DEPLOYMENT PLAN

511 Traveler Information Services

Prepared for

The Oklahoma Department of Transportation

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Executive Summary

On July 21, 2000, 511 was established as the national traveler information telephone number for the United States. 511 systems are currently deployed in 18 locations (13 statewide systems and five regional or metropolitan systems). A total of 44 states, including Oklahoma, have begun the process of investigating 511 systems and have each received $100,000 in funding from the Federal Highway Administration (FHWA) to assist with the development of a 511 Deployment Plan.

An initial deployment of a 511 system in Oklahoma can provide the following types of information to consumers via automated telephone information and a web site:

- Road/construction/work zone information/emergency road closures
- Weather conditions/forecasts and weather-related condition information
- Major traffic incidents

Traffic congestion/travel time data for Oklahoma City and Tulsa can be added to the basic 511 system relatively easily. However, before those areas can be added to the system, the installation of ITS infrastructure must be completed to provide near real-time traffic information to the 511 system.

Cost Information

Many states are purchasing 511 system services and are thereby avoiding the costly initial expenses for building their own system, as well as avoiding the cost and inconvenience of implementing major technological upgrades. The major system provider used in the Great Plains has estimated the costs for the initial deployment and on-going operation of an Oklahoma 511 system. The initial expenses would be expected to range from $155,000 to $230,000; yearly operations costs are estimated at $19,100. Other major costs of starting a 511 system would include:

- One-time fees to telecommunication companies to reprogram switches to allow 511 calls to be placed. Other states have experienced total costs of $0 to $75k for reprogramming.
- Advertising the 511 system to the driving public. Other states have experienced costs of

$40k to $125k for advertising.

• Adding urban traffic/congestion travel time data. Both service providers estimated costs of less than $50k per urban area to integrate those areas into an existing 511 system. Those figures do not reflect the costs of ITS infrastructure that feeds information to the 511 system.

Funding Sources

The FHWA has determined that existing Congestion Mitigation and Air Quality (CMAQ), National Highway System (NHS), and Surface Transportation Program (STP) funds may be used for the deployment of a 511 system. As mentioned previously, Oklahoma has already secured $100k to prepare a 511 Deployment plan. Some states obtain funding in the form of line item appropriations. On November 20, 2003, legislation to reauthorize TEA-21 was introduced in the U.S. House of Representatives. This legislation, referred to as the Transportation Equity Act – A Legacy for Users, includes a provision that would allocate $25M per year for five years for 511 systems. This bill died in the 108th Congress, but a similar piece of legislation is expected from the 109th Congress.

Timetable

Other states have initiated 511 service within six to twelve months of hiring a service provider. The six month time difference accounts for a test period that some states utilize before opening the system to the public. Oklahoma could initiate the Plan within six months and be fully operational in twelve months after hiring a service provider.

Recommendations

This report reaches conclusions that support the following recommendations concerning implementing a 511 traveler information system in Oklahoma:

• Engage a 511 service provider to provide hardware, software, pavement-level weather

information, and technological updates that the state must otherwise provide.

• Work with the Oklahoma Corporation Commission to negotiate switch reprogramming charges and per-minute tariffs with telecommunications companies.

• Work closely with ODOT personnel to ensure they understand that accurate and up-to-date information must always be available on the 511 system.

1. Introduction

The telephone number 511, also known as "America's travel information number," is an abbreviated three-digit dialing code that allows easy access to Traveler Information Systems (TIS) through the public-switched telephone network. 511 came about in response to the recognition of the value that TIS afford to the public. With over 300 telephone-based TIS in service across the United States, 511 alleviates the need for travelers to dial hard-to-remember seven- and ten-digit numbers. The following types of traveler information are most commonly disseminated:

- Weather-related road conditions and weather forecasts
- Construction / work zone information
- Congestion and incident information

The U. S. Department of Transportation (US DOT) petitioned the Federal Communications Commission (FCC) in March 1999 for an N11 number that could be assigned to nationwide access of telephony-based traveler information services. The petition enjoyed wide support among a number of state departments of transportation (DOTs), transit agencies, and metropolitan planning organizations (MPOs). As a result, the FCC assigned the 511 number on July 21, 2000. Several key points came out of the FCC's action:

- State public utilities commissions (PUCs) would have jurisdiction over 511 (in those states where PUCs have such authority).
- A government entity, e.g., a state DOT, must be the requestor.
- 511 call routing would apply to both wireline and wireless telephony providers.
- Cost recovery mechanisms and technical implementation issues not addressed by the FCC are left up to the PUCs/implementers.
- Regional approaches were encouraged, i.e., tailored to regional needs
- National deployment/consistency was encouraged.
- A five year target was established for revisiting the progress of 511 deployment.

Notably, the intent was to provide implementers flexibility in deploying regional 511 systems, but with a goal of ultimately arriving at the emergence of a "national" 511

system. The public sector is free to designate the operator of its choosing, whether private or public. 511 was not mandated as a free service to the public, but rather, carriers are free to recover costs.

A simplified explanation of how a 511 might work is as follows. A caller seeking traveler information dials 511, which is then translated by a telecommunications provider's switch to a local toll or toll-free number. The provider of an advanced traveler information system (ATIS) then answers the call via automated means and provides the requested information based on voice-activated queries. In some cases, the incoming call may be transferred to a live operator, depending upon the information request.

The following 511 Deployment Plan for Oklahoma will review the overall structure of 511 (Section 2), then present results from two stakeholder meetings and an online questionnaire (Section 3). The Technology and Operations Plan (TOP) (Section 4) provides a review of 511 deployment nationally, then specifically examines nine active 511 systems. The TOP goes on to discuss a potential technological approach. The Evaluation Plan (Section 5) presents a framework for assessing the effectiveness of a proposed 511 deployment in Oklahoma. Estimated costs (Section 6) are then examined for the installation, operation, and maintenance of the system. The Deployment Plan concludes (Section 7) with a summary of findings and recommendations for going forward with 511 in Oklahoma.

2. Content of a 511 Program

511 systems typically provide information that can be grouped into two distinct categories:

• Roadway Information – Defined by the 511 Deployment Coalition as "information associated with particular roadways in a 511 service area."(511 Deployment Coalition, August 2003)

• Weather Conditions and Forecasts – Defined by the 511 Deployment Coalition as "information associated with observed and forecasted weather and road surface conditions that may impact travel in the 511 service area." (511 Deployment Coalition, August 2003).

These categories of information are described in detail in the following sections.

2.1 Roadway Information

The 511 Deployment Coalition recommends the following specific types of information be provided to callers (511 Deployment Coalition, August 2003):

- Construction/Maintenance Projects: "Current information on active projects along the route segment that may affect traffic flow and/or restrict lanes"
- Road Closures and Major Delays: "Unplanned events, major incidents, or congestion that shut down or significantly restrict traffic for an extended period.
- In urban areas, information on all incidents and accidents, both major and minor, and congestion information along each route should also be provided"
- Major Special Events: "Transportation-related information associated with significant special events (fairs, sporting events, etc.)"

2.2 Weather and Road Surface Conditions

Weather or road surface conditions that could impact travel along the route segment must be provided.

The 511 Deployment Coalition further recommends that the following details be provided for each content type:

• Location – Location where the incident/event/condition is occurring, presented in terms of common landmarks (e.g., mileposts, interchanges, etc.).

• Direction of Travel – The direction of travel in which a reported incident / event / condition is having an effect.

• General Description and Impact – A brief account and the current / potential impact of the incident / event / condition.

• Duration – The period of time over which the incident / event / condition is expected to occur and to affect travel.

• Delay – The amount of time that the traveler may expect to be delayed by the incident / event / condition.

• Detours / Restrictions – A summary of the required travel detours and / or restrictions placed upon travel in the area of an incident / event / condition.

• Forecasted Weather and Road Surface Conditions – Short-term weather and pavement conditions along the route segment.

• Current Observed Weather and Road Surface Conditions – Weather and / or road surface conditions currently being experienced along the route segment.

2.3 Weather Conditions and Forecasts

The 511 Deployment Coalition outlines its vision for the presentation of weather data via a 511 traveler information system in Deployment Assistance Report #6: Weather and Environmental Content on 511 Services. This document recommends that 511 systems "provide information on current and changing travel conditions and forecasts for upcoming weather phenomena that are likely to impact the ability to travel". Where relevant, the report also recommends providing information regarding the impact of weather on transit operations (511 Deployment Coalition, June 2003).

The 511 Deployment Coalition recommends that the following types of weather events be presented via 511 (511 Deployment Coalition, June 2003):

• National Weather Service Watches – as issued.
• National Weather Service Warnings – as issued.
• National Weather Service Advisories – as issued.
• Actual conditions – location specific road observations.
• Nuclear, Biological, or Chemical Release.

At a minimum, weather condition reports via 511 should provide the following information (511 Deployment Coalition, June 2003):

• Temperature
• Wind speed and direction
• Precipitation
• Sky condition
• Visibility in miles (and eighths of a mile once visibility is below a mile)
• Accumulation (snow)
• Air quality
• Pavement temperature when below freezing

In addition to reporting current weather events, the 511 system should provide forecasts for the above weather events, especially when such events will have an effect on roadways. Deployment Assistance Report #6 notes that the National Weather Service is developing a National Digital Forecast Database (NDFD) which will enable users to obtain a unique forecast for 2.5 km blocks for any location in the United States. The report mentions that the NDFD provides only atmospheric data, not road condition information. Furthermore, the NDFD provides only a limited set of data for each location for three-hour time periods. It does not provide visibility or precipitation-type information or forecasted pavement temperature data. The report specifically notes that "this experimental program of the NWS may not satisfy needs for 511 weather content." Most 511 service providers obtain weather reports from multiple sources, including the NWS and private weather system brokers.

2.3 Transit Information

While not specifically considered to be roadway information, transit system information is often presented (where available) via 511. Transit information can be in the form of transit delays, schedules, fares, etc. If specific transit data is not entered into the 511 system, the system can allow call transfers to a transit information telephone number (e.g., subway system operator information line).

3. Oklahoma Stakeholder Surveys and Meetings

3.1 Stakeholders

Immediately after initiation of the 511 Implementation Study, a meeting was held of the 511 Steering Committee to develop a complete list of 511 Stakeholders and outline the general approach toward development of the 511 program. The 511 Steering Committee membership was selected by ODOT. The Steering Committee recommended a list of Stakeholders and approach to the program that was generally consistent with the programs in other states. Stakeholders recommended included:

- ODOT (Planning, Public Affairs, Traffic, Operations)
- Association of Central Oklahoma Governments
- Indian Nation Council of Governments
- Oklahoma Department of Public Safety, including the Highway Safety Office
- Federal Highway Administration
- American Automobile Association
- Oklahoma Trucking Association
- Telephone Service Providers
- Media Representatives (radio and television)
- Oklahoma Municipal League

The Steering Committee agreed that a questionnaire should be distributed to the Stakeholders to get their input, prior to holding meetings to gather formal Stakeholder input.

