PROJECT REPORT

ALASKA TRAVEL INFORMATION SYSTEM
FEDERAL #ITS-0106-003

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Project Location: Alaska

FY01 ITS Earmark Total: $955,639 (50/30/20)

Submitted by: Jill Sullivan, *ITS Coordinator*
ADOT&PF-Division of Program Development

Project Contact: Jill Sullivan
ADOT&PF- Division of Program Development
3132 Channel Drive
Juneau, AK 99801
PH: (907) 465-8592
E-mail: jill_sullivan@dot.state.ak.us

Web Site: 511.Alaska.gov

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OVERVIEW

The Alaska Department of Transportation & Public Facilities (ADOT&PF) initiated the Alaska Travel Information System by joining the Condition Acquisition & Reporting System/511 (CARS/511) Pooled Fund in October 2002. CARS was jointly developed by the member states of the REPORT Transportation Pooled Fund Program #SPR-3(079). CARS is a multi-state database of road and traffic situations (events) supported by multiple, widely distributed web browser data input terminals. These multi-state travel information databases drive automated 511 messages without further manual intervention.

CARS/511 Pooled Fund

When the ADOT&PF joined the CARS/511 Pooled Fund only 6 states were included: Iowa (lead state), Maine, Minnesota, New Hampshire, New Mexico, Vermont. Today, 14 states have joined. However, not all of the 14 states are part of the 511. These states use CARS as the travel information database, but they apply their own technology to deploy 511 by phone or web. Pooled fund membership is shown in Table 1.

Table 1. CARS/511 Pooled Fund Membership

Member	CARS Pooled Fund	511 Pooled Fund
Alaska	Yes	Yes
Florida	Yes	No
Iowa	Yes	Yes
Kentucky	Yes	Yes
Louisiana	Yes	Yes
Maine	Yes	Yes
Minnesota	Yes	Yes
Missouri	Yes	No
New Hampshire	Yes	Yes
New Mexico	Yes	Yes
New York	Yes	No
Rhode Island	Yes	Yes
Vermont	Yes	Yes
Washington	Yes	No

The benefits of joining the pooled fund group include:

- feasibility of the software and hardware involved – Each state pools funds to pay for updates, upgrades, technical support, and operations. This pooled fund concept produces a system that is much more affordable for states and helps states get more for their money. For example, the pooled fund group purchased a call center to drive down the costs of phone. Also, the pooled fund negotiated very low long distance rates from a phone company that could service 14 states. (Alaska Long Distance – 2.3 cents/minute)

- sharing innovative additions to CARS - When a pooled fund state pays for new features for their specific use, the other states have the benefit of using that new feature without added costs. In addition, if the pooled fund states want a new feature to CARS, it is cost-shared among the group.

- bargaining power and influence of pooled fund - The pooled fund has negotiated funding from FHWA, generated interest from other states and Canada to join, negotiated low long distance rates with Qwest, and built a call center at Bell South facility with the latest in voice recognition technology, generating interest and respect from other 511 states.

- telephone line availability- A typical 511-call center operates with just a few active lines, except during periods of a major event, such as a significant storm. Then the call center must have many additional lines to handle this peak event. By pooling with other states, their time-of-day peaks spread over five time zones, and major storm event peaks are unlikely to occur simultaneously, thus fewer lines are needed per state DOT.

- access to advanced technological equipment & resources – The pooled fund call center houses the latest voice recognition technology including speech recognition, text-to-speech systems and the interface to a data base via voice-XML protocols. This equipment is quite expensive without cost sharing. The pooled fund concept also helps states avoid the need to develop and maintain a complex state-vendor relationship alone.

CARS

CARS serves as a data collection system for road and traffic situations allowing for the manual entry and automated assembly of National ITS Standards compliant data that incorporates information on:

- accidents, incidents, obstruction hazard or other problems that may adversely affect safe and efficient travel
- current and planned road construction activities, lane closure or road closures
- current and expected weather situations, either observed or externally forecast
- National Weather Service watches and warnings
- congestion, delay, or other significant consequences of the above events

The Alaska CARS is mainly rural based, with major arterials in the Anchorage area. Congestion and traffic flow is not a current feature to the system, but has the potential as Anchorage interest grows. In addition to the list above, Alaska CARS includes ferry tracking information available on *511.Alaska.gov*. The next phase is to offer real time ferry arrival/departure information in 2005.

CARS obtains information by manual input from distributed terminals located at authorized information sources via internet/intranet. The public domain CARS software supports standards-compliant data exchange with other states, counties, metropolitan/city areas, and with private sector entities involved in traffic information and road reporting. CARS can also support data exchange with road and weather condition prediction systems. The Alaska CARS ingests road weather data from the Road Weather Information System (RWIS).

CARS Benefits

- improves internal communication – When an event is entered into CARS, that information is shared with all other users of the system who might be affected by that situation. For example, when the Division of Statewide Design & Engineering Services inspects a bridge with a lane closure and enters that event into CARS, commercial vehicle operations using CARS can make use of that information when issuing commercial vehicle oversize and overweight permits.

- improves external communication- As new partners join the Alaska CARS/511, transportation related agencies that have traditionally worked together can now use a single source to share travel information. For example, when the AST reports an avalanche event to CARS, this information is shared with ADOT&PF M&O personnel who may need to respond. This can also help improve incident response when one agency reports an incident that is unknown to another.

- reporting closer to the action and timeliness of information- M&O personnel previously reported road conditions from the various maintenance stations to the regional office by fax. The faxed reports were then retyped and posted as a daily web page in text format. This two-step process was tedious, error prone, expensive, and, the information was outdated by the time it was posted. With reasonable internet access each maintenance station can enter local conditions as they change using CARS. CARS allows for the exchange of real-time information The old system was time consuming due to manual processing and had the potential to generate outdated information.

511

Once the information is entered into CARS, it automatically generates events for *511.Alaska.gov* and the 511 telephone. No further entry is necessary unless there is an update in the event, i.e., weather change, accident delay status, etc. CARS has the intelligence to automatically time out situations so that users do not have to reenter CARS and delete the situation.

Travel information on the web is more detailed than on the telephone. The web provides time/date stamps for each situation. It also provides camera images from the road weather information system, National Weather Service (NWS) forecasts, ferry tracking information and other travel information links, like the Canadian road condition web pages. Less information is made available via the 511 telephone to maintain the safety of travelers calling from their vehicle.

511 Benefits

The main benefit of 511 is that it offers the public a single source of travel information. While State employees often think in terms of regions, camps, agency's or other internal distinction, the public cares little about these artificial boundaries. When making a long distance trip travelers should not be directed to four or more web sites and phone numbers to gather current travel information. CARS/511 offers the ability to collect this information from many different sections and agencies, and then present this information as a seamless portrayal of the overall travel conditions into a single web page and phone number.

Partners
The ADOT&PF relies on partners to deploy travel information through CARS/511. The ADOT&PF cannot provide enough travel information alone and relies on other transportation related agencies to help support the system.

The ADOT&PF signed a Memorandum of Understanding (MOU) with the Municipality of Anchorage (MOA) to help generate travel advisories for the Anchorage area. The only MOA section to really take an interest thus far is the Anchorage Police Department (APD). The APD generates 511 travel advisories for major accidents that affect travel or other urgent reports, such as hazardous road conditions due to weather. Other partners include the Alaska State Troopers (AST) and the Palmer Police Department, who recently joined to help enter travel advisories.

The ADOT&PF approached both the Yukon Roads Department and the British Columbia government to help generate road conditions in the 511. The benefits of this approach is to provide Canada/Alaska travel information from one phone number and one web page. The Canadian government, however, is pursuing 511 as a Canada wide travel information number. Until this passes, both the Yukon and British Columbia government are reluctant to join.

Other partners include the NWS, the Alaska Marine Highways (AMHS), US Customs & Border Protection (US Customs), and the ADOT&PF Commercial Vehicle Enforcement (CVE) The National Weather Service provides direct weather and forecast information to the 511. The AMHS shares the ferry position reports for the *511.Alaska.gov*. These reports will eventually be programmed to provide real-time arrival/departure information. The US Customs helps report road conditions to 511 at the borders. The CVE is working directly with the pooled fund contractor to automate oversize/overweight commercial vehicle permits using CARS.

