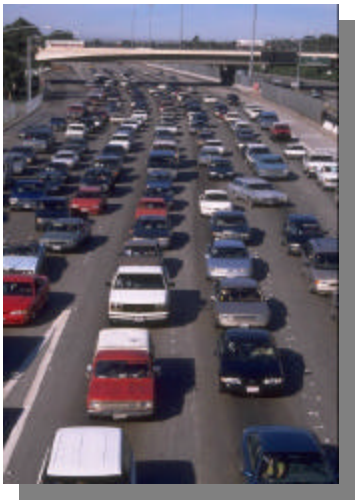

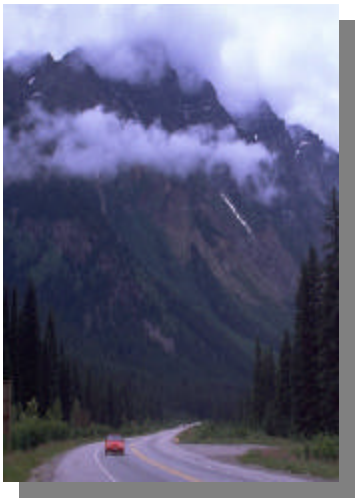

Deployment Assistance Report #7: *Roadway Content Quality on 511 Services*

June 2003

Published by the 511 Deployment Coalition

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I. Background

What is 511?

On March 8, 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. On July 21, 2000, the FCC designated 511 as the United States' national travel information telephone number. The FCC ruling leaves nearly all implementation issues and schedules to state and local agencies and telecommunications carriers. In 2005, the FCC will review our progress in implementing 511.

What is the 511 Deployment Coalition?

In early 2001, mindful of both the opportunity and challenge that 511 presents, the American Association of State Highway and Transportation Officials (AASHTO), in conjunction with many other organizations including the American Public Transportation Association (APTA) and the Intelligent Transportation Society of America (ITS America), with the support of the U.S. Department of Transportation, established the 511 Deployment Coalition (Coalition). An executive-level Policy Committee and a supporting Working Group were established to conduct the work of the Coalition. Membership of the Coalition draws from all levels and types of government agencies, various segments of the telecommunications industry and the fields of consulting, system integration and information service provision.

The Coalition has made their goal "the timely establishment of a national 511 traveler information service available to a majority of Americans by 2005 that is sustainable and provides value to users." The Coalition recognizes that 511 services will be developed in a bottom-up fashion with state and local transportation agencies establishing services in areas and timeframes determined by them.

The Coalition has developed "Implementation Guidelines for Launching 511 Services" to assist implementers in their efforts to develop quality systems and to lay the foundation for ultimately establishing a consistent nationwide 511 service. Implementation of these guidelines will lead to a certain level of expectation where users will understand the level of highway information, public transportation information and weather information that they will receive (see http://www.deploy511.org for the most current version of the guidelines).

What is a Deployment Assistance Report?

Deployment Assistance Reports (DAR) result from the focused efforts of Coalition volunteers, and are intended to provide in depth treatment to a topic or topic of interest to 511 implementers. As was the case for all of the DARs, these efforts originated to support development or refinement of the guidelines; the Coalition members determined that much was learned in exploring each area and that this information should be shared with the broader deployment community. Thus, each volunteer effort has concluded its activity by electronically publishing a DAR.

This DAR is the seventh in a series published by the Coalition:

- DAR #1: 511 Business Models and Costs Considerations
  http://www.its.dot.gov/511/511_Costs.htm
- DAR #2: Transfer of 511 Calls to 911
  http://www.its.dot.gov/511/511to911.htm
- DAR #3: 511 and Homeland Security
  http://www.its.dot.gov/511/511secur.htm
- DAR #4: Regional Interoperability Issues
  http://www.itsa.org/511.html
- DAR #5 Public Transportation Content on 511 Services
  http://www.itsa.org/511.html
- DAR #6 Weather and Environmental Content on 511 Services
  http://www.itsa.org/511.html
- DAR #7 Roadway Content Quality.doc
  http://www.itsa.org/511.html

What is the purpose of this Deployment Assistance Report?

The first 511 service became operational in the Cincinnati/Northern Kentucky area in July 2001. Less than two years later, over a dozen services are operational across the country serving more than 40 million people who, in total, are currently calling 511 nearly 1 million times a month. Every service in operation provides some form of information associated with roadway conditions. And while early feedback from 511 users has been positive, there is recognition within the Coalition that the ultimate quality and utility of information provided via 511 is a critical part of providing a valuable service to callers.

With many of the services likely to have their preponderance of callers interested in roadway conditions, the quality of roadway-related content will in many cases dictate overall satisfaction with 511. The 511 roadway quality 'levels' discussed in this DAR are for the basic 511 telephone travel information service. Roadway data quality needs vary greatly by application: traffic incident detection, long-range system-wide planning / modeling, oversize truck permit routing, construction project report analysis, long-range impacts of suburban development, etc. It is understood that all of these activities may need different levels of data disaggregation and quality.

The purpose of this DAR is to provide, in a single document, the most up-to-date information on guidelines, state-of-the-practice, state-of-the-art, implementation experience and lessons learned related to gathering and providing quality roadway content over 511 services.

In parallel, DARs focused on Weather Content and 511 and 511 and Transit are being developed and published.

The main audience for this DAR is the planners and implementers of 511 systems.

Where to find more information on 511?

Information on the 511 Deployment Coalition, including deployment assistance reports, educational and supporting resource materials, a marketing toolkit, and additional useful references for 511 implementers may be found at the following web sites:

- http://www.deploy511.org
- http://www.its.dot.gov/511/511.htm
- http://www.itsa.org/511.html
- http://511.transportation.org/511/site.nsf/HomePage/Overview
- http://www.apta.com/services/index.cfm

Also available is a listserv focused on 511 at: http://groups.yahoo.com/group/511WG.

Who is responsible for this DAR?

The 511 Deployment Coalition Working Group established a Task Force with the purpose of developing this DAR to further examine roadway content quality. All members of the task force contributed technical information, implementation experience and editorial assistance to enable the assembling of this report:

- Pete Costello, PBS&J
- Bryan Chamberlain, Utah DOT
- Gene Glotzbach, Florida DOT (*Leader*)
- Kelly Damron, North Carolina DOT
- David Lively, California Department of Transportation
- Leon F. Osborne, Jr., Meridian Environmental Technology
- Bob Rupert, FHWA
- Rick Schuman, PBS&J
- Rich Taylor, ITS America
- Tim Wolfe, Arizona DOT

What is the format of this DAR?

After this background section, the DAR will provide an overview of the Implementation Guidelines that apply to roadway content in Section II. In Section III, specific classes of roadway content data types, developed from a previous ITS America effort, will be introduced.

In Section IV, the "flow data" content type will be discussed in detail. In Section V, the "incident/event data" content type will be described at length. Section VI will provide some examples of how various types of roadway content data can be integrated. Section VII provides a current snapshot description of the types and quality of roadway data content provided on existing 511 services and what is being planned for the nation's 511 Model Deployment in Arizona.