3.2 Stakeholder Survey

One of the first tasks of the 511 Implementation Study was the survey of potential stakeholders to help determine the structure of the program, prioritize the information items that would be provided, and discuss funding and data gathering strategies. The questions asked in the survey were obtained from 511 guidance documents from the FHWA; the questions were refined during the Steering Committee meeting.

The complete Stakeholder Questionnaire is provided in Appendix A.

The results of the Stakeholder Questionnaire are provided in Appendix B.

3.2 Stakeholder Meetings

Several meetings were held at different locations around Oklahoma, attempting to get Stakeholder input into the 511 deployment. Two meetings were considered official Stakeholder meetings, for purposes of completing the 511 Implementation Plan. These meetings were held at the University of Oklahoma Shusterman Center in Tulsa on September 9, 2004, and in Oklahoma City on September 16, 2004. At both meetings, the OSU and OU project managers outlined the basics of a 511 program, discussed the "lessons learned" from 511 program officials in other states, and presented the results of the Stakeholder Survey.

Stakeholder input at both meetings confirmed the findings of other states and of the Stakeholder Survey.

- Weather and roadway information is most important to Oklahoma travelers. The only state-wide traveler information service in Oklahoma is the Oklahoma DPS weather hotline, which is not a toll-free number. It gets very heavy traffic during extreme weather events, which are common in Oklahoma. A 511 program in Oklahoma would be expected to address weather conditions.
- Roadway conditions would be another item expected to be present in a 511 program.
- Department of Tourism and Chamber of Commerce-type items would be beneficial, but were not considered a priority.
- No one thought that users in Oklahoma would be willing to pay for the service. It should be free to users, with "free" defined as the cost of a local call.

Minutes of the meetings and lists of attendees are present in Appendix C.

3.2 Technical Working Group Meeting

A meeting of the Technical Working Group was held on October 25, 2004, at ODOT Headquarters in Oklahoma City. The meeting examined technologies that can be used to deliver 511 services to Oklahoma. The technology that was examined in detail was that used by several of the states in the Great Plains region: Kansas, North Dakota, South Dakota, Montana, Minnesota, and Nebraska. The systems in these states is completely interoperable between the states, which makes the system ideal for consideration by Oklahoma.

The model system being considered is the use of a full-service 511 provider. The benefits of using a full-service 511 provider are:

- Includes privately-owned infrastructure, which allows sharing between the states, lowering the cost of infrastructure,
- Makes the service provider responsible for all personnel and operating equipment and technology advancements,
- Provides for overflow calls in emergencies, and
- Makes the vendor responsible for backup power requirements.

The service provider would supply all equipment and personnel to provide telephony, Automated Speech / Voice Recognition (ASR / AVR), Text-to-Speech (TTS), toll charges and system management. Telephony would consist of three layers:

1. General network access to each telephony system.
2. Modem back-up in the event of a network failure.
3. Portable media ingest on a recurring basis in the event of a failure of all remote telephony, until such time as the remote access is restored.

Data provided by the service provider would initially include

1. Integrated Nowcast / Forecast data and Mesoscale Weather Forecasting

2. State RWIS, and Road Condition information

3. Other information that could be fed directly from ODOT resources.

The system would be subject to rigorous quality control, which is discussed in the section on Evaluation.

4. Technology and Operations Plan

4.1. Introduction

The Technology and Operations Plan (TOP) for the deployment of 511 in Oklahoma is an important piece of the overall Deployment Plan, as it provides an essential roadmap for planners and implementers. In formulating the TOP, it is instructive to first consider the "lessons learned" from other states that currently operate 511 systems, or have proposed systems that are awaiting funding and/or implementation. A list of 511 information items to be provided to Oklahoma travelers is presented, and one can more clearly view the relevancy of these items in light of what other states have deemed prudent. An investigation of best practices for gathering and updating the 511 information items in a timely manner is then presented, along with a set of recommended goals and means of delivery.

Another important topic addressed by this TOP is the integration of 511 and the Intelligent Transportation System (ITS) program in Oklahoma, as planned ITS activities already include the development and deployment of an Advanced Traveler Information System (ATIS). To ensure success, seamless integration of 511 and ITS, recommendations for hardware and software requirements are also put forth. Finally, estimates of the capital, operations, and maintenances costs associated with 511 deployment in Oklahoma are examined.

4.2. Current/Proposed 511 Systems of Other States

Figure 4.1, excerpted from http://www.fhwa.dot.gov/trafficinfo/511.htm provides the current status of 511 deployment across the United States as of September 2, 2004 (the latest data available as of January 2005). In preparing this TOP, case studies and other resource materials from several of the early adoption states and/or metropolitan areas were reviewed to obtain an overview of the various user services and data that have been provided to travelers and to glean "lessons learned." This information is summarized in

the following subsections.

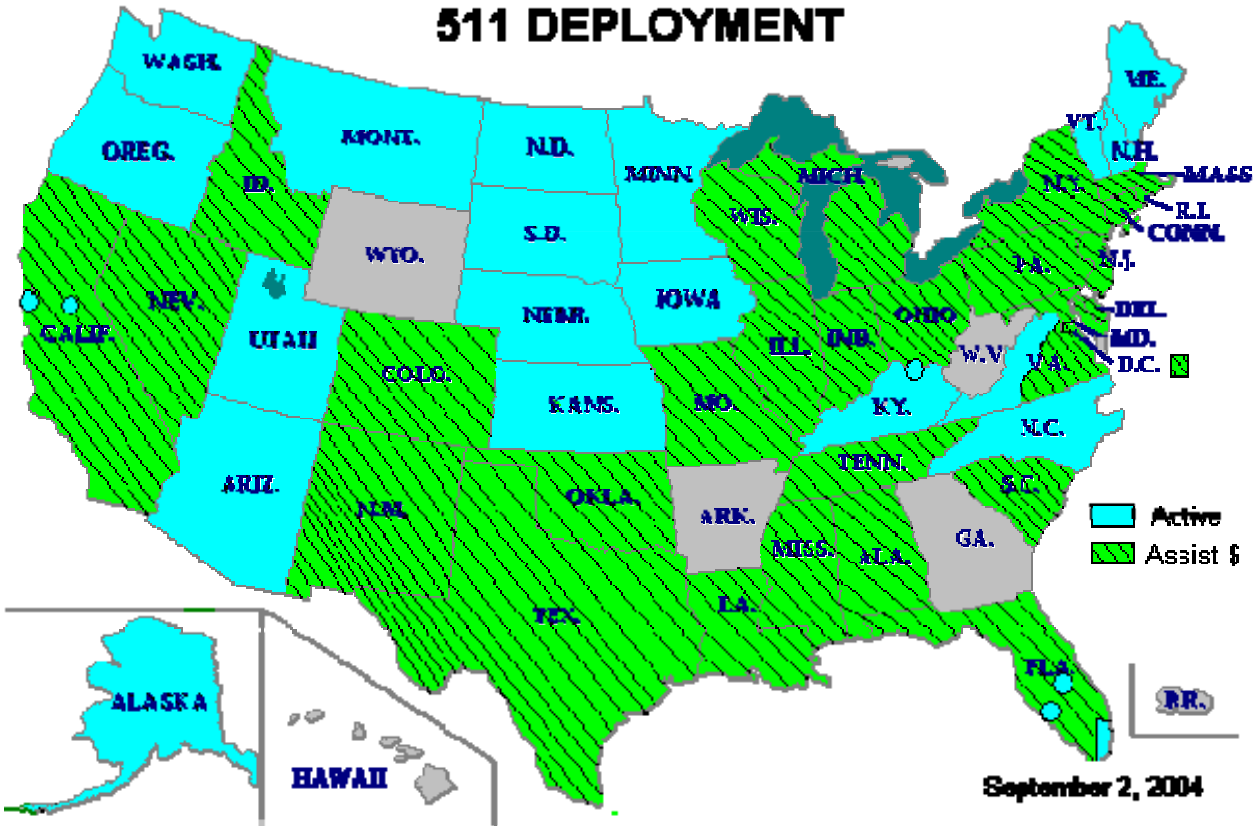

Figure 4.1: 511 deployment status for the United States as of September 2, 2004, excerpted from http://www.fhwa.dot.gov/trafficinfo/511.htm.

4.2.1 State of Arizona

The state of Arizona currently operates an 888 telephone system called the Voice Remote Access System (VRAS), through which users can get road closure and condition information. Callers, using their touch tone telephone, can obtain three main types of information through VRAS:

- Roadway conditions on major state roads. Information can be obtained by choosing the appropriate route number.
- City specific information in urban areas, and

- Weather information from the National Weather Service.

Individual agencies populate data into a Road Closure and Restrictions (RCRS) system which are uploaded to VRAS every five minutes to provide near-real time information. The visions of the Arizona's 511 deployment approach are:

1. Direct 511 calls to the VRAS system
2. Expand the capacity of VRAS to accommodate more users.
3. Reduce call dropping using call forwarding to appropriate agencies which in turn will answer user's queries.
4. Advertise the 511 system on roadsides.

4.2.2 Greater Detroit Region

The Michigan Department of Transportation is currently investigating approaches to combine the traveler information systems that are offered by many agencies, including the American Automobile Association into one system. Michigan has also plan to address international issues including sharing of data with the Canadian authorities.

4.2.3 Commonwealth of Kentucky

Kentucky is currently is working on integrating two of their popular systems, the ARTIMIS TATS and the Kentucky Road Report. The ARTIMIS TATS, operated jointly with Ohio Department of Transportation, uses a three digit 211 number to provide real time route information. The user, employing a touch tone telephone, queries traffic information on various interstate roadways. Databases are populated with real time information collected with many devices and sources, including closed-circuit video cameras, radar detectors, video imaging detectors, reference markers, and inductive loops. Information gathered from sources such as freeway service patrols, one aircraft, a network of drivers who serve as probes, police, fire departments, emergency communicators, and construction personnel are also used to populate the database.

The Kentucky Road Report is a facsimile service that provides reports on road

conditions. The information is also available on rest area monitors and on the Internet. Kentucky is currently working with the telecommunication companies for the 511 call routing. Development of enhanced ARTTIMIS TATS which integrates four regional systems is underway.

4.2.4 State of Minnesota

When the FCC assigned the 511 dialing code for transportation information in July, 2000, the Minnesota Department of Transportation (MnDOT) and the Minnesota State Patrol already had a plan to enhance the Advanced Traveler Information Systems (ATIS) that had been in place for two years. The goal was to provide Minnesota travelers with access to the information they needed "to have a safe, efficient, and satisfying trip." As of July, 2001, this included several telephone numbers providing real-time traffic updates, parking information, bus information, snow emergency information, metro transit schedules, routes, and trip planning, construction locations and restrictions, lane and road closures due to traffic incidents and weather, planned road closures and alternate routes, maintenance activities, and airport parking information, primarily in the Minneapolis / St. Paul area. There was also a separate telephone number providing road conditions and weather information on a statewide basis. These services, which were converted to the 511 system beginning in 2001, superseded a previous traveler information 800/local phone system maintained for the state by the University of North Dakota. In addition, through public-private partnerships, there are several commercial telephone and web-based traveler information services available (again primarily in the Twin Cities metro area), including SmarTraveler, TripUSA, and others, most of which share information across jurisdictional boundaries through coordinated sources using common data formats and protocols. On-the-fly estimates of travel time for user-specified routes is one service that is not currently available but is being considered for future implementation.

