

# Advance Traveler Information Systems

## Final Report

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## **EXECUTIVE SUMMARY**

This project was developed to understand and acquire best practices on the use of Advance Traveler Information Systems (ATIS) across the nation. As a first step, previous studies on ATIS technologies and applications were reviewed to establish a solid background on the system. Next, an evaluation of the use of ATIS in several states including Washington, California, Illinois, Washington, Colorado, Maryland, and Texas was documented. From this evaluation, the interactive traffic maps, closed circuit television (CCTV) cameras, and travel times were compared. A visit was also paid to the CT Department of Transportation (DOT) where an interview was conducted with the staff in the traffic operation program. The study has resulted in a promotion of consistent data storing systems, development of a system where raw data can be used more efficiently, effective real-time traffic information dissemination, and, consequently, a more reliable integration of freeway and arterial systems. A survey was then developed consisting of questionnaires about the types of traffic data collected, technologies applied, how the data are disseminated to the public, and the interfaces utilized to organize and display the data. The survey was also designed to gain suggestions and comments from experts on related topics and their future expectations or visions. Finally, the survey was sent to sixteen state DOTs to gain a general understanding of the different practices available. Responses were documented and compared.

## **ACKNOWLEDGEMENT AND DISCLAIMER**

This work was sponsored by the Student Grant Program of the Intelligent Transportation Society of Connecticut (ITS-CT). We thank them for their inputs and suggestions to make this project successful. The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views of the ITS-CT at the time of publication.

## **1. Introduction**

I am conducting an Intelligent Transportation Society of Connecticut (ITS-CT)-based project as part of the student grant competition initialized by the ITS-CT. This project was developed to obtain a best practice review of Advanced Traveler Information Systems (ATIS) in use within the U.S. and suggest potential implementation strategies used in Connecticut.

ATIS is the process of gathering raw traffic information and analyzing and distributing it to the public for useful purposes. The traffic information gathered usually includes vehicle counts, velocities, traffic densities, delays, and even images that display traffic operational conditions. These raw data are typically collected from an array of sensors ranging from in-road sensors such as loop detectors and pneumatic tubes to roadside detectors such as closed circuit television (CCTV) cameras and infrared sensors. Traffic surveillance technologies play an essential role in the collection of data for use in ATIS. The collected information is then analyzed and disseminated to the public via various media such as radios, online websites, and telephones. To any traveler, this traffic information is valuable. ATIS helps the public be more aware of what to expect and the description of traffic conditions. This awareness results in peace of mind and an overall safer trip. Thus, there is a strong need to improve upon the ATIS already established.

## **2. Review of ATIS Practices**

As a means to better understand the use of ATIS in various states, a brief review of the practice was first carried out. As a pilot study, six Departments of Transportation (DOT) websites were reviewed including California, Illinois, Washington, Colorado, Maryland, and Texas.

In general, all websites have color-coded, interactive traffic maps. These maps usually contain information about vehicle speeds, congestion levels, and icons to represent the locations of the state's CCTV cameras, rest stops, incidents and other items. Among the states reviewed, the Illinois and Washington DOTs have the most informative interactive maps. As shown in figure 1(below), both maps provide a variety of information that differs from the other websites researched in providing items such as airport locations, variable message signs, incident locations, and areas of construction. In addition, both interfaces are user friendly, which in turn facilitates navigation and improves the overall experience. One notable aspect of the Washington DOT website is the large area of coverage (eight major locations).

