



# Concept of Operations

Nevada 511 Advanced  
Second Generation  
Traveler Information  
System

Atkins Project  
No. 100022068

FINAL

**ATKINS**

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## Table of Acronyms

CAP	Common Alert Protocol
CCTV	Closed-Circuit Television Camera
ConOps	Concept of Operations
CAD	Computer-Aided Dispatch
FCC	Federal Communications Commission
HAR	Highway Advisory Radio
IRIS	Integrated Road Information System
ITS	Intelligent Transportation Systems
IVR	Interactive Voice Response
MPO	Metropolitan Planning Organization
NDOT	Nevada Department of Transportation
NHP	Nevada Highway Patrol
NWS	National Weather Service
O&M	Operations and Maintenance
PDA	Personal Digital Assistant
RTC	Regional Transportation Commission
RWIS	Road Weather Information System
TMC	Transportation Management Center
USDOT	United States Department of Transportation

# 1 Overview

## 1.1 System Identification

Formal Project Name:	Nevada Department of Transportation Advanced Second Generation 511 Traveler Information System Planning
Project Working Name:	NDOT Advanced Second Generation 511 Planning
Contract Number:	P059-11-050
Period of Performance:	June 6, 2011 to December 6, 2011
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Atkins Project Manager:	Stacy Unholz
Contact Information:	323-377-0408 (Office) <a href="mailto:stacy.unholz@atkinsglobal.com">stacy.unholz@atkinsglobal.com</a> 12301 Wilshire Blvd. Suite 430 Los Angeles, CA 90025

## 1.2 Purpose of Document

This Concept of Operations (ConOps) defines the advanced, second generation 511 system to be implemented by the Nevada Department of Transportation (NDOT) for the benefit of the traveling public in and through the state of Nevada. The ConOps is written to be available and relevant to all project stakeholders regardless of their background, technical expertise or role within the project. This document is intended to be as readable to upper level management as it is to the most technical staff member on the project. This ConOps endeavors to answer the who, what, when, where and why of the advanced, second generation traveler information system being planned for the state of Nevada. Specific questions answered by this document include:

- What are the known elements and the high-level capabilities of the system?
- Where are the geographical and physical extents of the system?
- When will the time-sequence of activities be performed?
- How will resources be used to design, build, or retrofit the system?
- Who are the stakeholders involved with the system?
- Why is Nevada's current travel information system being upgraded?

It is also a key step in developing a systems requirements document. In fact the development of the ConOps is considered the first concrete step in the development of the systems requirement document. However, the ConOps defines neither the requirements nor design of the new 511 system. The document is based on NDOT's strategic objective to develop an advanced, second generation traveler information system that reflects the wants and needs of stakeholders and the public, and delivers traveler information to the customers who need it.

This document provides NDOT, its agencies and potential vendors with:

- A brief overview of the current 511 system;
- A definition of the selected approach for the second generation 511 system;
- A description of the system's technical, business and functional objectives; and,
- A summary of the expected operations of the new system.

### **1.3 Project Stakeholder Activity**

At the beginning of this project, NDOT identified a list of stakeholders for this project. Those stakeholders are the intended audience for this ConOps. The overall stakeholder list has been divided into two categories: Informational Stakeholders and Active Stakeholders. The stakeholder list is a living document and has been updated at various points during development of the project as a whole. Some stakeholders originally identified at the outset of the project are no longer involved and may have been replaced by new names. Several stakeholders came to the project at the invitation of primarily identified stakeholders. Tables that illustrate all stakeholders, as of the printing of this Final ConOps, can be found in Section 5.

Core elements of this document were developed through stakeholder input gathered at a Project Kickoff Meeting in June 2011 at NDOT Headquarters in Carson City, Nevada. In addition, the project team distributed a stakeholder survey via email to all stakeholders, with the goal of assessing stakeholders' wants and needs for a new system. One-on-one interviews have occurred with operations managers, with the dual goals of assessing needs as well as collecting information on the intelligent transportation systems (ITS) data infrastructure of the state. Finally, elements of the draft ConOps were covered at two Concept Review meetings which took place on July 25 and 26, 2011. The first meeting took place at District 2 in Sparks, with staff from District 3 on video conference. The second meeting took place at the FAST Traffic Management Center in Las Vegas. The purpose of the two Concept Reviews was to review with stakeholders, in person, the input the project team had received over the previous two months

### **1.4 Role Within Systems Engineering Process**

The use of the systems engineering process within ITS is widely recognized as the most effective way to plan and deploy a successful project, as well as provide the documentation necessary for full operational understanding. In addition, the ConOps lays the groundwork for more seamless deployment of upgrades and changes in the future.

The development of the ConOps occurs near the beginning of the systems engineering process. True to the purpose of the systems engineering process as a whole, the ConOps is dedicated completely to the planning of the project and not at

all the actual design or development. Planning early and completely is the method by which costs are reduced, so that changes or updates necessary to deploy a successful system or subsystem can be completed before software has been designed, or hardware has been purchased.

The ConOps step falls after two previous steps; the definition of the Regional Architecture and a feasibility study and/or concept exploration. A Regional Architecture for the southern Nevada area was developed by Iteris and can be found online at <http://www.iteris.com/snvis/>. The plan for a new 511 system is aligned with the goals set forth in the Regional Architecture. A Concept Exploration was conducted by NDOT, which found that there was sufficient budget, interest and technological infrastructure to deploy an advanced, second generation 511 system.

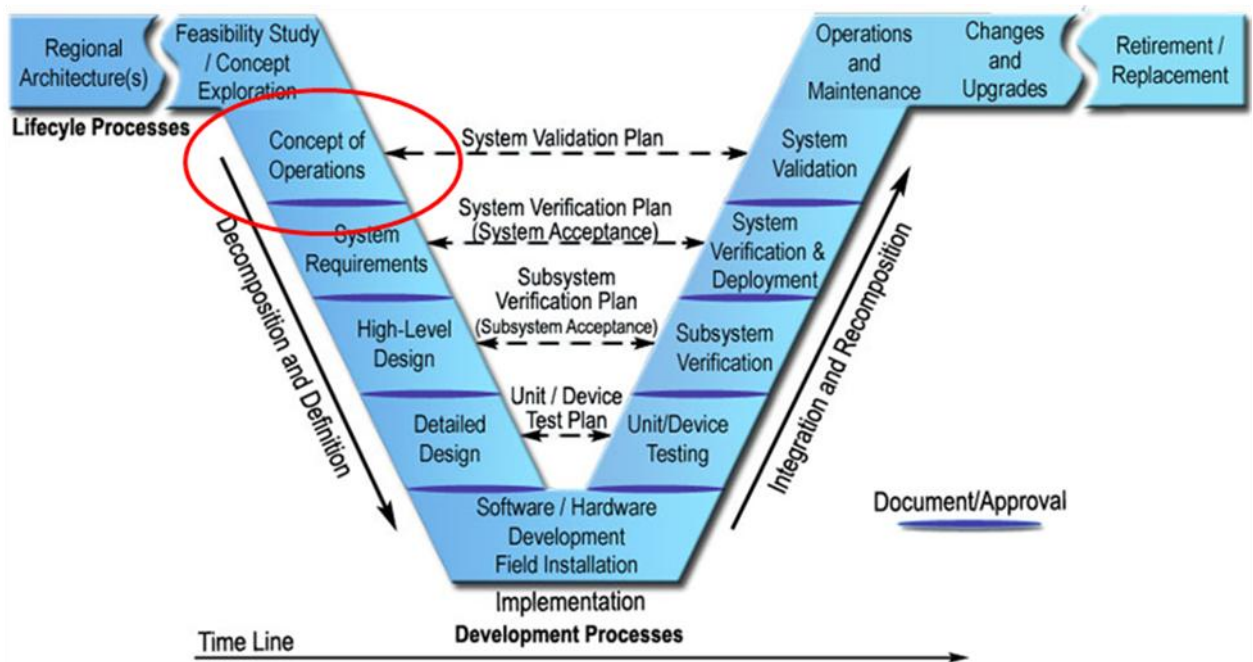


Figure 1: Development Process

### 1.5 Document Overview

This ConOps is divided into two general sections; a description of the current system, and a description of the vision for the new system. The document is arranged with the goal of providing the reader with a general picture of what exists today in terms of 511 in Nevada, and then provide a description from several angles of how a new system should and could operate.

