

INTELLIGENT TRANSPORTATION SYSTEMS

for Traveler Information



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In the 10 most congested areas of the country, each rush hour traveler pays an annual “congestion tax” of \$850 to \$1,600 in lost time and fuel and spends a total of almost 8 work days each year stuck in traffic. To address this costly problem, the U.S. Department of Transportation launched the *National Strategy to Reduce Congestion on America’s Transportation Network*. One element of this strategy is to advance low-cost operational and technological improvements that increase traveler information through expanded use of Intelligent Transportation Systems (ITS).¹ ■

Traveler Information



Real-time traveler information is information that allows travelers to choose the most efficient mode and route to their final destination. Traveler information systems use ITS to provide timely and detailed information about traffic incidents, the weather, construction, and special events to improve travel time predictability, allow drivers to make better choices, and reduce congestion. Measurable impacts of traveler information systems include:

- The use of dynamic message signs and highway advisory radio in South Carolina following Hurricane Floyd in 1999 made it easier for evacuees to use all freeway lanes as they returned home. Statistics show that traffic volume during the evacuation, when outbound traffic used only one side of the freeway, was 44 percent less than traffic volume during the return trip when inbound traffic used both sides of the freeway.²
- In California, it is estimated that the reduced travel times and vehicle operating costs for California travelers will provide a payback value of \$100 for every \$1 invested over the next 20 years in comprehensive statewide traveler information by using the generated data in other infrastructure operations.³
- In 2004, 92.3 percent of callers to the San Francisco Bay Area 511 number said that they were satisfied with the system, as did 90.3 percent of callers to Montana’s statewide 511 number. In a survey of callers to Virginia’s 511 system along I-81, 99 percent said they would call again.⁴
- In a 2004 survey, 41 States indicated they currently deploy traveler information websites,⁵ 25 use highway advisory radio,⁶ and 8 reported having either statewide or regional 511⁷ – a number that had grown to 26 States by September 2006.⁸
- 80 percent of surveyed visitors to Maine’s popular tourist destinations of Bar Harbor and Acadia National Park said that the availability of real-time information on the electronic departure signs influenced their decision to use the bus.⁹ ■

BENEFITS

Travel Time in Demand in Houston and Chicago



When drivers in the Houston metro area got tired of seeing dynamic message signs (DMS) without useful information posted, they let Houston TranStar –

the partnership responsible for coordinating the planning, design and operation of Houston's transportation systems, emergency management functions, and ITS – know about it.

TranStar currently posts travel times on 81 DMS across more than 250 centerline miles of Houston area freeways.¹⁰ Travel times are based on data collected from the nearly 2 million "EZ-Tag" automatic vehicle identification toll transponders currently circulating around the Houston metropolitan area.¹¹ Data from these vehicle probes are collected at 232 supplemental reader stations and transmitted to TranStar for analysis. Reader stations are,

on average, 2-3 miles apart, but not more than 5 miles apart.¹²

As a result of driver complaints about static messages posted on the DMS, TranStar staff conducted an Internet-based survey to determine the types of information people wanted to see posted. Results of this survey indicated that drivers were primarily interested in seeing incident information (93 percent) and travel times (82 percent). Many respondents indicated that while incident information is important, they also need travel time information to better determine how incidents impact their travel.¹³

The Illinois State Toll Highway Authority (ISTHA) covers a significant part of northeastern Illinois, the third most congested area in the country.

ISTHA provides average travel times from toll plaza to toll plaza based on "I-PASS" toll transponder data collected by its electronic toll collection system. Users of

the automated I-PASS toll collection system now exceed 1.5 million.¹⁴ These numbers provide ISTHA with a significant penetration of vehicle probes, providing high-quality, time-stamped location information to the Tollway in near real-time.¹⁵

ISTHA uses data from three sources to calculate travel times: I-PASS transponders, radar sensor stations along tolled roads, and loop detectors maintained by the Illinois Department of Transportation. ISTHA currently posts travel times on 33 DMS located on tolled and nearby non-tolled roads.¹⁶

Although ISTHA has not conducted a formal study, emails and calls to the customer input line indicate that drivers approve of travel time availability information, and will complain when a non-incident-related message is posted during times when travel time information is normally available.¹⁷ ■

LESSONS LEARNED

What Should It Say? Guidelines for Effective DMS



At typical highway speeds the message posted on a dynamic message sign (DMS) must be presented to motorists in about 8 seconds or less. This

translates to eight words at 55 mph, seven words at 65 mph, and six words at 70 mph.¹⁸ Therefore, the message must count, and the words used must have impact.

