AURORA Program Project 2001-01
Interjurisdictional Traveler Information Exchange

November 2004

PREPARED FOR:

TDOT

BY:

VOLKERT & ASSOCIATES, INC.

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Executive Summary

Providing current weather data to the motoring public has been a goal of departments of transportation for a long time. Until the 1990s, the technology was not available to provide that information to the majority of the public on a real-time basis. However, the exponential increase in technological advances has yielded the tools that can provide and disseminate this information in a timely manner. This report is an overview of current practices in various states, and how these states share information with the traveling public, other state agencies, and other state weather systems. The purpose of this research is to take this data and construct a framework for use by State DOTs in the development and implementation of a complete weather information system.

Successfully providing the traveling public with weather information requires that weather data be collected, assimilated, and then distributed in a simple format. Collection of weather data is accomplished in several ways. Some states collect their own data through the use of roadway puck installations, weather station installations, and Automated Weather Observing Systems (AWOS). Other states use a combination of state-owned and operated collectors in addition to data from another provider such as AWIS weather services. Several states rely totally on private vendor weather data suppliers for their collection of weather data. Collected data is then processed in a variety of ways. With the exception of those states that are served by a private vendor, data processing is unique to individual states.

The collected and processed weather information is distributed to the traveling public in several ways. Information can be accessed via the Internet through kiosks at rest areas, welcome centers or other public places or, for a majority of travelers, through the use of a personal computer. Many states maintain websites for Internet use and the sites themselves vary in detail. Some states have several graphics providing detailed information for particular areas or sections of roadway. Other states have less sophisticated sites that simply provide a link to the National Weather Service for a general weather forecast.

Information is also distributed through the use of Highway Advisory Radio (HAR) broadcasts and 511 systems. Distributing information via HAR has the advantage of being readily available to most drivers. However, one disadvantage of the HAR is poor transmission reliability in hilly or mountainous terrain. In some states, weather information is as close as the telephone. Weather information is provided via a 511 system or toll-free number. Given the widespread use of cell phones, a 511 system holds promise. One challenge to implementation of a 511 number is the coordination of local telecommunication utilities in providing the service.

The process of collecting, assimilating and distributing weather information can be very expensive. There are many options for pricing an individual system. For example, a state can maintain its own weather data collectors and the communications systems. This cost would not only include any equipment, hardware or software necessary for the system, but also include the costs of development, production and maintenance personnel. Weather data services can offer a cost-effective way to collect data, assimilate the data, and provide information to the state for use in a variety of ways.

One particular advantage of weather data services is the relative ease with which states can work together to provide information to the traveling public without regard to political

boundaries. The sharing of weather information across state lines can be hindered in those states that have unique weather information systems. Many states share data via FTP sites. However, hardware and software compatibility of these unique systems comes into play in the transfer of data and the capability to use that data.

It is noted that currently there is no standard for the sharing of information across state lines or even from government agency to government agency. The Federal Highway Administration has been working to standardize data formats through the National Intelligent Transportation Information Protocol (NTCIP) standards development in order to facilitate data sharing among these entities

As a result of the aforementioned review of current state practices, three scenarios for consideration in the building of a weather information system were chosen for further research and development. These included:

1) A Tennessee-Kentucky Road Conditions system
2) A system using a private information provider, such as SafeTravel USA,
3) A system that would utilize a public information provider, such as the Federally-funded Southeast Regional Climate Center

The advantages and disadvantages were discussed as well as the application of ITS concepts for each proposed system. The Tennessee-Kentucky Road Conditions system could be feasible pending the establishment of a standard protocol for data transfer. And such a system could utilize equipment and hardware already in place. A system using a private information provider, such as Safe Travel USA, seems extremely promising because of the ability to readily share information from state to state. A system utilizing the Regional Climate Centers seems to offer the least advantage for use in Tennessee. At least three different Climate Centers would need to be accessed to provide information on Tennessee's border states. Climate Center software and data format are unique to each Regional Climate Center and would present a barrier to the straightforward sharing of information state-to-state.

To research the cost of implementing a weather information system, a Request For Information (RFI) was issued. Various systems from other states were used as guides or models as a basis for the RFI. Of the vendors responding, a cost for the development of a website graphics page ranged from $25,000-$50,000 per page. The cost for web page maintenance ranged from $1,400 per month to $12,000 per month.

The costs to develop, install and maintain a weather data collection and distribution system can be substantial. The sharing of information from state to state within a region can present complex problems with regard to hardware and software compatibility. Weather services have shown that large amounts of data can be collected dynamically, in "real time" and be provided to the state at a significantly lower cost than "in house" collection. Because hardware and software compatibility is not an issue, weather service providers are readily able to service a region comprised of several states. Through the use of strict specifications and functioning within the limitations of the information provided by a weather service, a quite effective weather information system could be configured for use by the State of Tennessee.

Project Overview

Volkert & Associates was hired by the Tennessee Department of Transportation (TDOT) to review and evaluate the Road Weather Information Systems (RWIS) currently in use across the United States and in addition, to determine the best way for the State to develop and implement its own system to collect weather information, share it with other states and make that information widely available to the traveling public. More specifically Volkert was asked to:

- Review research efforts to determine the types of sharing activities that are underway in within North America. Select a few representative case studies and document the specific data collection processes that are installed as well as the type of information being shared. Review specifically the RWIS systems in states that surround Tennessee.

- Research and review three selected strategies for the development of an RWIS system for the State of Tennessee. These strategies include a Tennessee-Kentucky Road Conditions system using information from the Kentucky website, a system using a private information provider, such as SafeTravel USA, and a system that would utilize a public information provider, such as the federally-funded Southeast Regional Climate Center. The analysis would include the advantages and disadvantages of each system, including a benefits and costs comparison, and a review of interjurisdictional sharing of information for each selected system with emphasis placed on the operation and quality of service benefits for a system to be shared with the states of Kentucky and Tennessee.

- Include information on how each system is organized/structured and how these elements can be improved. Compare the existing structure of each system to see if it is consistent with the National ITS Architecture.

- Document the actual cost of each system and determine how systems could be initiated cost effectively. Determine if these systems could be expanded to provide information sharing on a larger scale.

CURRENT RWIS PRACTICES

Methods of Collecting Road Weather Data

Road Weather Information System (RWIS)

Weather data collection varies widely from one state to another. Some states have established a road weather information system (RWIS) that they use to assist their road crews with weather maintenance tasks and have also started using the same information for public use in 511 systems and state traveler information websites. This RWIS system consists of placing weather sensor pucks in the pavement along major interstates and arterials. This method has been problematic for some states because many companies that offer this service use different hardware and software for collection and data reporting. There has also been concern about the usefulness of the information collected from road puck sensors since information is only recorded at one particular spot along the roadway and does not always provide a thorough weather analysis of the area. The pucks have also been scrutinized for requiring constant maintenance. States that have had the most success with the roadway weather pucks have used them in trouble spots or in a grid pattern supplemented in other areas with new or existing weather station installations, weather forecast information, and Automated Weather Observing Systems (AWOS). Compatibility issues have been a problem for many years in the traffic and traveling industries. The Federal Highway Administration is making a concerted effort through its ITS initiatives to bring consistency to data flows between different suppliers of RWIS hardware. This is called National Transportation Communications for ITS Protocol (NTCIP).

Automated Weather Observing Systems (AWOS)

AWOS are weather stations that are commonly found at airports and provide detailed weather information including current air and wind conditions. This combination of weather data seems to provide a better overall weather synopsis for state use when compared with a system that is exclusively RWIS. Because drivers often travel across state lines, this information tends to be more useable than site specific information collected at a few locations.

One of the conveniences of having a weather system that is integrating AWOS as well as weather forecasting information is that most of the other states have the capacity to collect similar information in the same format. Since many of the AWOS stations are owned and operated by the Federal Aviation Administration (FAA), the compatibility problems experienced from state to state are reduced. Detailed information on AWOS can be found at http://www2.faa.gov/asos/awosinfo.htm.

Private Vendor Weather Data Suppliers

There are a number of vendors that provide weather data for a fee. Some examples of those are:

- Georgia Automated Environmental Monitoring Network – This Company offers a weather condition website that is powered by a series of weather sensors and data loggers. The weather sensors collect air temperature, relative humidity, wind speed and direction, solar radiation, soil temperature and moisture, rainfall, and barometric pressure. Each sensor is scanned on a one-second frequency and summarized every 15 minutes. The weather station is located in Griffin, GA operates 24 hours a day, 7 days a week. This station communicates with all the other stations and then downloads and processes the data. This data is then published on the web site. The information on the web is free but if more in depth data is preferred, there is a subscription fee of $25 per site per year. (www.GeorgiaWeather.net)

- AWIS Weather Services –All of the weather information is received via satellite. The NWS, FAA, and USDA maintain the weather stations and sensors that collect the data. The data is collected either electronically or by individuals. The information that is electronically collected is called First Order Data. First Order Data generally consists of weather stations located at airports and the data is collected hourly. One noted problem with these stations is that the precipitation data is generally inaccurate. The information that is collected by individuals is called Co-op Data. This data is collected every day at 7 AM for the entire day and the USDA maintains most of these sites. (www.awis.com)

- Southeast Regional Climate Center (SERCC) – The SERCC is one of six regional climate centers in the country. A federally funded agency, SERCC provides weather data for six states in the southeast. These states are Florida, Alabama, Georgia, South Carolina, North Carolina, and Virginia. All SERCC weather data is collected from a satellite. The weather stations that report to the SERCC are maintained by the NWS, FAA, and USDA. The information that is available through the SERCC is similar to the AWIS Weather Service. Hourly weather data is available from airports across the state and preliminary daily summaries are available for several locations in Tennessee. Most of the data provided by the SERCC is for historical or general research purposes. The data is collected and is normally placed in daily summaries. The Regional Climate Centers do not provide real time weather. (www.dnr.state.sc.us)

Methods of Distributing Road Weather Data

States have established a variety of ways to distribute road weather data, as the review of various state systems will show. However, most states rely on weather websites, kiosks at selected location, a 511 service, and/or Highway Advisory Radio (HAR) or some combination of these to disseminate information.

