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16. Abstract Project In this report, researchers review legislative, institutional, and technological issues relating to future advanced traveler information system (ATIS) developments and enhancements in the Houston region. The research team reports that the Texas Department of Transportation (TxDOT) appears to already possess sufficient authority to enter into a variety of possible public/public and public/private arrangements to facilitate and support ATIS development in Houston and elsewhere in the state. Consequently, additional legislation is not deemed necessary at this time. The report summarizes a number of possible public/private business arrangements (i.e., "business models") available for fostering ATIS development in the Houston region. The final chapter outlines a matrix of ATIS business model/ATIS market package alternatives and key analysis criteria to guide further evaluation as to their potential applicability in Houston.					
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**FUTURE ATIS DEVELOPMENT IN HOUSTON:
ISSUES AND ALTERNATIVES**

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TABLE OF CONTENTS

	Page
1. INTRODUCTION.....	1
TRAVELER INFORMATION SYSTEM	
DEVELOPMENT IN HOUSTON	1
RESEARCH OBJECTIVES	7
CONTENTS OF THIS REPORT	7
2. LEGAL CONSIDERATIONS REGARDING	
ATIS DEVELOPMENT IN HOUSTON	9
OVERVIEW	9
PRIVATE-SECTOR INVOLVEMENT	9
LEGALITY OF TXDOT ATIS ACTIVITIES	11
SUMMARY OF FINDINGS.....	15
3. ATIS DEVELOPMENT ISSUES IN HOUSTON.....	17
INSTITUTIONAL.....	17
Lessons Learned from Other Projects	17
ATIS Business Models.....	18
TECHNOLOGICAL ISSUES	24
4. ATIS ALTERNATIVES IN HOUSTON	27
CURRENT HOUSTON ATIS VISION	27
RITS Strategic Plan.....	27
TxDOT ITS Policies.....	30
HOUSTON ATIS ALTERNATIVES	30
Matrix of Alternatives	30
Analysis Criteria.....	32
5. SUMMARY AND PRELIMINARY RECOMMENDATIONS.....	35
6. REFERENCES.....	37
APPENDIX: REVIEW OF NATIONAL EXPERIENCES	41

1. INTRODUCTION

Intelligent transportation systems (ITS) are the application of current and evolving technology to transportation systems and the careful integration of system functions to provide more efficient and effective solutions to multi-modal transportation problems. Of the many different facets of ITS being deployed throughout the country, perhaps none has as much potential to directly impact transportation user decisions and behaviors as advanced traveler information systems (ATIS). ATIS are groups and systems of technologies that aid in the collection, collation, and dissemination of traveler information before and during trips (1). These systems provide multi-modal trip planning, route guidance, and advisory functions for travelers and drivers of all types.

Initiatives are underway in many metropolitan areas nationwide to improve the amount and quality of travel-related information provided to motorists, fleet operators, and other information users in the region. Many of these are demonstration projects and operational tests that are reaching completion. As efforts continue to improve traveler information availability and usefulness in the region, concerns have begun to surface about proper coordination and management of these dissemination activities, both between public-sector agencies and between the public and the private sectors. The coordination and cooperation between the public and the private sector is particularly important to a successful ATIS, because these entities typically view ATIS goals and operations very differently.

TRAVELER INFORMATION SYSTEM DEVELOPMENT IN HOUSTON

ATIS is a major goal for the Houston region (as well as for other major metropolitan areas in Texas). Public-agency information dissemination devices such as dynamic message signs (DMS), lane control signals (LCS), and highway advisory radio (HAR) are continuing to be installed at key locations throughout the Houston freeway network. In addition, a number of new technologies are being used, tested, or considered for gathering and disseminating traffic-related information as part of various demonstration projects and operational tests. Tables 1 and 2 summarize the status of some of these major efforts.

Table 1. Summary of Houston Advanced Traveler Information System Projects.

Project	Target Market	Info Provided	Info Source	Dissemination Technology
Real-Time Traffic Map	General public, TranStar, public agencies, traffic reporting services	Average freeway link speeds, average link speeds, link travel times, link distances, trip travel times with route builder utility on the Internet	AVI system of transponder tags (probe vehicles) and roadside antennae	Internet, kiosks, television (in the future as part of Priority Corridor work order #22)
Real-Time Kiosks	HEB dist. center, Harris County bldg., City Hall annex, METRO TranStar bus dispatch, TxDOT district office, TxDOT district annex, Metrolift dispatch	Real-time traffic map (route builder is not available with dial up access; however, detailed traffic reports by freeway are still available through use of the function keys)	AVI system of transponder tags (probe vehicles) and roadside antennae	Kiosk monitor via computer with dial up access
Changeable Lane Assignment System (CLAS)	US-290 freeway corridor (10 intersections along US-290, 1 initial test site at I-10 and Bingle)	Changeable turning/through movement lane assignments for frontage road signalized intersections	Time of day control and incident management by remote control from TranStar	Fiber optic signal signs at frontage road intersections and in advance of the intersections
Washburn Tunnel Tunnel Manag. & Info System	Washburn Tunnel travelers	Presence of an incident in or near the tunnel, notification of tunnel closure	Three incident detection systems in the tunnel	DMS, traffic reporting services, TranStar
Smart Commuter	Phase I – North Houston to downtown commuters Phase II – suburban West Houston to Galleria area commuters	Phase I – real-time I-45 mainlane, HOV lane and Hardy toll road traffic conditions, HOV information, bus routes, schedules and fares, electronic maps of downtown and locations of park-and-ride lots, construction information, and database forms. Phase II – real-time traffic and transit information	AVI system, METRO (bus route, schedules, fares), files with maps, survey forms and diaries	Phase I – Sony Magic Link handheld personal information device and interactive telephone system Phase II – pagers+cellular phones with alphanumeric text messaging

TxDOT = Texas Department of Transportation
 AVI = automated vehicle identification
 METRO = Metropolitan Transit Authority of Harris County

Table 1. Summary of Houston Advanced Traveler Information System Projects (continued).

Project	Target Market	Info Provided	Info Source	Dissemination Technology
En-Route Transit Info System	Transit patrons	Estimated next bus arrival time, next bus stop, and connecting routes/transfer information	System of bus/roadside communication equipment to 1) announce on board next stop and connecting routes, and 2) relay information to downstream bus stops and transit centers for forecasting bus arrival times	Visual display signs or kiosks located at bus stops, transit centers, and park-and-ride lots, and audible annunciators onboard the buses
Uptown Traveler Info System	Uptown (Galleria area) roadway, transit, and pedestrian facility users	Real-time transit, traffic, parking conditions, incident and construction information	CCTV, AVI system, vehicle detection systems, TranStar web site. A computerized traffic signal system for the Uptown area will be implemented and will ultimately be integrated with the Regional Computerized Traffic Signal System.	DMS and static signing, CLAS, potentially cellular phone hotlines, HAR, and the TranStar Internet web site
Downtown Traveler Info System	Downtown travelers	Street closings and lane blockages due to downtown construction projects provided in graphic format on a map of downtown Houston and in a text format. Information is being updated once a week.	METRO	Radio, television, newspaper, DMS, faxes to building tenants in vicinity of construction and web site. Recommendation made to develop email listserve, kiosks, and telephone hotline in future.

Table 2. Status of ATIS Projects.

Project	Funding Agency	Operating Agency	Current Status	Projected Completion	Percent Funded
Real-Time Traffic Map	TxDOT	TxDOT	Phases I, II, and III installed and operational on I-610, I-45 N, I-45 S, US-59 S, I-10 W, I-10 E, US-290, Hardy Toll Road, and a portion of Beltway 8. Phase IV installed 12 checkpoints on Hempstead Hwy as an alternate route for US-290 with 10 checkpoints at ½ mile spacing on US-290 for incident detection, 11 checkpoints at park-and-ride lots on Katy, North, and Northwest freeways to forecast bus arrival times, and 5 mobile readers for special event use. Information is being disseminated via the internet.	1998	100% budgeted. All of phases I and II paid. Phase III – 90% paid. Phase IV - 30% paid.
Real-Time Kiosks	TxDOT	TTI	Seven kiosks are currently operational. Two more have been requested by TxDOT and METRO. A recommendation has been made to upgrade communications from dial up access to an Internet connection to allow use of the route builder utility. This involves issues of higher costs and security of keeping the kiosk locked onto the real-time traffic map web page. Capability exists to connect an additional 8 kiosks to the existing dial up access system.	All planned kiosks have been installed. However future sites may be added as requested.	100% (Individual agencies pay for computer equipment, TxDOT pays for installation and phone lines for dial up access).
CLAS	FHWA (80%) TxDOT (20%)	TxDOT maintains, TxDOT and City of Houston operate	System installed and operational in 9/96. Technical concerns delayed system evaluation for approx. 1.5 years. The controllers were switched from a fixed control to time of day control in 2/97. TTI is currently evaluating time-of-day control. In the future, TxDOT will begin turn system operation over to the City of Houston for incident management purposes.	All components of the system are operational. The final evaluation task will be completed in 1999.	100% budgeted
Washburn Tunnel Manag. & Info System	FHWA (80%) Harris County (20%)	Harris County	The work order has been approved. An agreement has been reached whereby Harris County will have a consultant prepare design plans; Harris County will provide the plans to TxDOT and contribute the 20% matching funds.	Possibly by 2001	Funding arrangement complete between TxDOT and Harris County.

4

Table 2. Status of ATIS Projects (continued).

Project	Funding Agency	Operating Agency	Current Status	Projected Completion	Percent Funded
Smart Commuter	TxDOT (25%), METRO (25%), FTA (10%), FHWA (40%)	METRO, TxDOT	Before, 6 month, and one year surveys completed. Original budget cut from \$17M to \$5M. Time period to track participants cut to two years. Project eventually canceled.	Canceled	N/A
En-Route Transit Info System	FHWA (80%) METRO (20%)	METRO	The project will focus on next bus arrival time information at bus stops and transit centers. The system will be implemented on one selected bus route.	FY 2000	100% budgeted
Uptown Traveler Info System	FHWA (80%) Harris Co. Improvement District #1, City of Houston (20%)	Harris Co. Improv. District #1, City of Houston	Work order approved. Harris County Improvement District #1 is working with TxDOT through an interagency agreement for design and deployment. Possible private-sector involvement for additional DMS signing (number of available parking spaces, etc.).	Unknown at this time	100% budgeted
Downtown Traveler Info System	METRO	METRO	Finishing the proposal process for the short range plan. METRO has funded work performed to date. Actual project funding arrangements have yet to be determined. METRO is currently providing maps with lane closures to TV and newspaper media, text info to radio traffic reporting services, and using DMS. Maps are also being faxed to building tenants in the vicinity of the construction. The information is updated approximately once a week. METRO is currently developing a web site to disseminate the information.	Short range plan –2000 Long range plan not defined	Not resolved

These information sources are in addition to the broadcast traffic information that is sent out via the private-sector traffic reporting services to television and radio outlets.

