# FINAL

# Evaluation Plan

# Model Deployment of a Regional, Multi-Modal 511 Traveler Information System

## Task Order BA7746



**Prepared for:**

U.S. Department of Transportation
ITS Joint Program Office, HOIT-1
Washington, DC 20590

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# 1.0 Introduction

## 1.1 Background

This document presents the plan for the national evaluation of the regional, multi-modal 511 Traveler Information System Model Deployment. The model deployment is an enhancement of an existing statewide 511 telephone traveler information system operated by the Arizona Department of Transportation. As a United States Department of Transportation (U.S. DOT) Intelligent Transportation System (ITS) Model Deployment, the project is intended to generate findings that will help shape U.S. DOT approaches to 511 and that will be of use to others implementing and operating 511 systems. The national evaluation is the primary mechanism for documenting the performance of the model deployment and the lessons learned.

On July 21, 2000, the Federal Communications Commission assigned 511 as the nationwide traveler information telephone number and granted responsibility for it to government transportation agencies. Since that time, approximately 20 statewide and regional 511 systems have become operational throughout the United States, including the current Arizona statewide 511 system. The Arizona model deployment consists of a major enhancement of the existing system.

The Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) are jointly sponsoring the model deployment. The model deployment seeks to demonstrate the potential of 511 services to bring together various and disparate data, and provide useful information to travelers through a state-of-the-art telephone interface. The national evaluation will assess the extent to which the Arizona 511 project satisfies the objectives of the model deployment, which include:[1]

- Illustrate how the innovative application of technologies can create a highly effective 511 service that sets a standard for high quality telephone traveler information; "push the envelope" of traveler information quality production and dissemination.

- Utilize an innovative user interface that promotes ease of use without compromising the user's expectation for personalized information and allows callers to locate the content they desire quickly and efficiently. The user interface must take advantage of proven voice-recognition, voice response, and synthesized speech technologies.

- Provide information to callers automatically on a route segment or corridor basis, with no direct contact necessary between callers and human operators

- At a minimum, the information content on the 511 system shall include:
    - current traffic conditions;
    - major service disruptions for public transportation properties;

[1] 511 Model Deployment Solicitation, Federal Register: January 16, 2002 (Volume 67, Number 11), Federal Highway Administration, Federal Transit Administration.

- current information on active construction and maintenance projects along route segments that may affect traffic flow or restrict lanes;
- unplanned events, major incidents, or congestion that shut down or significantly restrict traffic for an extended period;
- transportation-related information associated with significant special events (fairs, sporting events, etc.); and
- abnormal weather or road surface conditions that could affect travel along the route segment.

## 1.2 Project Overview

The Arizona Department of Transportation (ADOT) is leading the 511 Model Deployment in partnership with other transportation agencies in the Phoenix and Tucson regions. The 511 Model Deployment implements a number of key enhancements to the existing statewide 511 system that became operational in March 2002, when ADOT converted their ten-digit system that had been operational for several years to 511. The planned enhancements to the system include:

- new content on arterial streets, airports, neighboring states (Utah), transit (major service disruptions and estimated arrival times), weather, and downtown Phoenix special events and parking;
- a complete redesign of the menu system, conversion from a keypad system to voice recognition, conversion from a highway route-based reporting to segment-based reporting;
- enhanced 511 marketing; and
- partnership with a private, for fee, premium service information provider.

ADOT received the award of the model deployment in July 2002 and immediately began the planning and design process. Starting in August of that year, 511 Task Force meetings have been held approximately monthly. A Program Management Plan document was completed in November 2002 that includes an overall schedule and high-level scopes of work for the various enhancements. At that same time, a System Requirements Document was completed that identifies the requirements for the various enhancements. Implementation of the system began in early 2003. Operation of the enhanced 511 system is scheduled to occur in a phased manner beginning in August 2003 with the majority of enhancements in place and operational by November 2003.

Battelle Memorial Institute is conducting the national model deployment evaluation. Battelle was given notice to proceed in September 2002. A kick-off meeting with the local evaluator, Dr. Mark Hickman, Assistant Professor at the University of Arizona, was held in October 2002. Since that time, Battelle and Dr. Hickman have been working closely, monitoring the status of the model deployment planning, design and implementation, and developing plans for the evaluation.

## 1.3 Evaluation Objectives

Nationally, implementation of 511 is in its early stages. Many more agencies are considering or planning 511 deployments than have implemented systems to date. Clear "best practices" have yet to emerge in a number of technical and institutional areas and key questions remain, including how much transit information should be made available directly on 511 versus transferring callers to existing transit agency customer information systems; how to interface with other state's 511 systems in border regions; the cost of 511 for public agencies and what sorts of private sector partnerships may be possible; and how to accommodate additional information while keeping menu systems easy to use. The model deployment and this evaluation are intended to address these questions.

Specific objectives of the U.S. DOT evaluation of the 511 Model Deployment are to:

- Provide an independent review of the performance of the model deployment, including the extent to which it accomplishes the national objectives (which is summarized in Section 1.1).
- Document how the model deployment was implemented, including system costs and how technical and institutional issues (especially cross-modal and interstate) issues were resolved.
- Provide ADOT and the other partners with feedback that will allow them to improve the effectiveness of the system.
- Deliver lessons learned that will inform the U.S. DOT 511 effort and that will be of use to agencies operating and planning to implement 511 systems.

## 1.4 Organization of the Report

The remaining sections of this Evaluation Plan document are organized as follows:

- **Section 2. Background.** This section provides additional background about the context within which the project is being implemented including an overview of the existing ADOT 511 system and other information systems.
- **Section 3. Arizona 511 Model Deployment Description.** This section describes the 511 Model Deployment, including the technical scope, expected benefits, project management, stakeholders and deployment schedule.
- **Section 4. Evaluation Approach.** This section describes the evaluation hypotheses and individual tests.
- **Section 5. Evaluation Management Plan.** This section provides an overview of the Evaluation Team's organization, the level of effort, deliverables and schedule.

# 2.0 Background

## 2.1 Project Context

The population of Arizona at the time of the 2000 Census was approximately 5.1 million. Geographically, the vast majority of the state is rural, although 88 percent of the population resides in urban areas.[2] Over two-thirds of the state's population is concentrated in Maricopa County (3.1 million), located in central Arizona and which includes the City of Phoenix and most of the greater Phoenix Metropolitan Area; and Pima County (843,000), located in southern Arizona and which includes the greater Tucson Metropolitan Area. Both the Cities of Tucson and Phoenix are partners in the 511 Model Deployment. The overall population density of the state is about 45 persons per square mile (ranked 36 in the US) compared to the overall average for the United States of 80 persons per square mile. Arizona has grown quickly over the last several decades. The population increased 40 percent between 1990 and 2000. Figure 1 identifies major cities and highways in Arizona.


**Figure 1. Location Map**

[2] Bureau of Transportation Statistics, 1990 Census figures; July 2003, www.bts.gov/publications/transportation .

Arizona is a major destination for US and international tourists. Arizona ranked 13th among US states with approximately 550,000 international visitors in 2002.[3] Major attractions include the Grand Canyon and over 30 other national parks and monuments, vacation resorts in Phoenix and Tucson, old west towns like Tombstone, Bisbee and Jerome scattered throughout the state, and the "red rock country" surrounding Sedona.

Arizona's highway system includes three major east-west interstates: I-8 in the southern portion of the state that serves as one of the major routes between Phoenix and San Diego; I-10 in the central portion of the state that links Phoenix with the Los Angeles area to the west and to southern New Mexico to the east; and I-40 in the north. Both I-10 and I-40 are major international trade corridors. Arizona includes two major north-south interstates: I-17, which links Tucson, Phoenix and Northern Arizona, and I-19 which links Tucson with Nogales, located on the international border with Mexico. Arizona includes several major international border crossings with Mexico, including San Luis Rio Colorado (in the west), Nogales (central), and Douglas (east).

Both the Tucson and Phoenix regions are characterized by low-density development and heavy reliance on the personal vehicle for transportation. Traffic congestion is significant in Phoenix, but below the levels of the handful of most congested urban areas in the United States, such as Los Angeles, San Francisco, Chicago and Washington, D.C. According to the 2000 Urban Mobility Study conducted by the Texas Transportation Institute (TTI), which studied 75 urban areas in the United States, Phoenix ranked 11th based on the "travel time index". The travel time index measures the amount of additional time needed to make a trip during a typical peak travel period in comparison to free-flow speeds. The average travel time index for all 75 urban areas is 1.39. Phoenix's travel time index of 1.40 is just above that average and indicates that a trip that would take 20 minutes at free-flow speed takes about 28 minutes (20 x 1.40 = 28). For comparison, the most congested urban area—based on the travel time index—is Los Angeles with 1.90. Of the ten urban areas that have travel time index values higher than Phoenix, eight of them are between 1.41 and 1.47, indicating that relatively little separates Phoenix from most of the more congested locations.

Tucson, which is much smaller than Phoenix, is far less congested, ranking 40th among the 75 urban areas studied by TTI with a travel time index of 1.20. Although below the average for all 75 urban areas (1.39), the Tucson travel time index is just above the average for urban areas of similar size (1.18).

Both Tucson and Phoenix have well-developed grid networks of major arterial streets at one-mile spacing and therefore there are a number of alternative routes for the portion of trips using local streets. However, both areas were relatively late in beginning to develop their urban freeway systems and there are very few viable alternate freeway routes in these areas.

[3] United States International Trade Administration, Office of Travel and Tourism Industries web site (http://tinet.ita.doc.gov), July 2003.

## 2.2 Existing Traveler Information Systems

### 2.2.1 Existing ADOT 511 System

ADOT converted their existing statewide road conditions telephone information system, or "Voice Response Activated System" (VRAS), which utilized a toll free ten-digit phone number (888-411-ROAD) to 511 in March 2002 (the ten-digit number also remained operational). The current 511 system allows users to obtain either highway (state highways and interstates) or transit information using touchtone (keypad) menu selections. Figure 2 illustrates the current system menu structure.

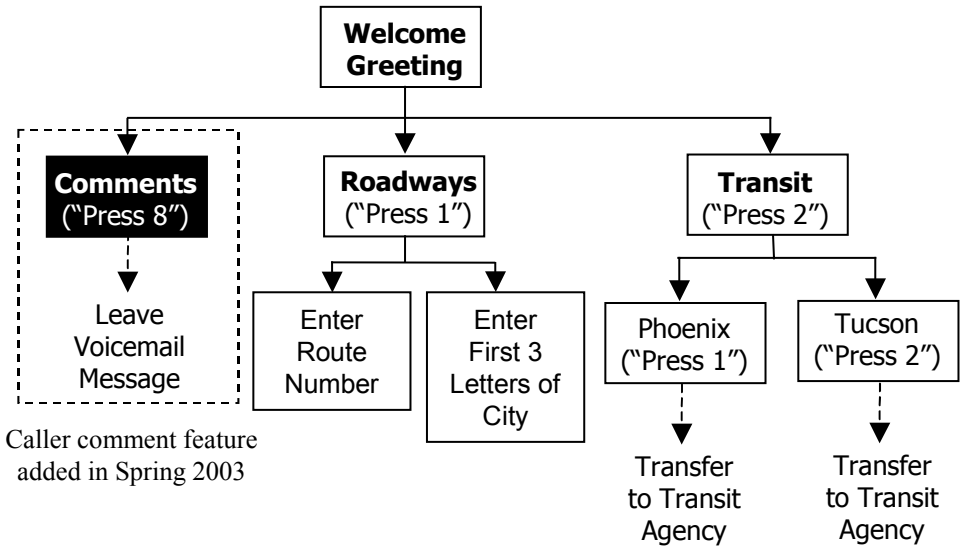


**Figure 2. Current ADOT 511 System Menu Structure**

All transit information requests are call-forwarded to the transit agencies where they are handled by the agencies' existing system; no transit information is provided directly through the 511 system. For highway information, users enter the route number of the highway and are provided recorded messages describing various "events", including roadway construction, closures, incident reports, weather updates, etc. Highway information is provided by segment based on mileposts. If there are multiple event messages on a given highway, each event will be described sequentially, starting at the lowest milepost. Events are not prioritized, that is, all incident related events are not reported first. The user cannot request information for only a portion of a given highway. Users may also receive reports on local arterial streets in Maricopa County by entering the first three digits of the city in which they want information. Although available, historically this feature has very seldom had information available, since the local agencies who are the source of this information have not regularly entered it into the system.

Information in the existing system is updated every 5 minutes. The 511 system is a text-to-speech system that draws its information from the ADOT Highway Closures and Reporting System (HCRS). Information is input to HCRS via approximately 90 workstations operated by the ADOT Headquarters Traffic Operations Center (TOC) in Phoenix, ADOT District Offices throughout the state, and Arizona Department of Public Safety (DPS) offices throughout the state.

Figure 3 presents monthly 511 call volumes for the period July 2001-June 2003. Prior to converting to the 511 number in March 2002, the usage of the ADOT traveler information telephone system ranged from about 4,000 calls per month upwards to about 20,000 calls during winter storms or during unusual events like major forest fires. After the conversion to 511, usage spiked from around 7,000 calls in January and February to about 20,000 calls per month in March. Since that time, usage has remained at that level or higher, ranging up to as high as 100,000 calls per month (in December 2003).

