7. Monthly call volume summary by Cincinnati Bell and TravInfo..... | 26 |
| 8. Etak/Metro Networks Traffic Architecture | 30 |
| 9. Etak/Metro Networks national ATIS | 30 |

LIST OF TABLES

| | |
|---|----|
| 1. Existing models of traffic management and traveler information systems | 13 |
|---|----|

EXECUTIVE SUMMARY

In the interest of reducing congestion and making better use of the existing infrastructures, many cities throughout the world have now implemented advanced traveler information systems. These systems are mostly supported by public funds, in the form of either field operational tests or model deployment programs. The purpose of these information systems is not only to benefit travelers but also to stimulate the deployment of privately offered advanced traveler information products and services. In 1998, three federally sponsored Field Operational Tests of Advanced Traveler Systems were completed in California. They were TravInfo, TransCal, and the Yosemite Area ATIS. The TravInfo field test was in the San Francisco Bay Area for an urban setting. The TransCal field test was in a rural environment between the City of Sacramento and the City of Reno. The Yosemite Area ATIS field test was in the regional recreational area. The objectives of these projects were to test advanced traveler information systems, including kiosks, changeable message signs, personal digital assistant (PDA) units, in-vehicle navigation devices, and traveler advisory telephone systems. In the San Francisco Bay Area, the TravInfo Field Operational Test (FOT) was completed in September 1998. Metro Traffic, a private firm retained by the management board to operate the system, operates TravInfo. Most of the field operational tests in the US are completed.

A question was whether the field operational test projects should continue operating and if so, from what source would the revenues come to cover the operating and maintenance cost of the Traveler Information Center (TIC) and its system. The purpose of this study is to explore alternative financing mechanisms for the sustainability of publicly funded TIC such as TravInfo after the field test. The study focuses on what revenue models are available for TIC operation for the post-FOT phase.

The study objectives were to understand the market structure of the ATIS and to identify revenue models for TIC operation. As part of the post-FOT TIC financing or business planning study, we investigated public-private partnership models that are currently available for ATIS deployment in the US and other countries (Europe, Australia, Japan, etc.) from the TIC operator perspective.

Existing or potential revenue models are identified from interviews with ATIS stakeholders and also from a literature review. The key findings of the study are:

- Many public agencies and traveler information industry believe that there will be a strong consumer market for advanced traveler information systems. The greatest potential for the delivery of the personalized traveler information service is in-vehicle navigation devices. However there is no current market for advanced traveler information systems.
- The market potential for ATIS is determined based on the deployment of electronic media. Presently, personalized traveler information can be disseminated through a variety of media. They include the Internet, cellular phones, pagers, personal digital units, a cable television, in-vehicle navigators, and message watches. It was predicted that there would be 5 million subscribers to Internet TV services by 2001 and 12 million by 2007. The 1998 survey showed that 71.6% of households in the San Francisco Bay Area have personal computers at home or at work and 52% of them have Internet access. Nearly half (46%) have pagers and 56.6% own a cellular phone. About 10% (9.3%) have personal digital assistants and 3.4% have in-vehicle navigator.
- Experts cited that the major trends in the evolution of the advanced traveler information industry are: a) creating national traveler information networks, b) establishing more public/private partnerships, c) marketing enabling ATIS technologies and products, and d) advertising ATIS products and services to targeted consumers.
- Three basic traveler information models were investigated: a) exclusively public, b) exclusively private, and c) public-private partnerships. The advantage of the public model is that the public sector can control maintenance and operation of the information system. However, the model requires extensive in-house skills and technical expertise to efficiently operate the system. There are also limits for private firms to compete for the improvement of the data quality and the cost-effectiveness of operations. The advantage of the private model is that the public sector is not directly responsible for data quality or

operational efficiency of the traveler information center. In addition, the public sector can benefit from the private sector business endeavor for the public interest in enhancing traffic operations system. The possible problems with this model are inconsistency of information and possible social inequity allowing information only to those who can offer to obtain it.

- Public-private partnerships are required to work effectively towards unified goals. Common motivations for the private sector in a partnership include: familiarity with large-scale projects, technological expertise, cross-fertilization of concepts, political neutrality and expanded funding. The first three of these are important for partnerships that combine with the private party's ability to market ATIS products and services to the general public. The US DOT identified models of public-private partnerships for delivery of advanced traveler information systems. Among them are: a) functional division of responsibilities, b) franchised operations, c) publicly owned, privately operated system, and d) unified public-private partnership
- Three basic revenue models were investigated; they were tax-based, user-fee based, and third party sponsorship based. There are basically three revenue-generating models available for TIC operations: the *tax based*, *user fee based* and *third party sponsor based*. Any combination of these three models is possible. The *tax-based model* is a system, which would support a publicly owned and publicly operated ATIS. The *user-fee based model* is when users pay a fee for access to information. There are basically two forms of user payment, the *per user transaction fee* and the *subscription fee*. The major advantage of the *user-fee based model* is that the system can be self-supporting if the user fees are high enough to cover the operating and maintenance costs of the TIC. With the *third-party sponsor-based model*, commercial sponsors pay for traffic information. This model replicates the practice currently being used by the private sector.
- The exiting models investigated are Smart Travel Business Model, SmartRoute Model Etak Model. The Smart Travel model shows that public sector supports creation of an asset business management entity for it to manage data assets, create data products,

broker those data products for sale to private firms and the coordination and distribution of revenues to all participants. The model will generate revenues from advertisement slots and user fees. SmartRoute Systems, Inc. is a private firm providing advanced traveler information services to the public in the form of franchises. It collects and disseminates traveler information to the public. Its clients are mostly public agencies that pay the company for its services. The Etak model is to deploy traveler information system with uniform formats for the development and deployment of ITS products and services in the US. Etak believes that the lack of the uniform format nationwide has been the major barrier for the development of national ITS markets. ETAK and Metro Network are jointly implementing a national ATIS infrastructure by installing Traffic Workstations at all Metro Networks offices throughout the US. Revenues will be generated from multiple sources including government contracts, advertising, commissions, subscriptions, sponsorships.

- Within the framework of revenue models, this section covers key issues likely to come up if revenue models are used. Institutional barriers of revenue sharing models include: a) uncertainty of the market for ATIS technologies, b) lack of national standards, c) equitable sharing of revenues, d) claiming intellectual property, e) exclusivity of Public Information, and f) procurement and contracting regulations.

As for the support of the post-FOT TIC operation, one of the public-private models or a combination of them could be considered in order to come up with a self-sustainable ATIS system. The viability of the third-party sponsorship based system and the user fee-based system for the TIC operation should be carefully evaluated since the examples of working models are limited in scope. Additional research on the development of a business plan for the TICs would significantly contribute to the ATIS research that is so important to both public agencies and private industry. Further research is also needed for a realistic assessment of the ATIS market structure.

1. INTRODUCTION

Over the past few years, public agencies have initiated a number of field tests of Advanced Traveler Information Systems (ATIS) throughout Europe and the United States. The purpose of these field tests is not only to help traffic system operators but also to stimulate the development of privately offered ATIS products and services [Metropolitan Transportation Commission, 1995; Hall, et al, 1994). In France, an extensive communications infrastructure program has been implemented to disseminate real-time traffic information via roadside changeable message signs on the major freeways of Paris, Strasbourg and Toulouse. In the United States, a telephone based traveler information system has been deployed in several cities, including Boston, Seattle, Cincinnati, and in the San Francisco Bay Area. These ATIS experimental projects were undertaken mostly with public seed money in order to help the deployment of ATIS technologies. With the shrinking size of public investments in transportation projects, alternative financing seems to be the only viable option for the sustainability of the system, especially in the United States. From the public standpoint, the sustainability of Traveler Information Centers (TIC) is extremely important not only because of the improvements needed for traffic surveillance but also for the support that is needed for private industry to develop business plans for the development and deployment of ATIS products in the consumer market.

More specifically, the study investigates alternative models that can support the operation of the newly created Traveler Information Centers in the post-field test phase. With regard to business plans, three basic revenue models have been identified; 1) tax-based, 2) user-fee based, and 3) third-party sponsorship based, in the form of advertisement. Many cities are currently evaluating various combinations of these three basic models for deployment of ATIS services. The study focuses on the evaluation of these models with the emphasis on the latter two, user-fee and third-party sponsor financing mechanisms, specifically for the Traveler Information Center's post-field test operations.

The study objectives are to understand the market structure of the ATIS and to identify revenue models for Traveler Information Centers, specifically for the TravInfo project. The TravInfo

project is housed in a Traveler Information Center (TIC) where traveler data are collected and disseminated. A private contractor operates the TIC with the Metropolitan Transportation Commission overseeing the entire management of the center. TravInfo disseminates traveler information directly to the public through the interactive Traveler Advisory Telephone System (TATS), a landline telephone network that can be reached by dialing 817-1717 from all Bay Area area codes, and to ISPs who have registered to participate in the TravInfo project. The registered ISPs can tap into the center's database through a modem or telnet connection to TravInfo's Landline Data Server.

TravInfo provides information on public transit, current traffic conditions, carpooling, highway construction reports, bikeways and airport ground transportation information. During emergencies and special events, additional information is disseminated and updated regularly.