Weather Websites

A weather website is used by many DOTs to provide weather information to the public. Weather websites range greatly in the information they provide from state to state. Some states have highly developed websites that offer route specific information, site-

specific information, area forecasts and warnings. In addition, some sites make use of traffic cameras to provide pictures and/or video illustrating certain areas of the state. Other states simply provide a link to the National Weather Service for a general forecast of area weather.

The design process of weather websites offers many options. As mentioned previously, the weather data can be collected by the state, provided by private vendor or assimilated from various sources. The actual web page can be designed "in-house" or by consultants. The same is true of web page maintenance. This research has yielded some excellent models for web page design. Some of the state websites that were found to be particularly useful were Kentucky, Iowa, South Dakota and Washington.

Since Kentucky borders Tennessee, there could be an advantage to developing a website similar in design, laying a foundation for the possible sharing of weather data. The Washington State website is particularly strong in design and content, as were Iowa and South Dakota. The actual costs of a website will obviously vary greatly depending on the amount of information, design detail, and type of weather collector chosen.

Kiosks

In some states, kiosks provide weather information to the traveling public. Placed in strategic locations such as shopping malls, rest areas and welcome centers, kiosks lend themselves very easily to displaying information that is available on the internet. Kiosks can be owned and operated by the State or are available through a private vendor, such as Touch and Go. Private vendors are able to custom-build to suit the needs of their clients and offer a variety of levels of service. An estimated cost per kiosk is $15,000 to $20,000 per unit. The maintenance costs varies greatly depending on the equipment and locations chosen.

The Highway Advisory Radio System (HAR)

The most readily accessible method of distributing weather information to the traveling public is through the HAR system. No need for cell phones or computers, weather information is as close as the radio selector button. Broadcasting weather information on HAR can be as easy as linking the HAR to the National Weather Service's broadcast. With this simple idea and taking that idea a step farther, Texas DOT has formed a partnership with the National Weather Service to incorporate Texas DOT highway safety messages into the weather broadcast. This allows the listener to hear a seamless message for the area of concern. However, most states with HAR generally want to broadcast information about major route delays. This includes information about any source of significant delay along a major route. This would include construction and accident as well as weather information.

Most states create their messages using a voice library. This allows for the most commonly supplied information to be accessed without operator interface. Standard messages can be used when there are no significant delays. Operator interface is only used when an extraordinary event occurs and the voice library cannot adequately explain the problem.

A private vendor, Highway Information Systems (HIS), was contacted regarding the price of equipment. A fixed HAR site installation is estimated to cost $24,000 to $26,000. A mobile /solar unit is estimated to cost $4,000 to $5000. The mobile unit includes two

transmitters and two antennas to allow broadcast to a different frequency if necessary. Flashing beacon signs will cost between $4000 and $10,000. These signs vary in detail and offer several different features. For states that seek to minimize operator interface, HAR software and training is available at an estimated cost of $25,000. Based on the above information, the estimated cost of a complete HAR system installation would range from $33,000 for the basic system to $72,000 for the totally enhanced system.

The advantage of HAR systems is the capability to provide information that is easily accessible to the traveling public. One of the disadvantages of the HAR system is the transmission reliability in hilly or mountainous areas. The western portion of Tennessee lends itself very easily to HAR transmission; however, the topography of the eastern portion of the state could present a problem in HAR transmission.

The 511 System

In July of 2000, the Federal Communications Commission (FCC) designated 511 as the single travel information telephone number to be made available for use by states and local jurisdictions. Leaving nearly all implementation and schedule issues to state and local agencies and telecommunication carriers, there are no Federal requirements or mandates to implement 511. In researching the 511 network system, it was discovered that some states contract with private companies, such as Meridian Environmental Technology, Inc. to maintain a 511 system. This results in reducing the cost of the system to a one-time installation fee and a monthly maintenance charge.

One of the challenges of installing a 511 system in Tennessee will be coordination of the some 100 certified Competitive Local Exchange Carriers (CLEC) to recognize the 511 number. The implementation of the system will require equipment modifications by the CLECs and most states recommended appointing a special committee to handle this task of coordination with utilities.

The potential cost of a 511 system will depend on how extensive the State will make the system. In some states the coverage is available statewide, while in other states, the coverage is available only in metropolitan areas. There is also a question of how much information to post on the “hotline”, how much user interaction is provided, and how often the system is updated. The number of incoming lines will also affect the cost of the system. The staffing of a 511 system is also a consideration in the cost of implementation and maintenance. Some states use a very basic 511 system that provides basic traffic information and have implemented the program with no additional staffing. Other states have developed entire new departments to oversee the handling of enhanced 511 calls.

Price estimates from private vendors include $75,000 for the system setup, $10,000 for telecommunications, and a monthly maintenance fee of $10,000 to $11,000. Nebraska was the first state to provide statewide access and implemented the program at an initial cost of $120,000. Annual operating costs are estimated to be $180,000. Though program costs vary depending on the variables mentioned above, it is estimated that the State of Tennessee could implement a program for $200,000 to $300,000 with an annual maintenance cost of $250,000 to $300,000 depending on the complexity of the system.

Research yielded many innovative ideas for offsetting some of the cost of a 511 system. Many of the states have funded a portion of their program with a grant from the federal

government. Several states have entered into a consortium and applied for grant monies as a group. Some states sell slots to vendors for advertisement in the tourism category. Other states share a limited number of telephone lines with the idea that neither state would need all available lines at the same time.

RWIS SYSTEMS REVIEW

RWIS Systems Across the Nation

Several DOT weather web sites are mentioned here as a short overview.

- Washington DOT– **http://wsdot.wa.gov/traffic/current/mainbas.htm**
  This program started developing in the late 1980s. The Washington DOT collects its internal data from a state owned and operated RWIS and ferry-based meteorological systems. Externally, weather data is received from the University of Washington provided by a weather consortium of members that include The University of Washington, the National Weather Service and numerous other federal, state and private partners. Other agencies seeking to share information should contact the University of Washington.
  (See **http://www.atmos.washington.edu/%7Ecliff/consortium.html**.)
  Vendor software is used to extract current data using a WSDOT custom-built product. The software extracts the data at certain intervals and makes it available for consolidation with information from other sources for graphical presentation. Their site provides visibility, temperature, forecasts, humidity, and wind speed along with other data. In addition, they use highway advisory radio and an 800 number to disseminate driver information. A road profile with weather conditions for selected routes is provided.
  . The University of Washington was the main integrator for the system with the costs for infrastructure improvements of the consortium's systems for advanced weather modeling capabilities funded, in part, by the WSDOT. Actual costs for the implementation of the system are difficult to assess. WSDOT spent an estimated $80,000 toward the cost of the consortium's infrastructure improvements. In addition, there were some "in house" Information Technology (IT) improvements made to support the website. Some three or four servers and software for various production and support applications were purchased, ranging in cost from $6,000 to $23,000.

  As far as maintenance expenses, an estimated $630,000 per biennium is spent for server support, replacement costs and operations staff. Additional IT training and material costs $20,000 to $25,000 per year with an estimated $60,000 spent annually to train WSDOT staff on the benefits, availability and use of road weather information for operations. WSDOT also provides an estimated $500,000 per biennium in research and development funds to the University of Washington's Atmospheric Department. WSDOT officials expressed a word of caution against comparative pricing of systems. Began in the late 1980's, this weather information system could actually be considered obsolete by today's standards and purchasing a similar system might be injudicious given the availability of new technology and new products on the market.

- Iowa DOT– **http://www.dotweatherview.com/** This system, started in 1988, utilizes a combination of RWIS and AWOS data. In the ten year

period between 1988 and 1998, Iowa DOT installed 50 RWIS sites. In the beginning days, this data was shared with surrounding states through a Data Transmission Network (DTN), but beginning in the year 2000, this RWIS data, combined with AWOS data, was shared through use of their internet website called Weatherview. The RWIS is a PC-based system managed by four servers while the AWOS is a mainframe application. Both applications data are converted to ASCII format and placed on a File Transfer Protocol (FTP) site that is accessible to users with a user name and password. RWIS data provides air temperature, relative humidity, wind speed and direction, precipitation type and intensity, pavement temperatures and subsurface temperatures. AWOS data includes air temperature, dew points, visibility, wind speed and direction, precipitation type and intensity, and a daily rainfall measurement. Weatherview website information includes the temperature at each station on a map, regional forecasts, road conditions, and links to other state DOT sites. They have worked extensively on the graphics for their web page to allow for easy access of weather data.