The most effective DMS are the ones that contain the following elements (in the order presented):

- Situation description
- Situation location
- Effect on travel (delays, lanes blocked, etc.)
- Action motorist should take
- Benefit of taking the action (usually implied by situation description).

Some tips to remember when creating dynamic messages include the following:¹⁹

- Motorists will ignore advice unless a reason is offered for taking it.²⁰ The "reason" in most cases is the problem (Accident, Left 2 Lanes Closed, etc.). Motorists expect this information to appear first in a DMS message.
- For incidents and roadwork, the location should immediately follow the situation descriptor.²¹ If there is an incident ahead, it is important to tell drivers where it is so they can determine whether or not to change their route. If a lane is closed, the DMS message should also include that information so drivers can begin to merge or exit.
- When a majority of motorists are commuters, the incident/roadwork location should be referenced to the nearest cross-street or exit ramp.²² Commuters are very familiar with cross-street names and exit ramp names (or numbers), so these should be included in the message.
- When a majority of motorists would be unfamiliar with the names of local cross-streets, the incident/roadwork location should be described in distances to the nearest half-mile.²³ On Interstates where numbers are used for exit ramps, the incident location can be referenced to the exit ramp number so non-local motorists can interpret the information as easily as local drivers.
- It is important to maintain the credibility of DMS messages by changing them in a timely manner and by validating the message displayed.²⁴ Displaying messages that are inaccurate leads to motorist confusion and can adversely affect both traffic flow and the transportation agency's credibility.
- Travel times should be generated automatically and not require a human operator to manually enter travel time data.²⁵ It is important to note that effective travel time messages do not require the data to be 100 percent accurate. Research indicates that data with error rates of 20 percent still produce useful traveler information. ■

COSTS

511 Costs Vary, But Customer Satisfaction Is High

Although 511 system costs vary depending on system size and other factors, in States where 511 is deployed, customer satisfaction rates are consistently high. For example, Arizona has a 511 customer satisfaction rate of 71 percent, and Washington State has a satisfaction rate of 68 percent.²⁶ Similarly, callers to the Eastern Kentucky Rural Highway Information Project system indicated their happiness with 511, with 94 percent of those surveyed stating they were very satisfied with the answers and information they received.²⁷

But informative, customer-friendly 511 systems do require varying levels of investment. The following are representative examples of 511 deployment costs collected from around the U.S. that can apply to either a State or metropolitan system.²⁸

Labor costs include personnel that are working on and providing support to the 511 system.

- Two tours by management and technical personnel to existing 511 deployments to gather information: \$13,720.
- Internal information technology department labor charges: \$100,000.

Equipment costs include software and hardware purchased for the 511 system as well as associated upgrades and expansions to integrate existing traveler information systems with the 511 system.

- Text-to-speech and voice recognition software: \$179,000.

- Completely new advanced traveler information system hardware and software: \$305,920.

Telecommunications costs associated with the system include both initial implementation and operation.

- Fees for one telecommunications company to transfer 511 calls in one metro area: \$12,000.
- Programming telecommunications equipment to properly direct 511 calls throughout one state: \$84,000.

Marketing costs include the initial and ongoing costs of outreach and advertisement to the traveling community.

- 511 advertisement in 350,000 travel guides: \$3,400.

- Signage, brochure, other collateral: \$41,000.

