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16. Abstract

This document provides interim guidelines and recommended action items for TxDOT in the pursuit of the most appropriate way to handle the administrative concerns of ownership of traffic management center (TMC) information, revenue opportunities associated with the data, and contractual agreements among agencies involved in the collection and dissemination of TMC data.

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INTERIM GUIDELINES FOR DATA ACCESS FOR TEXAS TRAFFIC MANAGEMENT CENTERS

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DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Federal Highway Administration (FHWA) or the Texas Department of Transportation (TxDOT). This report does not constitute a standard, specification, or regulation. The engineer in charge was Edward J. Seymour, Ph.D., P.E., (TEXAS, #50413).

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1. INTERIM GUIDANCE

There are four major sections in these Interim Guidelines for project 0-5213 "Data Access Requirements." This first section provides preliminary options for TxDOT to consider when considering data access. The second section describes the business environment for Intelligent Transportation Systems (ITS), the role of ITS data in that market, and the federal investments in the ITS marketplace. The third section describes traffic management center (TMC) specific business models and provides a characterization of TxDOT TMCs using those models. The fourth section highlights the results of the survey of TxDOT TMCs conducted during the first half of the project.

The ITS business environment is subject to free market forces, and only a limited amount of federal investment is being used to influence market growth and momentum. Widespread deployment of many ITS services and technologies predicted over the twenty-year life of the National ITS Architecture remain unrealized in the ITS marketplace. In spite of the existing marketplace experience, in the long run traditional TMCs may find significant competition for the production of ITS data. This competition may decrease the value, and therefore the market price, of public agency TMC data.

In the intermediate time period there is still an opportunity to leverage the value of TMC data. Based on the analysis to-date, the following interim guidelines and immediate action items are recommended.

- Continue to operate under existing agreements for data access until such time as this project is complete and TxDOT recommendations are available.

- If there is no formal signed agreement for data access in a particular district, develop one based on another district's agreement until such time as this project is complete and recommendations are available.

- Form a task group with a representative from each TxDOT District operating a TMC and including the TxDOT Operations Division (TRF) for the purpose of reviewing and discussing existing licenses and agreements for data access. Investigate the possibility of a standard agreement that could be used by all districts.

- Seek a TxDOT Office of General Counsel (OGC) and/or state attorney opinion regarding the legality of selling for profit real time traffic and video data to private entities (e.g., media, information service providers).

2. BUSINESS ENVIRONMENT

2.1. The National ITS Business Model – Role of TMC Data

This Project 0-5213 is concerned with access to ITS Architecture Flow data that is produced by a traffic management center.

In the early and middle 1990s the transportation community identified a vision for Intelligent Transportation Systems (ITS) and built a consensus-based set of high level requirements for the anticipated services and products that could develop in an ITS marketplace. These requirements were documented in a foundation product called the National ITS Architecture. Working with the requirements defined in the National ITS Architecture and with anticipated technology trends, the U.S. Department of Transportation (U.S. DOT) financed the development of ITS standards. The purpose of the ITS standards was to define the data, messages, and communications techniques that would link the systems described in the National ITS Architecture and would thereby provide ITS services.

The National ITS Architecture team of developers approached the Architecture definition task from a systems perspective. This enabled them to "unify" the diverse requirements, functions, and technologies involved in the transportation environment. Of course, the very nature of unifying differing perspectives creates a product that is different from traditional perceptions – hence, the introduction of concepts and terminology unfamiliar to traditionally trained transportation professionals.

ITS Architecture Flows contain the data that support ITS functions and services.

However, the National ITS Architecture effort started with a simple concept. There are goods and services (a.k.a., user services) that the implementation of ITS can provide to customers, who in turn will apply these services for their individual advantage. It is anticipated that the use of these services will collectively yield the benefits of reduced congestion, improved safety, more efficient operations, and increased productivity. Using the National ITS Architecture terminology, the data that support the goods and services are identified as Architecture Flows. This project 0-5213 is concerned with access to ITS Architecture Flow data that are produced by a traffic management center (TMC).

The ITS value propositions translate services and products into customer benefits that in aggregate may also produce mobility benefits.