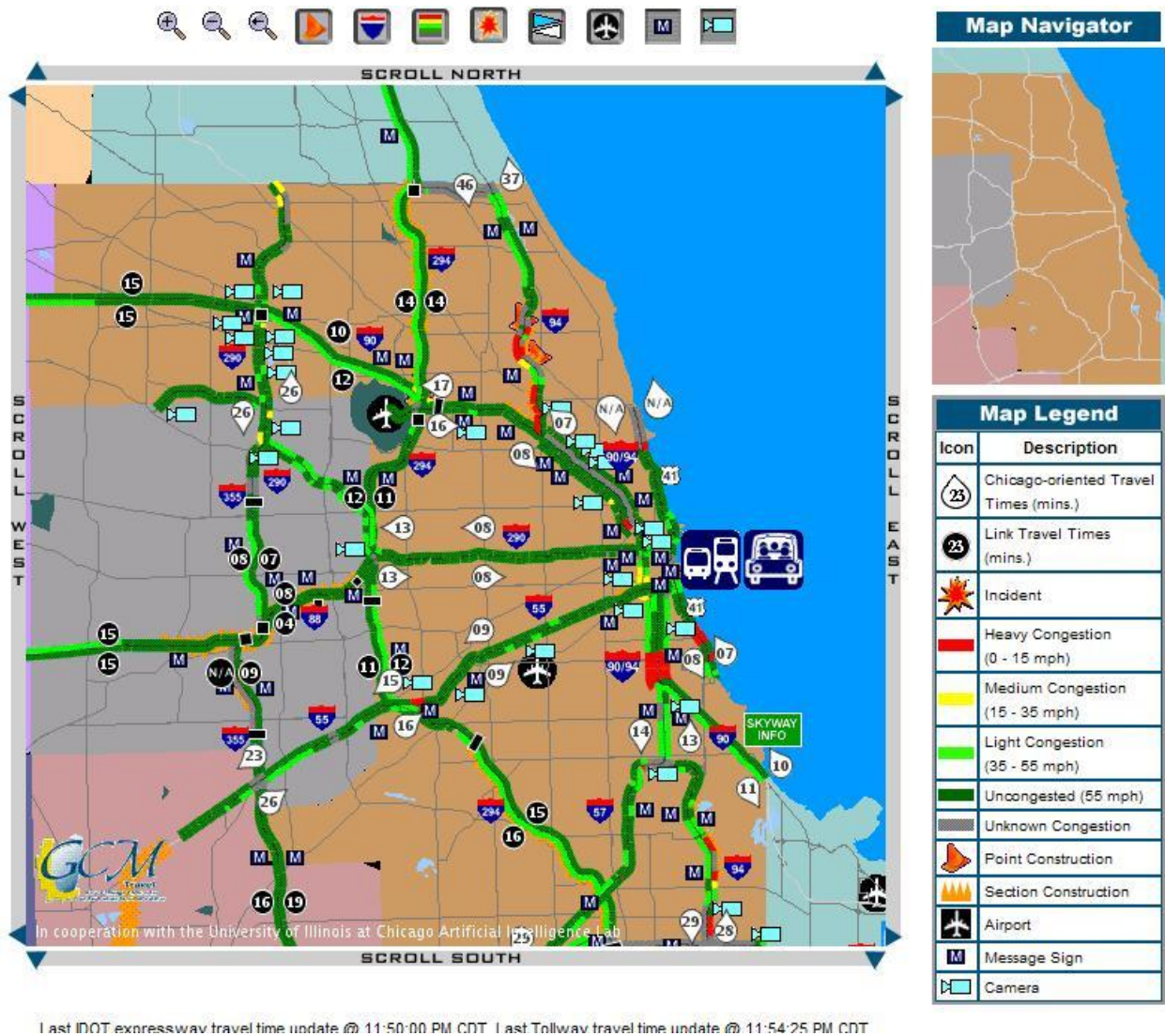


Figure 1. Illinois DOT interactive map. (Illinois DOT website)

CCTV is a camera feature available on all websites. Users can view updated clips of a particular highway section or arterial road. Most of the images are still frames that update every few minutes. Maryland DOT differs from the other websites by providing CCTV images in real-time.

All of the websites, except for California DOT's, provide information on variable message signs (VMS). With a click of the mouse, the websites will present the messages displayed to the public. The messages utilized are consistent from state to state. The

VMS inform the public on road closures, delays, warnings, and travel times from point A to B.

Four out of the six DOTs have travel time prediction capabilities, where travel times from point A to point B are presented. While most of the states update this information every few hours, the Colorado DOT highway travel times are based on the current traffic conditions and are updated approximately every two minutes. In addition, Illinois DOT provides driving direction capabilities. A person is able to input a start and ending location and the time of intended arrival. The system will then output directions and a time of departure in order to arrive at the desired time. However, these driving direction capabilities are limited to Illinois.

Tables 1 through 6 display a summary of the data that was observed in each of the DOTs' websites. Some of this data includes the various methods utilized to disseminate information such as interactive maps and variable message signs. The table also contains the descriptions, traffic information disseminated, characteristics and coverage for each of the methods of dissemination that was encountered.