The center operates 24 hours a day, seven days a week with three weekday shifts. The annual cost of TravInfo operation is \$1.5 million. Traffic and incident data are automatically fed into the TravInfo database from inductive loop sensors of Caltrans' Traffic Operations System and the Freeway Service Patrol. These sources do not provide sufficient geographic data coverage, because many of the loop sensors are not working and vehicle probes of the Freeway Service Patrol system cannot accurately produce freeway travel times. As a result, incident reports of the Computer-Aided Dispatch (CAD) system from the highway patrol have become the most significant source of data. The CAD data require significant manual interpretation by TravInfo operators.

In the wake of the emerging concerns about the sustainability of the TIC, the questions that must be addressed are: how can the operational and maintenance needs of the TIC be financially supported and, secondly, is there a consumer market for these commodities? In light of these issues, we investigated the market structure of emerging ATIS technologies and alternative financing mechanisms for the sustainability of the TIC.

In the past, public agencies have been reluctant to share traffic management responsibilities with the private sector. The current trend is toward a public-private partnership in the form of a

franchised or revenue sharing program. In the United States and Europe, many private entrepreneurs are presently conducting beta testing of the products for the determination of the business viability of ATI services. In Japan, some of the ATIS products are already available on the consumer market. The market potential for privately offered ATIS in the US and Europe is yet to be determined since we have little knowledge of consumer purchase behavior in traveler information.

Considering the uncertainty of the consumer market, the study investigated the TIC financing mechanisms in three phases. First, we looked at the structure of the current ATIS market, determined its probable path and whether there is any potential for the deployment of privately offered ATIS products or services. Second, we investigated alternative revenue models specifically tailored to the user-fee or third-party sponsor based financing capabilities. Third, we identified the potential barriers or issues that might come up in the process of implementing these models.

The scope of the study consists of three integrated research elements:

- Assessment of the ATIS market
- Investigation of revenue models for Traveler Information Centers
- Identification of institutional issues and potential barriers

The study will benefit the TravInfo project in three ways: 1) it will provide relatively comprehensive examples of revenue models based on which current TravInfo deployment plan can be evaluated; 2) it will enable the TravInfo Management Board to realistically assess the short- and long-term sustainability of the TravInfo services with revenues driven by the consumer market; 3) it will allow Information Service Providers relying on the TravInfo database to be informed of the various revenue models being developed and considered by public-private partnerships.

The paper begins with the methodology used for the study, followed by a literature review and current practices of traffic data collection and dissemination. It goes on to revenue models for TIC operations and then discusses business opportunity prospects for the ATIS market.

2. METHODOLOGY

The study focuses primarily on the revenue models for Traveler Information Center operation. It is, however, important to understand the market share for Traveler Information Center services since it is an integral part of the ATIS information industry. To understand the economic viability of the Traveler Information Center, it is necessary to determine the optimal level of consumer demand for the self-sustainability of the Traveler Information Center. The findings of the current studies on consumer behavior of ITS technologies are largely inconclusive in determining how large a market Traveler Information Center should tap into in order for the system to become self-supporting. The optimal market size will be determined based on the secondary data from those studies that have recently been completed or which are currently under way at PATH and in other parts of the US.

Existing or potential revenue models are identified from interviews with ATIS stakeholders and also from a literature review. In addition, new revenue models are explored in conjunction with the TravInfo working groups. Issues and potential barriers are identified from in-person or telephone interviews with the representatives of the business community in California and other states. The study consisted of three major tasks: 1) literature review, 2) empirical research on business plans and practices, and 3) evaluation of business models from the economic and market perspective.

Literature review

The initial phase of the research was an extensive literature search and review of existing literature in three areas: a) consumer acceptance of ATIS products and services to estimate the current and potential market size of the TIC service demand, b) revenue generating models based on private financing, and c) public policies on business practices regarding the selling and distribution of public goods.

Empirical research on business plans and practices

Several cities in the US and Europe are developing or implementing business plans for Traveler Information Centers. These plans are identified for comparison, mostly through available documents or interviews and, in some cases, site visits.

Evaluation of business models

The business models used or suggested for Traveler Information Center operation are evaluated from the economic viability (i.e., potential revenue sources which will cover at least the operating and maintenance cost), fairness of business opportunities created for small entrepreneurs, and the potential drawbacks that may be caused by political or legal constraints. Models are evaluated within the institutional framework of the public-private partnership.

The study is aimed at an understanding of several ATIS deployment issues:

- Should or can the public sector sell publicly collected traffic data to private Information Service Providers (ISP) or directly to end users (travelers)?
- Is there a consumer market for traveler information services in the US?
- What are the political and legal barriers in packaging and selling public information?
- What business strategies (i.e., public only, private only, public-private partnership) have been adopted in the US, Europe, Australia, and Japan for ATIS deployment?

Recent studies of the consumer market indicate that there has been an increase in the demand for traffic information and that both large and small business opportunities exist for a variety of personalized ATIS products and services specifically tailored to consumer needs (Charles River Associates, 1997, Williams, 1998). There is also a large body of travel behavior literature suggesting that consumers benefit by being able to make informed decisions by listening to traffic information either before or after leaving home (Orski, et al.,1996). The consumer benefits that have been identified in the previous studies generally include the help travelers receive in making pre-trip or en route decisions. These decisions lead to travel timesavings and better driving conditions as the result of avoiding traffic congestion. Nearly 15% of Bay Area households make a point of tuning into traffic reports every morning (Yim, et al, 1997). Other

studies in other parts of the United States show similar patterns (Abdel-Aty, 1993). With a few exceptions, traffic information is offered free to consumers. If more consumers knew about these sources of reliable traffic information and were knowledgeable about their benefits, the size of the current market might expand. However, the underlying question is, would people pay for the information? To understand the market structure, the study investigated the recent development of business plans for ATIS, models for ATIS financing and the status of the ATIS market.

3. ASSESSMENT OF THE ATIS MARKET

Two types of ATIS markets, TIC and privately offered ATIS, are investigated to understand the structure of the information industry. The financing of TIC deals with the public and private ownership of information and privately offered ATIS deal with the private ownership of information. The structure of these relationships in the marketplace is complex and there is a need for an understanding of the various economic components and social attributes associated with these ownership issues if we are to assess the business opportunities for offering information packages at a certain price in the current and the future consumer market. We asked, is there a consumer market for traveler information services in the US?

National Market

Many in public agencies and the traveler information industry believe that there will be a strong consumer market for advanced traveler information systems. The greatest potential for the delivery of the personalized traveler information service is in-vehicle navigation devices (Southern California Economic Partnership, 1997). In 1997, about 10,000 vehicles were equipped with in-vehicle navigation units in the US. It is expected that one million navigators will be in-vehicle by 2000. Currently, several automakers offer in-vehicle navigators as an option at the cost of \$2,000. Other companies offer owner-installed navigators for lesser costs. In all cases, GPS satellites are used for in-vehicle navigators. The price of navigators is expected to come down as competition increases. Experts estimated that the \$310 million market in 1995

would grow to a \$3 billion market by 2000. A survey conducted by the Consumer Electronics Manufactures Association in 1996, 55% of the consumer was aware of navigators with 18% of them interested in purchasing a unit. Experts also forecasted that between 1997 and 2011, \$209 billion would be spent on Intelligent Transportation Systems including traveler information services. Of \$209 billion, 80% is expected come from the private sector's ATIS products and services.

Experts cited that the major trends in the evolution of the advanced traveler information industry are ((Southern California Economic Partnership, 1997):

- Creating national traveler information networks
- Establishing more public/private partnerships
- Marketing enabling ATIS technologies and products
- Advertising ATIS products and services to targeted consumers

Private sector firms, such as ETAK and Metro Networks together, have developed a national network for travel information systems for privately offered ATIS products and services.

Public/private partnerships are necessary because private firms may need traffic data, such as inductive loop detector data, collected by the public sector as part of their traffic operations function.

Market penetration of traveler information devices

Personalized traveler information can be disseminated through the Internet, cellular phones, pagers, personal digital units, a cable television, in-vehicle navigators, and message watches.

Over half of households may have personal computers at home or work. In 1997, nearly 30% of households in the US regularly used the Internet at home or at work. It was predicted that there would be 5 million subscribers to Internet TV services by 2001 and 12 million by 2007.

The 1998 survey showed that 71.6% of households in the San Francisco Bay Area have personal computers at home or at work and 52% of them have Internet access. Nearly half (46%) have

paggers and 56.6% own a cellular phone. About 10% (9.3%) have personal digital assistants and 3.4% have in-vehicle navigator (Yim, 1999).

4. MODELS OF TRAFFIC DATA COLLECTION AND DISSEMINATION

Worldwide, three models have been employed in the practice of traffic data collection and dissemination. These are characterized as *exclusively public*, *exclusively private* and *public-private*. The information flow processes in these models vary, depending on the public policies or dissemination mechanisms in use in various regions and countries. Examples of the models are described and shown in Figures 1, 2 and 3.