It is important to note that most ITS applications will not be legislatively imposed on travelers; they are market driven. If ITS works for individuals and is cost effective, it is likely to produce meaningful mobility results. This is the capitalistic economic concept we use in everyday life. Customers buy a service from a business entity for personal consumption and in return receive a benefit or value for their purchase.

For a business, its "value proposition" is defined as the unique added value an organization offers customers through its operations. In the ITS marketplace the value propositions translate ITS services and products into customer benefits that in aggregate may also produce mobility benefits. In order to understand the role and opportunities for a traffic management center to identify and act on its value propositions for ITS data, the following sections describe the general environment of the National ITS market and the structure of typical TMC business models operating in that marketplace.

In this model ITS services are produced by various agencies that act as "factories" for the production of ITS services. These services are then "shipped" to ITS marketplace "shops" for use by travelers (the customers).

2.2. The ITS Market

In a general sense, when we consider the economic environment for consumer goods and services, there are producers, consumers, the transfer of goods and services, and financial transactions in return for delivery of services. The National ITS Architecture defines an environment that can be described from this perspective. Figure 2-1 illustrates a structural model of this economic activity for ITS and illustrates the flow of data (architecture flows) through this system. (1)

In this model ITS services are produced by various agencies and providers that act as "factories" for the production of ITS services. These services are then "shipped" to ITS marketplace "shops" for use by travelers (the customers). In some cases travelers pay for these services directly at the time they are received (e.g., paying a toll in cash). In other cases the costs of producing and delivering the services are paid indirectly through taxation at a different time from the receipt of the services. This difference in time between the delivery of services and the payment for those services through taxation is shown in Figure 2-1 as a "delay."

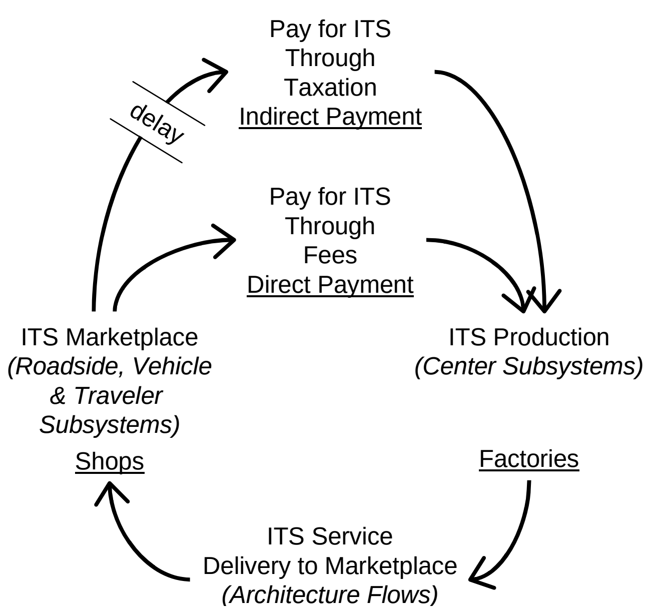

Figure 2-1 – ITS Market

The next four sections describe the main components of this National ITS market analogy. The components are the factories (defining who produces ITS), the shops (identifying where ITS is available to the traveler), the services (describing what ITS provides to travelers), and shipments to the ITS marketplace shops (defining how ITS services are delivered to the marketplace).

2.2.1. Factories – Defining Who Produces ITS

In the National ITS Architecture context, "factories" can be public agencies from which buyers "purchase" transportation-related services through taxation or they can be private sector providers who deliver user services for a fee. For example, providers can be state departments of transportation who provide traveler information through electronic roadside signs. In this case the costs for providing "data" services would likely be provided by taxes. (2) Or they can be information service providers who sell information regarding congestion and/or transit schedules directly to travelers – using a pager for instance.

Today, Centers produce most ITS data.

The National Architecture has devised a series of subsystems that represent the typical factories in this environment. These subsystems are named: traffic management, emergency management, toll administration, commercial vehicle administration, information service provider, transit management, fleet and freight management, and others. The entire group of provider subsystems is called center subsystems (or Centers in the figure below). In general, these subsystems are aligned with the organizational and institutional entities that provide ITS services – state and local governments, transit authorities, toll authorities, etc.