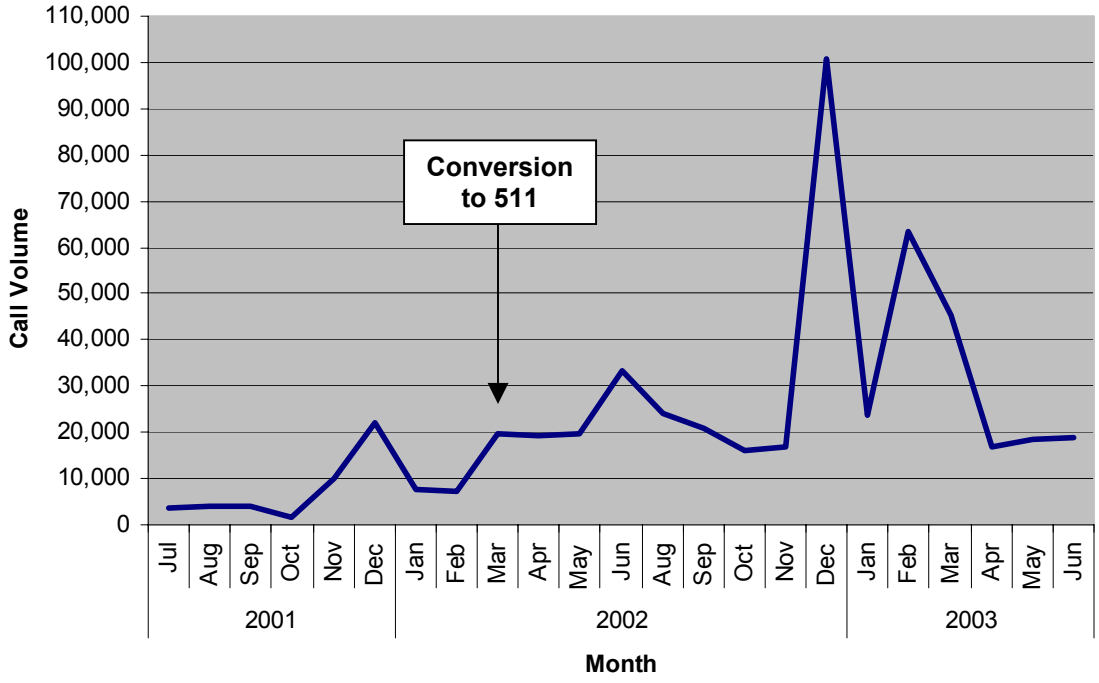


**Figure 3. Historic Monthly Call Volumes**

### 2.2.2 Other Traveler Information Sources

Aside from the 511 telephone system and the customer service telephone lines at the major transit operators, the other major public traveler information dissemination tool in Arizona is the ADOT traveler information web site. At about the same time that ADOT converted their ten-digit telephone information number to 511 in March 2002, they co-

branded their existing traveler information web site, adding the 511 logo and making the site reachable via either http://az511.com or the previous address of http://azfms.com. The ADOT traveler information web site draws information from the same data engine as the 511 system, the statewide Highway Closures and Restrictions System. The web site contains three types of information, as shown at the top of Figure 4, the main page: still images and live views from closed-circuit television cameras located on freeways throughout the Phoenix area; a color-coded freeway congestion map of the Phoenix area; and a statewide map with clickable icons showing highway closures, restrictions, accidents and weather information. Figure 5 shows the Phoenix area color-coded freeway conditions map. Figure 6 shows the statewide roadway conditions map.

Other sources of traveler information in Arizona include broadcast radio and television, which feature peak hour traffic condition reports oriented toward urban area commuters.


**Figure 4. ADOT Traveler Information Web Site Main Page**

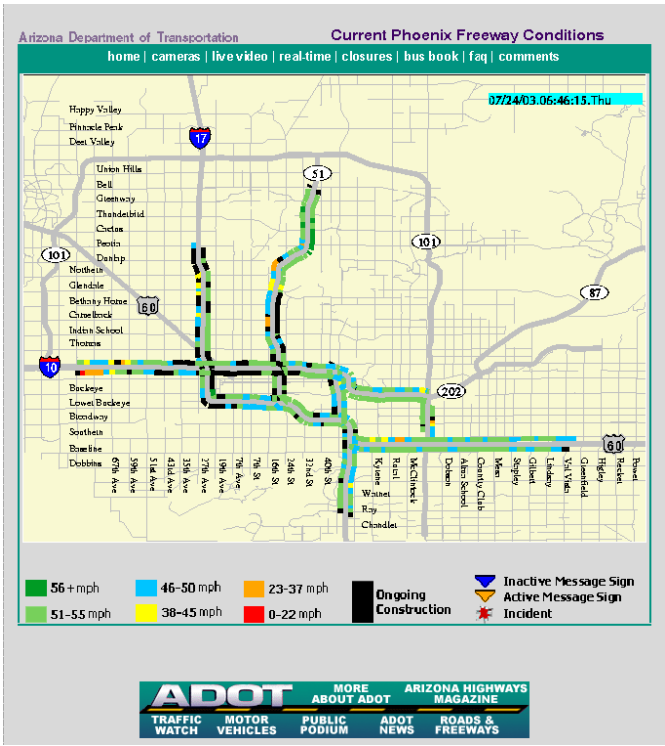


**Figure 5. ADOT Web Site Freeway Conditions Map**

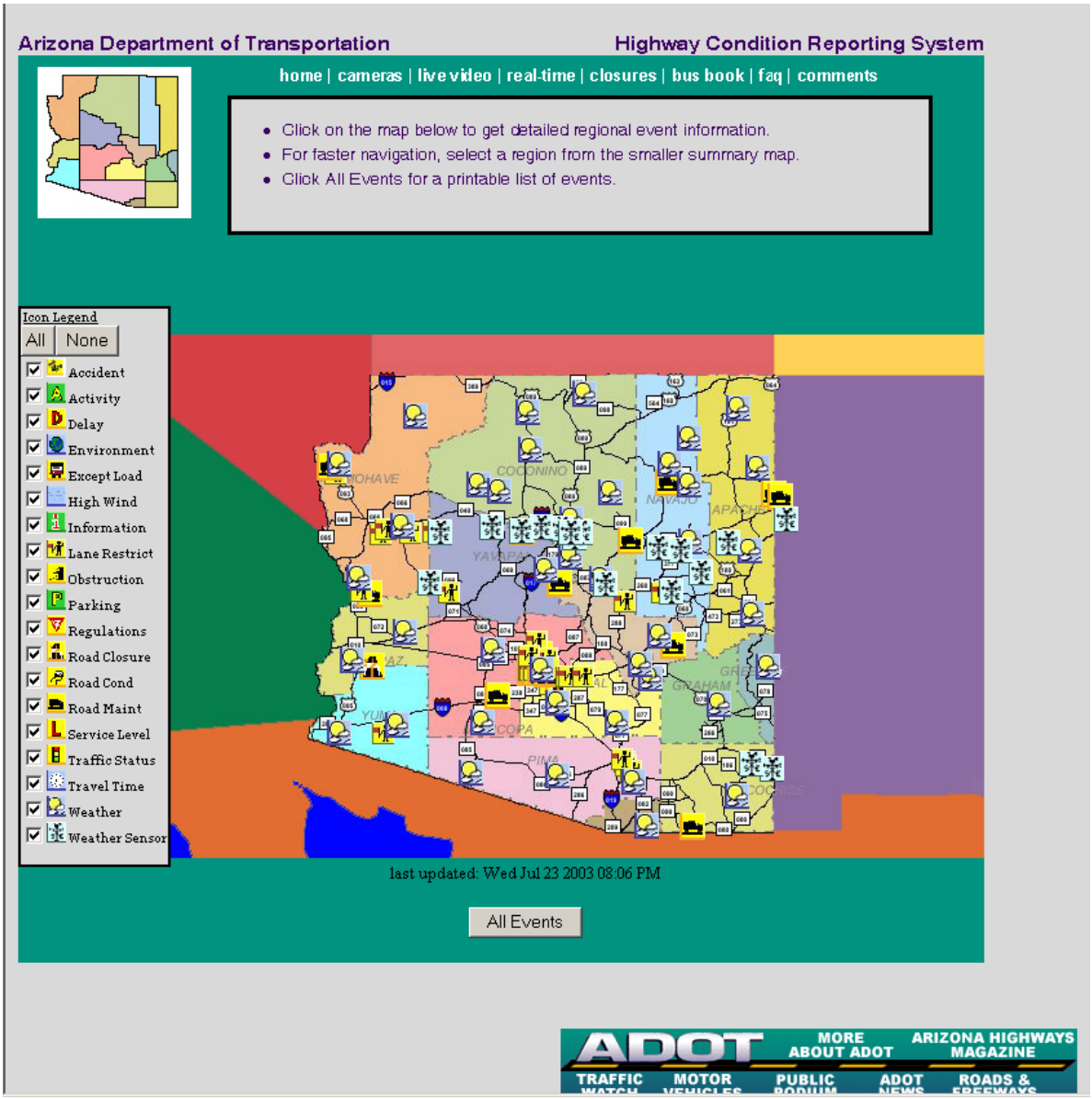


**Figure 6. ADOT Web Site Statewide Traveler Information Map**

# 3.0 ARIZONA 511 MODEL DEPLOYMENT DESCRIPTION

## 3.1 Enhancements

The model deployment consists of a number of enhancements to the existing ADOT 511 system. The project partners have categorized these enhancements into two types:

1. Information Content Enhancements
2. Telephone System Interface Enhancements

Information content improvements include a wide range of new types of information, including information on arterial streets; downtown Phoenix events and parking; airport information; additional weather information (including information from the state's Road Weather Information System); information from Utah; and a reporting scheme based on roadway segments rather than entire routes. System interface improvements include moving to a voice recognition system and a complete redesign of the menu system. Table 1 lists the various information content and telephone system interface improvements. Each of these enhancements is briefly described in the sections that follow.

**Table 1**
**Arizona 511 Model Deployment Enhancements**

| Type of Enhancement | Enhancement |
|---|---|
| Information Content Improvements | Add data from Tucson and Phoenix local streets. |
| | Implement standards upgrades (e.g., use of XML). |
| | Incorporate data from neighboring states. |
| | Improve data quality through further refinement of landmarks and terminology used in HCRS, operator training, and establishment of a data quality monitoring process. |
| | Incorporate travel time data for selected Phoenix region arterial streets and freeways. |
| | Incorporate some transit data, such as major service disruptions, directly into the 511 system. |
| | Incorporate estimated bus arrival times for selected Phoenix region routes and stops. |
| | Incorporate selected airport information for the Phoenix and Tucson airports. |
| | Incorporate information pertaining to Grand Canyon National Park. |
| | Incorporate additional weather information, including data from the ADOT Road Weather Information System (RWIS). |
| | Incorporate downtown Phoenix special event information, such as parking information. |
| | Provide highway reports at the segment rather than route level and provide regional traffic condition summary reports (i.e., Quick Reports). |

**Table 1**
**Arizona 511 Model Deployment Enhancements**

| Type of Enhancement | Enhancement |
|---|---|
| Telephone System Interface Improvements | Implement voice-recognition and modify menu structure based on user focus group input. |
| | Improve methods for tracking, reporting and assessing performance of the system. |

### 3.1.1 Tucson and Phoenix Local Street Data

Currently, the 511 system contains little to no information on local streets. The menu system includes an option for local street information for several cities in the Phoenix area but information is essentially never available. The local agencies responsible for inputting information on their local streets into HCRS, the 511 data engine, have not embraced that responsibility. This enhancement is intended to greatly increase the amount of local street information available through 511 through three mechanisms. First, several jurisdictions in the Tucson area, including the ADOT District Office and the City of Tucson, have been given access to HCRS. The City of Tucson in particular is expected to take an active role in entering information on local street conditions, focusing on incidents and road closures and restrictions. Second, as part of the model deployment, ADOT is dedicating their own staff at the ADOT Traffic Operations Center (TOC) to monitor Phoenix area police and fire department radio scanners for incident information and enter this information into HCRS, making it available via 511. New scanners and radio antennae have been purchased to support this effort. Third, members of Maricopa County's arterial street incident response team, REACT, will enter information into HCRS via wireless PCs.

ADOT is eliminating the current menu option for local street data (e.g., option 2 under "Roadways", "enter first three letters of city name"—see Figure 2). All of the new data on arterial streets will be accessible as "Quick Reports", regional/sub-regional summaries of traffic conditions that include information on freeways and arterial streets. Quick Reports are described further in Section 3.12, below.

### 3.1.2 Standards Upgrades

ADOT currently utilizes a number of standards in their 511 system, including the following:

- XML to retrieve information from their GIS map server.
- Intelligent Transportation Systems Information Interchange Systems (IT IS) Society of Automotive Engineers (SAE) Advanced Traveler Information Systemn (ATIS) descriptions to categorize event information in HCRS.
- Java Database Connectivity (JDBC) to provide interfaces with several databases simultaneously, including Sybase, SQL Server, Oracle, MySQL.

- ITE TM 1.03 standard, *Functional Level Traffic Management Data Dictionary (TMDD)* for: roadway link data elements; incidents and traffic-disruptive roadway event data elements, including traffic control, ramp metering, traffic modeling, video camera traffic control, parking management, and weather forecasting; as well as data elements related to detectors, actuated signal controllers, vehicle probes, and dynamic message signs.
- The J2353 standard, *Advanced Traveler Information System (ATIS) Data Dictionary*, for data elements.

As part of the model deployment, the SAE J2354 standard, *Advanced Traveler Information System (ATIS) Message Set*, will be used to exhange data with Utah. ADOT intends to use applicable transit related standards in importing bus arrival time estimates into HCRS from the Valley Metro (i.e., Phoenix area transit) vehicle management system, although this may or may not be possible.

### 3.1.3 Data from Other States

In the long term, ADOT intends to add data from several neighboring states to their 511 system. As part of the model deployment, they are focusing on Utah. HCRS is linked to Utah's traveler information system and data from Utah will automatically appear in HCRS and will be available in the ADOT 511 system as part individual highway route segment reports. For example, if a caller selects the roadway segment "US 89 – Flagstaff to Utah Border", information from Utah will automatically be reported along with information on the Arizona portion of the road.

### 3.1.4 Data Quality Improvements

Improvements aimed at improving the accuracy and timeliness of data entered into HCRS include additional HCRS operator training, increased supervisory oversight of HCRS, refinements of landmarks and terminology used in HCRS, and a feature that will allow HCRS operators to view a text message showing how the event information they have entered will be reported through 511. Currently, HCRS operators do not compose the text message that will be reported. Rather, they input event information using an on-screen data entry menu. This information is then automatically converted to a 511 message, without the opportunity for operators to view or revise their entries. In addition to being able to view the text output corresponding to specific event entries, plans call for HCRS operators or supervisors to call into 511 to hear the spoken version of the information.

### 3.1.5 Phoenix Region Arterial Street Travel Times

Travel time information will be made available on the enhanced 511 system for four north-south arterial streets located in North Phoenix: 35$^{th}$ Avenue, 19$^{th}$ Avenue, 7$^{th}$ Street/Cave Creek and Tatum Boulevard. Travel times will be available for an approximately six-mile section of each of these roadways, in the area bounded by Cactus Road to the north and Camelback Road to the south. In addition to these major arterial

routes, this corridor includes two freeways, I-17 and SR-51. The location of the roadways is shown in Figure 7.