PROJECT TIMELINE

ITS Earmark Secured .....May 2002

Joined CARS/511 Pooled Fund .....October 2002

MOU with Municipality of Anchorage.....April 2003

511. Alaska.gov and 5-1-1 Telephone Launch .....April 2003

Usage Study (Western Transportation Institute).....Spring 2005

CVE Oversize/Overweight Permits.....Summer 2005

511 USAGE

Chart 1 shows call volumes from June 2003 until November 2004. The data collected between June 2003 and November 2004 show seasonal spikes during winter months when many callers inquire about winter travel conditions. In particular, a sharp spike occurs in November, which is most likely due to the beginning of winter season. January 2004 shows as the peak month with 11, 946 calls. A slight increase in calls occurred in June and July due to roadwork events, but not a significant amount when compared to call volumes during the winter months.

Several items that may have affected the data collection are:

- calls placed to test the system by both the consultant and ADOT&PF personnel
- weather patterns
- construction and maintenance events
- change of the menu options in December 2003 to include "Highway Reports"
- new voice recognition technology that Alaskan travelers are not use to. (previous road condition reports were voice mail)
- voice recognition issues where the caller was unable to receive the information requested.

In mid-November, the ADOT&PF changed the menu structure to make key pad entry more apparent. This may also affect call volumes.

Chart 2 shows total minutes by month. The total minutes increased substantially in 2004 when compared to 2003. No data is shown for April 2004. From June – November 2003 total minutes were 34,432. From June 2004 – November 2004 total minutes were 104,966. The average phone call length in 2003 was 1 minute compared to 3 minutes in 2004. It is unknown why the total minutes increased when the call volumes were very close between the same time period. A major change in menu structure occurred in December 2003 which could have contributed to longer phone calls.

ADOT&PF launched *511.Alaska.gov* the same time as the phone in April 2003. We do not have use statistics since CARS and the 511 web page reside on Castle Rocks server.

Chart 1. 511 Call Volumes

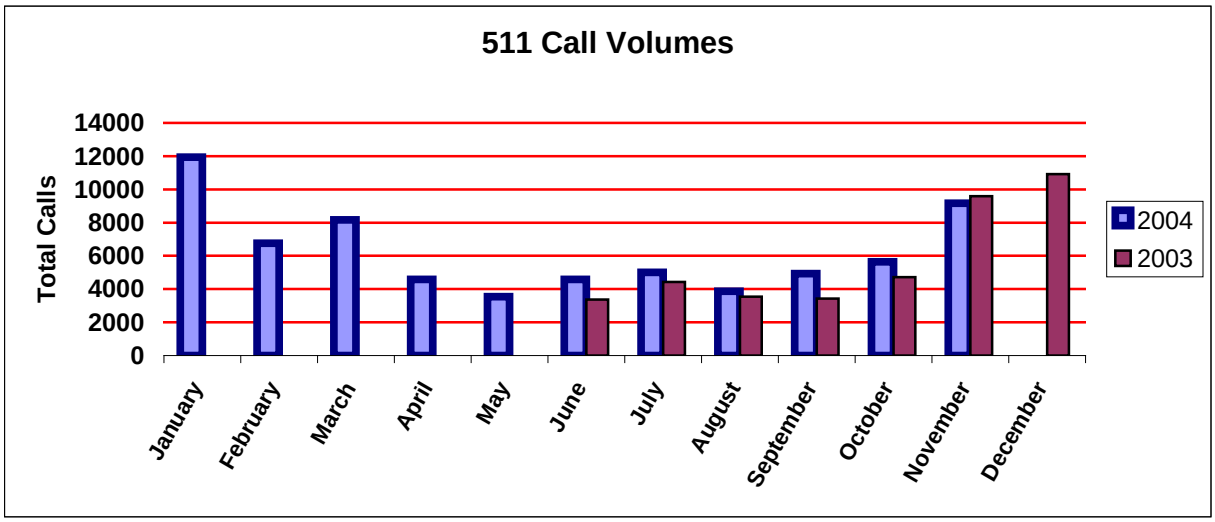
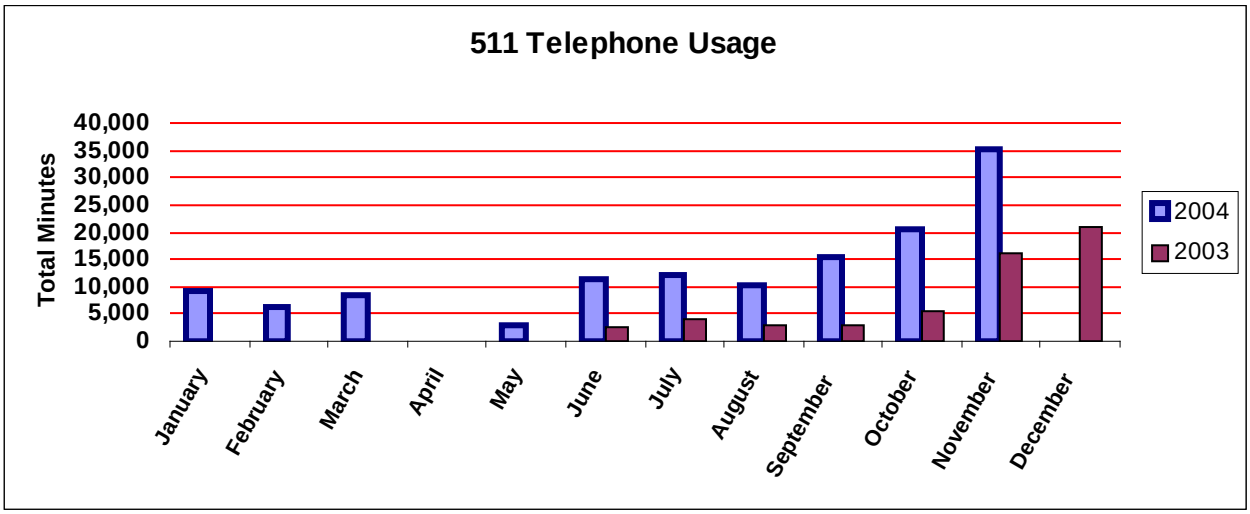


Chart 2. 511 Telephone Usage – Total Minutes



LESSONS LEARNED

Technical

The majority of issues are related to the technology itself. Updates and fixes to CARS are ongoing and numerous. In order to address these issues, the ADOT&PF created a 511 Steering Committee to steer the direction of CARS/511 and address ongoing issues and changes to the system. Most technical issues relate to the 511 telephone, which is based on voice recognition technology: They are:

- Voice recognition technology does not always recognize caller requests. Sometimes the 511 telephone will not understand a caller for several reasons: background noise, accents, speaking too fast or unknown requests. Anyone of these can foul up the system and make for a very frustrated caller. To address this issue, the contractor revised the menu structure in November 2004 to make the keypad entry more obvious.

- The 511 telephone has some mispronunciations of names and features. With voice recognitions software, all phrases, city/town names, features, highways/roads are pre-recorded in a studio. A New Mexico DOT employee generates the recordings for the entire CARS/511 pooled fund. These mispronunciations can be frustrating to the caller. To address this, the contractor can rerecord mispronounced words fairly easy.

- New technology is not widely accepted by Alaskan's. As with any new technology, it can generate reservations. Feedback from the general public has been mainly positive. However, the small number of callers do not like the system because it's not a "real" voice, thus providing a call system that does not have voice friendly verbiage. Again, the 511 telephone is based on prerecorded voices where it can sound programmed and unfriendly to callers use to a real voice message. For the

most part, the rural areas of Alaska were complacent with the old system. It is quite often heard, "why fix it if it wasn't broke" comments.

Technical issues related to the CARS include:

- Roads and features are inadequate in CARS. The roads in CARS are built on the ADOT&PF's Highway Analysis System (HAS), which houses the roads in a linear referencing system and contains various features i.e. rivers, bridges, buildings, commercial businesses, historical Mileposts, etc. The contractor also relies on the Milepost Magazine to fill in features that were missing or to add key landmarks. Between these two, the road features in CARS were still inadequate due to missing features along a route, features in the wrong location, not enough mileposts markers or features that were not "travel friendly" enough to use. When users create a situation in CARS, they need to identify an exact location to determine where the situation is occurring. A historical Milepost reference is generally the best option. When the CARS location list is inadequate, they are unable to enter the situation or enter the situation using correct location information. This creates problems for the public that is relying on this information when it's incorrect or missing. In addition, only Statewide highways and main arterials in the Anchorage area are included in CARS. This can create problems for the user. If the road is not in the system, they cannot enter a situation.