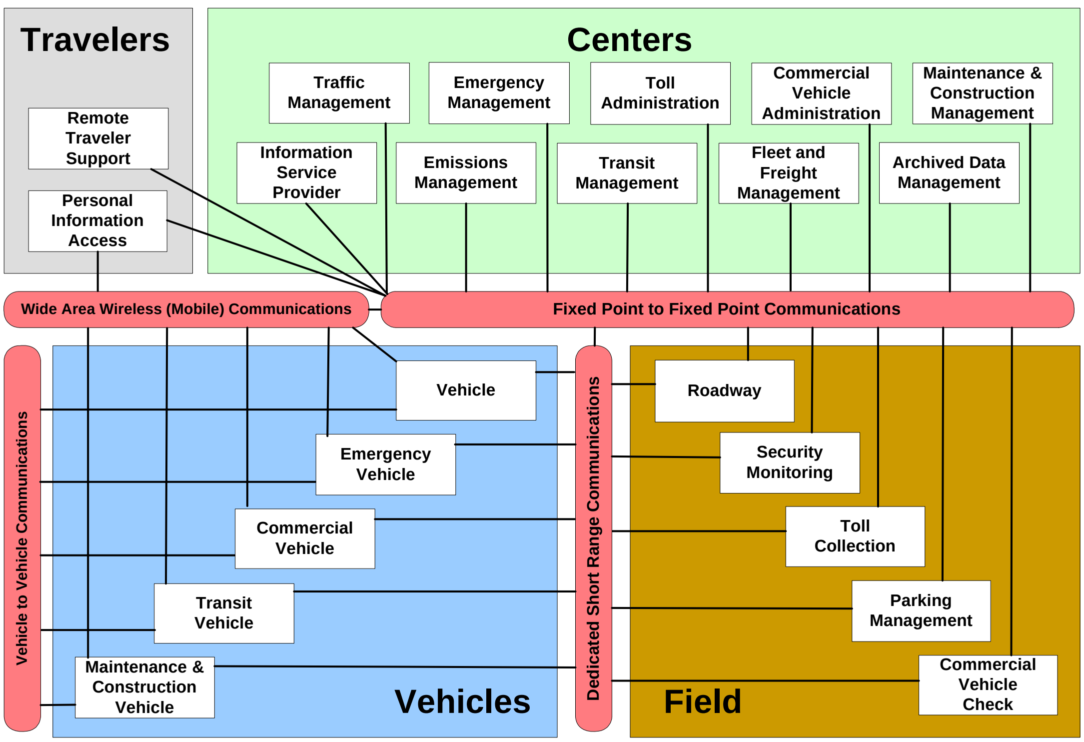

Figure 2-2 – ITS Architecture

Figure 2-2 illustrates the "physical entities" in the Architecture and their relationships with one another. (3)

2.2.2. Shops – Identifying Where ITS Is Available to the Traveler

In the economic model context, service providers need a marketplace to deliver their products to customers. For instance, they need shops in which customers can receive a service (a haircut, for example). In the transportation environment the providers need roadside devices that provide the service of traffic control (e.g., monitor and control traffic signals and ramp meters). Transportation providers need vehicle systems through which they can provide the service of vision enhancement that enables crash avoidance during foggy conditions. Transportation providers need remote traveler support subsystems (like kiosks) that can provide the service of pre-trip travel information.

The National Architecture has devised a series of subsystems that represent the typical shops in the transportation environment. There are three groups of these subsystems: roadside subsystems, vehicle subsystems, and traveler subsystems.

These subsystems represent typical "shops" in transportation: roadside, vehicles and travelers.

The roadside subsystem grouping is composed of equipment along the roadway including traffic signals, highway advisory radio equipment, dynamic messages signs (a.k.a., variable message signs), grade crossing warning systems, toll collection equipment, weigh-in-motion devices, and emissions and environmental condition monitoring devices.