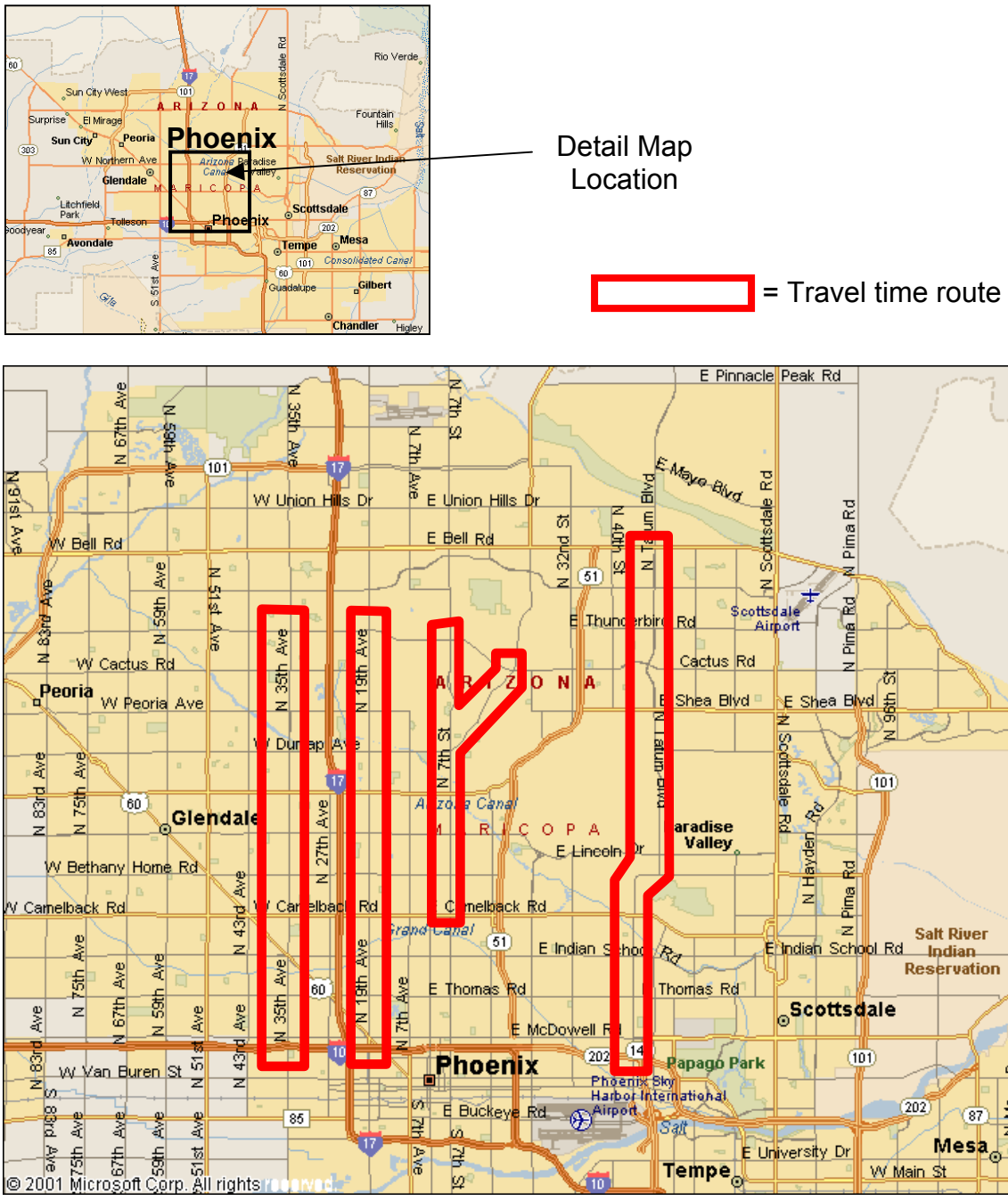


**Figure 7. Arterial Travel Time Routes**

As of July 2003 ADOT is evaluating vendor proposals for providing the travel time information. Their intention is not to procure the system hardware, but rather, to lease

the travel time time data produced by the system. ADOT has specified that the approach will utilize seven license plate readers.

The details of how the information will be provided on the 511 system have not been finalized although it is expected that a single corridor-long travel time will be provided for each of the three roadways. The arterial street travel time information, like all of the arterial street information on the system, will be available in the subregion (e.g., in the case of the travel times, North Phoenix) "Quick Reports", short summaries of travel conditions similar to those provided on commercial television and radio traffic reports.

### 3.1.6 Transit Service Disruptions and Estimated Bus Arrival Times

Currently no transit information is available directly on the 511 system. All callers interested in transit information are transferred to transit agency customer service operators. The model deployment will add two types of transit information to the 511 system: major service disruptions and estimated bus arrival times. Estimated bus arrival times will be provided for a limited number of Valley Metro (i.e., Phoenix transit) Bus Rapid Transit stops, expected to be less than 20, located in the downtown Phoenix area. Static signs will be located at these bus stops directing travelers to call 511 for the estimated bus arrival times. The estimated bus arrival times will be generated based on vehicle location and schedule adherence information collected by the vehicle management system that is being implemented by Valley Metro. The system is in acceptance testing as of July 2003 and bus arrival times are expected to be available via 511 sometime between November 2003 and February 2004.

### 3.1.7 Phoenix and Tucson Airport Information

Operators at the Phoenix and Tucson airports will manually enter information into HCRS, and Information content will include construction and parking information.

### 3.1.8 Grand Canyon National Park Data

Operators at Grand Canyon National Park will manually enter information into HCRS and provide digital voice recordings (.WAV files). Information content will include construction and parking information. Currently, the park does have an HCRS workstation and can enter information, but the information appears on the 511 system only on individual highway routes. The model deployment will create a new top-level menu selection that will include a traffic and parking conditions summary (.WAV file). Information entered into HCRS will continue to be heard as part of individual highway reports.

### 3.1.9 Segment Weather Reports

This enhancement includes incorporating statewide ADOT RWIS data with data from other sources and providing travelers with segment-specific weather reports that will be useful to travelers. The original plan for the "other sources" data was to utilize a private

information provider, to be modeled on the approach used in the Nebraska 511 system (which uses the vendor, Meridian Environmental Technology, Inc.). However, this approach was dropped due to cost considerations. The current plan is to utilize National Weather Service (NWS) one-mile grid forecasts to generate highway segment-specific traveler weather reports. Over the next several months the partners will be determining how to utilize the NWS information to generate advisories that will be useful to travelers. The timing of this enhancement is dependent on the NWS, who are in the midst of upgrading their one-mile grid forecast products. Implementation of this enhancement is unlikely to occur before Spring 2004.

### 3.1.10 Downtown Phoenix Special Event and Parking Information

In addition to several theaters, downtown Phoenix is host to a Major League Baseball stadium, Bank One Ballpark, and a multi-use (National Basketball Association and National Hockey League) arena, America West Arena. The 511 system will include information on downtown special events like sporting events and concerts covering a 24-hour period. This information is expected to include recommended routes for ingress and egress (most likely based on event traffic plans rather than real-time conditions) and parking location information. This information will be included in both the individual highway route reports for those segments that are within or adjacent to downtown Phoenix as well as via the downtown Phoenix subregion Quick Reports.

### 3.1.11 Segment-Based Highway Reports and Regional Quick Reports

The current 511 system provides information by highway route. If a caller selects "I-10", they will hear a listing of all events on the entire length of I-10 throughout Arizona. The model deployment will provide callers with information on route segments, rather than the entire route. For example, users interested in information on I-10 will be given the choice of several different segments, such as "Phoenix to Tucson", "Phoenix" and "Phoenix to California Border".

The enhanced 511 system will also allow callers to hear "Quick Reports" for various regions. These quick reports will summarize traffic conditions, including delay and incidents, within defined geographic areas. The Quick Reports will include information on both freeways and arterial streets.

### 3.1.12 Voice Recognition and Menu System Redesign

The current 511 system allows only keypad menu selections. The enhanced 511 system will utilize voice recognition, with the option of keypad menu selections. The model deployment also features a redesign of the 511 menu system, an effort supported by a series of focus groups with travelers held in late April and early May, 2002, two each in Phoenix, Flagstaff and Tucson. Figure 7 presents the current conceptual plan for the redesigned menu. Major changes include adding a "broadcast message" (urgent information of interest to all travelers and which cannot be bypassed) following the opening greeting and top level menu selections for the Grand Canyon National Park and

airports. As indicated in Figure 8, transit, airport and Grand Canyon information will be provided in the form of a .WAV file (a digital recording of a human speaker), in addition to information entered into HCRS, which gets converted through a text-to-speech process.

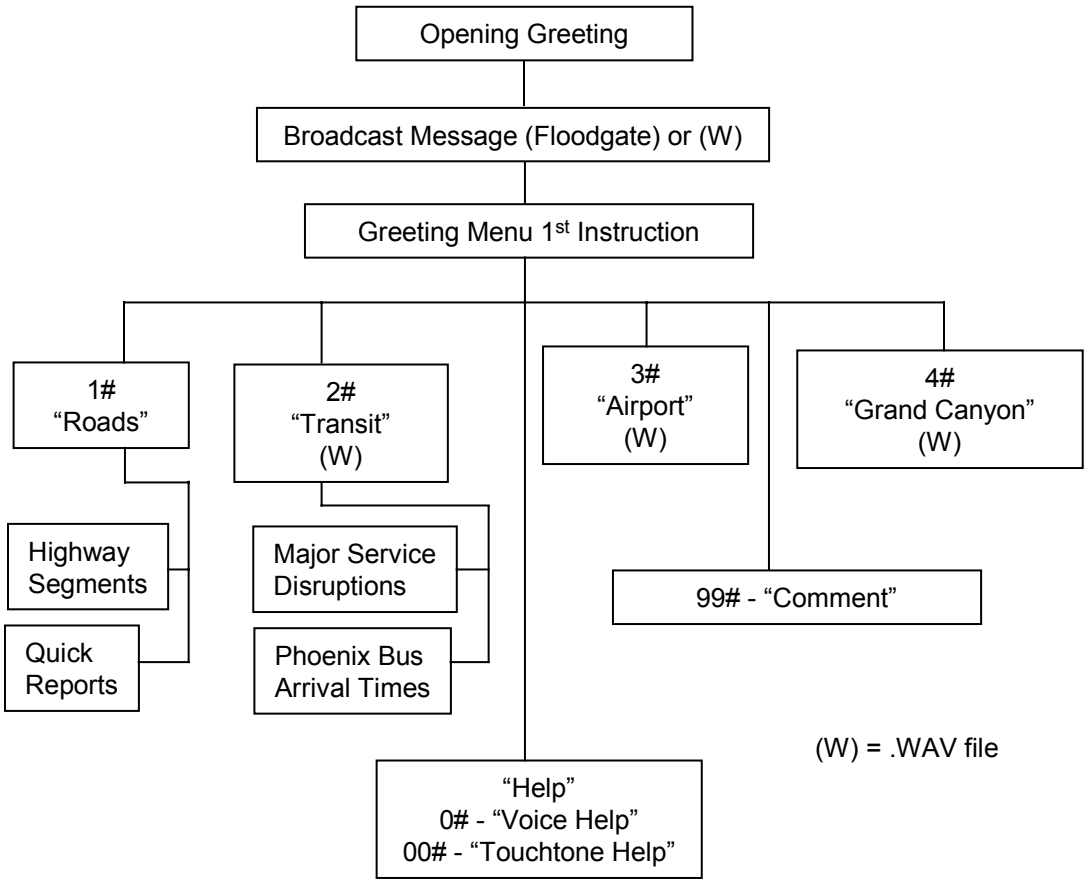


**Figure 8. Revised Menu Structure (Preliminary Concept)**

### 3.1.13 System Tracking, Reporting and Performance Assessment

Currently, ADOT collects and analyzes very little information on the usage and performance of the 511 system. The only data that are routinely collected and reviewed is the number of daily calls and, since Spring 2003, a manually transcribed paraphrased summary of call comments. As part of the system redesign that is occurring for the model deployment, ADOT is adding the ability to generate a range of additional reports that will allow for much more comprehensive tracking and performance monitoring in the future. Specification of these reports is being made in close cooperation with the local and national evaluation teams. Many of the reports on system performance (line utilization, system availability, wait times, HCRS transaction tracking, etc.) and usage (tracking transfers to transit, individual menu selections, etc.) that are being developed

for the evaluation will be available to ADOT in the future for on-going monitoring and analysis.

In addition to the above information content and telephone system interface improvements, the model deployment includes two other important components, which are described in the sections that follow.

### 3.1.14 Private Traveler Information Service Partnership

ADOT intends to include a private traveler information service partner in the 511 Model Deployment. ADOT advertised for partnership proposals and as of June 2003 had entered into negotiations with their preferred partner, iNetNow. INetNow offers a concierge type personal service whereby phone operators provide real-time Internet research services to callers, on a per minute fee basis, e.g., finding restaurants and movie information, driving directions, etc. As of publication of this document, the future of the partnership with iNetNow is very uncertain. ADOT has reported that iNetNow has recently undergone some internal reorganization and the partnership plan is being reconsidered.

### 3.1.15 Marketing Strategy

ADOT has prepared a draft marketing strategy to support the enhanced 511 service. The marketing plan identifies strategies in four areas:

- Media Relations (media kit, media contact list, press releases)
- Branding and Cross-Promotion (use of 511 logo, ADOT web sites, other agency web sites)
- Public Information and Outreach (highway signs, variable message signs, public service announcements, special event booth, user group communications)
- Collateral Materials (511 rack card, bumper sticker, promotional items)

Plans for highway signs consist of the deployment of 50 static signs on highways throughout the state. Location criteria include: approaches to metropolitan areas with populations greater than 50,000, average 50 mile spacing, roads approaching snow routes, locations of frequent storms and routes heavily used by tourists. Plans to use variable message signs call for advertising 511 on signs located on highways throughout the state. The posting of messages on various signs will be staggered in order to allow usage statistics to be gathered for each posting. The extent to which the 511 marketing will target transit users is not yet clear.

## 3.2 Key Enhancements

The partners have identified a large number of enhancements as part of the 511 model deployment, as indicated in Section 3.1. The national evaluation team will investigate each of these enhancements. Among these many enhancements the evaluation team considers a number of them likely to be especially important—"ones to watch", as it were. These enhancements stand out because they represent fundamental improvements

to the system (e.g., voice recognition) and/or because they incorporate approaches being considered by 511 planners and deployers throughout the U.S. (e.g., adding arterial street data, parking data and treatment of transit information). Based on these considerations, the following likely key enhancements have been identifed:

- **Segment-based highway reports and regional Quick Reports** – these represent a major improvement in the user interface. A number of participants in the focus groups conducted by ADOT indicated that the route based reporting convention is not convenient and that segment and regional reports are highly desirable.

- **Voice recognition and menu system redesign** – moving from a keypad only menu selection scheme to a voice recognition approach represents another major enhancement to the existing system and the challenge of accommodating a wide range of information while keeping a menu easy to use is one that many other 511 deployers face.

- **Arterial street data** – one of the major complaints among ADOT focus group participants was that the system was not complete, that it lacked data on major arterial streets. A lack of source data for widespread arterial street information is a challenger that many urban area 511 deployers will face and which ADOT is addressing through two techniques in the model deployment: purchasing travel time estimates on a few arterial streets and using ADOT staff to monitor police and fire scanners for incident information. The effectiveness of both techniques will be of wide interest in the 511 community.