An introductory 511 program was made available to wireless telephone users beginning in December, 2001. The full service, including both wireless and land lines, became operational in July, 2002. The 511 service is provided as a local call for users in the

Twin Cities and as a toll-free service for users in other areas. Whereas the previous system offered information retrieval using numeric codes for roadways and regions and could be refined by entering milepost numbers along a specific highway, the 511 system operates using Interactive Voice Response (IVR) technology. Initially, there were voice recognition problems with the user interface, and many people also experienced problems when trying to access the system from telephones at large companies. Many large concerns have their own central telephone switching, which may block access to all N11 numbers except 911, in order to avoid tolls for services like 411 directory assistance. The Minnesota system also has a web-based interface providing access to all of the available traveler information via the Internet (www.511mn.org).

Data is acquired from Road Weather Information Systems (RWIS) that provide real-time road surface and weather conditions and from the Minnesota Condition Acquisition and Reporting System (Mn/CARS) computer network. These data are collected at the University of North Dakota over the Internet where they are machine converted into concatenated speech files and served back over the Internet to the MnDOT telephone information system. Acquisition of the RWIS data is fully automated and is updated every ten minutes. The University of North Dakota runs weather models every three hours, and meteorologists create forecasts for every 10-km area in the State of Minnesota. The Mn/CARS data are manually entered, and districts are expected to update their local information at least twice daily using consistent, standardized descriptions specified by a Traffic Management Data Dictionary (TMDD). Data entered into Mn/CARS is updated system wide every five minutes. The Mn/CARS system was developed as a pooled-fund project with Iowa, Washington, and Missouri.

Initial installation of the interactive voice response system cost about $100,000. The system has 48 phone lines, of which 46 are used for incoming calls. There are base-recurrent monthly costs for each phone line, which total about $12,000 per year and include all local calls placed to the system. Incoming toll-free calls cost about $0.10 per minute and are billed in six-second increments. In July, 2001, the system was receiving 200-300 calls per day with an average call duration of about two minutes. The services

contracted to the University of North Dakota cost about $10,500 per month.

The landline 511 service involves nearly 100 Incumbent Local Exchange Carriers (ILEC's) and Competitive Local Exchange Carriers (CLEC's) that operate in Minnesota. Depending on the transport method for 511 calls, one or more of the over 200 long distance carriers operating in the state may also be involved. Wireless callers can access the system using services provided by about 20 wireless companies, including AT&T Wireless, Qwest Wireless, VoiceStream Wireless, Nextel, and Sprint PCS (Verizon Wireless has not yet implemented the 511 service). Routing of 511 calls must also be addressed by coin-operated payphone vendors. The cost of local payphone calls is borne by the callers, while the state must bear the additional cost of toll-free calls placed from payphones.

The following are "lessons learned" during the early stages of 511 deployment in Minnesota:

1. MIS and technical staff must be involved early on.
2. It is important to establish a reasonable firewall policy recognizing that operations and maintenance personnel will sometimes have to access the system remotely.
3. For aspects of the system will be permit-based, permitting functions and staff must be considered and involved early on to avoid costly modifications later.
4. There must be a clear, easily-understood menu structure and help systems in place for callers (and operators). Otherwise, they become frustrated by changes in the system.
5. It is crucial to establish consistent data entry standards and protocols.
6. Close cooperation with both landline and wireless telephone carriers is essential. It is particularly recommended that system implementers should obtain copies of any tariffs that may apply to 511 calls.
7. Implementing agencies must be prepared for changes and upgrades that will be required to meet the evolving expectations and desires of users and stakeholders as the system becomes operational.

8. Implementing agencies and their service providers must continually explore new business models that may be used to reduce costs and obtain additional funding for enhanced services.

4.2.5. San Francisco Bay Area

In 2001, the San Francisco Bay Area Metropolitan Transportation Authority (MTC) began implementing 511 telephone access to its already existing Advanced Traveler Information System (ATIS), the TravInfo® traveler information program, which had been operational since 1996. Initial phases of the 3-digit 511 service became operational in November, 2002. By spring of 2004, the 511 service was operational in the East Bay area and was expanding into the North Bay. The service area involves nine counties, including San Francisco, Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, and San Mateo. It includes about 100 cities and some of the most densely populated regions of the nation, where traffic congestion and "road rage" have been recognized as growing problems. The general population is also among the most environmentally-conscious in America, and this has created particular challenges for transportation officials in terms of implementing highway construction and improvement projects in a way that will not be perceived as detrimental to the environment. MTC serves as the regional transportation planning agency and as the metropolitan planning organization, working with municipalities, the state DOT (Caltrans), and the California Highway Patrol (CHP) to provide planning and oversight for mass transit, highways, airports, seaports, railroads, and bicycle and pedestrian programs and infrastructure.

The goals of the 511 program are to help motorists avoid congestion and to encourage use of public transportation and ridesharing services. It has been described as "a comprehensive system to gather, organize, and disseminate timely information on San Francisco Bay Area traffic and road conditions, public transit routes and schedules, carpooling, highway construction and road closures, van and taxi services for disabled travelers, park-and-ride facilities, and bicycle programs." Route-specific weather information is not currently provided by the system. Dynamically updated driving-time

estimates were added in May, 2004. The system is operated as a joint venture between MTC, Caltrans, CHP, federal agencies, and the University of California's ITS research and development institute "PATH" (California Partners for Advanced Transit and Highways). The service is free to callers, although charges may be imposed on the user in certain cases including when the system is accessed through a wireless service provider or payphone. Speed and congestion data are acquired from a network of roadway sensors, CCTV cameras, and probe vehicle data collected from FasTrak bridge toll payment devices, while crash and incident data come from the CHP Computer-Aided Dispatch system. Data on construction, road closures, and special events are also input to the system. Databases for all of the region's 28 public transit agencies are included as well, although access to schedules is not part of the voice activated system and is available only by routing a call to the various transit agencies where callers can speak with a telephone operator.

The main modes of public information dissemination are an Interactive Voice Response (IVR) system and a web-based user interface (www.511.org, www.travinfo.org). Modem-based direct access to the digital data is available to registered participants. Hearing- and speech-impaired users can access the system through the 711 relay services 3-digit dialing code. One novel aspect is that the Bay Area system provides an open access database free of charge to registered information service providers, who may re-package the data as commercial products and services including web pages, in-vehicle map displays, and downloads for Personal Digital Assistant (PDA) devices. The system receives 7,700 calls on an average work day, many of which are placed by repeat users (there were over 17,000 calls on the day that the new drive-time feature was introduced late in May, 2004). This is compared to an average of about 2,100 calls per day that were received when TravInfo® was only available through a system of seven- and ten-digit telephone numbers. The current one-day record for calls placed to the 511 system is 30,241, set on April 2, 2004. The number of phone lines supporting the system is being expanded from 92 to 138 in summer, 2004. Surveys indicate that over half of the users modify some aspect of their travel plans based on the information delivered by the system.

Since TravInfo® was already a reasonably mature system, many of the challenges faced in developing the 511 service centered around coordinating and obtaining buy-in from the region's telecommunications service providers. The vast majority of residential landline local telephone service in the region is provided by Pacific Bell and Verizon Communications. However, due to the Telecommunications Act of 1996, there are now hundreds of companies authorized by the California Public Utilities Commission (CPUC) to provide local and long distance service in the area. Unlike the residential market sector, viable competition for the provision of business services has emerged from several dozen companies. Moreover, there are no entry restrictions for wireless service providers to operate in the region. The wireless carriers that currently provide 511 service include AT&T Wireless, Verizon Wireless, Nextel Communications, PacBell PCS, Cingular Wireless, Metro PCS, T-Mobile and Sprint PCS, although Verizon was initially resistant to implementing the service for its customers. Several hundred companies and individuals also operate payphones in the Bay Area, and, under the Federal Telecommunications Act as amended in 1997, are entitled to reasonable compensation for delivering 511 calls. One of the major issues that had to be addressed was how to implement and pay for the reprogramming and maintenance of hundreds of local and tandem telephone switches to enable routing of 511 calls, which in many cases is accomplished by a table lookup that maps incoming 511 calls to a common toll-free 800 number. This reprogramming effort ultimately cost the MTC about $138,000. The total cost of the Bay Area 511 service has been estimated at $38M.

Lessons learned during the early deployment of 511 services in the San Francisco Bay Area include the following:

1. Early identification of a state agency to champion 511 efforts is critical to timely deployment.
2. It is essential to obtain buy-in and commitment of resources from telecommunications service providers early on. These providers need to be involved in efforts to address multiple and cross-jurisdictional issues.
3. Substantial marketing is required to create public awareness and usage of traveler

information systems.

4.2.6. State of Utah

The 511 system in Utah became operational in December, 2001. Prior to implementation of the 511 service, a confusing collection of at least a dozen transportation-related telephone information numbers were available, including most notably Utah Department of Transportation's (UDOT) Winter Road Conditions Hotline. CommuterLink (www.utahcommuterlink.com), a comprehensive ITS including traffic signals, CCTV cameras, ramp meters, pavement sensors, Amber Alert facilities, and Dynamic Messaging Sign (DMS) boards had also been active since the middle of 1999 and was initially deployed in the Salt Lake Valley area. CommuterLink is a cooperative venture between UDOT, Salt Lake City, Salt Lake County, the Federal Highway Administration (FHWA), the Utah Transit Authority (UTA), Wasatch Front Regional Council, and the Utah DPS. The initial cost of deploying CommuterLink was estimated at $70M. The 511 system automatically acquires data from both the Winter Road Conditions Hotline and CommuterLink. The initial cost of deploying the 511 system was estimated at $600,000 by UDOT.

Implementation of traveler information services including 511 in Utah was accelerated by the selection of Salt Lake City as the host for the 2002 Olympic Winter Games. In 2001, the Utah State Legislature tasked UDOT to implement and administer 511 services in the state and to coordinate with highway authorities and public transit districts to provide advanced multimodal traveler information through a 511 service and other means. A 511 Advisory Group was formed including members from UDOT, UTA, Salt Lake County, the Utah DPS and Highway Patrol, and the Utah Trucking Association. Georgia Tech Research Institute was contracted to develop a user interface specification, and UDOT conducted market research to identify the types and scope of services that were desired. Development and operation of the 511 system was fully outsourced by UDOT, with the prime contract being awarded to Tellme Networks, based in Mountain View, California. Calls to the system are mapped to a toll-free number that terminates at Tellme's

headquarters, where the system's telephony and voice recognition equipment is located. Tellme achieves cost recovery and revenue by charging fees to UDOT for the use of the system, at a rate of approximately $0.08 per minute. The system maintains 96 telephone lines for incoming calls (increased to 360 lines during the 2002 Winter Olympic Games).