The vehicle subsystem grouping is composed of technologies and applications on personal vehicles, transit vehicles, commercial vehicles, and emergency vehicles.

The traveler subsystem grouping is composed of technologies and services that enable a traveler to access travel information on personal computers from their home or on personal portable devices. It also defines applications to support access to travel information from shared devices, like kiosks.

2.2.3. Services – Describing What ITS Provides to Travelers

User services represent services travelers want from ITS.

The National Architecture began with a list of *user services* identified as part of the National ITS Program Plan prior to development of the Architecture. (4) These services represent the general types of capabilities customers want from ITS. Customers want route guidance, they want public travel security, they want electronic clearance of commercial vehicles, etc. These user services are grouped into bundles for convenience of description as follows:

- Travel and Transportation Management,
- Public Transportation Operations,
- Electronic Payment,
- Commercial Vehicle Operations,
- Emergency Management, and
- Advanced Vehicle Control and Safety Systems.

2.2.4. Shipment to the ITS Shops – Defining How ITS Services Are Delivered to the Marketplace

In a typical business model we tend to think of shipping or transporting goods between factories and shops where they are sold. In the National Architecture context *architecture flows* describe the flow of information between the subsystems.

2.3. Network Effects Business Model

Although it is difficult to identify the precise business models used to build the ITS marketplace, the federal government has continued to be a key facilitator of change.

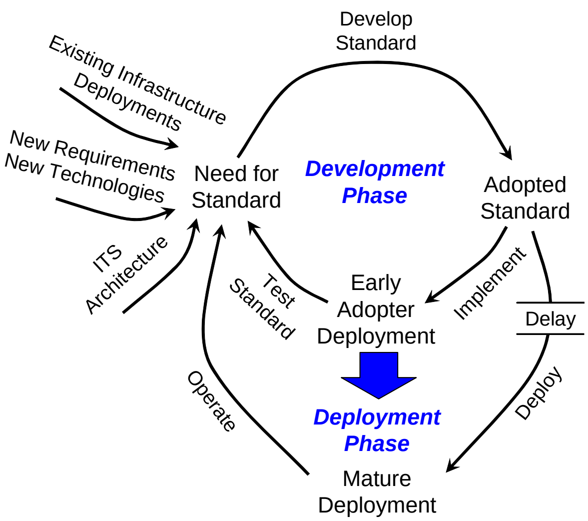

Figure 2-3 – Federal ITS Market Investment

The idea was to use federal and donated resources to fund the development of standards that would then be implemented by early adopters (using their own funding) who would subsequently provide feedback to the standards development process. The strategy is shown in the top loop of Figure 2-3.

As standards mature in the marketplace, the strategy moves from one emphasizing a "development phase" as early adopters are replaced by deployments based on mature standards and deployment experience. This transition is illustrated by the downward arrow in Figure 2-3.

Federal investment is primarily on the upper loops; state and local funding are on the lower loops.

Federal investment is primarily at the top of these loops and along the "test standard" path in Figure 2-3. State and local funding is along the implementation, deployment, and operation paths. It is also along the "develop standard" path through the contribution of volunteers who participate in the consensus standards development process.

This strategy has characteristics of a "networks effect" business model where standards enable multiple firms to interoperate, thus allowing network externalities to benefit the entire market. The network effect causes a good or service to have a value to a potential customer dependent on the number of customers already owning that good or using that service (ITS service in this case). That is, the more people who consume the good, the more each person will benefit and the more each person is willing to pay to acquire it.

By lowering the cost of entry though the development of the architecture and standards, deployments of ITS products and services are being seeded within a network effects model.

Deployment of ITS products and services is being seeded through the development of architecture & standards.

So what has happened? With a large number of standards and interdependencies, not all activities moved along the paths at the same rate. In addition, the differences in "product" complexities and installed base have created different opportunities. Some services, such as center-to-center standards, are only sparsely deployed in the transportation marketplace. Others, like traffic signals, are widely deployed. Still others, like camera control, have been historically driven by non-transportation industries such as security monitoring.