Section VIII briefly address the concept of basic and optional services related to roadway content quality and Section IX addresses many issues that the Task Force volunteers determined to be important considerations regarding roadway content quality. Finally, Section X provides an implementer self-assessment checklist to aid implementers in offering the best roadway content possible in their 511 services.

II. 511 Implementation Guidelines Applying to Roadway Content Quality

The Coalition's "Implementation Guidelines for Launching 511 Services" succinctly states what information, or "content," should be provided by a basic 511 service and the degree of uniformity and consistency of each service across the country. The Working Group has studied extensively existing telephone-based traveler information systems and the projected technological, political and economic environments in the near future to develop the guidelines. These guidelines are being maintained and updated, with Version 1.0 released in November 2001 and Version 1.1 released in June 2002. Version 2.0 is currently in development, scheduled for a mid-2003 release.

Basic Roadway Content Guidelines Overview

This section overviews the current guidelines, Version 1.1, as they specifically relate to providing quality roadway content. Presently, basic content comes in two general categories: Highways and Public Transportation. In this report, we are focused on the guidelines associated with highway – or roadway (we use the two terms synonymously) – content. In this section, we cover the elements of the guidelines that address roadway content overall, namely principles and quality. The following sections will address specific content recommendations in more detail.

Principles

There are four key principles associated with roadway content

1. *Content is route/corridor-based* – 511 services should provide information that is retrievable by route number and/or name. In certain circumstances, if one or more principal roads run parallel, it may be acceptable to provide information on a corridor-basis. However, providing information on major roadways on a broad geographic basis (e.g. "roads in the Northwest portion of the state will be…") is not recommended. When a route/corridor is operated by multiple agencies, these agencies should work together to provide an integrated description of conditions.
2. *Limited access roadways and the National Highway System should be the basis for basic 511 highway/roadway-related content* – With 40% of the nation's travel, including 75% of truck traffic and 90% of tourist traffic, the 160,000 mile National Highway System (NHS) should be the focus of basic 511 content. Limited access roadways that are not part of the NHS, likely to exist in urban areas, should also be part of the basic content. (State-by-state maps of the NHS can be found at http://www.fhwa.dot.gov/hep10/nhs/index.html#maps.)
3. *More detail needed in urban areas* – Given the increased traffic volumes and congestion levels in urban areas, even minor events could have large impacts to travel. Thus, greater content detail is recommended in urban areas.
4. *Content is automated* – Whether the information provided to the caller is a human recorded message, synthesized or digitized speech, the information is stored and automatically provided to callers. There is no direct contact between callers and human operators to provide basic highway content.

The fundamental structure of a telephone system design matches highways very well. Telephone systems are usually accessed through a "menu tree" that is navigated by voice commands or by touching a phone's keypad. Eventually, a caller reaches their desired destination in the system and either gets a recorded or digitized voice message. "Routes," "segments" and "content" serving as the key descriptors of the content guidelines. When seeking highway information, a caller will first find the specific highway or corridor for which they desire information. The caller will then find the specific segment of highway or corridor they are interested in, if it is a lengthy road. Segment specification is left to the implementer, but should follow logic with segments defined between major towns, landmarks, roadways or by climatological differences (see DAR #6 Weather and Environmental Content on 511 Services). In urban areas, segments should be defined between major interchanges and will generally be smaller in length than non-urban segments. Once the 511 service knows the specific section of highway the caller is interested in, it then provides the caller a report of the relevant basic content.

Quality

In an increasingly advanced information society, callers are generally accustomed to high quality information. 511 content must be no different. Specifically, 511 implementers must focus on the following quality parameters:

- *Accuracy* – Reports must contain information that matches actual conditions. If the system reports construction events that are not occurring (or worse, does not report a construction event that is occurring) or a road closure is not reported, callers will come to distrust the information provided. If inaccuracies persist, callers will discontinue their use of 511.
- *Timeliness* – Closely related to accuracy, information provided by 511 must be up-to-date. While it is recognized that non-urban areas will have more difficulty collecting, inserting and updating information quickly, every attempt must be made in both urban and non-urban areas to update information as soon as there is a known deviation from the current route segment report.
- *Reliability* – Often, transportation management systems operate during normal working hours. But travelers use highways 24 hours a day, 7 days a week. In fact, often the most challenging travel conditions may occur at night and on weekends. Methods must be developed to provide callers a reliable stream of information 24/7. Also, the inherent reliability of the 511 system needs to minimize the amount of time that callers will be unable to obtain a report along a route segment due to equipment or process failures.

Information quality is a major concern for the 511 Deployment Coalition. However, the Coalition has yet to include specific quality parameters as part of the guidelines, primarily due to the desire to gain more collective deployment experience and user feedback prior to determining optimal quality parameters. However, in future updates to the guidelines, possibly even Version 2.0, specific quality parameters may be added.

Consistency Guidelines Related to Roadway Content Quality

The second key element of the 511 Implementation Guidelines are the "Consistency Guidelines" – 16 areas in which decisions need to be made by implementers that will determine how consistent the patchwork quilt of 511 systems becomes. Most of the consistency guidelines

focus on system issues and are not directly related to the information content provided; however, two are related. These are:

- *Time Stamping of Information* – This guideline focuses on the issue of whether or not to providing a time/date identifier to provide callers with a sense of reliability and accuracy of the information provided. The current guideline reads: "Caller expectations are for timely information. If a 511 system provides basic content quality as defined in the content guidelines, then time stamping the information is unnecessary and undesirable. If a system knowingly provides information that is updated not as conditions change, but based upon a periodic schedule, then the schedule should be communicated to callers in association with the particular message." In other words, to put a timestamp such as "this information is valid as of 3:15 p.m." is redundant and superfluous if the underlying information being reported is of good quality.

- *Inter-regional Interoperability* – This guideline focuses on how 511 services with adjacent operating borders interrelate to give callers seamless information. This issue is relevant to Roadway Content Quality as it is not uncommon for callers to seek information on what is happening just over a state border on a certain roadway. Without either being able to incorporate information on those roadways or transferring the caller to the neighboring state's 511 service, the caller is essentially traveling blind. While the current version of the guidelines raised the issue, recommendations were still being developed. The Task Force looking at the issue has completed its initial efforts, culminating with the publishing of the Coalition's DAR #4, "Regional Interoperability Issues." While detailed information regarding this issue can be found in that report, the ultimate recommendations to implementers are as follows:

  - Identify travel corridors, other regions and neighbors and consider how to include their information for callers to your system either through data sharing or call transfer.
  - Recognize that their neighbors are also dealing with this issue and engage them in a two-way, or in some cases, multi-way dialogue.
  - Use standards when developing and upgrading information databases and system communications to facilitate the exchange of information.
  - Examine and understand wireless calling areas at the boundaries of your system and develop a plan for dealing with misrouted calls. Especially be mindful of the placement of signage near a border which may lead to someone calling 511 and not getting through because they are being handled by a switch where 511 is inactive or are routed to another state's 511 system.

