Pomona Valley
ITS Project

Project Deliverable 7.4.2

ATIS Analysis Report

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December 1, 2004

099017000.1

HISTORY OF REVISIONS

Version Date
5/29/02
7/19/02
10/15/02
02/27/03
02/04/04
12/01/04 - FINAL

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PROJECT DESCRIPTION

The County of Los Angeles, in cooperation with the cities within the Pomona Valley, has determined that development of an Intelligent Transportation System (ITS) in the Pomona Valley would help to reduce congestion, enhance mobility, provide traveler information during non-recurring and event traffic congestion, and manage event traffic. The Pomona Valley Intelligent Transportation Systems (PVITS) project was conceived as a recommendation from the Pomona Valley ITS Feasibility Study completed by the LACMTA in 1995. The ultimate objectives of the project are to:

- Improve mobility by optimizing traffic management on arterials and freeways;
- Enhance Route 60 capacity by better coordinating freeway traffic with parallel arterials;
- Improve agency efficiency by coordinating management of operations and maintenance efforts among and between agencies; and
- Increase agency staff productivity by providing low-maintenance, high-quality communications and computational tools to assist in daily management and coordination activities.

Phase 1 of the PVITS project is the development of a conceptual design that defines solutions to enhance capacity, reduce congestion, and improve traveler information in the Pomona Valley.

1.0 BACKGROUND

1.1 Purpose of Report

This report evaluates various types of traveler information systems that could be developed and deployed to support the traveler information goals of the PVITS project. The goal of the Advanced Traveler Information System (ATIS) for the Pomona Valley is to provide accurate pre-trip and en-route information to motorists about current road conditions, closures, restrictions, incidents, and other factors that could affect their commute. The ATIS will use real-time data generated by the Advanced Traffic Management System (ATMS) as well as event information from the various jurisdictions entered through the Information Exchange Network (IEN), and current travel condition information to broadcast information to motorists over various public and private systems.

For a part of the ATIS analysis for the Pomona Valley, several regional ATIS programs were reviewed and the results are documented in this report. This review specifically examined those ATIS programs with arterial traveler information components, inter-jurisdictional information sharing, and web and phone based ATIS systems.

The recommendations identified in this report are based upon the user and functional requirements, existing and planned ATMS, integration with other ATIS in nearby regions, and the objectives of the forum agencies for the regional traveler information program as identified in various reports submitted under previous tasks.

1.2 Methodology

The purpose of this ATIS analysis was to evaluate potential ATIS elements for deployment in the Pomona Valley as a part of the PVITS program. Five ATIS elements were analyzed for:

- Technology application and benefits;
- Needs and requirements addressed by the particular element/ technology;
- Operational requirements, maintenance, successes and challenges;
- Cost; and
- The potential for reaching travelers.

The analysis also looked at technologies and systems that have been successfully used in other regional ATIS programs, to identify which systems, elements, and technologies would meet the PVITS functional and user requirements for traveler information. The study team selected four metropolitan area ATIS systems for analysis:

- Orange County;
- Seattle;
- Phoenix; and
- Salt Lake City.

These areas have established ATIS programs and use hybrid systems that consist of multiple technologies for en-route and pre-trip information.

Recommendations of the ATIS technology analysis were then summarized, and include technology, deployment recommendation and benefits.

1.3 Report Organization

The information in this report is presented in the following sections:

Section 1 – Introduction

Section 2 – Evaluation of Potential Elements and Technologies

Section 3 – Evaluation of Other Regional ATIS Systems

Section 4 – ATIS Summary and Recommendations

2.0 EVALUATION OF POTENTIAL ELEMENTS AND TECHNOLOGIES

Based on the Project Architecture and ATIS User and Functional Requirements, the following elements are included as part of the ATIS evaluation for the PVITS:

- Highway Advisory Radio (HAR);
- Closed Circuit Television (CCTV);
- Dynamic Message Signs (DMS);
- Community Access Television (CATV);
- Public ATIS Web Site;
- Highway Advisory Telephone (HAT); and
- Kiosk

The purpose of this evaluation is to look at potential elements and technologies that could be deployed over time to meet the travel information needs of agencies and travelers in the Pomona Valley. The elements and technologies were evaluated based on their performance in other ATIS systems, and were examined using criteria including operational requirements, maintenance requirements, cost, technology issues, and usage. The results of this evaluation are presented below and in more detail attached in **Table A** in Appendix A.

The ATIS will rely on real-time data from the ATMS, near-real-time and static data from the IEN, and multimodal information in each city. Although integral components of the ATIS, these systems are functioning, stand-alone systems that will serve as data sources and as such are not included in this evaluation. Communications needs for the components evaluated are included.

2.1 Highway Advisory Radio (HAR)

HAR is used to provide en-route information about closures, restrictions, construction, detours/alternate routes, hazardous weather, special events and other factors that could impact travel. Although FM broadcasting is available (though there are fewer FM frequencies available, and hence they are difficult to obtain), HAR messages typically broadcast over AM radio frequencies. The average range is from 3-5 miles, depending upon the terrain. A 5-year license for a HAR station is obtained by filing a Form 601 with the Federal Communications Commission (FCC).

HAR is available in digital and analog technologies. The analog system has fewer capabilities, in terms of uploading, selecting, or otherwise preparing messages for dissemination. An analog HAR system allows a user to either record a message manually onto an audio tape or select a pre-recorded message using a touch-tone telephone. The analog message is then played on the HAR in the field. It is also possible to input messages locally, at the field controller, in the event of telephone line failure. An analog system requires messages to be recorded carefully for message clarity.

Digital HAR is a new technology that converts messages digitally from a central system or ATMS into voice messages for HAR broadcast. Digital HAR brings HAR into real-time – with messages changing on HAR stations as conditions change, which increases HAR message-relevance to the driver.

Technology

HAR technology is readily available and widely used. It has been widely deployed in urban and rural areas. HAR is scalable and can easily be expanded to allow for new devices. The removal or addition of devices will not impact performance of the system. Software Interface Modules allow the incorporation of HAR control into any integrated software solution. It is adaptable to disseminating new sources of information, as messages are recorded at the Traffic Operations Center (TOC) and sent via telephone line to the field unit. Applicable technology standards are listed in the Table A in Appendix A.

Requirements

Currently HAR technology supports all Functional Requirements except

- Performance Requirements
    - SFR 1.4: The ATIS shall include features for automatic update and clearing of information governed by the policies of the responsible agency(s).
    - SFR 1.7: The ATIS shall be capable of providing information to private entities (media and ISP) for dissemination via web-based, phone-based and telematics devices.
    - SFR 1.8 (N/A): The ATIS shall include a usage tracking function capable of generating usage levels by devices, types of information accessed, and other queries to support ATIS evaluation.
- Equipment and Technology Requirements
    - SFR 2.1: The ATIS shall interface with legacy and new information devices and systems, including the traffic control system devices. This may include, but is not limited to, traffic detection devices, ATMS, ATIS, Dial-in Telephone Service (511), Kiosks, Internet CCTV, and multimodal Automated Vehicle Location (AVL) systems.
    - SFR 2.2: The ATIS data consolidation system shall be based on an open architecture, and shall include all necessary information processing algorithms.
    - SFR 2.4 (N/A): The ATIS shall include a graphical user interface for operations.
- Data Management Requirements not applicable to standard HAR
- Availability of Technology Requirements

- SFR 4.2 (N/A): The ATIS shall be capable of interfacing to competing and complementary technologies from a variety of vendors using ITS standards.

- Adaptability Requirements
  - SFR 5.2 (N/A): The ATIS shall be capable of interfacing with new traffic collection and dissemination devices as they are deployed.
- Operational Considerations Requirements
  - SFR 8.2: The ATIS shall include security and firewall capabilities to control access to all functions within an agency, between agencies, and from outside entities such as private ISPs and the media.
  - SFR 8.3: Security and access shall be password based and defined by roles.
  - SFR 8.4 (N/A): Parameters for access levels shall be set by user (agency).
- System Interface Requirements not applicable to HAR (does not directly interface with outside systems)
- Reliability Requirements
  - SFR 12.1: Data shall be fused 24-hours a day, 365 days per year.
  - SFR 12.7 (N/A): The ATIS shall include a backup server to provide for automatic transition of system operations in the event of a malfunction of the primary server.
- Flexibility Requirements
  - SFR 13.1: The ATIS shall have the capability to interface with all existing and proposed ATIS equipment.

Additionally, Digital HAR would address the following:

- Performance Requirement SFR 1.4: The ATIS shall include features for automatic update and clearing of information governed by the policies of the responsible agency(s).
- Data Management Requirement SFR 3.1: The ATIS shall be capable of automatically collecting data generated by field devices.

O&M

Analog HAR requires an operator to determine when there is a message, to record the data for the message, and to turn off the message when it is no longer valid. Operations for analog HAR are intensive and therefore some agencies choose not to use this option.

Digital HAR has a higher capital cost than that of analog HAR, but lower operational cost. Digital HAR processes such as Interactive Voice Response (IVR) can reduce operational needs. IVR is a component that, in the context of HAR, would convert system data into voice messages for distribution via HAR.

Cost

The capital cost of HAR varies between $16,000 - $32,000/radio and includes all the equipment as listed in Table A in Appendix A. Operations and maintenance costs are estimated at $1,000 per year, including staff hours and maintenance.

Applicability to Pomona Valley

The occurrence of incidents within the project area impacts the route choice drivers make. HAR would be an appropriate ITS tool for drivers to confirm incidents and making educated and informed driving decisions. Not only can HAR assist in day-to-day roadway traffic management, but by acquiring portable HAR, these units could also be used effectively in the Fairplex area for event traffic management. The technology for HAR is cost effective and low-maintenance and can reach a broad audience.

Advantages

Advantages of HAR include the following:

- HAR technology is readily available, widely used, cost-effective and low-maintenance. New digital HAR provides for real time applications.
- Portable HAR units can be moved to high impact locations as needed (Fairplex, freeway to freeway interchanges, construction zones and rail crossings)
- HAR can provide event-specific en-route information.
- Can use recorded messages or text-to-speech applications.
- Potential to reach a wide audience.

Disadvantages

- Analog HAR can be time-consuming to keep up-to-the-minute message content being disseminate; the requirement of staff time to record new messages for dissemination on analog HAR can be prohibitive.
- Requires motorist action to tune to the HAR broadcasting station and motorist must listen to the entire message if part of the message is missed.

Recommendations

In the time since this evaluation was conducted, Caltrans has planned, designed and is installing HAR within the study area on SR-57 as a part of a traffic operation system (TOS) project. The nature of the HAR technology is that it is broadcast over a wide area and as such, additional HAR deployment would not be possible within the same area in the Forum.

2.2 Closed Circuit Television (CCTV)

CCTV cameras are generally used to provide an operator at a TMC with the ability to remotely visually confirm an incident and its impacts. In addition to incident verification, CCTV cameras also can verify weather conditions being reported from a road weather information system, assist with congestion-related studies, and increase information sharing with the public and the media. CCTV cameras also can be used to visually determine roadway conditions in spot areas where other means of vehicle detection are limited or non-existent. CCTV also can provide verification of Dynamic Message Sign (DMS) messages. Video can be made available to the public via ATIS such as web sites and kiosks.

Technology

The field components of the CCTV subsystem are controlled and operated by equipment located at the central operations point or TMC. The central CCTV control system takes commands issued by operators, routes them to the field equipment, and displays images sent by the CCTV cameras in the field. These components have little bearing on the selection of the field CCTV units other than compatibility issues.

In evaluating methods of providing Internet access of the CCTV camera outputs the following guidelines are recommended:

- Internet access needs to be secure (one way access);
- Reliable, highly available and simple to use; and
- Non-intrusive to other operations.

Historically, video has been transmitted in analog from the field to the central system. While analog transmission is proven technology, digital can provide greater benefits over analog, including ease of video sharing and enhanced video quality, as the signal does not degrade on its transmission path. Current implementations of digital transmission have encountered issues regarding the reliability of the video codecs (the equivalent of a video multiplexer in the analog technology).

The transmission of digital video over Ethernet (Gigabit Ethernet is the recommended communication medium for the Pomona Valley Forum) alone has recently become feasible due to the progression of digital video standards. Due to the momentum of Ethernet communications and the progression of digital video transmission standards, field hardened digital video equipment is anticipated to be in widespread use within the next ten years.

Requirements

CCTV supports all User Requirements except the following:

- UDR 1.9 (N/A): The ATIS shall be capable of consolidating and displaying traffic volume, speeds, incident, closure, special event, and other relevant information on the color-coded maps with easily identifiable icons and graphics.

CCTV supports all Functional Requirements except the following:

- SFR 3.3 (N/A): The ATIS shall be capable of receiving information from other stakeholders

O&M

CCTV cameras are used as needed by operators as a tool to check problematic intersections, to confirm operations when new time plans are implemented, and to potentially to confirm and manage incidents.

Typical maintenance for CCTV is estimated at five percent of capital cost in order to cover standard replacement of parts as necessary and maintenance of communication networks needed to relay graphic info back to the traffic management center.