So, in effect, we were using one business model to engage a number of different market segments, and we've had differing results in the market segments. Few ITS standards are mature and widely deployed in 2005. In many cases more development work will be needed as early adopter deployments are just now providing significant feedback to the standards development process.

In spite of those mixed outcomes, a number of standards have been developed and adopted by the standards development organizations, and they have gone through the multi-year procurement and deployment cycle typical of public sector organizations. Whether those standards can mature enough to encourage a network effect has yet to be demonstrated.

3. TEXAS TMC BUSINESS PRACTICES FOR DATA ACCESS

3.1. TMC Business Model Overview

TMCs follow one of nine business models.

Traffic management systems and their associated traffic management centers (TMCs) are deployed in many different configurations. The Federal TMC Pooled Fund Study sponsored a *TMC Business Planning and Plans Handbook* activity that characterized TMCs into various management and functional categories as follows. (5)

- Geographic area covered
  - Single jurisdiction TMC
  - Multiple jurisdictions TMC
  - Regional or district TMC
  - Statewide TMC
- Number and type of agencies involved
  - Single agency TMC
  - Multiple transportation agencies
  - Multiple agencies and disciplines
- Operating mechanism
  - Public agency staffed and operated TMC
  - Private sector staffed and operated TMC

3.1.1. Geographic Area Covered

Geographic definition is probably the most basic decision to be made in developing a traffic management system (TMS). Although other categorizations (e.g., multiple agencies, disciplines, operating mechanism) may influence the design and mission of the TMS, geographic definition is basic to any structure.

3.1.1.1. Single Jurisdiction Management Structure

The most common model is the single jurisdiction model. It is probably the easiest structure to operate because decisions and supervision are vested in one entity. In an urban area where there may be multiple other autonomous agencies, there may be a measure of cooperation and coordination without a unified management structure or data communication system.

3.1.1.2. Multiple Jurisdictions Management Structure

The multiple jurisdictions management model has application in larger metropolitan areas where multiple jurisdictional boundaries may abut. In a large urban area, a driver can travel on a major thoroughfare and pass through several cities each with its own computer-based signal system.

While drivers are not necessarily aware when they cross a jurisdictional boundary, they may be aware if the signal systems are not compatible.

3.1.1.3. Regional or District Management Structure

The regional or district model is a further iteration of the multiple jurisdictional model. While the multi-jurisdictional model will likely involve jurisdictions in which boundaries abut or a cluster of jurisdictions, a regional or district model will involve such clusters that may be more distantly located. Rural areas may also be incorporated.

3.1.1.4. Statewide Traffic Management Structure

The nine business models may overlap in some TMCs.

A statewide management structure will be influenced by the geographical size of the state as well as the number of major metropolitan areas contained therein. Although usually the initiator is the state transportation department, other related agencies, such as state highway patrols, may be co-located.

3.1.2. Number and Type of Agencies Involved

Previously described models have centered on geographic and jurisdictional considerations; the agency focus expands the jurisdictional aspects to related agencies. Geographical considerations may still influence some of the agency models.

3.1.2.1. Single Agency Management Structure

This structure, with a single agency (e.g., traffic department) within a jurisdiction has many of the same characteristics of the single jurisdictional structure.

3.1.2.2. Multiple Transportation Agency Management Structure

This structure would be characterized by the alliance of several transportation agencies, e.g., transportation departments of two or more cities combine forces to operate the traffic signal systems of the two agencies as a single system.

The definition of this structure would not include related agencies such as enforcement.

3.1.2.3. Multiple Agency and Disciplines Structure

Because of the complex nature of multiple agency and disciplines structure, it will the most difficult to implement. Numerous interagency agreements and agreed upon operating policies and procedures will need to negotiated. However, the cost efficiencies and the benefits of coordinated management will usually outweigh these complexities.

3.1.3. Operating Mechanism

Either of the two operating mechanisms described below may apply to the previously described management structures.

3.1.3.1. Public Agency Staffed and Operated Management Structure

This structure is perhaps the preferred model for most agencies since they will have direct control and management of their system. This assumes that adequate funding is available for both operational activities and personnel.