### 1.6 Project Background

In 1999, the U.S. Department of Transportation (USDOT) petitioned the Federal Communications Commission (FCC) to designate a nationwide three-digit telephone number for traveler information. This petition was formally supported by 17 state departments of transportation, 32 transit operators, and 23 metropolitan planning

organizations and local agencies. On July 21, 2000, the FCC designated "511" as the single traffic information telephone number to be made available to states and local jurisdictions across the country. Details regarding implementation procedures, deployment design and telecommunications coordination were left up to deployers. To apply for the seed funding, deployers had to be in the public sector and be a provider or aggregator of traffic and/or traveler information, which in effect meant that 511 could be deployed by departments of transportation and metropolitan planning organizations.

To date, 51 systems accessible via IVR system and/or website have been deployed in 37 states. Systems range from basic touch tone IVR systems that provide winter road conditions, to sophisticated phone systems that can recognize a caller by his or her phone number and deliver personalized route information, to complicated multi-jurisdictional transit trip planning to downloadable applications designed for access to 511 via mobile devices.

NDOT was an early adopter of 511, deploying a statewide system with partner Meridian Environmental Technology (Meridian) in 2006. NDOT is now in the process of planning an advanced, second generation traveler information system, to be available to the traveling public in and through Nevada via an IVR system, interactive website, internet-enabled mobile devices, and possibly more channels.

The project is sponsored by the ITS department of the Nevada Department of Transportation. The planning process, including this ConOps is being developed with the assistance of Atkins North America, formerly PBS&J.

The advanced second generation system will be managed and operated by the selected vendor or project team, under the ITS project management of NDOT.

## 2 Referenced Documentation

This section lists the publisher and document title of all documentation referenced in the ConOps document. This section also identifies a contact for all documents not available through normal channels.

**Document:**

State of Nevada Department of Transportation  
Request for Approach  
No 059-11-050  
RFP (Scope of Services) for Advanced  
Generation 511 Traveler  
Information System in Statewide Nevada

**Author:**

Nevada Department of Transportation

Regional ITS Architecture

Iteris

<http://www.iteris.com/snvits/>

Stakeholder Survey\_Final

Atkins

Data Infrastructure Survey

Atkins

cctvdmsall 5\_27\_11.pdf

RTC

## **3 Current System Situation**

### **3.1 What is the system?**

Nevada 511 is a traveler information and weather information system, owned by the Nevada Department of Transportation and managed by Meridian. The system is accessible via IVR, website, and mobile applications including alerts. The IVR system is accessible 24 hours a day, 7 days a week by dialing “511” within the coverage area, or from outside the coverage area by dialing the toll free number 877-687-6237. The website is accessible 24 hours a day, 7 days a week by pointing a standard browser to <http://www.safetravelusa.com/nv/>.

### **3.2 Data Collection and Entry**

Data entry for the current Nevada 511 system is accomplished through the use of Meridian’s proprietary Integrated Road Information System (IRIS). The system is available to NDOT operators and managers through a client installed on local machines at each of the state’s traffic management centers as well as other locations. Through this client, NDOT operators can use an interactive map of Nevada to input information in the following categories:

- Controls
- Construction
- Events
- Traffic Conditions

All traffic and event information; i.e. controls, construction and traffic events are input into the IRIS system must be completed manually by operators, using an interface that allows the operator to select choices from a series of drop down menus. Operators then submit the data to the IRIS database, which populates 511 with the submitted information. The IRIS clients log into and maintain connections with the Meridian server, which accepts and processes the data input.

Real time and forecasted weather is collected via Meridian’s proprietary software and delivered to the Nevada 511 system without operator intervention.

While RTC (in District 1) is rich in methods of ITS data collection: closed-circuit television cameras (CCTV), RWIS data, sensor and loop detector data, access to events reported in NHP’s CAD system, very little of that data is currently reported to 511. In District 1, 511 is managed by staff who are co-located in the FAST TMC in Las Vegas. At that location, District 1 operators, by their presence in a location dedicated to traffic management, are able to “pick up” information that they then manually input into 511 using the IRIS interface.

District 2 operators at the TMC in Sparks, NV also receive data manually from various sources, and use Meridian’s IRIS system to input data. Data can be received from maintenance workers in the field using radios, which are used to populate the Highway Road Restriction Reports. The data input by operators then goes to both the

central system software as well as a local Foxpro database. That database was initially developed to archive calls into the traffic management center (TMC), but is now used to archive all events entered into the system. Other data collected for the freeway management system but not for 511 is not covered in this document, but will be documented in the Data Inventory.

In District 3, operators at the TMC in Elko input traffic event information manually into Meridian's IRIS interface. In addition data from closed-circuit television cameras (CCTV) is collected for the purposes of monitoring road and weather conditions on summits and passes. Currently the district has 5 operational cameras in the region, which stream video and send the data back to a central server in Elko. That video is not distributed to the 511 system in any way currently. The district also manages several road weather information systems (RWIS) stations, which collect road weather conditions. Additional weather information is provided straight from Meridian as well. All data that feeds 511 is returned to a central database and data fusion engine managed by Meridian.

### **3.3 Dissemination**

Data dissemination is achieved through the following channels and includes the following components:

- IVR – The interactive phone system is accessible by calling 877-687-6237. Via phone, the system is capable of accepting both limited spoken and touchtone input. Using one or both inputs, the system offers callers traveler information in the categories of highway reports or weather reports, or backdoor phone numbers to reach 511 in neighboring states.
- Website – Online, 511 in Nevada is accessible by internet browser at <http://www.safetravelusa.com/nv/>. The website offers map and text-based traveler information, including road weather conditions, incidents, events, planned construction, atmospheric weather conditions, wind speed and temperatures, covering various roads in the state of Nevada.
- Email Alerts – The system offers users the ability to sign up for alerts on designated routes. The service is called “Clear Path 511” and is accessible by visiting <http://www.safetravelusa.com/login/index.pl?destination=%2Fnv%2Fcp511%2F>.
- HAR – Data input through Meridian's IRIS system can also be made available to the state's highway advisory radio (HAR) units through download files.
- Twitter – the state maintains a traveler information Twitter feed, located online at <http://twitter.com/#!/nevadadot>.

The IVR system offers two main categories of information; highway conditions and information in other states.

A user selecting “highway conditions” has the ability to speak or type the highway number, and is then prompted to pick from a list of segments. After the segment has

been chosen, the system prompts the user to indicate the direction of travel. After that input has been received, the system then repeats the chosen highway, segment, and direction, and offers text-to-speech, time stamped events and atmospheric weather reports that fall within the geographical constraints.