Costs

Capital costs for a CCTV camera are estimated at $30,000 per installation (including poles) and operations and maintenance costs are estimated at $1500 per year. Additionally, the communications network needs to be sized to accommodate the quantity and quality of video desired (these costs are included in the communications conceptual design component). Digital and analog video transmissions are comparable in cost.

Advantages

The following advantages are identified for using CCTV cameras:

- Video can be used to reduce maintenance staff time in responding to complaints by providing a remote view of field conditions prior to going to the field. This view could eliminate some field visits and could prepare maintenance staff better prior to the other field visits, making the trips more efficient.
- CCTV images can supplement real-time arterial maps based generated by an ATMS by providing visual confirmation of roadway conditions. The images can lend credibility to the map data for the general public and traffic operations/ maintenance staff.

Disadvantages

The following disadvantages are identified for using CCTV images:

- Cost of deployment;
- Additional communications capacity necessary to transmit images;
- Public concerns regarding privacy and use of images*
- Public concerns regarding aesthetics*

* While these are traditional, potential hurdles to CCTV camera implementation in some areas, discussions with the individual Pomona Valley cities confirmed that these will not be challenges to CCTV camera implementation in this Forum. For example, the city of San Dimas, while expressing concern over these issues, communicated a great need for CCTV implementation.

Recommendations and Applicability to Pomona Valley

CCTV cameras can be a valuable tool to traffic, engineering and maintenance staff in their daily activities. The cameras can be used for confirmation of field conditions, assessment of timing plan change impacts, spot checking of complaint calls prior to field checks, and various other traffic operations and engineering applications. CCTV cameras are recommended for traffic management use in the Pomona Valley.

Additionally the dissemination of CCTV images to the general public is an appropriate ITS tool for drivers to confirm incidents and making educated and informed driving decisions. CCTV cameras are recommended for implementation in the Pomona Valley region. Dissemination of CCTV images to the public is recommended.

Digital CCTV is recommended for use in the Pomona Valley Forum for advantages over analog for comparable costs, including ease of video sharing. It is anticipated that the reliability issues will be

worked out prior to implementation in the Pomona Valley. Digital CCTV is being deployed as a standard in all Forum projects per a decision by Los Angeles County DPW.

2.3 Dynamic Message Signs (DMS)

The primary function of DMS is to provide en-route information to drivers in spot locations regarding current traffic conditions. This information can assist drivers in choosing to take alternate routes or remain on current routes based on real-time information about adverse conditions.

Technology

This section describes each of the technologies evaluated and provides the pros and cons of each technology:

- Extinguishable or Blank-out signs
- Changeable Message Signs
- Dynamic Message Signs

Extinguishable or Blank-out signs are single message signs that can be turned on and off. The advantage of blank-out signs over static signs is that the information is only visible to drivers when they are on, thus increasing motorist confidence that the information is current and applicable. The cost for a blank-out sign is less than a Variable, changeable, or dynamic sign.

Figure 1 - Blank-out Sign Example

Changeable message signs (CMS) have a limited number of pre-defined messages that an operator can choose from for display. Messages can be chosen for display from this list, but a message cannot be developed "on the fly" by an operator. Film module signs and rotary signs, are typically associated with this category (detailed descriptions of each are provided in the following sections). Light Emitting Diode (LED) signs that do not have a complete matrix of pixels also are included in this category. CMS messages can be selected for display from a remote location. Again, cost for this limited capability sign would be lower than a fully dynamic message sign (described below). CMS technologies are also older than DMS and visibility is not as clear.

Film Module Signs

The film module sign consists of up to thirteen transparent Mylar signs, plus one opaque blank, wrapped around two rollers that are rotated by an electric motor through a shaft and worm gear arrangement. The roller ends and drive shaft are fitted with bearings affixed to the sign cabinet with brackets. The module assembly resembles the method used to assemble ancient scrolls. It is sometimes referred to as a scroll sign for this reason and because the signs scroll past when the message is being changed. These signs are available in both "internally illuminated" and "externally illuminated" options. Internally illuminated signs use one or more 75W florescent bulbs to back light the sign. Back lighting the sign enhances the

appearance of the sign, but also increases the temperature inside the sign cabinet limiting the operational temperature to +140 °F. Similarly, externally illuminated signs use one or more 75W florescent bulbs to light the surface of the sign. They have an operating limit of approximately +158 °F. The florescent bulb(s) are typically mounted behind the viewable area of the sign where drivers cannot observe them. Externally illuminated signs with diamond reflective sign surfaces also produce a highly readable and attractive sign without adding heat to the internal cabinet environment. Both options require a ballast resistor mounted within the sign cabinet. The lower temperature limit of the operating range for signs using a ballast resistor is typically –4 °F. A blank-out film module sign uses a blank screen.

The advantages of film module signs are:

- Lowest cost of all the technologies except static;
- Attractive when viewed;
- Ability to display different messages that may be required (as compared with extinguishable signs that can display only one message);
- In the event of power loss, film module sign messages can be manually positioned by a maintenance technician on location by spinning the "scroll" until the appropriate message is displayed;
- All signs are produced in color without additional cost; and
- Illuminated film module signs will standout when in use, drawing the motorist's attention.

The disadvantages are:

- The scrolling of signs for up to 120 seconds within view of drivers may cause them some confusion. A shutter could eliminate this problem by hiding the sign from view during scrolling, thus eliminating this problem. The estimated cost for a shutter is $1,000 to $1,500 per sign;
- The structure of the cabinets shown by vendors seems inadequate, specifically the sturdiness of the cabinets and their ability to provide an internal environment that is free of dirt and debris; and
- It is somewhat uncertain how long the Mylar material will last. This material may become brittle with time, requiring periodic replacement. Replacement has been estimated at about five years. Cost of replacement has been estimated at $2,000 ($4,000 lifecycle).

The second disadvantage is easily addressed by requesting a more sturdy cabinet. Most vendors contacted can make desired changes to the cabinets. Requested cabinet changes should include channelized flanges on the mating surfaces of the cabinet halves. These surfaces should be fitted with reinforced gaskets to provide a good seal to eliminate entry of water and dirt or debris.

Rotary Signs

Rotary signs utilize a system of drive shafts fitted with worm gears turned by one or more electric motors, which then turns a multi-sided rotating element (rotor). Each side of the rotor can display a line or graphic to the motorist. Rotors can range from three-sided (prism) to six-sided. From observation the motors and gears appear quite sturdy. The drive shafts observed were solid stainless steel. These were fitted with brass worm gears. The shafts rotated through

sealed bearings supported by brackets attached to the sign housing. Rotary signs can be blank-out or Variable Message Sign (VMS). A rotary blank-out sign uses a single motor to turn all the rotors in unison. A VMS sign may have additional motors, shafts, bearings, and micro-switches to rotate the elements individually. Reflective sheeting such as diamond grade is typically applied to the sides of the rotors.

The advantages of rotary signs are:

- In maintenance situations or if power is lost, rotary signs can be manually positioned;
- Lowest maintenance of the various sign technologies (excluding static);
- The motors, which drive the rotating signs, are readily available; and
- Wide cone of vision.

The disadvantages are:

- These signs use mechanical parts, which are subject to failure;
- Dust can enter through the front face and settle on the rotor face that is facing up. When that face is put into use, the message could be somewhat obscured; and
- Without illumination (very expensive) or flashing beacons, the rotary sign is less noticeable to the motorist than other technologies.

Dynamic message signs can display any character, text, or graphic image anywhere on the sign. Messages can be selected from a pre-defined set of messages in a central database, form several messages that are stored in the field at the controller, or the messages can be created "on the fly" to be catered to a particular situation.

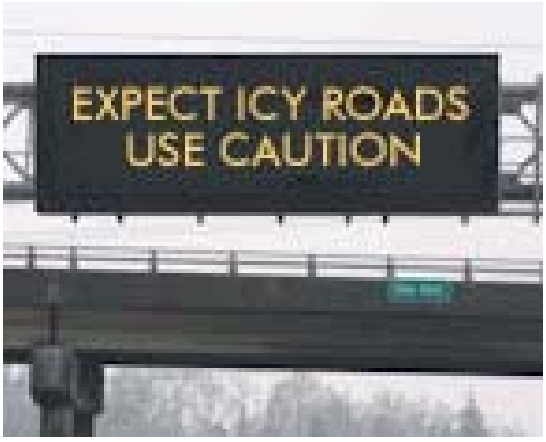

Figure 2 - Dynamic Message Sign Example

There are several sign technologies that could be considered for the Pomona Valley project. These technologies, and characteristics of each, are discussed in the following section and summarized in **Table 1**.

LED Signs

Clusters of LEDs make up each pixel on an LED sign. Characters are formed using a matrix of pixels, each of which can be turned on or off. The life of an LED sign can be extended if the inside of the sign is ventilated. Currently, most LED signs use AlInGaP technology. This technology (patented by Hewlett-Packard) results in the extended life of LEDs. LEDs manufactured using this technology do not experience the ongoing intensity degradation over time that is inherent with older LED technologies.

LED Flip-Disk Signs

LED flip-disk signs have pivoted disks that open and close to display the proper character or graphic. The open position allows the LED light to pass through the sign; the closed position blocks the light.

Table 1 – DMS Technology Options

Sign Technology	Benefit	Drawback	Preliminary Opinion of Probable Cost: Capital	Preliminary Opinion of Probable Cost: O&M
EMS (blank-out sign)	▪ Low cost	▪ Information only visible to drivers when sign is on	$15,000-$60,000	$500-$3,000
CMS				
Film Module	▪ Lowest cost of all technologies except static ▪ Attractive when viewed ▪ Ability to display different messages ▪ Film module signs can be manually positioned ▪ All signs produced in color without additional cost ▪ Illuminated film module signs will standout when in use	▪ Scrolling of signs for up to 120 seconds may cause confusion to drivers ▪ Structure of cabinets shown by vendors may be inadequate ▪ Mylar longevity is uncertain	$15,000-$20,000	$750-$1,000
Rotary	▪ Rotary signs can be manually positioned ▪ Lowest maintenance cost of all technologies except static ▪ Motors are readily available ▪ Wide cone of vision	▪ Utilizes mechanical parts ▪ Rotor face subject to malfunction ▪ Less noticeable to motorists than other signs	$25,000-$28,000	$1,250-$1,400
DMS				
LED	▪ Proven technology ▪ Low operating and maintenance costs ▪ High reliability ▪ Minimal intensity degradation over time ▪ High visibility ▪ Average initial cost	▪ Must be ventilated to keep inside of sign cool ▪ Light output fades over time	$30,000-$60,000	$1,500-$3,000
LED Flip-Disk	▪ Low operating cost ▪ Minimal intensity degradation over time ▪ Average initial cost	▪ Moving parts prone to failure ▪ Maintenance intensive	$60,000-$80,000	$6,000-$8,000

Fiber Optic Shuttered	▪ Best visibility ▪ High reliability, low failure ▪ Proven technology ▪ Low operating cost ▪ Primary and secondary light sources	▪ High initial costs ▪ Halogen bulb replacement ▪ Moving parts prone to failure	$55,000-$85,000	$2,750-$4,250
Fiber Optic Shutterless	▪ Good visibility ▪ Proven technology ▪ Low operating and maintenance costs ▪ Primary and secondary light sources	▪ High initial costs	$60,000-$80,000	$3,000-$4,000
Fiber Optic Flip-Disk	▪ Low initial cost ▪ Primary and secondary light sources	▪ Moving parts prone to failure ▪ Maintenance intensive ▪ Illegible	$60,000-$80,000	$6,000-$8,000

Fiber Optic Signs

Fiber optic signs use a cluster of approximately seven light emitting fibers attached to a light guide. The fibers from one or more light guides are used to make a pixel that is illuminated by a halogen lamp. The light guide passes the light from the lamp to all its fibers. To make a particular character, selected lamps are energized creating the character pattern. Brightness of pixels may be partially controlled by adjusting the number of fibers per pixel. A standby lamp is used when extra brightness is needed and as backup to the halogen lamps. The text or graphics are displayed in pure white light. Colored displays are obtained by the use of colored filters.

Fiber Optic Flip-Disk Signs

A fiber optic flip-disk sign consists of magnetized pivoted disks that are attached by a pair of pivoting points along the central axis of the disk. They make use of pixels, each consisting of one or more fiber optic light guides, and corresponding flip disks are either open or closed depending on the characters that are displayed. A short current pulse controls the flip disk. When not in use, the disk is displayed, blocking the fiber light from the motorist's view. The disk is typically matte black when viewed by motorists. Flip disks are prone to sticking.

A shuttered fiber optic sign uses a shutter that rotates about an axis perpendicular to the pixel. This method has proven to be less prone to sticking than the flip disk.

Requirements

DMS (extinguishable, changeable, or dynamic) support all User Requirements except the following:

- UDR 1.7 (N/A): The ATIS shall be capable of receiving and distributing video images received from arterial CCTV cameras and video detectors (both streaming video and snapshots).
- UDR 1.8 (N/A): The ATIS shall make CCTV images available (both streaming and video snapshots) for traveler information via Internet, kiosk, and television broadcasts (network and CATV).
- UDR 1.9 (N/A): The ATIS shall be capable of consolidating and displaying traffic volume, speeds, incident, closure, special event, and other relevant information on the color-coded maps with easily identifiable icons and graphics.