The major public-sector transportation system stakeholders in the Houston region have spent a significant amount of time in recent years mapping out a vision and a strategic plan for future ITS deployment, including components that directly or indirectly impact ATIS operations. These efforts are documented in two key publications (2, 3):

- *Houston ITS Priority Corridor Program Plan – 1996 Update*

- *A Regional Intelligent Transportation System (RITS) Strategic Plan for the Houston-Galveston Traffic Management Area (TMA) – August 1997*

The Priority Corridor Program plan identifies specific deployment projects of ITS technologies to be showcased within the Houston priority corridor, with emphasis on the short- to mid-term deployments (i.e., 5-10 years). Meanwhile, the RITS strategic plan defines the overall goals, objectives, and priorities of ITS development in the region.

To eventually achieve a fully functional and effective ATIS, there is a need to develop a vision of what an ATIS can and should be for the Houston region. Specifically, guidance is needed on the following topics:

- appropriate institutional arrangements that need to be established or enhanced to accomplish a truly integrated ATIS, taking into consideration the existing relationships that have already evolved through Houston TranStar, ongoing ATIS-related efforts in the region, etc.;
- appropriate methods of fostering and coordinating public/private agreements that contribute to an ATIS;
- necessary legislative changes to allow the Texas Department of Transportation (TxDOT) to establish the types of agreements needed for an ATIS; and
- the ATIS technologies (dissemination devices, data transfer protocols, etc.).

RESEARCH OBJECTIVES

This research project has been designed to help guide TxDOT, Metropolitan Transit Authority of Harris County “METRO,” Harris County, and the City of Houston in future ATIS development, implementation, and management in the Houston metropolitan region. The goal is to provide a long-term vision of a truly seamless and effective ATIS, to provide guidance on how to achieve such a system, and to identify (and recommend how to reduce) any impediments to system success.

CONTENTS OF THIS REPORT

This interim report focuses on identification and assessment of issues and alternatives for future ATIS development in the Houston region. It includes a review of legislative considerations regarding ATIS development, as well as a critique of institutional and technological “lessons learned” from various ATIS operational tests and demonstration projects nationwide. The report also presents several alternatives for future ATIS development given the prioritized goals and objectives of the major public-sector partners in the region (TxDOT, METRO, City of Houston, Harris County, and the Houston-Galveston Area Council). These alternatives focus on the possible business models that have been identified for ATIS development and how they may be applied to the existing Regional ITS Plan (3).

2. LEGAL CONSIDERATIONS REGARDING ATIS DEVELOPMENT IN HOUSTON

OVERVIEW

As partners in the Houston region move forward with ATIS implementation, the legality of partnering arrangements as well as the generation and sharing of revenues is a concern of most agencies. Generally speaking, TxDOT does have the general legal authority to undertake a regional ATIS under a variety of basic frameworks. In this section, TTI researchers describe various legal issues related to ATIS development and how legal concerns can best be addressed.

These issues were identified from information obtained from other states on various types of public/private initiatives and from discussions with personnel at TxDOT's Office of General Counsel (OGC).

Answering the basic question "Can we do this?" depends upon the authority granted by the Texas State Legislature. As with all government agencies, TxDOT can only undertake that which it has been given authority to do, either as it is expressly stated in or implied through enabling legislation. TxDOT has broad express authority to plan, design, construct and maintain the state highway system, yet the means by which this work is carried out, to a great extent, is implied. For example, current methods of traveler information dissemination through DMS, HAR, and web sites are not expressly stated in enabling legislation but are carried out under implied authority since they contribute to the mission of the department.

PRIVATE-SECTOR INVOLVEMENT

A more complicated proposition is that of private-sector participation in the provision of services that theoretically could be addressed by either the public or the private sector, such as ATIS. In general, TxDOT has the authority to use a number of different contracting mechanisms to engage the private sector in providing services. TxDOT's Policy Statement on ITS Information Sharing specifies that all ITS partnerships should be through written agreements or contracts, but these are not meant to be "traditional business partnerships."

Virtually all state DOT experiences with public-private partnering to date have followed more conventional approaches. States who are stretching the boundaries of conventional agreements have been given authority through their state legislation. Most of this legislation has been enacted for the purpose of allowing public/private ventures in the design, construction, maintenance, or operation of toll roads. For example, the state of Washington's legislation institutes a public-private initiative program that is broadly written to include "transportation systems and facility projects"(4). The state of Minnesota also has legislation that allows for unique agreements to be developed with the private sector:

"The commissioner may enter into agreements with other governmental or nongovernmental entities for research and experimentation; for sharing facilities, equipment, staff, data, or other means of providing transportation-related services; or for other cooperative programs that promote efficiencies in providing governmental services or that further development of innovation in transportation for the benefit of the citizens of Minnesota" (5).

This legislation was enacted in 1993 to enable the department to develop and conduct ITS demonstration projects. Now that the experiments have moved to implementation, the department is able to work within the broadly written language of this legislation. In essence, the department has stayed within the bounds of conventional contracting mechanisms without the need for further legislation.

The AZTech project in Phoenix, Arizona, is contracting with ETAK, a private-sector partner, to provide traveler information services. The contract is being administered by the Maricopa County Department of Transportation using their standard consultant services agreement. ETAK's job is to develop a customized traffic database and interfaces capable of transmitting and disseminating traffic information to various media, including portable notebook PCs, palmtop computers, and pagers. Part of the ETAK's involvement in the development of the regional effort is to prepare a comprehensive product and service provider business/marketing strategy to establish a self-supporting and sustainable ATIS. One of the primary aims of

AZTech's ATIS is to be a self-sustaining privatized venture, although initially AZTech may participate in cost-sharing contracts to assist with establishment costs or to act as a catalyst for market penetration. Other private partners contracting with Maricopa County are providing specialized components of traveler information dissemination, such as kiosks deployed by Ecotek Technology Solutions.

The most commonly used contracting mechanism currently in place is the license agreement, which can effectively incorporate a number of possible factors such as:

- private-sector profit,
- revenue-sharing,
- exclusivity, and
- intellectual property concerns.

LEGALITY OF TXDOT ATIS ACTIVITIES

Beyond the question of general authority and ability of a state agency to participate in ATIS ventures that relate to the overall mission of that agency, the legality of specific actions that might be taken by TxDOT (as the agency with primary responsibility for traffic and traveler information within the region) to facilitate ATIS development in the Houston region are also of interest. TTI researchers contacted TxDOT's Office of General Counsel (OGC) and other officials to explore the following questions:

- Can TxDOT charge for traffic data?
- Can TxDOT revenue-share (or engage in other types of value transfer) with a private company who wants to fuse and disseminate traffic data for profit? If so, where would the collected revenue go? Could the collected revenue be earmarked for operation and maintenance of the infrastructure used to collect the data?
- Can preferential treatment be legally given to a private partner (i.e., exclusive use by one or more private companies of data collected with public funds)?
- Can right-of-way (ROW) be used for private data collection?

- What is TxDOT's position on intellectual property? If a private company develops software to fuse TxDOT's data for dissemination to consumers, does state law require TxDOT to retain intellectual property rights? Can TxDOT cede rights to intellectual property if it is developed at private expense?
- Does TxDOT have the legal authority to enter into agreements with private entities to advertise their products or services for a fee on TxDOT facilities, such as web sites or kiosks?
- What are TxDOT's auditing requirements for public records? Would a private company in a partnership arrangement with TxDOT have to adhere to these requirements?
- What are the legal requirements for formalizing public partnerships?
- What is the state's position on privacy and the possession of personal travel data?

The following sections summarize answers obtained to these questions.

Can TxDOT charge for traffic data?

TxDOT can legally enter into a license agreement to be compensated for TxDOT's data. The current policy statement for ITS information sharing states that “information should be provided on a partnership basis where TxDOT will attempt to obtain some benefits, if possible, in return for information” (6). In all cases of information sharing thus far, TxDOT has received in-kind services as opposed to monetary compensation. However, it is OGC's opinion that monetary compensation is not prohibited by law.

Can TxDOT revenue-share (or engage in other types of value transfer) with a private company who wants to fuse and disseminate traffic data for profit? If so, where would the collected revenue go? Could the collected revenue be earmarked for operation and maintenance of the infrastructure used to collect the data?

There is nothing that precludes TxDOT from entering into an agreement to revenue-share, but all revenue received through the arrangement would go back into the Transportation

Fund. Revenue cannot be earmarked under current legislation, although the Transportation Commission has the authority to allocate funds.

Can preferential treatment be legally given to a private partner (i.e., exclusive use by one or more private companies of data collected with public funds)?

An exclusive license agreement can be awarded to a given private partner through the request-for-proposal (RFP) process. This is allowed under the intellectual property statute. It would be a negotiated process, not unlike the placement of private fiber optic cable in public ROW.

Can right-of-way (ROW) be used for private data collection?

ROW could be leased to a private company for data collection as long as information is shared. However, the ROW/fiber legislation already in place is broad, allowing “telecommunications facilities,” which could include cameras operated privately. The OGC did note that state agency requirements regarding open records could be a source of concern to private-sector participants who were developing unique components and/or systems. However, current legislation excepts “trade secrets” from open records requirements. The key will be that the private sector develops the unique components and systems and then leases them to the public agency (as opposed to having the public agencies pay for development and then “own” the components/systems and the associated trade secrets).

What is TxDOT’s position on intellectual property? If a private company develops software to fuse TxDOT’s data for dissemination to consumers, does state law require TxDOT to retain intellectual property rights? Can TxDOT cede rights to intellectual property if it is developed at private expense?

According to current policy, if TxDOT pays to develop a product, then TxDOT retains the rights to that product. This is similar to most public agency policies nationwide. TxDOT can license the data to a private-sector partner (as it now does for the real-time traffic map data) and

would have the intellectual property rights over the publicly generated data. However, a private company developing its own software for data fusion would retain rights to that software.

Does TxDOT have the legal authority to enter into agreements with private entities to advertise their products or services for a fee on TxDOT facilities, such as web sites or kiosks?

TxDOT currently does not have legal authority to directly advertise a product and receive advertising revenues. This is one potential area for legislation. However, TxDOT must determine whether getting into the business of advertising is a cost-effective approach. Given the immaturity of the ATIS market, the level of effort needed to accomplish such legislation may not be worth the potential revenue that might be generated. It would seem more prudent at this time (and more effective) to contract with a private partner to provide a service, let that partner generate advertising revenues, and then revenue-share with the partner to offset TxDOT's costs.