**Table 1: Information from the California Department of Transportation (Source: <http://www.dot.ca.gov/>)**

Dissemination	Description	Traffic Information	Characteristics	Coverage	Frequency	Link	
Interactive Map	Map that contains a variety of traffic data	Vehicle speeds	Color coded	Green- 51+ mph	San Diego Freeway	10 seconds	<a href="http://www.dot.ca.gov/dist11/d11tmc/sdmap/showmap.php">http://www.dot.ca.gov/dist11/d11tmc/sdmap/showmap.php</a>
				Yellow- 36-50 mph			
				Red- 1-35 mph			
		Construction areas	Describes reasons for closure/maintenance/ construction (click)	California State	N/A	<a href="http://traffic.511sd.com/traffic_map.asp">http://traffic.511sd.com/traffic_map.asp</a>	
Closures/Maintenance							
	Rest stops	Red and blue stars	California State	N/A	<a href="http://www.dot.ca.gov/hq/maint/ra/norcal.htm">http://www.dot.ca.gov/hq/maint/ra/norcal.htm</a>		
	Location of CCTV cameras	Displayed as a small camera	San Diego Interstate 5/ 805	30 seconds	<a href="http://www.dot.ca.gov/dist11/d11tmc/sdmap/cameras/merge_f5f805.html">http://www.dot.ca.gov/dist11/d11tmc/sdmap/cameras/merge_f5f805.html</a>		
Travels Times	Real-time travel times from point A to point B	You do not get to choose input and output.	Will tell you how long it takes to get to a particular point	San Diego, Chula Vista, Escondido, Oceanside, San Ysidro, El Cajon, Sorrento Valley	N/A	<a href="http://www.511sd.com/">http://www.511sd.com/</a>	
Incident Report	Report an accident	Tells you exactly what and where it happened	Also gives date and time of report and weather	California State	60 seconds	<a href="http://cad.chp.ca.gov/">http://cad.chp.ca.gov/</a>	
CCTV Cameras	Updated image of a particular road or area	Road conditions	Detailed image	San Diego Interstate 5/ 805	30 seconds	<a href="http://www.dot.ca.gov/dist11/d11tmc/sdmap/cameras/cameras.html">http://www.dot.ca.gov/dist11/d11tmc/sdmap/cameras/cameras.html</a>	
Problem Areas	States areas of concern	Gives you location and speed	N/A	California State	1 minute	<a href="http://www.dot.ca.gov/dist11/d11tmc/sdmap/problemareas.html">http://www.dot.ca.gov/dist11/d11tmc/sdmap/problemareas.html</a>	
Lane Closures	Gives you information on closed areas	Tells you date and time of closure due to construction or maintenance	Allows you input, time, location, route, number of lanes closed, etc.	San Diego and Imperial County	N/A	<a href="http://web1.dot.ca.gov/lcr/dist11/laneclosure/county.php">http://web1.dot.ca.gov/lcr/dist11/laneclosure/county.php</a>	
511 Systems	Phone system that enables you to acquire the same traffic information you would get from the website	Weather, congestion, driving times, incidents, closures	N/A	San Diego County	N/A	<a href="http://www.511sd.com/about511.aspx">http://www.511sd.com/about511.aspx</a>	

**Table 2: Information from the Colorado Department of Transportation (Source: <http://www.dot.state.co.us/>)**

Dissemination	Description	Traffic Information	Characteristics	Coverage	Frequency	Link	
Interactive Map	Map that contains a variety of traffic data	Travel speeds	Color Coded	Green- 50+ mph	Mayor roads (Interstates)	N/A	<a href="http://www.cotrip.org/atIS/web.ZoomboxMarshal?device=Speedmap&amp;Zoombox=12">http://www.cotrip.org/atIS/web.ZoomboxMarshal?device=Speedmap&amp;Zoombox=12</a>
			Yellow- 25-50 mph				
			Red- 15-25 mph				
			Black- 0-15 mph				
		Variable Message Signs	Displayed as a small message board				
		Location of CCTV cameras	Displayed as a small camera				
		Traffic alerts	Describes reasons for closure/maintenance/construction				
Real-time weather	Temperature, road conditions						
	HAR	Red icons					
Variable Message Signs	Signs with updatable messages	Presents closures, road work, delays, and warnings	Locations and message when you click on its image	I-70, I-25, US-160, US-285, US-50	N/A	<a href="http://www.cotrip.org/">http://www.cotrip.org/</a>	
Estimated Highway Travels Times	Travel times from point A to point B	You do not get to choose input and output.	Will tell you how long it takes to get to a particular point and length traveled	I-70 Westbound, I-70 Eastbound	2 minutes	<a href="http://www.cotrip.org/atIS/web.TraveltimeMarshal">http://www.cotrip.org/atIS/web.TraveltimeMarshal</a>	
CCTV Cameras	Updated image of a particular road or area	Road conditions	Detailed image	Mayor roads (Interstates)	N/A	<a href="http://www.cotrip.org/atIS/web.ZoomboxMarshal?device=CCTV&amp;Zoombox=13">http://www.cotrip.org/atIS/web.ZoomboxMarshal?device=CCTV&amp;Zoombox=13</a>	
Road Conditions	A list of several roads and their current conditions	Road conditions	N/A	Colorado State	N/A	<a href="http://www.cotrip.org/rWeather/All_Regions_052708_185403.html">http://www.cotrip.org/rWeather/All_Regions_052708_185403.html</a>	
Lane Closures	Webpage with information on lane closures	Road closures	List of PDF files	Colorado State	N/A	<a href="http://www.dot.state.co.us/TravelInfo/CurrentCond/">http://www.dot.state.co.us/TravelInfo/CurrentCond/</a>	
Weather Updates	Presents several links where you can find the overall weather	Presents the temperature and conditions	N/A	Colorado State	N/A	<a href="http://www.cotrip.org/">http://www.cotrip.org/</a>	
511 Systems	Website page is under construction					<a href="http://www.cotrip.org/its/511/index.html">http://www.cotrip.org/its/511/index.html</a>	