  Another issue with the roads and features is that CARS is built on the ADOT&PF's linear referencing method, the route Milepoint. HAS data is based on Milepoint, rather than the historical Mileposts which are mostly inaccurate and outdated. This poses issues with the CARS users, namely M&O and Construction who are familiar with the historical Mileposts. Personnel are very familiar with roads in their jurisdiction and having to use a system that references Milepoint, rather than their familiar historical Mileposts, is very frustrating. To alleviate this frustration, new road data is being added that contains historical Milesposts. However, the new data is not available all at once. Only several roads have been upgraded.

- CARS has a few software features that frustrate users. For example, users are not able to complete simple tasks such as cut and paste when using phrases to describe the situation. The contractor is aware of the features that are cumbersome and frustrating and will address them with each new software update.

- CARS generates occasional errors. CARS has bug issues that can sometimes be frustrating not only to the general public, but to the CARS users. For example, all of the situations were erased one day so that no travel information was showing on the 511. The CARS users soon discovered that the contractor was completing a software update and it accidentally erased all of the situations. Another example, is that CARS resets to Eastern time zone occasionally. This can keep the user from entering a real-time situation when the time zone is off by 4 hours.

Overall, addressing the CARS and 511 technology are ongoing. The 511 Steering Committee meets monthly via telephone to address these issues and discuss future changes.

Sometimes this is quite frustrating dealing with new technology, but overall CARS/511 is helping to improve efficiency for the ADOT&PF and supplies the public with a "one-stop travel information shop."

Lessons Learned - Technical

1. The ADOT&PF can't please everyone- Both ADOT&PF personnel and the general public provide comments and feedback on the system. It's very difficult to please all the users. Someone is always going to be unhappy. The ADOT&PF does take the time to form responses and try to make improvements based on feedback.

2. New technology generates reservations- For the most part, the rural residents were complacent with the old system. It is quite often heard, "why fix it if it wasn't broke." In order to address this, the ADOT&PF will continue making improvements based on public feedback.

3. New technology takes time to be successful- The ADOT&PF launched CARS/511 on April 2003, which has had numerous technical issues. It's taken time and patience to work out bugs and customize the system for the users. It also takes time to build trust and gain support from internal users.

4. Create a 511 Steering Committee- The steering committee includes various members within the ADOT&PF and meets monthly to address issues. This helps take the pressure off of the project manager who is burdened with trying to please everyone and prioritize new features and edits. More importantly, however, the committee has generated support internal to the ADOT&PF.

5. Need a contractor who is available 24/7 for technical support- Castle Rock Consultants (CRC), the pooled fund contractor, is sufficiently staffed to respond to technical issues 24/7. CRC has been very supportive and addresses our high priority concerns immediately.

Institutional

Internal:

Internal issues include gradual buy-in from within the ADOT&PF personnel, inconsistent use of the system and not taking the system seriously at first. These results occurred for several reasons:

- Many personnel were not accustomed to relying on technology such as computers and the internet. With the old system, M&O faxed the daily road condition reports. Accepting a new system that relies on computers takes time and patience.

- CARS/511 requires user training to enter a travel advisory. In many cases, where users are not computer savvy, the ADOT&PF had to provide follow-up training or a one-on-one user training.

- Some divisions already had a means to provide travel information to the public and have invested time and funding to do this. The Construction section already has a contractor in place to provide a logo, phone number, web page, and they coordinate

with the local newspapers to advertise the construction events. There were some bad feelings at first over the 511, but soon Construction learned of the efficiencies in the system and eventually became supportive. In 2005, the Construction division will completely convert over to the CARS/511.

- The ADOT&PF took a top-down approach. The ADOT&PF initiated the CARS/511 from the Headquarters office. The ADOT&PF required that all regions support and enter travel information into the CARS/511. The downside of this approach is that the regions feel forced into change, sometimes creating feelings of animosity. The upside is that Headquarters is able to control and mandate the system to the regional offices.

- Importance of entering travel information was not taken seriously at first. It took time for ADOT&PF personnel to realize the importance of CARS/511 and to have continuous use of the system to keep the public informed. Throughout the first year, many maintenance and construction activities were not being reported to the 511. Much of this may have been due to the lack of training, but it was also due to the lack of importance of having to report the information. The ADOT&PF sends out letters reminding the regional offices the importance and consistent daily use in entering travel information into CARS.

Other internal issues include working with the 511 Steering Committee. Each of the members have requests to make changes or updates to the system. It can be time consuming to figure out the best needs of the system for both the general public and ADOT&PF personnel.

Lessons Learned – Internal:

1. Gain early buy-in from personnel that will be using the system. Gaining buy-in is crucial before the system is deployed or bad feelings and slow buy-in will occur.

2. Emphasize the importance of getting travel information into the system continuously with the users by sending out reminders, making phone calls, etc.

3. Create a steering committee made up of members to represent each of the divisions. This can help increase support if personnel are well represented and they can contribute to the changes of the system.

4. Provide training as often as necessary and be available to answer questions.

5. Emphasize the benefits of the system. The ADOT&PF must continuously emphasize the benefits of CARS/511 to gain support from internal personnel, partnering agencies and the general public.

6. Complete a usage study from both the public and internal users. This can help the 511 Steering Committee agree and prioritize changes and updates to the system and help with overall management. The ADOT&PF is hiring Montana State University-Western Transportation Institute to complete a usage study in Spring 2005.

External
A major external institutional issue is partnerships with other transportation-related agencies to enter travel information. The ADOT&PF cannot provide statewide coverage without the aide of other agencies like the AST, local police departments, municipalities and boroughs. In the winter months, the ADOT&PF can only provide road condition reports at specific locations, such as the maintenance stations. A major comment from the public, is that this is not enough information. Travelers need information between these specific locations which, in some cases, is hundreds of miles. The AST, however, can help fill in some of these gaps, as well as local police departments. Unfortunately, support from AST has been slow. Their number one priority is 911 emergency. It's taken months of continuous calls, meetings and training to finally gain support.

Some of the local police departments, such as Palmer Police Department and Anchorage Police Department volunteered to support 511 right away. One of the main benefits to them is to refer callers to 511 when they use 911 to ask about travel advisories. The only downside has been getting consistent use in entering the travel advisories.

Lessons Learned – External:

1. Persistent selling of benefits to partner agencies is necessary to capture and maintain support.
2. Provide continuous training and technical support as needed.

PROCUREMENT

The ADOT&PF is part of the pooled fund group. Funding is directly sent to the lead state, Iowa DOT. Since this is government-to-government exchange of funds, there are no strict procurement rules that the ADOT&PF has to follow. Also, the ADOT&PF used an Invitation to Bid to produce highway "511 Travel Info" signs and uses stock requests occasionally to purchase smaller items such as marketing materials.

MARKETING SCHEDULE

The following is the marketing schedule:

- Letters & Marketing CD's (visitor centers, media and resorts) --------- June 2003
- 511 Decals –State Vehicles ---------- July 2003
- 511 Marketing Booth- Alaska State Fair ---------- Aug 2003
- 511 Marketing Booth-Alaska Municipals League---------- Nov 2004
- 511 Visitor Rack Cards (visitor centers, US Customs, Weigh Stations, ADOT&PF Regional offices)---------- Nov 2004
- 511 Highway Signs ---------- Spring 2005
- Highway Sign Press Release ---------- Summer 2005

See Appendix B for 511 Highway Sign
See Appendix C for 511 Visitor Rack Cards
See Appendix D for 511 Decals

ITS STANDARDS

CARS is fully compatible with the National Transportation Communications for ITS Protocols (NTCIP/ESS) standards as defined by AASHTO at the time of project completion. Castle Rock Consultants wrote an ITS Standards Plan for the pooled fund group. See Appendix A for the CARS/511 Standards Plan.