3.1.3.2. Contract Operation Management Structure

Depending on available funding, all or a part of the operational responsibilities may be contracted to a private organization or even another agency.

3.1.4. TxDOT TMC Business Models

TxDOT TMCs vary widely as to the business models they employ.

TxDOT currently operates eight transportation management centers across the state in Amarillo, Austin, Dallas, El Paso, Fort Worth, Houston, Laredo, and San Antonio. The TxDOT TMCs are all freeway management centers although other transportation agencies are co-located in some TMCs. The TxDOT TMCs vary widely with regard to services provided, coverage, maturity, and partnering with other agencies. Table 3-1 provides a summary for seven of the TxDOT TMCs operating system characteristics as described in the preceding sections.

Table 3-1 – TMC Operating System Characteristics

Traffic Management Center	Geographic Area	Number and Type of Agencies	Operating Mechanism
Austin CTECC	Regional (City & County)	Multiple Agencies and Disciplines 4 agencies, 4 disciplines TxDOT ITS, TxDOT Courtesy Patrol Austin PD, Austin FD Austin Transportation Austin/Travis Co. EMS Sheriff, Constables Office of Emergency Management Capital Transit Dispatch	Public Sector Operated
DalTrans Dallas, TX	Regional (Multiple jurisdictions in large metro area connected for data exchange)	3 Agencies, 3 disciplines TxDOT ITS DART (transit) HOV Sheriff dispatch of Courtesy Patrol City of Dallas (police / fire / EMS / traffic)	Public Sector Operated
El Paso TransVista	Regional (City & County)	Single agency TxDOT ITS, TxDOT Courtesy Patrol City of El Paso (police / fire / EMS / traffic)	Public Sector Operated
Fort Worth TransVision	Regional (Multiple jurisdictions in large metro area connected for data exchange)	Single agency TxDOT ITS, TxDOT Courtesy Patrol Connected: City of Fort Worth (police / fire / EMS / traffic)	Public Sector Operated
Houston TranStar	Regional (City & County)	5 agencies, 4 disciplines TxDOT ITS, TxDOT Courtesy Patrol METRO Transit City of Houston (police / fire / EMS / traffic) Harris County Emergency Management	Public Sector Operated
Laredo STRATIS	Regional (City & County)	Single Agency TxDOT ITS, TxDOT Courtesy Patrol City of Laredo (police / fire / EMS / traffic)	Public Sector Operated

Table 3-2 – TMC Operating System Characteristics (continued)

Traffic Management Center	**Geographic Area**	**Number and Type of Agencies**	**Operating Mechanism**
San Antonio TransGuide	Regional (City & County)	Multiple Agencies and Disciplines 3 agencies, 3 disciplines TxDOT ITS, TxDOT Courtesy Patrol City of San Antonio PD Dispatch VIA Metropolitan Transit Dispatch Emergency Management Emergency Responders Some City of SA Traffic Staff	Public Sector Operated

4. OVERVIEW OF TMC SURVEY FINDINGS

TxDOT currently operates eight transportation management centers (TMCs) across the state in Amarillo, Austin, Dallas, El Paso, Fort Worth, Houston, Laredo, and San Antonio. The TxDOT TMCs are all freeway management centers although other transportation agencies are co-located in some TMCs. The TxDOT TMCs vary widely with regard to maturity. One center will celebrate ten years of operation this year (San Antonio) and another TMC has been on-line for less than two years (Austin). The TMCs also vary widely as to the services they provide, the types of data they collect and save, and the data they share. All TMCs have communications with other transportation providers and related agencies (such as enforcement and emergency services) either directly or indirectly, so that traffic and transportation data and operational information may be shared.

The researchers interviewed staff from each of seven TxDOT TMCs. All researchers worked from an identical interview document to ensure that consistency was maintained. The following paragraphs summarize information key to this project.

The need for and types of traffic data varies among drivers, operating agencies and private providers.