Figure 1. Exclusively Public (Paris, France; Sydney, Australia)

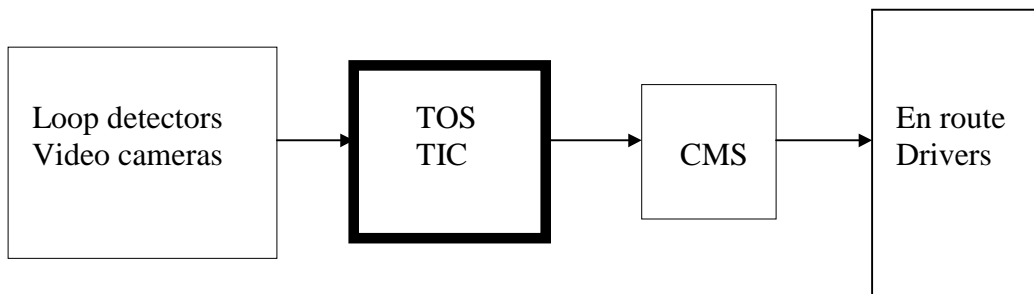


Figure 2. Exclusively Private (London, England)

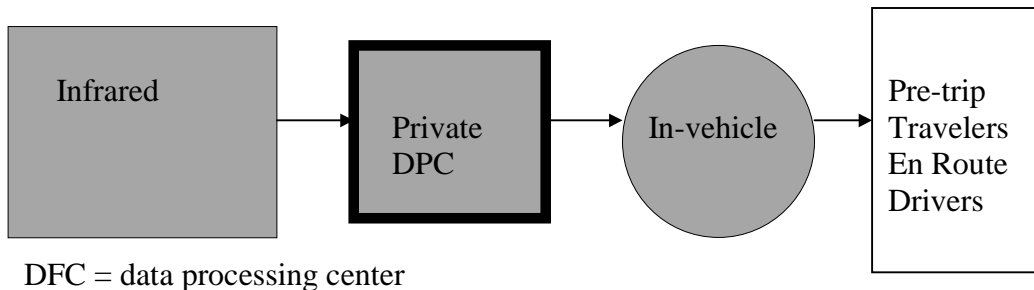
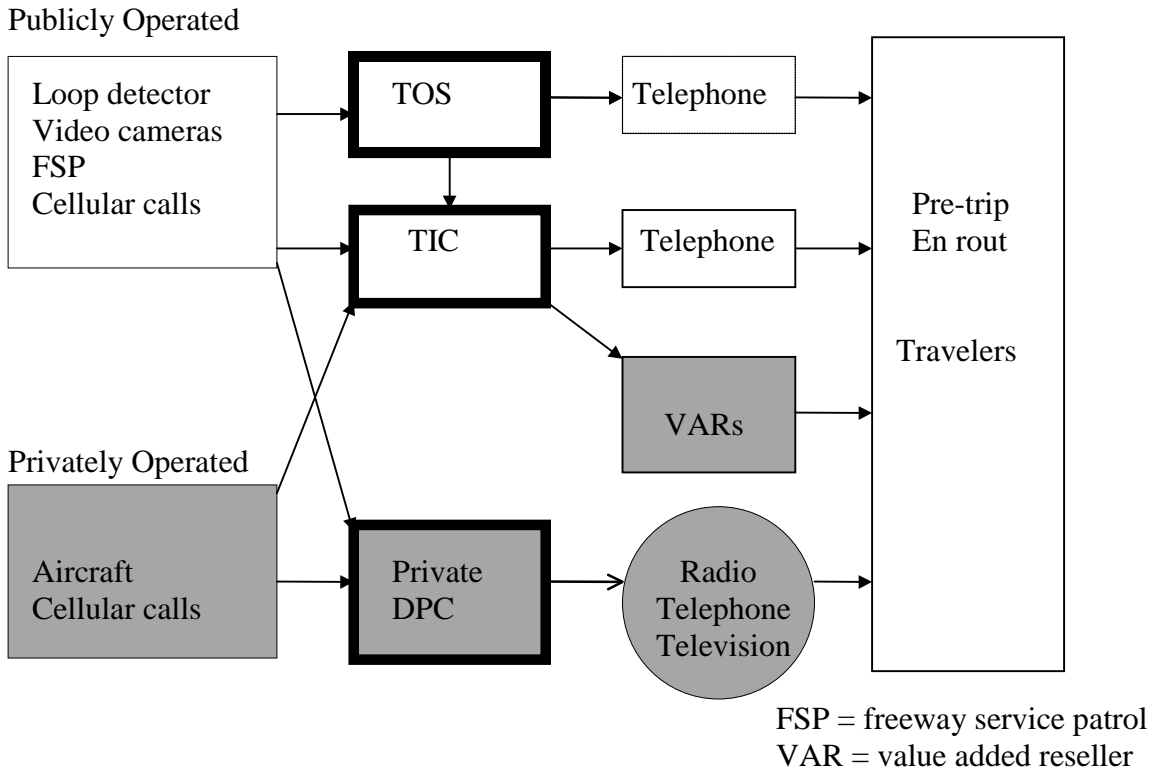


Figure 3. Public-Private (San Francisco Bay Area, USA)



Exclusively Public

The *exclusively public* model is normally seen when public agencies are completely responsible for the collection and dissemination of traffic information. Public agencies generally have large enough resources to provide for research and development and to execute public projects that require the design, construction, operation and maintenance of transportation systems. A typical example of such a model is the French transportation system. Historically, the French National Department of Transportation (DOT) and the Department of Law Enforcement have been jointly responsible for the financing and operation of the French national highways. In recent years, the French DOT has financed a large capital investment program called SIRIUS that is designed to collect and disseminate traffic information for motorists in the Paris region. SIRIUS is part of the field operational test of the European DRIVE program. With SIRIUS, traffic data are collected by means of loop detectors and video cameras. The traffic information is then disseminated by means of changeable message signs that suggest drivers to take less congested

routes. The system is publicly financed and is operated by the Traffic Information Center for the Paris Region (SIER). However, even in France, there is some private sector involvement with the traffic management system, primarily through turnkey projects contracted for by the government.

Another example is the recent development of an Australian advanced traveler information system, which was built exclusively with public financing. The heavy instrumentation of the city streets in Sydney and Melbourne is perhaps the most extensive publicly funded ATIS project in the world. In Sydney alone, 25,000 loop detectors were put in place, covering most of the intersections of the arterial streets. This system, which is called SCATTS, permits the coordination of all the traffic lights in the city. The Australian regional transportation authorities also disseminate traffic information for the major freeways.

The major advantage of the public model is that the public sector can control maintenance and operation of the information system. However, the model requires extensive in-house skills and technical expertise to efficiently operate the system. It also limits private firms to compete for the improvement of the data quality and cost-effectiveness of operations.

Exclusively Private

The exclusively private model is seen when traffic data collection and dissemination are conducted solely by the private sector without the help of the public sector. The best example is the city of London, England, where a private firm has installed infrared data collection devices for the purpose of selling traffic information by means of an in-vehicle paging device; they charge a user subscription fee. Developed by General Logistics PLC in England with an entirely private investment, the system uses simple and inexpensive, yet highly effective, infrared twin beam detectors, mounted side by side on overhead bridges that record vehicle speed in each direction. When a freeway is congested, which is defined as below a certain specified threshold speed level, i. e., slower than 35 mph, the in-vehicle device automatically alerts drivers with up-to-the-minute traffic information (Martell, 1992). Since the early 1990's, the TRAFFICmaster, an in-vehicle paging and route guidance device that provides traffic information, has been

marketed to European subscribers. Within a couple of years of its commercialization, local and regional governments hired General Logistics PLC to provide the necessary infrastructure for traffic data collection. As of now, this is the rare example in the traffic information industry of a private company's establishment of the regional standards and protocols.

Another example of the privately funded model, although not the only one, is the system in the United States. In American cities, private companies have supplied traffic information to distributors for nearly thirty years. Traffic information is disseminated through a communications network that mostly uses landline distribution or the digital broadcasting system. The distributors have usually been commercial radio and television stations. In the case of the larger companies, information is collected through air surveillance with their own planes and helicopters. To augment this information, they also utilize some public sources, such as state highway patrols, police and fire reports and cellular calls from motorists. These companies have generated their revenues exclusively from selling ad slots provided by distributors, mostly radio and television stations.

The advantage of this model is that the public sector is not directly responsible for data quality or operational efficiency of the traveler information center. In addition, the public sector can benefit from the private sector business endeavor for the public interest in enhancing traffic operations system. The possible problems with this model is that privately offered information may be inconsistent and may be tailored only to those who can pay for information, possibly discriminating against information recipients based on their economic class. It can create potential problems associated with social equity and injustice. Who gets information and who doesn't. On the other hand, previous studies indicate that the optimal benefits for all travelers can be achieved if only small number of travelers can redirect their routes, and in some cases, only 15% of traffic rerouting can make a big difference in traffic flow.