APPENDIX A

State of Alaska
CARS / CARS-511 Project

Technical Memorandum

ITS Standards Plan

April 10, 2003

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INTRODUCTION

Over the past several years, there has been a significant effort in the Intelligent Transportation System (ITS) community to develop standards that define how ITS components operate and interact. These standards efforts are being performed in parallel to the development of the National ITS Architecture. The goal of the National ITS Architecture is to define the communication and interaction needed between major systems and components to effectively use and benefit from ITS. To successfully achieve this interaction and achieve interoperability, the ITS standards efforts are identifying the format and type of data to be communicated between the various systems. Essentially, the National ITS Standards efforts are seeking to establish a common language and vocabulary so that components from different manufacturers and being used by an agency (or different agencies) can communicate.

Unfortunately, there have not been standards in the past to define how these devices communicate with other related equipment. As a result, each manufacturer has developed its own protocol to meet its particular needs. To integrate systems manufactured by different companies, considerable extra work must be performed resulting in increased costs. This shortcoming limits interchangeability of components between different vendors and restricts information sharing within and between user organizations. These problems have not been limited to any particular field or type of device. Many systems and devices need to exchange information. In surface transportation, examples include traffic signal controllers, dynamic message signs, bus priority sensors, weather and environmental monitoring, etc.

The development of standards will allow for a more open-systems approach among a wide variety of field devices. It is expected that this approach will result in lower deployment and equipment costs.

National ITS Standards Efforts

The United States Department of Transportation (U.S. DOT) is supporting specific ITS standards initiatives in areas that have significant public benefit. To expedite deployment of nationally interoperable ITS systems and services, seven standards development organizations (SDOs) are developing a host of non-proprietary, industry-based ITS standards. These SDOs include:

- Institute of Transportation Engineers (ITE) & American Association of State Highway and Transportation Officials (AASHTO)
- National Transportation Communications for ITS Protocol (NTCIP) a joint initiative of AASHTO, ITE, and National Electrical Manufacturers Association (NEMA)
- American National Standards Institute (ANSI)
- American Society for Testing & Materials (ASTM)
- Institute of Electrical and Electronics Engineers (IEEE)
- Society of Automotive Engineers (SAE)
- Electronics Industry Alliance (EIA)

To assist in disseminating information regarding National ITS Standards, the U.S. DOT established a web site with background information, a listing of available standards documents and links to the various organizations involved in the standards efforts. The web site, http://www.its-standards.net, also provides links and fact sheets for each of the National ITS Architecture interfaces and application areas. The links identify the relationship of the application area to the National ITS Architecture while the fact sheets provide links to all the relevant standards.

Center-to-Roadside

Communications between transportation or traffic management centers and roadside equipment that regulates the flow of traffic are covered under the standards for this category of application areas.

- Data Collection and Monitoring
- Dynamic Message Signs
- Environmental Monitoring
- Ramp Metering
- Traffic Signals

- Vehicle Sensors
- Video Surveillance

Center-to-Center

Those standards that facilitate communication between transportation management centers are incorporated in this category of application areas. This category also includes communications necessary for transit use.

- Data Archival
- Incident Management
    - Rail Coordination
    - Traffic Management
    - Transit Management
    - Traveler Information

Center-to-Vehicle/Traveler

This category of application areas includes those standards that facilitate communication between transportation management centers and the driver of a vehicle or a traveler planning a trip. This category also includes communications necessary for coordination between transit management centers and their vehicles.

- Mayday
- Transit Vehicle Communications
- Traveler Information

Roadside-to-Vehicle

This category of application areas includes those standards that facilitate wireless communication between roadside equipment and vehicles on the road.

- Toll/Fee Collection
    - Signal Priority

Roadside-to-Roadside

Standards that facilitate communications between railroad wayside equipment and highway roadside equipment are included in this category of application areas.

- Highway Rail Intersection (HRI)

RELEVANT STANDARDS OVERVIEW

The National ITS Standards efforts underway by the seven SDOs incorporate both the words (data elements or object definitions) and the sentence (message set) needed to communicate between systems and agencies. In addition to these two components, the specific format (encoding language) used to send the data has also been defined within the National ITS Standards effort.

Data dictionaries are essential components in the operation of computer-based ITS. They provide the basic information definitions, generally described as data elements (DEs), that are used in the exchange of information between systems. An established data dictionary with unambiguous definitions is one of the essential standards required to exchange messages among systems.

Message sets are an essential component in the design and operation of modern computer based systems. They provide the basic information flows (generally described as messages) upon which communications between systems depend. Specifically, a message set provides the information definition (semantics) and format (syntax) to handle individual information exchanges on specific topics. Thus, agreed upon message sets with unambiguous message definitions is one of the essential standards required for information exchange between individual traffic management systems as well as between a traffic management system and other ITS users and/or suppliers of traffic related information. In essence, message sets are the sentences whereas data elements are the individual words.

ITE/AASHTO - Message Sets For External Traffic Management Center Communication

This standard provides message sets necessary to convey data within and between traffic management centers and other ITS centers. It provides a list of specific data elements for each message plus other necessary format information. The standard is designed to be independent of any specific communications protocol.

The development of standardized message sets for Advanced Traffic Management Systems (ATMS) is an essential part of the suite of ITS standards for information exchange. It is a high priority within the ITS program. The development of the Message Sets For External Traffic Management Center Communication (MS/ETMC2) standard, is further seen as an important step in achieving the broader goal of implementing the National ITS Architecture which will assist in the deployment of ITS services and functions. An important message set within this standard is the Event Report Message (ERM), which was developed by a group of states participating in the Condition Acquisition and Reporting System (CARS) Pooled Fund Study.

The ERM defines a message set that provides an overview (summary) message for a near real-time data exchange between a traffic management subsystem and the following types of transportation center/subsystems: information service provider; transit management; emergency management; toll administration; emissions management. In being adopted into the MS/ETMC2 standard, the ERM message set prompted significant review of current messages and brought forth a strategic effort to harmonize and integrate data elements and messages between the ERM and the Information Exchange Network (IEN) currently used by Northeast states along Interstate 95. This harmonization will ensure that the ERM and CARS will be able to interact and exchange information with the IEN. The ERM also prompted collaboration efforts with the SAE Advanced Traveler Information System standards group to harmonize data elements and message sets for greater interaction with in-vehicle devices.

ITE/AASHTO - Traffic Management Data Dictionary (TMDD)

This standard provides a functional level data dictionary consisting of and defining a set of data elements necessary to support data communications within and among traffic management systems. The TMDD, as a national functional level data dictionary, provides a standardized national set of data elements that are intended to be the basis of data dictionaries implemented at specific sites.

This standard was developed for ITS systems that manage traffic. For the TMDD, the primary message set is the companion standard, described in Section 2.1. The standard provides a functional level data dictionary consisting of and defining a set of data elements necessary to support data flows within and among traffic management systems. Specifically, as a data dictionary standard, it provides meta attributes for each DE including definitions (semantics) and specific format (syntax) for individual DEs. The TMDD, as a national functional level data dictionary, provides a standardized national set of DEs that are intended to be the basis of individual application-level data dictionaries implemented at specific sites. The CARS Pooled Fund Study states submitted a series of data elements and enumerated lists to the TMDD that had not previously been considered for adoption. These additions formed a bridge between the specific needs of the transportation system users, the information service providers and the general public by ensuring that easily understood phrases be adopted.

NTCIP – Common Public Transportation Objects; Scheduling/Run-cutting Bus. Area Std.

These standards provide data elements and message sets for the management and operations of public transit systems. The standards include data elements and message sets for describing schedules, runs, routes, and trips, among other common industry entities. The data elements and objects are sufficiently generic to support a wide range of transit modes, including bus, light rail, and ferry boats. The Scheduling/Run-cutting standards enable discrete systems to share published timetables, schedule deviations, and other key transit events.

NTCIP - Object Definitions for Environmental Sensor Stations (ESS)

This standard provides the vocabulary for the management of environmental sensor stations, including road weather information systems (RWIS) and air quality monitoring systems. The standard defines those objects used to describe ambient conditions and pavement conditions. It includes conformance group requirements and conformance statements to aid in the preparation of procurement specifications. Environmental sensor stations (ESS) can collect a wide array of data including atmospheric and surface conditions. A Remote Processor Unit (RPU) connects these sensors and acts as the hub for transferring the data to a central database.