4.1. Typical Traffic Data Collected

The seven TxDOT transportation management centers typically collect data that are relevant to their mission of providing service to the travelers in the area. These data would include freeway operating conditions (speed, travel time) and locations of incidents that may affect freeway capacity. Other data collected will assist the operators in evaluating efficiency (volume, occupancy) but may be of less interest to those outside the agency such as drivers, information service providers (ISP), and media traffic reporters.

4.2. Quality of Data Collected

Most respondents considered the data collected to be of good quality. However, some respondents commented that field hardware outages sometimes degraded the data until repairs could be accomplished. Due to the cost of the field repairs, funding, and manpower limitations, reinstatement of operation was sometimes delayed. This delay compromised the data integrity at the locations in question.

Data quality is considered good when hardware systems are functional.

4.3. Types of Data Requested

4.3.1. Traffic Data

- Speed – Operating speed of particular freeway sections
- Travel Time – Estimated travel time from one freeway landmark (normally a major crossing street or freeway) to the next

- Other Data – Typically not of interest to the traveler or the ISP occupancy or traffic volume on a real time basis

4.3.2. Video Data

- Snapshots – Snapshots of a video frame would typically be provided on the TxDOT TMC web site or at a kiosk.
- Full Motion – Because of the bandwidth requirements, full motion video is normally only made available to commercial televisions or ISPs who are willing to pay for their own connection and equipment.

4.3.3. Freeway Incident Locations

Video data snapshots and full motion video are generally of interest to all parties.

Travelers, media, and ISPs have great interest in location of freeway incidents for obvious reasons. TxDOT makes these data available in a variety of ways, including their web sites.

4.3.4. Weather Data

Typically, weather data are not provided by the TMC directly. However, most TxDOT web sites provide a link to a no cost commercial provider.

4.3.5. Alternate Routing

Typically TMCs do not provide specific alternate routing; rather, traffic conditions are provided and the traveler makes his/her own choice.

4.4. External Requests for Data

Requests for traffic data have been received from the following parties:

- Travelers
- News Media
- Independent Service Providers
- Municipal Traffic Departments
- Enforcement and Emergency Services
- Transit Agencies

4.5. Medium for Data Access

There is not a standard agreement for data access: wording varies among districts.

While some traffic data may be accessed free of charge through the internet, TMCs generally require that agencies or private companies provide their data transmission medium (leased lines, leased fiber, owned fiber) and necessary equipment at their own expense for direct connection. The choice of medium has been left to the agency or company.

4.6. Typical Agreements for Data Access

The seven TMCs had a variety of arrangements for providing traffic and video data. All but one of the TMCs had a formal legal agreement for providing data. There was not a uniform agreement used by all agencies. However, TxDOT Austin requires review and approval of any such agreements.

4.7. Cost Associated with Data Access

Typically traffic data are provided free of charge to requesting agencies.

Costs over and above TxDOT's normal operational expenses are required to be paid by the requesting party.

4.8. Summary

Although the specific agreements and types of data provided varied from district to district, it appears that the existing arrangements work fairly well from the perspective of those interviewed. However, it may be prudent to standardize the agreements and policies among districts in the future.

5. NOTES AND REFERENCES

1 The systems drawing in Figure 2-1 is not included within the National ITS Architecture. It is a product developed by Dr. Seymour, a coauthor of this report, and is patterned after the business systems processes described by Peter M. Senge and others.

2 However, there may be opportunities to provide an income stream through advertising associated with the signs.

3 The National ITS Architecture documentation can be found at the following web site: http://www.iteris.com/itsarch/.

4 "National ITS Program Plan Synopsis," ITS America, 400 Virginia Avenue, S.W., Suite 800, Washington, D.C. 20024. ITS America, March 1995. Available from the ITS Electronic Document Library (EDL), Doc. No. 3845, http://www.its.fhwa.dot.gov/cyberdocs/welcome.htm .

5 The TMC Pooled Fund Study sponsored a project to develop a *TMC Business Planning and Plans Handbook* during the 2004 – 2005 time period. The Pooled Fund web site is located at http://tmcpfs.ops.fhwa.dot.gov. Drafts of the Handbook could be found at http://tmcpfs.ops.fhwa.dot.gov/cfprojects/new_detail.cfm?id=54&new=0.