DMS supports all Functional Requirements except the following:

- SFR 3.3 (N/A): The ATIS shall be capable of receiving information from other stakeholders.

O&M

A brief preventative maintenance procedure will be required once per year and potentially as often as once per month, depending on the technology employed. Fan filters in LED signs need to be replaced between once per month and once per year depending on weather and usage. Lamps within fiber optic signs need to be replaced once every one to four years. Depending on sight conditions, the sign face should be cleaned when necessary as preventative maintenance. Operations and maintenance costs range from five to ten percent of capital costs.

Analysis Summary and Costs

Costs for a DMS can range from $30,000 to $80,000 with operations and maintenance costs ranging from $1,500 to $8,000 per year as summarized in **Table 1**

Applicability to Pomona Valley

The occurrence of incidents and the manner in which they are reported may impact the route and driving decisions drivers make. The dissemination of information via DMS to the general public is an appropriate ITS tool to assist drivers in making educated and informed driving decisions. Specific locations for deployment will be identified in the Concept Design Report.

Recommendations

DMS is recommended for use on arterials in the Pomona Valley Forum. A combination of lower-cost CMS (i.e., Trailblazers) and full capability DMS should be used on arterial. To reduce the aesthetic concerns of having large, dynamic signs in neighborhoods, a limited number of full dynamic signs will be recommended to be supplemented by CMS used for identifying routes (Trailblazers) and for specific spot information such as around and leading to the Fairplex. Both the CMS and the DMS can be designed to be the minimum size necessary for local, arterial placement. Character height is designed for visibility based on the speeds of the facility on which the sign is located. Signs can also be designed to coordinate with the local aesthetics, by specifying a particular finish for the "frame" of the sign and specifying acceptable sign structures. It is also recommended that several portable DMS be purchased for shared use within the Pomona Valley Forum. Portable signs utilize wireless communications to upload messages. Portable signs could represent a good infrastructure investment for the Forum, as the signs can be moved around as needed to address different concerns, especially related to construction activities and events.

LED technology is recommended for use in the Pomona Valley due to the lower capital cost (compared with fiber optic technologies) and ease of maintenance (compared with shuttered or flip-disc options). The visibility of an LED will be acceptable for arterial use.

2.4 Community Access Television (CATV)

Using a combination of maps, graphics, icons, voice, text, and video images, CATV traffic stations provide an overview of congestion levels, incidents, closures, restrictions, special events, weather, and overall traffic conditions on freeway and/or arterials in a region. There has been limited deployment (less than ten) of dedicated traffic information channels across the United States. These channels are intended to provide continuous traffic conditions information during the AM and PM peak travel periods. The future of traffic information on dedicated community access channels is growing slowly. They often require participation from the private sector as the demand justifies it. CATV has proven itself to not be a revenue generating ATIS operation.

Technology

Television is a readily available technology, as is the Internet for transmitting data and information for broadcast. Traffic information on a dedicated Cable TV/public access channel has limited deployment, though broadcast stations widely disseminate traffic information. The reliability is dependent upon software and hardware interfaces with information sources, such as a central ATIS server.

Broadcast is a form of information dissemination. An unlimited number of users are able to receive information simultaneously. Information can be customized based on the need for information dissemination and availability. The flexibility of CATV is dependent upon the software ability to compile information prior to distribution. Television does not allow for interaction with the user. Information is regional and not personalized. Interoperability is dependent upon interfaces with other systems i.e. it relies on data and video from information sources and systems. It is adaptable to disseminating new sources of information. Content can be customized and updated as needed.

Requirements

CATV supports all Functional Requirements except the following:

- Performance Requirements
    - SFR 1.8 (N/A): The ATIS shall include a usage tracking function capable of generating usage levels by devices, types of information accessed, and other queries to support ATIS evaluation.
- Equipment and Technology Requirements
    - SFR 2.1: The ATIS shall interface with legacy and new information devices and systems, including the traffic control system devices. This may include, but is not limited to, traffic detection devices, ATMS, ATIS, Dial-in Telephone Service (511), Kiosks, Internet CCTV, and multimodal AVL systems.
    - SFR 2.2: The ATIS data consolidation system shall be based on an open architecture, and shall include all necessary information processing algorithms.
- Data Management Requirements not applicable to CATV
- Availability of Technology Requirements
    - SFR 4.2 (N/A): The ATIS shall be capable of interfacing to competing and complementary technologies from a variety of vendors using ITS standards.
- Adaptability Requirements
    - SFR 5.2 (N/A): The ATIS shall be capable of interfacing with new traffic collection and dissemination devices as they are deployed.
- Operational Considerations Requirements
    - SFR 8.2: The ATIS shall include security and firewall capabilities to control access to all functions within an agency, between agencies, and from outside entities such as private ISPs and the media.
    - SFR 8.3: Security and access shall be password based and defined by roles.
    - SFR 8.4 (N/A): Parameters for access levels shall be set by user (agency).
- Flexibility Requirements
    - SFR 13.1 (N/A): The ATIS shall have the capability to interface with all existing and proposed ATIS equipment.

O&M

Operations call for staff to update and format data as needed and manage interface and incoming data sources. Typical maintenance for CATV is estimated at 5 percent of capital cost in order to cover standard replacement of parts as necessary and maintenance of communication networks and public broadcast needs.

Costs

There is no capital cost for the public agency if CATV is operated by the private sector, which is not likely for the Pomona Valley. The agency would act as the data source and the private sector partner provides access to the ATIS server, data formatting and graphics, and then provides the communications to the broadcast station. If the agency wishes to contract operations out to a private partner when the market demand justifies it, costs would depend on the business model selected. In markets where this service is operational (Phoenix and Bay Area), ETAK is the private partner, and recovers cost through advertising during broadcasts.

Advantages

The following advantages are identified for using CATV images for ATIS purposes:

- With a private partner to take the lead in transmitting regional data, formatting for broadcast on CATV, coordinating with the broadcast station and helping to promote the service, there is no cost to agencies for this type of service.
- Public access stations are often looking for content, and will likely see a traffic report as a viable, important program to air.
- CATV has the potential to reach a broad audience, particularly in the AM peak.

Disadvantages

The following disadvantages are identified for using CATV images for ATIS purposes:

- The system may not be effective in the PM peak period because many travelers do not have access to a television
- The involvement of the private sector is dependent on the market demand for a CATV.
- The annual operating costs for a public sector partner would be high and require significant staff time to operate.

Recommendations and Applicability for Pomona Valley

CATV is not recommended at this time for deployment by Pomona Valley agencies. CATV has not demonstrated significant benefit for the cost and operations requirements, but could be re-evaluated over the next few years for potential future deployment. Pomona Valley agencies could serve as the data source (through the ATIS server located at the sub-regional TMC) if a private partner, such as ETAK/Metro Networks expresses an interest in providing such service to the public.

2.5 Public Traveler Information Internet Site

Traveler information web sites have been widely implemented by private, local, regional and state agencies throughout the United States. The convenience of the Internet has made this a popular and cost-effective way to disseminate traffic and travel information to a broad audience. Public agency sites are typically implemented and operated by city, county or state DOT's, transit agencies, or regional planning organizations. There are numerous private sites that also provide traffic and travel information.

Content and information will vary by site, but typically includes:

- Incidents, closures, restrictions
- Construction/detours
- Major delays
- Multimodal information or links

More advanced ATIS web sites also might include:

- Congestion levels (primarily freeways)
- Travel times
- Weather and pavement condition information
- CCTV camera video (snapshots or streaming video)
- Other regionally significant information or links (special events, tourism info, etc.)

The Internet has increased consumers' expectations of information availability, quality, and responsiveness. This effect is readily seen among ATIS web site customers, who are encouraged by sites that continually improve functionality and features. Some of these features could include:

- freeway on-ramp queues
- prediction of traffic congestion
- parking
- event information and advisories (such as a ball game or concert) on a map so that these areas can be avoided

Technology

Public Traveler Information Internet Sites uses widely available technology and is accessible to users through landline and wireless Internet connections. The technology for Public Traveler Internet Sites is continuing to evolve and new applications are developed on a daily basis. Reliability depends on data sources and the communications links. Data quality parameters, time stamping and other processes need to be implemented by agencies.

The Public Traveler Information Internet Sites uses easily expandable technology. Web applications can expand to accommodate new data sources and types of information. Linking to other agencies and sites also provide additional information and resources for the user.

ATIS web sites can be designed to be scalable to easily expand to accommodate new types of information and sources, as well as incorporate security features to restrict certain data from being displayed. Some ATIS web sites allow for personalization of content (specific routes, specific events and types of details, notification of incidents or events on 'personal' route, etc.).

Interoperability of the sites is dependent upon software and hardware interfaces with other systems, including data exchange networks, ATMS, CCTV, etc. Web systems also can be used as data sources for other ATIS, namely 511 phone service, through use of software that converts data to voice recordings.

The system is adaptable to disseminating regionally relevant and significant types of information. Interfaces can be automatic or data can be uploaded manually to provide current conditions information.

Requirements

The Public Traveler Information Internet Site supports all Functional Requirements except the following:

- Adaptability Requirements
    - SFR 5.2 (N/A): The ATIS shall be capable of interfacing with new traffic collection and dissemination devices as they are deployed.
- Flexibility Requirements
    - SFR 13.1 (N/A): The ATIS shall have the capability to interface with all existing and proposed ATIS equipment.

O&M

Operations will require personnel to input and update information and to oversee functionality of the site as well as integrate new technologies into the system as needed. Routine system maintenance will be performed as needed.

O&M costs will vary based on level of detail contained on the ATIS web site. 'Basic' web sites with static information, such as closures, construction, events, etc. will average $20,000-$30,000 annually. 'Enhanced' web sites with dynamic information such as real-time volume and speed data, travel times, incidents, and camera images will require additional O&M resources, communications, and server space. Annual O&M estimates for enhanced web sites range from $75,000 to $125,000. As an example, the Arizona DOT web site (www.azfms.com) with dynamic freeway conditions, camera views, and statewide closure/restriction information averages $117,000 per year in O&M.

Costs

The capital cost to develop and deploy an 'enhanced' Public Traveler Information Internet Site is approximately $85,000-135,000. The site would include real-time freeway/roadway speeds or congestion levels, incidents, as well as CCTV video images (snapshots or streaming video).

The cost for a scaled-back ATIS web site that includes closures and restrictions, advisories, and links to other ATIS information is estimated at approximately $50,000.

Advantages

The following advantages are identified for provision of a web site for traveler information:

- Low-cost, accessible technology for pre-trip information
- Makes extensive use of data gathered through IEN
- Web can serve as foundation for ATIS data for other technologies
- Easily expandable to accommodate new types of information
- Could be used to co-promote other ATIS services, including 511

Disadvantages

- O&M costs may be prohibitive for an 'enhanced' site

Recommendations and Applicability for Pomona Valley

It is recommended that an ATIS web site be provided for the Pomona Valley. The web site should include dynamic and static data for arterials. The site can be deployed in phases, initially providing static data such as:

- Map of arterials
- Construction/closures/alternate routes
- Events
- Links to multimodal information
- Links to PV forum agencies
- Links to regional and state agencies

The web site can be expanded, in future phases, to include dynamic data (i.e., detector data from arterials for speeds and volumes, CCTV snapshots). The value of the site will increase substantially with the incorporation of dynamic data.

The site can be provided by the private or public sector. Due to the size of the subregion, it may not be desirable from a business standpoint, to provide a service that is tailored to such a small area. It is recommended that the public partners develop a site. If and when private partners express an interest, the subregion can then provide access to the system data. In the future, if it becomes apparent that private web sites are providing the traveler information in quantity, quality and fee acceptable to the public partners, the public site could be terminated, thereby reducing the annual cost of operation and maintenance of the public site. The initial, publicly operated site could be maintained by the LA County staff (ITD and TMC operators) if the site is catered to a county-wide focus, rather than only the Pomona Valley sub region. If the site is sub regional in nature, the sub regional TMC staff should be responsible for operations and maintenance. Operations would require very little if the site is developed to be automated, collecting and repackaging data from the different Pomona Valley Forums through the IEN and displaying manually input data only when it has been entered.

2.6 Highway Advisory Telephone (HAT)

Agency phone hotlines for travel advisories, closures, detours, and other pertinent information are readily available and in operation throughout the country. These dial-in hotlines are primarily recorded information available through push-button menu trees. Private ISP's also offer ATIS information through wireless services and subscriptions.

511 has been designated by the FCC as a national travel information number. It is up to states and regions to implement the 511 service, which has been reserved for government entities. States that already have converted their travel advisory phone services to 511 or implemented new 511 services are:

- Arizona
- Kentucky
- Orlando & Miami-Dade Area, Florida
- Virginia
- Nebraska
- Minnesota
- Utah

Technology

Phone services for traveler advisories have been operational for many years. IVR is an emerging technology in the ATIS arena, and has demonstrated success where deployed (Utah). IVR converts data to text and vice versa.

Phone services are accessible by travelers for pre-trip and en-route information (via mobile phone). Information can be accessed by landline or wireless phone services.

Phone networks provide a robust and reliable communications medium. Reliability of information is dependent on accuracy, quality and timeliness of information being provided to the ATIS, whether automatically or manually entered.