Weatherview website development was contracted out to Iowa State University's Center for Transportation Research and Education. The estimated cost of the initial system was $100,000. The system is continually being modified and officials estimate Iowa DOT has about $155,000 invested in the system.

- South Dakota DOT – **http://www.sddot.com/Operations/Road_Condition_Report/index.htm**
  The data viewed at this site is provided to the SD DOT by Meridian-Environmental Services. The web site provides a graphic of the state with I-29 and I-90 as well as major state routes throughout the state and is divided into six regions. Reports can be obtained by selecting the route and/or region. Detailed information is displayed on a separate page. Winter road conditions are also posted in a report via a link on the main page.

  In October 2004, SDDOT fully automated their database. Once the data is entered by a staff member, a report is automatically generated and sent to the 511 center, the news media, the law enforcement, the National Weather Service, and the web site. Currently, SDDOT is working towards expanding the web site to include construction, maintenance, incidents, and emergencies. System development costs were not immediately available, but it is estimated the cost to rebuild the system would be $150,000.

RWIS Systems in Tennessee Border States

- Kentucky DOT – **http://www.kytc.state.ky.us/RWIS/index.htm**
  The KYDOT collects its information from weather data sensors located throughout the state. The data collection requires a long distance telephone call that is processed at the DOT headquarters. The display on their web site shows the state routes where weather stations are located. Future plans include the installation of cameras at selected weather stations to allow for visual observations. The data is stored in a comma

separated ASCII format and raw data can be shared through the use of an FTP site. Below is an illustration of the Kentucky RWIS data. Note that the temperature of the air, pavement and subsurface is displayed along with the time the data was collected and how old the data is.

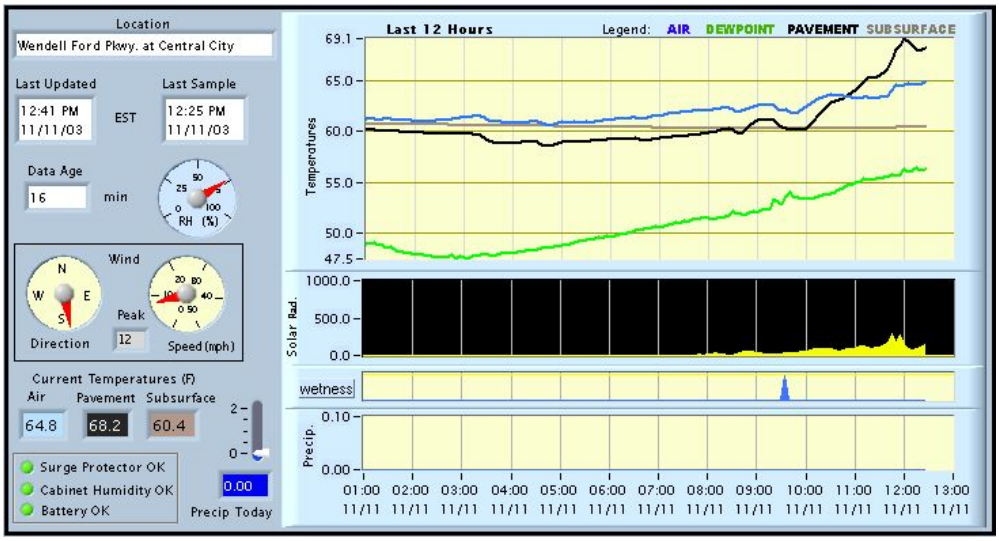


Figure 1. Kentucky RWIS Report Detail

Kentucky began data collection contracting with Surface Systems, Inc. and reports the cost of a weather station installation was between $80,000 - $120,000. Kentucky has since contracted with Campbell Scientific equipment and a private electrician and now installs weather stations at an estimated $12,000 per installation. They currently have 19 stations and hope to have 40 stations installed by 2004.

- North Carolina DOT – **http://www.ncsmartlink.org/**

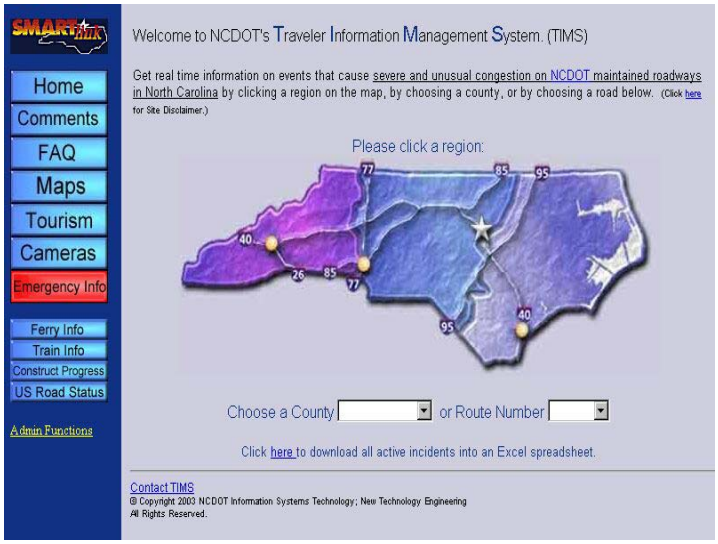


Figure 2. North Carolina Travel Information Site

Through this traveler information site, NCDOT provides current information on events that cause severe and unusual traffic congestion on major roadways in North Carolina. Extensive reporting is available by route or county basis. Weather information is not routinely disseminated unless those conditions adversely impact the flow of traffic.

One noticeable disadvantage to the county by county detail given in this site is the prerequisite that travelers must know the county location of their destination city. For local travelers, this may not be a problem, however, for those who travel the area less frequently, the site becomes less "user friendly", requiring additional research to obtain weather information.

- Missouri DOT – **http://www.modot.state.mo.us/road_conditions/index.htm#**

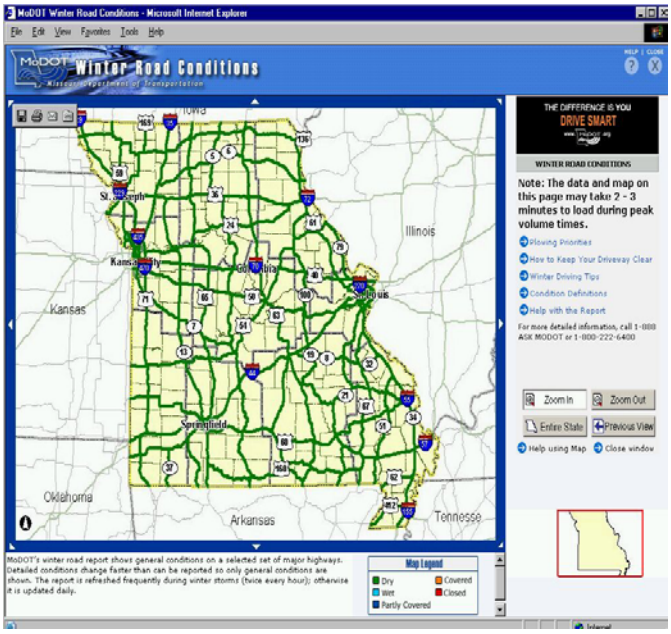


Figure 3. Missouri DOT Travel Information Site

The MoDOT website displays weather conditions on a map during periods of inclement weather. Routes shown on the map are color-coded to indicate a variety of weather conditions as well as road closings. Information is updated daily, except during winter storms when information is updated twice hourly. No weather information is provided on the website in the summer months. The DOT has an 800 telephone service that provides weather information in inclement weather.

- Georgia DOT – **http://www1.georgianavigator.com/perl/weather**

The large metropolitan area of Atlanta gives travelers in this state a distinct necessity for construction information and real time accident reporting to negotiate efficient travel. Intelligent Transportation Systems (ITS) development has been essential in disseminating this information. With those systems largely in place, the Georgia DOT is in the process of

enhancing their website to report weather conditions as well. Current weather data will be collected from road weather stations located across the state. Users can select a particular weather station, depicted as a graphic on the state map, and immediately access a pop-up display of weather data from that station. When the site is fully operational, users can be informed of most incidents whether weather, construction or accident related, that are likely to cause traffic problems or delays in the area. At this time, no provision has been made for the sharing of weather data.