- **Transit information on 511 and relationship to transit customer service lines** - the question of how multi-modal 511 systems should relate to the many heavily utilized, predominantly staffed (e.g., live operator) transit agency telephone customer service systems is a key one for deployers around the country. The main question is what level of transit information should be made available directly on the 511 system (versus transferring 511 callers to transit agency information lines). This determination has significant implications on:

    - 511 system capacity requirements (e.g., can the 511 system handle the massive volumes experienced by many existing transit information lines?).

    - Candidate users and associated marketing approaches (is the 511 service of greatest interest to infrequent transit users, including non-local travelers, whose primary interest is in a convenient way to connect to live transit operators for detailed information, or is 511 a good way to serve frequent transit riders?).

    - Operational efficiency and cost (e.g., if many users will still require interaction with a live transit agency operator, will the cost of transfers from the 511 system be prohibitive?).

- **Roadway segment-based weather reports -** among rural and long-distance travelers in particular, weather information is often cited as one of the most desired types of traveler information. Road Weather Information Systems (RWIS) and National Weather Service forecasts and bulletins represent a promising source of 511 weather information but the "raw" data/information from these sources may require additional processing in order to be useful to 511 users. The linkage between automated 511 systems and automated RWIS systems and the approach to performing any necessary data interpretation and conversion of RWIS and National Weather Service data to traveler advisory data are of interest.

- **Data from neighboring states (Utah)** - traveler information needs are a function of travel patterns, which do not necessarily conform to the jurisdictional boundaries associated with 511 system operational responsibility. Providing convenient access to traveler information that spans jurisdictional boundaries is a key consideration for 511 developers and deployers around the country. Both technical approaches and user responses are of interest.

## 3.3 Expected Benefits

In discussions with project partners, their focus has been on making the 511 system more useful to travelers and thereby increasing its utilization. They believe that providing useful traveler information to the public is a service that they should be performing, and to some extent, may view this activity as an important accomplishment in its own right. The model deployment represents an opportunity to simultaneously implement a number of major improvements that are expected to make the system easier to use and to enhance the quality and quantity of information available, both of which are expected to translate directly to increased system usage and customer satisfaction.

Although the broader objectives for the 511 system, and traveler information strategies in general, certainly include the benefits that accrue from wide-scale traveler utilization of traveler information in their trip making, including improving roadway safety, encouraging use of transit, reducing travel delay, reducing the adverse environmental impacts of travel, etc., the partners have not explicitly identified these as being "expected benefits" within the two-year time frame of the evaluation. They view establishing a useful, heavily utilized 511 system as a necessary precursor to any subsequent traveler information benefits.

## 3.4 Project Management and Partners

Arizona Department of Transportation is leading the 511 Model Deployment. Other partners include the Metropolitan Planning Organizations in Pima County (Tucson region) and Maricopa County (Phoenix region); Valley Metro (Phoenix Transit); Sun Tran (Tucson) Transit; Maricopa County; Pima County; City of Tucson; and City of Phoenix. The cities, transit agencies and airports will all contribute new information to the enhanced 511 system.

The consulting firm PBS&J is providing deployment assistance to ADOT, including the development of system requirements. OZ Engineering is leading the upgrades to the database that drives the 511 system. Kimley-Horn Associates is leading the development of the marketing strategy. Call Processing Systems is leading the upgrades to the phone system.

The local evaluation, a requirement of the model deployment, is being conducted by Dr. Mark Hickman of the University of Arizona (Tucson), under the direction of the Arizona Department of Transportation and the other 511 Model Deployment partners.

## 3.5 Deployment Schedule

The design and implementation of the 511 model deployment is well underway. The partners completed their Program Management Plan and System Requirements Document in November 2002 and these documents have served as a guide for the design and implementation work.

The partners plan to implement the various enhancements that constitute the model deployment in a phased manner, with the bulk of the new features coming on line in late November 2003. The only new feature that has been implemented as of the date of publication of this document is the caller comment option, which allows callers to leave a voicemail message and which was implemented March 6, 2003. Included among the features scheduled for implementation in November 2003 include voice recognition, segment-based highway and regional (Quick Reports) reports, and the redesigned basic menu system. Features that are likely to be implemented later than November 2003 include bus arrival time estimates (by February 2004), segment weather reports (Spring 2004). It is also possible that the arterial street travel time data enhancement will not be operational by November 2003, given that as of July, ADOT is still evaluating vendor proposals.

The one year post-enhancement analysis portion of the evaluation will start with the implementation of the basic enhanced system features currently scheduled for November 2003. For at least the first few months of the one-year analysis period, the system is not expected to include several enhancements, including some of those identified in Section 3.2. The decision to move forward even in the possible absence of some enhancements is based on evaluation schedule imperatives as well as the possibility for additional, continuing delays in the deployment of certain enhancements.

# 4.0 Evaluation Approach

## 4.1 Overview

The development of the evaluation approach has been a collaborative process among U.S. DOT, Battelle, and the Local Evaluator. As the evaluation work unfolded, the team found it necessary to revise some aspects of the evaluation identified in the original SOW, due to deployment schedule delays and to limitations to evaluation funding. The following sections discuss the original statement of work and subsequent revisions.

### 4.1.1 Key Elements of the National Evaluation Statement of Work

The Statement of Work for the National Evaluation identifies the following purposes:

- Document how the model deployment was implemented, including system costs and how technical and institutional (especially cross-modal and interstate) issues were resolved.
- Provide an independent review of the performance of the model deployment.
- Deliver lessons learned to other 511 system development and deployment efforts.

The following key directors of the Statement of the Work have shaped the proposed evaluation strategy:

- Evaluate the conformity of the model deployment to the objectives of the Request for Participation.

- Conduct a before-after analysis of the following attributes of the model deployment:

    - Performance (e.g., system down-time/availability)
    - Operation (e.g., system information content, data entry/capture, etc.)
    - Usage
    - Cost

- Collect data on post-enhancement performance, usage, user satisfaction, costs and transportation system impact for a period of one year after enhancement completion, in order to obtain trends over a twelve-month period relative to the baseline.

- Document technical and institutional processes and issues. Summarize the institutional process of the model deployment (especially cross-modal and interstate coordination), the technical features of the model deployment, schedule of deployment, the information sources incorporated, lessons learned, issues raised, and means of resolving issues.

- Include in usage measurements call volumes, length, menu selections (especially by mode), and mobile versus landline connections. Trends in usage will be highlighted and measures will be compared for the same season/month of consecutive years.

- Differentiate ***service-customer categories*** (i.e., market segments) at a minimum to include: through-travelers, commuters, other local travelers, and long-distance travelers.

- Differentiate by ***trip purpose***, e.g., business, commercial and recreational and to the extent possible, by trip destination (e.g., central business district, airports, tourist attractions, etc.).

- In the cost analysis, consider unit costs as well as system costs and will be informed by Cost Data Collection Guidelines and ITS Integration Program Unit Cost Collection Guidelines (http://www.its.dot.gov/eval/evalguidelines.html).

The system impact (before-after) analysis will not include customer satisfaction, that is, only a post-enhancement customer survey will be conducted. No adequate baseline customer satisfaction data currently exists and project resources are insufficient to support a baseline customer satisfaction survey. As described further below, an additional customer satisfaction analysis is proposed as an optional activity requiring additional funding: post-enhancement 511 user focus groups. Pre-enhancement focus groups were conducted by ADOT as part of the project design process and the results were well documented.

### 4.1.2 Overview of Evaluation Tasks and Phasing

The statement of work called for the evaluation to be conducted in three phases as described below.

Completion of the Phase I activities have been delayed due to uncertainties regarding the scope and scale of many of the enhancements, a result of a longer than anticipated planning and design process. Section 5.0 of this document lays out the proposed evaluation schedule. Delays in completing Phase I evaluation planning are not expected to jeopardize the completion dates for Phases II or III.

**Phase I- Evaluation Planning and Baseline Data Analysis**

Phase I consists of the initial planning for the national evaluation and the analysis of baseline (pre-Model Deployment enhancements) data. Phase I evaluation planning activities include development of this high-level Evaluation Strategy, an Evaluation Plan, and more detailed Test Plans describing individual evaluation analyses. The baseline analysis conducted in Phase I will serve as a reference to the process of creating the enhanced system and the change in performance of the enhanced system.

**Phase II- Enhancement Process Study**

Phase II consists of the model deployment enhancement process study. This includes completion of the baseline collection and analysis (regarding any significant updates to the baseline system between Phase I and completion of enhancements). Phase II also includes collection of data on management and deployment processes and issues during deployment of the enhanced system.

**Phase III – Post Enhancement Performance and Costs Study**

Phase III concludes the national evaluation of the 511 model deployment with completion of the post-enhancement performance and costs study. This includes collection and analysis of post-enhancement system cost, operation, usage, user satisfaction and transportation-system impact. Data collection on post-enhancement performance and costs shall extend for one year after enhancement completion, in order to obtain trends over a twelve-month period relative to the baseline.

### 4.1.3 Coordination with the Local Evaluator

Dr. Hickman of the University of Arizona, who is conducting the Local Evaluation on behalf of the partners, is also a participant in the 511 Evaluation Panel, an adjunct activity to the model deployment evaluation that is led by Battelle and Volpe. The National Evaluation Team is coordinating very closely with Dr. Hickman. A kick-off meeting was held in October 2002 to review overall evaluation issues, possible approaches, and a rough division of labor. Since that time the national and local evaluators have continued to coordinate, including participation in (and debriefing with one another following) each of the ADOT 511 Task Force meetings (i.e., 511 model deployment project meetings) and regular teleconferences with ADOT 511 contacts to discuss deployment status and evaluation data collection.

Both the national and local evaluators will be involved in all aspects of the evaluation, including providing input to approaches, reviewing draft results, providing input to documentation, etc., and the open and frequent communication between the teams will continue. However, in order to leverage evaluation resources, a general division of labor has been identified between the national and local evaluators, in terms of lead versus support roles for various evaluation activities.

Dr. Hickman will take the lead role in evaluating system performance and usage. The rationale for this assignment lies in Dr. Hickman's access to relatively inexpensive student research assistants and the ability to cost-effectively collect, reduce and analyze large system data sets. Battelle has been very involved in setting the direction for these efforts and will continue to work closely with Dr. Hickman in these areas. Battelle will lead the other areas of evaluation described below, with support and input from Dr. Hickman.

## 4.2 Evaluation Goals, Objectives and Hypotheses

The development of evaluation goals, objectives and hypotheses takes into consideration both ITS goal areas of national interest (safety, mobility, efficiency, productivity and economic vitality, customer satisfaction, and energy and the environment) as well as the goals, objectives and likely impacts identified by the partners. As discussed in Section 3.3, Expected Benefits, the 511 model deployment partners are focused primarily on the short-term objectives of improving the quality of the system and thereby improving customer satisfaction and usage. They are also interested in documenting lessons learned.

Figure 9 is a high-level illustration of the major areas of partner activity (the top row in the figure) and the potential impacts of the 511 Model Deployment, beginning with more immediate impacts at the top. The evaluation will focus on those impacts where meaningful findings are most likely, which include customer satisfaction and usage, both in terms of the volume of 511 calls and how travelers use the information. The evaluation will not directly measure safety, roadway efficiency (i.e., throughput), energy and the environment, or productivity and economic vitality impacts. These areas are not the immediate focus of the partners, it is not likely that system usage will reach sufficient levels to influence these factors, and it would be very hard to control for the influence of other variables on these factors.

Table 2 presents evaluation goals and associated objectives, hypotheses, measures and data collection methods/sources. Table 2 is organized according to the national ITS evaluation goal areas. Table 2 presents hypotheses at a very disaggregate, detailed level, for the purposes of illustrating traceability to specific data types and sources. A more concise, higher level summary of key hypotheses is as follows:

- The addition of a number of types of new data to the 511 system will contribute to increased usage and customer satisfaction.
- Users will view the information available on the 511 system as comprehensive and multi-modal.
- Usage of the 511 system will increase as a result of enhanced marketing.
- Enhancements to the user interface, including voice recognition, segment-based reporting, and "Quick Reports" will contribute to improved customer satisfaction.
- The addition of transit information, downtown Phoenix information, and a top level menu selection for the Grand Canyon will promote mobility and access.
- Providing users with arterial street travel times will allow them to avoid congestion and reduce travel time and travel time variability.
- System efficiency will be improved by increasing the number of phone lines, implementing new arterial street data capture methods, and enhanced data entry training and quality control.