Requirements

The use of a telephone ATIS supports all Functional Requirements except:

- Equipment and Technology Requirements
    - SFR 2.4 (N/A): The ATIS shall include a graphical user interface for operations.
- Data Management Requirements
    - SFR 3.1: The ATIS shall be capable of automatically collecting data generated by field devices.
    - SFR 3.2: The ATIS shall be capable of receiving information from local city ATMS' (local city control sites) and the sub regional TMC.
    - SFR 3.5: The ATIS shall consolidate data and information from public and private entities in a central ATIS server platform.
    - SFR 3.8 (N/A): The ATIS shall support a data archiving function so that historical ATIS information can be used by planning, research, and other public and private entities.
- Availability of Technology Requirements

- SFR 4.2 (N/A): The ATIS shall be capable of interfacing to competing and complementary technologies from a variety of vendors using ITS standards.

- Adaptability Requirements
  - SFR 5.2: The ATIS shall be capable of interfacing with new traffic collection and dissemination devices as they are deployed.
- Operational Considerations Requirements
  - SFR 8.2: The ATIS shall include security and firewall capabilities to control access to all functions within an agency, between agencies, and from outside entities such as private ISPs and the media.
  - SFR 8.3: Security and access shall be password based and defined by roles.
  - SFR 8.4 (N/A): Parameters for access levels shall be set by user (agency).
- System Interface Requirements
  - SFR 10.4: The ATIS shall be capable of interfacing with Caltrans for video exchange.
- Flexibility Requirements
  - SFR 13.1: The ATIS shall have the capability to interface with all existing and proposed ATIS equipment.

O&M

HAT requires operations to determine when information needs to be communicated, to record the data and to transfer data to the phone network. Processes like IVR automate and ease processes of converting data to voice transmission, reducing operational needs.

The average cost per call (which includes all operations and maintenance costs) can be estimated at $1.08 per the 511 Deployment Coalition[1].

Costs

The capital cost for a phone service for traveler advisories can vary greatly depending on the type and quantity of information, the technology and equipment choices, and the call volume. The 511 Deployment Coalition published average costs for deployment and annual O&M in May of 2004 as follows: average cost for deployment is approximately $416,000 and the average cost per call (which includes all operations and maintenance costs) is $1.08.

Advantages

The following advantage is identified for using a phone service for traveler advisories for ATIS purposes:

- Provides pre-trip and en-route information via landline and wireless telephones.

[1] *The Value of Deploying 511*, published by the 511 Deployment Coalition, May 2004.

Disadvantages

The following disadvantage is identified for using a phone service for traveler advisories for ATIS purposes:

- Access to a telephone is required to obtain information from the system.
- Annual operations costs will increase with increased usage

Recommendations and Applicability for Pomona Valley

Due primarily to the annual operations and maintenance costs, Highway Advisory Telephone is not recommended at this time. This technology is generally a wider-region deployment and is being considered for deployment in the greater Los Angeles metropolitan area by regional agencies such as SCAG and MTA.

2.7 Kiosks

ATIS kiosks are self-contained interactive computer centers for traffic and travel information. Kiosks are typically equipped with a touch-screen that allows users to navigate to the information they want to see. They provide static information, and if connected via an Internet connection, can provide real-time (or near-real-time) information using text, graphics, video clips and sound. Some kiosks also can be equipped with printers.

Kiosks may become more interactive, containing more localized information dependent upon kiosk location. More reliable connections to real-time information (connection speed) will improve kiosk performance and perception of effectiveness by users.

Future concepts of kiosks may include large-screen, flat-panel liquid crystal displays (not interactive), which may be more cost-effective than single-user interactive devices. Such displays could contain essential real-time information, and be located in areas of high pedestrian traffic.

Technology

Kiosks are primarily web site based, and so the technology is well established, proven, and mature. A web site is developed, that is catered to the touch screen or non-interactive type of kiosk deployment, and displayed on the appropriate equipment. The significant cost savings of a non-interactive deployment over the traditional kiosk is that the equipment does not have to be specified to hold up to the elements, users, and potential vandalism.

Requirements

The use of a Kiosk service supports all Functional Requirements except:

- Data Management Requirements
    - SFR 3.1: The ATIS shall be capable of automatically collecting data generated by field devices.
    - SFR 3.2:The ATIS shall be capable of receiving information from local city ATMS" (local city control sites) and sub regional TMC.

- SFR 3.3 (N/A): The ATIS shall be capable of receiving information from other stakeholders.

- Adaptability Requirements
  - SFR 5.2: The ATIS shall be capable of interfacing with new traffic collection and dissemination devices as they are deployed.
- Flexibility Requirements
  - SFR 13.1: The ATIS shall have the capability to interface with all existing and proposed ATIS equipment.

Costs

The capital cost for the software development of a kiosk averages $9,500 - $50,000 and can be greater than that depending on the content, interaction, and what infrastructure is already in place (for example, this range of costs presumes that a dynamic ATIS web site is already operational, the additional cost to develop a kiosk deployment if a web site has not been developed would exceed this range). Unit cost estimates of the kiosk equipment can range from $10,000 to $16,000, including hardware, enclosure, installation, and modem server.

O&M

Operation requires staff to input data and update a dynamic website as well as maintenance of communication elements in order to provide real-time information. Routine (software and hardware updates) and incidental maintenance will be required.

O&M can range from $1,000 - $5,000 per year for the hardware. Software maintenance, presuming that a dynamic web site is already in place and operational, would be an additional annual cost of $9,500 - $50,000.

Advantages

The following advantages are identified for using a Kiosk service for traveler advisories for ATIS purposes:

- Placement of non-interactive kiosks at high pedestrian traffic areas (Fairplex, City Halls, large employment centers) can provide better exposure to the data
- Non-interactive kiosks can provide a real cost-benefit, especially if a dynamic web site is already in place for the region.

Disadvantages

The following disadvantage is identified for using a Kiosk service for traveler advisories for ATIS purposes:

- High maintenance requirements and potential for vandalism in public spaces can adversely impact the cost effectiveness of a traditional kiosk.
- Poor usage for traffic-data could make traditional (and potentially non-interactive) kiosks a poor investment (since kiosks are available to only those individuals that physically walk by

them, and are only used by a portion of those, kiosks are not usually a strong benefit/cost investment).

Recommendations and Applicability for Pomona Valley

Stand-alone Kiosks not recommended for deployment in the Pomona Valley. Kiosks have demonstrated success in specialized applications (such as transit or rail), but not for traffic information. Non-interactive Kiosks, such as a mounted flat screens showing regional maps, incidents, events and traffic 'hot spots', could be installed in the future at the Fairplex, city halls or large employment buildings and centers.

3.0 EVALUATION OF OTHER REGIONAL ATIS SYSTEMS

In order to assess the application, effectiveness and performance of ATIS technologies, the study team examined four operational ATIS programs in the United States. They are:

- TravelTIP, Orange County, CA
- Smart Trek, Seattle, WA
- AZTech™, Phoenix, AZ
- Utah Commuterlink, Salt Lake City, UT

These systems were selected based on the types of information provided (freeway, arterial and multimodal) and application of a variety of ATIS elements to deliver pre-trip and en-route information to local and regional travelers. These elements include travel information web sites, travel advisory telephone, highway advisory radio, kiosks, and community access television. Data sources, ATIS partners, and arrangements with the private sector (including ISPs and media) also were noted as part of the program evaluations. Where available, system funding and O&M funding requirements are included. It is important to note that the ATIS programs profiled in this section are components of regional, integrated ITS systems; they are an integral part of larger ITS programs, and rely on regional communications networks and data from a variety of incident management, traffic management, event management, and other systems. As such, the deployment and operational costs listed in this section reflect costs beyond just the ATIS components.

By examining what is currently at work in other metropolitan areas, PV agencies can gain a better understanding of what ATIS technologies and programs have the potential to effectively reach a broad audience and how best to leverage their technology and resource investment to achieve the desired goals and benefits.

Sections 2.1 through 2.4 provide an overview of the four travel information systems evaluated.

3.1 TravelTIP, Orange County, CA (OCTA)

TravelTIP was a public/private partnership that provided real-time transportation information in Orange County. TravelTIP included information on arterials, freeways, and transit services. A primary focus of TravelTIP was real-time arterial information, which made this system unique among other regional ATIS programs in the United States.

Partnership Structure

Orange County Transportation Authority (OCTA) was the lead agency for TravelTIP, and coordinated with several other state and municipal agencies in the area to provide comprehensive information about current congestion, incidents, closures, construction activities, special events, and other impacts to the county's roadway system.

TravelTIP's public partners included:

- California Highway Patrol
- Caltrans District 12
- City of Anaheim
- City of Brea
- City of Buena Park
- City of Costa Mesa
- City of Fountain Valley
- City of Fullerton

- City of Garden Grove
- City of Irvine
- City of Newport Beach
- City of Santa Ana
- City of Westminster
- City of Huntington Beach
- City of Mission Viejo
- City of Orange
- City of Tustin

The public agencies supplied real-time and static data from the arterials, freeway and transit, and provided information about incidents, advisories and special events. They also were responsible for operating public agency-owned systems and devices, including the TravelTIP web page, phone line, and kiosks.

Traveler Advisory News Network (TANN) was TravelTIP's private partner. TANN served in a consolidation/fusion role, and distributed data to other media and data publishing outlets for distribution. TANN established arrangements with other private parties to distribute Orange county travel information via the Internet, cable television, pagers, business intranets wireless devices, and other means.

Phasing and Status

Initial development of TravelTIP began in 1995 with activities such as user needs assessment, technology options, and architecture report. Detailed system design and development began in 1998. The system operated in a trial mode, where the public could utilize it on a trial basis for testing and fine-tuning purposes, prior to the public launch event. The final system test was completed. The system was publicly launched on June 11, 2001 and is no longer operational.

ATIS Capabilities

- *Infrastructure, Technologies, and ATIS Data Sources*
  - Sensors on freeways and arterials collected real-time volume, speed and occupancy information.
  - TravelTIP workstations – partner agencies entered information for their jurisdiction (closures, restrictions, incidents, special events), and information was compiled in the TravelTIP server and distributed through web page, kiosks, dial-up, and value-added reseller (VAR) interfaces.
  - TravelTIP Internet – other agencies entered information for their jurisdiction (incidents, advisories, events, and closures) via secured access over the Internet. Information was compiled in the TravelTIP server and distributed through web page, kiosks, dial-up, and VAR interfaces.

- *ATIS Dissemination*
  - www.traveltip.net provided real-time traffic conditions information, incident closures, restrictions, and special events traffic info. The system also provided estimates of travel times for certain routes, as well as estimates of delay times or closure times. In addition, links to static transit/multimodal information, Transtar trip planning, other regional traveler information sites, ridesharing, and regional airports were also provided.
  - 949-451-1TIP provided real-time traffic conditions information, incident closures, restrictions, and special events traffic information.
  - Interactive, touch screen kiosks were installed at major transit centers (Irvine, Transportation Center, Santa Ana Transit Terminal, Fullerton Transportation Center). Kiosks provided the same information as the TravelTIP web page.

- http://traffic.tann.net – TANN's traffic web page displayed color-coded congestion levels, incidents, and Caltrans' camera views for cameras along I-5 in Orange County.

Accessibility of Information by ISPs, Media and other Private Interests

TANN served as the private partner and information broker for TravelTIP. TANN then distributed TravelTIP information to various private partners and media affiliates.

Usage

- The traveltip.net page received more than 24,000 hits on its first full day of operation. The web page averaged 12,000 hits per week for June, July, and August 2001. In early September 2001, the web page averaged 25,000 hits per week.
- The telephone system received over 1000 calls during its operational period.
- The kiosks were getting high usage with mostly transit information being accessed. This was largely attributed to the kiosks being located at major transit centers.

Cost, Level of Investment and Funding

- TravelTIP = $4.3 million for design, system deployment, and one year of operations. 80% paid by the Federal Highway Administration (FHWA) ITS Grant. 10% paid by Caltrans and 10% by OCTA. Additional $200k by OCTA for follow-on marketing activities.
- TANN = $2.6 million for design, deployment and operations. 80% paid by FHWA ITS Grant. 10% Paid by Caltrans and 10% by OCTA. Private sector partners also contributed over $100k in matching funds with additional funding being provided through other contributions.

3.2 Smart Trek, Seattle, WA (Puget Sound Regional Council and WSDOT)

Smart Trek was established as the Seattle area Metropolitan Model Deployment Initiative (MDI) in 1996. Smart Trek provides real-time, multi-modal information on Seattle area freeways, transit services, weather and other travel-related information.

Partnership Structure and Roles

Smart Trek was initially established as a public-private partnership, with Washington State Department of Transportation (WSDOT) as the lead agency. In 2002, the Puget Sound Regional Council (PSRC) took over the Smart Trek name. WSDOT continues to provide the real-time freeway data and closed-circuit television CCTV camera images to the Smart Trek ATIS, as well as statewide mountain pass, closure and weather information links.