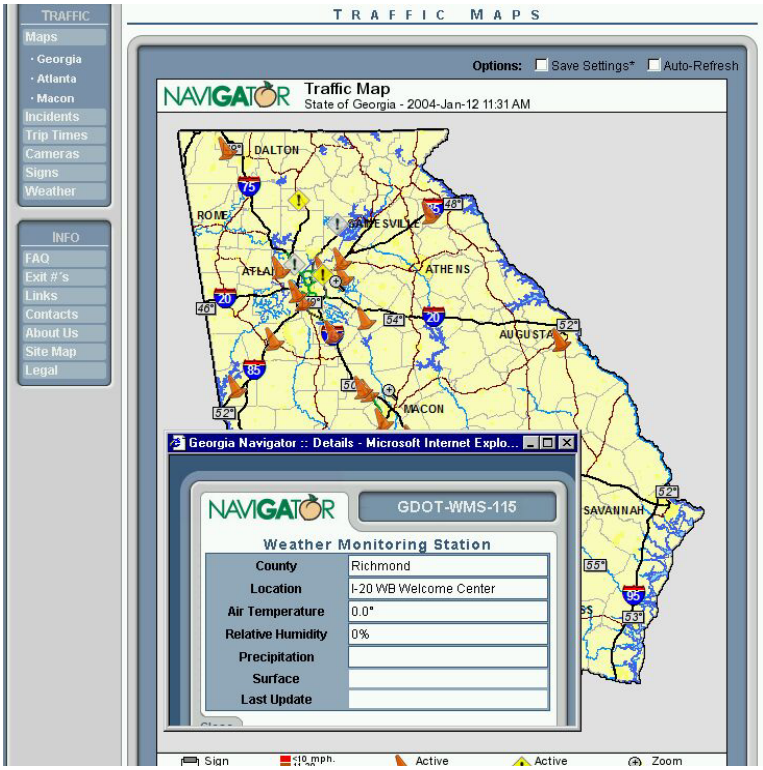


Figure 4. Georgia DOT Traveler Information Site

- Alabama DOT – **http://www.dot.state.al.us/**

Where roads are not as likely to be closed as a result of weather conditions, specific weather data is not as critical to travelers and websites from states in the Deep South often reflect this in their design. General weather information in an area usually provides the traveler with adequate weather information to assist in travel planning. Alabama provides weather information through the National Weather Service. When the icon is selected for weather, a link connects the user directly to the NWS. A similar icon can be selected for emergency road closure information. Information is listed in a text format. Since weather information is obtained from the National Weather Service, no provision has been made for sharing weather data.

Figure 5. ALDOT Web Page Showing Weather Link

- Arkansas DOT – **http://www.ahtd.state.ar.us/Road/map.htm**
  The Arkansas State Highway and Transportation Department website provides a statewide map that is color-coded to indicate roadway conditions including snow, heavy snow, slush, sleet, ice patches and flooded roadways. If the roadway is highlighted, a zoom-in window can be displayed to get a closer identification of the area. If no hazardous driving conditions exist, no data is displayed.

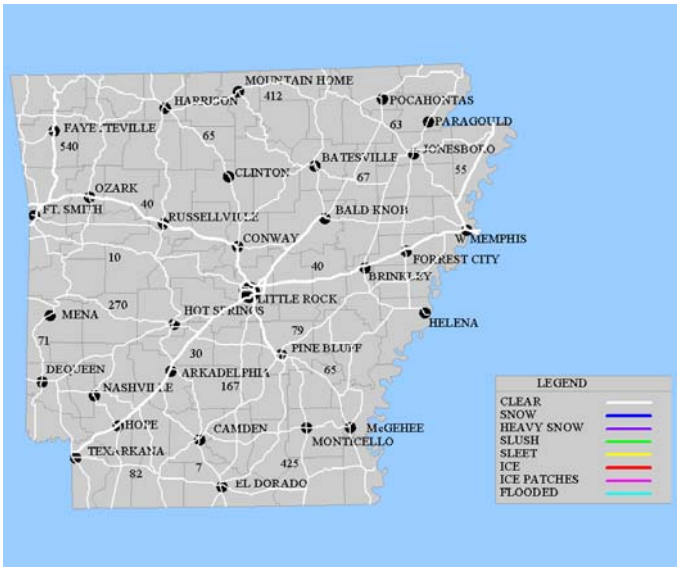


Figure 6. Arkansas DOT Travel Information Site

- Mississippi DOT – http://www.mstraffic.com/
  Titled "Mississippi Traffic Watch", this page can also be reached by clicking a link provided on the MDOT website. Traffic information is displayed in a column on the left of the map after clicking on icons depicted on the state map. These icons are limited in number and provide

information for only three areas of the state. Information is provided for northern Mississippi in Southhaven Community near Memphis, for southern Mississippi along the Gulf Coast near Biloxi and for central Mississippi in the Jackson area. Weather information displayed is obtained from the National Weather Service and is collected from weather observation sites located at Olive Branch Airport located in Olive Branch, Keesler Air Force Base located in Biloxi, and Jackson International Airport in Jackson. Displaying only the temperature and a brief description of general conditions, this information is generally updated by the NWS on an hourly basis. One nice feature of the Traffic Watch weather map is the graphic links provided for surrounding states. By clicking on a surrounding state, the user is linked to that state's DOT traffic web page. This link is useful if the user is interested in out of state travel information.

Figure 7. Mississippi DOT Travel Information Site

The Mississippi Department of Public Safety also provides information at http://www.dps.state.ms.us/dps/dps.nsf/roadmap?OpenForm with regard to road closures and weather conditions. A statewide map illustrating the counties of the nine DPS districts is provided. Clicking on a particular district will give road conditions and closure information. This information is only provided when weather is a contributing factor to hazardous driving conditions.

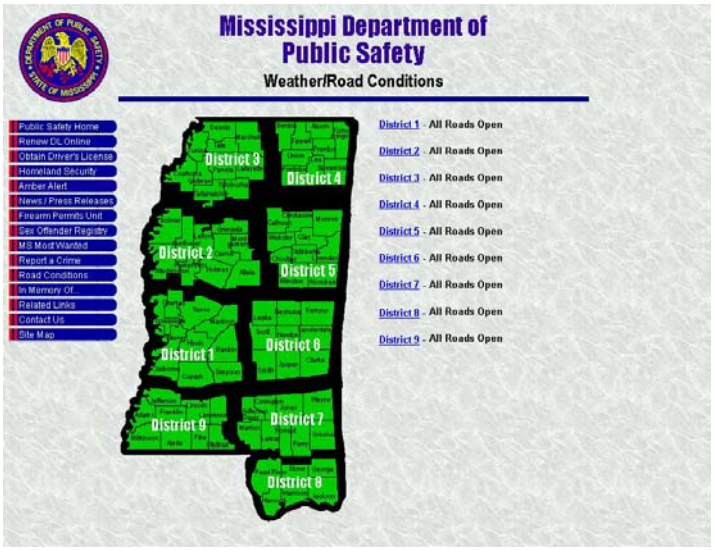


Figure 8. Mississippi DPS Travel Information Site

SELECTED CASE STUDIES

Three RWIS system designs were selected for further research in consideration of the design and implementation of a complete traveler information system. Those systems are:

Case 1. Tennessee-Kentucky Road Conditions

Case 2. SafeTravel USA, and

Case 3. Southeast Regional Climate Center

There was also a request to closely examine current practices of sharing weather information, particularly in the cases above.

Sharing Weather Information State to State

At the time of this publication there is no prescribed method or standard for sharing weather information state to state. The FHWA has initiated a group under the National Transportation Communication for ITS Protocol (NTCIP) to establish communications standards that will assist in reducing the barrier of transferring data between traffic management centers.

Several states that have elaborate weather collection projects have established FTP sites that allow other states to download raw weather data at no cost to the recipient state. The problem with this type of communication is that there is no consistent method by which the weather data is collected and formatted. The major barrier to overcome with the FTP site transfers will be the ability to interpret the raw weather data that is received from the corresponding DOT. Software incompatibility is often a factor in the ability of the recipient state to utilize the raw data. In cases where the recipient state must expend staff time or hire an integrator to manipulate the data for use in the state's information system the benefit must be weighed against the cost. The Minnesota DOT will occasionally access the Iowa DOT FTP site, but only in times of severe weather. Whether or not such information transfers are economically feasible may be in direct proportion to the number of times the information is actually accessed.

One method that seems to be frequently used among states is a weather website that provides links to the neighboring state's DOT homepage or weather website. A common problem with this method is that a user is not able to see one picture or a complete list of road problems from state to state without changing websites. Coupled with the fact that the data presentation is not likely to be consistent from site to site, this can be frustrating for the user.

Sharing Weather Information Between Tennessee and Kentucky

As described above, the State of Kentucky does display graphical weather information on its web site and it is displayed on a map of the state with the stations identified on state routes. They also provide a graphic that shows the last update for each station across the state on air temperature, pavement temperature and subsurface temperature. For other information in regards to

Figure 9. Kentucky 511 Travel Information Site

potential travel route problems on the Kentucky state highways, the DOT provides their 511 Traffic and Travel Information Service as displayed below. This site provides information on construction and incident delays. Three levels of roadway congestion can be displayed: Accident, Alert, and Difficult Driving Conditions. When the cursor is placed over the congestion symbol, additional details of the type of delay are further described. The Kentucky DOT currently posts its raw RWIS data on an FTP link for anyone to access. However, at the time of this writing, no other DOT has asked to have access to the FTP site.

This 511 information site was developed by a joint team from both the Kentucky Transportation Cabinet (KYTC) and the Governor's Office of Technology (GOT). Both offices worked to develop the site and GOT developers completed the necessary programming. Castle Rock Consulting developed the maps that were needed.

The data provided on the website is a combination of sensor data (referred to above in current RWIS practices) and National Weather Service Data. The sensor data is collected from the RWIS sensors that are owned and operated by the KYTC. The National Weather Service data is supplied free of charge.

The design and development costs totaled about $35,000 in addition to the cost of map development which ran about $70,000 for a grand total of $105,000. The State of Kentucky spent an additional $3,000 on maintenance costs from October 2002 to June 2003. Additional information on the development of this website can be found in the appendix to this report.

One advantage of sharing this data would be that travelers could obtain real time weather information on one site as they plan for their travel. To share the information across the Tennessee-Kentucky border, TDOT would need to ensure the integrator of their future RWIS system use software compatible with the Kentucky program or else design their own program to accurately display the information that Kentucky currently offers from their FTP site.