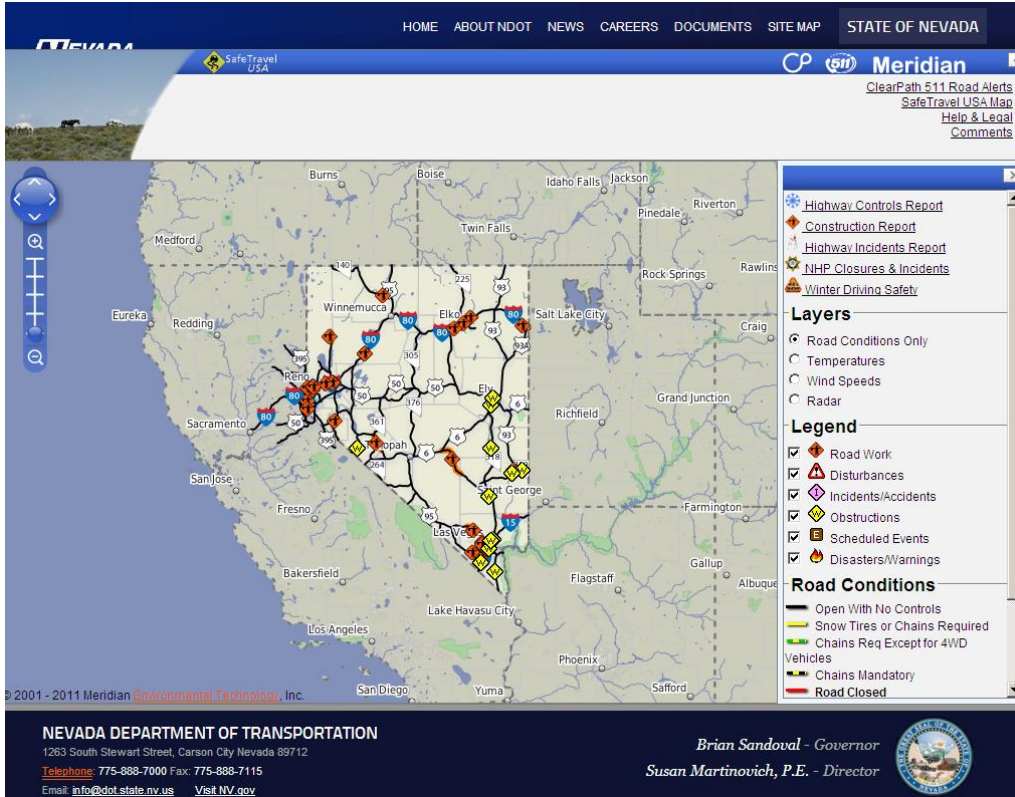


Figure 2: NDOT 511 Web Site Splash Page

The “other states” option offers contact phone numbers for the following states:

- California
- Utah
- Arizona
- Idaho

The website’s splash page features a partial map of 8 western states, including Nevada. Selectable layers of content are provided in the right frame, which allow users to toggle views of road conditions, temperatures, wind speeds and radar. Road segments are selectable by the user and change color when selected. Clicking on a road segment will display the name of the segment as well as control and weather conditions for that segment, as per Figure 3.

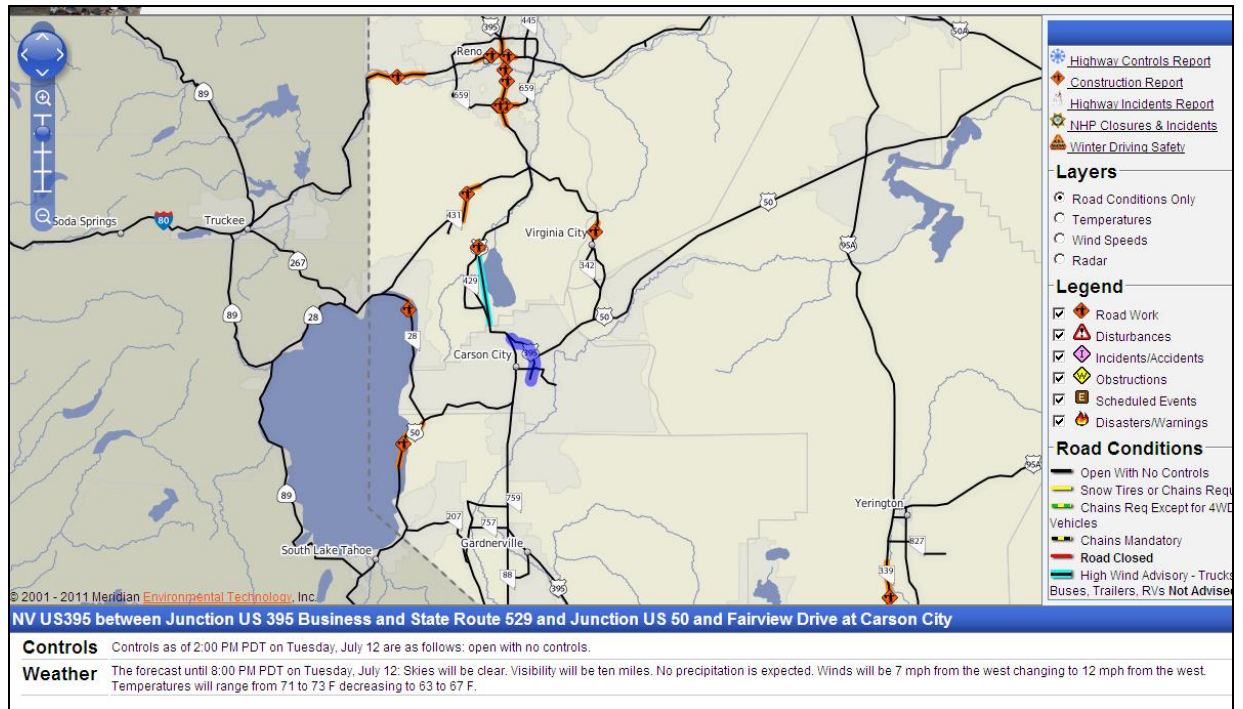


Figure 3 Information Display for Road Segment

### 3.4 Who owns, operates, and maintains the system?

The Nevada Department of Transportation owns the 511 system. Meridian Environmental Technologies, Inc. has operated and maintained the system since it became operational in August 2006 after a design and development period that began in 2004.

### 3.5 How well does the system perform?

The current system's functions and capabilities have served the state since 2006, but now the decision has been made to procure a new, advanced system that utilizes advances in technology, additional data being collected in Nevada, and significant changes in the channels by which traveler information can now be disseminated.

The various processes by which NDOT staff enter highway and incident information currently results in duplication of effort, redundancy in data dissemination and creates an operational scenario where errors can be made.

### 3.6 What is the system's geographic coverage?

NDOT is divided into three districts, as illustrated in Figure 4.

- District 1 covers the southern portion of the state, with a district office and TMC located in the state's largest metropolitan planning organization (MPO) of Las Vegas.
- District 2 covers northwest Nevada, with a district office located in Sparks, NV. Reno. District 2 is the state's smallest, with coverage in the north and northwest portion of the state. Several MPOs are located in District 2.

- District 3 is located in Elko, with sub-districts in Winnemucca and Ely. The district is characterized by a large amount of rural area.

The current 511 system covers all interstates and state routes owned by NDOT.

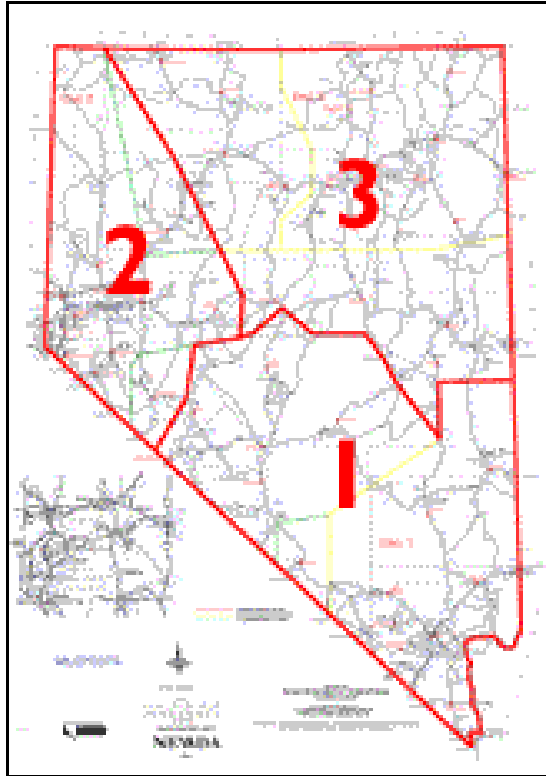


Figure 4 NDOT District Map

### **3.7 With what other systems does the system communicate?**

The current 511 system does not offer direct links to other systems; instead, the IVR offers users a menu choice that provides backdoor phone numbers to reach the 511 systems of adjacent states. On the web, all SafeTravel state 511 partners are accessible via hyperlink from the Nevada 511 website.