Smart Trek's public partners include:

- City of Bellevue
- Greater Redmond Traffic Management Association
- King County Metro Transit
- University of Washington
- Federal Highway Administration
- City of Seattle
- City of Brea
- Puget Sound Regional Council
- Washington State Ferries
- Federal Transit Administration

Smart Trek's public partners collect real-time and static data, provide regional ITS planning, architecture development and transit applications. Public agencies are data suppliers as well as data disseminators (via web, phone and field devices). The University of Washington (UW) has been a key partner since the MDI started. UW served as a data contractor that fused the public-sector data for display on the web site. UW also has done extensive work developing the real-time transit applications (MyBus and BusView) in close cooperation with King County Transit.

Private partners in Smart Trek focus on providing value-added consumer ATIS applications, including web, wireless and subscription services (pagers, e-mail alerts).

Phasing and Status

1997 – Model Deployment. Smart Trek deployments and projects ongoing. Previous infrastructure included a freeway management system in the Seattle area and King County Metro Transit Automated Vehicle Location (AVL) system.

2002 – PSRC took over the Smart Trek name, with WSDOT focusing more on branding of its information. WSDOT converted the original rWeather site to more comprehensive ATIS information, including real-time conditions and freeway status.

ATIS Capabilities

- *Infrastructure, Technologies, and ATIS Data Sources*
  - Freeway detector data from WSDOT for approximately 110 miles of freeway in Seattle and 10 miles of freeway in Tacoma. Includes majority of I-90, I-5, and I-405 in the Seattle, Renton, Bellevue areas; detection equipment also on SR167, SR520, SR599, and I-5 in Tacoma.
  - Freeway CCTV video from WSDOT; includes metro freeways and mountain passes.
  - Arterial CCTV from Bellevue (17), Seattle (3).
  - Web cams at six ferry landings from private companies and WA State Ferries.
  - AVL on approximately 1200 buses to provide real-time status and location information.
  - Statewide Road Weather Information Systems (RWIS).
  - Closure/construction information from WSDOT.
  - Incident information from State Patrol and local police.
- *ATIS Dissemination*
  - www.smarttrek.org (current, real-time freeway conditions and volumes, links to real-time transit, ferry cams, weather, and ride-matching information). The Smart Trek site is now maintained by the PSRC, the Seattle-area Metropolitan Planning Organization (MPO). Real-time freeway and traffic conditions are provided by WSDOT.
  - www.wsdot.wa.gov/Traveler.htm (on-line statewide multimodal information including traffic and travel conditions, rail/transit, ferries, airports, and transportation options).
  - www.wsdot.wa.gov/traffic (on-line statewide information about weather, closures, restrictions, border crossings into Canada, highway advisory radio (HAR) messages, mountain pass and road conditions, and statewide CCTV images).
  - busview.its.washington.edu (on-line, real-time information for buses throughout King County).
  - www.its.washington.edu/mybus/ (on-line schedules and status for buses in King County).
  - www.soundtransit.org (on-line information about commuter rail, light rail and transit in King, Pierce, and Snohomish Counties).
  - WSDOT is implementing 511 for dial-up information on travel and road conditions. The interactive voice response system is initially available for wireless phones only.

- Highway advisory radio provides construction, closure, detour, and weather information.
- Kiosks provide highway and multi-modal information.

Accessibility of information by ISPs

Smart Trek information is available to private partners through a registration process. WSDOT and the other Smart Trek partners developed guiding principles that private partners are to follow when using data and images from the web site. These principles provide terms of use, disclaimers, and other written guidelines.

Usage

- WSDOT FLOW map (www.wsdot.wa.gov/pugetsoundtraffic/) averaged 300,000 hits per month (January-September 2001). Peak month was February 2001 with 750,000 user sessions.
- Hotline (368-HIWY or 800-695-ROAD) averages 3,000 calls per day during the summer months, and over 120,000 per month during winter months (November 2000-February 2001).

Cost, Level of Investment and Funding

- Public – $15.6 million
- ITS Backbone O&M – $250,000 per year
- Freeway Management System – $105 million (estimated expenditures since 1980s)
- O&M for FMS – $2.2 million per year (approximate)
- Private – $2.3 million (Smart Trek Model Deployment Partners)

The above O&M costs and FMS costs are the responsibility of the Washington State DOT. O&M costs for the FMS and ITS backbone are programmed into WSDOT's annual program plan.

3.3 AZTech™, Phoenix, AZ

AZTech™ was established as the Phoenix area MDI in 1996. The primary goals of AZTech™ were to showcase public private partnerships for ATIS, enhance data sharing and coordination among the public partners, and provide a regional transportation forum for ongoing planning, deployment and operations of ITS in the Phoenix metro area. AZTech™ was able to utilize the Arizona Department of Transportation (ADOT) Freeway Management System and Traffic Operations Center as a backbone and hub for AZTech™. Other existing systems that played a key role in the foundation for AZTech™ included Maricopa County DOT, local cities (Phoenix, Tempe, Scottsdale, Glendale), transit, and emergency services.

AZTech™'s public partners include:

- Arizona DOT
- City of Chandler
- Town of Gilbert
- Town of Paradise Valley
- City of Peoria
- City of Tempe
- Maricopa County DOT
- City of Glendale
- City of Mesa
- City of Phoenix
- City of Scottsdale
- Regional Public Transit Authority

- Phoenix Transit Department
- Pima Association of Governments
- Sky Harbor International Airport
- Maricopa Association of Governments
- Arizona State University

Private partners have been an integral part of the AZTech™ program since its inception in 1996. These partners are selected for AZTech™ through a competitive procurement process. The majority of AZTech™'s private partnerships have focused on ATIS distribution, although AZTech™ has contracted with private consultants to provide program support, planning, design, and other services. AZTech™'s private partners have included:

Phase 1	**Phase 2**	**Phase 3**
▪ ETAK/Metro Networks	▪ Cue	▪ OZ Engineering
▪ TRW	▪ TranSmart	▪ Mobility Technologies
▪ Fastline	▪ SmartRoute Systems	▪ TANN
▪ Scientific Atlanta	▪ PBS&J/Traffic Station	▪ US Wireless
▪ Touchvision		

Phasing and Status

- Phase 1 – 1996-1998
- Phase 2 – 1999-2001
- Phase 3 – Current (selection made June 2001)

ATIS Capabilities

- *Infrastructure, Technologies and ATIS Data Sources*
  - Freeway detector data available from ADOT (volumes, speed and occupancy). Data on I-10, I-17, SR51, SR202, SR143 (approximately 50 miles).
  - Freeway CCTV from ADOT.
  - SMART Corridors on priority arterials throughout metro area. Includes arterial detection, signal coordination, dynamic message signs (DMS), and CCTV deployment.
  - Transit AVL to provide real-time status and location information.
  - Statewide RWIS.
  - ADOT Highway Closure and Restriction System to provide information about construction activities, closures, maintenance, etc.
  - Arterial Road Closure and Restriction Systems to provide information about construction activities, closures, maintenance, etc. on major arterials throughout Maricopa County.

- *ATIS Dissemination*
  - www.az511.com (previously azfms.com) for freeway speed and volume information, ADOT camera views along I-10, I-17, Loop 202, and SR51. CCTV images are snapshots that can be selected by route/location. ADOT's web site provides access to statewide closure and restriction information, weather, links to transit, other traveler information sites.
  - ADOT uses dynamic message signs on Phoenix area freeways, and some statewide locations, for en-route information. HAR also is used on highways and near Sky Harbor Airport.

- Dynamic message signs have been installed on major arterials to provide en-route information as part of the AZTech™ Smart Corridors program.
- www.aztech.org web site includes current information about AZTech™ projects, partners, and links to ADOT's CCTV camera views and road closure information.
- Arizona has converted its travel advisory phone system to 511 for statewide road conditions and closures, and transit in the Phoenix and Tucson metro areas. ADOT still maintains its toll-free 888-411-ROAD information line.
- 602-253-5000 provides transit traveler information.
- AZTech™ kiosks are installed in transit centers, civic buildings, and other locations throughout the Phoenix metro area. As part of the initial phases of AZTech™, 27 kiosks were deployed.
- ADOT provides access to live video feeds from freeway CCTV to local news broadcast stations for AM and PM traffic reports.
- www.etaktraffic.com/phoenix – incidents, closures on freeways and major arterials.
- Traffic Check on local cable channels (Tempe 11, Glendale, and Mesa) with freeway and arterial conditions, incidents, closures.
- TranSmart provides commercial vehicle operations ATIS on their website.

Accessibility of Information by ISPs

AZTech™ uses a Modified Franchise business model for traveler information, where the public sector provides data to multiple private partners at no charge; however, private partners must provide the infrastructure required to obtain the data (i.e., link to web or traffic operations center [TOC]). These partners include Information Service Providers (ISPs) as well as local media. ISPs disseminate information through subscription services such as for wireless phones, pagers, Personal Data Assistants (PDAs) and in-vehicle systems; ISPs also re-sell or broker the information to other ISPs and media. In its agreement with Mobility Technologies as part of Phase 3, Mobility Technologies also will provide AZTech™ public agency partners with access to real-time incidents and events that it gathers in the Phoenix metro area.

Usage

- 100,000 phone calls to ADOT's 888-411-ROAD in 2000. 511 service was launched in Arizona in March, 2002 – current call volume numbers are not yet available.
- Kiosk usage is estimated at 750,000 hits annually.

Cost, Level of Investment, and Funding

- Public agencies in the Phoenix metropolitan area had $250M existing baseline ITS infrastructure – including existing and programmed FMS infrastructure (1996), city and county TOCs, and communications.
- Public agencies provided funding for program additions, which was expansion to the existing infrastructure – included expanding ATIS and transit capabilities, initial instrumenting of priority Smart Corridors and integrating key center systems in the metro area (ADOT, Maricopa County DOT, cities, transit and emergency services). This included the $7.5M federal grant for AZTech; $4.6M in ADOT (state) and MCDOT (county) funds; and $15M earmarks for new ITS projects in the MPO Transportation Improvement Program.
- Private partners provided ongoing operations of their systems

3.4 Utah Commuterlink (Salt Lake City Area), Utah DOT

Utah's Commuterlink is a comprehensive traffic management, incident management and traveler information program in Salt Lake City. The ATIS component of Commuterlink provides real-time traffic, incident, closure and weather information through 511, Internet, and via commercial radio and television broadcasts. Dynamic message signs on freeways and highway advisory radio provide en-route ATIS information. Commuterlink's primary coverage area is the greater Salt Lake Valley, and future plans are to expand the system to include additional locations and corridors throughout the state.

Partnership Structure

The Utah Department of Transportation (UDOT) is the lead agency for Commuterlink and Utah's ATIS activities. Additional public partners include:

- Federal Highway Administration
- Salt Lake County
- Wasatch Front Regional Council
- Salt Lake City
- Utah Transit Authority
- Department of Public Safety

The public partners are responsible for collecting and consolidating data in the region, operating the Transportation Operations Centers, deploying/operating/maintaining infrastructure (including the utahcommuterlink.com web page), and conducting outreach activities. Utah and its public partners have been aggressively and successfully deploying ITS since the mid 1990s in order to have key transportation management infrastructure installed and operational for the 2002 Winter Olympics.

At present, Utah has limited private involvement in its ATIS, although with the Olympic Games in 2002, new partners were added, and UDOT is looking to further expand its ATIS private partner network. For its 511 service, UDOT partnered with TellMe Networks to launch the first voice-activated 511 service in the nation. Private partners for Utah's ATIS include:

- TellMe Networks
- Digital Options
- Local Media
- Westwood One/Tele Atlas
- Avant Go

These partners distribute UDOT generated information via web, phone, PDAs, wireless and other telematics systems. Local media include commercial radio and television news broadcasts; local radio stations have personnel in the UDOT TOC to deliver traffic reports on their respective stations during AM and PM peak travel hours. Westwood One/TeleAtlas broadcast real-time traffic information on government access channels, using Westwood One/Metro information and data from Commuterlink.

Phasing and Status

Planning for the Commuterlink ATIS began in 1995, in conjunction with a major freeway management program along I-15. Utah Commuterlink was launched in April 1999, and the voice-activated 511 system was launched in December 2001 prior to the Winter Olympics in Salt Lake City.

ATIS Capabilities

- *Infrastructure, Technologies and ATIS Data Sources*

– UDOT has deployed freeway detectors on portions of I-15, I-215 and I-80 and SR201. These provide real-time information about volumes, speeds and occupancies on metro area freeways.
– DMS are deployed on freeways and on several arterials in the Salt Lake City metro area for en-route information.
– CCTV cameras on freeways and arterials for incident verification and real-time condition information.
– Eight RWIS stations are deployed in the Salt Lake City metro area.
– Utah Transit Authority plans to implement AVL on buses and light rail to provide real-time transit schedule and status information.