III. Overview of Roadway Content Types

The previous section provided an overview of the principles governing desired roadway content and its quality. The next few sections will provide an in-depth treatment of the content we hope to have provided over 511 services across the country as soon as possible. In the process, we hope to clarify the types of information according to the guidelines that could – and should – be provided over 511; examine issues associated with collecting, fusing and integrating such data; share known customer feedback related to the information they desire; and provide examples of how what might seem like an enormous amount of information can be provided clearly and succinctly to callers.

There are many roadway characteristics worthy of data collection. Examples range from highly accurate mapping of roadways to pavement quality and loading and real-time status. Information relevant to 511 is almost exclusively real-time status information, that is dynamic information describing the travel conditions along a given highway including weather forecasts and construction that might impact travel.

This section serves as an overview to the next few sections, by presenting a categorization scheme first promoted in an ITS America-sponsored publication in 2000, prior to the creation of 511 guidelines. In August 2000, culminating over 18 months of volunteer effort, ITS America published *"Closing the Data Gap: Guidelines for Quality Advanced Traveler Information System (ATIS) Data."* These guidelines focused on the types and quality of roadway-related data needed to establish ATIS to meet consumer needs. Though this work pre-dates 511 – as this report was published roughly the same time the FCC designated 511 – much of the report's conclusions served as the foundation for the roadway content portions of the 511 Implementation Guidelines (to see the full report, go to: http://www.itsa.org/ITSNEWS.NSF/4e0650bef6193b3e852562350056a3a7/6ac5d7655216c1438525696300704435/$FILE/ATIS%20Guidelines%20Version%201.doc). In particular, *Closing the Data Gap* provides instructive definitions of four primary types of dynamic roadway related content – most of which are directly applicable to 511.

- *Traffic Sensor Data* – Data of this type are speed, travel time, volume and occupancy data or other numerical measurements used to characterize the flow of vehicles at a specific point or over a specific segment of roadway. This data can be generated from many types of detection systems, such as loop detectors, microwave, infrared or sonic detectors, video image detection, automatic vehicle identification, license plate matching systems and wireless phone probes.
- *Incident/Event Reports* – This data type is characterized by descriptive information on planned, or unplanned, occurrences that affect or may affect traffic flow. Incidents, construction/maintenance, events and road and weather conditions are some of the types of data collected. This data is usually manually entered into a "system," although it can be stored and communicated either as text or through numeric codes. The manual entry into a system is the key differentiation from the Traffic Sensor data type

- *Road/Environmental Sensor Station Data* – This data type encompasses a wide array of sensors including those that monitor weather, roadway, surface and air/water quality conditions. These sensors provide roadside data to support Road Weather Information Systems (RWIS). Providing travelers with environmental data allows more informed selection of modes, routes and departure times, resulting in improved safety and increased convenience for travelers. The utility of this data will vary with local environmental conditions.
- *Images* – This data type represents a "snapshot" of a roadway to give a visual depiction of current traffic conditions. Images give a quick impression of traffic conditions that can be easily assessed, which consumers of ATIS services find valuable. However, this data type is not conducive to deriving detailed information such as that which can be provided by traffic sensors. Images can be disseminated through multiple outlets including web pages, TV stations, kiosks, etc. Images can also be used to verify or identify information that can then be manually inserted into a traveler information service.

The first two of these four content types – traffic sensor data and incident/event data – were addressed in great detail in the Closing the Data Gap report, including specific definitions of data attributes and data quality. Each will be addressed in detail in the following two sections.

The latter two content types – Road/Environmental Sensor Station Data and Images – were only partially addressed due to their limited maturity at the time of the report's publication. Since the August 2000 publication, significant progress has been made in identifying what weather-related content is relevant to travelers – regardless of whether it is from general forecasts or data collected from sensors along roadways. As stated earlier, a DAR is currently being developed to specifically address weather related content on 511. Thus, this topic will not be covered in this DAR. (In version 2.0 of the guidelines, we will seamlessly incorporate the findings of this DAR and the weather content DAR.) Images, while clearly having a key role in traveler information, both in terms of providing them to travelers through visual media and providing information that can be translated into incident/event reports, are inherently incapable of being shared with callers directly over 511. We will not address Images in this report.

IV. Traffic Sensor Data

Traffic sensors can gather a wide array of data to characterize the flow of vehicles at a specific point or over a specific segment of roadway. As stated in Section II, in the area covered by a 511 service, at minimum, information on all roads designated to be part of the NHS – and in urban areas, all limited access roads not part of the NHS – should be available to callers. Further these roadways should be divided into logical segments. In the context of 511, traffic sensor data simply relates to the ability to provide travel time, speed or delay that the average traveler will encounter over these logical roadway segments.

What traffic sensor data is required to implement 511?

Traffic sensor data is not required to deliver the basic roadway content defined in Version 1.1 of the 511 Implementation Guidelines. However, the quality and utility of information provided to callers can be greatly enhanced by the proper incorporation of traffic sensor data.

As described in Section V, the foundation of 511 roadway content is incident/event reporting. Traffic sensor data can positively impact the quality of these reports, by improving their detail, accuracy and timeliness. Similar to the role images play in incident/event reporting, data can assist in:

- Determining the location of an incident/event
- Identifying the affected direction of travel
- Assessing the impact of the incident/event (such as the length of a back-up)
- Determining the begin and end points for congestion

In other words, you do not need sensor data to create a 511 system, but if you have data available, you should leverage it as much as possible to support incident/event reporting.

What about providing travel times, speeds or delay for road segments to callers?

Using sensor data to give callers a quantitative measure of travel conditions is the most beneficial use of such data. However, given the wide variance in sensor coverage across the country, the Coalition determined it was impractical and unnecessary to ask all implementers to establish a full-scale traffic sensor system before launching 511 services. Instead, the guidelines contain an "implementation recommendation" regarding segment travel times. This means that providing segment travel times is recommended to be included in initial 511 services if possible. Further, as services improve and evolve towards the long-range vision, segment travel time information should be incorporated into the service if not done so at the outset. The specific implementation recommendation regarding segment travel times is as follows:

> "Particularly in urban areas, estimated travel times across a route segment have proven highly desirable by callers. Travel times could be provided each in absolute terms ("segment travel time is 24 minutes") or in terms of delay from normal conditions ("segment travel time is delayed 5 minutes"). In the case of absolute travel times, it is recommended that the travel times given do not exceed the speed limit travel time. In urban areas, multi-segment or corridor travel times would also be acceptable."

How can flow data be gathered?

Through the rest of this section, we will use the term "flow" data in place of traffic sensor data, as we will be discussing both automated and manual means for generating such data. At the highest level, there are two approaches for generate segment flow data: direct measurement and estimation.