**Table 3: Information from the Illinois Department of Transportation (Source: <http://www.dot.il.gov/>)**

Dissemination	Description	Traffic Information	Characteristics	Coverage	Frequency	Link	
Interactive Map	Map that contains a variety of traffic data	Congestion Levels	Color Coded	Green- free of congestion	Gary, Chicago, Milwaukee corridor	10 minutes	<a href="http://www.gcmtravel.com/gcm/maps_chicago.jsp">http://www.gcmtravel.com/gcm/maps_chicago.jsp</a>
			Yellow- some congestion				
			Red- a lot of congestion				
			Black-Traffic Has stopped				
		Variable Message Signs	Displayed as a small message board				
		Location of CCTV cameras	Displayed as a small camera				
		Construction areas	Describes reasons for closure/maintenance/construction	State of Illinois	N/A	<a href="http://www.gettingaroundillinois.com/default.aspx?q=const">http://www.gettingaroundillinois.com/default.aspx?q=const</a>	
		Closures/Maintenance					
Real-time weather	Temperature, road conditions						
Rest stops, hospitals, gas stations, many more	icons for each are displayed						
Variable Message Signs	Signs with updatable messages	Travel times from point A to point B, food, fuel	Locations and message when you click on its image	Gary, Chicago, Milwaukee corridor	1.5	<a href="http://www.gcmtravel.com/gcm/maps_chicago.jsp">http://www.gcmtravel.com/gcm/maps_chicago.jsp</a>	
Travels Times	Real-time travel times from point A to point B	You do not get to choose input and output.	N/A	Bishop Ford, Dan Ryan, Ronald Tollway, Edens, Eisenhower, Elgin O' Hare, I-290, I-294, I-355, I-55, I-57, I-80, I-88, I-90, I-94, IL-53	1 minute	<a href="http://www.gcmtravel.com/gcm/traveltimes.jsp">http://www.gcmtravel.com/gcm/traveltimes.jsp</a>	
Getting Directions	Input start and end point to receive directions	N/A	Inputs and out puts will result	State of Illinois	N/A	<a href="http://www.gettingaroundillinois.com/getdirections.aspx">http://www.gettingaroundillinois.com/getdirections.aspx</a>	
Incident Report	Report an accident	N/A	N/A	State of Illinois	N/A	<a href="http://www.iltrafficalert.com/ens/home.html">http://www.iltrafficalert.com/ens/home.html</a>	
CCTV Cameras	Updated image of a particular road or area	Road Conditions	Detailed Image	Bishop Ford, Dan Ryan, Ronald Tollway, Edens, Eisenhower, Elgin O' Hare, I-290, I-294, I-355, I-55, I-57, I-80, I-88, I-90, I-94, IL-53	1.5-4 minutes	<a href="http://www.gcmtravel.com/gcm/cameraReport.jsp?location=GATEWAY.IL">http://www.gcmtravel.com/gcm/cameraReport.jsp?location=GATEWAY.IL</a>	
511 Systems	In progress???						
Maps and Data	Documents/studies that the DOT has collected	N/A	Includes many links to their documents	N/A	N/A	<a href="http://www.dot.il.gov/tpublic.html#trains">http://www.dot.il.gov/tpublic.html#trains</a>	

**Table 4: Information from the Maryland Department of Transportation (Source: [www.chart.state.md.us](http://www.chart.state.md.us))**

Dissemination	Description	Traffic Information	Characteristics	Coverage	Frequency	Link	
Interactive Map	Map that contains a variety of traffic data	Traffic Speeds	Color Coded	Green+ 50 mph	Maryland State	N/A	<a href="http://www.chart.state.md.us/MapNet/MapDOTNET">http://www.chart.state.md.us/MapNet/MapDOTNET</a>
				Yellow- 30-50 mph			
				Red- 0-30 mph			
		Dynamic Message Signs	Displayed as a small message board				
		Location of CCTV cameras	Displayed as a small camera				
		Construction areas/accidents	Describes reasons for closure/maintenance/construction				
Closures/Maintenance							
	Real-time weather	Temperature, road conditions					
Variable Message Signs	Signs with updatable messages	Closures, pay tolls, warnings	Locations and message when you click on its image	Highway	N/A	<a href="http://www.chart.state.md.us/travinfo/dmsSigns.asp">http://www.chart.state.md.us/travinfo/dmsSigns.asp</a>	
Incident Report	Report an accident	Tells you exactly what and where it happened	N/A	Maryland State	60 seconds	<a href="http://www.chart.state.md.us/TravInfo/trafficEvents.asp">http://www.chart.state.md.us/TravInfo/trafficEvents.asp</a>	
CCTV Cameras	Updated image of a particular road or area	Road conditions	Detailed image	Various Interstates, I-495, I-70, I-795, I-95, US 50, I-395	Every second	<a href="http://www.chart.state.md.us/TravInfo/trafficCams.asp">http://www.chart.state.md.us/TravInfo/trafficCams.asp</a>	
Speed Sensors	Captures data that gets converted to velocities	Speed data	Green- higher speeds Red- lower speeds	I-270, I-495, I-695, I-70, I-795, I-83, I-95, I-97, US 50, MD 140 N.	N/A	<a href="http://www.chart.state.md.us/travinfo/speedData.asp">http://www.chart.state.md.us/travinfo/speedData.asp</a>	
Weather	Weather data	Tells you location, temperature, and several other conditions	N/A	Various Interstates	N/A	<a href="http://www.chart.state.md.us/travInfo/weatherStationData.asp">http://www.chart.state.md.us/travInfo/weatherStationData.asp</a>	