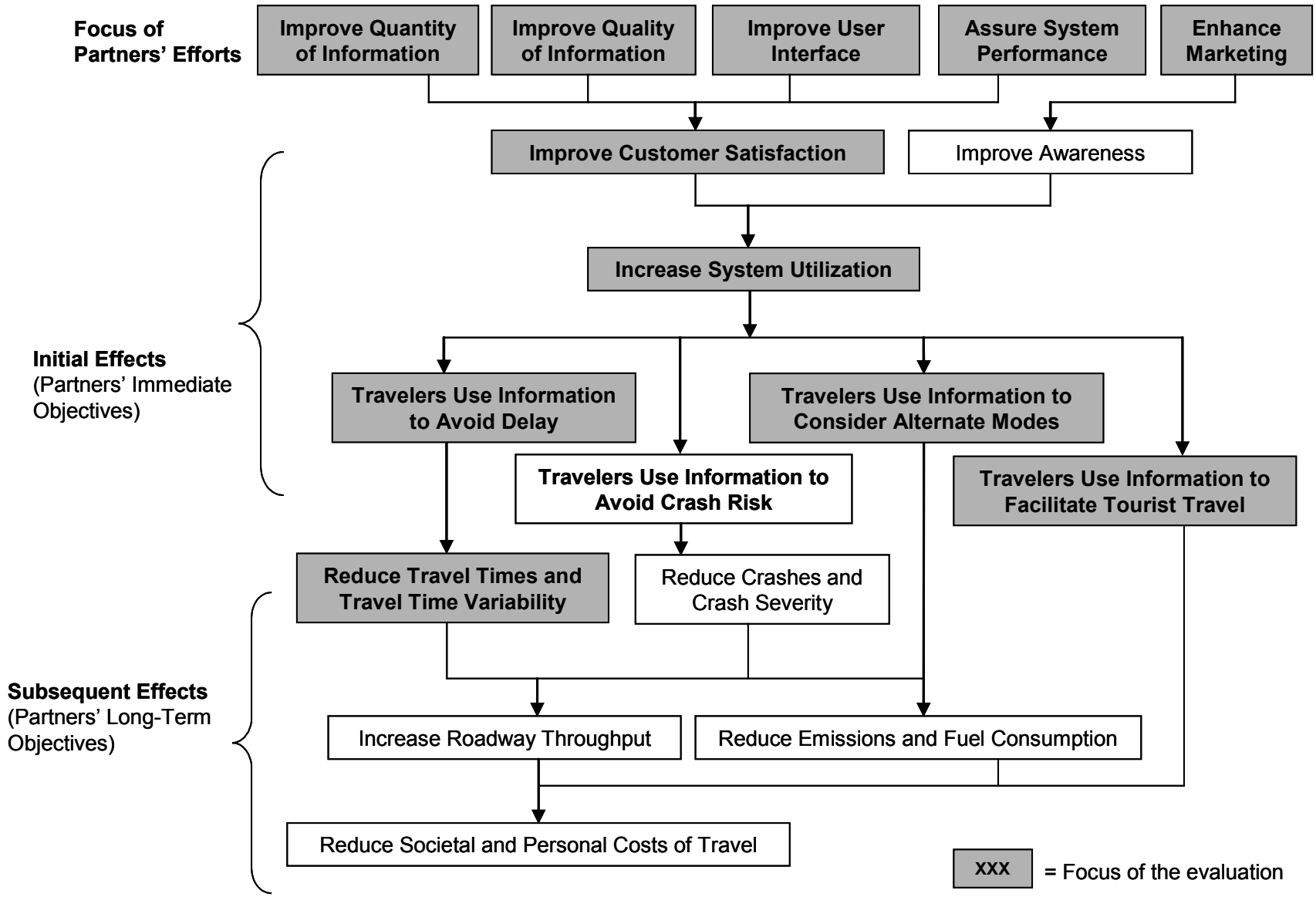


**Figure 9. Impacts Trace**

**Table 2**
**Objectives, Hypotheses, Measures and Data Collection Methods**

| National ITS Goal Area | Objective | Hypothesis | Measure/Surrogate Measure | Data Collection Method/Source |
|---|---|---|---|---|
| Customer Satisfaction | Improve usage and customer satisfaction by increasing the ***quantity*** of information. | The addition of arterial street travel time information will contribute to increased use of 511 and customer satisfaction. | • Number of arterial street inputs to the system, including travel times and incidents/delay.<br>• Overall usage of arterial street menu selections.<br>• Most common other menu selections by users who make arterial street menu selections.<br>• Percent of all callers and percent of new callers accessing primarily arterial street menu selections.<br>• 511 users' perceptions of the usefulness of arterial street information, including impact on their travel behavior or attitudes. | • HCRS system input data<br>• 511 system usage data (log files)<br>• Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |
| | | The addition of airport information will contribute to increased use of 511 and customer satisfaction. | • Number of airport related inputs to the system.<br>• Overall usage of airport menu selections.<br>• Most common other menu selections by users who make airport menu selections.<br>• Percent of all callers and percent of new callers accessing primarily airport information.<br>• 511 users' perceptions of the usefulness of airport information. | • System input data<br>• 511 system usage data (log files)<br>• Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |

**Table 2**
**Objectives, Hypotheses, Measures and Data Collection Methods**

| National ITS Goal Area | Objective | Hypothesis | Measure/Surrogate Measure | Data Collection Method/Source |
|---|---|---|---|---|
| | | The addition of transit service disruption and estimated bus arrival times will contribute to increased use of 511 and customer satisfaction. | • Number of transit related inputs to the system.<br>• Overall usage of transit menu selections.<br>• Most common other menu selections by users who make transit menu selections.<br>• Percent of all callers and percent of new callers accessing primarily transit information.<br>• 511 users' perceptions of the usefulness of transit information. | • System input data<br>• 511 system usage data (log files)<br>• Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records<br>• Transit center call volume data |
| | | The addition of information on Utah will contribute to increased use of 511 and customer satisfaction. | • Number of Utah inputs to the system.<br>• Overall usage of Quick Reports and roadway segment menu selections that contain Utah information.<br>• Most common other menu selections by users who select options that contain Utah information.<br>• Percent of all callers and percent of new callers accessing menu selections that contain Utah information.<br>• 511 users' perceptions of the usefulness of Utah information. | • System input data<br>• 511 system usage data (log files)<br>• Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |

**Table 2**
**Objectives, Hypotheses, Measures and Data Collection Methods**

| National ITS Goal Area | Objective | Hypothesis | Measure/Surrogate Measure | Data Collection Method/Source |
|---|---|---|---|---|
| | | The addition of segment weather reports for travelers will contribute to increased use of 511 and customer satisfaction. | • Number of weather inputs to the system.<br>• Overall usage of Quick Reports and roadway segment menu selections that contain weather information.<br>• Most common other menu selections by users who select options that contain weather information.<br>• Percent of all callers and percent of new callers accessing menu selections that contain weather information.<br>• 511 users' perceptions of the usefulness of weather information. | • System input data<br>• 511 system usage data (log files)<br>• Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |
| | | The addition of downtown Phoenix special event and parking information will contribute to increased use of 511 and customer satisfaction. | • Number of downtown Phoenix inputs to the system.<br>• Overall usage of menu selections that contain downtown Phoenix information.<br>• Most common other menu selections by users who select options that contain downtown Phoenix information.<br>• Percent of all callers and percent of new callers accessing menu selections that contain downtown Phoenix information.<br>• 511 users' perceptions of the usefulness of downtown Phoenix information. | • System input data<br>• 511 system usage data (log files)<br>• Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |
| | | Users will view the information available on the 511 system as comprehensive and multi-modal. | • 511 user perceptions. | • Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |

**Table 2**
**Objectives, Hypotheses, Measures and Data Collection Methods**

| National ITS Goal Area | Objective | Hypothesis | Measure/Surrogate Measure | Data Collection Method/Source |
|---|---|---|---|---|
| | Increase usage and customer satisfaction by improving the ***quality*** of information. | Users will view the information available on the 511 system as accurate. | • 511 user perceptions. | • Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |
| | Increase usage and customer satisfaction through ***enhanced marketing***. | Usage will increase as a result of installation of static road signs. | • 511 usage by date and route.<br>• Date of installation of signs by location.<br>• 511 user awareness and perceptions of the impact of new signs. | • 511 system usage data (log files)<br>• ADOT records on sign installations<br>• Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |
| | | Usage will increase as a result of radio and television advertising. | • 511 usage by date.<br>• Timing of radio and television ads.<br>• 511 user awareness and perceptions of the impact of radio and television advertising. | • 511 system usage data (log files)<br>• ADOT records on television and radio ads (dates, content, channels)<br>• Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |

**Table 2**
**Objectives, Hypotheses, Measures and Data Collection Methods**

| National ITS Goal Area | Objective | Hypothesis | Measure/Surrogate Measure | Data Collection Method/Source |
|---|---|---|---|---|
| | | Usage will increase as a result of VMS advertising. | • 511 usage by date.<br>• Timing and location of VMS messages.<br>• 511 user awareness and perceptions of the impact of VMS message postings. | • 511 system usage data (log files)<br>• ADOT records on VMS advertising<br>• Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |
| | | Usage will increase as a result of other marketing. | • 511 usage by date.<br>• Timing and location of other marketing strategies.<br>• 511 user awareness and perceptions of the impact of other marketing strategies. | • 511 system usage data (log files)<br>• ADOT records on other marketing<br>• Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |
| | Improve usage and customer satisfaction by improving the ***user interface***. | Users will find the menu structure easy to use. | • 511 user perceptions of ease of use. | • Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |
| | | Voice recognition will be viewed as a convenient user interface. | • 511 user perceptions of ease of use. | • Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |

**Table 2**
**Objectives, Hypotheses, Measures and Data Collection Methods**

| National ITS Goal Area | Objective | Hypothesis | Measure/Surrogate Measure | Data Collection Method/Source |
|---|---|---|---|---|
| | | Users will find the synthesized speech information intelligible. | • 511 user perceptions. | • Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |
| | | Segment-based and regional/sub-regional "Quick Reports" will be viewed as convenient. | • 511 user perceptions. | • Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |
| Mobility | Help travelers reduce travel times by identifying roadways with conditions that create unusually long travel times, and providing estimates of point-to-point travel times for four parallel arterial streets in north Phoenix. | Travelers will be able to avoid routes with non-recurring congestion, thus reducing travel time and travel time variability. | • 511 users' perceptions of the impact of the information on their travel decisions and travel times.<br>• Individual callers' menu selections of alternate routes after hearing a longer than usual travel time (which would suggest that they are looking for a faster route). | • Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records<br>• ADOT reported arterial street travel time data files (system inputs)<br>• 511 system usage data (log files) |

**Table 2**
**Objectives, Hypotheses, Measures and Data Collection Methods**

| National ITS Goal Area | Objective | Hypothesis | Measure/Surrogate Measure | Data Collection Method/Source |
|---|---|---|---|---|
| | Facilitate access to the Grand Canyon and downtown Phoenix special events. | Moving Grand Canyon travel information to the top-level menu and adding information on downtown Phoenix special events and parking will facilitate access to these destinations. | • Number and timing of Grand Canyon and downtown Phoenix special event and parking information inputs to the system.<br>• Overall usage of Grand Canyon and downtown Phoenix special event and parking menu selections.<br>• Percent of all callers and percent of new callers accessing primarily Grand Canyon and downtown Phoenix special event and parking menu selections.<br>• 511 users' perceptions of the usefulness of Grand Canyon and downtown Phoenix special event and parking information. | • System input data<br>• 511 system usage data (log files)<br>• Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |
| | Enhance consideration of transit as an alternate mode choice. | Increases in 511 usage will expose more travelers to transit information who would not normally consider transit, thus increasing their consideration of transit as an alternate mode. | • Total 511 call volumes and call volumes for transit content.<br>• Percent of callers accessing transit information.<br>• 511 users' perceptions of the impact of transit information on their consideration of transit as an alternate mode. | • 511 system usage data (log files)<br>• Survey of 511 users.<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |
| | | Increased marketing of 511 as a source of multi-modal information, including transit, and/or increased marketing aimed at transit users, will increase the use of 511 for transit information. | • Extent of ADOT 511 marketing emphasizing multi-modal content.<br>• Extent to which ADOT 511 marketing strategies target transit users.<br>• Percentage of 511 callers that select transit menu options in relation to the timing of specific marketing strategies. | • ADOT marketing materials and strategy documents<br>• 511 system usage data (log files) |

**Table 2**
**Objectives, Hypotheses, Measures and Data Collection Methods**

| National ITS Goal Area | Objective | Hypothesis | Measure/Surrogate Measure | Data Collection Method/Source |
|---|---|---|---|---|
| Efficiency | Maintain acceptable system availability. | Doubling phone line capacity and the implementation of call waiting will assure a high level of system availability. | • Incoming line utilization statistics.<br>• Call waiting statistics.<br>• User perceptions of system availability. | • ADOT VRAS system data<br>• Survey of 511 users<br>• 511 user focus groups (optional)<br>• ADOT 511 caller comment records |
| | | Improved VRAS server and HCRS server reliability will improve system availability. | • HCRS and VRAS server mean system down time.<br>• Perceptions of ADOT VRAS and HCRS technical staff. | • ADOT HCRS and VRAS system data<br>• Interviews with ADOT technical staff<br>• ADOT 511 caller comment records |
| | Minimize the number of incomprehensible caller inputs. | A good menu structure, intelligible system speech and a good voice recognition system will keep the number of incomprehensible caller inputs to a minimum. | • Number and percentage of occurrences when the system cannot interpret a user's entry (before and after for keypad; after only for voice). | • VRAS system logs |
| | Increase the effectiveness of capturing arterial street incident data. | Having ADOT Traffic Operations Center Staff monitor law enforcement scanners will increase the amount of arterial street traffic information. | • Arterial street related inputs made by ADOT TOC staff.<br>• ADOT TOC HCRS operators and supervisors perception of the effectiveness of the strategy. | • System input data<br>• Interviews with ADOT TOC HCRS operators and supervisors |

**Table 2**
**Objectives, Hypotheses, Measures and Data Collection Methods**

| National ITS Goal Area | Objective | Hypothesis | Measure/Surrogate Measure | Data Collection Method/Source |
|---|---|---|---|---|
| | | Providing Tucson area agencies the ability to enter information to 511 will increase the amount of Tucson area information. | • Number and timing of inputs by Tucson area agencies.<br>• Tucson area agency HCRS operators and supervisors perceptions of the strategy. | • System input data<br>• Interviews with Tucson area agency HCRS operators and supervisors |
| | | Increased training of HCRS operators, refinement of landmarks and terminology used in HCRS, and enhanced on going monitoring of data quality will result in more effective data entry, with fewer inaccurate and duplicative entries. | • Increase in number of hours of HCRS operator training.<br>• Information content in HCRS operator training sessions.<br>• Number and type of additions to HCRS operator and supervisor user manuals.<br>• Implementation of new procedures on the part of HCRS operators and supervisors.<br>• HCRS operators and supervisors' perceptions of the effectiveness of new procedures in improving timeliness and accuracy of entries.<br>• Timing of HCRS entries in relation to actual events (e.g., planned events and major incidents). | • HCRS operators and supervisors manuals and training materials.<br>• Interviews with HCRS operators and supervisors and staff responsible for developing and implementing training and revisions to manuals. |

## 4.3 Evaluation Test Plans

Evaluation analyses have been organized into individual "tests", with each test focusing on particular types of data. The tests and their relationship to the major focal points of national Intelligent Transportation System (of which 511 systems are an example) evaluations are shown in Table 3. In addition to these formal tests, a cost analysis will be performed and various other types of supporting data will be collected and utilized to aid in the interpretation of test results and to identify management and deployment issues and lessons learned.

**Table 3**
**Evaluation Tests**

| | **Tests** | | |
|---|---|---|---|
| **Analysis Area** | **Usage Logs[(1)]** | **User Survey** | **Key Informant Interviews** |
| Customer Satisfaction | **X** | **X** | |
| Mobility | **X** | **X** | |
| Efficiency | **X** | **X** | **X** |
| Management and Deployment Issues | | | **X** |

(1) The analysis of system usage will include consideration of system data content (inputs from the various agencies that supply data to the system) and the reliability (e.g., system downtime) and availability (phone line utilization) of the system.

Table 4 identifies the general division of responsibilities for the evaluation activities between Battelle and the Local Evaluator, Dr. Mark Hickman of the University of Arizona. Designation of Dr. Hickman as the lead in certain areas is based on his interests and availability of lower cost student researchers who can assist with data reduction. For each test, activities will be very closely coordinated between Battelle and Dr. Hickman to ensure that all evaluation needs are met.

**Table 4**
**Evaluation Lead and Support Roles by Evaluation Activity**

| **Evaluation Team** | Usage Logs Test | User Survey Test | Key Informant Interviews Test | Cost Analysis |
|---|---|---|---|---|
| Battelle | Support | **Lead** | **Lead** | **Lead** |
| University of Arizona | **Lead** | Support | Support | Support |

Each of the three test plans will be developed in detail and documented in the Detailed Test Plan documents, which will follow this Evaluation Plan. Each of the Detailed Test Plans will include a schedule; approach, including overall test strategy, data collection methods, analysis methods and key supporting conditions and equipment needed to conduct the test; a description of pre-test activities, test activities, and post-test activities; data requirements; a data analysis plan; report format and expected contents; and estimated resources required to complete the test.