In the overall development of a traveler information system the ability to share weather data with Kentucky would have obvious advantages. Bordering almost

the entire state to the north, the contiguous border with Kentucky covers a larger geographical region than that of any other border state. A system that will share weather information with Kentucky could be expected to be accessed more often by more users than a similar system sharing with any other border state. And given that Kentucky has a useable FTP site already, the cost of developing a system that would be compatible for sharing information would be considerably less than the retrofit of an existing system. The State of Tennessee has an advantage in being in the planning stages of developing such a system and could plan from the beginning to ensure system compatibilities.

Sharing Weather Information Through SafeTravel USA

Safe Travel USA website is a product offered by Meridian Environmental Technology, Inc (Meridian). There are currently five states on the Safe Travel website http://safetravelusa.com/index.html. Various information on the state roadway systems is available including current roadway weather conditions, local area forecasts, and construction information simply by clicking on the section of roadway of interest. Meridian is capable of collecting weather data from roadway pavement sensors, weather stations at airports, as well as the various other weather stations that can be found across the state. This includes all the weather stations that the regional climate centers use to collect data across a state. The Meridian staff processes the forecast information, weather station information, and roadway sensor information and then places it onto to one website. This enables the user states to inform the general public with a compilation of information using only one website. Meridian is able to customize each state's weather and travel information to fit the preferences, needs and budget for each DOT that subscribes to this service. Sharing information between states would be very straightforward with the Meridian System. With weather information being processed by one company, the process of sharing information across state lines is then eliminated. Regardless of the data format, it would be the company's responsibility to make sure that the information is formatted and displayed for the contracted area of multiple states.

Sharing Weather Information Through Regional Climate Centers

There are currently six Regional Climate Centers (RCC) in the United States. Tennessee is located in the Southern Region. Weather information can be viewed by selecting the state and the region. The actual weather data is displayed as text. To be able to share information on weather with bordering states, Tennessee would have to get information from the Southeast Regional Center, the Midwestern Regional Center and the Southern Regional Center then create the graphics for information for Tennessee and add the information from the other states. Each center is federally funded and they operate independently from one another. The database structure is different in each of the centers. Large universities in each area operate most of the centers and their main purpose is to supply climate data for the selected states in their area for a variety of issues. Subscriptions for the climate data can be purchased and the cost is directly related to how much data needs to be collected and how often the data is collected. The data that is collected by the RCCs is normally placed into daily summaries. They are capable of collecting temperatures and precipitation data from several stations across a state but the information is only updated on a daily

basis. The RCCs do not handle real time weather data. The data is simply collected over a period of time and then distributed to their clients. Upon review of the individual RCC sites, there are no common attributes between the different center's web sites.

Given that the RCCs do not work with real time weather data, their services currently do not fit into the scope of work that TDOT has envisioned. Based on the research to date, real time data is most useful to the general public, particularly for systems such as 511 and Highway Advisory Radio (HAR). The use of real time data will be more critical during the winter months when road conditions can change within a few hours. However, if there is interest in knowing the historical weather patterns for a particular part of the state or one of the neighboring states, then the local RCC for that area could accommodate those needs.

APPLICATION OF ITS CONCEPTS

Weather information is an integral part of the information transported through an Intelligent Transportation System (ITS). The weather information processing and distribution are depicted graphically in Figure 10. For a state agency, Figure 10 would be the type of configuration that would be expected for the ITS architecture.

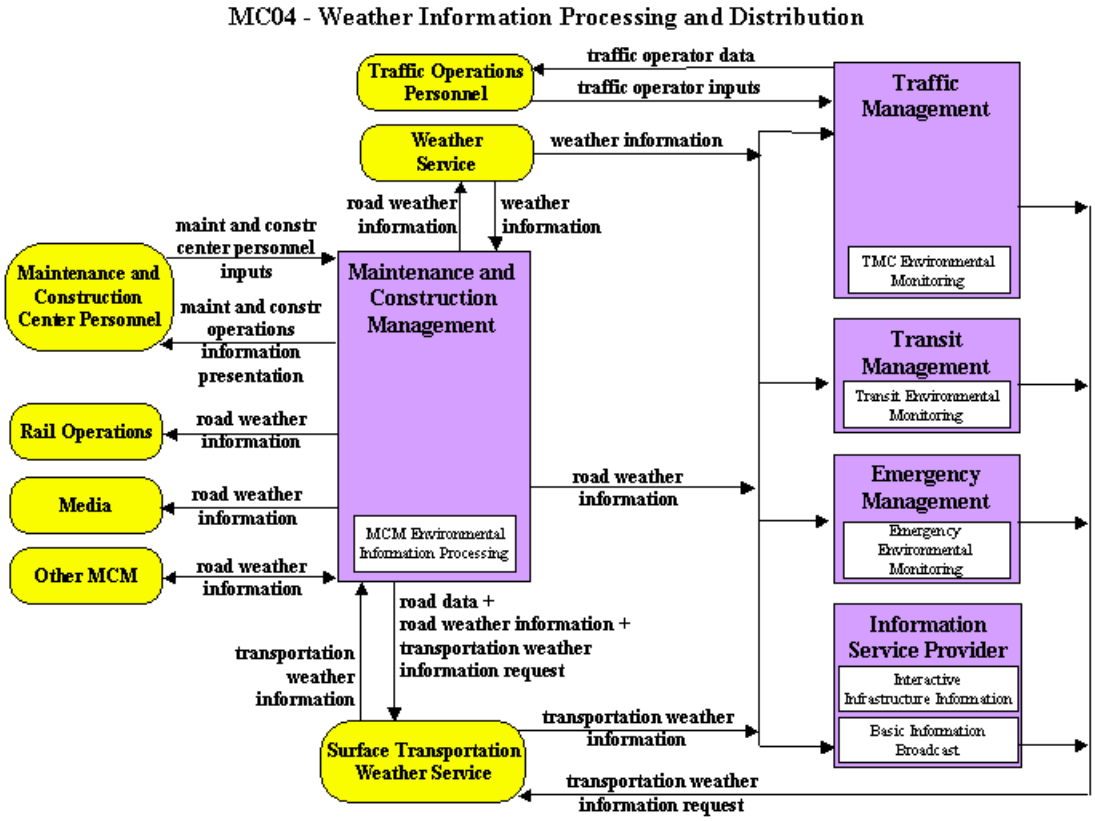


Figure 10. Weather Information Processing and Distribution

In Case 1, with the State of Tennessee and the Commonwealth of Kentucky, the information from the weather data collection field devices, the weather service provider and other sources of weather data would be sent from the Maintenance and Construction Management Group, Weather Service and Surface Transportation Weather Service to the Traffic Management, Transit Management, Emergency Management and Information Service Provider Groups. The information would then be transferred from the Information Service Provider at the State of Tennessee to the Information Service Provider at the Commonwealth of Kentucky. The information could then be formatted for display on the respective web pages of each state. Construction or incident data would be transferred in the same manner. This is called “Information Transfer from Center to Center”. Adding another state would simply require setting up an information transfer from the first state to the second state through the Information Service Provider of each state. At a more detailed level, the data structure and formats must be made compatible either through the use of some type of interpreter or by the use of the same software.

Both the State of Tennessee and the Commonwealth of Kentucky have a Statewide ITS Plan which are consistent with the National ITS Architecture.

As of this writing, the standards for data transfer using National Transportation Communications for ITS Protocol (NTCIP) have not been finalized. When the standards are finalized, it will assist considerably with simplifying data transfers between Traffic Management Centers in different states. In the future, Traffic Management Centers (TMCs) could have different data structures for their weather databases, convert the database to NTCIP standards and then transmit that data to other TMCs with a NTCIP interpreter. The receiving TMC could then read and transfer the data into their system with very little difficulty. For more information on NTCIP standards see http://www.ntcip.org/.

In Case 2, SafeTravel USA is a weather service provider and thus is one component of the ITS Architecture. The communication between states would be simplified considerably using such a provider because the same weather data would be used with the same format internal to each state. Addition of other states would be quite straightforward for the same reason.

In Case 3, each Regional Climate Center uses its own specific software that varies from region to region. When asked about expanding their database to show weather conditions in other states outside their region, the response indicated there was no interest in such a product currently.

COST OF IMPLEMENTING A STATE WEATHER INFORMATION SYSTEM

To be able to better quantify the cost of implementing a weather information system, a Request For Information (RFI) was issued asking several universities and private companies to supply information about how to establish a high-tech website for the state of Tennessee. The purpose of the RFI was find out how much it would cost to establish a website that could eventually incorporate other states in the southeast that would display traveler information on interstate and major roadway systems. Because this is not a set of plans and no set of specifications was provided to the contractors, it was felt an exact cost estimate would not be valid. Thus, a range of prices for each category was specified for the potential contractors so that a range of costs could be identified.

Five RWIS systems were used as guides or model websites. They were selected based on their user-friendly format as well as the information they make available to the average driver. These included:

State of Washington - This website can be viewed at http://wsdot.wa.gov/traffic/. This website offers one of the most complete traveler/weather information displays in a very easy to read format. Below is one of many illustrated weather conditions maps.