The 511 service provides integrated road weather conditions, information about incidents (including traffic accidents) and congestion, alternate routes, and construction information for major highways and principal arterials. In addition, the system routes calls to various transit and other agencies who supply additional types of information, including transit schedules and fares, as well as information about special events. State and city construction workers, maintenance workers, and permit workers can also enter information about the status and traffic impacts of their projects via a telephone interface.

About a dozen incumbent local exchange carriers (ILEC's) operate in Utah, with the largest portion of the population being served by Qwest Communications. There are also about a dozen wireless service providers, including AT&T Wireless, Sprint PCS, Nextel, Voicestream, Verizon Wireless, and Qwest Wireless, that operate primarily in the metropolitan areas along the Wasatch Front region and along the major highways. UDOT negotiated with these carriers for an undisclosed amount to implement reprogramming of their switches so that they would route incoming 511 calls to the common toll-free number. Recurring charges for the call routing are not anticipated. Although 511 service for customers of Verizon Wireless was initially delayed due to contract negotiations, it was in place in time for the 2002 Winter Olympic Games.

Lessons learned in the early deployment of the 511 service in Utah include the following:

1. Participation in the national 511 Deployment Coalition is highly recommended and provides multiple benefits and high value.
2. Use of existing voice recognition technology and Internet standards and protocols have enabled Utah to quickly establish a superior product at competitive costs.
3. System development time was significantly reduced by using the system integrator already on contract to select the 511 service operator. The use of

existing contract mechanisms is highly recommended in cases where a rapid deployment is desired.

4. It is critical to develop a clear and complete understanding of the anticipated costs early on, particularly with respect to the cost of switching incoming calls to the customer service center.

4.2.7 Shenandoah Valley, Virginia (I-81 Corridor)

The first 511 system to be implemented in the Commonwealth of Virginia was Travel Shenandoah (TS), which was activated on April 26, 2000. TS was the first in a family of traveler information services planned for implementation statewide. TS covers the 325 mile segment of I-81 in Virginia, plus Skyline Drive (a scenic byway along the Blue Ridge Mountains), and neighboring sections of I-64, I-66, and I-77. TS is accessible via voice activated mobile and landline telephones, via the Internet at www.travelshenandoah.com, and through Cable TV. TS is a joint venture between the Virginia Tech Transportation Institute (VTTI) and the Shenandoah Telecommunications Company (SHENTEL), with support from the Virginia Department of Transportation (VDOT) and the Virginia Tourism Corporation (VTC), along with the participation of the Virginia State Police and the Shenandoah National Park. This is notable because SHENTEL coordinated the support of the telecommunications providers along the I-81 Corridor, which included 21 incumbent and competitive local exchanges carriers and 14 wireless carriers.

Accessible traveler information includes traffic and construction alerts, weather forecasts, local hotel and restaurant accommodations, and details regarding special events. VTTI has the responsibility of collecting, organizing, and disseminating relevant information, while SHENTEL manages the web and telephone interfaces. SHENTEL also provides marketing support for TS and handles the sale of advertisements. The revenue generated from these sales is applied toward TS's ongoing operational costs. Basic public access to TS is free, but additional revenue is generated from the sale of subscriptions to customized services developed for commercial interests and other interested

organizations. Revenue is also generated from mobile roaming charges.

4.2.8 State of Nebraska

The State of Nebraska's 511 traveler information system became available on October 1, 2001, and was the first to use the 511 telephone number statewide since the Federal Communications Commission approved 511 for that purpose. The 511 program is a partnership between The Nebraska Department of Roads (NDOR) and the Nebraska State Patrol (NSP), along with private contractor Meridian Environmental Technology Inc. Nebraska's 511 system was modeled after #SAFE Advanced Traveler Information System that Meridian developed for deployment in North Dakota, South Dakota, Montana, and Minnesota. A key feature of the new 511 system is the ability for travelers to access an Advanced Traveler Weather Information System (ATWIS) by dialing 511 or via the Internet. While the system was developed to initially deliver road and weather conditions, including construction and detour information, tourism information will also be provided, with opportunities for commercial sponsorships. #SAFE reports for neighboring states can also be accessed by 511.

Information available from 511 is primarily collected from:

- Doppler Weather Radar
- National Lightning Detection Network
- Road Sensor Network
- Agricultural Weather Network
- Satellite data
- First person reports from NDOR and NSP personnel

Nebraska Traveler Information is available by dialing 511 from anywhere in Nebraska or by accessing Web 511. There is no charge for callers using land lines. Cellular callers incur charges at their normal service plan rate. There are no long-distance charges, as a result of cooperation between the State and communications carriers. The Nebraska Division of Communications had the responsibility for tracking 511 implementation

efforts by landline and cellular communications providers. By telephone, 511 replaced the NSP's previous 1-800 road report number. Web 511 is a service provided by both NDOR and NSP. Web 511 is not maintained by the NDOR, but rather by Meridian. Traffic forecasts for the next several hours are available for road segments, as well as road condition information that is provided throughout the day by NDOR personnel in the field. The estimated annual cost of operations is $110,000.

4.2.5. State of Kansas

The State of Kansas now has an operational, statewide 511 system offered by the Kansas Department of Transportation (KDOT), launched in January 2004. Travelers may access road conditions, construction detours, and weather information toll-free by dialing 511 on a landline or wireless telephone, or by dialing 1-800-511-KDOT from outside Kansas. Traveler information is also available over the Internet using KDOT's Kanroad system (www.kanroad.org). The 511 system is hosted by Meridian Environmental Technology Inc. by an agreement where KDOT paid a one-time telephone fee and pays ongoing monthly operating fees.

4.3. Proposed List of Information Items to be Provided by the Oklahoma 511 Program

The full scope of 511 information items is extensive, as was discussed in Section 2 of this report. The number and detail of items to be provided by the Oklahoma program will depend upon budget. It is likely that the initial offering will include weather-related road conditions, incidents, and construction updates. As the program matures and more funding becomes available, lower-priority items may be added. Items include, in approximately priority order:

- Weather-related road conditions, e.g. snow/ice, flooding
- Road incident reports
- Construction updates, e.g. scheduled lane closures
- Severe weather advisories, e.g. tornado watches and warnings

- Amber alerts
- Traffic congestion – freeways and arterials
- Average travel time estimates, i.e. between two map references
- Average speed estimates, i.e. between two map references
- Driving directions
- Transit information
- Special events, e.g. sporting events
- Parking information
- Tourism information, e.g. attractions, lodging, dining

4.4. Best Practices for Gathering and Updating 511 Information Items

Every 511 information system should satisfy the following minimal requirements:

- The system should be easy to use and should provide location-dependent information.
- The system should be easy to integrate with the systems that collect information on road conditions, weather, and other data; data transfer should be across well-defined access interfaces.
- Data collected should be timely to provide commuters with accurate and reliable information.
- Interfaces with 511 telephone providers should be seamless thus allowing landline and cellular calls to be treated the same manner.
- Growing Internet Protocol (IP) telephony system integration should also be considered.
- The system should take advantage of GPS information provided by cellular callers.
- The system should be built in such a way it is interoperable with other state systems without user intervention.
- Multilingual support should be considered. If multilingual support is provided, the system should perform these translations in a seamless fashion. However, few

(if any) systems currently provide this function, according to our research of other states' 511 programs.

Recent advances in communication and computing will allow us to design a robust and reliable system satisfying the above requirements. The essential components of the 511 information system are Interactive Voice Response (IVR) system, Communication Interface system, and Intelligent Transportation Interface system. These are shown in Figure 4.2.

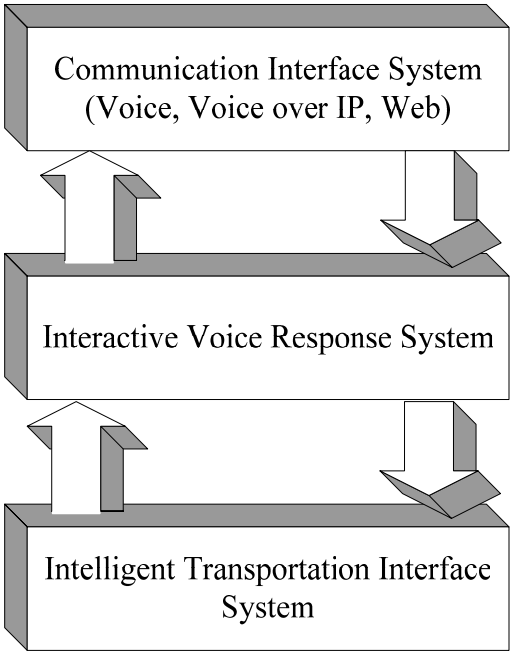

Figure 4.2: The essential components of a 511 information system and their interactions.

4.5. Recommended Goals and Means of Delivery of 511 Information Items

4.5.1. Interactive Voice Response Systems

The Interactive Voice Response (IVR) system is the central piece for a successful 511 information system; it is used to provide information to a caller or web user without human intervention. This system collects appropriate information from information

bases collected by the intelligent transportation system and provide the information in appropriate formats that the user desires.

When the user dials up the system, the system responds with a greeting and a set of options that can either be chosen by speech or selected by pressing the buttons on the phone. When the button is pressed, the IVR system recognizes the unique tones and responds appropriately. If the user selects by speech, the speech is converted using text-to-speech engines and sent to the communication system; the system responds to the caller by converting the requested text back to speech. Sophisticated interfaces allow the interruption of the speech by the caller.

Text-to-speech features are also commonly incorporated into IVR systems. For example, one can ask about the road conditions between Oklahoma City and El Reno. The system performs a query of the ITS database and sends back the message as a voice signal. A schematic of the communication links is shown in Figure 4.3.

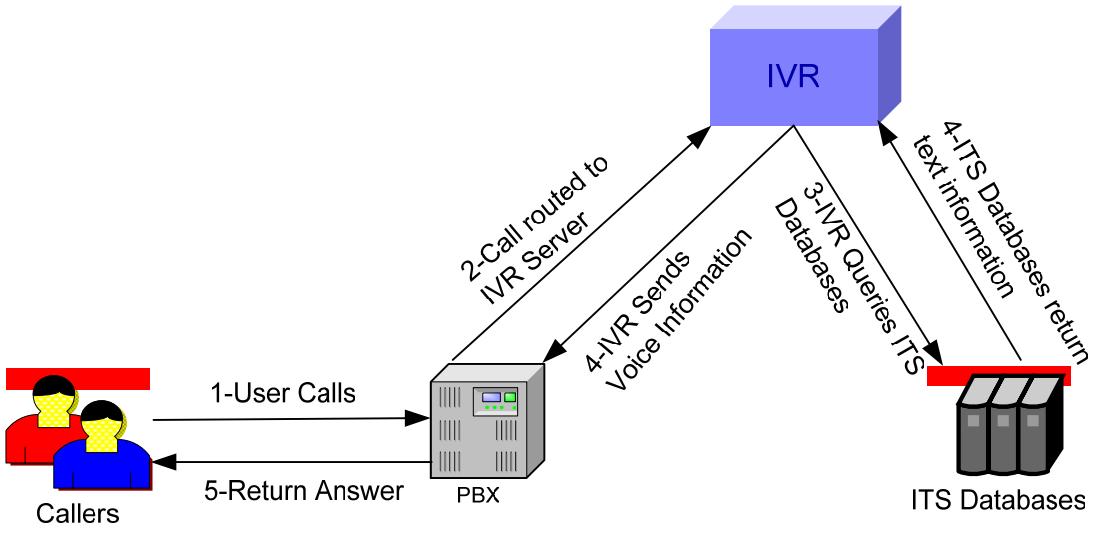

Figure 4.3: A traditional IVR scenario

Figure 4.3 shows a traditional IVR scenario. The Private Branch Exchange (PBX) and IVR system are both stand-alone hardware devices. The PBX handles routing the call to the request extension, and the IVR system performs the media-processing-related tasks of playing outgoing messages and detecting input from the user.