What are TxDOT's auditing requirements for public records? Would a private company in a partnership arrangement with TxDOT have to adhere to these requirements?

What is paid for with public funds is subject to audit requirements. In a revenue-sharing arrangement, full auditing would seem to be a requirement.

What are the legal requirements for formalizing public partnerships?

The type of contract used depends on the agencies involved. An interlocal cooperation contract (such as has already been developed among TranStar agencies) is the appropriate mechanism to use between the state and other governmental agencies.

What is the state's position on privacy and the possession of personal travel data?

It is OGC's recommendation to keep the data statistical in nature and not tied to an individual's vehicle. Any private company would have to comply with the state's privacy laws, as does any public agency. It does appear that videotaping for training, education, and continuous improvement by TxDOT and other TranStar members would not create liability concerns.

SUMMARY OF FINDINGS

The following findings were drawn from these activities regarding the legality of ATIS in Texas:

- TxDOT has the general legal authority to undertake a regional traveler information system as lead agency under a variety of basic ATIS frameworks involving other public agencies and private-sector partners.
- TxDOT has the conventional contracting mechanisms in place to address typical legal concerns related to private-sector involvement in ATIS.
- Revenues received by a given TxDOT district for information provided cannot be earmarked for return to that district, according to current legislation. However, the Transportation Commission makes decisions regarding funding allocations from the Highway Fund (where revenues would go) and could presumably make adjustments to allow those revenues to be returned to a district for operations and maintenance. This will become an issue in the future only if significant revenues begin to be generated from the data being collected.
- New legislation would be required if TxDOT desired to pursue advertising revenues directly as a funding source for ATIS activities. TTI researchers believe that such an initiative would encounter significant opposition from the private sector and other special interest groups if pursued. It appears to researchers that it would be simpler to enter into an arrangement with a private-sector information service provider that allowed TxDOT to share revenues if that agency were able to generate a significant profit. Various mechanisms for accomplishing that objective have been developed through other research and are summarized in [the next chapter](#).

3. ATIS DEVELOPMENT ISSUES IN HOUSTON

INSTITUTIONAL

Lessons Learned from Other Projects

TTI researchers reviewed the following six ATIS initiatives for insights and “lessons learned” as they have developed and implemented systems in their respective regions:

- SWIFT (Seattle, WA),
- Partners in Motion (Washington, D.C.)
- Genesis (Minneapolis, MN),
- TravInfo (San Francisco, CA),
- AZTech (Phoenix, AZ),
- NAVIGATOR (Atlanta, GA), and
- SmarTraveler (Boston, MA).

The [appendix](#) provides a summary of literature about each project and conversations with selected officials involved in those initiatives. Some of the major recommendations and lessons learned from these projects include the following:

- identifying “champions” of the system to inform and persuade elected and agency officials about the importance of the system;
- conducting outreach and marketing efforts to justify ATIS expenditures to the public;
- being careful not to “oversell” the expected benefits of the system to elected officials, other agencies, or the public;
- establishing ongoing budget support by agencies for operations and maintenance;
- recognizing the uncertainty of the ATIS consumer market and potential for revenue-sharing;
- recognizing the need for flexibility in requests for proposals from current or potential private-sector stakeholders;

- establishing and maintaining channels of internal communications amongst the stakeholders; and
- understanding the difficulty in obtaining complete agreement among stakeholders on every issue pertaining to system development and operation, and consequently the need for one stakeholder to serve as the “lead” in the effort.

These issues are also mentioned in a recent FHWA publication regarding ATIS development and implementation (1). The unique partnership arrangement between state, transit, county, and city transportation agencies in the Houston region that has been established at TranStar has allowed the agencies in the region to acknowledge and address most of these concerns already. The arrangement has placed the region ahead of many other locations nationwide in terms of developing and fostering ATIS.

ATIS Business Models

One of the major issues addressed recently at the national level are the specific public/private relationships, or business models, that can be used and are the most appropriate for long-term sustainment of ATIS in a region (7, 9). The models address the roles that the public and private sectors play in terms of data collection, fusion, and dissemination to the traveling public and other end users of the data such as fleet operators.

There exist four basic types of ATIS business relationships (7):

- public-centered operations,
- contracted operations,
- franchise operations, and
- private, competitive operations.

Figures 1 through 4 present a conceptual illustration of each type of relationship (7).

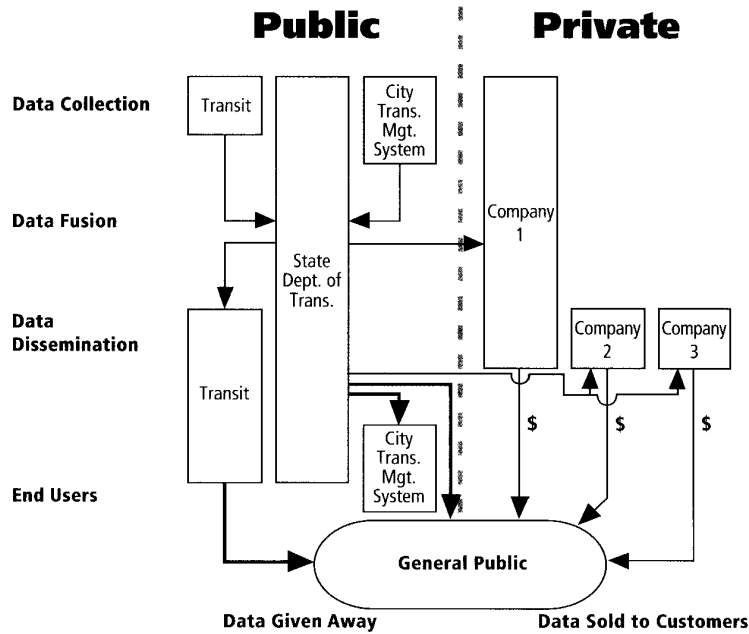


Figure 1. Example of a Public-Centered ATIS Operation (7).

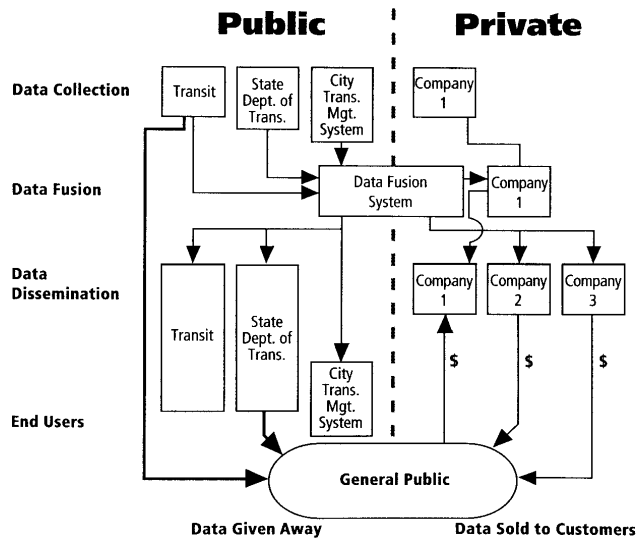


Figure 2. Example of a Contracted ATIS Operation (7).

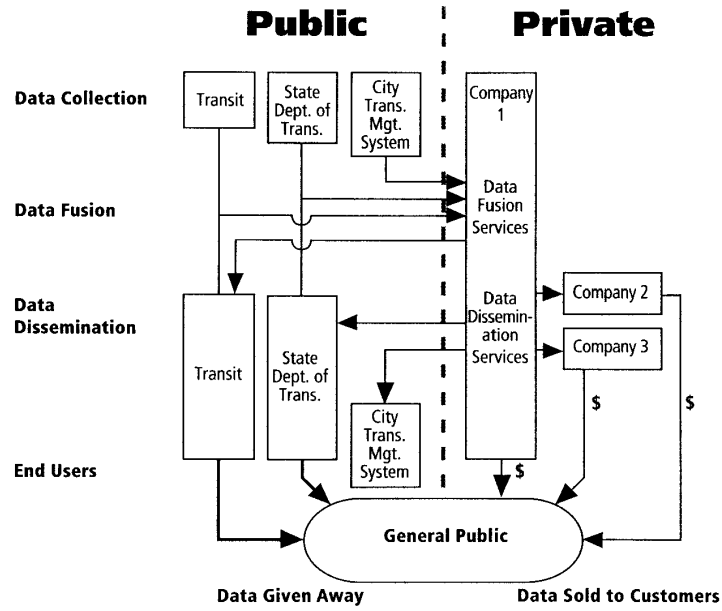


Figure 3. Example of a Franchised ATIS Operation (7).

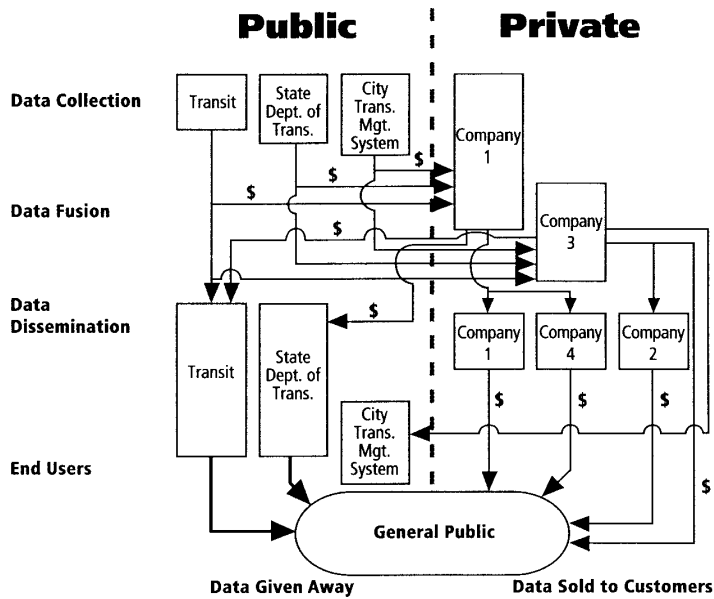


Figure 4. Example of a Privatized, Competitive ATIS Operation (7).

Relationship Descriptions

Public-centered operations involve a relationship whereby one or more agencies have exclusive responsibility for developing, operating, and maintaining the ATIS. This type of relationship allows involved agencies the greatest degree of control. However, because the agencies generally disseminate a significant amount of traveler information themselves, there is a smaller potential for revenue generation via ATIS services. Also, this type of operation requires the public sector to pay for nearly all facets of ATIS development, operation, and maintenance and to maintain adequate staff on-hand to accomplish these activities (8).