Public-Private Partnership

The public-private model refers to the situation where both public and private parties are involved in the collection and dissemination of traffic information. Many variations on the public-private model exist such as 1) functional division of responsibilities, 2) franchised operation, 3) publicly owned, privately operated system, and 4) unified public-private partnership. The first model in which the *functional responsibilities* are clearly divided between the public and private is exemplified by the weather information system in the United States. The second model, the *franchised operation* is where the public sector collects the data and sells it. If it is sold to a private firm for its exclusive dissemination it is called an exclusive franchise. If the public sector retains some rights to the information and sells it to more than one firm it is called a non-exclusive franchise. The third model, the *publicly owned but privately operated system*, is where the public sector finances and deploys the ATIS system and also designates the standards. The private contractor provides the equipment and operates it, while allowing the public to benefit from the superior technology, which the private sector might provide. The last model, the unified *public-private partnership*, is where both public and private parties collect the data and funnel it through traveler information centers for dissemination to clients, using both public and private facilities.

The San Francisco Bay Area system, the TravInfo ATIS field operational test, has all of these characteristics, at least to some extent. While it is envisioned that TravInfo will follow the model which divides the functional responsibilities between the public and the private sectors, it is still an open question whether or not it should evolve to a different form in its post-FOT phase. As its on-line service, the management board, which consists of three regional transportation authorities (the Metropolitan Transportation Commission, the California Department of Transportation and the California Highway Patrol), has retained Metro Networks to operate the TravInfo TIC.

In the United States, the common practice at the current time is for the various state Departments of Transportation and their Highway Patrol Divisions to allow suppliers to acquire publicly

collected incident and accident data without a fee. The traffic information is then disseminated mostly by the private sector via radio, television and telephone. Telephone information services are available from both private and public suppliers. In the San Francisco Bay Area, FASTLINE and CITYLINE are the privately operated telephone information services. Currently TravInfo and Caltrans road information, publicly operated services, are providing traveler information through the landline telephone system. The TravInfo database is offered to value added resellers to test and disseminate Bay Area traveler information. The TravInfo TIC is an advanced traveler information system designed and implemented through a joint venture of public and private parties. The TravInfo TIC however has raised interesting institutional and marketing questions: 1) should TravInfo compete with existing information suppliers, 2) who should be responsible for the operation and maintenance of the TIC, 3) is there a latent demand for traffic information beyond what is provided today?

The similarities and differences in the various data collection and dissemination methods are described in Table 1.

Table 1. Existing Models of Traffic Management and Traveler Information Systems

| | Australia | England | France | Japan | USA |
|--------------------------------|--|---|--|--|---|
| Data collection | exclusively public with high cost heavy infrastructure | exclusively private with low cost infrastructure investment | exclusively public with high-cost heavy infrastructure | exclusively public with high cost heavy infrastructure | both public & private with low cost infrastructure investment |
| Data dissemination | exclusively public | exclusively private | exclusively public | exclusively public | primarily private |
| TOS | exclusively public | exclusively public | exclusively public | exclusively public | exclusively public |
| TIC* | Exclusively public | not defined | exclusively public | exclusively public | public-private partnership |
| ATIS product/service marketing | inactive | very active | research stage | very active | test stage |
| Public CMS facilities | active | inactive | active | very active | test stage |

* described in function, not necessarily separate physical facilities

Public-private partnerships are required to work effectively towards unified goals, but in the US, it has been generally less effective at establishing public-private ventures than in Europe or Japan. In a public-private partnership, the public sector facilitates development of the infrastructure and allows for contribution from the private sector. There are several common motivations to include the private sector in a partnership: familiarity with large-scale projects, technological expertise, cross-fertilization of concepts, political neutrality and expanded funding. The first three of these are important for partnerships that combine with the private party's ability to market ATIS products and services to the general public.

The US Department of Transportation identified several models of public-private partnerships for delivery of advanced traveler information systems (US Department of Transportation, 1992).

1. Functional division of responsibilities

This is modeled after the weather information system, where the public sector collects the information and sells it to private firms.

2. Franchised operations

There are two variations, exclusive franchise and non-exclusive. In exclusive franchise, the public collects the data and sells the information to private firms for dissemination by one firm entirely. In non-exclusive, the public sector may retain some rights to the information and/or sell the information to more than one firm.

3. Publicly owned, privately operated system

The public sector would finance and deploy the ATIS system and designate standards. The private contractor would provide the equipment and operate it, allowing the public to benefit from the superior technology which the private sector might provide.

4. Unified public-private partnership

Both parties would collect the information, funnel it through a traveler information center for dissemination to clients, using both public and private facilities.

Institutional barriers of public-private partnerships include:

- Unwillingness of the public sector to share traffic management responsibilities with the private sector
- Jurisdictional fragmentation
- Legal constraints regarding the use of public right of way
- Procurement and contracting regulations
- Uncertainty of the market for intelligent-transportation system technology.

5. REVENUE MODELS OF TRAVELER INFORMATION CENTERS

Most federally funded Field Operational Tests or model deployment programs have adopted a public-private partnership model. Many variations on the public-private model exist such as 1) functional division of responsibilities, 2) franchised operation, 3) publicly owned, privately operated system, and 4) unified public-private partnership (US Department of Transportation, 1992). While these models offer general guidelines on how the public, private partnership works, numerous variations of these models exist. When revenue alternatives are considered, from user fees or third party sponsorship to generate revenues, the study investigated the alternative revenue models within the framework of the above outlined public-private partnership structure.

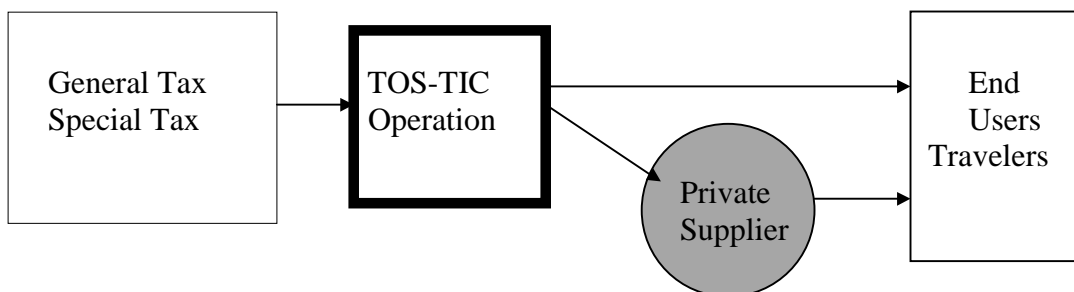
Although ATIS was established in many urban areas through FOT or Model Cities deployment programs, public funds were always limited and over time it became increasingly evident that a search needed to be made for alternative financing mechanisms for TIC operation and maintenance. In addition to the uncertainty about public funding, there was a strong belief among some that the TICs should be self-supporting. There are basically three revenue-generating models available for TIC operations: the *tax based*, the *user fee based* and the *third party sponsor based*. Any combination of these three models is possible.

The *tax-based* model is the model least likely to be used for generating revenue in the United States because, since the Reagan presidency, there has been an increasingly strong opposition to

the idea of tax increases to provide for publicly funded projects. The *tax-based* model is a system which would support a publicly owned and publicly operated ATIS (Figure 4). Until recently this model was used in various countries, especially for freeway construction and other transportation facilities. The great advantage of the tax-based model is that publicly funded projects are not market sensitive. They are independent of fluctuations in the economy and continue to operate as part of the essential public services. A good example of this is seen in public transit in many urban areas throughout Europe and the United States. The disadvantage obviously lies in the uncertainty of public funding for continuation of the TIC operations. In the United States, the likelihood is that public money will not be available for the maintenance of the post-FOT TICs. In other countries, such as France and Australia, the traveler information system is likely to be continuously funded by the public sector.

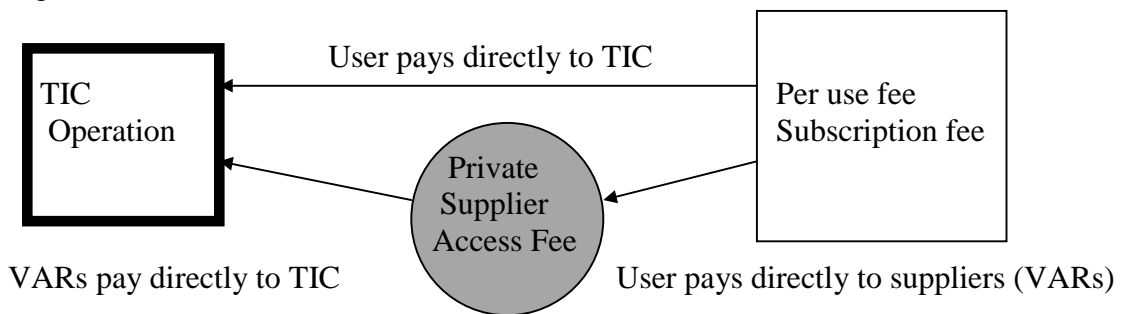
The *user-fee based* model is when users pay a fee for access to information (Figure 5). There are basically two forms of user payment, the *per user transaction fee* and the *subscription fee*. Information can be sold to both consumers and to value added resellers (VARs) or be sold just to consumers or just to VARs. The proponents of a self-supporting system say, "ideally, any operation or infrastructure spending should be supported through user charges or special taxes that reflect the proportional benefits enjoyed, as opposed to having them supported by general taxes except in those cases where consumer needs and the public good coincide or the costs of measuring the needs of the individual and collecting the taxes outweigh the benefits (Hayens, 1996)." In the case of traveler information services, there is no definitive benefit ratio that can be drawn between a traffic system operation and the driving public. An *a priori* assumption is that the marginal benefit of the ATIS will exceed the marginal cost of its operation.