4.5.2. Unified Messaging Systems

The Unified Messaging System (UMS) allows users to query the IVR through text, and messages are sent via voice and/or text messages from the IVR. In a common UMS a message is sent through the web. The message contains the requested detail along with request as to how the return information has to be delivered. The user can request that the return message arrive as text via email, voice message, or request the system dialup and send the voice information. Such systems are very intricate in their design and implementation.

4.5.3. Speech-Enabled Web Applications

There has been tremendous growth in the use of speech in web based application due to the advances in speech recognition and text-to-speech technologies One intriguing scenario involves the use of a voice specific markup language, such as the Windows Telephony Engine (WTE), which allows Web pages to have voice interaction specific tags. Several markup languages exists to make the Web content and services to be accessed through telephony connections and rendered as speech rather than text or graphics. For example, in Figure 4.4 (as described by Microsoft) one can access the speech enabled web site for a variety of information.

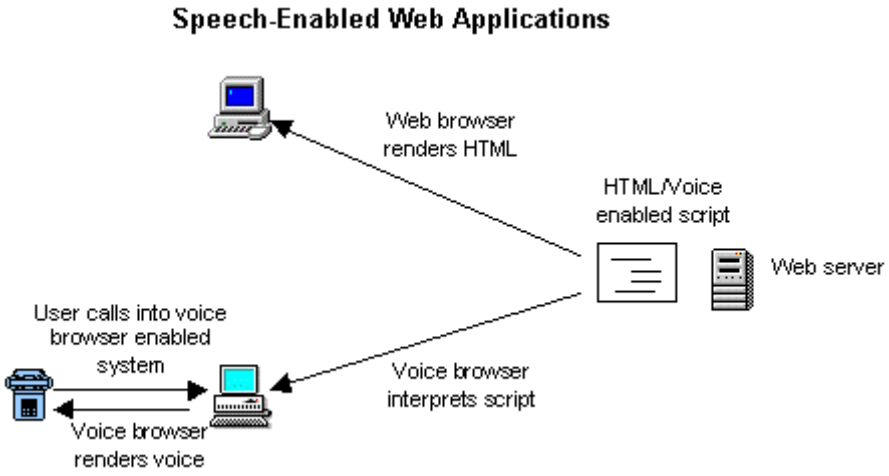

Figure 4.4: Speech-enabled Web applications

4.5.4. Advanced Traveler Information Systems

An Advanced Traveler Information System (ATIS) is a web-based resource that provides travelers with a host of information, most notably current traffic and roadway conditions. Most ATIS implementations incorporate a map-based Geographic Information System (GIS) to graphically display information, such as near real-time average speeds along roadway segments. An ATIS typically resides on computer workstation that is tied to a database, which in turn is populated by an Intelligent Transportation System (ITS). The ITS includes a variety of deployed sensors (e.g., vehicle detectors, cameras, pavement sensors, and remote weather stations) which are connected via a broadband communications network, to one or more computer workstations. The sensor information is collected and stored in the database, and subsequently accessed by the ATIS workstation. The workstation serves the relevant information out to travelers via broadband connection to the World Wide Web. Travelers may then access and display the information provided by the ATIS using a web browser.

An example of the prototype Statewide ATIS homepage being developed for ODOT by the University of Oklahoma is shown in Figure 4.5. From the homepage, travelers can click on a tab for a specific metropolitan area, or they can click on the map in the vicinity of city of interest. Upon making the selection, a GIS map image of the metropolitan area appears, complete with roadways that are color-coded depending on the average speeds being measured by the deployed vehicle detectors, as shown in Figure 4.6.

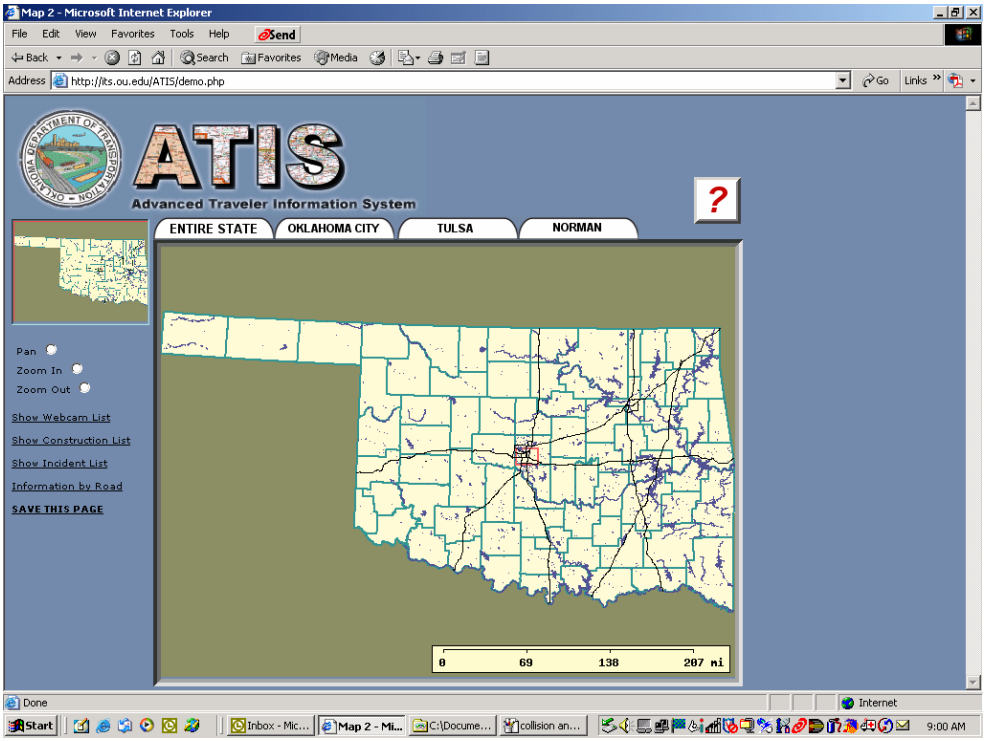

Figure 4.5: A prototype ATIS homepage for Oklahoma.

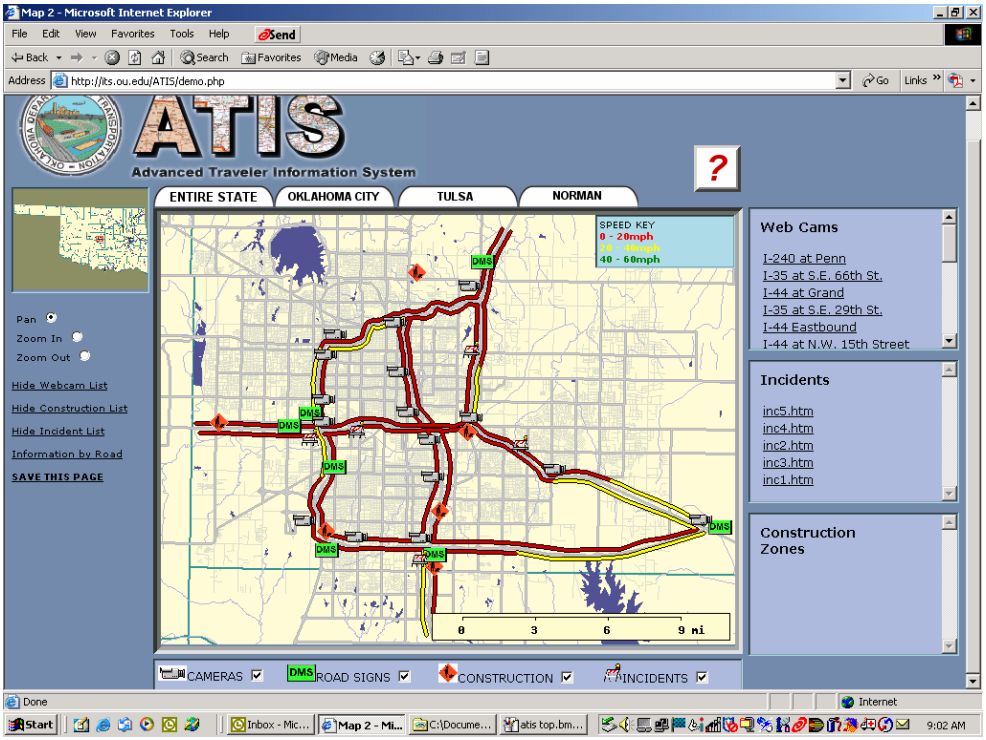

Figure 4.6: A prototype ATIS map image for the Oklahoma City metropolitan area showing the freeways color-coded according to average vehicle speeds. Note that additional information is also provided, such as the location of construction zones,

incidents, dynamic message signs, and cameras.

One clear advantage of an ATIS over a voice-based system is the ability to display information-rich visual images that can be quickly assimilated by the user. Another appeal of an ATIS is the ability to provide the public with near real-time images of traffic conditions, as shown in Figure 4.7. In this case, a user need only to click on a map-referenced camera icon to display an image.