Mitretek, who provide oversight support to the FHWA for this evaluation, also have significant experience and expertise in the area of ITS costs and benefits, and the evaluation team will work very closely with them on the cost analysis. The approach to the cost analysis is being documented through memoranda.

The sections below summarize the approach to the three evaluation tests and the cost analysis.

### 4.3.1 Usage Logs Test

The Usage analysis consists of three main components. The primary component of the test consists of the analysis of 511 system usage data itself, which consist of VRAS server log files, and in the case of the baseline analysis, electronic phone bill records. The two secondary components of the Usage test focus on data and issues that provide context to the interpretation of the usage data. Those secondary, supporting components include an analysis of agency data inputs to the 511 system, and the performance of the 511 system itself, in terms of system downtime and phone line availability/utilization. The test plan will identify the approach for all three aspects of the Usage analysis. Those approaches are summarized in the sections that follow.

**Usage Data - Analysis**

Utilization of the 511 system will be documented in detail and utilization will be compared pre- and post-enhancement. The results of this analysis will contribute to the testing of a number of hypotheses associated with various Customer Satisfaction and Mobility objectives.

In the case of Customer Satisfaction, the partners' intend to increase customer satisfaction and usage by adding a variety of new types of information (airport, arterial streets, downtown Phoenix, transit, etc.) and by enhancing their 511 marketing efforts. This test will document changes in overall 511 system usage and the contribution of these various new information types to those changes. An attempt will be made to differentiate new users of the 511 system (those who did not use the system before the model deployment enhancements) from existing users.

In the case of mobility, users selections of specific menu item combinations will be investigated as suggestive of arterial street travel time savings. Specifically, we will be looking for cases where, after hearing a travel time for one of the four parallel arterial

streets that is significantly longer than usual, the user then selects one of the other parallel routes and finds a significantly shorter travel time. Such a pattern would be suggestive of alternate route utilization and travel time savings. Usage data will also be used to investigate Mobility related objectives to facilitate consideration of transit and access to the Grand Canyon and to and through downtown Phoenix.

In addition to testing the specific hypotheses from Table 2, the analysis of system usage data will also explore issues that are expected to contribute to lessons learned in the Management and Deployment Issues area. First, the analysis of usage data will consider various user submarkets, including cell phone versus wireline callers, commuters versus recreational travelers, and will consider average call durations. This analysis will investigate a number of different theories regarding what types of users are most interested in what types of information. For example, it is expected that arterial street travel time information will be of greatest interest to local commuters, but it is unclear whether users will tend to access the information before starting their trip, from home or work (which would be suggested by a high percentage of landline calls) or en-route (which would be suggested by a high percentage of cell phone calls).

The usage analysis will also examine menu selection combinations, overall, and how they relate to user submarkets. For example, to help determine the extent to which Grand Canyon information is accessed pre-trip versus at some point en-route, the selections before and after the Grand Canyon menu selection will be examined. The identification of popular chains of menu selections could also be an aid to ADOT and other 511 deployers in menu design, both in determining the placement of various types of information within the menu structure and grouping information by regions (e.g., the Quick Report concept in the model deployment).

Another planned area of investigation that may provide lessons learned is the analysis of "incomplete calls", that is, calls where the user hangs up before receiving any complete traveler advisories (with the exception of the top level "broadcast message", which if present, will not avoidable). Understanding how many call the system but hang up before getting information may help shed light on the percentage of wrong numbers, or callers who were expecting something completely different, as well as a potential indicator of caller frustration with the menu structure.

**Usage Data - Sources, Availability, Formats, and Sampling and Collection Methods**

There are two primary usage data types and sources. VRAS log files preserve every single menu selection of every phone call to the system, along with time and date. The Local Evaluator has begun working with several server log files, which are unformatted text files, and is developing text parsing and data reduction routines. The second source of usage data are electronic phone bill records. These records provide caller identification information which is not included in the VRAS logs and which are expected to provide a means of distinguishing wireline from cell phone calls, and wireline caller geographic location. The evaluation team is working with ADOT to attempt to capture, in the post-enhancement VRAS log files, a wide range of caller

identification information, including ten-digit caller ID, as well as information that would allow for the differentiation of wireline and cell phone calls and geographic location. If that information is not available, then phone bill records will be used, as is being done in the baseline.

VRAS log files are not available for approximately 6 months of the 12-month baseline comparison year, which would be November 2002-October 2003. ADOT inadvertently overwrote the log files for the period January 2003-June 2003. The determination of exactly which months of data will be compared to which (before-after) will be made once all available data is collected and reviewed. Only appropriate comparisons, those that take into account seasonal effects, will be made. Unfortunately, use of the prior year's baseline data (November 2001-October 2002) is limited because ADOT converted from their ten-digit number to 511 during this period (March 2002). Call volumes increased dramatically, from about 7,000 calls per month to about 20,000 calls per month, during "baseline" periods (i.e., not during winter storms, large wildfires, or other large scale events).

**Usage Data - Pre-, Test, and Post-Test Activities**

Pre-test activities consist of discussions with ADOT to identify data needs, ensure data preservation and to identify data formats and data collection procedures; and investigation of data sources and data reduction and analysis methods, for example collecting sample phone bills, investigating ways to differentiate cell phone callers, and developing VRAS log file text parsing routines. These activities have been underway for several months. Test activities consist of collecting the before and after data. Baseline data collection is occurring now and is expected to be complete in August 2003. Baseline data analysis is scheduled to be complete in September 2003 and the preliminary baseline data findings will be documented in the Interim Analysis Report, to be completed in draft form in October 2003. Post-test activities will consist of utilizing the results of this test in documenting evaluation results in the Efficiency area.

**Agency Data Inputs**

Documenting what sorts of information is entered into HCRS (by whom, in what quantity, and in what general patters) and which is therefore available through the 511 system, provides part of the context necessary for interpreting both usage analysis results, and the results of the user survey. For example, knowing that little or no information of a certain type was available on the system at a certain time could help explain a low number of user menu selections for that type of information.

This analysis will compare information entered into the 511 system before and after the model deployment enhancements. The change in the volume of information of various types entered by various agencies will be identified. This comparison will contribute to testing of hypotheses and measuring progress toward objectives in several goal areas, including:

- Customer Satisfaction – objectives related to increasing customer satisfaction by increasing the quantity of information available.

- Mobility – objectives related to enhancing access to downtown Phoenix special events, reducing travel times and travel time variability, and promoting the consideration of transit as an alternate mode.

- Efficiency – objectives related to improving the quality and quantity of information on the system through the capture of arterial street incident data and data for Tucson roadways.

In the case of Customer Satisfaction, increasing the variety and quantity of information on the system is a key objective intended to improve customer satisfaction and stimulate greater use of the system. The extent to which the proposed new and expanded data elements are successfully added to the 511 system will be evaluated through an analysis of before and after HCRS system data inputs. Other tests will address the extent to which the expanded data content may be correlated with system usage increases and customer satisfaction.

In the case of Mobility, the partners intend to improve the accessibility to downtown Phoenix destinations and travel through downtown by adding information to the system on downtown events (e.g, sports and cultural events) and parking. This test will evaluate the extent to which this information is included in the enhanced system, again using ADOT HCRS system inputs data records. Other tests will gauge the usage of the menu items pertaining to this new data and customer reactions. The potential for travelers to reduce their travel time and travel time variability depends on the availability of 511 information that will allow them to differentiate faster routes. This test will examine in detail the reported travel times for the four arterial streets that are featured in the Travel Time Trial. The analysis will search for specific time periods when one of the four reported travel times is significantly longer than usual, indicative of an incident. In the Usage Log Files Test, individual call menu selection patterns will be examined for these time periods to determine how many callers obtained travel time information on one or more of the other three alternate arterial routes after hearing the unusually long travel time report. Such usage patterns would suggest that users are able to use the information to avoid slower routes. Another aspect of Mobility that will be considered in this test is the extent to which providing information on transit will facilitate consideration of transit as an alternate mode.

In the case of Efficiency, the partners are implementing new procedures intended to improve capture of arterial street incident and Tucson roadway data. The analysis of data inputs performed in this test will evaluate to the extent to which those enhancements succeed in increasing the amount of this information entered in the system.

The primary sources of the data for this test are summary reports prepared by ADOT, and the detailed ADOT HCRS transaction records. The HCRS system preserves information showing the number, timing, type and source (which HCRS workstation) of all inputs to

the system. Baseline data has been requested and it appears that the necessary data will be made available. Post-enhancement data needs in this area have been discussed with ADOT and it appears that the necessary post-enhancement data will also be made available.

The specific format of both the before and after data is uncertain, and is pending current discussions with ADOT that are being led by the Local Evaluator, who will lead this test. To date, ADOT has made available before data in the form of summary reports in spreadsheet format, e.g., the number of HCRS entries by type (divided into approximately 20 categories, based on ITIS codes), by inputting workstation, by roadway, by month. The raw HCRS transaction records will be preferable to these summary reports and the evaluation team is engaged in discussions with ADOT to determine the availability of those detailed records. The only area where unavailability of these detailed records would jeopardize a test activity is in the area of arterial street travel times, where scrutiny of individual HCRS transactions is required.

One of the issues related to the after data is that not all of the new data available on 511 will be entered into HCRS. This data is expected to include data from Utah, bus arrival time estimates, segment weather reports, arterial data travel times and digital speech recordings (.WAV files), all of which will not be recorded in the HCRS transactions database. It is not yet certain exactly which data will bypass HCRS, as the partners are currently finalizing approaches in this area. It appears that transactions of these other data will be preserved using separate logs.

It is anticipated that all data for this test will be provided in electronic format, either in the form of spreadsheet, database or raw data files. It is expected that post-enhancement data will be provided on a monthly basis.

A full year of before and after HCRS transaction data will be obtained. The analysis year is expected to be approximately November-October (the model deployment enhancements are expected to be complete in November 2003). Baseline data is expected to be available for the November 2002 – October 2003 period.

**511 System Performance**

Analysis of the availability of the 511 system, a function of both server downtime and phone line capacity, will provide additional context for interpretation of both usage and user survey data. The analysis of 511 system performance will focus on evaluating the availability of the 511 system and the ability of the system to recognize user inputs, using VRAS and HCRS server log files. Maintaining acceptable system availability, that is, keeping the system open and available to callers, and keeping to a minimum the number of times that the system is unable to interpret a user input are Efficiency-related objectives.

This analysis will examine system availability from two perspectives, server downtime and phone line utilization, including call queuing (the enhanced system will include 24

lines of call waiting). Obviously, either down servers or a "full system", that is, no lines available, equate to system unavailability. The results of this test will be statistics showing how often the post-enhancement system is unavailable to users, cross-tabulated with the cause of the unavailability, including failure of either of two different types of servers (the HCRS server, which provides the data, or the VRAS server, which operates the phone system) or unavailability of phone lines. The latter will consider both absolute unavailability, e.g., a busy signal (all lines utilized, including the 24 line call queue) and the extent of utilization of call queuing, including the relative frequency of various levels of call queues and corresponding average wait times.

Four different levels of system unavailability will be considered:

- HCRS server down, but VRAS system operational
- VRAS server down
- System in "overflow" mode, that is, at least one call waiting in the queue
- System at absolute capacity (e.g., busy signal)

Of these conditions, VRAS server downtime and absolute system capacity are of greatest concern, since they completely deny users' access to information. HCRS server outages, while the VRAS server is still up, is the next most serious sort of system unavailability, since in these cases the VRAS system continues to report the last information that was made available to it before HCRS went down. For very short HCRS server outages this may not be of great concern, indeed, since the system normally refreshes once every 5 minutes, outages of less than 5 minutes would never result in VRAS information more than 10 minutes old (which would occur if HCRS went down immediately after a scheduled 5-minute refresh). For this reason the analysis will consider the duration of the HCRS outages. Of the four levels of system unavailability, overflow (queuing) is the least serious, but still of concern, since callers are unlikely to be willing to wait very often or very long.

In addition to testing hypotheses related to system availability, the analysis of phone line utilization data, which will attempt to identify utilization in relation to major traffic and weather occurrences, is also expected to contribute lessons learned in the Management and Deployment Issues area. Understanding the timing of unmet caller demand will help deployers in effectively sizing their systems' capacity.

In addition to gauging server availability, VRAS server log files will be used to compare before and after number and percentage of occurrences when the system is unable to interpret user keypad entries. After data on failures to recognize voice commands will also be examined.

Both types of data to be utilized in this test, server availability and phone line utilization, are available through ADOT server log files. The HCRS log records the incidence and timing of HCRS server outages. The VRAS log provides data showing phone line utilization, including how often all available lines are utilized and how often various amounts of call queuing occur.

The analysis of server outages will focus exclusively on the post-enhancement period because baseline data is not available. Aside from incomplete anecdotal information from ADOT technical staff, there is no information available on pre-enhancement HCRS and VRAS server outages.

The analysis of phone line utilization will feature before and after comparisons. ADOT is building in the ability to collect detailed reports on phone line utilization and these will be made available post-enhancement. Baseline data is available but will require significantly more effort to derive. No explicit records of phone line utilization are maintained, but the VRAS server log files, which capture each keystroke of each call, do identify the line number that the call came in on, which provides a reasonable surrogate measure of phone line utilization.

Post-enhancement data is expected to be available for every month of the one-year operation period (November 2003-October 2004). Baseline data is constrained on two counts. First, given the effort required to derive phone line utilization, a sampling procedure will be utilized. For example, a few weeks of data will be derived for several different seasons of the year. Second, VRAS log files are not available for approximately 6 months of the 12-month baseline comparison year, which would be November 2002-October 2003. ADOT inadvertently overwrote the log files for the period January 2003-June 2003. The determination of exactly which months of data will be compared to which (before-after) will be made once all available data is collected and reviewed. Only appropriate comparisons, those that take into account seasonal effects, will be made. Unfortunately, use of the prior year's baseline data (November 2001-October 2002) is limited because ADOT converted from their ten-digit number to 511 during this period (March 2002). Call volumes increased dramatically, from about 7,000 calls per month to about 20,000 calls per month, during "baseline" periods (i.e., not during winter storms, large wildfires, or other large scale events).

Sample VRAS log files have been provided to the Local Evaluator who has initiated data reduction. These log files are text files with no fixed format, so some text file parsing is required to derive useful data.