### **3.8 System Architecture Diagram**

The general data flows of the current Nevada 511 system are illustrated in a top-level functional block diagram shown in Figure 5. A detailed description of the elements and flow depicted in this diagram is covered in the *Inventory of Data and Data Gaps*.

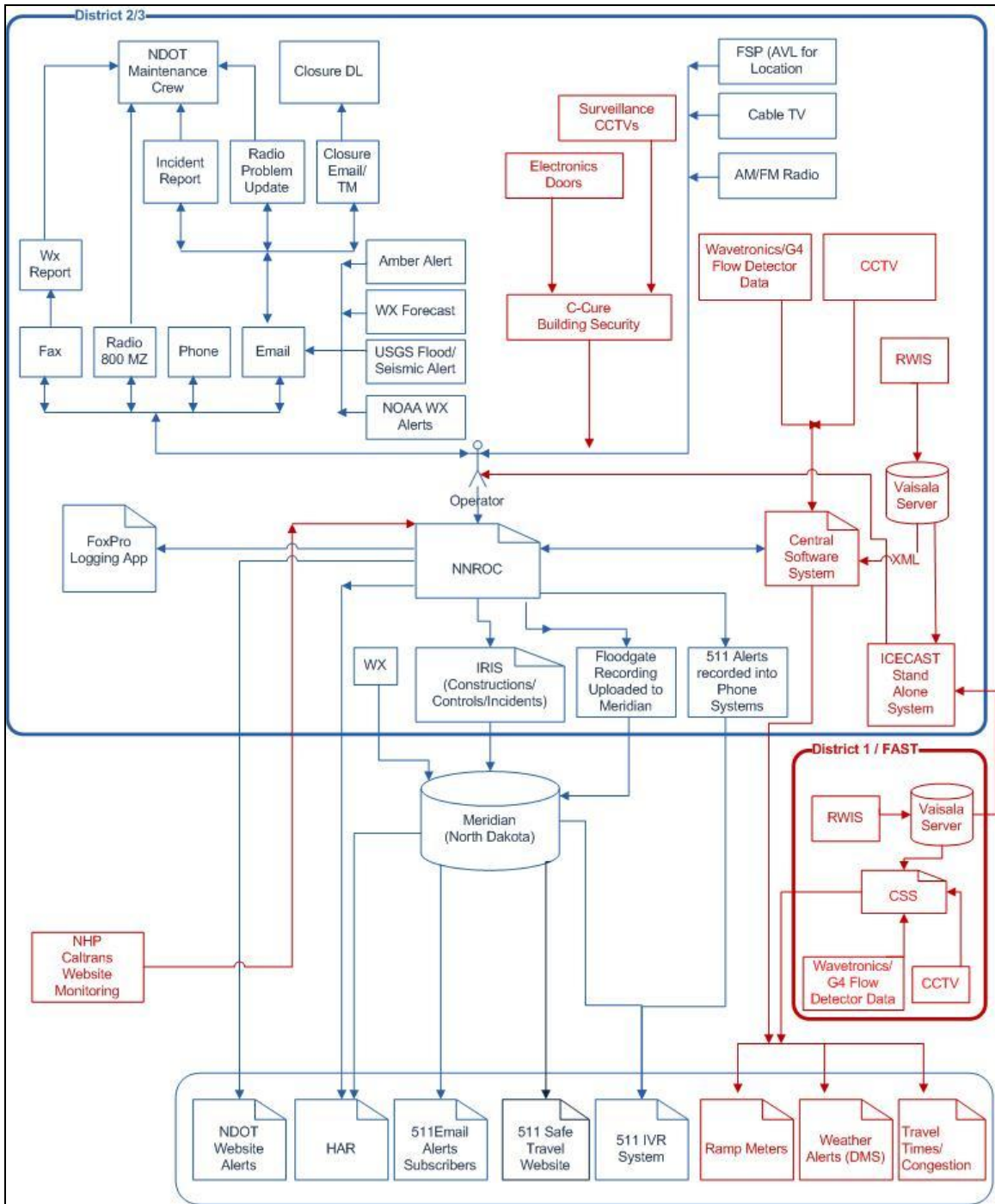


Figure 5 Top Level System Current Architecture

## **4 Next Generation 511: Background, Objectives, and Scope**

Since the deployment of 511 in Nevada in 2006, the world of traveler information has advanced significantly in the areas of data collection, fusion, and dissemination. New methods for collecting traffic data include national data feeds managed by third parties, newer and more cost effective radars, sensors and loops, CCTV that can use imaging to monitor the flow of traffic and calculate estimated travel times, and more. Data fusion can be achieved in a fraction of the time and with more processing speed than ever before. Methods by which travelers can access and be automatically provided with information has advanced to the point where GPS systems can locate travelers and provide them with location specific information based on where they are at that very moment in time. And, options for funding traveler information systems are finally changing. The public agency deploying 511 or other traveler information systems now has various options to generate revenue, thereby offsetting the cost of design, deployment and operations.

The advanced, second generation 511 system will be designed and developed with the express objectives of improving the functionality and efficiency of NDOT's existing system, using the technology available and better serving the traveling public in and through Nevada. The new system will continue to be an essential part of NDOT's commitment to provide real-time information to the traveling public.

### **4.1 Project Constraints**

The Concept of Operations for any ITS project must state the potential constraints faced by the project. This section does not seek to provide a detailed accounting of all possible constraints and roadblocks to successful system deployment. Instead, the purpose of this section is to provide a brief and high level documentation of the most widespread and likely constraints to design, deployment, and operation.

Much of the state of Nevada is rural, and the advanced, second generation 511 system may be limited in certain areas of the state by a lack of equipment and infrastructure necessary to monitor and report real time traffic and road conditions. The amount of area characterized as rural, coupled with the lack of ITS equipment for both detecting real time conditions and disseminating up to date traveler information, will likely result in technical constraints to system deployment.

As of the writing of this document, the U.S. economy as a whole is growing only at a sluggish pace, and public agencies who have had to lay off employees over the past several years find themselves still short on staff. Following from the constraints of physical equipment and communications infrastructure in the field, all districts may experience limitations in regards to staff resources necessary to operate and maintain the system. While much of the data that supports the system is envisioned to be automatically input, there will likely still be some manual input of data, as well as

quality checks of data being entered. Resource limitations is an area that must be examined during the planning process.

Budgetary limitations are present in most ITS projects, and the constraints of available budget will likely impact the project at some level. The budget for the new 511 system is still to be determined, and the planning project team is gathering wants and needs without regard to budgetary limitations. It is likely that when the functional requirements are being finalized, they will be subject to the limitations of available funding.

## 5 User Profiles

The main stakeholders in the NDOT Advanced Second Generation Traveler Information System are the staff of NDOT's Headquarters, Districts 1, 2, and 3, NDOT Public Affairs, Nevada Highway Patrol, the Regional Transportation Commission of Southern Nevada (RTC). Two stakeholder lists have been developed by NDOT. One identifies an "Informational" list of high level managers who are updated from time to time on project updates. The other is the "Active Stakeholder" list, which contains the people who are likely to use 511 on a regular basis, and have a stake in ensuring the system is designed to meet their needs. The complete lists of stakeholders who are expected to use or contribute to the second generation 511 system are provided in Table 1 and

Table 2.