- ***Direct Measurement*** – To date, direct measurement of flow conditions have fallen into three areas:

  – *Real-time point sensing* – Point-sensor oriented traffic data collection systems monitor traffic conditions at individual points along a roadway. There are several different types of point sensing detectors, including loop detectors, VID cameras and infrared, microwave, and acoustic-based sensor systems. These systems are capable of generating information concerning instantaneous (point) speed at instrumented points along a road. This point speed is then processed to determine average speed and estimated travel time over a desired segment. However, given that point detectors are often spaced at intervals one-half mile or greater in length and are unable to assess conditions in between (i.e., sense congestion or incidents), periodically, when conditions are right (or wrong, as the case may be) errors can be introduced in a segment travel time calculation. Point sensing is commonly used on limited access roadways, with an estimated 22% of urban limited access roadways equipped in 2000. However, point sensing for segment travel time determination on arterials is not presently – and is unlikely to be in the near future – capable of generating useful data.

  – *Real-time link sensing* – Link sensing applications utilize vehicle identification technologies, such as toll collection transponders or license plate readers, to track vehicles as they pass specified points within a network of roadways, such as the beginning and end of a roadway segment. Field controllers transmit location, time and vehicle identification information to a central processor. By knowing the beginning and end times for many vehicles that traveled on the link, travel time for that link can be determined. Software is used to analyze the data and remove anomalies. The quality of link sensing is based largely upon the sample size (for a given time period, the percentage of vehicles for which travel times have been calculated versus the total number of vehicles that traveled along the segment) and the quality of the software used to filter out anomalies. A few link sensing systems are currently in place in the U.S. – Houston and San Antonio are the largest – but this detection approach is growing in popularity, with significant implementations ongoing in New York, San Francisco and Orlando. Link sensing techniques can work on all types of roadways, including arterials. As part of Arizona's 511 Model Deployment, a trial implementation of link sensing is being planned on some key arterial road segments in the Phoenix area.

  – *Real-time probe vehicle data* – Interest in the development of probe vehicle-based data collection systems stems from their hypothetical ability to track the location and speed of multiple target vehicles by monitoring wireless devices carried onboard. Whereas traditional data collection technologies require the installation and maintenance of large

amounts of fixed roadside infrastructures, probe vehicle-based data collection systems are designed to require significantly less infrastructure, with none located at the roadside, while also having the ability to provide traffic data on a specific point as well as over defined road segments. While significant interest exists in using probe vehicle data as a means to determine segment travel times, no operational systems currently exist in the U.S. There was a test on the Capital Beltway in metropolitan Washington, DC that showed promise. This is a technique worth watching in the near future however, as it could result in highly cost-effective data collection.

- ***Estimation*** – This approach utilizes past or present data to provide estimated segment travel times. This is why we have introduced the term "flow data," as it is possible to provide segment travel times without real-time traffic sensor data – or with using a combination of real-time and historical data to make estimates. There are many different methods and combinations of methods of estimation that are sometimes used on roadways where quality real-time data does not exist, or to improve the quality of forecast on those where it does exist. A few of the more popular approaches are described below:

  – *Historical Estimates*: A popular approach with digital map database providers is to incorporate estimated segment travel times into their map databases. These travel times are created based upon known parameters such as segment length, speed limit, type of roadway and periodic test runs. Those who use online or computer-based routing programs have seen estimated travel times (see Figure 1 at right, from Microsoft Streets and Trips). While no 511 system currently provides such data, this possibility exists.

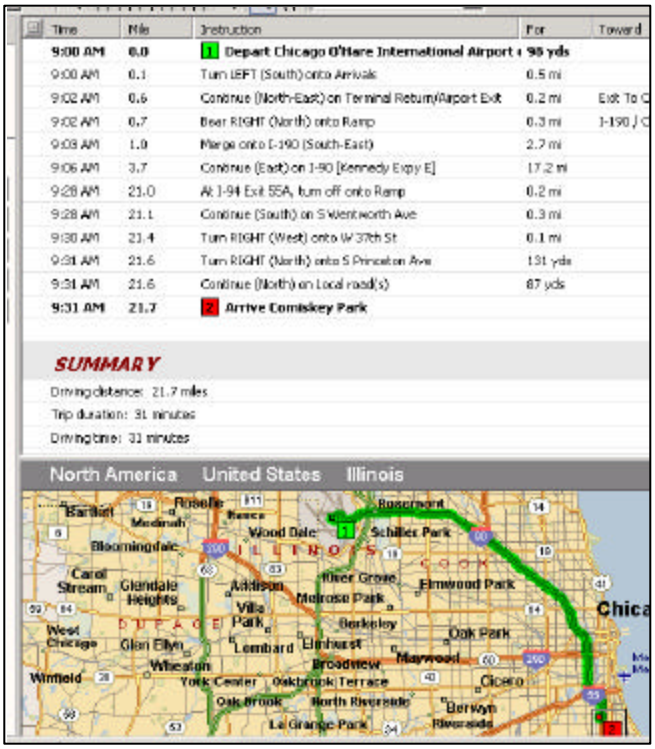

Figure 1

  – *Manual Estimates*: Several regional traveler information systems, including a few 511 services, provide segment travel times based upon operator-entered estimates. These estimates are determined through some combination of examination of images, sensor data, incident/event reports and historical knowledge. While this approach may seem labor intensive, trained operators can achieve this very efficiently. As an example, in the Cincinnati/Northern Kentucky area, estimated travel time is provided for eight roads, divided into 16 road segments – 32 discrete travel times, since they are provided for both directions, with one or two staff members on duty (with updating travel time estimates being only a small portion of their responsibilities). Also, in an independent evaluation of the Minnesota SmarTraveler service, the accuracy of these estimates has been verified.

– *Travel Time Forecasting*: This approach uses complex multivariable analysis to estimate and forecast segment travel times. TrafficCast (http://www.trafficcast.com) provides this service as its principal offering. To give an example of what goes into forecasting, TrafficCast says that five elements are utilized: historical travel times and real-time speed; weather conditions and forecasts; scheduled construction projects; roadway accidents and other incidents; and special events.

What quality metrics are associated with flow data provided over 511?

As stated in Section II, specific quality parameters are not yet provided in the guidelines, though there is clear guidance for implementers to focus on the reliability, accuracy and timeliness of the information provided. ITS America's *Closing the Data Gap* report does provide some clear guidance about the quality of flow data to support a full-range of ATIS applications. Key elements of those more general quality guidelines are:

- Data from general purpose lanes and special purpose lanes (e.g., high occupancy vehicle lanes) should not be mixed;
- No more than 15% mean error in reported data (e.g., a true 60 MPH average speed being reported between 51 and 69 MPH);
- No more than a five minute delay in data (e.g., data collected at 6:00 p.m. should be available on the 511 service by 6:05 p.m.); and,
- Data should be available for a given road segment at least 90% of the time, on average (e.g., equipment and communications failures should result in no report being available for a road segment for no more than 876 hours throughout the course of a year).