The specific format of baseline and post-enhancement HCRS server log files is unknown, as the evaluation team has not yet received these files from ADOT. They are expected to be available in an electronic format. The specific format of the post-enhancement phone line utilization data is not known, although it is expected to be in the format of detailed reports and will not require the data reduction necessary to extract phone line utilization from the baseline data files. The evaluation team has provided their detailed data needs to ADOT and they have indicated that the requirements have been passed to their VRAS contractor.

It is expected that post-enhancement data will be collected at monthly intervals.

### 4.3.2 User Survey Test

**Analysis**

This is one of the most important tests of the evaluation. The results of this test will contribute to hypothesis testing in all of the goal areas: Customer Satisfaction, Mobility and Efficiency. User survey data will play a supporting role in the areas of Mobility and Efficiency, but is the focus of the Customer Satisfaction analysis. Users will be surveyed regarding their perceptions of the breadth of information available on the system (the many new types of information); the usefulness and accuracy of the information; the influence of the various enhanced 511 marketing activities; the ease of use of the system; including the menu system, intelligibility of the synthesized speech, and voice recognition capability; and users' perceptions of the influence of the information on their travel.

In the Mobility area, user survey data will include perceptions of the usefulness of 511 information in reducing travel times and travel time variability, facilitating access to the Grand Canyon and downtown Phoenix event venues, and facilitating consideration of transit as an alternative to travel by private vehicle. In the area of Efficiency, survey data will complement the assessment of system availability utilizing server data.

The user survey analysis will consider only the post-enhancement period. No existing information on customer satisfaction exists and, early in the planning process, the National Evaluation Team and the U.S. DOT COTM came to the conclusion that project resources are not sufficient to support a baseline survey.

The specific questions for the user survey will be developed as the Evaluation Plan and individual test plans are developed, and shaped by the preliminary system usage data. The development of the survey will be closely coordinated with the emerging "511 customer satisfaction core question set" under development by Battelle and Volpe with the 511 Evaluation Panel. Candidate areas of questioning included in the current draft National 511 core question set include the following:

Use of 511:
- How did you hear about 511?
- How many times have you called 511?
- How frequently do you access various types of information on 511?

Trips:
- For what types of trips do you consult 511?
- What kind of information are you looking for?
- When do you call 511 (pre-trip, en-route, etc.)
- What kind of phone do you usually call from (cell, payphone, etc.)?
- Do you consult other sources when planning or taking these trips?

Satisfaction:

- How satisfied are you with the information you've received from 511 (5-point scale, for each of a range of information types)?
- Please rate your level of agreement to each statement on a 5-point scale (various statements pertaining to accuracy, timeliness, coverage, interest in customizing information, etc, tailored for different information types, e.g., traffic, transit).
- What do you like best about 511?
- What do you like least about 511?
- Overall, how would you rate your satisfaction with 511 (5-point scale)?
- What benefits, if any, did you obtain from 511 (open response or prompted, such as "reduced travel time", "on time arrival", "improved safety", "peace of mind", etc.)?

Improvements to 511:

- If you could improve or add new features to 511, which would you find most useful (rank order 1-3).

About You and Your Travel Patterns:

- Are you (male/female)?
- How old were you on your last birthday?
- What is the zip code where you currently reside?
- What was the last level of school or college that you attended?
- Etc.

**Data Sources, Availability, Formats, and Sampling and Collection Methods**

The details of the survey methodology are currently being worked out in consultation with ADOT. A "call intercept" methodology (i.e., to break in on 511 calls) is preferred since this type of proactive recruitment tends to reduce the self-selection bias that often occurs when users are more passively recruited (e.g., through a pre-recorded message). Discussions are underway with ADOT on how such an intercept can be performed. During an intercept the caller would be asked to provide contact information so that the survey can be administered via a call back to the user at a time convenient for them.

The advantage of the follow-up approach, that is, performing the survey during a pre-arranged follow-up phone call rather than during the initial 511 call provides the opportunity to ask more questions than would be possible during the intercept itself. It is assumed that many 511 calls are made either en-route or immediately before trip departure, times when callers will not want to spend more than a couple of minutes on a survey. This assumption is supported by the findings of the focus groups conducted by ADOT as part of the menu redesign effort. Participants in the Phoenix focus group expressed an overall sense of urgency and preference for extreme brevity.

The user survey will be conducted in approximately September 2004, allowing for an adequate 9-month (December 2003-August 2004) system break-in period during which time users can become aware of the system and form opinions and sufficient time for data analysis and reporting. In finalizing the timing of the user survey, the following

information will be taken into consideration: the timing of specific marketing activities, 511 system usage (which will be monitored on an on-going basis once the enhancements have been completed) and season (e.g., 511 usage has traditionally been highest in Arizona during winter storm season, November – March, but may also increase during summer tourist season which peaks in July-August).

Necessary survey sample sizes will be determined as the User Survey Detailed Test Plan is developed. Unlike the other Detailed Test Plans, which will be developed in draft form in August 2003, the User Survey Detailed Test Plan will not be completed until March 2004, which will allow the survey development to be shaped in response to the preliminary system usage findings. One of the key issues that will be addressed is to what extent users of particular types of 511 information may be targeted, for example through intercepts conducted at different points in the menu system. This may be necessary in order to ensure input from users of what are expected to be the less frequently utilized menu selections, including transit and airports.

It is expected that the minimum sample size for the user survey will be 400-500. Analysis of user submarkets, e.g., transit information users, will require larger sample sizes, possibly as large as 1,000.

**Pre-, Test, and Post-Test Activities**

Pre-Test activities consist of development of the survey, including resolving issues with ADOT regarding a potential intercept methodology, identification of sample sizes, development of survey protocols and questions. The development of the survey will include pre-testing of the survey instrument although the pre-test may not feature call intercept recruitment. Development of the survey will take into account preliminary system usage data and the progress of the partners' marketing activities. Test activities will consist of conducting the user survey and basic data cleaning and formatting. Post-Test activities will consist of data analysis and reporting.

**Other Supporting Data Analyses**

Although not accommodated within the project budget, post-enhancement focus groups have been identified as a possible evaluation activity that, along with the user survey results, would address customer satisfaction. Although focus groups would be limited in size and therefore the results could not be generalized to the larger population, the results would shed additional light on user reactions to the 511 system. ADOT conducted focus groups in three cities throughout Arizona as part of the design of the 511 system. The results of those sessions would provide a comparison point for post-enhancement sessions.

Given budget constraints, it is unlikely that post-enhancement focus groups can be conducted; however the final decision has not been made. One scenario would feature the use of focus groups to pre-test the user survey, and therefore the decision on focus groups may depend on the final approach to user survey development.

Another data source that will be considered and which may augment the user survey results are 511 system caller comment records. In March 2003, ADOT added the caller comment feature to the 511 system, which allows callers to leave a voicemail message. Those calls are logged by ADOT in a spreadsheet and that data is being provided to the evaluation team. In addition to providing another means of gauging user reaction to the 511 system (although given the sample bias the results would not be generalizable), the caller comment logs may provide insights into user expectations and the impact of marketing. Review of some of the caller comments indicates that a fairly large percentage of the questions and comments reveal that the users did not understand the scope and purpose of the 511 system.

### 4.3.3 Key Informant Interviews Test

**Analysis**

Post-enhancement interviews with key informants will be used in the testing of Efficiency-related hypotheses and to support the analysis of Costs and Management and Deployment Issues. Within the Efficiency area, interviews with ADOT technical staff responsible for overseeing the operation of the HCRS and VRAS servers will complement the system data in the assessment of system availability. Interviews with ADOT Traffic Operations Center (Phoenix headquarters) HCRS operators and supervisors will complement the system input data in the assessment of improvements in the capture of arterial street data. Interviews with HCRS operators and supervisors at Tucson area agencies (ADOT District Offices, City of Tucson traffic, airport and transit) will help assess to the extent to which the model deployment is successful in making available more information on Tucson available. Interviews with HCRS operators and supervisors will also help assess the effectiveness of increased training and changes in data entry and verification procedures. Finally, interviews with various model deployment partners will be used to collect cost information (ADOT, primarily) and lessons learned, including challenges encountered and their resolution.

**Data Sources, Availability, Formats, and Sampling and Collection Methods**

Interviews with HCRS operators and supervisors, including those at the ADOT TOC and Tucson area agencies, will occur in approximately July 2004, long enough after the completion of enhancements to allow for system break-in and for the interview subjects to gain some perspective. Interview sessions will be broken into two parts, the first involving both the HCRS operators and the supervisors and the second involving only the supervisor. ADOT TOC interviews will be conducted primarily in person whereas Tucson agency interviews will be conducted primarily via telephone. The results of each interview session will be documented in a narrative report. The product of this test will be a report or report section that includes a summary of interview findings along with test conclusions.

The interviews conducted with model deployment partners for the purpose of identifying Management and Deployment Issues will focus on the partners' perceptions of the

successes and failures of the planning, design and operational phases of the deployment and on the various technical and institutional issues encountered and their resolution. In preparation for the partner interviews, a list of candidate issue areas for tracking will be developed, based on a review of 511 literature and any input from the National 511 Coalition. A "Technical and Institutional Issues" notebook will be created where all information will be filed. Issues will be organized into categories by project phase (e.g., planning/design, implementation, and operation) and major enhancement (e.g., Menu Redesign, Voice Recognition, Premium Service, etc.). Questions related to these various issue areas will be asked as warranted during regular meetings and other interactions with the partners throughout the evaluation period.

Model deployment partner interviews will include large group (10-20 participant) "lessons learned" debriefing sessions, and as necessary, additional follow-up, smaller, agency-specific sessions. The large group sessions will be conducted with the ADOT 511 Task Force, which includes all of the major partners. The first session will occur soon after the enhancements are completed and will focus on the planning and implementation process (approximately December 2003). The second session will occur mid-way through the one year of post-enhancement operations (approximately June 2004) and will focus on operations issues. The final session will occur immediately following the completion of the first year of post-enhancement operations (approximately November 2004) and will focus on operational issues and overall project lessons learned.

In addition to these large group sessions, it may be desirable to conduct some individual follow-up with some of the major partners, such as ADOT, City of Phoenix (traffic, airport and transit), City of Tucson and the private partner. Given the differing perspectives of the various partners the large group debriefings may inhibit some input that would be more freely extended in one-on-one settings. The need for such one-on-one sessions (either in-person or teleconferences) will be monitored and the final determination will probably not be made until after the large-group debriefings. If it appears that there are "sensitive" areas where certain partners appear to be inhibited, the necessary (brief) follow-on sessions will be conducted.

Prior to each of the large group debriefings, a list of candidate issues for discussion will be provided to the attendees. This list will include both the "typical" potential issues, as well as a summary of the issues encountered to date and their resolution, from the perspective of the evaluation team. The debriefings will provide an opportunity to verify and expand on those preliminary observations.

**Pre-, Test, and Post-Test Activities**

Pre-Test activities consist of development of the HCRS operator and supervisor interview questions. This activity will be based primarily on a review of ADOT written material documenting operator training and changes in HCRS entry and verification procedures, and a preliminary discussion with the ADOT staff member leading up this area of the deployment. For the deployment partners debriefing sessions and possible follow-up interviews, the Pre-Test activities consist of developing a list of candidate technical and

institutional issues for tracking and discussion. Test activities consist of conducting the interviews and debriefing sessions and summarizing and analyzing results. Post-Test activities consist of utilizing the test findings to develop conclusions, and documenting results in the Model Deployment Evaluation Report.

### 4.3.4 Cost Analysis

The cost analysis will be closely coordinated with Mitretek, who have considerable expertise and experience with national ITS cost and benefits analysis. This coordination will help ensure the results will be useful to other agencies and will be as consistent as possible with the National ITS Cost Database.

The costs analysis will attempt to document, as fully as possible, both Unit Costs and System Costs. The 2003 ITS Benefits and Costs document ("Green Book") provides examples of both Unit Cost and System Cost formats, and these will be used as a guide. Battelle will also review, and use as a guide, the January 2002 "Business Models and Cost Considerations for 511 Deployment" document, noting especially Section 6 (Cost Elements and Issues) and Attachment E (Cost Estimate for Data Collection and Data Processing for a 511 Traveler Information System).

Battelle will attempt to break costs down according to the enhancements described in Sections 3.1.1 - 3.1.15 of this Evaluation Plan. Several of these enhancements map directly to the ten "projects" that ADOT has divided the Model Deployment into, and for which they have issued individual work orders. Tracking costs for these should be straight-forward. However, several of the "enhancements" as identified in Section 3.1 are included, as pieces, in multiple ADOT "projects", which will make differentiation of costs more complicated.

In addition to generating both Unit Cost and System Cost data, and differentiating costs by individual 511 enhancement, the analysis will attempt to differentiate costs by deployment phase, e.g.:

- Design and development
- Implementation
- Operation

In addition to the costs borne by ADOT, an effort will be made to document costs incurred by other major partners that are directly related to the 511 Model Deployment. This will include the labor costs associated with HCRS data input.

The approach to the costs analysis was discussed with ADOT and cost data has been requested.

### 4.3.5 Marketing and Training Agency Records

ADOT records documenting 511 marketing activities and HCRS data input procedure changes (and operator training) will be collected and analyzed. Both pre-enhancement and post-enhancement data will be collected. This data will be used in conjunction with other data (usage, user survey and interviews) in testing hypotheses related to Customer Satisfaction (impact of marketing in increasing system usage), Mobility (impact of marketing in stimulating use of the system to access transit information) and Efficiency (enhancement of data entry through training and revised procedures).

HCRS operator and supervisor training will be collected from ADOT TOC and District Office staff. 511 marketing information will be collected primarily from ADOT, who is leading the marketing effort, as well as any other agencies that may take a role in marketing 511. This information will primarily be in the form of reports and other documentation, although some interviewing of agency personnel may be performed to further investigate issues not fully documented.

Baseline data has been requested from ADOT and the evaluation team has reviewed plans for post-enhancement data collection with them. It is expected that good baseline data will exist on HCRS operator and supervisor procedures but that information on marketing may be less comprehensive and more likely to require discussions. Post-enhancement documents will be collected as they become available over the months prior to completion of the enhancements (November 2003) and immediately thereafter.

## 4.4 Responsiveness to Key Statement of Work Directives

Table 5 indicates which evaluation analyses will address the various key directives from the evaluation statement of work (listed in Section 4.1.1).