Because the costs to design, build, and implement 511 traveler information systems can vary widely depending on the size of the system and the availability of existing infrastructure, the average development cost, as well as the cost-per-call, which includes all operations and maintenance costs, have been recognized as useful comparative measures to assist deployers with developing appropriate budgets. Data collected from several statewide and metropolitan systems show the average development cost is \$415,683 (ranging from \$133,000 to \$1,028,000), and the average cost-per-call is \$1.08 (ranging from \$0.12 to \$2.84).²⁹ ■

Roadside Equipment Costs³⁰

Unit Cost Element	Life (Years)	Capital Cost	Operations and Maintenance Cost*(per year)
Dynamic Message Sign	10	\$47,000-\$117,000	\$2,300-\$6,000
Dynamic Message Sign Structure	20	\$25,000-\$120,000	Not available
Portable Dynamic Message Sign	14	\$18,300-\$24,000	\$600-\$1,800
Highway Advisory Radio	20	\$15,000-\$35,000	\$600-\$1,000
Highway Advisory Radio Sign	10	\$5,000-\$9,000	\$250

*In 2005 dollars.

DEPLOYMENT

Traveler Information Vital During Emergencies

On a typical day, traveler information is an important tool for communicating with the traveling public, and State and local agencies have typically used dynamic message signs (DMS) and highway advisory radio (HAR) in advance of exits and interchanges where alternative routes may help drivers avoid congestion delays or work zones.

But traveler information systems are also crucial for getting information to motorists who need to know about evacuation routes and the impacts of national security or other emergencies. For example:

- Florida residents contemplating travel during extreme weather can access the State Department of Transportation's website to view the statewide network of real-time traffic volume and speed

data recorders. It also provides links to hotels in Florida, Alabama, and Georgia that allow evacuees to make online hotel reservations.³¹

- On September 11, 2001, within 2 minutes of the decision to close the main bridge to New York, DMS alerted motorists 10 miles away. The New York Department of Transportation quickly deployed portable DMS at New York City bridge and tunnel entrances advising of road closures. After TRANSCOM, the regional transportation management coalition, alerted the I-95 Corridor Coalition agencies of problems in the New York region these agencies used HAR and DMS on I-95 as far south as Delaware and as far north as Connecticut to alert travelers to avoid the New York City region.³² ■

BENEFITS

Let the Web Do the Work



During the 2002 Winter Olympic Games in Salt Lake City, Utah, a survey about the CommuterLink Website showed that 41 percent of visitors and 70

percent of residents were aware of the website. Overall, 98 percent of visitors and 97 percent of residents who used the website said it worked well for them.³³ In California, 70 percent of survey respondents indicated California's GoVentura website trip planning system helped them make a transit trip that they would otherwise have made by automobile.³⁴

LESSONS LEARNED

Traveler Information Systems – Lessons from Experience

The following are lessons learned on how to plan, design, operate, and maintain traveler information systems and are taken from the ITS Lessons Learned Knowledge Resource.

Policy and Planning

- **Perform local consumer research on the 511 service during the planning stage of the project.**³⁵ The Utah Department of Transportation held planning stage focus groups to gauge consumer reaction to the 511 system that it had envisioned. Although the focus group had a strongly negative reaction to an automated system, after hearing a demonstration of what a voice-activated system would sound like, the participants found it more than acceptable and were surprised at the system's quality and ease of use.
- **Consider the future when planning and deploying a traveler information system.**³⁶ Because New Mexico's State Highway and Transportation Department (NMSHTD) planned for future use, the agency used a combination of equipment purchases and rentals for its project to rebuild the "Big I" interchange in Albuquerque. Once the project ended, NMSHTD was able to reuse the purchased equipment as part of a permanent freeway management system.
- **Clearly define roles, responsibilities, plans, and processes.**³⁷ Without a systems engineering plan, the Montana Department of Transportation and its partner, Montana State University's Western Transportation Institute, encountered delays and confusion whenever development issues arose in creating the Greater Yellowstone Regional Traveler and Weather Information System, making it necessary for management to spend additional time and effort coordinating resolutions.

THERE'S MORE ONLINE!

ITS Applications Overview:
www.itsoverview.its.dot.gov

FHWA Office of Operations 511 Program:
www.ops.fhwa.dot.gov/511/index.htm

FHWA Office of Operations Real-Time Traveler Information Program:
www.ops.fhwa.dot.gov/travelinfo/index.htm

511 Deployment Coalition:
www.deploy511.org

The online version of this document contains a full list of sources used:
www.its.dot.gov/jpodocs/repts_te/14319.htm

Leadership and Partnerships

- **Encourage private sector involvement to help reduce program risk and support on-time deployment.**³⁸ By partnering with more than 20 public and private organizations to create "SmartTrek," Washington State effectively integrated new and existing data sources to establish a regional, multimodal transportation information network that significantly expanded the distribution of traveler information.
- **Educate tourist-oriented businesses and tourism organizations about the economic benefits of ITS.**³⁹ Deploying ITS components to provide real-time traveler information contributed to both a positive visitor experience and a longer stay at Acadia National Park, but 61 percent of local business managers reported being unaware of any of the ITS-based traveler information technologies used there. ITS deployers should consider marketing the benefits of ITS to tourist-related businesses, particularly the positive contributions to the local economy.