In support of its Transportation Management Systems Master Plan, Caltrans recently completed a TMS Detection Plan. In that plan, Caltrans established several data quality requirements, a few of which are directly relevant to the provision of traveler information:

- Speed: accuracy to +/- 5 MPH over 30 second intervals, 99% availability; and,
- Travel Time: 95% accuracy between detection points, 95% available.

How should flow data be presented to callers? Travel Times? Speed? Delay?

Through 511, there are three different ways to communicate quantitative traffic flow over a given road segment: travel time, average travel speed and delay time. Each is a valid approach, though each requires some thought in terms of the details of the message.

In the few locations where flow data is provided over 511 today, it is provided in only a single parameter, such as travel time or delay. A key point that implementers need to recognize is that callers to your 511 service may or may not be familiar with the local area and the road segment about which they are seeking information. Thus, callers will have different points of reference from which to interpret the information provided. For example, if a service says that the travel time for a given road segment is 25 minutes, a local caller might have an idea of both the length of the segment and how the current travel time compares with the normal expected travel time for that day and time. However, someone unfamiliar would have no such point of reference to determine if 25 minutes is good, if there is delay, if the delay is typical or unusual and if an alternative route might be in order.

While it may be impractical and confusing to give flow data in all its possible forms within a single report, we recommend that at least enough information be provided to give callers – both familiar and unfamiliar with the road segment – the opportunity to "do the math" to assess the meaning of the provided information. Generally, this will require at least two pieces of information be provided. Some examples include:

- Segment length and segment travel time
- Segment travel time and average speed
- Segment travel time and delay
- Average speed and delay

If an implementer provides delay times, we recommend providing enough information so the caller knows if the delay is calculated versus free-flow/speed limit travel times or versus typical travel times for a given time/day.

Cleary, providing flow information could be confusing and potentially costly, as a message could become quite lengthy if care is not given to structure message to provide information in a quick and understandable fashion. Implementers will need to consider the ramifications of providing flow data, including the potential cost implications of longer call lengths that could result.

Another implementer consideration is whether providing flow data should be a routine occurrence or be provided on an exception basis, only when things either depart from free-flow or typical conditions. While we foresee the day when flow data on 511 will become the equivalent to temperature data of a weather forecast, we understand the complexity and difficulty of providing such data comprehensively and to the quality levels expected by an increasingly discriminating public.

What does consumer research say regarding flow data?

At the National 511 Launch Conference in March 2002, a complete session was dedicated to presenting and sharing consumer research regarding 511 and ATIS. ITS America's National 511 Consumer research, conducted in late 2001, showed that in a nationwide telephone survey, with an accuracy of +/- 5%, that travel times and average speeds are desired by callers. 60% felt that average travel time estimates were important, 11% of the sample rating it as critical, while 49% rated it as useful. 50% felt that average speed estimates were important, 9% critical and 41% useful.

The California Bay Area's Metropolitan Transportation Commission (MTC) confirmed ITS America's findings from travelers in their region desiring estimated travel times. In the 1990's, multiple studies were undertaken to determine consumer's needs related to ATIS, particularly in metropolitan areas. In a paper summarizing the studies, published in 2000 (http://www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE/9H801!.PDF), estimating trip duration was the fourth most important use of ATIS, behind assessing traffic congestion on their route, judging the effects of incidents on their trip and deciding among alternate routes. This paper also confirmed that the most critical features of a "traffic service" – as it was described in the paper – was the accuracy, reliability and timeliness of the service, underscoring the need to focus on quality.

V. Incident/Event Reports

Incident/event reports are the backbone of roadway portions of 511 services. This broad category of roadway content includes all types of anecdotal reports of issues and problems along roadways. In the previous decade, tremendous strides have been made to improve the completeness and quality of incident/event reporting. Further, technological advances – including the Internet – have made it possible for incident/event reports coming from a wide array of sources to be integrated to form a single "picture" of travel conditions. These advances have also made it possible to present incident/event information to 511 callers by pre-defined road segments, as recommended in the 511 Implementation Guidelines.

What incident/event content is necessary to implement 511?

Version 1.1 of the guidelines provides detailed recommendations for incident/event report content. For each road segment, in all areas, information should include:

- *Construction/maintenance projects* – Current information on active projects along the route segment that may affect traffic flow and/or restrict lanes.
- *Road closures and major delays* – Unplanned events, major incidents or congestion that shut down or significantly restrict traffic for an extended period. In urban areas, information on all incidents and accidents, both major and minor, and congestion information along each route should also be provided.
- *Major special events* – Transportation-related information associated with significant special events (fairs, sporting events, etc.).
- *Weather and road surface conditions* – Weather or road surface conditions that could affect travel along the route segment.

For each of these types of incidents/events types, it is necessary to provide details that enable callers to assess travel conditions and make travel decisions associated with a route segment. The table below illustrates the detailed information needed for each content type.

	Geography		Content Detail					
Content Type	Non-urban	Urban	Location	Direction of Travel	General Description and Impact	Days/Hours and/or Duration	Detours/Restrictions/ Routing Advice	General forecasted weather and road surface conditions
Construction/Maintenance	✓	✓	✓	✓	✓	✓	✓	
Road Closures/Major Delays	✓	✓	✓	✓	✓	✓	✓	
Major Special Events	✓	✓	✓		✓	✓	✓	
Weather and Road Conditions	✓	✓	✓		✓			✓
Incidents/Accidents (Minor)*		✓	✓	✓	✓			
Congestion Information*		✓	✓	✓	✓			

* Major Congestion Information and Incident/Accidents are considered part of the "Road Closures/Major Delays" Content Type

- *Location* – The location or portion of route segment where a reported item is occurring, related to mileposts, interchange(s) and/or common landmark(s).
- *Direction of Travel* – The direction of travel in which a reported item is occurring.
- *General Description and Impact* – A brief account and impact of the reported item.
- *Days/Hours and/or Duration* – The period in which the reported item is "active" and possibly affecting travel.
- *Detours/Restrictions/Routing Advice* – As appropriate, summaries of required detours, suggested alternate routes or modes and restrictions associated with a reported item.
- *General Forecasted Weather and Road Surface Conditions* – Near-term forecasted weather and pavement conditions along the route segment.

As stated earlier, the weather-related recommendations are presently undergoing review by the Coalition, and recommended changes will be published in another DAR, with these recommendations being incorporated into the next version of the guidelines, version 2.0 due in summer 2003.

How can incident/event data be gathered?