**Table 1: NDOT 511 Informational Stakeholders**

<b>Stakeholder</b>	<b>Type</b>	<b>Agency</b>	<b>Title</b>
Dennis Baughman	Informational	NDOT	Chief Administrative Services
Pete Booth	Informational	NDOT	Assistant District 2 Engineer
Todd DeVito	Informational	NDOT	Acting Chief of IT
Thor Dyson	Informational	NDOT	District 2 Engineer
James Ellis	Informational	NDOT	IT Professional
Eric Glick	Informational	NDOT	Rail and Aviation Manager
Mario Gomez	Informational	NDOT	Assistant District 1 Engineer
Denise Inda	Informational	NDOT	Chief Traffic Operations
Kevin Lee	Informational	NDOT	District 3 Engineer
David Loar	Informational	NDOT	IT Professional
Rudy Malfabon	Informational	NDOT	Deputy Director
Dorothy Martin	Informational	NDOT	Chief Information Services
Mary Martini	Informational	NDOT	District 1 Engineer
Susan Martinovich	Informational	NDOT	Director
Jeff Milligan	Informational	NDOT	IT Professional
Tom Moore	Informational	NDOT	Assistant Chief Traffic
Mike Murphy	Informational	NDOT	Assistant District 3 Engineer
Rick Nelson	Informational	NDOT	Assistant Director Transportation
Greg Novak	Informational	FHWA	Major Projects Manager, FHWA
Scott Rawlins	Informational	NDOT	Deputy Director
Mohammed Rouas	Informational	NDOT	Assistant District 1 Engineer
William Story	Informational	NDOT	Bike/Ped SRTS Manager
Dave Titzel	Informational	NDOT	Assistant District 2 Engineer
Jason Van Havel	Informational	NDOT	Intermodal

**Table 2 NDOT 511 Active Stakeholders**

<b>Stakeholder</b>	<b>Type</b>	<b>Agency</b>	<b>Title</b>
Trooper Chuck Allen	Active Stakeholder	NHP	NHP, PIO
Bill Bainter	Active Stakeholder		Department of Public Safety
Michelle Booth	Active Stakeholder	NDOT	PIO
Jon Dickinson	Active Stakeholder	NDOT	ITS Project Manager
Trooper Mike Edgell	Active Stakeholder	NHP	
Trooper Jeremie Elliott	Active Stakeholder	NHP	NHP, PIO
Autumn Estes	Active Stakeholder	NDOT	
Mike Fuess	Active Stakeholder	NDOT	District 2 Traffic Engineer
Bill Hance	Active Stakeholder	NDOT District III	
Damon Hodge	Active Stakeholder	NDOT	PIO
Brian Hoeft	Active Stakeholder	NDOT	Acting Director FAST
Sergeant Kevin Honea	Active Stakeholder	NHP	NHP, PIO
Chris Joncas	Active Stakeholder	NDOT	Project Manager
Scott Magruder	Active Stakeholder	NDOT	PIO
Jennifer Manu bay	Active Stakeholder	NDOT	
Rick Moore	Active Stakeholder	RTC	
Kim Munoz	Active Stakeholder	NDOT	IT
Perrin Palistrant	Active Stakeholder	RTC	RTC Transit
Shital Patel	Active Stakeholder	NDOT	
Meg Ragonese	Active Stakeholder	NDOT	PIO
Jeff Richter	Active Stakeholder	NDOT	ODV Permits Manager
Lisa Schettler	Active Stakeholder	NDOT	Principal Ops/ITS Engineer
Rodney Schilling	Active Stakeholder	NDOT	ITS Project Manager
Kent Sears	Active Stakeholder	NDOT	District 1 Traffic Engineer
Wayne Seidell	Active Stakeholder	DMV	
Lynn Shomers	Active Stakeholder	NDOT	Supervisor LV Roads

Stakeholder	Type	Agency	Title
Trooper Jim Stewart	Active Stakeholder	NHP	NHP, PIO
John Talbott	Active Stakeholder	NDOT	Supervisor Reno Roads
Bill Thompson	Active Stakeholder	NDOT	Freight Manager
John Wells	Active Stakeholder	NDOT District III	Elko Roads
James Whalen	Active Stakeholder	NDOT	
Steve Williams	Active Stakeholder	NDOT	Maintenance Manager, District II
Tina Wu	Active Stakeholder	RTC	RTC Transit

## 5.1 Connections and Access

**Connections with internal users** – Internal users may physically be located in NDOT facilities, at off-site locations (work at home, while traveling using secure Internet connections), at the facilities of partnering agencies (municipalities, transit agencies, Nevada State Troopers, etc.) or at any other Internet accessible location.

**Connections with external systems** – External systems are expected to include neighboring states, a computer-aided dispatch CAD system to be hosted by the Nevada State Troopers, the RWIS server operated by NDOT, possibly a nationwide Clarus server, and other systems operated by partnering agencies (e.g. transit, ferries). All connections with external systems shall follow the procedures and protocols of National ITS Standards as well as NDOT system standards and architecture format.

**Connections internal to the 511 System** – The modules to the second generation 511 system will include a 511 conditions reporting entry tool, a 511 IVR system, a co-branded 511 website and website designed for mobile devices, social networking services, and an email and text alerting system. Depending upon the approach, these may be separate systems connected together by standard data exchanges or one consolidated system. Regardless of the architecture and approach, the event reports in the entry tool need to reach the dissemination tools (phone and web).

**Connections with the end users** – Travelers may be located in Nevada or any other state/country. Their methods for access will range from low bandwidth Internet connection to high speed, as well as from basic land-line telephones to web-enabled sophisticated cellular phones and personal digital assistants (PDA).

### 5.1.1 Support Environment

The Nevada Advanced Second Generation 511 System will be maintained by the selected vendor or project team of vendors / consultants. The details regarding facilities, equipment, support software and hardware, and repair and replacement criteria will be determined at a later stage in the planning process.

## **6 Concepts for the Proposed System**

### **6.1 Operational Environment and Characteristics**

The New 511 system will be designed, developed and operated based upon the concepts outlined in this document and the requirements defined in the Functional Requirements document, due to be delivered later in the planning process.

### **6.2 Operational Policies and Constraints**

- The selected vendor will operate the advanced second generation 511 System(s) as a full time 24/7 operated system;
- Procedures should be in place by the selected vendor operating the system to have staff available to restart services or correct system outages on a 24/7 basis;
- All software and server upgrades and changes must be performed during no-peak hours (Nevada time); and,
- The selected vendor will supply staff to receive and respond to feedback via IVR and through a feedback link on the website.

### **6.3 Accessible and Consistent Data Input**

Based on extensive stakeholder input, the second generation 511 system will provide to operators statewide a single, consistent method for entering manual data into the 511 system. The entry tool to be used by operators statewide must be available to all operators at all locations where operators work, whether the entry tool is developed as a web-based input form accessible by an authorized user from any internet browser or by software clients installed on every necessary local computer.

NDOT's preference is that the entry tool purchased or developed for this project be a commercially available solution and not subject to nor needing extensive customization to fit the needs expressed by stakeholders and documented in the system requirements documents.

### **6.4 Major System Components**

It is envisioned at this point in the planning process that NDOT's 511 phone system shall include, but not be limited to, the following functionality and categories of information:

- Highway information
  - Incidents/Accidents
  - Highway Conditions
  - Lane Restrictions
  - Construction/maintenance events
  - Special events
  - Congestion events

- Travel times
- Weather information
  - Impacts to roadway
  - Current weather conditions/forecasts
- Floodgates
- AMBER alerts, national security and other informational alerts
- Customer Feedback
- Report Incidents
- System transfers to partner agencies such as:
  - The state's five main commercial airports
  - Bicycle and pedestrian information
  - Nevada Commission on Tourism
  - Other states

It is envisioned at the point in the planning process that NDOT's 511 new website shall include, but not be limited to, the following functionality and categories of information:

- Interactive map that includes the ability to zoom in and out
- CCTV locations and images
- DMS locations and messages
- HAR locations and messages
- RWIS locations and weather Highway information
- Incidents/Accidents
- Highway Conditions
- Lane Restrictions
- Construction/maintenance events
- Special events
- Congestion events
- Travel times
- Weather information
- Impacts to roadway
- Current conditions/forecasts
- Floodgates
- AMBER alerts, national security and other informational alerts
- Link to provide customer feedback
- Link to report incidents
- Links to partner websites such as:
  - The state's five main commercial airports
  - Bicycle and pedestrian information
  - Nevada Commission on Tourism
  - Other states

## **6.5 Geographical Coverage of the System**

The new 511 system will cover at a minimum all state owned interstates as well as other major routes. The system overall will cover and be available state-wide. However, while the geographical coverage extends state-wide, accessibility will focus on the regional needs of users. Information will be accessible both via phone and web based on regions, districts, and/or metro areas of the states.