Effectiveness and Evaluation

- **Incorporate mechanisms for capturing user feedback for system evaluation, including the ability to intercept incoming 511 calls for survey or focus group recruitment.**⁴⁰ Arizona Department of Transportation used a live intercept approach to survey 511 callers for feedback. Approximately 31 percent of intercepted callers agreed to be surveyed and approximately 71 percent followed through, yielding 411 surveys and a survey completion rate of 22 percent. No complaints were received from intercepted callers regarding the method of recruitment for survey completion.
- **Recognize that interoperability is becoming an important issue in achieving the vision of a nationwide 511 system.**⁴¹ In San Francisco, efforts to implement 511 access were frustrated by the need for regional telecommunications company SBC to develop its plans for 511 access on a system-wide basis. However, the advantages of developing a region-wide 511 system that has been tested and deployed will shorten the implementation schedule for other agencies as they prepare to implement 511 and will help to distribute the development costs among all the system implementers.

**For these and other lessons, visit:
www.itslessons.its.dot.gov. ■**

BENEFITS

Traveler Information Gets Thumbs Up from Truckers.



In a Washington State Department of Transportation sponsored survey of commercial vehicle operation companies, 57 percent of respondents said the availability of the new highway advisory radio (HAR) system made them somewhat or a lot safer.⁴² Of those interviewed during the post-deployment period, 56 percent indicated they tuned in to one or both of the HAR stations while traveling in the area, and 51 percent found the HAR messages useful.⁴³ General travelers were also surveyed, and 94 percent agreed or strongly agreed that the website road weather information made travelers better prepared for their trips. More than half agreed the information helped them avoid travel delays.⁴⁴

Traveler Info Is Most Valuable When It's Free

One study used an Internet survey to evaluate customer satisfaction with Web-based real-time traffic information in Pittsburgh and Philadelphia. Results showed that 68 percent of users in Pittsburgh and 86 percent of users in Philadelphia changed their original travel route, while 47 percent of users in Pittsburgh and 66 percent of users in Philadelphia changed their original time of travel as a result of the traffic information.⁴⁵ Notably, less than 10 percent of Internet respondents in Pittsburgh and 27 percent in Philadelphia were willing to pay money for the traffic information.⁴⁶

DEPLOYMENT

Mile Marker

September 2006 saw the 511 Traveler Information system mark the following milestones:⁴⁷

- More than 60 million calls received nationwide since inception in 2001.
- 25 consecutive months with more than 1 million calls.
- 511 availability reached more than 100 million Americans (35 percent).

for Traveler Information



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Dynamic Message Sign – Low capital cost is for smaller dynamic message sign (DMS) installed along arterial. High capital cost is for full matrix, light-emitting diode, 3-line, walk-in DMS installed on freeway. Cost does not include installation.
Dynamic Message Sign Tower – Low capital cost is for a small structure for arterials. High capital cost is for a larger structure spanning 3-4 lanes. DMS tower structure requires minimal maintenance.
Dynamic Message Sign – Portable – Trailer-mounted DMS (3-line, 8-inch character display); includes trailer, solar or diesel powered, and equipped with cellular modem for remote communication and control. Operating costs are for labor and replacement parts.
Highway Advisory Radio – Capital cost is for a 10-watt highway advisory radio (HAR), which includes processor, antenna, transmitters, battery back-up, cabinet, rack mounting, lighting, mounts, connectors, cable, and license fee. A “super HAR,” used to gain a stronger signal with a larger antenna, costs an additional \$9,000 - \$10,000.
Highway Advisory Radio Sign – Cost is for a HAR sign with flashing beacons. Includes the cost of the controller.

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