- *ATIS Dissemination*

– Traffic information is available via radio and television broadcasts, dial-up via 511, Internet (public and private). DMS and HAR provide en-route information.
– From the www.utahcommuterlink.com, travelers have access to:
  - Freeway speeds for areas covered by detection;
  - Camera views of freeway and arterial cameras (snapshots only);
  - DMS locations, and message (if any);
  - Incidents and construction;
  - Weather information from RWIS stations;
  - Links on web page to transit, city and county pages, and weather;
  - Automatic e-mail alert system for incidents, closures, etc. – information is sent to subscriber based on profile he/she has created (preferred routes, time for message); and
  - An Olympic Traffic Information page was established for the 2002 Olympics in Salt Lake City. Included traffic conditions and delays by region, route and venue; park and ride locations; venue shuttle information; and where to go to avoid Olympic traffic and delays.
– 511 (or 866-511-UTAH) – voice activated traveler information line that provides information on Traffic, Public Transit, Commuter Information, and Road Conditions. UDOT and the Utah Transit Authority provide the data via the Internet and other services such as TellMe which converts the information to speech through the 511 system.
– En-route information provided by HAR and DMS about closures, restrictions, weather, events, etc.
– Utah Transit Authority – web page at www.utabus.com and several phone numbers provide static information about routes, schedules, operating hours, fares, rideshare programs, etc. Also includes an on-line trip planner, and a link to AvantGo (private partner), which provides schedule information for PDA subscribers.
– ATIS information, including incidents, conditions, and closures also is available through local media broadcasts (television and radio traffic reports), government access (Westwood One/Tele Atlas travel information).

Accessibility of Information by ISPs

UDOT and the Commuterlink information are available to ISPs and the media for value-added redistribution and broadcast; UDOT has made branding of the information a condition of re-use. UDOT has developed terms of use for media broadcasting of information, and stipulates that camera images be broadcast with the Commuterlink logo and tagline (“Know Before You Go”),

and that radio broadcasts must mention Commuterlink. Media outlets must also provide a link from their website to the utahcommuterlink.com web site.

Usage

- Web site usage – hits to utahcommuterlink.com went from 1.5 million in March of 2001 to 32 million the first week of February 2002.
- Phone – 4600 calls were made to Utah's 511 the first day it was in operation. The system received 3700 calls per day during the Olympics.

Cost, Level of Investment, and Funding

- Public funds for the overall Commuterlink program include $90M in state funds, $17M in federal funds (CMAQ/NHS/STP), $17M in federal Congressional earmarks (1996-2001), and $1M in local funds.
- Public funding for O&M includes $2M in state funds and $0.6M in federal CMAQ funds.
- Private partners provide ongoing operations of their systems and networks.

4.0 ATIS SUMMARY AND RECOMMENDATIONS

Based on the ATIS component analysis, **Table 2** below shows the technology recommendations and associated benefits for the Pomona Valley traveler information system. Costs are summarized in **Table 3**.

Table 2 – Summary of ATIS Forum Technology Recommendations

Technology	Recommendation	Benefits
Highway Advisory Radio	HAR is not recommended for deployment in the Pomona Valley. In the time since this evaluation was conducted, Caltrans has planned, designed and is installing HAR on SR 57 within the study area, precluding additional HAR deployment by the Forum partners.	▪ HAR units can be moved to high impact locations (major events at Fairplex, construction zones, etc.) ▪ Provide event-specific en-route information ▪ Cost-effective, low-maintenance technology ▪ Can use recorded messages or text-to-speech application ▪ Potential to reach broad audience
CCTV Cameras	▪ CCTV cameras are recommended for traffic management use in the Pomona Valley. ▪ Dissemination of CCTV images to the public is recommended. ▪ Digital CCTV is recommended for use in the Pomona Valley Forum for advantages over analog for comparable costs, including ease of video sharing.	▪ Video can be used to reduce maintenance staff time in responding to complaints by providing a remote view of field conditions prior to going to the field. This view could eliminate some field visits and could prepare maintenance staff better prior to the other field visits, making the trips more efficient. ▪ CCTV images can supplement real-time arterial maps generated by an ATMS by providing visual confirmation of roadway conditions. The images can lend credibility to the map data for the general public and traffic operations/ maintenance staff.
DMS	DMS is recommended for use on arterials in the Pomona Valley Forum. To reduce the aesthetic concerns of having large, dynamic signs in neighborhoods, a limited number of	The primary function of DMS is to provide en-route information to drivers in spot locations regarding current traffic conditions. This information can assist drivers in choosing to

	full dynamic signs will be recommended to be supplemented by CMS used for identifying routes (Trailblazers) and for specific spot information such as around and leading to the Fairplex. LED technology is recommended for use in the Pomona Valley due to the lower capital cost (compared with fiber optic technologies) and ease of maintenance (compared with shuttered or flip-disc options). The visibility of an LED will be acceptable for arterial use.	take alternate routes or remain on current routes based on real-time information about adverse conditions.
Community Access Television	CATV is not recommended at this time for deployment by Pomona Valley agencies. CATV has not demonstrated significant benefit for the cost and operations requirements, but could be re-evaluated over the next few years for potential future deployment. Pomona Valley agencies could serve as the data source (through the ATIS server located at the subregional TMC) if a private partner, such as ETAK/Metro Networks expresses an interest in CATV deployment.	▪ Public access stations are often looking for content, and will likely see a traffic report as a viable, important program to air ▪ Has potential to reach a broad audience, particularly in AM peak
Public Traveler Information Web Site	An ATIS web site for the Pomona Valley should be developed. This web site should include information from the IEN as well as manually entered data, as provided by individual agencies. As part of the initial web launch, primary information areas should include: ▪ Map of arterials and freeways ▪ Major incidents ▪ Construction/closures/alternate routes ▪ Events ▪ Links to multi-modal information ▪ Links to Pomona Valley Forum agencies ▪ Links to regional and state agencies The web site should be expanded to include dynamic data as soon as possible in order to provide the most benefit to the users. Dynamic data should include detector data from arterials for speeds and volumes, CCTV snapshots, etc.	▪ Low-cost, accessible technology for pre-trip information ▪ Makes extensive use of data gathered through IEN ▪ Web can serve as foundation for ATIS data for other technologies ▪ Easily expandable to accommodate new types of information ▪ Used to co-promote other ATIS services, including 511 and HAR
Travel Advisory Telephone	Highway Advisory Telephone is not recommended at this time.	▪ Provides pre-trip and en-route information via landline and wireless telephones. ▪ Regional travel advisory telephone service eliminates need for PVITS to host service or phone lines.
Kiosks	Stand-alone kiosks not recommended for deployment. Kiosks have demonstrated success when they are for specialized applications (such as transit or rail), but not for traffic. Modified kiosks, such as a mounted flat screens showing real-time data, incidents, events and traffic 'hot spots', are recommended for the Fairplex and other high-traffic generators.	▪ Non-interactive kiosks (large, wall-mounted displays) at major generators could provide highly-visible ATIS information to broader audience than stand-alone kiosk ▪ Maintenance requirements and potential for vandalism reduced with non-interactive, wall-mounted display.

Table 3 – Summary of Costs

Technology	Units/Costs
Highway Advisory Radio	The capital cost of HAR varies between $16,000 - $32,000/radio and includes all the equipment as listed in Table A in Appendix A. Operations and maintenance costs are estimated at $1,000 per year, including staff hours and maintenance.
CCTV cameras	Capital costs for a CCTV camera are estimated at $30,000 per installation (including poles) and operations and maintenance costs are estimated at $1500 per year. Additionally, the communications network needs to be sized to accommodate the quantity and quality of video desired (these costs are included in the communications conceptual design component). Digital and analog video transmissions are comparable in cost.
DMS	Costs for a DMS can range from $30,000 to $80,000 with operations and maintenance costs ranging from $1,500 to $8,000 per year as summarized in **Table 1.**
Community Access Television	There is no capital cost for the public agency if CATV is operated by the private sector, which is not likely for the Pomona Valley. The agency would act as the data source and the private sector partner provides access to the ATIS server, data formatting and graphics, and then provides the communications to the broadcast station. If the agency wishes to contract operations out to a private partner when the market demand justifies it, costs would depend on the business model selected. In markets where this service is operational (Phoenix and Bay Area), ETAK is the private partner, and recovers cost through advertising during broadcasts.
Public Traveler Information Web Site (publicly operated)	Initial implementation 1 @ $50,000 O&M for 3 years $90,000 $30,000 per year, includes staff hours, server upgrades, and server space charges from ISP

Travel Advisory Telephone	The capital cost for a phone service for traveler advisories can vary greatly depending on the type and quantity of information, the technology and equipment choices, and the call volume. The 511 Deployment Coalition published average costs for deployment and annual O&M in May of 2004 as follows: average cost for deployment is approximately $416,000 and the average cost per call (which includes all operations and maintenance costs) is $1.08. The average cost per call (which includes all operations and maintenance costs) can be estimated at $1.08 per the 511 Deployment Coalition.
Kiosks	The capital cost for the software development of a kiosk averages $9,500 - $50,000 and can be greater than that depending on the content, interaction, and what infrastructure is already in place (for example, this range of costs presumes that a dynamic ATIS web site is already operational, the additional cost to develop a kiosk deployment if a web site has not been developed would exceed this range). Unit cost estimates of the kiosk equipment can range from $10,000 to $16,000, including hardware, enclosure, installation, and modem server. O&M can range from $1,000 - $5,000 per year for the hardware. Software maintenance, presuming that a dynamic web site is already in place and operational, would be an additional annual cost of $9,500 - $50,000.

LIST OF ACRONYMS

ACE	Alameda Corridor East Construction Authority
ADOT	Arizona Department of Transportation
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System
AVL	Automated Vehicle Location
Caltrans	California Department of Transportation
CAMS/IEN	Los Angeles County Countywide Arterial Management System/Information Exchange Network
CATV	Community Access Television
CCTV	Closed Circuit Television
CMS	Changeable Message Sign
DMS	Dynamic Message Sign
FHWA	Federal Highway Administration
HAR	Highway Advisory Radio
HAT	Highway Advisory Telephone
IEN	Information Exchange Network
ISP	Information Service Provider
ITS	Intelligent Transportation System
IVR	Interactive Voice Response
LA	Los Angeles
LACDPW	Los Angeles County Department of Public Works
LACMTA	Los Angeles County Metropolitan Transportation Authority
LCC	Local Control Center
MDI	Model Deployment Initiative
MOU	Memorandum Of Understanding
MPO	Metropolitan Planning Organization
NTCIP	National Transportation Communications for ITS Protocol
O&M	Operations and Maintenance
OCTA	Orange County Transportation Authority
PC	Personal Computer
PDA	Personal Data Assistant

PSRC	Puget Sound Regional Council
PTZ	Pan, Tilt and Zoom
PVITS	Pomona Valley Intelligent Transportation System
RWIS	Road Weather Information System
SCAG	Southern California Association of Governments
TANN	Traveler Advisory News Network
TMC	Traffic Management Center
TOC	Traffic Operations Center
TOD	Time-of-Day
UDOT	Utah Department of Transportation
UFR	User Functional Requirements
UIR	User Interjurisdictional Requirements
UOR	User Operational Requirements
USR	User Supplementary Requirements
UW	University of Washington
VAR	Value-Added Reseller
VMS	Variable Message Sign
WSDOT	Washington State Department of Transportation
WWV	National Institute of Standards and Technology Time & Frequency shortwave radio station that broadcast accurate real time

APPENDIX A

Table A – ATIS Technology Analysis

Analysis Criteria	Highway Advisory Radio (HAR)	Community Access Television (CATV)	Public Traveler Information Internet Site	Highway Advisory Telephone (HAT)	Kiosk
Performance					
Present	HAR is used to provide en-route information about closures, restrictions, construction, detours/alternate routes, hazardous weather, special events and other factors that could impact travel. Presently, HAR broadcasts are predominantly static, recorded information. HAR stations can be fixed or portable. Although FM broadcasting is available, HAR messages typically broadcast over AM radio, which is available in most vehicles; in 1992, the FCC allowed HAR radio stations to be licensed for operation on any open frequency. Range is limited to a few miles (average range is from 3-5 miles, depending upon the terrain). Arterial streets may have a more limited range due to buildings or other structures that could interfere with transmission.	There have been few (<10) deployments of dedicated traffic information channels across the United States. These channels are intended to provide continuous traffic conditions information during the AM and PM peak travel periods. Using a combination of maps, graphics, icons, voice, text, and video images, CATV traffic stations provide an overview of congestion levels, incidents, closures, restrictions, special events, weather, and overall traffic conditions on roadways in a region.	Traveler information web sites have been widely implemented by private, local, regional and state agencies throughout the United States. The convenience of the Internet has made this a popular and cost-effective way to disseminate traffic and travel information to a broad audience. Public agency sites are typically implemented and operated by city, county or state DOTs, transit agencies, or regional planning organizations. There are numerous private sites that also provide traffic and travel information. Content and information will vary by site, but typically includes: ▪ Incidents, closures, restrictions ▪ Construction/detours ▪ Major delays ▪ Multimodal information or links More advanced ATIS web sites also might include: ▪ Congestion ▪ Travel times ▪ Weather and pavement condition information ▪ CCTV camera feeds ▪ Other regionally significant information or links (special events, tourism info, etc.)	Agency phone hotlines for travel advisories, closures, detours, and other pertinent information are readily available and in operation throughout the country. These dial-in hotlines are primarily recorded information available through push-button menu trees. Private ISPs also offer ATIS information through wireless services and subscriptions. 511 has been designated by the FCC as a national travel information number. It is up to states and regions to implement the 511 service, which has been reserved for government entities. States that already have converted their travel advisory phone services to 511 or implemented new 511 services are: ▪ Arizona ▪ Nebraska ▪ Kentucky ▪ Minnesota ▪ Orlando and Miami-Dade Area, Florida ▪ Utah ▪ Virginia Several other states are in the planning and implementation stages of their 511 services. Some are using Interactive Voice Response (IVR) technologies, while others are using the more traditional push-button menus. The California model is that Caltrans will receive all rural and SACOG calls and each metro area (as desired by each region) will have their own systems with call transfers between them to accommodate caller's needs.	ATIS kiosks are self-contained interactive computer centers for traffic and travel information. Kiosks are typically equipped with a touch-screen that allows users to navigate to the information they want to see. They provide static information, and if connected via an internet connection, can provide real-time (or near-real-time) information using text, graphics, video clips and sound. Some kiosks also can be equipped with printers. Future concepts of kiosks include large-screen, flat-panel liquid crystal displays, which may be more effective than single-user interactive devices. Such displays could contain essential real-time information, and be located in areas of high pedestrian traffic. Although these would not be interactive, they will still provide valuable information in high-profile locations.