## **6.6 Capabilities and Functions of the System**

Listed below are some of the features to be addressed with the development of the advanced second generation Nevada 511 system:

- Phone Features:
  - Voice activated System
  - Touch Tone Back up
  - Ability to identify and associate localisms to specific routes
  - Ability to support customized reports
  - No busy signal
  - No dropped calls
  - Barge In option
  - Repeat/Skip/Next ability
  - Attended call transfers
  
- Web Features:
  - Customized page views
  - MY 511 page setup
  - Ability to zoom
  - Streaming video where possible
  - Selectable layers
  - Trip planning capability
  - Regional Capabilities
  
- System Features:
  - Redundant servers
  - Must interface with Nevada Highway Patrol (NHP) and receive/process data
  - Interface with various stakeholders and receive/process data. This shall include but not be limited to transit, rail, ferry, tourism, and bicycle/pedestrian agencies, National Weather Service, Other states, etc.

## **6.7 Support Environment**

A basic support environment already exists at NDOT, as the state has been operating a 511 system for several years. NDOT as the primary stakeholder will be responsible for the staff necessary to operate and maintain accurate data entry and quality assurance, as those staff members do currently. As for the overall support, operations

and maintenance of the software and hardware involved in providing 511 via phone, web and mobile devices, the selected vendor will provide the staff necessary to satisfy all requirements on an ongoing basis.

### **6.8 Relationship to Other Systems**

The design of the new 511 must take into account the need to interface with other data systems. Direct interfaces to collect, process, and report agency data will include:

- NDOT TMC's
- NDOT District Offices
- NDOT Construction/Maintenance Offices
- NHP offices statewide
- National Weather Service

Call transfers and web links to partner agencies may include

- Transit Agencies, both multi-state, statewide, regional, and local
- Rail Agencies, both statewide and multi-state
- Tourism, both statewide, regional, and local
- Bicycle/Pedestrian agencies
- Other States 511 systems

### **6.9 Conformity and Compatibility**

The design process for the 511 system must take care to align with current architectures, goals, and IT requirements currently established in the state. Those may include specifically:

- Nevada Statewide ITS Architectures
- Nevada Regional ITS Architectures
- NDOT IT requirements
- NDOT architecture requirements
- NDOT Website Standards
- NDOT Public Information Office Social Media Policy

### **6.10 High Level Architecture**

The diagram in Figure 6 illustrates, at a high level, the methods by which data will be collected, fused, and disseminated in the new 511 system.

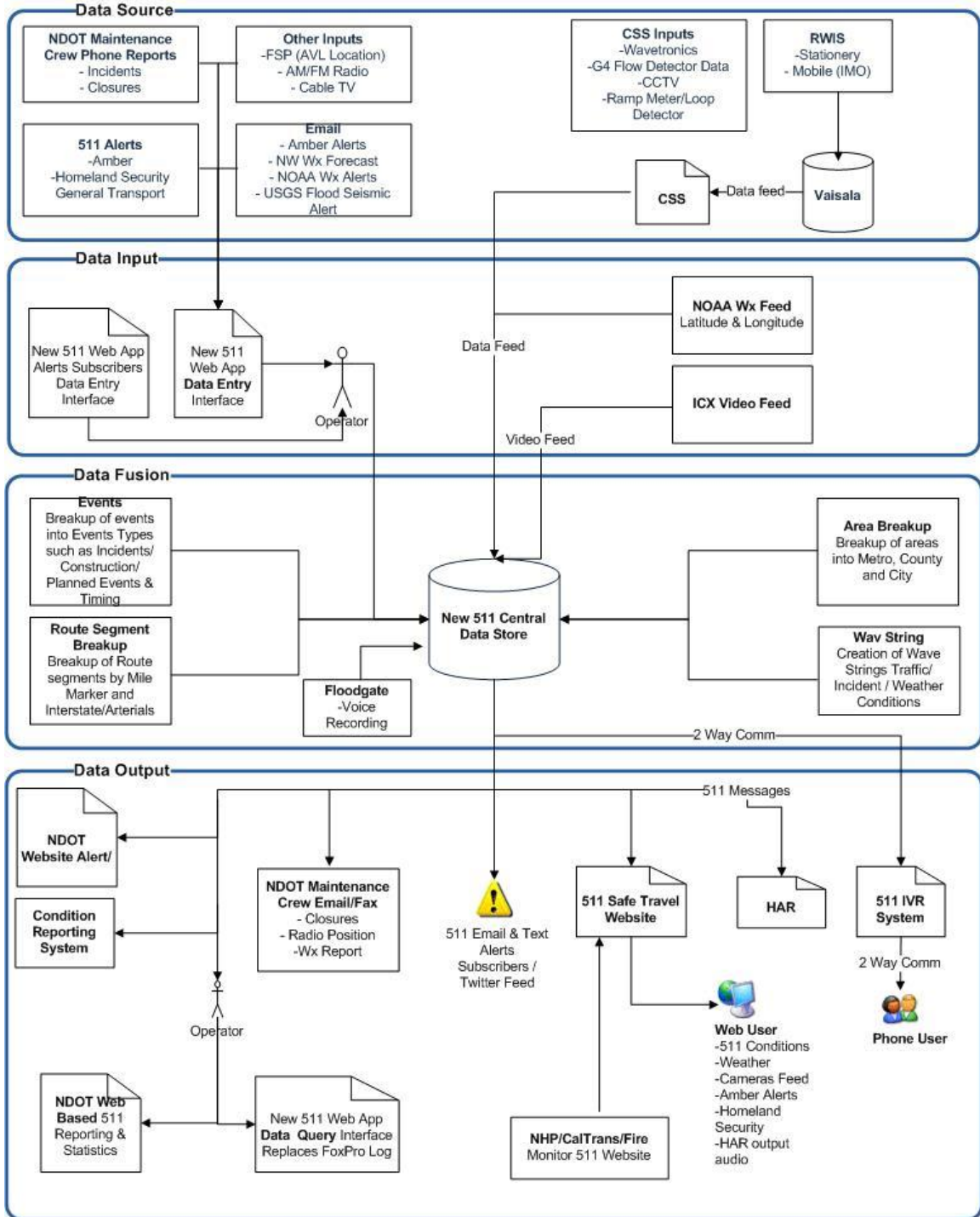


Figure 6 NDOT Second Generation High Level System Architecture

## 7 Operational Scenarios

The following scenarios are written to illustrate how disparate categories of users will interact with the system. Different types of travelers, as well as operators and system managers within NDOT are described in this section, with the goal of describing the different or similar ways in which users will interact with the 511 system.