**Table 5: Information from the Texas Department of Transportation (Source: <http://www.txdot.gov/>)**

Dissemination	Description	Traffic Information	Characteristics	Coverage	Frequency	Link
Interactive Map	A map with an assortment of traffic information	Construction Areas/accidents	Describes reasons for closure/maintenance/construction	Texas state	N/A	<a href="http://www.dot.state.tx.us/GIS/HCRS_main/viewer.htm">http://www.dot.state.tx.us/GIS/HCRS_main/viewer.htm</a>
		Closures/Maintenance				
		Real-time weather	Ice=white, flood=blue			
		Location of CCTV cameras	Displayed as a small camera			<a href="http://amait.sdot.state.tx.us/AMA-ITS/default.htm">http://amait.sdot.state.tx.us/AMA-ITS/default.htm</a>
		Variable message signs	Displayed as a small message board			
Rest stops	Red and blue stars	<a href="http://www.dot.state.tx.us/mnt/sra/map.htm">http://www.dot.state.tx.us/mnt/sra/map.htm</a>				
Variable Message Signs	Signs with updatable messages	Travel times from point A to point B, click it or ticket	Locations and message when you click on its image	Amarillo	N/A	<a href="http://amait.sdot.state.tx.us/AMA-ITS/default.htm">http://amait.sdot.state.tx.us/AMA-ITS/default.htm</a>
CCTV Cameras	Updated image of a particular road or area	Road conditions	Detailed image	Amarillo, Austin, Dallas, El Paso, Fort Worth, Houston, San Antonio, Wichita Falls	8-10 minutes	<a href="http://www.dot.state.tx.us/travel/traffic_cameras.htm">http://www.dot.state.tx.us/travel/traffic_cameras.htm</a>

**Table 6: Information from the Washington Department of Transportation (Source: [www.wsdot.wa.gov](http://www.wsdot.wa.gov))**

Dissemination	Description	Traffic Information	Characteristics	Coverage	Frequency	Link	
Interactive Map	Map that contains a variety of traffic data	Congestion levels	Color Coded	Green- free of congestion	Standwood, Moroe, Tacoma, Dupont, Olympia, Gig Harbor, Seattle Area, most of the state	2 minutes	<a href="http://www.wsdot.wa.gov/traffic/seattle/default">www.wsdot.wa.gov/traffic/seattle/default</a>
			Yellow- some congestion				
			Red- a lot of congestion				
			Black-Traffic Has stopped				
		Variable Message Signs	Displayed as a small message board				
		Location of CCTV cameras	Displayed as a small camera				
		Construction areas	Describes reasons for closure/maintenance/const ruction				
		Closures/Maintenance					
Real-time weather	Temperature, road Conditions						
Rest stops	blue icons						
Variable Message Signs	Signs with updatable messages	Travel times from point A to point B, food, fuel	Locations and message when you click on its image	Seattle Area, Major Roads	1.5 minutes	<a href="http://www.wsdot.wa.gov/traffic/seattle/vms/">www.wsdot.wa.gov/traffic/seattle/vms/</a>	
Travels Times	Real-time travel times from point A to point B	You do not get to choose input and output.	Will tell you how long it takes to get to a particular point	Seattle Area and Major Roads	3 hours	<a href="http://www.wsdot.wa.gov/traffic/seattle/raveltimes/">http://www.wsdot.wa.gov/traffic/seattle/raveltimes/</a>	
Travel Time Prediction	Input start and end point to receive time to get there	It will also show you a map on how to get there, and when you should leave.	Input start, end point, and time of arrival. Output will be time you should leave.	Seattle Area	Uses historic records from 2006	<a href="http://www.wsdot.wa.gov/traffic/seattle/traveltimes/reliability">www.wsdot.wa.gov/traffic/seattle/traveltimes/reliability</a>	
Incident Report	Report an accident	Tells you exactly what and where it happened	N/A	Washington State	continuously	<a href="http://www.wsdot.wa.gov/traffic/seattle/incidents/">http://www.wsdot.wa.gov/traffic/seattle/incidents/</a>	
CCTV Cameras	Updated image of a particular road or area	Road conditions	Detailed Image	Standwood, Moroe, Tacoma, Dupont, Olympia, Gig Harbor, Seattle Area, interstate, interchange, some urban arterial intersections	1.5-5 minutes	<a href="http://www.wsdot.gov/traffic/default.aspx">www.wsdot.gov/traffic/default.aspx</a>	
		Conditions on mountain passes					