Contracted operations represent a typical “fee for service” arrangement that commonly occurs between the public and private sector. Technical specifications for a service are prepared and sent out to interested parties who prepare proposals and bids to do the work specified. The public agency reviews the proposals and bids and then selects a winner. In the example shown in [Figure 2](#), the private sector is being contracted to do part of the data fusion task, and so raw or partially-fused data from each agency (including transit) would be sent to the company that wins the contract. The private sector would then deliver the completely-fused data back to each of the agencies and directly to the end users. This approach does allow the public agency to retain control over the services while taking advantage of the staff and technical expertise offered by the private sector. However, the public agency must know and understand the final product to be produced so that the product is effectively articulated through the technical specifications. This approach also requires the public agency to maintain staff who can effectively manage the contract (8). A modification of this approach relative to the ATIS model shown in [Figure 2](#) utilizes an asset manager in conjunction with a private-sector data fusion contractor (9). The asset manager is a broker who works with the data fusion provider to create the data products to meet the requirements of various users and to help sell those products to generate revenue.

Franchised operations generally involve the public sector giving a private-sector participant the exclusive right to fuse, market, and sell the data from the public sector for some given period of time (7). A competitive process is used to select the private-sector participant, based in large part on the amount that the participant is willing to pay for the exclusive rights to the data. The private sector then develops products to meet the market needs of the users. This

approach does appear to foster faster improvements and technology enhancements to the system because it is market-driven. However, the public sector loses control over how the data is used, which may create social inequity issues for those who cannot afford to pay for the data. A variation on this type of arrangement is the use of competitive licensing agreements, whereby the public sector allows two or more private firms access to the data. This approach may create a competitive market and ultimately benefit consumers (7). However, it may fragment the market and prevent any firm from recouping expenses and ultimately making a profit (9, 10).

Privatized, competitive operations represent the most market-driven arrangement available. In this approach, public agencies make data available to several private-sector firms willing to provide data fusion and/or dissemination services. The companies add value to the data according to their own business approaches and then resell the data to the public directly or to other ISPs. The public sector may or may not receive monetary compensation for the data. This approach maximizes competition between firms and should result in better, lower-cost services. However, this approach can create problems if the market is too small to sustain multiple firms or if the revenue stream is too small to bring about the better, lower-cost services desired (7, 8).

Current TranStar Arrangement

Current operations at TranStar most closely reflect those of a public-centered operation, as depicted in Figure 5. The organizational structure is consistent with TxDOT's policy to provide the public with free access to its data and to make that data available to as many people as possible. The structure is also consistent with the TranStar agencies' intent to establish a seamless, integrated traffic management system that supercedes jurisdictional boundaries. Public agencies collect traffic data via closed-circuit television (CCTV) cameras, automatic vehicle identification (AVI) readers, and motorist assistance patrol (MAP) reports. In addition, transit operator reports of conditions and bus status are obtained on the control room floor, and police activities relevant to travel conditions are available from an officer on site. Information from flood monitoring gauges is also obtained. However, some private-sector data sources that can impact travelers do exist (e.g., private parking lot operators) but are currently not planned for integration in TranStar.

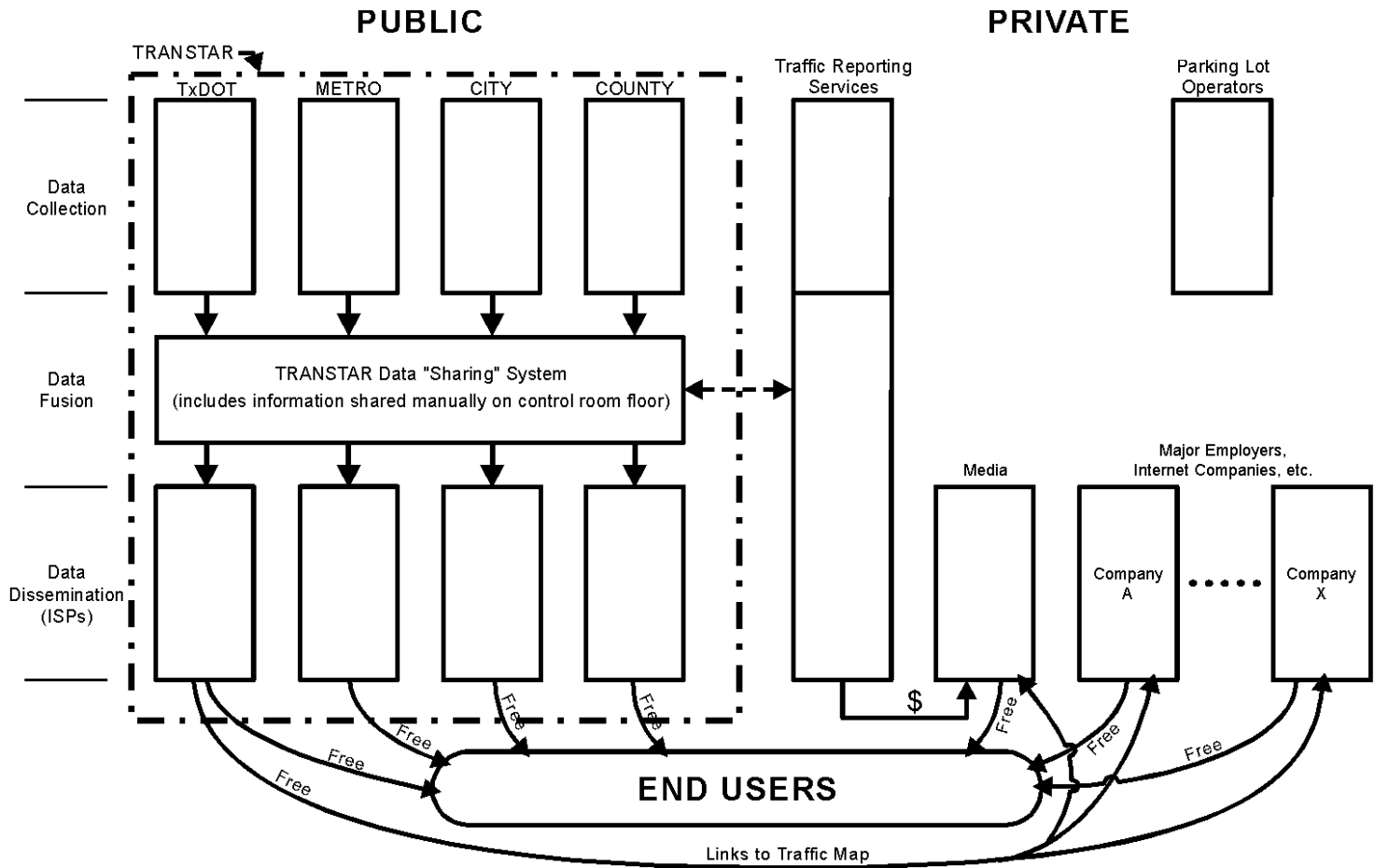


Figure 5. Current Public-Centered ATIS Operation of the Houston Region.

Data fusion is accomplished (or will be in the future) within TranStar for use among the various agencies and others. The agencies are also heavily involved in data dissemination as well. TxDOT provides a significant amount of data directly to the public via DMS on area freeways, information kiosks located at key traffic generators, and the real-time traffic map of average speeds (from the AVI data) that is posted to a web site for public access. METRO also owns several DMS for use in managing the high-occupancy vehicle (HOV) lanes, maintains its page of transit-related information, and is working towards real-time information dissemination in transit vehicles and at key transit stops (2). Both the City of Houston and Harris County have Priority Corridor projects underway that involve them in the dissemination of traveler information as well (2).

Although currently a public-centered operation, it is apparent from this review of other business models and from [the previous chapter](#) on legal issues that TranStar and the Houston region have several options regarding future ATIS development and the potential promotion of private-sector activities in that development. Exactly what these alternatives should be and how they should be evaluated are discussed in [the next chapter](#).

TECHNOLOGICAL ISSUES

From an ATIS-function perspective, a recent FHWA publication has summarized the key technology considerations that have been determined from the various operational tests and deployment projects to date (1). These include the following:

- Traveler information must be timely, accurate, and reliable.
- Most consumers are not willing to pay directly for traveler information alone, unless it offers a significant improvement over the traveler information that would be available free-of-charge (via commercial television and radio broadcasts, for example).
- Many consumers believe traveler information is an attractive feature when bundled with other for-pay services such as stock quotes, weather, sport scores, yellow page information, etc.

- Travelers are more interested in information for long-distance trips or for travel in unfamiliar areas.
- Travelers are less interested in information for local or familiar trips, other than that useful for avoiding extended delays or other inconveniences along their trip.
- Travelers are more interested in having en-route information than pre-trip information.

The majority of the field operational tests recently completed or still underway nationally focused on technology evaluation relative to the collection and dissemination of traffic and travel-related data to various types of users (see the appendix for examples). Through the Priority Corridors program, the Houston region itself has become a major showcase of several technologies (2). From a technical perspective, most devices that have been deployed have been shown to be feasible. The primary issue, however, has been and continues to be whether or not these devices offer any real value and will be used by the consumer. Unfortunately, the interdependence between the dissemination technology being used to provide information and the type/quality of that information (as noted in the bulleted list above) make technology assessment difficult.

One technology which does not appear to be particularly well received by the public is the personal data assistants (PDAs) equipped with radio frequency (RF) communications to obtain and request travel information. Based on experiences in both Minneapolis and in Houston (11, 12), the value of the information received via these devices generally does not appear to offset the effort required for its use. Utilization of PDAs in both cities fell far below expectations during tests that were conducted.

An interesting technology recently with potential to impact the Houston region in a few years is the Auto-PC, an in-vehicle device with functionalities similar to those of desktop or laptop computers (13-15). It is reported that voice commands will replace the traditional operator interface methods (keyboard, mouse) to allow travelers to use the device to control various vehicle components, check and send e-mail, and access the Internet while in their vehicle. Theoretically, this technology will allow regions with dynamic traveler information web sites (such as the Houston TranStar Real-Time Traffic Map) to move quickly towards en-route,

interactive ATIS operations. Furthermore, the value of Internet access to consumers already demonstrated by America Online (AOL) and other providers suggests that there might be potential for revenue-sharing by TranStar agencies with ISPs to help fund operations and maintenance activities of the data collection and fusion infrastructure.

4. ATIS ALTERNATIVES IN HOUSTON

The summary of possible ATIS business relationships discussed in [Chapter 3](#) provides a starting point regarding identification of future ATIS alternatives in a region. In this chapter, a matrix of alternatives and an analysis methodology are presented to further assess the future applicability of each of these relationships to the Houston metropolitan area. The matrix is based upon the ATIS priorities and deployment guidelines defined within the RITS strategic plan.

In [the next section](#), the regional ATIS vision from the RITS plan is summarized. The key facets of that summary are the prioritized market packages that are a component of the National Architecture program. Using these market packages and the main ATIS business model relationships described in [Chapter 4](#), an ATIS alternatives matrix is presented for the Houston region. The chapter is then concluded with a discussion of the analysis criteria to be used to assess these alternatives to arrive at recommendations about future ATIS development in Houston.