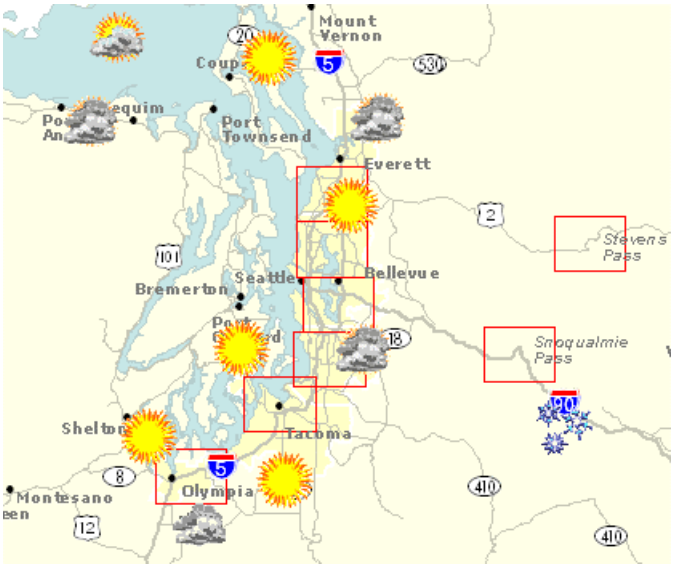


Figure 11. Washington DOT Travel Information Site

State of Iowa – This website can be viewed at http://www.dotweatherview.com/. This website was chosen because it offers complete information in an easy to read format.

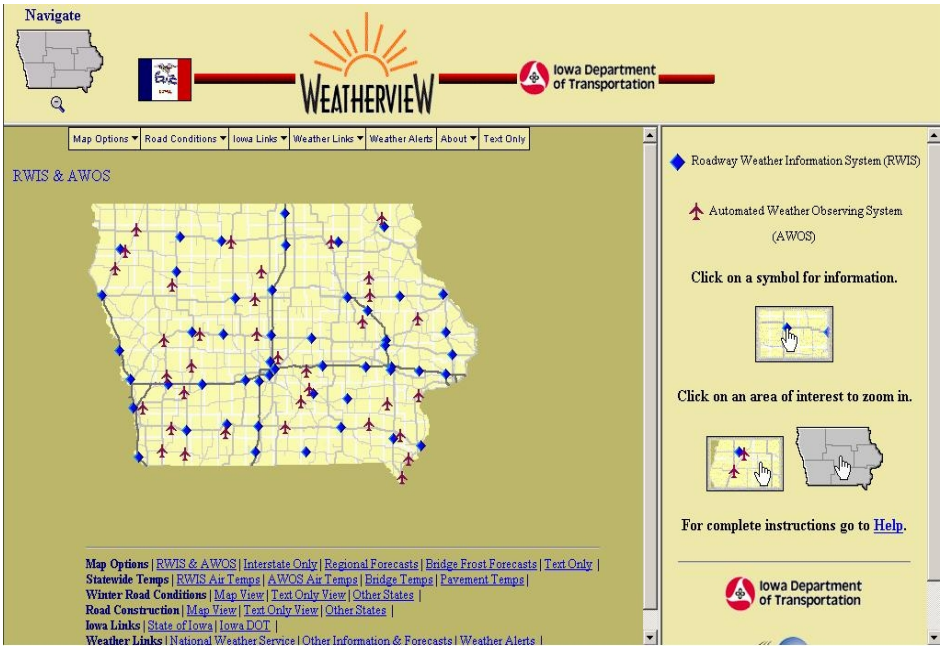


Figure 12. Iowa DOT Travel Information Site

State of Utah - This website can be viewed at http://www.commuterlink.utah.gov/ie.htm. This website also offers a substantial amount of information to the public including the option to sign up for email updates based on user preferences.

State of South Dakota - This website can be viewed at http://www.safetravelusa.com/process.pl?state=sd. This website was chosen because it is a complete traveler/weather website that is being maintained by a private contractor. A winter road condition report is published on the South Dakota DOT website 3 times daily from early November to late March. From April through October the report is updated only during severe weather that causes poor road conditions over a large portion of the state. This site is available at http://www.sddot.com/Operations/Road_Condition_Report/index.htm

State of Kentucky – This website can be viewed at http://511.ky.gov/. This website was chosen for a variety of reasons. Kentucky is one of the most experienced states in gathering information for a 511 calling system. It is also the most technologically advanced state in the southeast with regards to collection of weather and roadway conditions.

All of these states present their information differently and each program that the websites are based on is unique. All of these websites have been widely accepted by the general public as an informative method of receiving travel/weather information. All of these states have also expanded the number of services that they offer the public regarding traveler/weather information. These states started with small programs such as a weather website or highway advisory radio and then continued to expand the program as technology progressed. In addition, all of them provide road construction information as part of the website. This feature is very popular during the summer

months when winter road conditions are not an issue. Some of the most common features found on a comprehensive traveler/weather website are:

1. Current Traffic Conditions
2. Current roadway conditions during times of inclement weather
3. Road Construction information, including road closures and delays
4. General weather forecasting

Some of the states have included more sophisticated information into their traveler websites. These items tend to be options that are more critical to that specific area and may not be warranted for every state.

1. Email subscriptions to updates, changes or other information.
2. Information on how to access the 511 system
3. Variable message sign information along popular routes
4. Video images of the areas prone to congestion
5. Mass transportation information

These websites were used as guidelines for what is easily understood by travelers when they access a traveler/weather website. The RFI included a basic outline of a weather website and incorporated features that a contractor would be expected to provide for this website. The contractor would be expected to:

1. Incorporate the various methods of weather data collection (e.g. remote weather sensing devices, weather services, NOAA, NWS, or other sources as specified by the DOT) in order to make use of the greatest amount of weather information available within the state,

2. Create a website that could be expanded to include neighboring states and overcome the problems of data sharing,

3. Incorporate the best features found on other traveler/weather websites so that the website is current with today's technology and that website users have the greatest amount of travel/weather information available to them in an easy to read/comprehend format.

The following pages illustrate the RFI.

Request for Information

Tennessee Department of Transportation
Road Weather and Traveler Information Website

May 12, 2003

The Tennessee Department of Transportation (TDOT) is interested in developing a road weather/traveler information website for use across the state. Research has been completed on different weather websites as well as different DOT websites. A wish list of criteria has been made based on the research. The objective is to combine the best parts of these websites into one useful website that can be used for the state of Tennessee as well as every state that touches Tennessee. This RFI will pertain only to developing information for the state of Tennessee. Eight adjacent states may wish to be added at sometime in the future.

The websites that were used as a model for this RFI were:

Southeastern Climate Center – SERCC-
http://water.dnr.state.sc.us/climate/sercc/products/asos.html

Weather Underground -
http://www.wunderground.com/US/Region/Southeast/Temperature.html

Washington State DOT –
http://wsdot.wa.gov/traffic/views/newviews.htm

Iowa DOT –
http://www.dotweatherview.com/

Tennessee DOT –
http://www.tdot.state.tn.us/roadcondition/currentmap.asp

Website Criteria:

This website will consist of three graphic pages. Graphic page 1 will be considered the main page. There will be an individual graphic page 2 and graphic page 3 for each state that is on graphic page 1.

1. Graphic page 1 for this website will display the state map of Tennessee and the eight states that share the Tennessee border with each state correctly labeled. These states are Arkansas, Alabama, Georgia, Kentucky, Mississippi, Missouri, North Carolina and Virginia. The map should be similar to the one found on SERCC website or the Weather Underground website that were previously noted.

Preliminary Estimated Cost for Graphic page 1:

- ☐ Cost ≤ $ 25,000
- ☐ $25,001 ≤ Cost ≤ $50,000
- ☐ $50,001 ≤ Cost ≤ $100,000
- ☐ Other

2. Graphics page 2 will be an individual state map. Each state shown on graphic page 1 will have its own graphic page 2. Each state will be "clickable" from graphic page 1 once the state's information is added to the main website.

   Once a state is selected a new and separate window will open displaying only the state that was selected by the user. For example, by selecting Tennessee a new window showing only the state of Tennessee map and the items outlined below would be displayed.

3. The following information is part of the individual graphic page 2 that should be developed for each state.

   A. Label and display the locations of all the major metropolitan areas within a state. The state of Tennessee has four metropolitan areas that will need to be labeled. They are:

      1. Memphis
      2. Nashville
      3. Chattanooga
      4. Knoxville

   B. Include a graphical display of the interstate highway system that runs through the state with each route properly marked. The graphics outlined in this section and in section A should be similar to ones found at the TDOT website that is given above. County boundaries within the state will not be needed.

      The interstates in Tennessee that need to be included are:

      1. I-24
      2. I-40
      3. I-65

4. I-75
5. I-81
6. I-181

Preliminary Estimated Cost for Graphic page 2:

☐ Cost ≤ $ 25,000
☐ $25,001 ≤ Cost ≤ $50,000
☐ $50,001 ≤ Cost ≤ $100,000
☐ Other

4. Graphic page 3 will have "clickable icons" for every weather collection station in the state. Each state shown on graphic page 1 will have its own graphic page 3. In order to maintain a clear understanding of the data available graphic page 3 should be accessible only from graphic page 2.

   It may also be necessary to provide more detailed images of the metropolitan areas in order for the user to see all the icons that are available in a small area. If needed, the metropolitan area's weather information could be displayed in a separate, more detailed map once selected by the user. This new window, graphic page 3b, would show the road structure for that particular city and provide more detail on where the weather stations are in that area. This feature should work similar to ones found on the Iowa DOT website or using a "zoom window" feature similar to the one used on the Washington DOT website.