Figure 4. Tax-Based Revenue Model



The major advantage of the *user-fee based* model is that the system can be self-supporting if the user fees are high enough to cover the operating and maintenance costs of the TIC. The uncertainty among researchers in their consideration of this model is caused by a lack of knowledge of how much consumers would be willing to pay for such a service. Several studies have attempted to determine the value of this sort of information to the individual traveler but so far the results have been inconclusive (Malchow, et al, 1996). In addition, since the *user-fee based* system encourages competition among service providers, there are limits as to how much can be charged for such information.

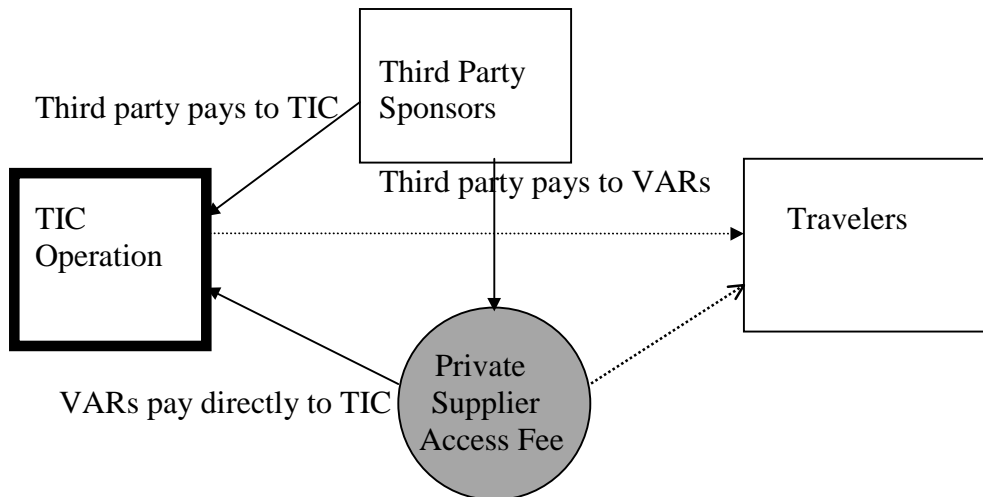
Figure 5. User-Fee Based Revenue Model



With the *third-party sponsor-based* model, commercial sponsors pay for traffic information (Figure 6). This model replicates the practice currently being used by the private sector. Metro and Shadow earn their revenues from ad slots on radio and television and the San Francisco Chronicle, a newspaper company, earns its revenue from selling ad slots for telephone traffic information. This *third-party sponsor-based* model is unique to the United States where it is common in the larger cities, especially in the delivery of traffic information. A recent study of traffic information suppliers by the University of California at Berkeley revealed that many characteristics of the information market are quite different from that of most other items that are currently bought and sold in other markets (Yim, et al, 1995). Traffic information suppliers do not market their services directly to end users, in this case, travelers; rather, the information is provided directly to the disseminators, the radio or television stations or the value added resellers (VARs), in exchange for air time. In the United States, about one half of all radio and

television airtime is sold to sponsors for advertisement of their products. The study found that the demand for traffic reports has increased in recent years and that commercial networks see the traffic information services as good revenue generators. The cost to the suppliers is mostly in the equipment (typically their surveillance aircraft) and the personnel, which is needed for operations and data collection. Another characteristic of the information suppliers is their decreasing marginal cost and increasing marginal revenues. With this increase in profits, there is currently a significant economy-of-scale in the market. For this reason, the trend in the traffic information market has been toward just one supplier in small cities, with competition existing only in the larger metropolitan areas.

Figure 6. Third-Party Sponsorship Based Model



6. BUSINESS OPPORTUNITIES

Traffic information can be seen as a commodity bundle, which has some quantifiable value to the individual consumer. The value of traffic information depends on the usefulness of the information to each individual traveler. When one considers the business opportunities in selling this commodity bundle, the fundamental question is, will people buy traveler information? Related questions are: 1) How big does the consumer market need to be in order for a private party to make a profit? and 2) How much are people willing to pay for this information? In most European countries, with the exception of England, traffic data collection and dissemination have been carried out under the strict control of the public authorities. Traffic information is thus viewed as a "public good," similar to the way freeways and arterial streets are viewed in the United States.

In the United States, as mentioned earlier, both the public and the private sectors collect traffic data but in almost all cities it is the private sector that disseminates the information to the driving public. Although it has not been defined as such, the historic role of the public sector in the United States has been to provide freeway surveillance so that a quick response can be made to traffic accidents/incidents, not in order to influence drivers to modify their travel behavior. The recent trend, however, in this area shows that the public sector has a keen interest in providing accurate and timely traffic information so that the productivity of the existing roadway infrastructure can be increased. Along with the public sector's interest in advanced traveler information systems, several business opportunities have been created. By category, the business opportunities are in: 1) the design of the TIC itself, 2) the operation of the TIC, 3) the maintenance of the TIC system, 4) the collection of traffic data and 5) the dissemination of traveler information. For the design of TICs, the public sector needs to retain the private sector for its expertise in system architecture and computer programming. Similarly, there is a need for the private sector's talents and expertise in the operation and maintenance of the system.

With the automotive industry's interest in providing in-vehicle route guidance systems, there are also new opportunities for the private sector to distribute information through the various emerging media, including the internet, kiosks, laptops, thin client devices (smart phones, hand-

held personal computers), etc. Even in France, many business opportunities exist for personalized in-vehicle devices.

Privatization of TIC

Government limitations, including both financial constraints and the lack of administrative ability, have provided an impetus to the trend toward privatization, even though privatization is not necessarily the solution for all ATIS projects. In the past, the transition from governmental financing to private financing has often been considered evolutionary, as is seen in the example of the energy industry in the United States.

Several studies of public policies in different countries indicate that private capital can be employed for public services in a variety of forms, from the privatization of certain functions to the formation of joint ownership and risk-sharing ventures. "These range from essentially enfranchising private firms to own and operate facilities in natural or local monopoly service areas (e.g., waste water treatment) or public-private risk sharing of facilities that compete in otherwise private markets." (Haynes, 1996) However, some barriers exist. These include: a) the public sector's unwillingness to share traffic management responsibilities with the private sector, b) jurisdictional fragmentation which does not allow the public sector to protect its own turf, c) legal constraints regarding the use of the public right of way, d) procurement and contracting regulations, and e) the uncertainty of the market for ATIS technologies. In recent years, a new trend has emerged. Some examples of this new trend are described in the following section.

Emerging Trend

The recent trend in the ATIS market structure suggests that government agencies are willing to confer concessions on private parties or share their profits with them. An indication of this is seen in the recent agreements between the public and the private sector in Westchester County in New York State and in the cities of Cincinnati and Seattle. For instance, when Westchester County and New York Metro Networks entered into a contract, certain provisions were agreed

upon. Among these were that the private party, New York Metro Networks, would establish a public-private traveler information center that would be responsible for the operation and maintenance of the system and that it would also be responsible for the collection and dissemination of traffic information. The cost of the center would be borne by the private party and a certain percentage of the net revenues would be paid to the public party. The percentage would be based on the revenue scale, ranging from 10% to 50%, depending on the revenue volume. (Westchester County receives 20%, up to a \$1 million profit, and 50%, over a \$5 million profit.)

The telecommunications network is another area with joint venture potential for public and private parties. In light of the urgency caused by federal and local policies that stress the acceleration of the deployment of ITS, many cities are working hard to cope with that improvement in the infrastructure of the communications network that is necessary for traffic data collection, data transmission and data dissemination. The instrumentation of a road network is seen as an essential part of the dissemination of accurate and real-time traffic information to the driving public. In most cities, the installation, operation and maintenance of roadway instruments have been the responsibilities of the state and the local public works departments. However, the shrinking of public funds for transportation projects worldwide has prompted efforts to find alternative financing mechanisms.

An example of alternative financing is the leasing of communication network concessions along freeways. A contract recently entered into by the Missouri Highway Transportation Commission (MHTC) and Digital Teleport is an example of an emerging trend toward public-private partnerships. The contract between the two parties defined the terms whereby Digital will provide the MHTC with a network of dedicated fiber optic strands in exchange for an exclusive easement and the right to build a fiber optic network in the cable corridor. The contractor is to be liable for all damages resulting from the failure to adhere to timetables and is contractually obligated to provide uninterrupted service.

These current trends indicate that alternative financing and revenue sources are evolving for the mutual benefit of both parties in the development of an intelligent transportation related

infrastructure. These new arrangements should also cause a modification of the initial partition of public and private funding for the large-scale dissemination of traffic information. Such partnership activities may encourage more business enterprises to provide the basic infrastructure necessary to foster a consumer market for traffic information. The conjecture is that an ATIS consumer market will emerge when the basics of the necessary infrastructure, the instrumentation of the network system, are completed.