Table A – ATIS Technology Analysis (continued)

Analysis Criteria	Highway Advisory Radio (HAR)	Community Access Television (CATV)	Public Traveler Information Internet Site	Highway Advisory Telephone (HAT)	Kiosk
Performance (continued)					
Future	Digital HAR is a technology that converts messages digitally from a central system or ATMS into voice messages for HAR broadcast. Digital HAR claims to bring HAR into real-time – with messages changing on HAR stations as conditions change, which increases HAR message-relevance to the driver.	The future of traffic information on dedicated community access channels is growing slowly. They often require participation from the private sector when feasible, and CATV has not proven itself to be a revenue generating ATIS operation.	The Internet has increased consumers' expectations of information availability, quality, and responsiveness. This effect is readily seen among ATIS web site customers, who are encouraged by sites that continually improve functionality and features. Some of these features could include: ▪ freeway on-ramp queues ▪ prediction of traffic congestion ▪ parking ▪ event information and advisories (such as a ball game or concert) on a map so that these areas can be avoided.	511 will continue to drive the need and demand for faster, more accurate, real-time and more personalized ATIS information. Because telephone service users are frequently calling from the road, they require fast and easy access to information. New voice recognition software that allows callers to tell the service which road segment or region to describe is a great improvement over push-button information trees, particularly for drivers.	Kiosks may become more interactive, containing more localized information dependent upon kiosk location. More reliable connections to real-time information (connection speed) can improve kiosk performance and perception of effectiveness by users.
PV ATIS Functional Requirements					
Current	Supports all Functional Requirements <u>except:</u> ▪ Performance Requirements SFR 1.4, 1.7, 1.8 (N/A) ▪ Equipment and Technology Requirements SFR 2.1, 2.2 and 2.4 (N/A) ▪ Data Management Requirements not applicable to standard HAR ▪ Availability of Technology Requirements SFR 4.2 (N/A) ▪ Adaptability Requirements SFR 5.2 (N/A) ▪ Operational Considerations Requirements SFR 8.2, 8.3 and 8.4 (N/A) ▪ System Interface Requirements not applicable to HAR (does not directly interface with outside systems) ▪ Reliability Requirements SFR 12.1, 12.7 (N/A) ▪ Flexibility Requirements SFR 13.1	Supports all Functional Requirements <u>except</u>: ▪ Performance Requirements SFR 1.8 (N/A) ▪ Data Management Requirements not applicable to CATV ▪ Equipment and Technology Requirements SFR 2.1 and 2.2 ▪ Availability of Technology Requirements, SFR 4.2 (N/A) ▪ Adaptability Requirements SFR 5.2 (N/A) ▪ Operational Considerations Requirements SFR 8.2, 8.3 and 8.4 (N/A) ▪ Flexibility Requirements SFR 13.1 (N/A)	Supports all Functional Requirements <u>except</u>: ▪ Adaptability Requirements SFR 5.2 (N/A) ▪ Flexibility Requirements SFR 13.1 (N/A)	Supports all Functional Requirements <u>except:</u> ▪ Equipment and Technology Requirements SFR 2.4 (N/A) ▪ Data Management Requirements SFR 3.1, 3.2, 3.5, 3.8 (N/A) ▪ Availability of Technology Requirements SFR 4.2 (N/A) ▪ Adaptability Requirements SFR 5.2 ▪ Operational Considerations Requirements SFR 8.2, 8.3, 8.4 (N/A) ▪ System Interface Requirements SFR 10.4 ▪ Flexibility Requirements SFR 13.1	Supports all Functional Requirements <u>except</u>: ▪ Data Management Requirements SFR 3.1, 3.2, 3.3 (N/A) ▪ Adaptability Requirements SFR 5.2 ▪ Flexibility Requirements SFR 13.1
Anticipated	Digital HAR and real-time information could potentially address Performance Requirement SFR 1.4 and Data Management Requirement SFR 3.1.	None noted.	None noted.	None noted.	None noted.

Table A – ATIS Technology Analysis (continued)

Analysis Criteria	Highway Advisory Radio (HAR)	Community Access Television (CATV)	Public Traveler Information Internet Site	Highway Advisory Telephone (HAT)	Kiosk
Operations Requirements					
Software	Can be operated from TMC via windows based software.	Software is required for consolidating data and images, and converting to graphics, text-to-speech capabilities.	Commercial-off-the-shelf software packages or customized web software applications.	Automated custom-developed voice response software.	Information stored in Hyper-text Markup Language (HTML) format, the same as used by the WWW. Often requires vendor supplied software, web interface to other systems.
Hardware	Needed hardware includes processor, antenna, transmitters, battery back-up, cabinet, rack mounting, lighting, mounts, connectors, cable. Flashing advisory signs will require a sign controller (can be via pager). HAR can use a 10-watt transmission or a 0.1-watt transmission antenna.	Processing equipment is required for exporting of real-time traffic images to TV stations. Typically uses a standard NTSC video and audio signal suitable for regular broadcasting, cable casting or satellite broadcasting. Can also use the internet to transport automated CATV to broadcast center.	Hardware platform consists of a PC (Pentium PIII 450 MHz processor and Dialogic DSP voice boards).	Premise-based (or on-site) 511 systems would require more than just a PC. They would need a telephony system that would require multiple servers to get calls, extract the needed information, provide that information to the callers (via a recorded message or structured message), or transfer the call to where it needs to go. A Network-based service would be hosted by a contracted provider (e.g., Tell Me, Be Vocal, or perhaps a telecommunications carrier with that capability). A feed would need to be established from the ATIS server to the network provider, who would then take care of the information retrieval, formatting, and providing it back to the caller.	Kiosk enclosure, screen, peripheral keys, web-based device. Printers may be installed at kiosk location.
Interface	Analog messages are voice recorded, so automatic interface with other ATIS is limited. Digital technology includes text-to-speech applications that allow for typed messages to be distributed via e-mail, fax, on internet and routed to HAR.	Must interface with central ATIS server or private sector server (with agency ATIS information).	Interface with central ATIS server. Requires human interface to manually enter certain types of data as well as verify accuracy, completeness.	Interactive Voice Response (IVR) or text-to-speech systems need to interface with ATIS or web server for data.	Even with local content stored on kiosk hard drive, requires interface to other systems, either through dedicated link or web browser, for updated information about conditions, status, events, weather, etc. Also requires interface with vendor system for maintenance and updating of hard drive contents.
Reliance on Other Systems	Communication with TMC is done with conventional landline or by wireless phone.	Requires automated and manual input of information for consolidation.	Dependent on inputs and information from other systems.	Reliance upon local telephone exchange carriers and wireless providers for phone service. Also dependent on inputs from other systems, and in some cases, dependent on operations staff to record or update messages. If contracted, relies on third party/private partner for operations.	Relies on outside sources of data for updated information about conditions, weather, events, etc. Kiosks may require dial-up phone line or Local Area Network in the residing facility to provide connection to the internet.
Technology					
Availability	▪ HAR technology is readily available and widely used. ▪ Can be fixed or portable stations. ▪ Solar-powered is available, which eliminates the need for electrical service. ▪ Digital or analog	Television is a readily available technology, as is the Internet for transmitting data and information for broadcast.	Widely available technology, accessible to users through landline and wireless Internet connections.	Available technology and widely accessible for pre-trip and en-route information (via mobile phone). Can be accessed by landline or wireless phone services.	Widely available technology.
Maturity	The FCC initially authorized HAR for use in the United States in 1977, and HAR has been widely deployed in urban and rural areas. HAR capabilities and functionality has evolved with innovations in wireless and voice applications.	Traffic information on a dedicated Cable TV/public access channel has limited deployment, though broadcast stations widely disseminate traffic information.	Continuing to evolve and develop new applications.	Phone services for traveler advisories have been operational for many years. IVR is an emerging technology in the ATIS arena, and has demonstrated success where deployed (Utah).	Mature technology. However, continuing to evolve and improve as web-based applications evolve and develop.
Reliability	Overall, HAR is a reliable technology. There is potential for interference from existing radio, commercial radio stations, and interference from	Reliability dependent upon software and hardware interfaces with information sources, such as central ATIS server. Also dependent upon private	Reliability depends on data sources and communications links. Data quality parameters, time stamping and other processes need to be	Phone networks provide a robust and reliable communications medium. Reliability of information is dependent on accuracy, quality and	Deployments experienced a latency of 20 – 50 seconds when dynamic information is requested. This is due to reliance on standard phone lines for

Analysis Criteria	Highway Advisory Radio (HAR)	Community Access Television (CATV)	Public Traveler Information Internet Site	Highway Advisory Telephone (HAT)	Kiosk
	environmental conditions or surrounding buildings. Sound quality can be affected by: phone lines used to load messages, quality of the original recording and voice characteristics of person recording the message, and the quality of the equipment (especially the digital recorder and transmitter).	partner for data conversion and for broadcasting (station).	implemented by agencies.	timeliness of information being provided to the ATIS, whether automatic or manually entered.	dial-up access to dynamic information, and depending on the type of communications line, the user may experience slow connection time and slow refresh rates. Usually up to the deploying agency to maintain phone lines and connections.

Table A – ATIS Technology Analysis (continued)

Analysis Criteria	Highway Advisory Radio (HAR)	Community Access Television (CATV)	Public Traveler Information Internet Site	Highway Advisory Telephone (HAT)	Kiosk
Technology (continued)					
Expandability	HAR is scalable, dependent upon the number of field units deployed. System can be easily expanded to allow for new devices. Range is typically 3-5 miles.	Broadcast form of information dissemination. Unlimited number of users able to receive information simultaneously. Information can be customized based on need and availability.	Easily expandable technology. Web applications can expand to accommodate new data sources and types of information. Linking to other agencies and sites also provide additional information and resources for the user.	VoiceXML allows for agility and flexibility in programming to adapt to additions and new information sources in the service being provided.	As kiosks are web-based, kiosk enhancement is performed remotely.
Flexibility	The removal or addition of devices will not impact the system performance. Each unit operates individually. Portable HAR provides greater flexibility for urban areas, as the units can be located in areas where and when the advisories are needed (construction, detours, special events).	Flexibility dependent upon software ability to compile information prior to distribution. Television does not allow for interaction with user. Information is regional and not personalized.	ATIS web sites can be designed to be scalable to easily expand to accommodate new types of information and sources, as well as incorporate security features to restrict certain data from being displayed. Some ATIS web sites allow for personalization of content (specific routes, specific events and types of details, notification of incidents or events on 'personal' route, etc.).	Phone systems allow for transferring or switching to other agency systems, depending on the type of information requested. Phone systems also allow for multiple users to access the system simultaneously (this could be limited by the number of available phone lines).	The removal or addition of devices will not impact the system performance. Each unit operates individually. Content is limited to information stored on hard drive and established links.
Interoperability	Software Interface Modules allow the incorporation of HAR control into any integrated software solution. Digital HAR technologies allow for text to speech applications, allowing the same information to be distributed via web, e-mail, fax and uploaded to HAR for broadcast.	Interoperability dependent upon interfaces with other systems; relies on data and video from information sources and systems.	Interoperability dependent upon software and hardware interfaces with other systems, including data exchange networks, ATMS, CCTV, etc. Web systems also can be used as data sources for other ATIS, including 511 phone service and kiosks (interactive and non-interactive).	Interoperability dependent upon software and hardware interfaces with other systems. Some 511 systems are designed to utilize information from web or other text-to-speech applications.	Interoperability dependent upon software and hardware interfaces with other systems.
Adaptability	Adaptable to disseminating new sources of information, as messages are recorded at the TMC and sent via telephone line to the field unit. Messages can be manually updated based on current conditions.	Adaptable to disseminating new sources of information. Content can be customized and updated as needed.	Adaptable to disseminating regionally relevant and significant types of information. Interfaces can be automatic or data can be uploaded manually to provide current conditions information.	Adaptable to disseminating new sources of information, transferring to other agencies or live operator.	Adaptable to disseminating new sources of information. Will require reconfiguring settings and adding content (stored on hard drive) or establishing new links.
Applicable Standards	▪ Data Radio Channel (DARC) – CEA/EIA- 794 ▪ Subcarrier Traffic Information Channel (STIC) System – CEA/EIA-795 ▪ ATIS Data Dictionary – SAE J2353 ▪ ATIS Message Set – SAE J2354 ▪ ATIS Message Sets delivered over Bandwidth Restricted Media – SAE J2369 ▪ Traffic Management Data Dictionary (TMDD) ▪ HAR also is subject to FCC Rules and Regulations.	NTSC industry standards (non ITS) CATV also is subject to FCC Rules and Regulations	▪ ATIS Data Dictionary – SAE J2353 ▪ ATIS Message Set – SAE J2354 ▪ Traffic Management Data Dictionary (TMDD) ▪ Internet TCP/IP and UDP/IP Transport Profile – NTCIP 2202 ▪ Application Profile for Simple Transportation Management Framework (STMF) – NTCIP 2301	▪ ATIS Data Dictionary – SAE J2353 ▪ ATIS Message Set – SAE J2354 ▪ Traffic Management Data Dictionary (TMDD) ▪ Unofficial traveler information industry standard, VoiceXML, has emerged. VoiceXML allows for agility and flexibility in programming to adapt to changes in the service being provided.	▪ ATIS Data Dictionary – SAE J2353 ▪ ATIS Message Set – SAE J2354 ▪ Traffic Management Data Dictionary (TMDD) ▪ Internet TCP/IP and UDP/IP Transport Profile – NTCIP 2202 ▪ Application Profile for Simple Transportation Management Framework (STMF) – NTCIP 2301
O& M Issues					
System Support Capabilities	Can be operated and maintained by agency staff, with supplemental maintenance from vendor (if agreed in contract).	Requires automated and manual inputs of data for broadcast.	Requires on-going updating.	Requires on-going updating for recorded messages, staffing needs for operator-assisted systems, or contract for system operations and hosting.	Requires vendor support for routine maintenance (nightly or weekly updates to static content), and staff support for communications maintenance.