**Table 6 (continued): Information from the Washington Department of Transportation (Source: [www.wsdot.wa.gov](http://www.wsdot.wa.gov))**

Dissemination	Description	Traffic Information	Characteristics	Coverage	Frequency	Link
511 Systems	Phone system that enables you to acquire the same traffic information you would get from the website.	Traffic conditions, construction, incident reports, mountain pass conditions, weather, traffic congestion, statewide alerts, connection to Oregon 511 system	N/A	Washington State	Every few minutes	<a href="http://www.wsdot.wa.gov/traffic/511/">http://www.wsdot.wa.gov/traffic/511/</a>
Maps and Data	An assortment of documents/studies that the DOT has collected	N/A	Includes many links to their documents	N/A	N/A	<a href="http://www.wsdot.wa.gov/mapsdata.htm">http://www.wsdot.wa.gov/mapsdata.htm</a>

### 3. Connecticut DOT Visit

To establish a benchmark practice to compare with other states, a visit was made to the CT Department of Transportation (DOT) where an interview was conducted with the staff in the traffic operations program. The interview was performed in order to better understand the use of ATIS in the state. The following is a summary of this interview.

#### 3.1 Technologies:

CT-DOT introduced some of the technologies utilized in the operations. It was learned that there is a heavy reliance on scifi-radar, CCTV cameras, detectors, and VMS technology. Below is a description of some of these technologies.

- **Scifi-Radar:** Mainly used to collect traffic volume, occupancy, and vehicle speeds.
- **CCTV Cameras:** Located on major highways, Hartford, I-95 corridor and Greenwich up to New Haven. CT-DOT receives a direct fiber feed from the field so all of the displays are provided in real time. These cameras are used to determine road conditions and locate vehicle incidents.
- **Offline GIS Maps:** GIS maps are utilized to visually display the area of interest. This program is also used to show the flow of traffic in select locations. A color legend was developed to illustrate the severity of congestion, where the color green represents no congestion while the color red symbolizes highly congested areas.
- **VMS (Variable Message Signs):** Variable message signs are electronic boards that display information such as traffic delays, road closures, and vehicle

incidents. The CT-DOT utilizes VMS to notify the public of travel time delays, construction ahead, road closures, and vehicle accidents.

- **Incident Report System:** One of the main priorities of the CT-DOT is to locate and quickly respond to vehicle accidents. Usually, the police are called when an accident happens. Then the police inform the CT-DOT. At this point, the CT-DOT responds in the appropriate manner. The CT-DOT can also detect an incident through the CCTV cameras.

**Observations:** Since the date of the interview, the CT-DOT has not provided any online maps. A functional traffic map was available at the headquarters but the problem was getting the map out to the public. There is a strong need for contractors or related enterprises to develop the online map. Other questions also arise such as what to put on the map. Providing travel times is also a problem. At this point, there is not enough collection of data, and legal issues like privacy become a concern. Ultimately, more time and work is required.

### 3.2 Experience with use of Technology:

If something is maintained, then it should be reliable.

### 3.3 In Development:

- **511 System:** As of this point, the CT-DOT is developing its 511 system. This system will provide all of the information observed on the CT-DOT website.
- **Revamp:** The CT-DOT is also trying to revamp the camera images on the CT-DOT website.

### 3.4 Major Concerns:

The CT-DOT concerns itself with the time it takes to find and identify a vehicle incident. A main priority is to notify the public of what is happening. With the CCTV cameras and a call from the police, the CT-DOT can get a visual image and location of where the accident is occurring. With this knowledge, the DOT is able to simultaneously activate select VMS signs so that the public knows that there is an accident ahead. The CT-DOT wants to minimize the response time to send out a cleanup crew.

### 3.5 Best Practices:

The CT-DOT believes that the best practice lies in the resources that can be provided to the public. Currently, the CT-DOT has a wealth of cameras that capture valuable data. In addition, highway advisory radio (HAR) and E-alerts (text) services are also provided. The CT-DOT also favors its DOT website, which can be accessed through any portable device or a computer. This website allows the public to easily access information from any location. Lastly, the CT-DOT admires the wealth of resources that it has established to minimize the time needed to respond to accidents.

### 3.6 Future Improvements:

The CT-DOT's future goal is to integrate the highway systems in order to develop a more automatic and quicker response system when accidents occur. It is believed that to achieve this goal, all of the current equipment must be integrated into one application. CT-DOT hopes to improve its website by adding VMS messages and inputting displays for accidents and delays. Lastly, CT-DOT would like to make its public emergency responder a real-time factor with the use of E-mail alerts, for example. As mentioned

before, the only problem with this project is that the appropriate funding and time is needed.