The ATIS Consumer Market

Is there a consumer market for ATIS products and services? Recent studies of ATIS are too inconclusive to permit the forecasting of any prospects, either negative or positive, for either the present or the long-term development of ATIS products or for their service deployment. From the market point of view, there are several hypotheses that need to be tested before it will be possible to make any market forecasts:

- 1) Traffic information has a value to consumers. This value is large enough that consumers are willing to pay for the information, either directly or indirectly (through third-party sponsorship).
- 2) A network optimal level can be reached through the ATIS.
- 3) There is sufficient interest in the distribution and deployment of ATIS products and services among private sector suppliers.
- 4) There is sufficient consumer demand for traveler information to warrant the support of the TIC.

The automotive suppliers, especially the European companies, who are involved in the design of in-car traffic information devices, have supported the first hypothesis. However, the commercialization of the devices has been limited. In the United States, several start-up companies have tried to market a hand-held or in-car-mounted one-way communication device for traffic information services; they have had little success.

A communication device dedicated solely to traffic information was offered at an initial fee of about \$100 plus a \$10 monthly subscription fee; it could not penetrate the consumer market in the United States. As of today, autonomous route guidance systems are the only systems that have been accepted, and then only by the rental car market. Avis and Hertz in the United States and, more recently, CITER in France are proposing to offer such devices to their customers.

In Japan, automakers and suppliers have targeted the consumer market with autonomous route guidance devices for several years with great success. More than one million of the devices have been sold. And a dynamic route guidance option, that gives the optimal route based on the current traffic congestion level, has recently been added to the existing Japanese route guidance technology. The additional charge for this value added product for traffic information is about \$1000 more than the price of the regular autonomous route guidance device. When it came onto the market recently, it did not sell very well.

In France, an in-car device dedicated to traffic information will be commercially available in 1997; its starting price will be approximately 2,500 Francs, equivalent to \$450. If this product is fully supported by French automakers, it will be the first device made available to the general public.

Recent experiments with consumers have demonstrated that people are willing to acquire traveler information and willing to modify their travel habits based on that information. However the demand level for traffic information is still not clearly understood. As with transportation projects, traffic information services have been perceived as a public commodity. If this perception is borne out in reality, the necessary cost recovery or, indeed, any eventual profit, may have to be generated in other ways, such as by selling commercial advertisement slots.

An international comparison of consumers would provide interesting results as to how people on each continent or in each region respond to advanced traffic information services. Consumer research in the United States and France on drivers' willingness to pay for in-car traffic information devices showed a remarkable similarity in the price range. The surveys showed that

the vast majority of drivers would pay up to around \$300 for such a device. However, they are willing to pay no more than a couple of dollars a month for the subscription fee.

One notable difference observed between the different continents in the ATIS market is in the institutional structure of data collection and dissemination between the public and the private sectors. In some countries, investors are cautious and understandably reluctant to embark on the commercialization and mass production of ATIS devices without knowing what the market is like. In other countries, such as Japan, ATIS technology is already taking off and penetrating the consumer market although it is too early to determine its market penetration rate.

Business Opportunities for the Private Sector

In recent years, ATIS have provided business opportunities in a number of ways, with in-vehicle devices for the automobile industry and service providers for information content and dissemination. As mentioned earlier, the business opportunities for private sector involvement with TIC operation in France or Australia and even in Japan are somewhat restricted (Ygnace, 1996). These countries, however, could provide opportunities for the marketing of in-vehicle or hand-held computers for traffic information services, along with other value added features. In Japan, the public and the private sector roles are clearly defined; the public sector collects and disseminates traffic information via variable message signs without any private sector involvement. The private sector's role is to provide value added traffic features through an in-vehicle route guidance system. The auto industry, on the other hand, targets the in-car market with a few products that offer traffic information. The core market has been in autonomous in-vehicle route guidance devices, although the dynamic route guidance device has also been actively promoted.

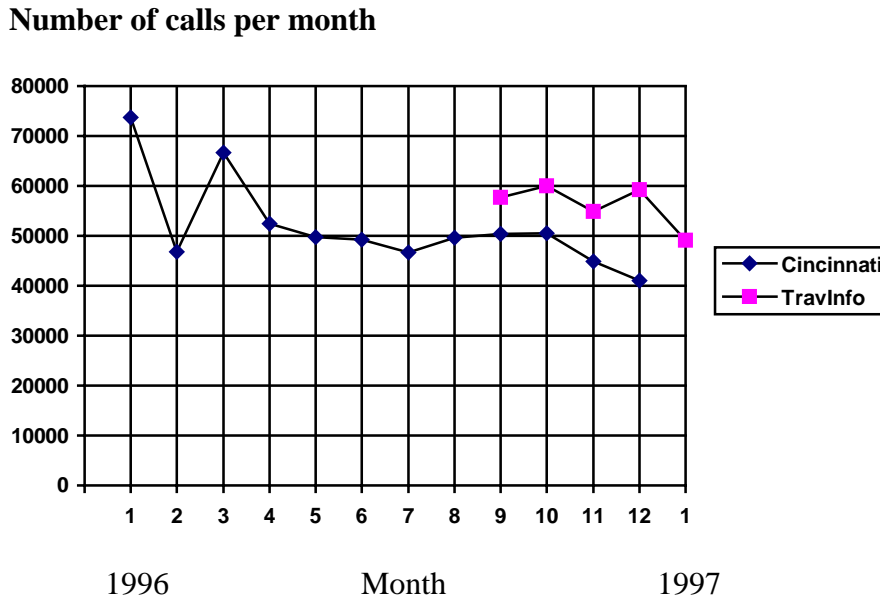
In Australia, the public sector defines the level of necessary traffic information for the purpose of traffic management and operation. Public investment in the traffic information infrastructure is important in Australia because the country has been exporting their design expertise of the traffic management system to other countries, mostly Asian. Observations of the traffic management

and traveler information systems indicate that variations of the organizational structure exist and that market opportunities are strongly linked to the organizational structure.

Early experimental in-vehicle or hand-held devices dedicated solely to traffic information, i.e., Autotalk, the Way to Go, etc., did not catch on with the motoring public and were subsequently discontinued. With the advancement of electronic and computer technologies, a multi-functional yet convenient hand-held personal computer has become commercially available in recent months. In 1997, it is expected that approximately 500,000 units will be deployed; this number is far greater than the number of Apple Newtons that have been sold over the past few years. Value added resellers are testing the marketability of real-time traffic information for more than just commercially available products but also for potentially popular products. The consumer market for ATIS devices or services is not well understood and inconsistent results have been reported in previous consumer market studies. It is not yet clear whether there is a market for either the in-vehicle or the hand-held traffic reporting devices and their accompanying dynamic route guidance services.

In the Bay Area, VAR activities in data access from the TravInfo database suggest that only three or four VARs out of forty registered participants obtained the TravInfo data on a regular basis for their experiments. Since TravInfo came on line in August, the call volume has remained steady, with no increases, in spite of a three months ad campaign. The Cincinnati Bell reported the similar results. Contrasting to the Boston SmarTraveler case, the cellular call volume in the Cincinnati area declined during 1996. Figure 7 shows the TravInfo call volume in comparison with the Cincinnati Bell call volume for the traveler information services that each provides in its own region.

Figure 7. Monthly Call Volume Summary by Cincinnati Bell and TravInfo



7. EXISTING MODELS IN THE U.S.

Business models are concerned with funds necessary to collect data that are high quality and cover large geographic areas. It is highly desirable to have data coverage of at least 80% of major freeways, bridges, and arterials in order for data to be marketable (Southern California Economic Partnership, 1997). When data have an asset value, traveler information can be sold to wholesale and retail ISPs. Institutional concerns are whether the public sector can sell publicly collected traffic data to private Information Service Providers or directly to end users and whether the public agencies are interested in and willing to take a business endeavor. Three models, Smart Travel, Smart Route, and Etak/Metro Networks, are discussed in this section.

Smart Travel Model

Smart Travel business model is adapted by the California Department of Transportation. The Smart Travel model seeks to improve transportation in California by developing an optimal business structure with strategies for development of a robust, revenue producing, personalized

Advanced Traveler Information delivery system. Its vision is that an asset management function can be created to manage public data and generate revenues for data collection activities. Presently most of the public agencies collect traffic data as part of the traffic and incident management and operations. Only 20%-40% of freeway, toll roads and primary arterial highways are covered with the current practice. An effective data coverage goal should be 80% of the roadways to support Information Service Providers' needs to compete in the consumer market. With this model, raw data will be fused into uniform data products that can have some asset value to information service providers, both wholesalers and retailers. If data have the asset value, revenues can be generated from the sale of those assets to ISPs, end users and through advertisement. This new revenue stream will expand and improve the data collection infrastructure, and thus, the quality of data will improve for use by wholesalers, retailers and end users. The model points out that public and private interests can best be represented through an asset business management function. A concern, however, is that the public sector is not in the business of consolidating assets, packaging them, and marketing products for sale. An alternative approach is to grant exclusive right to asset business management for data consolidation, marketing and distribution of data to ISPs. Data exclusivity can potentially result in higher prices of consolidated data than the price under the competitive market. In turn, it may result in market stagnation and limiting the number and type of products or services. "A preferred scenario is one in which open competition sets the fair market value for the products delivered." (Southern California Economic Partnership, 1997)

The recommended model is that the public sector supports creation of an asset business management entity for it to manage data assets, create data products, broker those data products for sale to private firms and coordinate and distribute revenues to all participants. The model will support streamlining the business efforts of both the public and private sectors, will generate the most revenues and will be able to offer advanced information (i.e., shortest route information) to the ATIS industry.