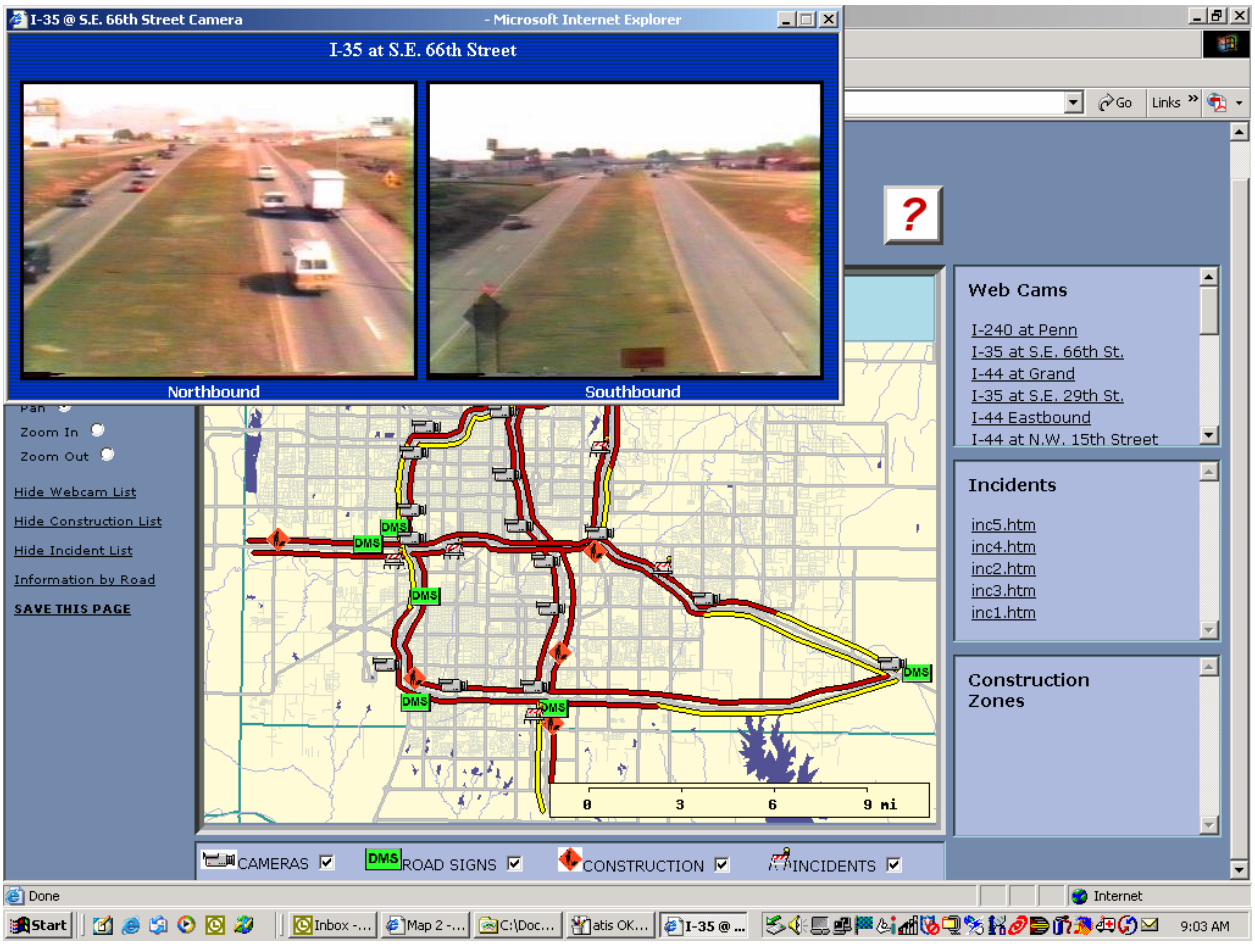

Figure 4.7: A prototype ATIS image illustrating the ability to provide near real-time snapshots of traffic conditions.

4.6. Integration of 511 and ITS in Oklahoma

An eventual 511 system in Oklahoma would likely interface with ODOT's ATIS. A prototype ATIS, currently named Pathfinder, was delivered to ODOT in September 2004

and is currently undergoing a one-year evaluation before it is scheduled to be made available to the public in the fourth calendar quarter of 2005. Pathfinder's degree of functionality is dependent upon the phased deployment of ITS technology across Oklahoma. For example, images of present traffic conditions cannot be made available where no cameras exist. More important, the near real-time display of average speeds along roadway segments requires incoming data from vehicle detectors. In some cases, the vehicle detectors are not scheduled to be deployed for several years.

In 2004, ODOT signed a contract with Mobile Technologies to install and operate a network of vehicle detectors in the Oklahoma City metropolitan area. While these detectors will remain the property of Mobile Technologies, ODOT will gain access to the near real-time traffic data at no cost (Mobile will repackage and sell the data to various outlets as a value-added product). The deployment of these detectors is scheduled to begin in 2005. Presently, there is no agreement to deploy vehicle detectors in the Tulsa metropolitan area.

In late 2005, the basic functionality that Pathfinder will be able supply is access to GIS-based incident and construction updates, as well as links to weather-related roadway information. The database that services Pathfinder can be ultimately linked with a 511 voice implementation to provide traveler information. Such a linkage presents no significant technical challenges.

4.7. Recommended Hardware and Software Requirements

4.7.1. Software Requirements for IVR Systems

The essential components of the IVR system are speech recognition, text-to-speech engine, tone generation/detection, and ITS interface system.

4.7.1.1. Speech Recognition

There are a few speech engines currently available. Good examples include the Microsoft Speech Engine and the ViaVoice from IBM. The speech engines serve two important functions--speech recognition and text-to-speech conversion. There are two important components within the speech recognition system--speech training and application grammar. With sufficient training the system can recognize words and phrases. The 511 system has to be built with speaker independence. The spoken words are recognized and these tokens are sent to an application grammar that is written in eXtensible Markup Language (XML). Upon receiving appropriate words and phrases from the speech engine, the words are sent to the XML grammar. The grammar is useful for word and phrase recognition. The output of the grammar for each spoken word or sentence is a token that the application recognizes and executes the appropriate actions. A good speech recognition system should have a very good speech engine and a useful grammar with it. The speech recognition can be made more robust with appropriate writing of the grammar.

4.7.1.2. Text-to-Speech

The text-to-speech (TTS) engine is the opposite for speech recognition. The TTS has two main methods—loading the string of text to render into speech, and choosing the voice in which the speech will be generated. The application programmer simply provides the string to speak and the TTS engine does the rest. More modern TTS engines allow speech tags to be embedded into the text that is to be spoken. These are called as Speech Application Language Tags (SALT). The following quote from the SALT forum shows the application of SALT in various speech applications.

"The Speech Application Language Tags (SALT) 1.0 specification enables multimodal and telephony-enabled access to information, applications, and Web services from PCs, telephones, tablet PCs, and wireless personal digital assistants (PDAs). The Speech Application Language Tags extend existing mark-up languages such as HTML, XHTML, and XML. Multimodal access will enable users to interact with an application in a variety of ways: they will be able to input data using speech, a keyboard, keypad, mouse

and/or stylus, and produce data as synthesized speech, audio, plain text, motion video, and/or graphics. Each of these modes will be able to be used independently or concurrently."

It is clear from the above that SALT extends applications to allows for speech input and output. With SALT and its implementation provided by several vendors, powerful applications can be built.

4.7.1.3. Tone Detection

When the user presses the buttons of a touch-tone phone, the one must be recognized by the IVR system in order to take the appropriate actions. The process of recognizing the various tones to distinguish the buttons pressed is called tone detection. Touch-tone phones generate dual tone multifrequency tones (DTMFs); the DTMFs are more reliable and accessible as compared with speech applications. There are several digital signal processors that detect the various tones.

The speech generated by the TTS engine must be sent over the telephone. Microsoft has created an application program interface namd Telephone Application Program Interface (TAPI) that allows one to stream audio through the telephone. It also allows other telephone operations such as answering, call hanging, tone detection, and others. Table 4.1 shows a typical call sequence that uses the TAPI interface.

Table 4.1 Typical TAPI Call Sequence

IVR System	TAPI usage
The 511 user calls a toll-free number for support.	The IVR system is notified of a call through TAPI.
The call is answered automatically, and the IVR system plays a message indicating the users' options.	A file of text is converted to a voice stream and sent to TAPI which in turn sends it through the telephone connection.
The user chooses the option to get the status of a road segment.	The TAPI tone detection terminal is used to listen for the user's selection.
The IVR system asks the user to input the road segment using the buttons in the key pad or by saying the road segment's name.	The SALT XML file is used to request for appropriate prompts.
The user selects the appropriate road segment.	The user's voice or tone is detected, appropriate tokens are generated and the system requests the information from the ITS interface.
The IVR system uses TTS to provide the condition of the road segment.	The text string of the result from the ITS interface is converted into a voice stream using TTS and sent to TAPI.
The user hangs up.	

5. Evaluation Plan

It is critical that a system such as 511 be evaluated periodically after its initial implementation. The evaluation scheme should include both an initial evaluation, performed approximately six months after implementation, and an ongoing evaluation, performed periodically throughout the life of the program. This section of the Oklahoma 511 Implementation Plan outlines the evaluation approach, evaluation goals and objectives, and discusses the make-up of a 511 Oversight Group. Steps in the on-going evaluation were adapted from the federal document, *Final Evaluation Plan: Model Deployment of a Regional, Multi-Modal 511 Traveler Information System*, Department of Transportation ITS Joint Program Office, 2003.

5.1 Evaluation Approach

The broad purposes of the 511 system evaluation include the gathering and analysis of the following items:

- Documentation of how the system was actually deployed, to compare with the estimates prepared prior to deployment.
- Documentation of construction and operational costs.
- Documentation of actual deployment schedule.
- Data on customer satisfaction.
- Data on system technical performance (system down-time/availability)
- Data gathering and evaluation for continuous quality improvement (call volume, duration, menu selections, mobile vs. landline connections; trends in usage vs. time, severe weather; trip purpose; customer service categories; customer complaints vs. resolution.)
- Periodic comparison with system evaluations from other state DOTs.

The first three items relate to the initial implementation of the program. This evaluation is important for comparison to other programs and to provide a "lessons learned" for states that have not yet implemented 511 programs. The documentation can be gathered by ODOT or a subcontractor. This step is self-explanatory and will not be discussed

further in this document. At the end of the initial evaluation, a 511 Oversight Group needs to be established. The composition and mission of this group will be outlined in the following section.

5.2 Evaluation Goals, Objectives, and Hypotheses for the On-Going Program

The development of evaluation goals, objectives and hypotheses takes into consideration both the goals of the national 511 program (safety, efficiency, productivity, economic viability, customer satisfaction) and the goals outlined by Stakeholders in the Stakeholder meetings held during the 511 Implementation phase.

Table 5.1 lays out the broad evaluation goals, hypotheses, measures, and data collection methods/sources. It can be seen that several goals can be supported with some common measures and data sources, most notably 511 usage data and customer surveys.

5.2.1 Improve Availability of Traveler Information Services

The first goal is to improve the availability of traveler information services to the general public. Currently, the only government-provided traveler information service in Oklahoma is the DPS weather hotline, which is provided through a toll call. It is proposed that the provision of a free service will greatly increase the availability and use of traveler information. It is further proposed that additional information can be added to the basic 511 program as the program matures, further increasing use of traveler information services. This hypothesis will be tested by measuring 511 usage statistics and counting “hits” to the 511 webpage.