CURRENT HOUSTON ATIS VISION

RITS Strategic Plan

The RITS strategic plan for the Houston region defines overall goals, objectives, and TranStar consortium member roles for ITS deployment (3). The plan has been organized around the guidance provided from the National ITS Architecture program and uses a systems engineering approach to match the region's transportation problems with potential solutions (16). One of the major advantages of the RITS plan is its integration of transportation problems, user services (defining ITS solutions to the identified problems), and market packages (defining equipment packages required to work together to deliver needed services and architecture flows between each other and with various external systems). This is accomplished by means of a matrix of prioritized user services and market packages. [Table 3](#) presents the portion of the prioritized user service/market package matrix from the RITS plan that addresses the ATIS-related market packages.

**Table 3. Ranking of ATIS Market Packages Based on User Service Ranking
(adapted from 3).**

User Services		ATIS Market Packages						
		High Priority					Medium	
		Priority						
		Broadcast Based ATIS	Interactive ATIS with Driver and Trav Info	Interactive ATIS with Infra Route Selection	Interactive ATIS with Yllw Pgs & Reserve	Interactive ATIS with Dynamic Ridesharing	Route Guidance	In Vehicle Signing
High Priority	Incident Management							
	Traffic Control							
	Pre-Trip Information	X	X	X	X	X		
	Public Transportation Management							
	En-Route Transit Information		X	X		X		
	Travel Demand Management							
	Public Travel Security					X		
	Haz Mat Incident Response							
	Emergency Veh Management							
	Highway-Rail Intersection		X	X				
Medium Priority	Emergency Notif. & Personal Sec							
	En-Route Driver Information	X	X	X	X	X	X	X
	Electronic Payment Services		X	X	X	X	X	X
	On-Board Safety Monitoring							
	Ride Matching and Reservation					X		
Low Priority	Route Guidance			X			X	
	Traveler Services Information				X			
	Emissions Testing and Mitigation							
	Personalized Public Transit							
	Automated Vehicle Operation							
	Longitudinal Collision Avoidance							
	Intersection Collision Avoidance							
	Comm Fleet Management							
	Comm Veh Admin Processes							
	Automated Roadside Safety Inspection							
	Comm Veh Electronic Clear							
	Vision Enhancement for Crash Avoidance							
	Safety Readiness							
	Pre-Crash Restraint Deployment							

From this table, one sees that Houston region transportation stakeholders have assigned the following marketing packages with a high priority:

- Broadcast-based ATIS,
- Interactive ATIS with Driver and Traveler Information,
- Interactive ATIS with Infrastructure-based Route Selection,
- Interactive ATIS with Yellow Pages and Reservations, and
- Interactive ATIS with Dynamic Ridesharing.

Meanwhile, the following packages received medium priority by the stakeholders:

- Route Guidance, and
- In-Vehicle Signing.

Both pre-trip and en-route travel information is emphasized in the RITS plan, as is the desirability of establishing cost-effective public/private partnerships where possible. The following list identifies some of the key deployment guidelines specified in the plan that relate to both pre-trip and en-route driver information (3):

- Information flow to the public regarding traffic flow is a joint responsibility of the public sector and the private sector.
- TxDOT is the primary contact for infrastructure-based transportation information for private-sector ATIS providers.
- Cities, the Tollroad authority, and METRO will provide TxDOT access to their transportation infrastructure information for subsequent delivery to the private sector.
- Dynamic message signs (DMS)
 - Transportation infrastructure providers should limit deployment of public-sector DMS and other ATIS services that compete with the private sector.

- TxDOT-owned DMS should be placed primarily at strategic locations (e.g., freeway to freeway) and not at regular, repeated intervals along the freeway.
- Arterial and intersection DMS system should be a component of the RITS plan. However, it will be an intermediate-term element for traffic generators.
- Highway advisory radio (HAR) should be implemented for all freeway segments.

TxDOT ITS Policies

The designation in the RITS plan of TxDOT as the primary agency with ATIS responsibility implies that future development and deployment efforts in the Houston region be compatible with its own internal policies regarding ITS information sharing and standardization. The following principles from the TxDOT Policy Statement on ITS Information Sharing are most relevant to this research effort:

- Traffic management center information will be available on the Internet.
- TxDOT will share transportation information (traffic data) with other government agencies to the greatest extent possible.
- Information should be provided on a partnership basis by which TxDOT will attempt to obtain some benefits, if possible, in return for information.
- All partnerships or other means of sharing information with both public and private sectors should be through written agreements or contracts. These are not meant to be traditional business partnerships.
- Private-sector information service providers should be encouraged to add value to TxDOT information (6).

HOUSTON ATIS ALTERNATIVES

Matrix of Alternatives

As noted in [the previous chapter](#), current ATIS efforts within the Houston region are best characterized as following a public-centered business model operation. TxDOT and the other TranStar consortium agencies continue to expand their real-time traffic and other travel-related data

collection capabilities. Meanwhile, efforts are underway to fuse this data into a centralized database using the Priority Corridors program and other initiatives. Finally, a significant amount of travel information is being disseminated through TranStar agencies to the public and this dissemination is likely to continue in the future.

Given current conditions, the question that arises is whether any of the other business relationships described in [Chapter 3](#) has any opportunity to succeed in the Houston region. Both the RITS plan and TxDOT's own information-sharing policy emphasize the desirability of fostering private-sector participation in ATIS and of exploring the opportunity of obtaining value from the information being collected and shared. At the same time, the prioritized ATIS market packages define several areas of opportunity with regard to further ATIS development in the region. Although "ATIS" is discussed in the ATIS business model guidance literature in singular terms, TTI researchers believe a disaggregate view is more appropriate when considering public/private partnering options (7). Consequently, it is only logical to critique the feasibility of other ATIS business relationships within the context of the priority ATIS market packages for the region. Such a critique requires the analysis of a matrix of alternatives, as is illustrated in [Table 4](#).

For each market package, the various business relationships can then be critiqued considering current and planned TranStar ATIS initiatives that impact that market package, the potential for revenue generation (and subsequent sharing of that revenue), the need for agency control of the data being used to meet that package, etc. The results of such an analysis will be two-fold. First, those business relationships that do not appear viable at all within the market package can be identified and removed from further consideration. Second, the remaining potential business relationships can be prioritized based on key analysis criteria (these are defined in [the next section](#)). Ultimately, this should be of benefit to TranStar agencies both in terms of focusing their public/private partnering emphases as well as in reacting to future partnering requests from the private sector with respect to ATIS initiatives.

Table 4. Matrix of ATIS Alternatives.

ATIS Market Package	Type of ATIS Business Relationship			
	Public-Centered Operation	Contracted Operation	Franchised Operation	Privatized Operation
Broadcast ATIS				
Interactive ATIS w/ Driver and Traveler Info				
Interactive ATIS w/ Infrastructure-Based Routing				
Interactive ATIS w/ Yellow Pages and Reservations				
Interactive ATIS w/ Dynamic Ridesharing				
Route Guidance				
In-Vehicle Signing				

Analysis Criteria

Assessment of the practicality and desirability of the possible ATIS business relationships within each particular ATIS market package requires the consideration of the following key criteria:

- technologies and mechanisms currently in place within the region that are partially or wholly addressing the specific user service/market package combinations (and the implications of changing to that business relationship in the future);
- expected potential for revenue;

- potential for other types of benefits to public agencies;
- anticipated start-up and continuing costs to TxDOT and other TranStar agencies (due to a lack of data, these will probably need to be comparative rankings among possible business relationships rather than actual dollar estimates);
- implications upon agency control of information and recognition of its data contributions; and
- compatibility to existing agency policies in the region.

The technical report being prepared at the conclusion of this project will provide the results of these analyses.

5. SUMMARY AND PRELIMINARY RECOMMENDATIONS

This report has attempted to summarize some of the main legal, institutional, and technological issues that can impact future ATIS developments in the Houston region. Based on published literature and discussions with state and local officials from other ATIS projects nationwide, the following list highlights some of the findings of the analysis:

- TxDOT appears to have the general legal authority to participate in ATIS under a variety of basic business frameworks involving other public agencies and private-sector companies.
- Currently, revenues paid to TxDOT as part of an ATIS would be returned to the State Highway Fund for reallocation. This makes it difficult for the individual districts (where such revenues originate) to participate in revenue-sharing agreements directly with other agencies or with the private sector. Barring major changes in state policy, TxDOT will need to rely on other mechanisms for sharing any costs and revenues from ATIS efforts.
- Despite several tests and initiatives recently completed or still underway nationwide, the consumer market potential for ATIS (and thus revenue sharing) is still fairly unknown at this time. Better geographic coverage of conditions, better consumer products, and improved marketing and publicity have all been cited as important focus areas for improving the market potential for ATIS services.
- Although improved publicity has been cited as a need in future ATIS efforts, this publicity must be grounded in realistic goals and promises to the public. Failure to do so is believed to degrade consumer confidence in the system and will delay market penetration.

The report also recommends further analysis of the possible implications of the various types of partnering arrangements possible between the public and private sector for future ATIS activities. Although the literature discusses these alternative arrangements in singular terms for a given ATIS (i.e., a contracted operation, a franchise operation, etc.), TTI researchers believe that future ATIS efforts may incorporate several or all of them. Consequently, an assessment of each one's

applicability towards meeting the long-term ATIS priorities for the region (as defined by the ATIS market packages from the National Architecture) will be useful. The assessment will be documented in a subsequent report.

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APPENDIX: REVIEW OF NATIONAL EXPERIENCES

SELECT TRAVELER INFORMATION EXPERIENCES

Many metropolitan areas throughout the United States have developed some form of ATIS. These projects generally utilize data obtained from several sources including inductance loops, CCTV, assistance patrols, emergency services, and other ISPs. The data are then disseminated to travelers through several means including DMSs, Internet sites, cable television, electronic mail messages, telephone, in-vehicle devices, pagers, and many other techniques and technologies.

Both public and private agencies are pivotal in the planning, design, and development of traveler information systems. The discussion below is intended to provide insight into the experiences of select ATIS developments that provide unique lessons learned including contractual arrangements and agreements among agencies, technical suggestions, and other relevant information. A literature review was performed by investigating available references and contacting select personnel within agencies and companies of interest. To better understand the private-sector perspective of ATIS deployment, private-sector companies that are involved with national ATIS deployment are also described. This information all provides valuable guidance to personnel and agencies that are involved in developing an ATIS plan and business model for the Houston area.