**Table 5**
**Evaluation Plan Responsiveness to Key Statement of Work Directives**

| Key Directives from SOW | Usage Logs Test | User Survey Test | Key Informant Interviews Test | Cost Analysis |
|---|---|---|---|---|
| Evaluate conformity to RFP | X | X | X | |
| Before-After Analysis | X | | | X |
| One Year of "After" Data | X | | | X |
| Technical and Institutional Issues | X | X | X | X |
| Usage | X | X | | |
| Differentiate User Submarkets | X | X | | |
| ITS Cost Data Guidelines | | | | X |

# 5.0 EVALUATION MANAGEMENT PLAN

## 5.1 Overview

Battelle Memorial Institute under contract to U.S. DOT ITS Joint Program Office will lead the evaluation of the Arizona 511 Traveler Information System Model Deployment. Dr. Carol Zimmerman of Battelle is the evaluation team leader and is assisted by Mr. Matt Burt and Dr. Jeff Jenq of Battelle's Phoenix office. Dr. Zimmerman also manages Battelle's ITS Program Assessment Support (IPAS) contract with JPO and leads the Marketing subcommittee of the National 511 Coalition. Mr. Burt and Mr. Jenq both have considerable experience evaluating Federal ITS Integration Program funded projects under the IPAS contract. Dr. Chris Cluett will provide expertise in survey and focus group design and Dr. John Orban will provide expertise in statistical analysis. Figure 10 presents the organizational structure of the evaluation team.

Dr. Zimmerman will report to Ms. Jane Lappin of the Volpe National Transportation Systems Center, who is serving as U.S. DOT Contract Officer Task Manager for the evaluation. As evaluation leader, Dr. Zimmerman will have overall responsibility for the evaluation program and will assign responsibilities to Battelle evaluation team members.

Battelle is coordinating closely with the Local Evaluator, Dr. Mark Hickman of the University of Arizona, who reports to the lead partner (under an intergovernmental agreement), the Arizona Department of Transportation (ADOT). Mr. Tim Wolfe, Assistant State Engineer, is leading the 511 project for ADOT. Dr. Hickman will lead evaluation efforts in the areas of System Performance and Usage, supported by Battelle. Dr. Hickman will provide support to Battelle in the other evaluation areas (Customer Satisfaction, Cost, Technical and Institutional Issues, and Transportation System Impacts).

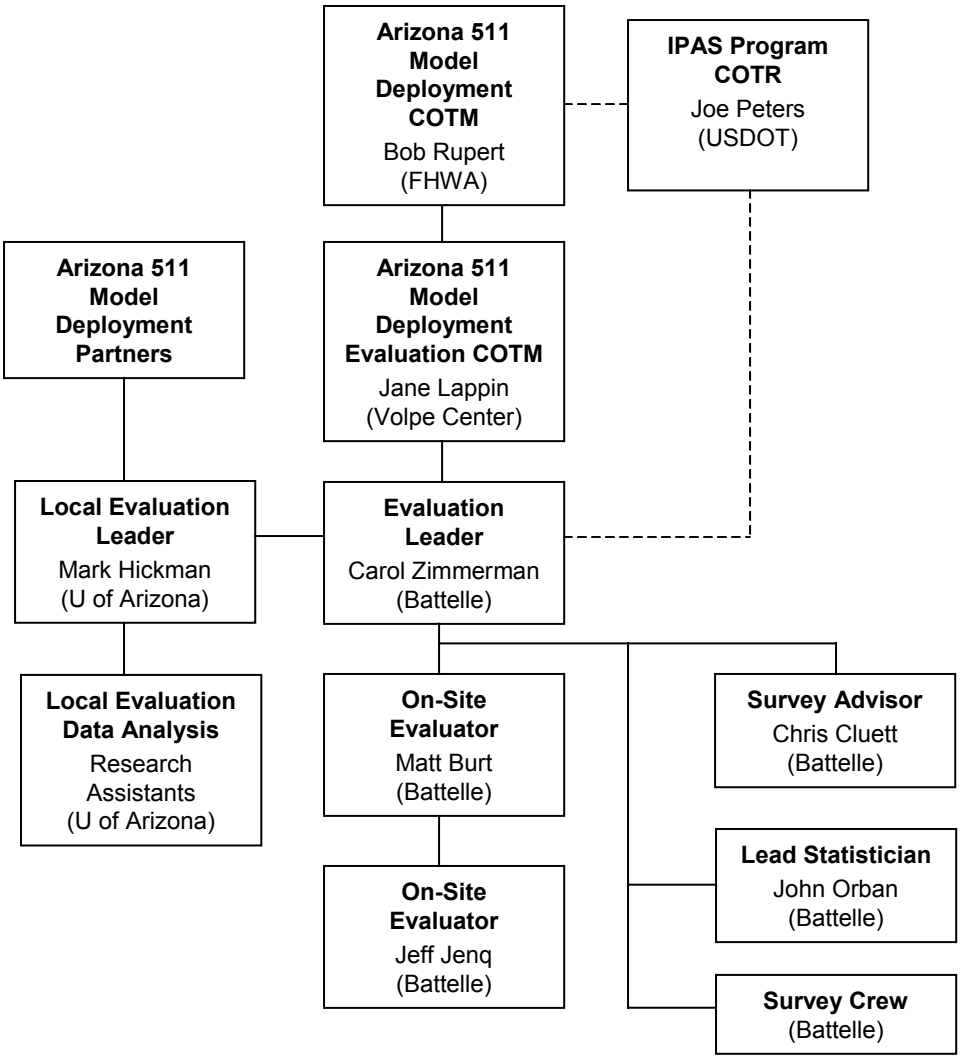


**Figure 10. Organization Chart**

## 5.2 Level of Effort

Table 6 indicates the hours allocated for Battelle personnel by evaluation activity.

**Table 6**
**Allocation of Team Member Hours to Evaluation Activities**

| Team Member | Role | Usage Logs Test [1] | User Survey Test [2] | Key Informant Interviews Test | Cost Analysis | Interim Analysis Report | Enhancement Process Briefing | Model Deployment Evaluation Report | Project Management and Miscellaneous Other Data Collection | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Carol Zimmerman | Evaluation Leader | 2 | 64 | 10 | 4 | 8 | 2 | 56 | 62 | **208** |
| Matt Burt | On-Site Evaluator | | 76 | 165 | 56 | 40 | 6 | 100 | 96 | **539** |
| Jeff Jenq | On-Site Evaluator | 86 | | 12 | | 22 | 4 | 40 | 2 | **166** |
| Chris Cluett | Survey Design | | 8 | | | | | 16 | | **24** |
| Ben Pierce | Statistician | | 48 | | | | | 20 | 2 | **70** |
| Survey Staff | Survey Data Collection & Coding | | 333 | | | | | | | **333** |
| Support Staff | Administrative and Clerical Support | | | | | | | 92 | 17 | **109** |
| **Total** | | **88** | **529** | **187** | **60** | **70** | **12** | **324** | **179** | **1,449** |

***Hours for individual tests/analyses reflect only test plan development and data collection. Analysis and reporting is reflected in the briefing and reports figures***.

[1] Includes analysis of agency data inputs and system performance.
[2] Includes analysis of caller comment logs.

## 5.3 Deliverables

Table 7 presents the high-level outlines of the contents of each of the four deliverable reports that will be produced following this Evaluation Report.

**Table 7**
**Deliverable Report Outlines**

| Deliverable Report | High-Level Outline of Contents |
|---|---|
| Detailed Test Plans | I. Introduction and Background<br>• Relevant Characteristics of the 511 Model Deployment<br>• Relevant Characteristics of the 511 Users<br>• Relevant Characteristics of the Transportation System<br>II. Test Plan Objectives, Hypotheses, and Key Supporting Conditions<br>III. Data Collection Sources and Methods<br>IV. Analysis Methods<br>V. Test Schedule<br>• Pre-Test Activities<br>• Test Activities<br>• Post-Test Activities<br>VI. Results Report Format and Contents<br>VII. Resource Requirements |
| Interim Analysis Report | I. Introduction and Background<br>II. Deployment Process and Status<br>III. Baseline Data Status and Observations<br>IV. Issues Encountered |
| Management and Deployment Issues Report | I. Executive Summary<br>II. Introduction and Background<br>• Model Deployment Overview<br>• Model Deployment Participants<br>III. Enhancement Process and Chronology<br>IV. Issues Encountered and Outcomes<br>• Funding and Cost<br>• Institutional System Users<br>• Public Users<br>• Hardware, Software and Functionality<br>• Vendors<br>• Other<br>V. Implications for Other Deployments |
| Model Deployment Evaluation Report | I. Executive Summary<br>II. Introduction and Background<br>• Model Deployment Description and Context<br>III. Evaluation Approach Overview |

**Table 7**
**Deliverable Report Outlines**

| Deliverable Report | High-Level Outline of Contents |
|---|---|
| | • Goals, Objectives and Hypotheses<br>• Analyses and Tests<br>• Data Collection Methods and Sources<br>• Analysis Methods<br>IV. Results<br>• System Performance<br>• Usage<br>• Customer Satisfaction<br>• Costs<br>• Transportation System Impacts<br>• Management and Deployment Issues<br>V. Summary of Key Findings, Conclusions and Implications for Other Deployments |

## 5.4 Evaluation Schedule

The schedule for the evaluation activities is identified in Table 8 and summarized graphically in Figure 11.

**Table 8**
**Evaluation Schedule**

| Evaluation Task/*Sub-Task* | SOW Schedule Relative to Deployment Milestones | Scheduled Completion Based on Current Deployment Schedule [1] |
|---|---|---|
| **Phase I** | | |
| Evaluation Strategy Briefing | Within 5 months of Notice to Proceed (2/1/03) | Completed June 25, 2003 |
| Evaluation Plan- Draft | | Completed Aug. 7, 2003 |
| Evaluation Plan – Final | | October 15, 2003 |
| Detailed Test Plans – Draft[2] | | October 15, 2003 |
| Detailed Test Plans – Final | | November 15, 2003 |
| Baseline Data Collection and Analysis | | October 31, 2003 |
| Interim Analysis Report – Draft | | November 15, 2003 |
| Interim Analysis Report – Final | | January 15, 2004 |
| **Phase II** | | |
| Conclude Baseline Data Collection and Analysis | Within 2 months of completion of 511 implementation (1/31/04) | February 28, 2004 |
| Conclude Documentation of Enhancement Process | | February 28, 2004 |
| Managerial and Deployment Issues and Lessons Learned Debriefing I with Deployment Team | | January 31, 2004 |
| Enhancement Process Briefing to USDOT | | February 28, 2004 |
| **Phase III** | | |
| Collect and Analyze Post-Enhancement Data | Within 5 months of completion of one year of project operation (4/30/05) | January 31, 2005 |
| Customer Satisfaction Survey Design and Testing | | July 31, 2004 |
| Customer Satisfaction Survey Implementation | | September30, 2004 |
| Management and Deployment Issues Debriefing II with Deployment Team | | November 30, 2004 |
| Model Deployment Evaluation Report - Draft | | February 28, 2005 |
| Model Deployment Evaluation Report - Final | | April 30, 2005 |

[1] Based on partners' projection of system being fully operational in November 2003.

[2] The User Survey Test Plan, which features only post-enhancement data collection activities (the user survey), will not be completed until March 2004. Development of the Customer Satisfaction Test Plan will draw upon preliminary post-enhancement system usage data that will be collected starting in November 2003.

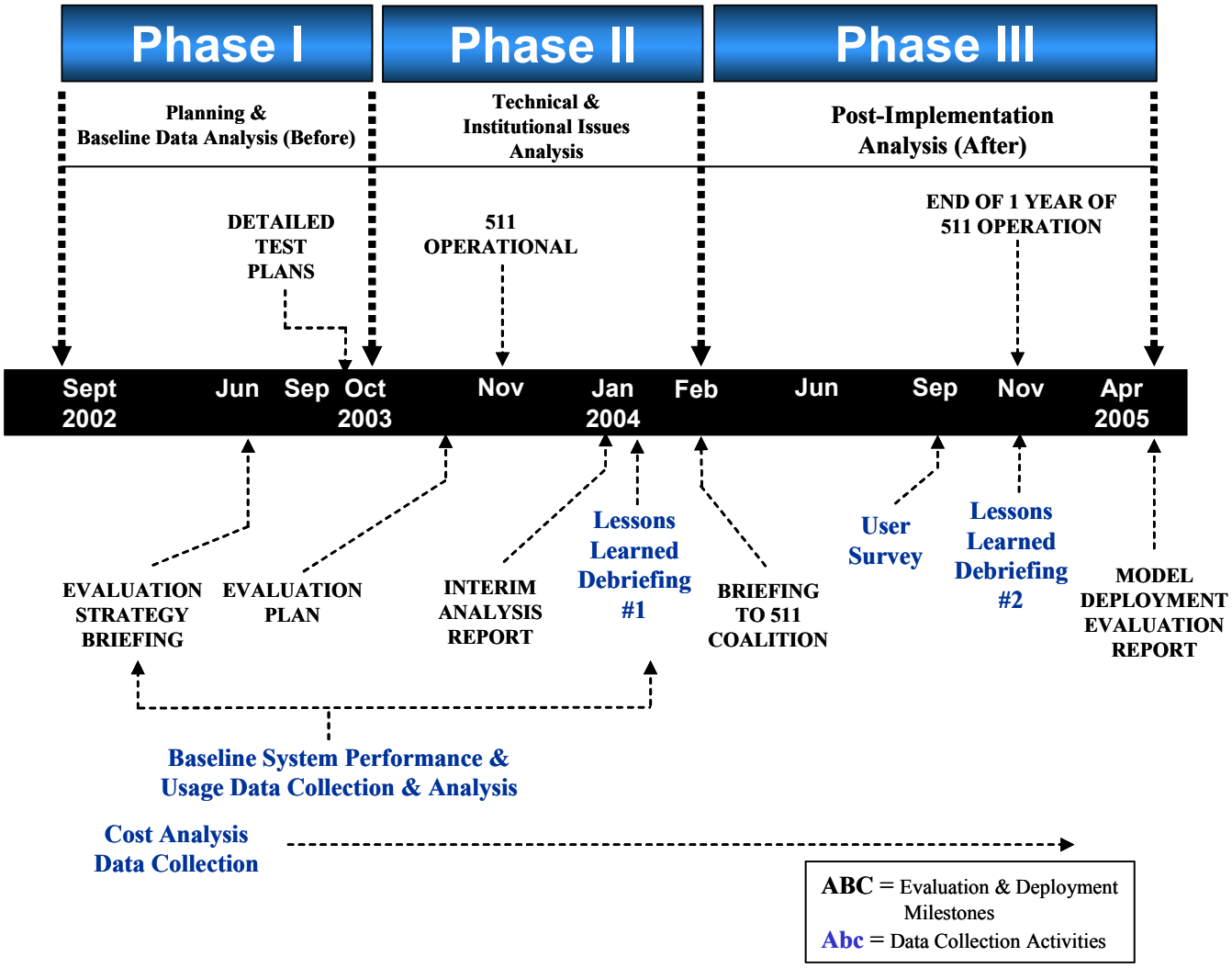


**Figure 11. Evaluation Schedule Summary**