5.2.2 Improve Customer Satisfaction with Their Trips in/through Oklahoma

The most important goal of the 511 program is to improve customer satisfaction with travel. It is our hypothesis that the 511 service will greatly improve customer satisfaction by giving the consumer information and choices about travel times and itineraries. We also propose that consumers will find the information easy and accurate. This will, of course, require on-going evaluation and fine-tuning of the service. This hypothesis will

Table 5-1. Oklahoma 511 Project Evaluation Goals, Hypotheses, MOEs, and Data Sources

Goal	Hypotheses	MOE	Data Sources
Improve availability of traveler information services.	Making traveler information more complete and available without cost to the traveler will greatly increase the availability of travel-related information. As more information items are added to the basic 511 package, additional benefits to travelers will accrue.	511 usage statistics. Visits to the public transportation information pages on the ITS website. The number of transportation service providers with a presence on the Web and the sophistication of the information available.	Service Provider data on usage by date. Web Pages (physical count). Hit counts from web pages.
Improve customer satisfaction with their trips in/through Oklahoma	The 511 service will improve customer satisfaction with ability to effectively and efficiently plan trips. Customers will perceive the information provided as easy to access, accurate, reliable, and useful.	Stakeholder perception of trip planning information relative to information available before the 511 project (accuracy, reliability, usefulness, willingness/ likelihood of using again, etc.).	Daily logs of phone comments compiled by Service Provider. Periodic detailed survey from Service Provider. Periodic customer surveys (either web-based or by telephone/mail).
Increase traffic mobility.	Improved access to traffic information will lead travelers to select routes that are faster and safer, resulting in decreased trip time/trip delays and decreased accidents.	Traveler feedback. ITS data feedback. DHS feedback.	Periodic customer surveys. ITS statistics on routes, vehicle counts, vehicle speeds, etc. Input of DHS representative on the 511 Oversight Committee.
Provide Continuous Quality Improvement for the 511 Program	As experience is gained and as technology changes, the 511 program will have to adapt or it will lose its value to the traveler. Continuous quality improvement will ensure the continued viability of the program.	511 Usage statistics. Traveler feedback. ITS data feedback. Service Provider feedback. Analysis of the technical literature.	Service Provider data on usage by date. Periodic customer surveys. Input of ITS representative on the 511 Oversight Committee Input of Service Provider representative on the 511 Oversight Committee. Input on ODOT or other technical representative on the 511 Oversight Committee.

be tested through the evaluation of customer comments and periodic detailed surveys of the service provider and selected customers.

5.2.3 Increase Traffic Mobility

A secondary strong goal of the 511 program is the improvement of traffic mobility. It is hypothesized that improved access to timely, accurate traveler information will lead travelers to select routes that are faster and safer, resulting in decreased time of travel and decreased accidents. This hypothesis will be tested through customer surveys, ITS statistics, and data from the DPS on highway safety.

5.2.4 Provide Continuous Quality Improvement for the 511 Program

To keep the 511 program current with changes in customer needs and changes in technology, continuous quality improvement will be required throughout the life of the program. It is hypothesized that the 511 program will have to adapt or it will lose its value to the traveler. To achieve this goal, the 511 Oversight Committee (discussed in the next section) will gather data on 511 usage, traveler feedback, ITS data, service provider feedback, and changes in technology. These will be discussed and evaluated at the semi-annual meeting of the committee.

5.3 511 Oversight Committee

It is strongly recommended that ODOT appoint a 511 Oversight Committee. The committee should meet semi-annually to review and evaluate the results of the on-going 511 program evaluation outlined in the sections above. Recommended committee membership includes

- ODOT 511 Program Director
- ODOT Traffic Representative
- ODOT ITS Representative
- ODOT PA Representative
- FHWA Representative
- Service Provider Representative

- Oklahoma Transportation Center ITS Representative
- Oklahoma DPS Highway Safety Representative
- Tulsa Traffic Representative
- Oklahoma City Traffic Representative

The committee should, at the first meeting, develop a set of surveys to use to measure customer satisfaction and other metrics specified in the previous sections. Good sample surveys are found in the document discussed in the chapter introduction, *Final Evaluation Plan for the Model Deployment of a Regional, Multi-Modal 511 Traveler Information System.*

Continuous evaluation and improvement of the 511 system should maintain its viability with changes in travel patterns and changes in technology.

6. Estimated 511 Capital, Operations, and Maintenance Costs

There are several cost models available to provide 511 services. The document *Deployment Assistance Report #1: Business Models and Cost Considerations* published by the 511 Deployment Coalition summarizes the experiences of existing 511 programs and lists pros and cons of suggested business models. That document concludes that 511 services should be provided to the end user at a cost not to exceed that of a local call. That was also the conclusion reached during the Stakeholder meetings held for this project. The cost data presented in the 511 Coalition report greatly exceeded those experienced by 511 programs in the Great Plains states, but the general types of costs are valid for the Oklahoma 511 program.

Costs for deploying and maintaining a 511 program are broadly classified as one-time capital costs and on-going operational costs, the same as any program. Capital costs are very high if the state DOT purchases stand-alone equipment for its own exclusive use. Few 511 programs have taken this approach. The most cost effective approach, according to officials from other state highway departments, is through a vendor. The costs below are based on the use of a vendor as service provider. Using a vendor allows pooled infrastructure and personnel, reducing the costs to each individual state highway department. If it were decided to provide the services with a stand-alone group (such as those used for provision of 911 services), costs would be substantially higher.

Total Construction Costs are estimated at …… **$155,000**
for 120 ports. This estimate includes vendor travel costs, which were not included in the vendor estimate, and a 20% contingency (based on experience of Kansas DOT)

Switch Conversion Fees are estimated at ……. **$20,000**
The fees that other 511 implementing agencies have been charged vary between $0 and $75,000. The fee must be negotiated with the TSPs in Oklahoma.

Monthly Costs from Vendor are estimated at…….. $**17,100**
(this estimate includes Vendor-supplied weather data. If Mesonet data were used, costs would go down. The exact amount would require negotiation.)

Monthly Costs from TSPs (511 Tariff) are estimated at …… **$2,000**
(per-minute charges; based on Kansas experience)

7. Summary of Findings and Recommendations

This document was prepared to assist the Oklahoma Department of Transportation in the deployment of a state-wide 511 Traveler Information program. The 511 Traveler Information system is a national, voluntary system in use or under study in 44 states throughout the United States. The deployment of a 511 system in Oklahoma would be of benefit to travelers within the state and those traveling through Oklahoma. Programs in other states have been very successful.

It is recommended that Oklahoma begin with a basic 511 system, using a service provider (the most common model in this section of the U.S.). The services provided would include weather, roadway conditions, and any other information available automatically through ODOT. ATIS services being developed through the ITS program could be added to the 511 system as they become available. By using a service provider, capital costs would be minimized, and operation and maintenance costs could be reasonbly projected from year to year.

To keep the 511 system current and successful, it is recommended that a 511 Oversight Committee be established after the 511 program is deployed. Routine data evaluation and surveys would be used to update services and technology.

Appendix A. Stakeholder Questionnaire

State of Oklahoma
511 Traveler Assistance Program

Introduction

The Oklahoma Department of Transportation (ODOT) wishes to develop a deployment plan for the "511 Traveler Assistance Program." The "511 Traveler Assistance Program" will be similar to the "911" emergency assistance program. With the 511 program, a caller will be connected to a system that will provide information useful for travel planning. The exact format of the Oklahoma 511 program will be developed during the upcoming year. We are seeking input from your agency, as a program stakeholder, in the development of the plan. Please answer the following questions, so that we may develop a plan that is practical, economical, and serves the needs of the people of the State of Oklahoma.

To gather some additional information on 511 programs, you can visit the following websites:

www.its.gov/511/511.htm
www.deploy511.org
www.fhwa.dot.gov/trafficinfo/511.htm
www.itsa.org/511.html

If you have additional comments, do not hesitate to add them to the end of the questionnaire. You may also call the project manager; contact information is given at the end of the questionnaire.

Thank you for your assistance.

Questionnaire

1. What are the transportation challenges in your area? Circle all that apply

    a. Congestion
    b. Incident response
    c. Transit operation
    d. Other (Describe)

2. What information regarding the transportation system does your agency regularly collect? How often and in what format (electronic, paper).

	Frequency			Format	
	Daily	Monthly	Annual	Electronic	Paper
a. Traffic volume data					
b. Traffic speed data					
c. Accident data					
d. Transportation needs data					
e. Transportation availability data					
f. Condition assessment					
i. Pavement					
ii. Traffic					
g. Videotapes from closed-circuit TV					
h. Ridership data					
i. Other (Describe)					

3. What information do you get from other agencies (DOT, MPO, police)? How often and in what format (electronic, paper)?

	Frequency			Format	
	Daily	Monthly	Annual	Electronic	Paper
a. Accident statistics					
b. Socioeconomic data					
c. Land use data					
d. Ridership data					
e. Traffic volume					
f. Traffic speed					
g. GIS data sets					
h. Travel trend data					
i. Commercial vehicle statistics					
j. Incident reports					
k. Special event reports					
l. Other					

4. What additional information would you like to get? How often and in what format (electronic, paper)?

	Frequency			Format	
	Daily	Monthly	Annual	Electronic	Paper
a. Accident statistics					
b. Socioeconomic data					
c. Land use data					
d. Ridership data					
e. Traffic volume					
f. Traffic speed					
g. GIS data sets					
h. Travel trend data					
i. Commercial vehicle statistics					
j. Incident reports					
k. Special event reports					
l. Other					

5. Please indicate what communications system or technologies are available within your agency that might be used to exchange information with other agencies (circle all that apply)

   a. Scheduled mailings
   b. Telephone
   c. Fax
   d. Agency radio network
   e. Press releases
   f. Paper
   g. Internal e-mail
   h. Internal browsing capabilities
   i. Internet-based (external) e-mail
   j. Internet access (browsing capabilities)
   k. TOC center-to-center communications
   l. Other (please specify).

6. What existing ITS-related facilities are controlled/owned by your agency? How old? Upgrade plans?

	Age of Facilities	Upgrade Scheduled?
a. Traffic signal control		
b. Transit management controls		
c. Ridesharing system		

d. Data collection system
e. Weather info systems
f. Video system
g. Other (describe)

7. What existing communications (radio, copper cable, fiber cable, microwave) infrastructure (for transportation or other uses) are controlled/owned by your agency? How old? Spare capacity? Upgrade plans (when)? Does your agency currently lease communications?

	Age of Facilities Own/Lease	Spare Capacity	Upgrades?
a. Radio			
b. Copper cable			
c. Fiber cable			
d. Microwave			
e. Other (Describe)			

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8. What types of traveler information should be provided through the 511 program? Please rate the following items according to priority, from very low to very high

	VeryLow/Low/Mod/High/Very Hi
a. Incident information	
b. Highway construction information	
c. Route information (route, distance, time)	
d. Alternate route information	
e. Scenic route information	
f. Ozone alert information	
g. Route congestion info	
h. Weather info for route	
i. Mass transit information	
j. Amber alert info	
k. Connection to 911	
l. GIS capability	
m. Traveler support (fuel, lodging, meals)	
n. Entertainment, calendar of events	
o. Event info, incl. parking	
p. Others (list)	
q. _____	
r. _____	

9. Do you think that the public would accept a fee-for-service system for 511? How could fees be collected? What would be the fee basis (per call, per minutes)? Would your agency help fund a 511 system?