   Graphic page 3c will show the weather information from the weather station selected by the user. The Iowa DOT illustrates this by showing a red circle around the selected station and opening an adjacent window showing the data charts. The Washington DOT accomplishes the same point by using a zoom window and red circles. In both instances the weather data is displayed without removing the state weather station map displaying the sensors.

   The Tennessee DOT, airports, National Weather Service (NWS), state universities, etc operate some of these stations. Locating these stations and acquiring the data will be the responsibility of the contractor. TDOT operates some of the roadway weather information sensors (RWIS) and will assist the contractor on those locations and provide

information on how to access the data. Airports typically operate automated weather observing systems (AWOS). Other criteria for this task would be:

A. The sensor map should be similar to the one used on the Iowa DOT or the Washington DOT websites that are mentioned above.

B. TDOT will establish the criteria for what information needs to be displayed based on the type of station that is being used. Each station should be "clickable" and provide the following minimum information:
   1. Location of sensor
   2. Date data was collected
   3. Time data was collected
   4. Air Temperature

C. Other information to be provided if available:
   1. Pavement Temperature
   2. Sub Surface Temperature
   3. Precipitation
   4. Wind Speed, Gust and Direction

5. Provide route profiles with current weather information for the major interstates between metropolitan areas. This task should operate similar to the one used on Washington DOT's website. The following minimum information should be provided for this task:

   A. Name of route with date and times data was collected.
   B. Cross-section of route between the two metropolitan areas or roadway intersections. The corresponding DOT will set the starting and ending point for each route cross section. Smaller cities or major landmarks should be correctly noted at the bottom of the profile to give the user reference points when looking at the profile
   C. Color-coded road temperature key that can be referred to by the user. These same colors should be used in conjunction with the profile to let the user know what the pavement temperatures are at different parts of the route.
   D. Current air temperature
   E. Sky condition if available

F. Wind data if available

Preliminary Estimated Cost for Graphic page 3:

☐ Cost ≤ $ 25,000
☐ $25,001 ≤ Cost ≤ $50,000
☐ $50,001 ≤ Cost ≤ $100,000
☐ Other

The RFI above was sent to six universities and four private companies. No universities responded. Four private companies provided responses: Weather Bank, Inc., Weather Underground, Inc., Meridian Environmental Technology, Inc., and 3 Tier Environmental Forecast Group, Inc. The following page contains a chart listing the companies' contact information and responses. As can be seen, there were three companies that would prepare the three-page graphic display for less than $75,000. Maintenance costs ranged from $1,400 to $12,000 per month. Because the request was broad, a detailed RFP would be required for a proper bid comparison.

Figure 13. RFI Responses for a Traveler/Weather Website for TDOT

Company Name	Contact Name	Phone Number	Email	Website	Address
Weather Bank, Inc.	Michael Root	405-359-0773	mroot@weatherbank.com	http://www.weatherbank.com	1015 Waterwood Pkwy., Suite J Edmond, OK 73034
Weather Underground, Inc.	Chuck Prewitt	415-543-4806	chuck@wunderground.com	http://www.wunderground.com	185 Berry St., Suite 5501 San Francisco, CA 94107
Meridian Environmental Technology, Inc.	Mark Owens	701-787-6044	mark_owens@meridian-enviro.com	http://www.meridan-enviro.com	P.O. Box 14178 Grand Forks, ND 58208
3 Tier Environmental Forecast Group, Inc.	Kenneth Westrick	206-325-1573	kwestrick@3tiergroup.com	http://www.3tiergroup.com	2825 Eastlake Ave. East, Suite 330 Seattle, WA 98102

Company Name	Cost Estimate for Graphic Page 1	Cost Estimate for Graphic Page 2	Cost Estimate for Graphic Page 3	Maximum Total	Web Page Maintenance
Weather Bank	Less or equal to $25,000	Less or equal to $25,000	Less or equal to $25,000	Less than or equal to $75,000	$1400/mo
Weather Underground	Less or equal to $25,000	Less or equal to $25,000	Less or equal to $25,000	Less than or equal to $75,000	$3000/mo
Meridian Environmental Technology, Inc.	Less or equal to $25,000	Less or equal to $25,000	Less or equal to $25,000	Less than or equal to $75,000	$1400/mo
3 Tier Environmental Forecast Group	Less or equal to $25,000	$25,000 to $50,000	$50,000 to $100,000+	$100,000 to $200,000+	$10,000-$12,000* *Depending on services

COMMENTS ON BEST MANAGEMENT PRACTICES

From the methods of collecting and displaying weather information the following should be considered:

1. Covering a state with weather sensors at multiple locations to provide coverage to the most users requires a considerable amount of state funds for the initial capital investment and staffing necessary to keep the system fully operational. These comments were made by at least six state DOTs during the research process. Consideration should be given to contracting out the specialized nature of maintaining a weather data collection system.

2. Use as many sources of weather data as possible, such as National Oceanic and Atmospheric Agency (NOAA), National Weather Service (NWS), airport weather data, etc. Consideration should be given here to the complicated process of incorporating the different data formats in which data is available, and compiling the data into the necessary format for the graphics display.

3. User-friendly graphics are essential. Consideration should be given to providing easy to understand graphics with proper descriptions of the information available.

If a weather web page is to be created, several items that should be considered in preparation of the web site are:

- User-group feedback is critical for a web site that is functional, easy-to-use, and relevant. Furthermore, it is essential that this feedback be aggregated, analyzed, and included in future web enhancements and upgrades.

- Extremely high reliability of the web site is critical; do not underestimate the technical requirements as well as the importance of this task. A web-provider should be located as close as possible to the internet backbone to reduce the likelihood of the site being inaccessible. The best strategy is for the forecasting and data providers interface with the operational web site (see Figure 14, provided by 3 Tier Environmental Forecast Group), but that the actual page be served to the public through a highly reliable 24/7 web provider specializing in web delivery. The best providers also can provide a great deal of statistics on the users and how they look at this site; this can be critical for effective future updates to the page and interface.

- Different web sites will need to be created and maintained for DOT staff, DOT managers, and the public if all these groups are to be served. In many cases, the DOT requires a level of information that would overwhelm and confuse the public. A perfect example is Road Temperature forecasts - while these are critical to DOT staff, the majority of the non-snow belt drivers do not understand the significance of road surface temperature. There are numerous methods to safeguard this more detailed DOT-specific information so that it is not available to the general public.

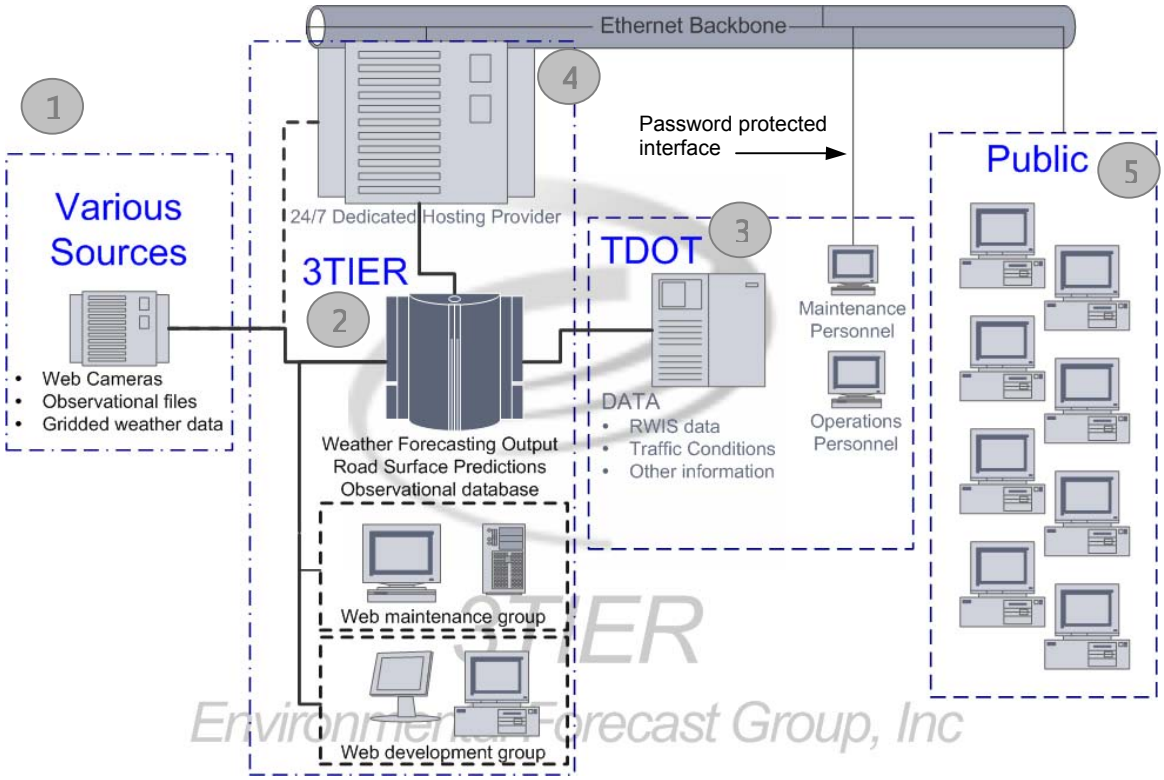


Figure 14. Recommended Web Information Interface Configuration (Courtesy of 3 Tier Environmental Forecast Group)

- A number of User Interface issues will confront the DOT when they begin development of the page, so constant revisions can be expected. For example, for the WSDOT page, the idea of using additional popup screens for displaying additional forecast and nowcast information became problematic when users began installing pop-up killers to reduce the number of advertisements received. These pop-up killers can not differentiate between an advertisement and useful information. These are the types of issues that will have to be quickly identified and addressed in a rapidly changing environment like the Internet.