#### 4. Web-based Survey on ATIS

A web-based survey was developed as a means of acquiring additional information to gain a better understanding of the different practices available. The survey consisted of questions concerning the types of traffic data collected, technologies applied, how the data are disseminated to the public, and the interfaces used to organize and display the data. The survey was also designed to obtain suggestions and comments from experts on related topics and future expectations or visions. The survey was sent to sixteen agencies. Seven of these organizations completed the survey. See appendix A and B for a copy of the original and revised surveys. The tables below summarize the responses.

<b>Table 7. Information Collected</b>	
<b>Type of Information</b>	<b>Response Count</b>
<b>Travel Speed</b>	<b>7</b>
Vehicle Delays	3
Travel Time	6
Vehicle Count	5
Weather	4
<b>Incident Reports</b>	<b>7</b>

Table 7 displays the results of the first question in the survey. This question asks about the types of information collected. All of the DOTs collected travel speed and incident reports. Most of the agencies also collected travel times and vehicle counts. Less than 50% of the agencies collected vehicle delay information.

<b>Table 8. Roads Where Information Is Gathered</b>	
<b>Types of Roads</b>	<b>Response Count</b>
<b>Freeways</b>	<b>7</b>
Arterial Roads	0

Table 8 displays the results of the second question in the survey. This question asks about the type of roads where information is gathered. All of the DOTs collected information from freeways, mainly interstates. Consequently, none of the DOTs collected data on arterial roads.

<b>Table 9. Technologies Utilized to Collect Data</b>	
<b>Type of Technology</b>	<b>Response Count</b>
Automated Vehicle Location Data	1
<b>In-road Sensor: Inductive Loop Detectors</b>	<b>6</b>
In-road Sensor: Magnetometers	1
In-road Sensor: Electric Detectors	0
<b>In-road Sensor: Microwave/Radar</b>	<b>6</b>
In-road Sensor: Acoustic	0
In-road Sensor: Self Power	2
In-road Sensor: Pneumatic Tubes	2
<b>Roadside Sensor: CCTV Cameras</b>	<b>6</b>
Roadside Sensor: Passive Detectors	1
Roadside Sensor: Active Detectors	0
GPS	0

Table 9 displays the results of the third question in the survey. This question asks about the type of technologies utilized to acquire the information. Most of the agencies collected data by using inductive loop detectors, microwave/radar technology, and CCTV cameras. Caltrans, Illinois DOT, and Colorado DOT, were the only agencies to utilize magnetometers, passive detectors, and automated vehicle location data, respectively.

<b>Table 10. How Data Is Disseminated to the Public</b>	
<b>Type of Programs</b>	<b>Response Count</b>
<b>State Website</b>	<b>6</b>
E-mail Alert	5
Television	3
511 or other Phone Systems	5
Personal Digital Assistant	2
HAR	3
AAA	1
Google Maps	2
Traffic.com	4
<b>Variable Message Signs (VMS)</b>	<b>7</b>
Cable TV	1

Table 10 displays the results of the fourth question in the survey. This question asks about the resources utilized to disseminate the data for the public. All of the DOTs displayed information with the use of variable message signs (VMS), and most utilized state websites to demonstrate information. Only Colorado DOT disseminated information through AAA.

<b>Table 11. Traffic Information Provided to the Public</b>	
<b>Type of Information</b>	<b>Response Count</b>
Travel Speed	3
<b>Travel Time</b>	<b>7</b>
Congestion Levels	2
Incident Reports	6
<b>Work Zone/Construction Updates</b>	<b>7</b>
Alerts of high-impact events that affect travel	1
Safety Messages	1

Table 11 displays the results of the fifth question in the survey. This question asks about the traffic information that is provided to the public. All of the agencies provided both travel time and work zone/construction updates, while most of the organizations provided incident reports. Surprisingly, less than half of the DOTs displayed travel speed and congestion levels. Kentucky and Oregon DOT were the only organizations to exclusively provide alerts of high-impact events and safety messages, respectively.

<b>Table 12. Interfaces Utilized to Organize Data</b>	
<b>Type of Interfaces</b>	<b>Response Count</b>
GIS maps	3
<b>Center to Center interface</b>	<b>6</b>
Store View: Displays time and spatially averaged speeds.	1
Probe View: Displays vehicle speeds	2
GPS Programs	0
<b>Travel Time Update</b>	<b>5</b>
ATMS	1

Table 12 displays the results for the sixth question in the survey. This question asks about the interfaces utilized to organize data. All of the DOTs use center-to-center interface and most utilize travel time update. Half of the organizations used ArcGIS to arrange data. Caltrans and Texas DOT were the only agencies to exclusively use ATMS and Store View, respectively.