### 7.1 *Commuters and Local Travelers*

- Morning travelers will tune their radios or televisions to one of several available private sector media outlets offering morning descriptions of road conditions and traffic in the major metro areas.
- Highway travelers will access data via mobile applications developed by either internal NDOT resources or from private agencies that provide transportation information related to travel times, traffic delays, incidents, etc.
- Transit riders will access data via mobile applications that provide transit routes, schedules, route/mode transfers, costs, etc.
- Travelers will either visit the 511 website or call 511 to access information about current travel times available along key routes.
- Transit riders will visit the 511 website as a portal to the various transit agencies websites to access route information, schedules, costs, transfers, etc.
- Travelers will periodically check the 511 website to view lane or road closures and delays due to construction and/or special events such as parades, sporting events or other activities in the metro areas. On-screen maps will support dynamic zooming and contain details of the road network that travelers have come to expect by using such products as Google maps or maps using a similar familiar interface. Descriptions of lane or road closures and delays will be consistent and carefully worded in order to inform travelers of what they need to know to plan their trip. Travelers who wish for more details beyond simply the traffic impacts will have the option to select to view additional information about the events.
- Travelers will also have the option to call 511 from any land-line or cellular phone to hear reports of lane and road closures and delays. Again, reports will be consistent and concise, and will be limited to the details about the traffic impacts.
- Travelers may visit the 511 website to view driving condition reports, lane/road closures, and information about crashes or other delay causing events. These same travelers may also call 511 and will have the option to select major roadways, allowing them to hear driving condition reports, road/lane closures, and reports of other delay-causing events.
- Any traveler visiting the 511 web or phone system will be presented with Amber Alert notifications whenever an Amber Alert is posted, or similarly will be informed of major alerts that may impact their travel.

- Travelers who are unexpectedly stopped in traffic congestion may call 511 to hear reports of the cause and likely duration of delay. This knowledge will help lower their anxiety and frustration.
- Travelers can access both the 511 website and the 511 phone line to obtain information on other transportation modes (e.g. bicycling, ferries, rail, etc.), that they may wish to use in their trip.
- Road conditions related to weather will be accessible via the 511 website or 511 phone system to alert drivers of possible delays or closures.
- Travelers will be able to obtain current and forecasted weather via the 511 website and phone system.
- Users will visit the 511 website and access the 511 phone line to access information on planned road closures and delays.
- If information on an incident is not in the 511 system or on the 511 website, users will be able to report those incidents to NDOT and operations staff will verify the status of the reported event.
- Tourists and residents will visit the 511 website for a transit trip planner, allowing them to specify their origin and destination and receive a transit trip plan to reach their destination.

## **7.2 Commercial Vehicle Drivers**

- CVO dispatchers will be able to receive a direct data feed from NDOT to obtain real time information related to construction/maintenance activities, lane closures, accidents, weather events, special events, etc.. This data can be directly processed and sent to the CVO drivers on board units to alert them of unusual conditions on Nevada's roadways.
- In the winter months, CVO drivers will be able to obtain actual road conditions as it relates to weather and mountain pass conditions. (e.g. chains required, roads/lanes closed, etc.)
- CVO drivers will tune their radios to one of several available private sector media outlets offering descriptions of road conditions and traffic in the major metro areas.
- Access to data via mobile applications developed by either internal NDOT resources or from private agencies that provide transportation information related to travel times, traffic delays, incidents, etc. will be available to the CVO community.
- CVO dispatchers as well as the drivers will either visit the 511 website or call 511 to access information about current travel times available along key routes.
- Drivers/Dispatchers will periodically check the 511 website to view lane or road closures and delays due to construction and/or special events such as parades, sporting events or other activities in the metro areas. On-screen maps will support dynamic zooming and contain details of the road network that travelers have come to expect by using such products as Google maps or maps using a similar familiar interface. Descriptions of lane or road closures and delays will be consistent and carefully worded in order to inform travelers of

what they need to know to plan their trip. Travelers who wish for more details beyond simply the traffic impacts will have the option to select to view additional information about the events.

- CVO drivers will also have the option to call 511 from any land-line or cellular phone to hear reports of lane and road closures and delays. Again, reports will be consistent and concise, and will be limited to the details about the traffic impacts.
- They will be able to visit the 511 website to view driving condition reports, lane/road closures, and information about crashes or other delay causing events. These same drivers may also call 511 and will have the option to select major roadways, allowing them to hear driving condition reports, road/lane closures, and reports of other delay causing events.
- Any traveler visiting the 511 web or phone system will be presented with Amber Alert notifications whenever an Amber Alert is posted, or similarly will be informed of major alerts that may impact their travel.
- Dispatcher and CVO drivers will be able to obtain current and forecasted weather via the 511 website and phone system.
- Users will visit the 511 website and access the 511 phone line to access information on planned road closures and delays.
- If information on an incident is not in the 511 system or on the 511 website, users will be able to report those incidents to NDOT and operations staff will verify the status of the reported event.

### **7.3 Specific Operational Scenarios for 511**

The following scenarios are offered to describe in detail some examples of how events will be entered, processed and disseminated using the New Generation 511 systems.

Scenario #1: Winter snow storm impacting highways

***On a weekday afternoon, snowfall begins at approximately 2:00pm and continues for approximately 24 hours, impacting highways between Elko, NV and the California State Line.***

National weather forecasts have been forecasting the storm for the past day and therefore travelers and CVO drivers are not surprised by the storm. However, there are a number of commercial and leisure travelers planning or in the middle of trips and therefore they will be watching the website and calling the 511 phone system for updates on the impacts of the storm.

- NDOT Operations and Maintenance (O&M) staff at each O&M facility enter events that describe conditions as the snow begins.

- NDOT Operations Staff enters National Weather Service's (NWS) warnings/watches into statewide floodgates on both the 511 website and phone system.
- NDOT Operations Staff updates floodgates as NWS updates their information and as road conditions change, whether related to weather or incidents due to the weather.
- O&M staff use the entry tool to select pre-defined segments and select the phrases that best describe the observed conditions.
- As snow plow operators observe localized (e.g. stretches or intersections that are especially icy or hazardous) they radio or phone in updates to the M&O staff to allow operators to update conditions.
- O&M staff continues to update and enter conditions throughout the day/evening, based on their observations and the observations of field personnel.
- After normal business hours (in the evening and overnight) snow plow operators and field personnel radio or phone in updates to the TMCs.
- The 511 TMC staff are regularly receiving calls or emails about condition reports or updates to the condition reports. The entry tool allows them to quickly sort and search through existing events to find the event that needs to be updated.
- The above operations of updating roadway conditions and floodgates by O&M staff is continued until all roads are clear or drivable.

*From the Travelers' View*

- The Nevada 511 website has displayed driving condition reports through icons and/or colored roads from the onset of the event.
- Each time a traveler clicks on an event icon, they view a description of the conditions as well as a time stamp of when the event was entered or last updated.
- In addition to the manual events entered by M&O staff, travelers have access to National Weather Service reports describing atmospheric weather conditions and weather reports from RWIS sensors as well. The public website is an amalgamation of manual reports of driving conditions, NWS reports, route specific weather reports from a private vendor (optional), and RWIS sensor data, supported by links to camera images wherever available.
- Travelers calling the 511 phone system select the highway they are traveling on, and may select specific segments of interest and hear reports of conditions along the segment.

- Travelers with mobile devices and web enabled cellular phones may access basic web sites to view travel conditions while traveling.
- Travelers who are linked to the NDOT's social messaging networks (such as Twitter, Facebook, and various blog sites) have viewed the automatically generated posts throughout the day and are informed of any road closures and generally understand the travel conditions having watched the posts change throughout the day.
- Travelers who have signed up for alert notifications can receive weather related information via their mobile devices, text messages, or emails.

*From the CVO Community's View*

- The Nevada 511 website has displayed driving condition reports through icons and/or colored roads from the onset of the event.
- Each time a dispatcher clicks on an event icon, they view a description of the conditions as well as a time stamp of when the event was entered or last updated.
- In addition to the manual events entered by M&O staff, CVO drivers and dispatchers have access to National Weather Service reports describing atmospheric weather conditions and weather reports from RWIS sensors as well. The public website is an amalgamation of manual reports of driving conditions, NWS reports, route specific weather reports from a private vendor (optional), and RWIS sensor data, supported by links to camera images wherever available.
- CVO drivers calling the 511 phone system select the highway they are traveling on, and may select specific segments of interest and hear reports of conditions along the segment.
- CVO drivers with mobile devices and web enabled cellular phones may access basic web sites to view travel conditions while traveling.
- CVO dispatchers and drivers who are linked to the NDOT's social messaging networks (such as Twitter, Facebook, and various blog sites) have viewed the automatically generated posts throughout the day and are informed of any road closures and generally understand the travel conditions having watched the posts change throughout the day.
- CVO drivers and dispatchers who have signed up for alert notifications can receive weather related information via their mobile devices, text messages, or emails.
- CVO dispatch centers who have access to the third party data feed and have processed the information into their systems will be able to receive real time information on roadway and weather conditions.