Seattle Wide-area Information for Travelers (Seattle, Washington)

A significant amount of traveler information knowledge has resulted in the Seattle region as part of the Model Deployment Initiative (MDI). Smart Trek is the name of the MDI effort in this region. One ATIS effort that has been recently completed is the Seattle Wide-area Information for Travelers (SWIFT) intelligent transportation systems field operational test. The operational test was concluded in August 1997. Draft reports of the evaluation were available at the time of this document (17-20). A total of 520 message watches, 90 in-vehicle navigation devices, and 80 portable computers to transmit bus and traffic information via high speed data system (FM Sub-carrier) was used in the test (20). The SWIFT project team includes the following:

- Delco Electronics Corp., a subsidiary of General Motors Corporation;
- ETAK, Inc.;

- Federal Highway Administration;
- International Business Machines, Inc.;
- King County Department of Metropolitan Services;
- Metro Traffic Control, Inc.;
- Seiko Communications Systems, Inc.;
- University of Washington; and
- Washington State Department of Transportation (WSDOT).

There were many findings of the SWIFT project (17). The consumer acceptance study utilized questionnaires, focus groups, and telephone interviews. It generally found that the users of the traveler information placed a high degree of importance on the information for their travel planning. Information such as incident location and duration and general traffic congestion information was all found to be valuable. Among transit users in the sample of users, the bus schedule and route information was also found useful.

Generally, participants in the SWIFT study felt that the information was accurate, reliable, timely, easy to understand, and useful. However, users of the Seiko MessageWatch were concerned with the timeliness of incident information. The ease of understanding of the MessageWatches was also lower than with the Delco in-vehicle navigation unit or the personal computer. However, the in-vehicle navigation unit and the personal computer sometimes experienced problems receiving personal-paging messages. Understanding the nature and location of congestion generally received higher ratings with the map display of the personal computer. The extent of congestion was more difficult to understand with the MessageWatch, while the period of time of the congestion was difficult to understand with the in-vehicle navigation unit.

The Delco in-vehicle navigation unit also included a voice message to go along with the text message. Users were rather neutral toward their satisfaction of the voice message, and they also noted that they did not perceive the voice message to be a safety concern. Additional suggestions made by users of the in-vehicle device include a map-based display, route specific information, and information for alternate routes. The information provided by the personal computer was rated

relatively high, especially the map-based display. However, the physical and operational characteristics caused the users to be very dissatisfied. Their large size and weight made the units cumbersome. A smaller and lighter device with a less-complicated communications connection was desired. The physical and operational characteristics of the Seiko MessageWatch were ranked very high by users of the devices. Improvements were suggested including a full alphanumeric display with more storage capability.

Overall, SWIFT was successful at demonstrating the use of a high speed data system for ATIS in a significantly large metropolitan area (17). Generally, the users of the Seiko MessageWatch were the most satisfied, while those using the personal computer were the least satisfied. A willingness-to-pay study with the use of a focus group determined that the system is worth between \$5 and \$20 per month if the data are timely, accurate, reliable, and provided for relevant routes.

Additional insight has been provided through phone conversations with the WSDOT Smart Trek Project Manager. It is important to note that the technology has advanced since the SWIFT project. Technology can now accommodate many of the recommendations provided by system users. It has been found that the demographics of a metropolitan area will define, to some extent, what type of ATIS applications may be successful (21). It was found that about 32 percent of Puget Sound residents have Internet access at home, and 31 percent have Internet access at work or school. In February 1998, the WSDOT Traffic FLOW map displaying real-time traffic conditions on the Internet received 9 million hits (22).

The business model approach in the Seattle area also provides significant insight for other regions developing an ATIS plan. The following experiences and lessons learned are compiled from references (8, 21-24):

- The cooperation and understanding of each agency's role and involvement in ATIS development is important.
- Private-sector involvement is inevitable for the success of ATIS deployment.

- The dilemma for the public sector that arises is that personalizing traveler information to each individual is not the role of the public sector; rather, it is to ensure the common good. Therefore, ATIS applications become a question of when do traveler information efforts become a commercial venture.

The ATIS market in the Seattle area has been found to be relatively immature. It is still nearly impossible to predict that one technology will be the “product of the future.” Rather, depending upon the demographics, willingness-to-pay, market demands, and other factors, market forces will define the extent of the ATIS market. Much of this information is currently available free-of-charge through Internet sites, telephone, or cable stations. Furthermore, the consumer willingness-to-pay for this information when packaged in different forms is yet to be determined. The ATIS market that is still developing will define the success of new technologies such as the Auto PC (13). The eventual ATIS deployment is likely to include a combination of technologies.

One very understandable concern of the private sector is the lack of national coverage with ATIS developments. In Seattle, as in other regional locations, ATIS developments have been implemented for the region itself. It is difficult for large private-sector companies to invest heavily in ATIS markets when there is no compatibility between large metropolitan areas. To attract public interest, there must be the opportunity for a nationally compatible system. Private companies are developing systems intended to provide national compatibility.

One lesson learned in the Seattle region is that it is often difficult to get broad-based consensus about specifics of an ATIS deployment plan. It was found that it may be better if the public-sector champion of the ITS effort simply begins to move ahead. The ITS business plan market is simply too large to attempt to satisfy all stakeholders, policy makers, and other decision makers prior to service delivery. The Seattle experience also notes that individuals must realize the large amount of time that will be necessary to describe the usefulness and benefits of the system to legislators and agency personnel.

Partners in Motion (Washington, D.C.)

The experiences with the Partners in Motion ATIS effort in the Washington, D.C., area have provided valuable insight into many institutional, financial, and technical aspects of ATIS development. Data are received from both the public and private sources and are sent to the traveler information center for fusion. After the data are fused, they are sent to participating agencies within the District of Columbia, Maryland, Virginia, and various ISPs. The information is then provided to the traveling public.

Many lessons have been learned from this project with respect to institutional arrangements and partnerships. The Partners in Motion project did not include a binding contract to ensure that agencies would become involved, and stay involved, with the project. Public and private agencies in the region were contacted about the project, including traffic and transit agencies as well as federal, state, and local governments (25). Agencies were encouraged to be involved with a project that would address the goal, *“to provide additional travel information to help mitigate the safety and congestion problems which are common in the area, without expanding the current transportation infrastructure”* (26). Agencies were encouraged to join the Partners in Motion effort so that they would not give the impression that they were uninterested in increasing transportation effectiveness in the Washington, D.C., area. Such a perception can easily deteriorate the reputation of the agency in the eye of the public (27).

The Virginia Department of Transportation (VDOT) has taken the leadership role of the project, including development of the RFP and contractual agreements. No technical aspects or detailed designs were included in the RFP in an effort to ensure that the goal stated above was achieved and to gain the full potential from the strengths of the public and private sectors as well as to provide flexibility (26). This approach allowed the bidders in private industry to utilize their creativity in meeting the objectives and functional requirements of the RFP.

Specific objectives for this overall effort include (not in priority order) (adapted from [26](#)):

- Demonstrate to the public the benefits of timely and accurate travel information.
- Present a positive, concrete example of ITS progress to elected and transportation officials and to the public.
- Begin the marketing process for building a customer base and attracting future dissemination partners.
- Provide enhanced communications between the participating agencies to create immediate benefits of interagency cooperation.
- Demonstrate to other transportation agencies in the region the benefits of becoming part of the traveler information systems program.

The following is a list of requirements for the overall program:

- The information must be aggressively marketed.
- The program must be multi-modal.
- Basic travel information must be made available to all income groups.
- The program must be operational within one year, preferably sooner for some elements.
- Information must be provided for both pre-trip and en-route travel.
- The security of data and the security of connected systems must be maintained.
- A variety of methods must be incorporated for gathering and disseminating information to the media, the public, and among agencies to maximize user access.
- Offerors must agree to actively participate in and support an independent evaluation.
- Maximum use must be made of existing data sources, including integration/interfaces with currently implemented and planned systems.
- Network developments must be distributed with a sufficiently open architecture to accommodate travel data and dissemination for today as well as the future.
- Responsibilities are to be shared between the public and private sectors.

Battelle became the prime contractor for the project, but to provide a reasonable chance for success in developing a self-supporting business the contractor needed some level of commitment from the agencies involved (25). Early in the process of establishing the roles of each of the 26 agencies involved in the project, the possibility of having each agency (26 in all) bound to a Memorandum of Understanding (MOU) was dismissed. The agreement consisted of a non-binding letter of commitment from each agency to VDOT that had two provisions: 1) the public agency would not give away or sell ‘enhanced data’ it received from the traffic information center to another party, and 2) the public agency would agree to recognize VDOT as the contracting agent for this project (25). Further, each agency could still provide the services it was providing prior to the Partners in Motion project; it was merely the distribution of the “new” data that was restricted with this agreement. This agreement ensured that the data would not be disseminated directly by the public agencies and potentially undermine the market that Battelle was interested in developing (25, 27).

The financing of the Partners in Motion project also provides valuable insight for agencies developing an ATIS plan (25, 27). The project is funded by several public and private sponsors with \$12.2 million, of which \$8.3 million is from public agencies, and \$3.9 million is from private agencies.

The most unique element of the six-year contract is that it has been developed to become fully privatized after three years. The public sector is taking the role of providing resources, information, and infrastructure. The private sector can then develop its ideas and technologies into the traveler information market. After the third year of the project, 10 percent of the profits of the project will go back into an escrow account to be dispersed back to the participating agencies. These funds are likely to be reinvested into ATIS efforts. Clearly, there is a risk involved in this project because the market for services is uncertain. It is too early to foresee the future market for the traveler services in the region. This information will become available over time.

Many technical elements of interest also surfaced with the experience of this project. One concern was that since the functional requirements discussed above did not restrict bidders with a technical design and specifications, there was no information available early in the

planning of the project to define the needs of such a system. This information would have been useful earlier in the planning of the project, because it was necessary after a bid was accepted. Information such as what information each agency had, operating procedures, software and hardware used, and communications available for each agency would have been useful (25). Development of a system and communication network to provide real-time delivery of both text and map-based formats of data from agencies spread over a large geographical area also proved to be more time-consuming than originally expected. Significant amount of bandwidth was necessary.

Although some of the systems are automated, there is still a need for human operation of some of the systems, including matching incident information coming in different forms from various agencies. Development of the ATIS must consider the personnel needs and attempt to automate the system to the extent possible (25). Though some quality control is still necessary, more automation results in less human workload and the likelihood for human errors. Finally, intellectual property rights were also an issue to be resolved. Under the Freedom of Information Act, any software developed with public funds can be made available to others, and the public agency gets the license. The solution to this was to use no public funds for software development. Although the software would then be owned by the private sector, a license would be provided to the public agency for its use (24).

Genesis Project (Minneapolis, Minnesota)

The Genesis project is operated by the Guidestar program, the state's intelligent transportation systems program. The Genesis project began in 1992 as a field operational test (28).