The seventh question asks the surveyed to give an opinion on the best practice, observation, or knowledge of ATIS in the region. Only two agencies responded to this inquiry. One of the best practices in Colorado DOT lies in its ability to allow the public to make valued decisions. In addition, Caltrans prides itself on the RIITS in the LA region and ITMS/RAMS in the San Diego region.

## **5. Conclusions and Recommendations**

From the survey, it is possible to compare future visions and expectations that each agency will be concerning itself in the near future. All of the organizations identified that accurate and reliable travel time prediction will be a chief concern in the coming years. More than half of the agencies are also interested in initiating and developing real-time information on major arterials. According to the survey results, none of the DOTs collect information from arterials. In developing data for arterials, factors such as travel time predictions and travel delays may be improved. Other factors mentioned include incident prediction, best route decisions, improving travel time reliability, acquiring information from local jurisdictions, and systems where drivers can be notified of traffic congestion and receive alternative routes before entering the freeway. The survey results also show that less than half of the agencies neither disseminate traffic congestion levels nor utilized GIS maps. Both of these features have been known to be useful to the public and for data arrangement/distribution. As ATIS technologies further develop, these projects and concerns will hopefully be implemented to further improve the already valuable transportation engineering field.

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# Appendix A

## ATIS Survey

Neftali Torres  
University of Hartford  
CT DOT Research  
Focus: Real Time Traffic Information Systems

### **Introduction/ Purpose:**

Greetings everyone,

My name is Neftali Torres and I am currently a Civil Engineering sophomore at the University of Hartford. Under the supervision of Dr. Clara Fang at the University of Hartford, I am conducting an ITS based project as part of the student grant competition initialized by the Intelligent Transportation Society of Connecticut (ITS). This project was developed to gain a best practice review of real time traffic information systems in use within the U.S. and suggest potential implementation strategies for our own Connecticut Department of Transportation. The following survey will only take a few minutes of your time and will serve as a means of gathering vital information.

### A Survey on Advance Traveler Information Systems (ATIS)

Question 1: Which of the following traffic information do you collect? (Please check all that apply)

- Travel Speed
- Vehicle Delays
- Travel Time
- Vehicle Counts
- Weather
- Incident Reports
- If other measures are collected, please specify: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
- What kind of roads do you gather traffic information from?
  - Freeways- Please specify Route #'s: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
  - Arterial Roads: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Question 2: Which of the following technologies do you use to collect traffic data? (Please check all that apply)

- Automated Vehicle Location data
- Sensors:
  - In road:
    - ❖ Inductive Loop Detectors
    - ❖ Magnetometers
    - ❖ Electric Detectors
    - ❖ Microwave/ Radar
    - ❖ Acoustic
    - ❖ Self Power
    - ❖ Pneumatic Tubes

- ❖ Others: \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_
- Road sides:
  - ❖ CCTV cameras
  - ❖ Passive detectors
  - ❖ Active detectors
  - ❖ Others: \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_
- GPS
- Others: \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_

Question 3: How do you disseminate this information to the public?

- Internet:
  - State website
  - Others: \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_
- Variable Message signs (VMS)
- Wireless Communication systems
  - Email Alert
  - Television
  - Text Message
  - 511 or other phone systems
  - Personal Digital Assistant
  - Others: \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_
- HAR
- Commercial providers. Please specify what kinds are used:
  - AAA
  - Google Maps
  - Traffic.com
  - Others: \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_

Question 4: Which of the following traffic information do you provide to the public?

- Travel Speed
- Travel Time
- Congestion Levels
- Incident Reports
- Work Zone/ Construction Updates
- Others: \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_
- How often does this data update? \_\_\_\_\_

Question 5: Are there any programs or interfaces used to display and organize your data?

- GIS maps
- Center to Center interface
- Store view (A java applet that displays time and spatially averaged speeds)
- Probe view (A java applet that displays vehicle speed as vehicles pass a set of virtual sensors)
- GPS programs
- Travel time update
- Others: \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_

Question 6: In your opinion, what is the best practice, observations, or knowledge about ATIS in your region?

Question 7: Do you have any future visions/expectations or systems that you hope to work on?

- Incident Prediction
- Travel Time Prediction
- Best Route Decisions
- Real-time Information on Major Arterials
- Others: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Question 8: In your opinion, list 5 agencies/states with the best practice of ATIS.

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

- Please state your name, position, and contact information:

When all the questions have been answered to the best of your abilities, please send this document back to me at:

[NeTorres@hartford.edu](mailto:NeTorres@hartford.edu)

Thanks for all the help, it is greatly appreciated!!

## **Appendix B**

To access the Web version of the survey, please use the link below:

[http://www.surveymonkey.com/s.aspx?sm=aiQwHqno1x58Rz\\_2fpN9Dn6g\\_3d\\_3d](http://www.surveymonkey.com/s.aspx?sm=aiQwHqno1x58Rz_2fpN9Dn6g_3d_3d)