NTCIP - Object Definitions for Dynamic Message Signs (DMS)

This standard provides the vocabulary for traffic management and operations personnel to advise and inform the vehicle operators of current highway conditions by using dynamic message signs. This standard also includes a message syntax, which allows objects to be grouped into a message object. A dynamic message sign is any sign that can change the message presented to the viewer. The standard includes conformance group requirements and conformance statements to support compliance with the standard. The objects include commands to the signs, messages for display, and responses from the signs to the transportation management center, as well as "free text" objects that allow an operator to have stored or newly created messages displayed by the sign.

SAE - Advanced Traveler Information Systems Data Dictionary

This standard defines the data elements for advanced traveler information system (ATIS) messages. In addition, it may be used by other ITS systems that convey information about ATIS-related items. This standard is the repository of definitions needed to convey information to travelers and is one of a group of basic standards.

This standard, SAE J2353, defines the data elements for ATIS messages. In addition, it may be used by other ITS systems that convey information about ATIS-related items. This standard is the repository of unambiguous definitions needed to convey information to travelers and is one of a group of basic standards that are often referred to as functional area data dictionaries. It provides the concise definition of data elements, including instructions on how to encode them at the bit level. It also describes the implied meaning of various phrases and points to other related data concepts on an element-by-element basis.

SAE - Advanced Traveler Information Systems Message Sets

The standard Advanced Traveler Information Systems Message Sets (SAE J2354), provides the messages that are exchanged among information providers, traffic management centers, and other ITS centers. This standard defines message sets for advanced traveler information systems (ATIS) for general use independent of medium of transmission or bandwidth. The message sets themselves are made up of the data elements defined in companion standard SAE J2353. This standard also provides a variety of ATIS messages, both one-way and two-way in nature, as well as various profiles for requesting such messages. In addition, it contains a diverse array of supporting messages including traffic flow, navigation, transit, weather, parking, and other commercial uses of ATIS. This standard provides a catalog of ATIS messages that can be used for many ATIS applications.

IEEE - Standard for Data Dictionary for Intelligent Transportation Systems (Standard 1489-1999)

This standard provides message sets necessary to convey data within and between traffic management centers and other ITS centers. It provides a list of specific data elements for each message plus other necessary format information. The standard is designed to be independent of any specific communications protocol.

This standard provides the rules for developing and defining data concepts used in the ITS functional area data dictionaries. There are three types of data dictionaries defined in this standard: application-specific data dictionaries; functional area data dictionaries; and the ITS data registry. The data registry is a single repository for all ITS data concepts developed by the other data dictionaries with the purpose of

encouraging unambiguous data interchange and reuse among the ITS functional subsystems via their specific application systems.

Historically, there have been no standards used to define the information exchanged between electronic systems. When microprocessor-controlled equipment and systems are integrated into a central control system, the commands, responses, and data may be different for each item and may be subsystem-specific. The lack of standardization made it difficult for developers to combine different systems into a larger system resulting in higher costs, as unique translators had to be developed to define the data being exchanged by the systems. However, because this standard establishes a national standard for defining data concepts, it allows transportation systems to interoperate. This standard embraces features of existing worldwide and U.S. national interconnectivity standards on how information is defined in open systems.

DATEX-ASN.1

One of the first efforts to standardize the interface between transport control centres was a European Union effort led by the DATEX Task Force. A common interface was initially developed and named the Data Exchange Network (DATEX-Net) Specifications for Interoperability. In 1997, worldwide efforts began to merge together with the Abstract Syntax Notation (ASN.1) structures for the Data Exchange in Abstract Syntax Notation (DATEX-ASN) messages. Messages may be sent from a Traffic Management Subsystem to any other transportation center/subsystem that conforms to the data exchange requirements of the NTCIP-Application Profile-Data Exchange-ASN.1 (DATEX-ASN-AP). DATEX-ASN is currently being standardized through ISO/WD 14827-2, Transport Information and Control Systems – Data Interfaces between Centres for Transport and Information Control Systems, Part 2: DATEX-ASN (Reference 2.2.7).

The standard which details the Octet Encoding Rules (OER), known as NTCIP 1102, is a presentation layer standard that defines how NTCIP objects are encoded (i.e., the exact digital representation of the value of an object that is to be transmitted over a communications path). It is used in conjunction with application layer protocols defined in other standards. This standard is applicable to both center-to-roadside and center-to-center communications. Unlike the other types of encoding rules used in standards-based implementations, such as ASN.1 basic encoding rules (BER) and packed encoding rules (PER), OER addresses the specific needs of certain application layer protocols used by the transportation community. Originally, a subset of the encoding rules defined in this standard was specified in the Simple Transportation Management Framework (STMF) standard. However, in order to address extended ASN.1 functionality needed for center-to-center communications, the necessity to develop a stand-alone document became apparent. The result is this standard, which replaces section 5.1.2.2 of the NTCIP 1101 standard (along with its Amendment 1 of 1998).

INTERNET STANDARDS

The communication protocols for transmitting information between systems are governed by the standards, guidelines and procedures for communication over the Internet. The main protocols used are direct dial-up links and the dedicated links via the internet. A wide range standards exist, including:

- Point-to-Point Protocol (PPP) - which can be used for dial-up links;
- File Transfer Protocol (FTP) - allows for the transfer of files between connected systems;
- Internet Protocol (IP) - which can be used for networks (local-area and wide-area); and
- Transport Control Protocol (TCP) - which provides connection-oriented services over networks.

Traveler Information via 5-1-1

There are several methods available for delivery of traveler information including the most recent development into 5-1-1 services. Recently, the U.S. DOT assisted in establishing a coalition of 30 state and local agencies is led by AASHTO. The 511 Deployment Coalition is addressing issues raised by the Federal Communication Commission. These issues include minimum levels of content, national consistency of information and access cost. The policy committee identified a need to establish minimum content level guidelines that will enable public and private sector providers of traveler information.

The working group is currently drafting guidelines for content to identify baseline content, data quality levels, additional and value-added services. The committee is also addressing if there is a need to segment the requirements based on geography, ensuring the guidelines include experience from transit and highway services, and ensuring that the services provided do not make 511 service cost prohibitive. Perhaps most importantly, the working group is developing guidelines for system navigation and user interface design. This includes determining if menu trees should be compulsory and consistent, will voice recognition subsystems be required, initial greeting structure, timestamp information and minimum hours of operation.

While most of these efforts primarily involve the areas of service content, structure and user interface, the exchange of data between transportation agencies and providers of 5-1-1 service (public or private) are governed by the ERM, TMDD, MS/ETMC2 and SAE ATIS standards.

Low Power FM and Highway Advisory Radio

Low power FM (LPFM) and Highway Advisory Radio (HAR) have been available resources to transportation agencies for providing traveler information over a localized area. Some agencies have implemented these systems and currently operate them using a variety of business models. However, insufficient interest was generated while seeking to develop standards for the equipment or the development of message standards and therefore no standards currently exist.

IEEE - Standard for Common Incident Management Message Sets for Use by Emergency Management Centers (IEEE Std 1512)

Coordination among the emergency management centers of agencies that respond to traffic-related incidents can be aided by a common set of established procedures and operational methods for exchanging vital data. Typically, each agency has responsibilities that vary over time, based upon the type of incident, local custom, and agreed-upon responding resource allocations, which may be determined at the incident scene or at dispatching points within each agency. This standardizes messages communicated among different emergency management centers during and after the occurrence of an emergency incident.

It does not limit the data contained in the messages; rather, it allows the transmission of any mutually agreed-upon messages among centers, as well as messages composed of standard ITS data elements. It leaves responsibility to the participating local jurisdictions to determine the level of interoperation that meets their needs. The messages have been structured so that centers can continue to use different legacy systems.

Transit Communications Interface Profiles (TCIP)

The Transit Communications Interface Profiles (TCIP) is a family of standards that specifies the rules and terms for the automated exchange of information in transit applications such as operations, maintenance, planning, management, and customer services. TCIP standards define the information and information-transfer requirements among public transportation vehicles, transit management centers, other transit facilities, and ITS centers. TCIP standards also identify mechanical and electrical interfaces (physical layer) and methods for ensuring data integrity (data-link layer), specify required message sets, and provide a common set of conformance requirements.