***Scenario #2: Crash on US 95 just south of Cactus Springs***

***A crash on US 95 has caused almost impassable conditions in the northbound direction. Eventually, one lane of traffic is allowed through during the cleanup, however traffic moves very slowly. The result is a long queue backing up to Las Vegas and over an hour delay impacting many commercial vehicles and tour buses.***

- NHP dispatchers receive notification of the event by one or more cellular 911 phone calls reporting the crash.
- After dispatching emergency response to the crash, NHP dispatchers will use the Nevada 511 Reporting tool to perform a very quick entry of the crash, and estimate a clearance time.
- Entry of the event will be similar to ‘Crash on the US 95, south of Cactus Springs, at Milepost XX, blocking northbound lanes, impacting northbound traffic heading north out of Las Vegas, for the next 2 hours.
- As conditions change or as lanes reopen, NHP will update the information in the crash event.
- 30 minutes prior to the event expiring, a dispatcher will be alerted that the event will expire soon, giving them the option to extend the event or let it expire. If the event is cleared earlier, the dispatcher will be able to terminate the event.

***From the Travelers’ View***

- The Nevada 511 website has displayed the crash as an icon on the map within two minutes following the entry of the event.
- The 511 phone system will describe the crash and the location to all callers.
- This severe crash has created an automated post to several NDOT blog sites, Facebook, and Twitter sites. Travelers who have identified the DOT sites as linked friends notice the report of the closed road.

***Scenario #3: Construction is planned on a stretch of road near Reno***

***Paving operations will close a lane of traffic on a highway located in the Northern Region for approximately 3 days.***

- Shortly after construction plans are defined, construction engineers in the Northern Region office will pass information about the event on to designated administrative assistants.
- North Region administrative assistants log in to the condition reporting system and enter the planned construction report, identifying the planned start and end date and time.
- At the time that the construction event was scheduled to begin, authorized users in the Northern Region receive an email notice that the event is about to become active in the reporting system. Users may alter the start date/time if the construction has been delayed for any reason.
- Once the event is active (the time is between the start and end date/time), the event will show on the 511 webpage and the 511 phone system as planned construction for a period of 7 days prior to the start of work. Once the event starts, it will change over to construction and play for the duration of the event.
- Shortly before the event is scheduled to end, the system will notify authorized users in the Northern Region, alerting them to the fact that the event is scheduled to be removed from the system. The users have the option to extend the event or let it expire.

*From the Travelers' View*

- The Nevada 511 website has displayed the construction event for 7 days prior to the start of the construction activity beginning.
- The 511 phone system will announce the construction activity beginning at the time the event is initially entered. It will either play as a planned event or an active event until the event is over.

***Scenario #4: Construction is planned in the Las Vegas Area***

***Paving operations will close a stretch of Interstate 15 within Las Vegas.***

- Southern Region NDOT staff members communicate the construction activity to FAST staff members.
- FAST staff members edit and customize the report to ensure consistency and enter the construction report into the on-line tool.
- FAST staff members are notified automatically by the condition reporting system when the construction event becomes active.

- FAST staff members are notified automatically by the condition reporting system when the construction event is scheduled to be removed from active status, allowing them to check with the NDOT Project Manager to verify if the activity is completed.

*From the Travelers' View*

- The Nevada 511 website has displayed the construction event for 7 days prior to the start of the construction activity beginning.
- The 511 phone system will announce the construction activity beginning at the time the event is initially entered. It will either play as a planned event or an active event until the event is over.

***Scenario #5: Amber Alert Issued in Nevada***

***In response to information received about an abducted child, the Nevada Highway Patrol (NHP) will issue an Amber Alert for the State of Nevada.***

- NHP dispatchers may either enter the event in the 511 Entry Tool or the 511 Phone system by typing an entry or recording a message, or may enter the event through that Nevada emergency alert system.
- If entered through the emergency alert system, the emergency alert system automatically sends a message using the Common Alert Protocol (CAP) to the Nevada 511 Reporting System.
- The Nevada 511 Reporting System receives the message and enters a situation with an active Amber Alert.

*From the Travelers' View*

- Because there is an active Amber Alert, the 511 phone system and 511 webpage both promote the Amber Alert message as a floodgate message. The 511 phone system greets callers with a message similar to ‘Welcome to Nevada 511, there is currently an Amber Alert impacting the Carson City area, to hear details of the Amber Alert remain on the line, to go to the main menu, say ‘Main Menu’’. Therefore, callers will by default hear the Amber Alert message unless they opt not to.
- Visitors to the 511 web site will view a notice of the Amber Alert, possibly using such things as a scrolling message, a special alert floodgate box, or a flashing alert.

- Once the Amber Alert is closed, the emergency alert system will send a message to the Nevada 511 Reporting System to inform the system that the Amber Alert has been cancelled, and the Amber Alert (and all outgoing messages) will be expired from the system.
- Subscribers to social messaging utilities will view alerts posted by the NDOT staff automatically. The word will spread quickly to people not calling the 511 phone system or viewing the website, but those that are simply monitoring their messaging utilities.

## 8 Summary of Impacts

The desire of the NDOT staff is to have a system that travelers of all modes can access information on their preferred mode and be notified of delays on those modes. Whether it's construction events or an accident on Nevada's roadways, a transit route that has been canceled or a delay of a flight of specific airline, users want timely, accurate, and reliable information.

With the development of a second generation 511 system, Nevada has the advantage of looking back on what's not working and modifying it and also looking at what resources can enhance their system to better meet the needs of all its users. However, with those modifications/additions, some impacts can be expected during development.

### 8.1 Operational Impacts

- Transition of the old system to the new system will provide an area that could possibly impact the system performance, however, this transition should be a moderate risk. If the current vendor is selected, they will continue to maintain the existing system while making modifications to meet the requirements of the new system. The major impact with the existing system is the possibility that making changes/modifications could introduce failures in the existing system. If a new vendor is chosen, the risk/impact is minimal. A new vendor is able to develop the new system in an environment that is not under a requirement to maintain an existing interface to the users. They will be able to develop, build, and test the system with all the existing and new features in a sterile environment, thus reducing the risk to the system.
- Once the system transitions to the modified format, NDOT can expect to receive feedback from system users that they don't like the changes, they can't find the information they need, it is hard to understand, etc. NDOT can defer this impact by marketing the system and its new features prior to the new launch.

### 8.2 Organizational Impacts

- As stated previously, the desire of NDOT staff is to have a system that provides a single point to where users can obtain information on all their transportation needs. Currently, systems work independently now and by merging these resources together, there could be issues with agencies not wanting to or not being able to share their data because they are afraid they would lose their agencies identity or due to security issues. NDOT and the selected vendor will have to work with these agencies to determine the reasons that the data can't be shared and then find a resolution.

### **8.3 *Developmental Impacts***

- By interconnecting data from various sources, it is likely that there will be different formats of the data distribution or no connectivity available to that data. An impact to the success of the NDOT vision is that not all transportation modes can be connected and available within the system. NDOT and the selected contractor will have to coordinate with the transportation agencies and determine how to get the needed data. As part of this project, however, the agencies that NDOT desires to coordinate with will be identified and the availability of their data to be shared and in what format will also be determined. So NDOT will know prior to developing requirements what agencies they will interface with and the level of effort it will take to get the data from that agency.