There are multitudes of ways in which incident/event data can be gathered. However, the experience gained to date offers several "best practices" suggestions for all implementers to consider:

- *Multiple information sources need to be accommodated.* To be complete, information needs to come from a variety of agencies and from multiple departments within agencies. Though state roads are typically owned and operated by a state DOT, they are usually patrolled by state and local police. Initial reports and on-site verification of a problem often comes through the police department having jurisdiction. Construction information may be the purview of the DOT's construction division, while the maintenance division is the only source for planned and emergency maintenance and road closure information and the traffic operations division may know where congestion, breakdowns and incidents are located. Throughout a 511 service's operating area, there could be multiple owner/operators of roadway infrastructure and a similar number of patrol authorities. Experience has demonstrated that a single source is unlikely to be able to gather and maintain all the information on the full range of incident/events. For example, even when the police clear the incident in their system as they have completed their work, another agency may still have lanes closed for clean up and repair. Thus, it is imperative that methods to accept information from all root sources is critical to provide complete, timely, accurate and reliable content to callers. During implementation planning, a thorough analysis of the "root" sources of information needs to be conducted, including identifying who they are, what type of information they have (and in some cases what type they should have if their current information falls short), their willingness to make it available to support 511 and how such information could be accessed.
- *An Internet-based, integrated reporting system should be used.* While there are a few examples of 511 systems operating using manual approaches to gathering and reporting information, quality services need to rely on quickly and accurately fusing information from

a wide array of sources, such that a single route report can be created for each covered road segment. The most successful are using Internet-based applications to accept reports – both from people entering information via a browser-based user interface and from automated interfaces. Examples include the Highway Conditions and Reporting System (HCRS) and the Conditions Acquisition Reporting System (CARS). Arizona uses the HCRS system in which hundreds of professionals from dozens of organizations statewide can enter event reports into a single integrated system from their own computer using only a web browser (for more information on HCRS, go to: www.az511.com). Several states utilized a different, but similar system, known as CARS as their integrated reporting system (for more information, go to: http://www.carsprogram.org/public.htm).

- *The importance of operational procedures and processes.* If a region or an agency waits until a major event has occurred to begin to gather information from multiple sources to share with callers, the result is likely to fall far short of caller expectations. It is imperative that both the inter- and intra-agency integration of information is based upon well thought out, documented and agreed upon processes and procedures that clearly state the roles and responsibilities of all parties in terms of entering and monitoring event reports. The best designed automated reporting system with inconsistent, incomplete and poor quality event reports will be less useful than a fully manual system that provides information based upon solid procedures that are carried out fully and completely. **We cannot say this strongly enough – the processes and procedures are at least as important as the reporting system backbone in terms of incident/event reporting quality.**

What quality metrics are associated with providing incident/event reports via 511?

As stated in earlier sections, specific quality parameters are not yet provided in the guidelines, though there is clear guidance for implementers to focus on the reliability, accuracy and timeliness of the information provided. ITS America's *Closing the Data Gap* report does provide some clear guidance about the quality of incident/event reports to support a full-range of ATIS applications. Key elements of those more general quality guidelines are:

- No more than 10 minutes from the time an incident/event occurs to when it is available in a 511 service.
- Incident/event reports are verified in some fashion prior to being included in 511 messages.
- Incident/event report information (such as location, nature, severity, duration, etc.) is fully accurate in at least 85% of reports.

In support of its Transportation Management Systems Master Plan, Caltrans recently completed a TMS Detection Plan. In that plan, Caltrans established several data quality requirements, one of which is directly relevant to the provision of traveler information regarding incident/event reports:

- Conditions (fog, dust, snow, etc.): 95% accuracy and 99% availability.

What does consumer research say regarding incident/event reports?

At the National 511 Launch Conference in March 2002, a complete session was dedicated to presenting and sharing consumer research regarding 511 and ATIS. ITS America's National 511 Consumer research, conducted in late 2001, showed that in a nationwide telephone survey, with an accuracy of +/- 5%, that the top six reasons caller would use 511 related to incident/event reports:

- Weather Related Road Surface Conditions – 78% (40% Critical, 38% Useful)
- Accident or Road Incident Reports – 75% (28% Critical, 47% Useful)
- Construction Updates – 74% (26% Critical, 48% Useful)
- Traffic Congestion – Freeways – 69% (24% Critical, 45% Useful)
- Special Events – 69% (19% Critical, 50% Useful)
- Traffic Congestion – Arterials – 64% (17% Critical, 47% Useful)

Utah DOT reported findings of focus groups conducted in late 2001 in Salt Lake City prior to the rollout of Utah's 511 system that concurred that consumers indeed viewed incident/event reports as the primary use of 511 in terms of roadway information.

In the 1990's, multiple studies were undertaken to determine consumer's needs related to ATIS, particularly in metropolitan areas. In a summary paper published in 2000 (http://www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE/9H801!.PDF), the top two uses of ATIS were to assess traffic congestion on their route and to judge the effects of incidents on their trip. This paper also confirmed that the most critical features of a "traffic service" – as it was described in the paper – was the accuracy, reliability and timeliness of the service, underscoring the need to focus on quality.

VI. Putting it all together: Integrating Roadway Data

The previous sections have provided a large amount of information regarding roadway content for 511. While it may seem overwhelming, we will illustrate in this section how such a broad array of information can be communicated completely and concisely to a caller. While we hope to show that giving relevant and complete information in a short time is achievable, we hope it will also be clear that it is only achievable if every effort is made to limit superfluous or redundant information.

As stated in Section II, at a minimum, information on all roads in one's 511 service area that are part of the NHS should be available to callers, with each road divided into logical road segments. All information associated with a segment should be provided in a single, integrated road segment "report." Below are purely illustrative examples putting the recommendations in a real-world context.

Hypothetical Example #1: I-26, South Carolina

For this example, we chose I-26 in South Carolina (see Figure 2), with the route segment running from I-95 in the west to Charleston in the east. Here is what a road segment report could sound like:

"Here is the report for Interstate 26, between I-95 and Charleston: Eastbound towards Charleston, expect to travel at or near the posted speed limit over the 52 mile segment. Westbound towards I-95, expect about 15 minutes of delay due to emergency pot hole repair which has closed the right lane stretching from exit 203, College Park Road in Ladson to exit 199, US 17 Alternate, in Summerville. These repairs are scheduled to be completed at 3:00 p.m. this afternoon. There are no reported weather-related problems at present, though there is a 70% chance of severe thunderstorms in the Charleston area from 5:00 to 6:00 p.m. this evening."

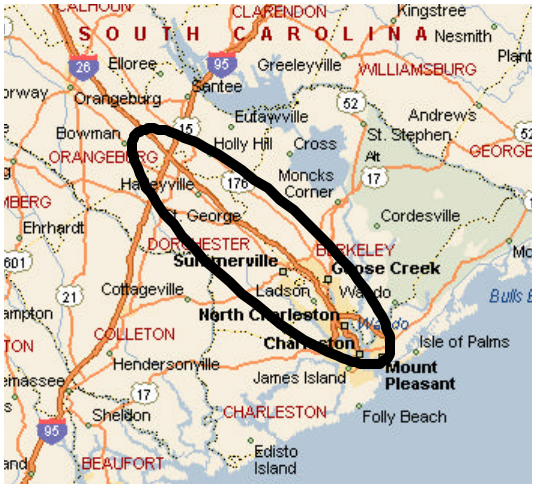

Figure 2

Hypothetical Example #2: I-290 (Eisenhower Expressway), Chicago

For this example, we chose I-290, the Eisenhower Expressway in the Chicago area (see Figure 3), with the route segment running from I-294 in the west to the loop in downtown Chicago. Here is what a road segment report could sound like:

"Here is the report for Interstate 290, the Eisenhower Expressway, between Interstate 294, the Tri-state Tollway and the loop in downtown Chicago: Eastbound towards the loop current travel time is 30 minutes over the 15 mile segment. Westbound towards the Tri-State, current travel time is 60 minutes. A major accident westbound, approaching exit 28A, Damen Avenue, has blocked the left 2 lanes and is the principal cause of delay in both directions. Clean up is ongoing and scheduled to be completed by 6:30 p.m. Westbound congestion begins at Racine Avenue; eastbound congestion begins at Western Avenue. Please use extreme caution, as freezing rain is impairing visibility and causing icy conditions along the entire corridor until at least 11 p.m."