The standard provides the basic concepts necessary for conveying transit application information (data) among a variety of users, such as transit organizations, emergency response services, regional traffic management centers, and other related entities. It defines a transit classification scheme, naming conventions, rules for identification of data elements and messages, guidance on the use of the ASN.1 syntax, and levels of conformance for all TCIP standards.

Additional Standards Efforts

The National ITS Standards efforts include a vast array of functional and application areas as described in the sections above. In addition to these efforts, several other initiatives are underway or nearing completion in areas involving Closed Circuit Television (CCTV), commercial vehicle safety and

credentials, actuated traffic signals, location referencing and Mayday systems. As these standards mature, further consideration of their impact on the transportation network will be required.

BENEFITS OF STANDARDIZATION

The National ITS Standards being developed provide a common standard that can be used by all vendors. These standards provide agencies with the ability to choose from different vendors without concern for interoperability of equipment and provide increased flexibility in operating systems such as RWIS. It removes barriers to coordination between agencies and allows a single communications link to be used at a given location. By following and requiring conformance with the National ITS Standards, agencies will benefit in the future. These benefits to the ITS community include:

- National ITS Standards will allow agencies to communicate with devices owned by other users and vendors. Agencies will be able to select and procure equipment from multiple vendors without concern for compatibility between devices.

- National ITS Standards will enable centralization of commands for control of field devices by allowing a single central computer to communicate with all devices. This will allow for a computer that controls a Highway Advisory Radio to collect data from a nearby ESS and, based on the conditions, adjust the message to advise travelers.

- National ITS Standards will allow for all future equipment to use a single structure, format and message structure to be followed by vendors. This consistency will ensure that computers are capable of communicating with all devices and that agencies will be able to obtain technical support and replacement parts well into the future. It should be noted that it may be cost prohibitive to retrofit some existing equipment to support the National ITS Standards and interim applications to interface the legacy systems may be required.

- Once an agency has a system that includes support for NTCIP, it can buy field stations from any manufacturer offering NTCIP-compatible products, and they will communicate with the agency's "Information Management Subsystem" ('IMS', typically termed CPU).

EVENT REPORT MESSAGE AND MESSAGE SETS FOR EXTERNAL TRAFFIC MANAGEMENT CENTER COMMUNICATION (MS/ETMC2)

The messages developed for external traffic management center to center communications are defined within the context of the National ITS Architecture. In the MS/ETMC2 standard, the messages are collected into message sets and message groups. The Event Report Message (ERM) is an additional message set that can be sent at a regular updated interval or in response to an event occurrence. It defines a message set that provides an overview (summary) message for a near real-time data exchange between a traffic management subsystem and the following types of transportation center/subsystems: information service provider; transit management; emergency management; toll administration; emissions management. In future, Event Request messages may also be defined, allowing these requests and ERM to be exchanged in a request-reply (or subscribe-publish) sequence.

The message sets specified by MS/ETMC2 satisfy the data flow requirements of the logical architecture of the Traffic Management Subsystem and the following transportation center based subsystems:

1. Other Traffic Management Subsystem (other TMS);
2. Information Service Provider (Advanced Traveler Information Subsystem);
3. Transit Management Subsystem (TRMS);
4. Emergency Management Subsystem (EMS);
5. Emission Management Subsystem (EMMS);
6. Toll Administration Subsystem (TAS).

The Event Bulletin Message Set meets state agency needs by carrying full descriptions of a current or predicted roadway situation to ISPs and to other agencies not closely involved in managing the situation. The Event Report Messages are one-way "summary" messages sent from a TMS to another center-based subsystem. Their main purpose is to support detailed, real time event summaries or overviews for exchange between TMCs, and from TMCs to ISPs, collecting together all those parts of detailed event messages that are relevant for traffic management or may be passed on to the public.

The Event Report Message is intended to serve the public interest by facilitating the interconnection and interoperability of traffic situation and road condition information exchange systems. The Event Report Message defines transportation operations data that can support exchange of travel situations and events (congestion, accidents, roadwork, road conditions, dry pavement, road clear, etc.) together with associated interpretation data (e.g. sender, source, quantifiers, time stamps, priority, confidence level).

The messages seek to explain the situation in ways easily understood by users. Event Report Messages can be exchanged between interested parties in language-independent forms suitable for automated processing, sorting and selection. Situation and event information can be sent from TMCs to ISPs for eventual dissemination to travelers. This information may also be of use to centers other than ISPs, especially centers not actively involved in managing the event.

ENVIRONMENTAL SENSOR SYSTEMS STANDARDS

Standards related to Environmental Sensor Stations are governed by the National Transportation Communications for ITS Protocol which have identified the requirements for field devices. The NTCIP-ESS is the definitive standard that must be followed for deployments of ESS devices in order to remain NTCIP compliant and in line with national standards. The entire standard (NTCIP Object Definitions for Environmental Sensor Stations - Recommended Standard 1204) is available from http://www.ntcip.org and should be consulted prior to defining or procuring for RWIS deployments.

This standard is broken down into multiple components so that adherence to the standard can be easily verified. As discussed in Section 1, the National ITS Standards are generally divided into the main components necessary to communicate, such as the definition of the word (data elements or objects), the grammar of the sentence (message set) and the language to be used (communication rules). The NTCIP-ESS standard defines each of these three components. It defines the specific data objects, their structure and format, as well as the message structure and if a specific data object (or group of objects) are required components in an ESS deployment.

The objects (or data elements) are defined so that agencies and other users can understand the specific meaning of each object, understand the range of values allowed, the units to be used and the proper spelling of the object. This is similar to people spelling and using the word "tree" in various ways until the first dictionary defined how to spell it, what it meant and how to use it within a sentence. The standard also recognizes the fact that not all sensors will be deployed at a particular ESS and that not all sensors are capable of generating the exact same information. To accommodate these variations, the NTCIP-ESS standard defines which particular objects are required to effectively communicate relevant information and which may be considered optional. Specific object groups combine related objects so that information of a similar nature are transmitted as a group.

DYNAMIC MESSAGE SIGNS STANDARDS

The National Transportation Communications for Intelligent Transportation System (ITS) Protocol (NTCIP) is a family of standards that provides both the rules for communicating and the objects necessary to allow electronic traffic control equipment from different manufacturers to operate with each other as a system. The NTCIP is the first set of standards for the transportation industry that allows traffic control systems to be built using a “mix and match” approach with equipment from different manufacturers. Therefore, NTCIP standards reduce the need for reliance on specific equipment vendors and customized one-of-a-kind software. To assure both manufacturer and user community support, NTCIP is a joint

product of the National Electronics Manufacturers Association (NEMA), the American Association of State Highway and Transportation Officials (AASHTO), and the Institute of Transportation Engineers (ITE).

Objects define all possible commands, responses and information that may be exchanged among microprocessor-controlled electronic equipment, a central computer, and by extension, their human operators. The objects defined in this standard allow an operator to command a dynamic sign to do something, verify that the sign has accomplished the command, and, through the use of "free text objects," have the sign display any written information desired.

NTCIP - Object Definitions for Dynamic Message Signs (NTCIP 1203) provides the vocabulary necessary for traffic management and operations personnel to advise and inform the vehicle operators of current highway conditions by using dynamic message signs. Since dynamic message signs require multiple objects to operate (information object, paging object, flashing object, etc.), this standard also includes a message syntax, called MULTI (Mark-Up Language for Transportation Information), which allows objects to be grouped into a message object. The message object is analogous to a sentence in that both the message object and a sentence require a syntax, or ordering of the information objects, to be understood.

This standard contains object definitions to support the functionality of DMSs used for transportation and traffic control applications. A dynamic message sign is any sign that can change the message presented to the viewer. The standard includes conformance group requirements and conformance statements to support compliance with the standard. The objects include commands to the signs, messages for display, and responses from the signs to the transportation management center, as well as "free text" objects that allow an operator to have stored or newly created messages displayed by the sign.