The model is broadly defined in three main functional areas: 1) data collection, 2) asset management, and 3) information distribution. Data collection includes collecting and reporting traffic and transit data. Sources would include loop detectors, signal sensors, CCTV cameras,

and vehicle probes. Asset management involves the functions and responsibilities for consolidating public transit and traffic data for the marketplace. The data distribution part of the model deals with the wholesale and retail markets. The ultimate responsibilities will lie on wholesalers and retailers for the ATIS industry's success through innovative means of reaching and attracting the consumer market.

Revenues will be generated from sale of advertisement slots and customer subscription fees. Advertisement slots will be sold to various businesses for TV, radio, billboards, and other media as have been done in the past by Metro Networks and Shadow Traffic for TV and radio spots. The model predicts that Subscription fees can be charged to cable viewers, Internet users and other types of customers who will pay for access to the information database. Some customers may be willing to pay more to receive customized or personalized information contents from cable TV channels or web sites. Revenues generated from user fees are expected to be minor in comparison to revenues from advertising. It is also expected that revenues generated from user fees attributable to the Smart Traveler content specifically will be very small.

Smart Traveler revenues will be distributed to the TICs and the Data Farms after the manager's expenses are covered. Data Farms are defined as those public agencies collecting the majority of the primary data and feeding the data into TICs or database fusion centers. Data Farms include city governments, state highway patrol agencies and transportation agencies. The Smart Traveler model is implemented through the Travel Advisory News Network called "TANN." TANN delivers advanced traveler information utilizing advanced electronics and computer technologies.

SmartRoute Model

SmartRoute Systems, Inc. is a private firm providing advanced traveler information services to the public in a number of US cities including Boston, Cincinnati, Philadelphia, Washington D.C., Detroit and Minneapolis. The SmartRoute services are typically commissioned by city or metropolitan agencies to set up, operate and maintain a traveler information system. The company collects and disseminates traveler information to the public. Their clients are mostly public agencies that pay the company for their services. In essence, their services are in the form

of franchises. Its proprietary servers are planned to be established in over 30 cities. It is estimated that its top 15 cities will reach 80 million households.

The database belongs to the company and their software and operating systems are proprietary. Traveler information from these databases is shared with partner agencies but may not be transmitted without the company's approval (the PMR Group, 1999). The company builds their own database and, when appropriate, incorporate DOT traffic data, but never rely on public sector data; they are working on developing fully automated traffic data collection systems. Revenues are from fees charged to commissioners.

Etak/Metro Networks Model

Etak recognizes the importance of the national availability of real-time traveler information in uniform formats for the development and deployment of ITS products and services in the US. The lack of the uniform format nationwide has been the major barrier for the development of national ITS markets. Etak and Metro Network are jointly implementing a national ATIS infrastructure by installing Traffic Workstations at all Metro Networks offices throughout the US. Its private-sector initiative is to provide an infrastructure that will make real-time traveler information uniformly available throughout the U.S. with a wide variety of standard and special formats (Sweeney and Ravier, 1999). Etak estimates that Etak/Metro Network based products and services will operate in the top 25 markets by June 1999, in the top 40 markets by the end of 1999, and in the top 65+ markets (or virtually everywhere) in 2000.

Revenues will be generated from multiple sources including government contracts, advertising, commissions, subscriptions, and sponsorships. There will be decreasing reliance on public funds and increasing engagement in private sector initiatives such as the national traveler information infrastructure. The national rollout of Etak/Metro Networks' ATIS information infrastructure is under way with a large number of local agencies and a wide variety of ATIS product and service providers. The traveler information market continues to be volatile, but Etak believes that some segments of information services such as Internet travel information, wireless, and in-vehicle

navigation systems are taking off. The real-time traffic architecture of Etak Workstation is shown in Figure 8 and Etak/Metro Networks national network is shown in Figure 9.

Figure 8. Etak/Metro Networks Real-Time Traffic Architecture (Source: Etak)

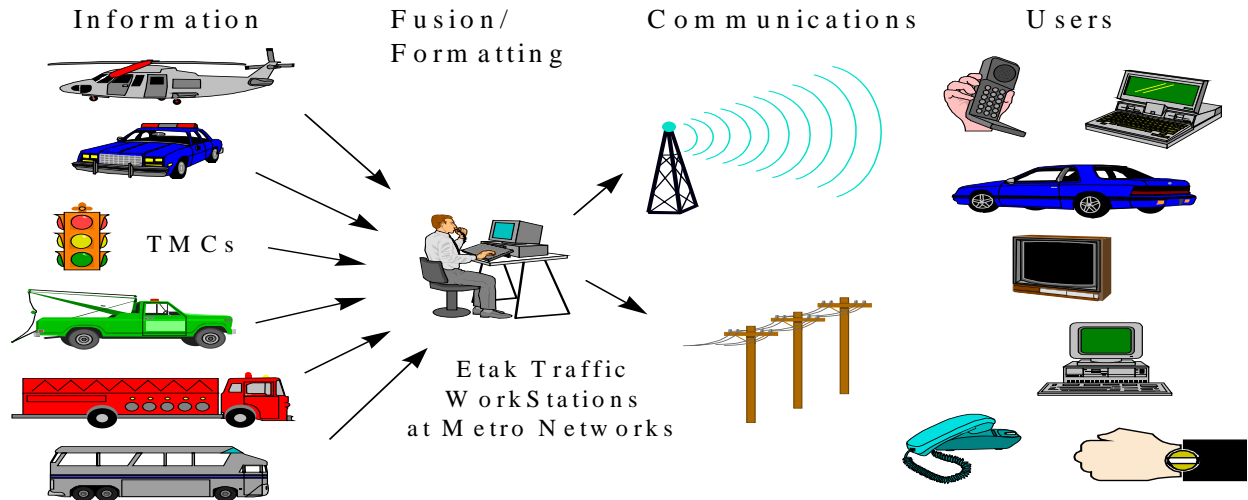
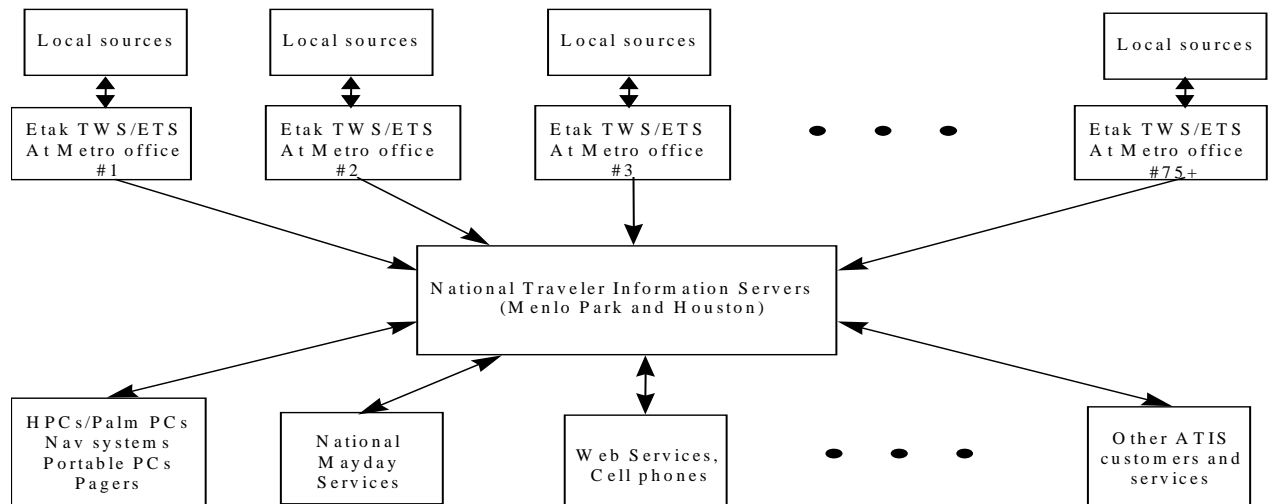


Figure 9. Etak/Metro Networks National ATIS (Source: Etak)



8. IMPLEMENTATION ISSUES AND POTENTIAL BARRIERS

Within the framework of revenue models, this section covers key issues likely to come up if revenue models are used. Examples include equity issues concerning equal business opportunities and market issues concerning the price competition of information, which may discourage small firms from participating. This part of the study is aimed at an understanding of the consumer market size and how it affects investment decisions among both public and private parties. The legal issues are generally associated with intellectual property rights, public information access, data collection and distribution, procurement/contracting and revenue sharing.