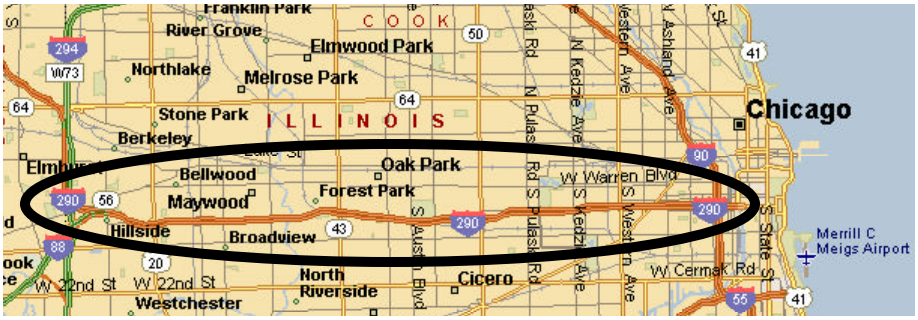

Figure 3

Both of these examples could be communicated to a caller in 30-45 seconds and provide the caller with a single, integrated report for the road segment. As stated earlier, these examples are hypothetical and we have utilized specific locations to give concrete examples of 511 road segment reports. As states in section IV, there are many way to provide flow information over a given road segment, these two examples illustrate a few other those ways.

When creating the structure of an integrated road segment report, an implementer needs to consider a number of items, including:

- A telephone system cannot possibly convey everything that a visual medium, such as an Internet site or a TV can;
- To most people, a telephone based report they receive through their ears will not be as easy to comprehend as a text report of the exact same information they would view through their eyes; and,
- The longer road segment reports are, the longer the average call length will be, driving up system costs.

This, it is important – both to the implementer and the caller – to be as concise as possible with road segment reports, while still conveying useful and relevant information.

Road segment information may also be aggregated, or compared, in a trip report below:

Hypothetical Example #3: Bridge / Tunnel Crossings, New Jersey to New York

For this example, we chose the Tappan Zee, George Washington and Verrazano Narrows Bridges and Holland and Lincoln Tunnel crossings of the Hudson River. Here is what a report that offers travel times over various trip segments could sound like:

"Here is the report for the Eastbound Hudson River Crossings: the Tappan Zee is up to 50 minutes due to sacks of cement on the roadway; the George Washington upper deck is 20 minutes, while the lower deck is only 15 minutes; the Lincoln is up to 30 minutes due to a bus broken down in the bus lane on the approach; the Holland is at 20 minutes; and the Verrazano Narrows is at 40 minutes due to a stalled car blocking the right lane right before the toll plaza on the Staten Island expressway. Westbound out of New York everything is normal for the morning rush hour and experiencing no extra delays."

With more deployers considering offering travel times, like the San Francisco Bay Area by reading FasTrak toll tags and the Arizona Model Deployment using license plate readers, reports like the one above may become common on 511. These types of reports comparing travel times over various trip segments could offer travelers a real choice when alternate routes are available and enable real, informed decisions to be made. Based on the report above: a traveler in Northern New Jersey going to Connecticut might choose the lower deck of the George Washington Bridge instead of her planned crossing of the Tappan Zee Bridge; and a traveler in Central New Jersey going to lower Manhattan might choose the Holland Tunnel instead of his planned crossing of the Verrazano Narrows Bridge.

VII. What is Being Provided Today

What roadway content are current 511 services providing?

In preparation of this DAR, a scan was performed of existing 511 services to determine what types of roadway content are currently being provided. Each operational 511 service provides at least some form of roadway content. The table below summarizes for each service at a high level the types of roads covered and the content provided.

	Type of Roads Covered					Roadway Data Types				
System	Interstate	Other Ltd Access	US Routes	State Routes	Other	Weather	Construction	Incidents	Congestion	Travel Times
Statewide										
Nebraska	•		•	•	CO, WY, IA, SD Interstate Corridors	•	•			
Utah	•		•	•	SLC Main Arterials	•	•	•	?	
Arizona	•	•	•	•		•	•	•	•	
Minnesota	•	•	•	•		•	•	•	?	
Iowa	•		•	S		•	•	?		
South Dakota	•		•	•	ND, MN, NE, MT	•	•			
Kentucky	•	•	•			•	•	•		
Montana	•		•	•	ND*, SD*	•	•			
North Dakota	•		•	•	MN, SD, MT	•	•			
Metro Area										
Cinncinati/ Northern Kentucky	•	•	F	F	Xfer to Statewide Ohio (800) and Kentucky (511) Services	?	•	•	•	•
Orlando	•						•	•	•	D
SE Florida	•	•	•	•			•	•	•	•
San Francisco	•	•	?	?			•	•	•	*
Corridor										
I-81 (VA)	•		•	•		•	•	•	•	

F = few, S = some, D = delay, * = to be included later in 2003

This table shows that in general, statewide services have been focused on weather, construction, road closure and restrictions information and metropolitan services have been focused on congestion and incident information. While this is logical as a starting point, the 511

Deployment Coalition believes that services should strive to provide all forms of content at the desired quality levels, regardless of the type of area being covered.

What roadway content is the 511 Model Deployment in Arizona going to provide?

Several enhancements are currently under development related to improving existing roadway content in the Arizona 511 Model Deployment, scheduled to be operational in the late fall of 2003. Presently, Arizona provides road closures, restrictions, construction, major incident and congestion information for all state roads. Planned enhancements include:

- *Decomposing roads into logical segments.* Presently the service provides a report for each road in its entirety. That will change, as logical segments are determined throughout the state.
- *The addition of travel times along Phoenix area freeway segments.* Efforts are underway to automatically calculate segment travel times using the available data from Arizona DOT's freeway management flow sensors (loops and ultrasonic detectors, primarily) and inject the calculated travel times into HCRS for use on the 511 service.
- *Arterial road segment reports.* A concerted effort will be made to gather and make information available on the major arterial roads in the Phoenix, Tucson and, possibly, Flagstaff areas. Also, a field trial will be conducted to gather and incorporate travel times along a few arterials in Phoenix with the aim of evaluating the utility and cost-effectiveness of such content.
- *Data Quality Enhancements.* A systematic development of operational procedures to ensure the completeness and quality of reported data is underway. An operations manual will be developed and training will be provided to key data entry operators. The purpose is to achieve tangible improvement in both completeness of information as well as its quality.