TRANSIT COMMUNICATIONS INTERFACE PROFILES (TCIP)

The TCIP Framework Standard (NTCIP 1400) covers data used to carry out public transportation operations, service, and planning. It pertains to all data that is sent or received in transit business areas, including:

- NTCIP 1401 – Transit Communications Interface Profiles (TCIP) Common Public Transportation (CPT) Objects
- NTCIP 1402 – Transit Communications Interface Profiles (TCIP) Incident Management (IM) Business Area Standard
- NTCIP 1403 – Transit Communications Interface Profiles (TCIP) Passenger Information (PI) Business Area Standard
- NTCIP 1404 – Transit Communications Interface Profiles (TCIP) Scheduling (SCH) Business Area Standard
- NTCIP 1405 – Transit Communications Interface Profiles (TCIP) Spatial Representation (SP) Business Area Standard
- NTCIP 1406 – Transit Communications Interface Profiles (TCIP) On-Board (OB) Objects
- NTCIP 1408 -- Transit Communications Interface Profiles (TCIP) Fare Collection (FC) Objects

NTCIP 1401, TCIP Common Public Transportation Business Area Standard, defines the common public transportation data elements and messages that are used by other business areas of the TCIP. The data elements within this standard include the core set of infrastructure data elements for vehicles, employees, facilities, and other transit assets.

NTCIP 1402, TCIP Incident Management Business Area Standard, defines the incident management data elements and messages that are supported by the TCIP. The standard also provides for information transfer among transit departments, emergency response service centers and regional traffic management centers. The incident management domain includes data and messages related to detecting, verifying, prioritizing, responding to, and clearing unplanned events (i.e., accidents, weather-related events, crimes, etc.) that affect transit operations. These include all data needed to identify the date, time, and location of events, the

source of the information about the event, codes for indicating the type and severity of the incident, detour information, and emergency response team dispatching.

NTCIP 1403, TCIP Passenger Information Business Area Standard, defines the passenger information data elements that are supported by the TCIP for passenger customer service. The passenger information domain deals with data needs related to providing passengers with the information necessary for planning and taking trips using public transportation. The data element needs that are supported by this standard include data associated with traveler preferences (departure time, arrival time, mode, and cost), expected times of arrival, schedules, and other information related to transit services. The standard also supports transit data element needs of many types of information services, such as customer service information centers, regional traveler information services, and information service providers (ISPs). The information may be supplied to users via the Internet, dynamic message signs, or interactive information kiosks. The passenger information domain relies heavily on the TCIP scheduling business area for support data such as transit schedules and vehicle assignments, and on the TCIP control center business area for real-time travel information.

The TCIP passenger information business area standard allows real-time information on schedules, schedule adherence, and transit amenities to be provided to ISPs, TMCs, intermodal transportation operators, other transit managers and, most importantly, transit passengers. It allows the passenger information business area to receive information from TMCs, transit vehicle systems, transit garage management systems (TrGMS), other TrMCs, parking management systems, intermodal transportation service providers, and planning systems.

STANDARDS CONFORMANCE

A key factor in developing interoperable and integrated systems is the conformance of devices to the developed standards. In the case of ESS devices, developing a standards compliant system requires conformance to the NTCIP-ESS standard. Conformance to the standard can be achieved at various levels, depending on the scope of the system being investigated. A device, a group of devices or an entire station can be considered standards compliant pending it meeting certain criteria, with a few exceptions. Specific exceptions, and examples are provided within the standard documents. Similar standards for conformance rules exist for DMS signs (NTCIP), the Event Report Message (ITE/AASHTO) and other devices or systems. In addition to the device and conformance groups, the communication protocols used to exchange data must also be adhered to.

Data dictionaries work in conjunction with at least two other types of standards to provide effective data exchange. The first of these other standards is a message set that handles individual information exchanges on specific topics. The second required standard provides for the actual data exchange protocols, many of which are being defined by National Transportation Communication for ITS Protocol development process. These standards describe how the messages are encoded for transmission and then transmitted and received by either party.

Conformance of Messages

A message defined within the National ITS Standards identifies the structure or the message being communicated and details the order of the object or data element. Some of these messages provide the flexibility to optionally include data elements that may not always be necessary for transmission. This flexibility provides the ability to reduce the message size, when appropriate, thereby reducing transmission time and costs.

Conformance with the message set standard requires that an application specific message set use the messages in all cases where they are applicable to the functions supported by the system. An application specific message set is defined as the message set used by a specific and actual installation of an ITS system. Conformance with the standard requires that individual messages contained are used as specifically defined and described by the message and data element meta attributes. No changes are permitted and required variants shall be separately described and established in compliance with IEEE

P1488 as additional application specific messages. Additional messages are permitted to support system specific functions or variations where the messages do not exist. However, these system specific messages are to be developed in compliance with IEEE P1488.

Conformance of Objects or Data Elements

The objects or data elements defined within the standards are viewed as the words to the National ITS Standards language. The standards identify the full meaning and context of data collected from each device and transmitted between systems. In defining each object, the standard lists the proper naming convention, the syntax, status, a detailed description and the reference to any other standard or source from which the object was derived.

The syntax identifies the type of object (integer, enumerated list, variable string, etc.) as well as the range of acceptable values. In the case of enumerated lists, the particular descriptions assigned to each value are defined. The status of the object defines whether it is a required object. Particular note should be made of the object's description that will identify the units of the object. The units are typically metric, however may be listed and transmitted as a fraction of a unit (e.g. Integer value in 1/10 degree Celsius) as illustrated in the example below.

essAirTemperature	OBJECT-TYPE
SYNTAX	INTEGER (-1000..1001)
ACCESS	read-only
STATUS	mandatory
DESCRIPTION “The dry-bulb temperature in tenths of degrees Celsius. The temperature is an instantaneous reading at the height specified by *essTemperatureSensorHeight*. The value 1001 shall indicate an error condition or missing value.”	
REFERENCE “Resolution is based on WMO Code Form FM 94 BUFR Table B item 0 12 001; temperature in kelvin is determined by adding 273.15 to this value.”	
::= { essTemperatureSensorEntry 3}	

(* Source: NTCIP-ESS Standard 1204)

Conformance of Data Communications

There are several standards efforts that deal with communication of data between systems, centers and field devices. When systems were first developed, a message was to be conveyed using the NTCIP Simple Transportation Management Framework (STMF) protocol for communications between agency centers and the field devices. These messages were to be for access and modification of data element values.

However, since that time the use of DATEX-ASN.1 for communications became the defacto standard used by several other SDOs to define the method and protocols for communication. Some work was being considered to use DATEX-ASN.1 for NTCIP-ESS communications and data exchange, however this work has not yet been published. There are a number of additional methods available, including Simple Transportation Management Framework (STMF), Common Object Request Broker Architecture (CORBA) and Simple Network Management Protocol (SNMP).

In the last year, the increased functionality and software market use of XML has pushed most SDOs to begin considering XML as an additional communications standard available for adoption in certain applications. XML allows for data to be exchanged over the Internet using commercial-off-the-shelf software to read and parse the data into a local database. The use of XML for ITS community would be a logical avenue to exchange data both from the field device or RPU and the agency's central database, as well as between agencies. Work is currently in progress to develop message sets, with DATEX-ASN.1 and XML being considered for use in ITS. It is recommended that continued monitoring of the progress of this work be done so that agencies may adopt and require data to be transmitted by the standard communication method when it is published and recommended for use.

CARS / CARS-511 ITS STANDARDS IMPLEMENTATIONS

This report identifies the various National ITS Standards that will impact Alaska's CARS / CARS 511 architecture. By following the National ITS Architecture tools and concepts, the application areas listed in Section 1 provide a basis for reviewing and determining the interfaces and the associated implications on those interfaces as a result of the standards development efforts. The completed standards and those being developed or finalized must be considered for adoption in the CARS / CARS-511 project in order to meet federal guidelines.

The benefits of adopting those standards into the development and enhancement of advanced traveler information systems such as CARS / CARS 511 go far beyond any requirement or mandate. By adhering to and formally adopting completed national standards, the agencies involved in the project will benefit from:

- increased interoperability within the organization, as well as with other agencies;
- reduction in costs (capital, operation and maintenance);
- interchangeability of parts; and
- the ability to gain insight from systems already in operation in other states.

Though the benefits of standards compliance are numerous, there are some significant obstacles to the effective implementation of systems when draft or incomplete standards are used. Software/firmware modifications, inconsistencies in deployments from changing standards and untested standards are some of the problems encountered by other agencies when adopting or issuing Request For Proposals based on these unfinished standards.
Therefore, as CARS expands to support other facets of Alaska's ITS infrastructure, the commitment to standards will remain strong. At the same time, the state will remain cautious about adopting standards that are not fully production-ready.