Implementation barriers of revenue sharing models include:

- Uncertainty of the market for ATIS technologies
- Lack of national standards
- Equitable sharing of revenues
- Claiming intellectual property
- Exclusivity of public information
- Procurement and contracting regulations

Uncertainty of the market for ATIS deployment

Revenue generated from sale of advanced traveler information depends on the size of the market. The current assessment is that the ATIS market is not mature enough to generate any significant revenues from the sale of advanced traveler information.

Data coverage and the quality of data supplied by the public sector are not good enough to attract ISPs for their product development.

The private sector is generating significant revenues by selling traffic information in the form of the third party sponsor-based model. The data are mostly generated by the private sector (i.e. airborne traffic surveillance) and augmented by publicly supplied data.

There isn't sufficient interest to purchase electronic devices for traveler information alone. Traveler information can however be bundled with other types of information services, such as stock quotes, major events and sports information, airline scheduling, and yellow page information.

Market penetration of electronic devices is closely related to the ATIS market. Since the deployment of the Internet, demand for the traffic website has been increasing at a significant rate. Over 50% of the 1998 survey participants in the San Francisco Bay Area indicated that they have access to Internet at home or at work.

Over the past few years, a large number of firms have shown a great deal of interest in product testing and in entering the ATIS market. Many of them are already given up on product development because public data are not adequate to provide quality information and there is no immediate market for ATIS products and services. Speaking of privately collected data, two major private traffic information suppliers, Metro Networks and Shadow Traffic, have merged, leaving the supply market with almost no competition. Most of the privately collected data are proprietary, which makes it difficult for the ATIS industry to create competitive market. Many firms have business alliances (i.e., Etak and Metro Networks), which makes it difficult for small firms to compete with large entrepreneurs.

Lack of national standards

One of the major institutional barriers is the lack of national standards to make the ATIS system interoperable. Whatever the ATIS standard developed first often becomes the defacto standard. The ITS community has been developing the national and international standards and implementation of these standards is extremely important for the development and deployment of ATIS products and services.

Equitable sharing of revenues

Typically public agencies do not have a mechanism to collect revenues directly from public products sold or services rendered and deposit them for the use of the revenues to improve and enhance the traveler information system. Cash payments to public agencies are often not acceptable by the agencies providing services directly. Revenues are generally deposited to the state's general funds account. This makes agencies less willing to directly participate in revenue generation. As an alternative, barter arrangements are used for the public-private partnership. The barter arrangement is that exchange of goods or services is provided between the parties involved. There may be a number of limitations and unfair equity exchanges between the public and private parties and the public sector may need to settle for a lesser amount of private sector payment than the public sector deserves. Other concerns are that revenues generated from public products or services can be subject and liable to income tax.

Claiming intellectual property

The intellectual property issue is quite sensitive to products or services developed by the public-private partnership. In most cases, privately developed software products are usually claimed by the private sector. Consequently, intellectual property rights are given to the private sector. At the same time when the products or services are developed by the public sector, the public or the private sector shares the public properties. In some cases, an agreement can be reached that the private sector can claim its Intellectual property and the public sector can access the system as long as it needs even though the product is developed with the public funds. This type of agreement is fairly common in the public-private partnership and TravInfo is an example.

Exclusivity of public information

Should a public agency give rights to use information exclusively by a single private vendor? In some situations, public ally collected information has been given exclusively to a single Information Service Provider. Such an arrangement invites criticism from other vendors since such exclusivity prohibits free access to public data and ultimately requires other vendors to pay

for public information. However, the legal implications of exclusivity depend on local jurisdictions.

Procurement and contracting regulations

The types of contracting arrangements are public contract to the private sector, turnkey projects, and bidding (Hollenbeck, 1998). Any government contracted TIC would require procurement and contracting regulations. Franchise operations are heavily reliant on the private sector to use their resources and performances to build and operate a traveler information center through procurement and contracting. In this case, the public sector depends on the private sector to collect, fuse, and disseminate traveler information. The private sector can sell the fused data to other vendors while the public sector can receive the data free of service. However the public sector pays to the contracted private firm for the franchised operation of the information center. When public agencies are contracting out their work, proper procurement and contracting languages are critical for the success of public-private partnerships. Oftener than not, public agencies have many problems contracting projects out to the private sector.

9. CONCLUSION

The paper investigated a number of issues concerning alternative revenue models of Traveler Information Centers and market prospects for Advanced Traveler Information Systems products and services. The working models of alternative revenue models included various forms of public-private partnerships. Some cities are experimenting with public-private financing mechanisms but it is too early to tell how successful any of these partnerships have been. The advanced traveler information system is here to stay whether or not it is economically viable because both the system operators and the system users have found it to be valuable. The consumer market for ATIS devices is yet to be determined since the industry is still just in the beta testing stage.

The key findings are that business opportunities for the ATIS are closely associated with the political and economic system of each country. Observations of the ATIS market structure and interviews with ATIS stakeholders, however, suggest that the market prospects for personalized traveler information are worldwide in scope. When cellular phone subscribers were asked about an in-vehicle traffic information service, 40.3% of those in the Paris region responded that they would use such a device as compared to only 20.4% of those in the Bay Area (Yim and Ygnace, 1995). The reason mentioned is that the traffic in the Paris region is so severely congested that any device which would help motorists avoid traffic congestion would be attractive to drivers. The other probable reason is the competition between commercial radio and in-vehicle ATIS devices. Bay Area drivers are already offered on-time traffic information services via radio and television while drivers in the Paris region have no in-vehicle information services. In France, commercial radio or television stations seldom broadcast traffic information. The other possibility is that there is a strong correlation between the level of congestion and the demand for traffic information.

As for the support of the post-FOT TIC operation, one of the public-private models or a combination of them could be considered in order to come up with a self-sustainable ATIS system. The viability of the third-party sponsorship based system and the user fee-based system for the TIC operation should be carefully evaluated since the examples of working models are limited in scope. Additional research on the development of a business plan for the TICs would significantly contribute to the ATIS research that is so important to both public agencies and private industry. Further research is also needed for a realistic assessment of the ATIS market structure.

REFERENCE

Abdel-Aty, Mohamed, Kenneth Vaughn, Ryuichi Kitamura, Paul Jovanis, *Impact of ATIS on Drivers' Decisions and Route Choice: A Literature Review*, PATH Report, UCB-ITS-PTT-93-11, September 1993.

Charles River Associates, *User Acceptance of ATIS Products and Services: a Report of Qualitative Research*, CRA Project No. 952-03, January 1997.

Hallenbeck, Mark, "Choosing the route to traveler information systems deployment, decision factors for creating public/private business plan, ITS America, 1998.

Haynes, Kingsley, *Assessing Alternative Financing Mechanisms for ITS*, The Institute of Public Policy, George Mason University, 35th Western Regional Science Association Annual Meeting, Napa, CA. February 1996.

Malchow, Matthew, Adib Kanafani, Pravin Varaiya, *Modeling the Behavior of Traffic Information Providers*, PATH Working Paper, UCB-ITS-PWP-97-5, October 1996.

Martell, D. (1992) *Cost Benefits Available to Industry for Better Quality Driver Information*, BC Technical Services Ltd, *Improving Road Traffic Management in 1990s: The Integration of I.T. and Practical Solutions*, Conference Proceedings, 1992.

Orski, Kenneth, *Consumer Response to Traveler Information Systems*, Innovation Briefs, USA, Traffic Technology International, December 1996.

Southen California Economic Partnership, "Advanced Traveler Information Business Model, a revenue-generating means to improve transportation capacity efficiency," SmartTravel California, 1997.

Sweeney, Larry E. and Joan Ravier, "A National Traveler Information Infrastructure," Transportation Research Board, Washington DC, January 1999.

The PMR Group, "ATIS-Alternative Revenue Approaches," PATH Working Paper, January 1999.

U.S. Department of Transportation, "public and private sector roles in intelligent vehicle-highway systems (IVHS deployment)," searching for solutions, a policy discussion series, Federal Highway Administration, Number 3, 1992.

Williams, Ellen and Rob Fox, *A business Strategy for Commercial Advanced Traveler Information*, 4th ITS World Congress, Berlin, Germany, 1998.

Ygnace, Jean-Luc, *Le marche de l'Information Trafic - Cadrage, Organisation et Tendances*, T.E.C n° 138: Paris, 1996.

Yim, Youngbin, Jean-Luc Ygnace, *a Comparative Analysis of Cellular Phone User Profiles and Travel Behavior in the San Francisco Bay Area and the Paris Region*, Transportation Research Board, 74th Annual Meeting, Paper No. 950826, Washington DC, January 1995.

Yim, Youngbin., Randolph Hall, and Stein Weissenberger, *TravInfo Evaluation: Traveler Response Element, Broad Area Study*, PATH Working Paper, UCB-ITS-PWP-97-9, March 1997

Yim, Youngbin, “TravInfo Field Operational Test Evaluation: Traveler Response Element, Broad Area Study, Phase 2 Results, Analysis of Wave 2 Survey, “ PATH working paper, June 1999.