10. What are the current responsibilities of your agency for the provision of traveler information? What is the geographical jurisdiction of your agency? What is your budget for traveler information items (if known)?

11. What existing inter-agency agreements for traveler information are currently in place between your agency and other public agencies? What format (Joint Project Agreements, Memoranda of Understanding, etc)? When did they start and when do they expire? How are they funded?

12. If you have an agreement with another agency on the provision of traveler information please answer the following questions:

	Yes	No
a. Is there a formal contract?		
b. Is the exchange free of charge?		
i. If NO, is the sum charged based upon usage?		
ii. If NO, is the charge a flat fee (monthly, annual)?		
c. Is the other agency allowed to provide the same information to others?		
d. Is the end user service required to mention the source of information?		
e. Are there agreements about the quality of the information?		
f. Is the information formatted?		

13. What are your agency's needs (training, funding, information) for further traveler information system development?

14. What barriers (institutional or other) do you see to a regionally-integrated traveler information system? Do you see a need for language translation services in your area? If so, which languages?

15. Please indicate your agency, your name, a phone number, fax number, and email address so that we can contact you about upcoming project activities.

If you have any questions, please call Ron Curb at the Oklahoma Department of Transportation, (405) 521-2536, or the team's project manager, Dee Ann Sanders (405) 744-9302.

Please return this survey to:
Dee Ann Sanders, Ph.D., P.E.
School of Civil and Environmental Engineering
207 Engineering South
Oklahoma State University
Stillwater OK 74078
Phone (405) 744-9302
Fax (405) 744-7554
Email: deeann@okstate.edu

Appendix B. Stakeholder Questionnaire Results

ODOT 511

Questionnaire Results

Question 1. What are the transportation challenges in your area? Circle all that apply

	No. of responses
1a. Congestion	11
1b. Incident response	9
1c. Transit operation	7
1d. Other (Describe)	3

Question 2. What information regarding the transportation system does youir agency regularly collect?
How often and in what format (electronic, paper).

		Frequency			Format	
		Daily	Weekly	Yearly	Electronic	Paper
a. Traffic volume data	6	2	2	4	6	3
b. Traffic speed data	3	1		1	3	
c. Accident data	3		2	1	1	1
d. Transportation needs data	6	5		3	4	5
e. Transportation availability data	3				1	2
f. Condition assessment	3			1	1	2
i. Pavement						
ii. Traffic						
g. Videotapes from closed circuit TV	2			2	2	
h. Ridership data	1		1			1
i. Other (describe)	1					

Question 3. What information do you get from other agencies (DOT,MPO,Police)? How often and in what format (electronic, paper)?

		Frequency			Format	
		Daily	Weekly	Monthly	Electronic	Paper
a. Accident statistics	7			2	5	3
b. Socioeconomic data	5			1	4	2
c.Land use data	2		1		1	
d. Risership data	3			2	1	2
e. Traffic volume	3					3
f. Traffic speed	2		1		1	1
g. GIS data sets	3					
h. Travel trend data	1					
i. Commercial vehicle statistics	1					
j. Incident reports						
k. Special event reports	1					
l. Other	1					

Question 4. What additional information would you like to get? How often and in what format (electronic, paper)?

	Frequency				
	Daily	Weekly	Monthly	Yearly	Paper
a. Accident statistics 2			1	1	
b. Socioeconomic data					
c. Land use data					
d. Ridership data					
e. Traffic volume					
f. Traffic speed					
g. GIS data sets					
h. Travel trend data					
i. Commercial vehicle statistics 3			1	2	
j. Incident reports					
k. Special event reports					
l. Other					

Question 5. Please indicate what communications system or technologies are available within your agency that might be used to exchange information with other agencies (circle all that apply).

	No. of responses
a. Scheduled mailings	7
b. Telephone	10
c. Fax	10
d. Agency radio network	9
e. Press releases	4
f. Paper	6
g. Internal e-mail	9
h. Internal browsing capabilities	6
i. Internet-based (external) e-mail	9
j. Internet access (browsing capabilities)	7
k. TOC center-to-center communications	2
l. Other (please specify)	

6. What existing ITS-related facilities are controlled/owned by your agency? How old? Upgrade plans?

Total responses - 3

	Age of facilities	Upgrade scheduled?
a. Traffic signal control		
b. Transit management controls 1		
c. Ridesharing system		
d. Data collection system		
e. Weather info systems		
f. Video system		
g. Other (describe) 2		

7. What existing communications (radio, copper cable, fiber cable, microwave)
infrastructure for transportation or other uses are controlled/ owned by your agency?
How old? Spare capacity? Upgrade plans (when) ? Does your agency currently lease communications ?

Total responses - 1

	Age of facilities	Spare capacity	Upgrades?	Own/lease
a. Radio 1				
b. Copper cable				
c. Fiber cable				
d. Microwave				
e. Other (Describe)				

8. What types of traveler information should be provided through the 511 program? Please rate the following items according to priority, from very low to very high.

	Very low	low	mod	high	very high
a. Incident information			3	1	9
b. Highway construction information			2	9	
c. Route information (route, distance, time)		2	3	6	3
d. Alternate route information			6	2	6
e. Scenic route information	1	4	5	3	1
f. Ozone alert information	1	2	5	3	2
g. Route congestion info			1	7	6
h. Weather info for route		1	2	8	2
i. Mass transit information	1	2	1	5	4
j. Amber alert info	1	2	3	3	4
k.Connection to 911		1	5	6	2
l. GIS capability		3	6	3	2
m. Traveler support (fuel, lodging, meals)	1	4	5	2	2
n. entertainment, calendar of events					

o. Event info, incl. parking	1	6	5	2	
p. Others (list)	3	5	3	2	1
q.					
r.					

9 a. Do you think that the public would accept a fee-for-service system for 511?
9 b. How could fees be collected? What would be the fee basis(per call, per minutes)?
9 c. Would your agency help fund a 511 system?

Total responses - 11

	Yes	No	Can't say
a.		8	3
b.			
c.		2	2

10. What are the current responsibilities of your agency for the provision of traveler information?
What is the geographical jurisdiction of your agency? What is your budget for traveler information items (if known)?

Total responses - 10

11. What existing inter-agency agreements for traveler information are currently in place between your agency and other public agencies?
What format (Joint Project Agreements, Memoranda of Understanding, etc.)?
When did they start and when do they expire? How are they funded?

Total responses - 0

12. If you have an agreement with another agency on the provision of traveler information please answer the following questions:

a. Is there a formal contract?	
b. Is the exchange free of charge?	2
c. Is the other agency allowed to provide the same information to others?	1
d. Is the end user service required to mention the source of information?	1
e. Are there agreements about the quality of the information?	
f. Is the information formatted?	
g.	2

13. What are your agency's needs (training, funding, information) for further traveler information system development?

Total responses - 9

Training	3
Funding	5
Information	4
Staff	3

14. What barriers (institutional or other) do you see to a regionally-integrated traveler information system?
Do you see a need for language translation services in your area? If so, which languages?

Total responses - 7

	Yes	No
Funding barrier	4	
Language translation	6	1
Spanish	6	
Vietnamese	2	

Appendix C. Stakeholder Meetings

1. ODOT 511 Stakeholder Meeting, Tulsa, Oklahoma, Training Room of the Shusterman Center, University of Oklahoma Campus, September 9, 2004.

In attendance:

Dee Ann Sanders, OSU
Jim Sluss, OU
Bob Huck, OU
Joe Havlicek, OU
Ron Curb, ODOT
Ken O'Donnell, Bi-State MPO
Ellen Tynon, B-State MPO
Craig Murray, Tulsa PD
Vickie Morris, PB Farradyne
John O'Laughlin, PB Farradyne
Jack McCoy, OHP-Troop B

Agenda covered:

Jim Sluss gave an overview of the 511 program, covering the national guidance from FHWA, information on state programs, and what was envisioned for Oklahoma.

Dee Ann Sanders presented the Stakeholder Questionnaire and the analysis from stakeholder input.

The floor was opened to questions and comments. Stakeholers present generally agreed with the findings of the Stakeholder Questionnaire survey. There was extensive discussion about "lessons learned" from 511 programs in other states, and about the types of information that should be provided by a 511 service.

Several 511 programs were cited by the PB Farradyne representatives as exemplary programs, especially the one in the San Francisco Bay Area. The Arizona system was considered to be outstanding, but there are problems with updates in the Phoenix area. Minnesota has an excellent system, which allows an over-ride of the University of Minnesota radio station by transportation officials during a transportation emergency, such as a blizzard.

The representatives from the Bi-State MPO were concerned with the content of a 511 program. In northwest Arkansas, tourism is a major player, and a 511 program there would have to cover tourism-related items to be of benefit to travelers. There was considerable discussion of these items, but no resolution. It is unlikely that Oklahoma would emphasize tourism in an initial 511 offering.

2. ODOT 511 Stakeholder Meeting, Oklahoma City, Oklahoma, Area Council of Governments Conference Room, September 16, 2004.

In attendance:

Dee Ann Sanders, OSU	Mary Howell, Dept. Rehab. Svc.
Jim Sluss, OU	Fred Liebe, Okla. Emergency Mmgt.
Bob Huck, OU	Andrea Ledhler-Behringer, ACOG
Joe Havlicek, OU	Doug Rex, ACOG
Ron Curb, ODOT	Josie Adams, ACOG
Terry Jessup, ODOT	Chris Fiebrich, Okla. Mesonet
Richard Jurey, FHWA	Missy Dean, OML

Agenda covered:

Jim Sluss gave an overview of the 511 program, covering the national guidance from FHWA, information on state programs, and what was envisioned for Oklahoma.

Dee Ann Sanders presented the Stakeholder Questionnaire and the analysis from stakeholder input.

The floor was opened to questions and comments. Stakeholders generally agreed with the results of the Stakeholder Questionnaire survey. There was extensive discussion about the types and sources of information that would be provided by the 511 system in Oklahoma.

The OEM representative was concerned over the current handling of calls on road conditions, and what aspects of the current system would be retained and which ones would be phased out. He was also concerned over tourist services, such as the option to book a hotel room through 511.

The Mesonet representative was concerned over the areal coverage of 511, and how the system would differentiate between a caller in Oklahoma City and one in the Panhandle. He asked how many call centers would be located in the state, and what portions of the state would be covered by 511. Weather data were also discussed. Sources of weather data that were presented included Mesonet; mobile weather stations available from private vendors; SSI, a corporation in St. Louis that is now placing weather station and ITS sensors around the country, and the ATIS weather information that is available at any airport.

Terry Jessup of ODOT asked about the sources of data. Items discussed included the incorporation of ITS data in the 511 system, for example, traffic speed via the system of roadway sensors now being placed by ODOT and others.

Mary Howell from the Department of Rehabilitation Services said that TTY/TTDD equipment should be available, and the centralized system capable of handling TTY/TTDD queries.