Table A– ATIS Technology Analysis (continued)

Analysis Criteria	Highway Advisory Radio (HAR)	Community Access Television (CATV)	Public Traveler Information Internet Site	Highway Advisory Telephone (HAT)	Kiosk
O& M Issues (continued)					
Maintenance Requirements	Basic maintenance of field equipment, including cabinet and contents and antenna. Recording analog messages for broadcast also falls under maintenance requirements. Estimate for staff time required for maintenance is an average of one hour per week. Automated digital technology would require less staff commitment.	O&M would include basic maintenance of software and hardware.	No field maintenance required. Basic maintenance required of network servers.	Deploying agencies may host the database, the source code, and all audio files, or contract operations to a call center or other entity for hosting (such as TellMe).	Routine maintenance performed remotely via a WAN or telephone dial-up connection. Content update, usage data and on-line monitoring of individual kiosk condition is performed remotely. Kiosks designed to restart themselves when a problem arises (i.e. a screen freezes). Staff will need to periodically monitor to ensure communications are operational.
System Readiness	Once hardware and communications are established, the system can be readily operated. Requires activating information recordings, and monitoring/updating by agency staff to maintain accuracy and timeliness of information being broadcast.	Readily available. Interfaces to data sources and content needs development. Data stream from ATIS server can be available for broadcast 24 hours per day, but will depend on station's content need and broadcast time slot (which is typically just AM peak).	Readily available and accessible to multiple users simultaneously.	Readily available and accessible to multiple users simultaneously.	Readily available providing content is loaded, outside communications established, and kiosk is in good working order.
Life cycle	20 years (radio) 10 years (sign)	Dependent on success and use.	Varies. Internet ATIS technology continues to evolve and expand.	Varies	7 years
Liability and risk	Minimal. Could incur liability as a result of broadcasting incorrect or outdated information.	Minimal. Could incur liability as a result of broadcasting incorrect information.	Low liability and risk. Could incur liability by disseminating incorrect information – disclaimers are recommended for both automated and manually entered data. Security of information needs to be addressed through firewalls, terms of use, and agreements with third parties that are redistributing the information.	Low liability and risk. However, may incur liability by disseminating incorrect information. Extremely high call volumes could cause system to 'drop' calls.	Kiosks can be subject to vandalism – including screen, kiosk enclosure, or printer. Non-interactive kiosks are less prone to vandalism and should require less maintenance as users do not interact with the hardware physically.
Staffing / Training	Requires training of technicians to maintain field equipment. Recording and monitoring of analog broadcasts can be accomplished with existing staff (typically public information officer, TMC operator, or other designated staff). Maintenance of equipment also will fall under responsibility of existing maintenance staff or will need to be contracted to vendor per warranty specifications. Will not require additional staff to operate and maintain.	Basic maintenance of hardware and software and some coordination with broadcaster and/or private partner and/or advertising contracts (if advertising slots or displays are sold for return on investment or for profit).	May require training of programmers. Information will need to be monitored for accuracy and timeliness, and staff will need to update some information as needed. Current Information Technology (IT) staff able to perform many essential functions.	Using a contractor (such as TellMe) eliminates the need for any investment in infrastructure and hardware to learn and run the system. If operated In house, existing staff would need to provide updated messages (TMC staff or public information officer).	Requires knowledgeable programming staff and vendor support. Requires some training of staff on how to reboot the kiosk, line maintenance, etc.

Table A– ATIS Technology Analysis (continued)

Analysis Criteria	Highway Advisory Radio (HAR)	Community Access Television (CATV)	Public Traveler Information Internet Site	Highway Advisory Telephone (HAT)	Kiosk
Cost					
Capital	$16,000 - $32,000/radio. Includes processor, antenna, transmitters, battery back-up, cabinet, rack mounting, lighting, mounts, connectors, and cable. Super HAR costs an additional $9-10K (larger antenna). Primary use of the super HAR is to gain a stronger signal. $1,000/year O&M, includes staff hours and maintenance (might be less for digital system) Government entities are exempt from FCC application and renewal fees.	In markets where this service is operational (Phoenix and Bay Area), ETAK is the private partner, and recovers cost through advertising during broadcasts.	$85,000-135,000 to develop and deploy a public ATIS web site that includes real-time freeway/roadway speeds or congestion levels, incidents, as well as CCTV video images (snapshots or streaming video). $50,000 for an ATIS website that includes closures and restrictions, advisories, and links to other ATIS information. O&M costs will vary based on level of detail contained on the ATIS web site. 'Basic' web sites with static information, such as closures, construction, events, etc. will average $20,000-$30,000 annual O&M (which includes staff hours, network/server maintenance, and service provider charges for Internet server space). 'Enhanced' web sites with dynamic information such as real-time volume and speed data, travel times, incidents, and camera images will require additional O&M resources, communications, and server space. Annual O&M estimates for enhanced web sites range from $75,000 to $125,000. (As an example, the Arizona DOT web site with dynamic freeway conditions, camera views, and statewide closure/restriction information averages $117,000 per year in O&M).	$75,000 (depending on the number of calls) with estimated maintenance cost of $10,000 per year.	$9,500 - $50,000 for software development. Unit costs are $10,000 to $16,000 Includes hardware, enclosure, installation, modem server, and map software for indoor and outdoor. O&M $1,000 - $5,000. (presumes that a dynamic ATIS web site is already established and operational.) Software maintenance $9,500 - $50,000 annually (presuming dynamic web site is already in place and operational)
Associated (communication, programming req's)	Utility/electrical service (if applicable)	Cable Channel Airtime – estimated at $78,000 per year.	N/A – these are included as part of Capital and O&M.	Telecommunication charges depends on number of calls.	$2,000 - $27,000 Software costs are for COTS (low) and developed/outdoor (high).

Table 1 – ATIS Technology Analysis (continued)

Analysis Criteria	Highway Advisory Radio (HAR)	Community Access Television (CATV)	Public Traveler Information Internet Site	Highway Advisory Telephone (HAT)	Kiosk
Cost (continued)					
Estimated Life Cycle Cost	Assuming: $24,000 per 10-watt HAR and 2 HAR signs per installation 20-year life cycle for HAR, 10-year for signs $44,000 per HAR (incl. capital & O&M) $5,000 for signs (inc. capital & O&M)	Capital costs would include software development and purchase of some hardware to process and disseminate the data. O&M would include basic maintenance of software and hardware. The currently operational CATV systems are provided by private partners. Life cycle, and therefore life cycle cost, is dependent on the success and use of the system.	Life cycles for ATIS web sites are not easily defined. With rapidly changing technology and system capabilities, these are dynamic outlets that are continually being modified, upgraded and expanded. High-end estimates for a 'basic' site (as described above): Initial Deployment: $50,000 Annual O&M: $30,000 Five Year O&M $150,000 Five Year Life Cycle: $200,000 (includes initial deployment and five years of operations and maintenance) High-end estimates for an 'enhanced' site (as described above): Initial Deployment: $135,000 Annual O&M: $125,000 Five Year O&M: $625,000 Five Year Life Cycle: $760,000	Varies dramatically based on type of service offered (live operator, contracted hosting service, number of available lines, etc.)	$54,500 - First kiosk in system, includes development, unit cost and O&M (assumes low-end unit and development cost, high-end maintenance cost); 7 year life cycle. $45,000 – each additional kiosk with same configuration, same enclosure, etc.; 7 year life cycle.
Other (training, warranties, etc.)	Warranty and manufacturer-supplied maintenance and technical support costs will vary by vendor/manufacturer.	N/A	Terms of use, privacy policies, disclaimers	Deployed agencies' maintenance agreements have included provisions for updating of most current version of text to speech software, enabling continuous improvement of software.	Typically requires vendor maintenance and support contract – for routine as well as major maintenance activities.
Ownership					
Licensing requirements	To obtain a license for a HAR station, one must file a Form 601 with the FCC. A license is issued for a five - year term and must be renewed at the end of that period.	Requires license fee – cost is to broadcasting station.	A domain name would need to be purchased/ established for the site.	None noted.	None noted.
Usage					
Potential for usage	HAR has the potential for widespread use, as radios are standard in most vehicles. HAR allows for more complex, detailed messages than what can be displayed on a DMS.	Television and cable television are widely available, and have the potential to reach a broad audience with pre-trip information. Higher potential for usage in AM peak hours when users are at home. Usage levels decrease in PM peak.	High potential for usage as pre-trip information – depends on travelers' awareness of site and information provided. Information needs to be accurate, timely and relevant for users to see it as a reliable source of ATIS information.	Has been demonstrated to be successful in highly congested metropolitan areas where consumers value the low-tech, easy access to information.	AZTech™ (Phoenix, AZ) kiosk usage was found to be less than satisfactory. Kiosks deployed in public administration buildings received little use, while those deployed in libraries and other public facilities had relatively higher usage rates. Kiosks in locations such as malls had the highest usage level. Potential for usage is greatest where pedestrian traffic is high, or for specialized services (such as transit).
Limitations of use	Requires motorist action to tune to the HAR broadcast station. Motorist must listen to entire message if part of message is missed. Messages often regional in nature, not specific or personalized. Broadcast and message clarify could be subject to interference.	Limited by quality of information, and the inability for the user to receive information directly applicable to his/her route. As part of the Smart Trek and AZTech™, traffic channels on CATV were launched in Seattle and Phoenix. Responses to surveys distributed in Seattle and Phoenix MDI were not strong, which may indicate low viewership. Those surveyed found the service more useful than traffic	Content gaps, lack of real-time information, and lack of promoting the site could limit usage.	Limited by information quality and production costs, although one service provider has developed a way to automate production.	Effectiveness largely depends on the complexity of transportation environment and commute scenarios, quality of contents provided, and upon the system performance. Marketing efforts are needed to promote awareness of the kiosks, locations, and how to use them.

Analysis Criteria	Highway Advisory Radio (HAR)	Community Access Television (CATV)	Public Traveler Information Internet Site	Highway Advisory Telephone (HAT)	Kiosk
		information on the radio, but overall felt that en-route information was more useful and accurate than pre-trip.			

Usage (continued)					
Expected level of use	Most prevalent in rural areas or in urban areas where other ATIS is limited. Successful urban applications are event-specific (construction, detours, special events, airports).	Level of use will depend on how well service is promoted and received by viewers. Unlike web, phone or kiosk systems, television viewership is difficult to measure. It is common practice among many TV news stations to provide traffic reports, including CCTV feeds (where available), during the AM and PM peak travel periods.	Web site usage varies depending on how well the service is promoted, and how valuable travelers find the information and content. In Seattle, monthly web hits average 300,000. In winter months the usage more than doubles. Other web systems including Utah and Arizona experience similar spikes in usage during periods of extreme weather. Major events (such as Utah Olympics) can generate several million hits per week.	As cell-phones gain larger market penetration, demand for telephone-based service will increase. 511 deployers report increase in usage after 511 was implemented. In Utah, 4600 calls were received on the first day, and averaged 3700 per day during Olympic games. Seattle's hotline receives an average of 3000 calls per day during summer, and 12,000 calls per day in winter. Similar to increased web hits during periods of extreme or hazardous weather, calls to agency information hotlines also increase, in some cases by more than 300%.	Kiosks have been more successful in locations with more complicated multi-modal transportation systems, such as Seattle and New York. In these areas, integrated ITS systems produce significant real-time traveler information across different transportation modes. AZTech™ kiosks showed a significant drop in usage between 1999 and 2001 – overall a 25% reduction in numbers of hits. The kiosk that showed the most increase in usage (over 350%) was located in a heavily traveled downtown transit station.