CARS and ERM (Event Report Message)

The use of the CARS system by several states has allowed for significant testing of the CARS system and its application of the ITS standards. Based on user feedback and system testing, CARS has developed into a reliable and effective tool for collecting, managing and disseminating traveler information in these states. The ERM standard used by the CARS system has therefore also seen substantial testing to verify the effectiveness of transmitting information between like systems. The ERM has become a key standard in the deployment of traveler information systems by early adoption and testing through the CARS program and the use of an open-architecture to provide the flexibility to exchange data in a variety of forms and with a range of different users.

Through use of the ERM, CARS enables agencies to collect, exchange and disseminate a wide variety of data. The flexibility within CARS provides the opportunity to develop subsystems that can identify the current conditions observed at environmental sensor stations, post the current messages displayed on a dynamic message sign or even produce a playlist of messages to broadcast over LPFM or HAR.

CARS and TCIP (Transit Communication Interface Profiles)

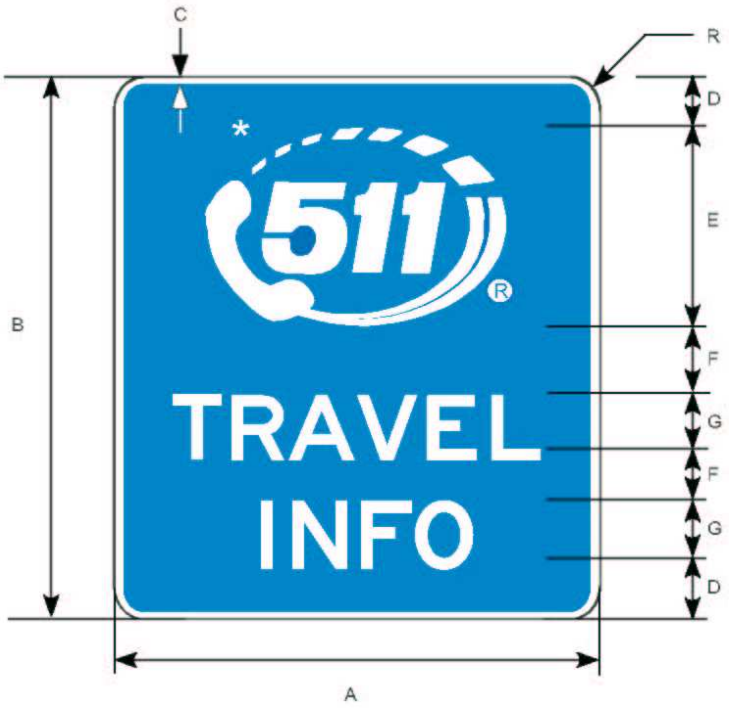
As CARS / CARS-511 expands to include ferry transit information, the use of TCIP data elements and message sets will be explored. CARS will use those standards to communicate with external systems in order to retrieve and ingest schedule and other ferry-related information.

For example, data elements from TCIP will be used to send timetables/schedules from the Alaska Marine Highway System's vessel tracking system to CARS. Once in the system, CARS will use the ERM standard to report any deviations from the master schedule. In that regard, CARS will make use of the most appropriate standard to fit the project requirement.

By conforming to the TCIP standards, the path for future transit information integration will be paved. Because of the way in which the standards were designed, by successfully implementing the ferry schedule ingestion, CARS / CARS -511 will be poised to share that data with other states/agencies, as well as ingest transit information not only from ferry systems but also from any other TCIP-compliant system.

APPENDIX B

D12-5



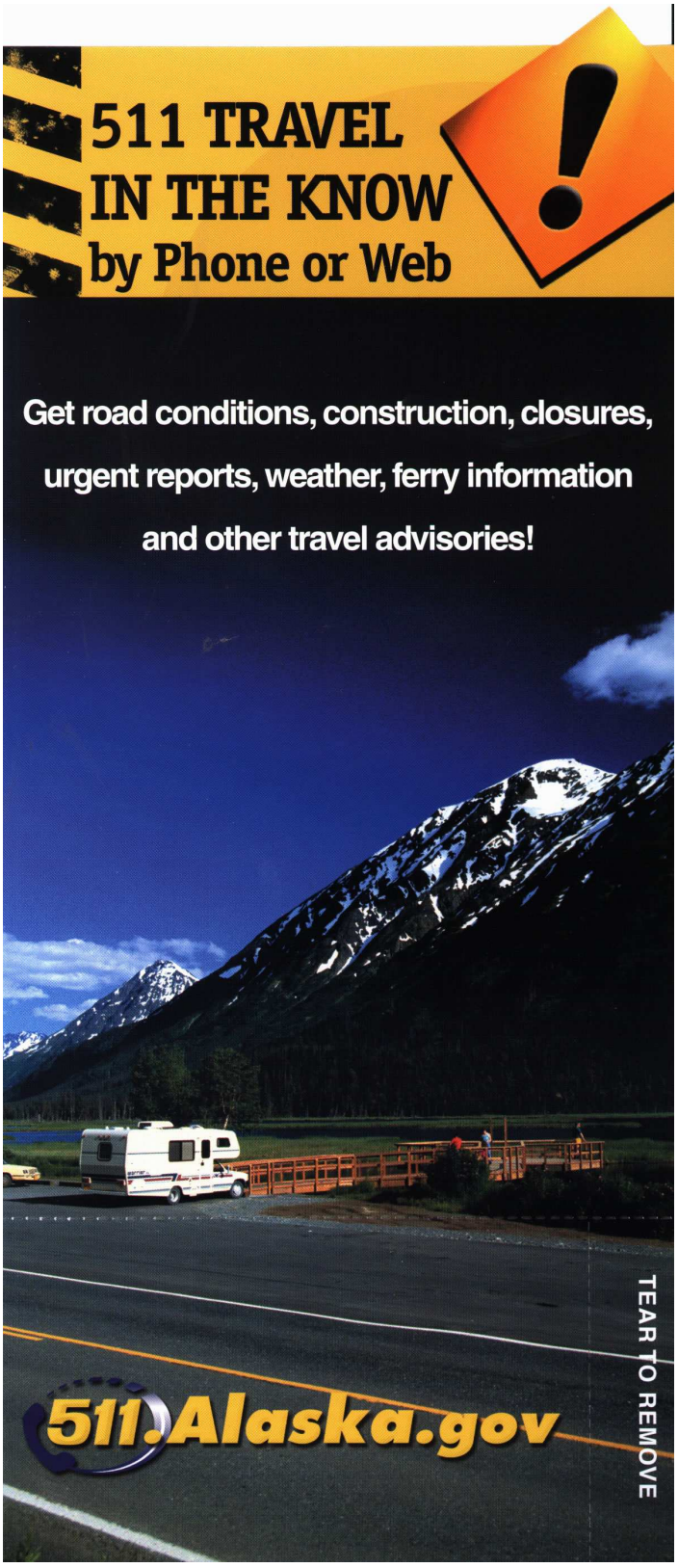
Border, Symbol and Legend: White
Background: Blue

* Make symbol and lettering proportional to graphic shown.

Road Class	Dimensions (inches)							
	A	B	C	D	E	F	G	R
Off Roads (Terminals)	24	30	0.38	3	10	3	4D	1.50
Conventional	36	48	0.63	5	16	5	6D	2.25
Expressway	48	60	0.75	7	18	6	8D	3.00

APPENDIX C

Front



Back

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PHONE OR WEB

5-1-1

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Dial 511
in Alaska

Outside Alaska
1-866-282-7577

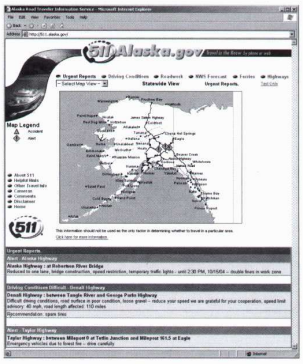
More travel
info on the web!

- helpful hints
- about 511
- contact info
- and more

Helpful Hints:

- Follow instructional prompts
- Speak clearly
- Avoid background noise
- Say "menu" to play menu options

24/7 service



TEAR TO REMOVE

511 Travel
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APPENDIX D