The study evaluated the use of two types of personal communications devices (PCDs) to provide alpha-numeric text travel information. The two products were the Motorola pager and the Apple Newton Message Pad 110 with a Motorola message card paging receiver card. Technical problems with the Apple Newton turned the primary focus of the test to the Motorola pager. The Genesis data collection took place in the Twin Cities area in 1995 and 1996. Forty-three of the 492 Genesis participants used the Apple Newton personal digital assistant (PDA),

while 210 participants were current pager users (i.e., used their pager for other uses such as news, sports, etc.), and 239 were new users who had been recruited for the Genesis project.

The Genesis project was a successful demonstration of the use of an ATIS for congestion avoidance and technology demonstration (28). It also illustrated the commercial market for PCDs for traveler information. Finally, it demonstrated the potential for public/private partnerships in disseminating traveler information.

Various evaluations of the Genesis project were performed including a systems effectiveness test, user perception test, human factors test, and an institutional issues test. The following bullet points are some of the findings of these different evaluations that may be useful to those developing an ATIS plan (adapted from 11, 29).

- Genesis was the preferred means of obtaining traffic information for 52 percent of the respondents. The next most frequently cited means of obtaining traffic information was to see the signs of, or actually encounter, an incident (22 percent).
- Genesis decreased the percentage of users who drove through incident areas from 42 percent to 12 percent.
- Genesis increased the percentage of users who took alternate routes of travel from 32 percent to 73 percent.
- Genesis users reported diverting from congestion resulting from incidents based on information received by PCDs.
- Reported frequency of use did not vary as a function of age, gender, income, education, driving experience, or computer experience.
- Users tended to view the messages as accurate, useful, and easy to understand. For the most part, users reported messages to be timely.
- Congestion messages were often mentioned as not useful because of uncertainty of the distinction between slow, stop-and-go, and heavy traffic.

- Future improvements to the system, as suggested by participants, included the following:
 - Inclusion of more roadways.
 - Expansion of the coverage area.
 - Enabling of personalized reports--roads and times specified by the user.
 - Reporting of travel speed, time, and severity of congestion more clearly.
 - Suggestions of alternate routes.
 - Reporting anticipated clearance times for incidents and congestion.
- Pager users were generally satisfied with the Motorola Advisor. With few exceptions, users did not report problems with receiving messages. However, members of the previous user group did not like the feature that prevented them from viewing messages while new pages were being received. This feature had a negative influence on their perception of Genesis messages, as traffic information messages could tie up the device for up to 20 seconds.
- PDA users were not satisfied with the MessagePad and Messagecard combination. Users viewed the process of downloading messages as inconvenient. The PDA was regarded as too bulky to be carried everywhere, and too valuable to leave at home or in the vehicle.
- Approximately one-half the pager users and nearly all of the PDA users do not believe it is safe to consult their respective devices while driving. There is no direct evidence that Genesis participants created a hazard when they consulted their pagers, nor is there evidence to suggest that providing traffic information on pagers will increase the overall incidence of traffic accidents.

TravInfo (San Francisco, California)

TravInfo is another field operational test that began development in June 1993. By September 1996, real-time traveler information, including both traffic and transit information, was being provided to Bay Area travelers (24). The project continues today, providing valuable insight into the ATIS development process.

Data sources for TravInfo include the California Department of Transportation's (Caltrans') traffic operations systems (TOS). The TOS collects volume and speed data from loop detectors in the freeways and high-occupancy vehicle lanes in the Bay Area. Roving tow trucks

in the freeway service patrol also provide data. Metro Network's Airborne fleet provides incident information. The California Highway Patrol's Computer-Aided Dispatch system also provides valuable incident information. Closed-circuit television cameras and vanpools with cellular phones also provide information to TravInfo (24, 31).

The experiences with organizational structure and public/private partnerships of TravInfo have proven to be successful (24). TravInfo includes many public and private partners. The Metropolitan Transportation Commission (MTC) is the lead agency in developing, managing, and operating the project. In addition, a management board has been created to provide guidance on the project. The board includes representatives from MTC, Caltrans, CHP, FHWA, and the California Partners for Advanced Transit and Highways. Further, the relationship between the public and private sectors is strengthened by a forum of TravInfo ISPs. Approximately 100 public and private companies are represented in three meetings of the forum every year. This group determines the best ways to use the data produced by TravInfo and how to disseminate the information to travelers. Nearly 50 registered participants are part of the ISP forum. These individuals are very important as they are the ones developing new products and services that will disseminate the information that TravInfo provides (24).

A reliable and accurate data stream is also important. TravInfo has had occasional difficulty with the loop detectors. The private sector becomes reluctant in disseminating traveler information and seeking out the ATIS market when problems of this sort arise. Following national standards is also a consideration. The public sector is sometimes reluctant since officials are unsure of what the national standards may be (32).

Data are primarily disseminated from TravInfo through either the Traveler Advisory Telephone System (TATS) or the Landline Data System (LDS) (31). TATS is the telephone number service in which travelers can call up the system to obtain traveler information, while LDS is the system that TravInfo-registered participants may use to access the data via phone line.

The goals of the TravInfo project were as follows (adapted from [31](#)):

- collect and integrate traveler information;
- broadly disseminate information throughout the San Francisco Bay Area;
- provide timely and accurate traveler information; and
- stimulate and support the deployment of a wide variety of ATIS products and systems creating a competitive market with products providing a range of prices and capabilities.

Preliminary results of evaluations have shown that TravInfo has been successful in achieving the first goal, but the second goal is still far from being achieved ([31](#)). The volume of calls during the evaluation period (September 1996 to June 1997) was between 1,700 and 2,080 calls per day. This number equates to about 50,000 to 60,000 calls per month. Data in the spring of 1997 indicated that a conservative estimate of the average user of TravInfo is seven calls per month. Using the upper estimate of 60,000 calls per month would yield approximately 8,500 users--much less than the metropolitan area of six million. It is also interesting to note that 74 percent of the calls were for transit information during the evaluation period. Therefore, real-time data are not being disseminated as much as transit information. It is still relatively early to determine the success of marketing traveler information systems, and the private sector, along with the market, will determine this success in the future.

There were several other lessons learned by personnel at TravInfo ([24](#), [32](#)). The first is the fact that although it was beneficial to have buy-in from so many individuals and agencies, the large number of interested parties sometimes made decision-making cumbersome. The public and private sectors do not have much experience working with one another, and there was often confusion understanding one another and their roles and responsibilities. In addition, marketing of the product is very important. The TravInfo marketing campaign (public-service announcements, newspaper articles, billboards, etc.) was not adequate. Other areas developing an ATIS plan must consider the importance of marketing the system. To facilitate this need within a budget constraint, the public sector should consider free media opportunities that may be available to a public agency.

In addition, the private sector is reluctant to pursue a project without knowing there is a national standard since companies want to know that they can use software they develop elsewhere in the nation. Further, the uncertain future of ATIS makes it difficult to secure new registered participants. Since this technology is rather new and the future is uncertain, benefits have not been established for long-term planning and the education of stakeholders.

AZTech (Phoenix, Arizona)

The AZTech MDI is a seven-year project funded at \$35.5 million to increase the efficiency of the traveling public. The first two years of the project are for implementation, while the last five years of the project are for operations. Approximately \$4.6 million will be used for traveler information technologies (33).

The project is a partnership of several public agencies, private agencies, and individuals with the intent to provide traveler information through several types of media including in-vehicle navigation units, portable computers, pagers, cellular telephones, internet pages, cable television, and kiosks. TRW is providing communications technologies for traveler information. ETAK, Inc., will disseminate the traveler information through several means, and data fusion will be provided through ETAK's subcontractor, Metro Networks. Scientific Atlanta is also providing its subcarrier traffic information channel to users and rental companies to provide travelers with turn-by-turn instructions and traffic updates. In the end, AZTech will be one of the first fully-privatized ATIS in the nation (24).

The AZTech deployment initiative has the objective of getting information out to the traveler (24). Therefore, the partnership is allowing the private sector to use any services and technologies available for this objective. Public agencies are not concerned with revenue sharing at present, but as the private market establishes itself, may look into sharing revenue in the future. Since the major objective is to provide traveler information, this approach provides for the most flexibility of the private sector in providing the appropriate services and technologies.

Many additional lessons have been provided by the AZTech experience in Phoenix, including the following (34):

- Time will be needed to define the future market of ATIS. A free service must be provided since the public is accustomed to receiving some traveler information at no cost. This service may come from an internet source, television station, or telephone line. In the future, advanced technologies, such as in-vehicle devices, may have an established market.
- The Arizona Department of Transportation could not buy partners nor did it have a large budget for this project. However, other public partners were familiar with current transportation concerns, had a strong interest, and wanted to be involved. The private sector also had an interest because participants could see a market for the technologies and services. It is best if partners do not need to be bought to bring them into the project. If partners use their own money, they are more likely to care about the project and stay involved.
- The private-sector business plan must be considered in the development of the ATIS plan. The private sector must have adequate incentives to be involved in the project.
- There is a strong sense that ATIS is highly beneficial to travelers and that there is also a strong possibility of a highly successful market for technologies and services by the private sector. However, it is yet to be seen exactly how much comfort and convenience these systems can and will provide.

NAVIGATOR (Atlanta, Georgia)

NAVIGATOR is the name of the Atlanta area's ATIS effort led by the Georgia Department of Transportation (GDOT). The system's development was driven by the 1996 Olympic Games. Partners with GDOT include the five major metro Atlanta counties, the Metropolitan Atlanta Rapid Transit Authority, and the City of Atlanta. ATIS technologies and strategies include DMS, HAR, cable television, kiosks, and internet access.

Data are provided through loop detectors, CCTV, AVL on MARTA buses, and aerial helicopters that are available through a partnership with the Georgia Department of Public Safety. Each of the five counties has its own transportation control center. Data collected and obtained by any partner is available to any other partner that may want it (24).

Several important points can be made from the experiences of the NAVIGATOR ATIS effort. These experiences are as follows (adapted from 24):

- An immovable deadline ensures rapid deployment.
- A common cause ensures cooperation across most jurisdictional barriers.
- Fear of public embarrassment is a prime motivation for almost every agency.
- One or more champions with the authority to cause action is a necessity. Locally, this has been referred to as having a “Benevolent Dictatorship.”
- Standards must be set and enforced by state and federal agencies that have control of the funding.
- The technology enabling the implementation of ITS is changing so rapidly that some reversals (mistakes) are inevitable. These should be acknowledged as the price of innovation and should not be perceived as failure.
- Expectation management is difficult, especially with enthusiastic participants. If not controlled, reasonable tasks will grow out of reason as they are recounted by uninformed bystanders.
- Operational improvements must be accompanied by continuing budget support and personnel resources.
- Upper management must be kept informed and must commit the budget and personnel resources needed to operate and maintain the systems.
- Upper management must keep legislators informed and educated.
- Even controversial solutions to problems can be implemented with advance education and proper public notification (e.g., road construction, HOV lanes, ramp meters).
- Environmental conditions can be addressed by ITS. Traveler Information Systems and other air quality solutions work well together.
- The bureaucratic process in large government may be the biggest impediment to public/private partnering.