- The general public likes both text and graphical based information. Finding the right combination of the two is accomplished through careful advance planning and effective use of feedback obtained from user-group testing sessions

- The current resolution of weather forecast information may not be relevant to the area of interest. In many cases, the creation of travel forecast information along a transportation network in complex terrain is best accomplished by running a numerical weather prediction model at horizontal scales of 5km or finer. Furthermore, if land surface details (such as terrain shading on road surface temperature) then a Land Surface Model at a horizontal scale of 100m or finer should be utilized to downscale the model output. Utilizing coarser scale model output may lead to large prediction errors.

- Weather forecasting and the forecasting of road travel conditions is uncertain by nature. Hence, the most useful type of information tends to be probabilistic in nature. For example, DOT staff may want to know the probability that a certain pass will experience freezing conditions tomorrow evening. The general public might want to know the probability that that same pass will be experiencing snowfall while they drive over it. Through the use of ensemble based weather forecasting and/or statistical estimates of error, it is possible to provide such information.

- Future transportation web sites will include much more environmental type forecast information as well as advanced methods for showing this information spatially (i.e., map-based products). The product should be developed in such a way that future advances in technology and forecasting can be integrated without the development of a completely new product and/or support infrastructure. This is most important from a data acquisition and storage perspective.

- The various observational and forecast information can and should be integrated into decision models, especially for DOT specific web pages. An example would be radar information; rather than just show radar images of precipitation, the effects of this precipitation on road and traffic conditions should be portrayed. There are many other examples of the integration of various information and data sources to create more relevant transportation products that can help mitigate weather-induced traffic problems.

- The public as well as maintenance staff like webcams and other 'on-ground' truth for getting information. Web cams are available through a variety of sources, having different levels of reliability. The integration of web cams and other on-ground truth observations has to be well planned and will require constant maintenance to identify broken or unreliable links.

CONCLUSION

The costs to install and maintain a weather data collection and distribution system for providing weather information to the general public can be substantial. Though the estimated cost of existing systems can serve as a guide, the cost of a new system can range widely. The sharing of that information with one or more departments of transportation (DOTs) can present a large problem with costly solutions.

In the scenario of Case 1 where TDOT is interested in developing a system that will allow the data sharing with Kentucky, it seems this could be accomplished with proper planning. Since Kentucky offers the possibility of sharing their RWIS data through the use of an FTP site and their other source of weather information for the traveler site is the National Weather Service, the sharing of data is feasible.

However, weather services have shown that large amounts of information can be collected dynamically in “real time” and be provided to the DOTs at a significantly lower cost than ”in house” collection. Through the use of strict specifications and functioning within the limitations of the information provided by a weather service, a quite effective weather information system can be configured for an individual state. If several states desire to share the information, the weather service providers can take information from a state’s existing data collection system and incorporate that data into a larger weather information database.

APPENDIX

KENTUCKY TRANSPORTATION CABINET
ROAD CONDITION REPORTING PROJECT (a.k.a. CARS)

Project Abstract

Background

The previous Road Condition Reporting System was replaced for several reasons. First and most importantly, this system did not provide timely road condition reports to the traveling public; it was updated, on average, once a weekday and not at all on weekends. Also, the maps on which accidents and construction were displayed and published on the World Wide Web were in need of being revised and made more interactive.

Project's Goal

The goal of this project was to provide the motoring public with timely information about roadway conditions, both planned and unanticipated, in order to ensure public safety and the uninterrupted flow of traffic.

Scope

The scope of phase 1 of the project included identifying the user's requirements, evaluating existing software packages, enhancing the software where needed, designing and developing training for the end users and system administrator, delivering the training, coordinating user acceptance testing, and deploying the software components. There are an estimated 400 users and approximately 2,200 miles of roadways included in this phase. Also included is publishing the road condition report on the KYTC Web site as well as over a phone system that allows callers access with a 3-digit number (511). Phase 1 involved the deployment of three systems or sub-systems. They are:

1. CARS – the browser-based system used to collect road condition data
2. MapClient – the sub-system used to produce Maps for the revised Web-site (511.ky.gov)
3. CARS 511 – the 3-digit phone system that includes voice recognition

Business Case

This project was approved because the Transportation Cabinet wished to provide better service to the traveling public with near real-time reports of the NHS roadways in Kentucky. It is anticipated that the number of serious accidents will decline as a result of the traveling public becoming aware of the current road conditions. Deploying this system 12 months prior to moving to the new Statewide Operations Center should provide time for the users to become proficient with the new software and processes.

Schedule

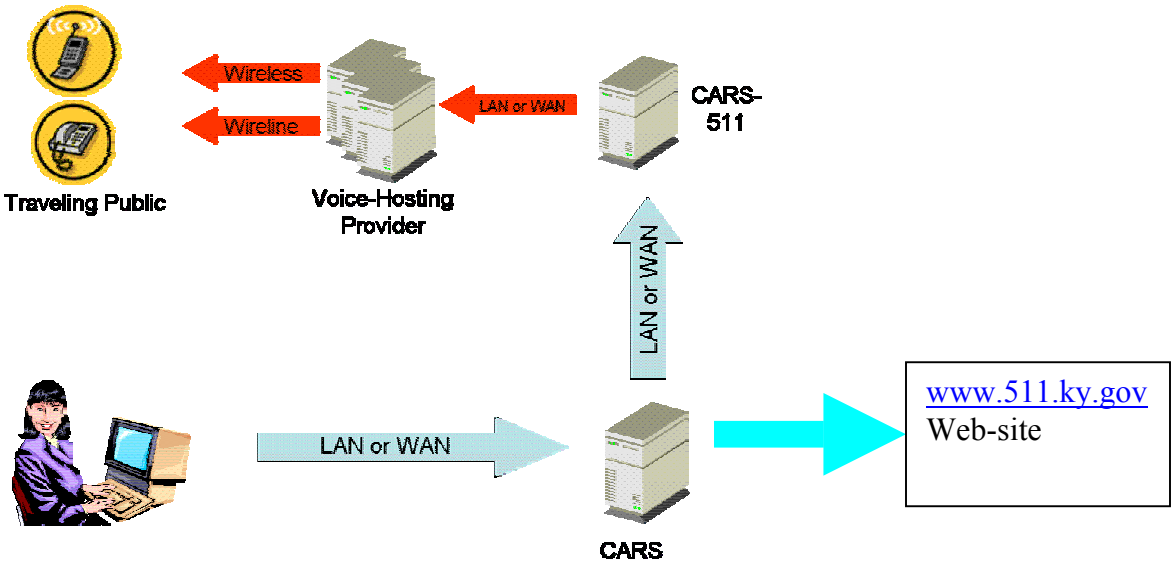
The schedule for Phase 1 was as follows:

- CARS – October15, 2002
- MapClient – October 15, 2002 (included launch of 511.ky.gov)
- CARS 511 – November 15, 2002

CARS-511- Condition Acquisition and Reporting System for Traveler Information Services

CARS-511 is a road reporting system that utilizes information which was created within the CARS multi-state database of highway events. CARS-511 provides timely information to travelers who can access this information via a telephone by simply dialing “5-1-1” on the touchpad. Authorized staff use CARS to input construction, accidents, delays, and other roadway, weather and tourism information into statewide databases, using standard web browser software. CARS servers also support routine DOT dispatch, press release and emergency response activities.

The information entered into CARS is then continuously updated to the CARS-511 system. CARS-511 provides traveler information through a variety of categories including urgent reports, routine reports, road weather and it also provides transfers to outside phone numbers that provide transit-related information.



CARS 511 SCHEDULE

ID	Task Name	Start	Finish
1	**Road Condition Reporting Project - Renamed 511 Project**	**Thu 2/15/01**	**Fri 10/31/03**
2	**Phase 1**	**Thu 2/15/01**	**Wed 11/27/02**
3	Implement Back-end Appl (CARS)	Thu 2/15/01	Tue 10/15/02
4	Implement Web-site (511.ky.gov)	Mon 6/3/02	Tue 10/15/02
5	Implement IVR Phone System (511 in KY/866-737-3767 out-of-state)	Thu 8/1/02	Fri 11/15/02
6	Announce 511 to the Public	Wed 11/27/02	Wed 11/27/02
7	**Phase 2**	**Mon 11/18/02**	**Tue 9/30/03**
8	Add Additional Miles	Mon 11/18/02	Fri 5/30/03
9	Add Additional Users	Mon 11/18/02	Fri 5/30/03
10	Implement Interface to Tourism Call Cente	Mon 3/3/03	Mon 9/1/03
11	Install Software Upgrades	Mon 12/16/02	Thu 4/10/03
12	Monitor CARS Usage	Mon 11/18/02	Tue 9/30/03
13	**Phase 3**	**Mon 3/3/03**	**Fri 10/31/03**
14	Build KY 511 Call Center	Mon 3/3/03	Wed 10/15/03
15	Cut-over to KY 511 Call Center	Fri 10/31/03	Fri 10/31/03