SmarTraveler (Boston, Massachusetts)

The SmarTraveler project began providing traveler information to the Eastern Massachusetts area in January 1993 and was funded as the first FOT. Travelers can receive

information by calling in on a touch-tone telephone. Construction and event information, along with traffic conditions, are available through the telephone service. Traveler information is also available in the region through an Internet congestion map and television and radio stations.

The SmarTraveler project is a public/private partnership between SmartRoute Systems, Inc. and the Massachusetts Highway Department (MassHighway). It is now in its fourth year of operation in the metropolitan Boston area. The following are some of the highlights of the evaluator's findings from surveying 2,000 users of the Traveler Advisory Telephone Service. These highlights are adapted from reference (35):

- Forty-eight percent of respondents reported the information they received during the particular call about which they were being questioned, had a direct influence on their travel decision making.
- Twenty-eight percent reported making some kind of change in their travel behavior.
- Fourteen percent reported changing the time of departure.
- Twelve percent reported using a different route.
- Two percent reported canceling the trip.
- One percent reported changing the route and time.
- Twenty percent indicated that they used the information to choose between two or more relatively equal alternative routes.
- Most of the remaining callers in some way used the information they received to verify that their preferred route would be viable.
- Eight percent reported they contacted others to indicate that they would be delayed, based on the information they received.
- Ninety-seven percent of users expected to use the service again.
- Eighty-five percent of users rated the service “8” or better on a scale of “1 to 10.”
- Sixty-eight percent reported reduced frustration as a consequence of using the service.
- Sixty-seven percent indicated that SmarTraveler provided all types of information that they desired from a traveler information service.
- Sixty-three percent reported the ability to avoid traffic problems.

- Fifty-nine percent reported that they saved time.
- Fifty-one percent reported that they were aided in arriving on time.

The SmarTraveler project has also provided valuable experiences from which other areas developing ATIS may benefit. Some of these experiences are as follows (adapted from [24]):

- MassHighway has gained an appreciation for the speed at which the private sector can transfer resources and establish relationships. In particular, SmarTraveler has been structured to allow SmartRoute Systems the flexibility to shift resources within an existing contractual framework and enter into non-exclusive agreements with other private-sector entities.
- An ongoing issue between MassHighway and SmartRoute Systems involves sharing information between the two organizations. This dynamic is framed by the need for MassHighway to ensure that its agents operate in a manner consistent with the legalities of the public sector and the need for SmartRoute Systems to manage its business in a competitive and confidential manner.

PRIVATE-SECTOR TRAVELER INFORMATION PERSPECTIVES

The [previous section](#) of this appendix discussed several traveler information systems in place throughout the United States. These experiences provide valuable insight into the planning, development, and implementation of traveler information systems. The following [section](#) will specifically describe the expectations and perspectives from some of the private-sector companies involved with traveler information systems.

SmartRoute Systems (Cambridge, Massachusetts)

SmartRoute Systems is headquartered in Cambridge, Massachusetts, and provides traveler information through its SmarTraveler service. The service provides information that is

located in regional operations centers to travelers through existing and developmental media. Travelers can receive several types of information, including route-specific, real-time traffic and transit information, weather conditions, turn-by-turn directions, flight information, and entertainment-related information. Another patented service provided by SmartRoute Systems allows travelers to be called, paged, or e-mailed when there are conditions along their frequented routes that they may desire to know (e.g., severe congestion on their main route to work) (36). The SmartRoute Systems is involved with projects in several cities, including Boston, Bridgeport, Philadelphia, Washington, D.C., Cincinnati, New York City, Detroit, and Minnesota.

There are several experiences that SmartRoute Systems can provide to other areas developing traveler information systems. Some of these experiences and recommendations are summarized below (37).

- Do not make RFPs too technical. Ensure that the objectives are performance-oriented and written at a relatively “high level” to ensure that the private sector has the flexibility to be creative in solving the problems through technical services and hardware. This is a new concept for the public sector, which is traditionally used to providing contracts that clearly specify design and construction terms. A good example of such an RFP is the Partners in Motion project in Washington, D.C. (previously described), in which functional requirements were written as well as objectives for the region.
- The future market of traveler information will surely experience technological advances. In relation to the bullet-point above, partnerships and contracts must allow the private sector to be flexible in providing technical services and equipment as technologies are advancing. The Partners in Motion project is also a good example of addressing this point, as public funding ends after the third year of the project, at which time the private sector is responsible for operating and maintaining the traveler information system.
- High risk means the potential for high reward. Although there are significantly high risks in what the future of the traveler information market may hold, SmartRoute Systems is aware of the risks and understands that there is a high reward potential if its efforts are successful.

- SmartRoute Systems indicates that there are some elements that provide encouragement when implementing its services to a metropolitan area. These include: 1) public officials willing to innovate with new opportunities, 2) an extensive existing infrastructure, and 3) market potential.

ETAK, Inc. (Menlo Park, California)

ETAK, Inc., is a subsidiary of Sony Corporation and has been in business since 1983. The company specializes in digital software mapping services and ITS.

One of the predominant concerns hindering the potential development and expansion of ATIS is the lack of national coverage. Many companies are leery of entering a market in which their product(s) will have limited coverage. It is the intent of ETAK, Inc., to develop this common format throughout several metropolitan areas with the ETAK Traffic WorkStation (TWS) (24, 38, 39).

In January 1997, ETAK and Metro Networks announced the implementation of their plans to install the TWSs in all locations throughout the United States where Metro Networks is located. Metro Networks is a traffic reporting service company that currently operates in over 65 metropolitan areas and will expand to 75 (Metro Networks and Shadow Traffic Services have subsequently merged under the Shadow Traffic Services name, but will continued to be referred to as Metro Networks in this section of the report for consistency purposes). The service provides broadcasts of radio and television traffic information. Combining Metro Networks' information with ETAK's TWSs will allow information to come from a variety of sources, including inductance loops, cameras, police dispatchers, traffic management centers, cellular phone callers, vehicle fleets, and surveillance aircraft. Communications can be provided by either wireline or wireless sources to end users using a variety of technologies, including in-vehicle navigation systems, PCs (fixed, portable, or handheld), pagers, telephones, cellular phones, kiosks, radios, televisions, and the like. The TWSs will act as an interface between data sources and ATIS products and services (24, 38, 39).

The objective of developing the TWSs with Metro Networks is to reach the maximum number of end users in the shortest amount of time with ATIS applications (39). A common

format for data as well as a national data set will be available when the project is completed, as all data from the 75 metropolitan areas will be available at ETAK headquarters in Menlo Park, California, and at Metro Networks' headquarters in Houston, Texas. This system will allow for a uniform format and protocol throughout the United States. Finally, additional information including news, sports, weather, stock quotes, personal alerts, and others will also be available as part of the National Rollout.

CUE Network Corporation (Irvine, California)

CUE Network Corporation was founded in 1984 and provides regional messaging throughout North America, including the United States and Canada. The company's TrafficNet service will eventually provide traffic information through Cue's FM subcarrier network to 600 markets and 570 FM radio stations. The coverage area includes 85 percent of the interstate highway system. Information is sent in radio data system-traffic message channel (RDS-TMC) format. Data are received with a standard RDS receiver with a software upgrade. The standard RDS-TMC format can accept data from all commercial service providers (e.g., SmartRoute Systems and ETAK) (40-42). In a given region, the network updates up to 50 incidents or 100 segment speeds in both directions every two minutes. The traffic data are all sent to the CUE headquarters in Irvine, where the national data server is located. The data are then sent by land line to Chicago where the data are uplinked to a satellite. The information is then broadcast to radio stations where the downlink can be addressed to receive only local information (42).

The company's president indicates that the use of this FM subcarrier allows wireless information to be provided to a number of devices and is compatible through different regions (43). Traffic information can be purchased at the subscription rate of \$60 per year. For this rate, the user receives two-minute traffic updates on 50 incidents and 100 segment speeds.

CONCLUSIONS OF ATIS EXPERIENCES

Institutional Issues and Public/Private Partnerships

One of the most recurring issues with regard to institutional issues and public/private partnerships is the importance of clearly outlining the roles and responsibilities of all agencies

involved (i.e., what is the role of the private and public sectors). Historically, the public and private sectors have not contracted with one another to the extent that ITS projects and arrangements are encouraging. The roles and responsibilities must be clearly outlined and understood.

RFPs should not contain highly technical aspects or detailed design specifications. Relatively “high-level” objectives and functional requirements should be described in the RFPs. This allows the bidders to utilize their creativity in developing the system without technical restrictions. The bidding private sector is likely to have a much better understanding of the current market trends and appropriate technologies and strategies than the public sector developing the RFP.

The final recommendation that is provided from an institutional perspective is that ATIS projects should be initially implemented with strong support from the public sector in supplying data, infrastructure, and initial funding. However, over time, the role of the public sector should decrease in terms of funding and the private sector should be encouraged to help develop the market for the services and take on the burden of further operation and financing. The public sector may be able to realize some revenues from the project at this point, while the private sector develops a successful market for the appropriate technologies and strategies.

Technical Aspects

Although it appears to be beneficial to keep project objectives and functional objectives of the RFP relatively non-constricting, it is necessary to consider some of the system design and specifications prior to initiating the project. It is important to begin to understand critical elements, including knowing what type of data will be provided by each agency and in what form. Realizing the bandwidth and potential communication needs of the integrated system, along with knowledge of the operating procedures of the public and private partners that may be involved, is also important. This will help to facilitate many of these planning steps after the project has been awarded.

Another technical aspect of importance is that it is best to automate the system to the highest extent possible. Although human operators are still necessary for system maintenance,

operation, and quality control checks, the more automated the system, the better. This is especially true when data originate from many different locations and may come in various formats.

There is also an issue of intellectual property. Public agencies that develop software with public funds may be subject to the Freedom of Information Act. Clearly, if released, this information would in all likelihood affect competing businesses that are attempting to develop an ATIS market. Therefore, it may be beneficial for the private sector to develop the software and simply provide a site license to the public agency.

Finally, education is important. The technical systems used to operate an ATIS, and many ITS strategies, may be quite different from those typically experienced by operators in the transportation field. Personnel must be properly trained in operating these ever-changing technologies.