VIII. Basic vs. Value-Added services

The 511 Implementation Guidelines establish that beyond the basic services that should be available to callers at no more than the cost of a local call, implementers have the option to consider adding additional content or services to their 511 service. In the Guidelines, this is called "optional content," and is also often includes "premium" or "value-added" services.

What are "value-added" services?

Optional content is up to the discretion of the system implementers and can include additional content supported by the public sector and/or private sector supported services. "Value-Added" services have typically been thought of as those that are provided by the private sector and have some sort of associated revenue generation capability.

The Guidelines provide several examples of possible value-added, roadway-oriented services:

- *Tourist Information* – Specific information about local tourist attractions, tourist information centers, convention and visitors bureaus, etc. Could be recorded messages or connections to live operators.
- *Parking* – Parking location and possibly parking lot status information.
- *Local Information/Points of Interest* – Information such as restaurant locations, gas stations, taxis, etc. Could be extended to include reservation services.
- *Interregional Information* – Information pertaining to transportation conditions in other, perhaps adjacent, regions. Examples include extension of an interstate travel corridor or a major city in an adjacent state.
- *Driving Directions* – In a voice-activated 511 service, callers can provide their location and their desired destination and obtain driving directions. These directions could be based upon real-time conditions and/or can include estimated trip travel time if such information is available.
- *Concierge Services* – Operators can provide any of the above information to callers. These operators could also handle additional services, such as reservations and purchases.
- *Personalized Services* – Callers can provide profiles of their normal travel patterns and the system, by recognizing the phone number of the caller, can provide a complete report along the caller's route(s) (e.g., the conditions on a commuter's complete normal route) without requiring callers to locate and review reports on multiple route/corridor segments.

Do recommendations change if content is value-added as opposed to basic?

This DAR is focused on the content quality of basic roadway services. However, its recommendations can also apply to value-added services. Those considering offering value-added services should recognize, however, that callers are likely to expect as good, or better, quality of information when compared to the service's basic content.

IX. General Issues

This section addresses, in question and answer format, several issues that have arisen in early 511 planning and implementation.

How much and how good should data be in a region before offering 511?

This is perhaps the most asked question, "Do I have enough knowledge of my system to share with prospective callers?" It is the collective experience of the Task Force developing this DAR that a minimum essential element that needs to be ready before going "live" with a 511 service is an incident/event reporting system covering the service area, along with – and this is crucial – procedures and commitment to using and populating the reporting system with all relevant reports, at or above the quality levels specified earlier. Traffic sensor data is not a requirement to initiate a 511 service. However, services that have such data available should determine how to incorporate the data. Services that do not have existing or planned traffic sensor data implemented in their service area should develop a plan, as quickly as possible, for creating and incorporating traffic sensor data. This is particularly true in metropolitan areas.

What is this difference in terms of roadway content in urban and rural environments?

Simply stated, the non-urban areas that are covered by 511 get the most benefit from weather, construction and major events/closures content. While these are also important in urban areas, congestion related information is valued much higher. In urban areas, commuters are much more likely to use the system if such traffic flow related data is provided. Of course, ideally we will have all relevant information, including flow data, for all covered road segments, regardless of location. But as implementers initiate their systems and make resource allocation decisions, keep in mind that good traffic data is probably going to determine usage and caller satisfaction with roadway-oriented content in urban areas, while weather and major incident/event information that pose safety risks or lead to major delays is probably going to determine usage and call satisfaction with roadway-oriented content in rural areas.

What is the relationship between 511 and Advanced Traveler Information Systems (ATIS)?

Defined by ITS America in 1992, "ATIS acquire, analyze, communicate and present information to assist surface transportation travelers in moving from a starting location (origin) to their desired destination. The systems provide such assistance in a manner that best satisfies the traveler's needs for safety, efficiency and comfort. The travel may involve a single mode of transportation or it may link multiple modes together during various parts of the trip." There are many methods of providing information to travelers with telephone systems available via 511 being one of them. While 511 has become an important part of ATIS, implementers need to recognize that 511 is part of ATIS, not its sum total. When developing a 511 strategy, it is important that an overarching ATIS strategy is either already in place or developed in conjunction with the 511 strategy. The same underlying information base necessary to provide quality roadway content over 511 services can also be utilized to provide other forms of ATIS, either directly to consumers or through private sector information service providers.

Can 511 be a tool to aid in work zone management?

511 can clearly assist in managing and sharing information with the public about work zones, by warning travelers of expected and real-time delays. 511 can also provide callers with notice to be on the lookout for work zones at specific locations on their route ahead. However, experience has demonstrated that to be an effective tool, care must be taken and there must be a commitment on the part of the agencies involved to ensure real-time management of work zone status information. In a recent Caltrans study, fully 60% of approved planned lane closures do not actually occur. Thus, if information were provided only based upon plans, more often than not, the traveler would not experience the reported work zone. Also, not all work zones are significant enough to justify communication over 511. Many work zones occur off the roadway, such as mowing, and many others occur along shoulder and do not significantly impact traffic flow. Caltrans has developed a rule-of-thumb that for a work zone to be included as an item on its 800 telephone service (currently being planned for conversion to 511), more than half the lanes in a given direction must be closed and more than 10 minutes of traveler delay needs to be created as a result – or if 20 minutes of delay is created, then the work zone of any scale would be included. Thus, while 511 can be a tool in work zone management, like any tool, it must be used wisely.

What relationship does 511 system interoperability have to roadway content?

The Coalition's Deployment Assistance Report #4 deals with 511 system interoperability in great detail. In the context of roadway content, implementers need to consider, at minimum, how to provide information along travel corridors that cross the boundaries of their 511 coverage area. Travelers heading towards a state line, or through an invisible – to them – boundary between 511 services, will likely expect to be able to obtain information beyond the coverage area. While there are several issues that need to be addressed to make this possible – many of which are covered in DAR #4, implementers need to be aware that offering 511 services that do not enable callers to obtain information just over your system's boundaries could lead to unhappy callers.

What about using predictive data in 511 services?

As archiving of segment travel time data grows, the opportunity to use historical information increases. In fact, in Houston, the Transtar web site (http://traffic.tamu.edu/transtar.html) provides not only current segment travel times, but also provides a comparison of the current day's travel time trends over a segment versus recent historical patterns (see figure 4). In regions where historical data exists, it may be possible to provide forecasted travel time/speed/delay in addition to, or in lieu of, current travel time/delay/speed. However, we recommend that great care be taken when providing forecasts, as the audio medium of the telephone cannot provide the same perspective that a visual medium or the Internet can. Although predictive travel times have not been provided via 511 as of yet, the Task Force offers the following for any possible implementation: (1) predictions should be

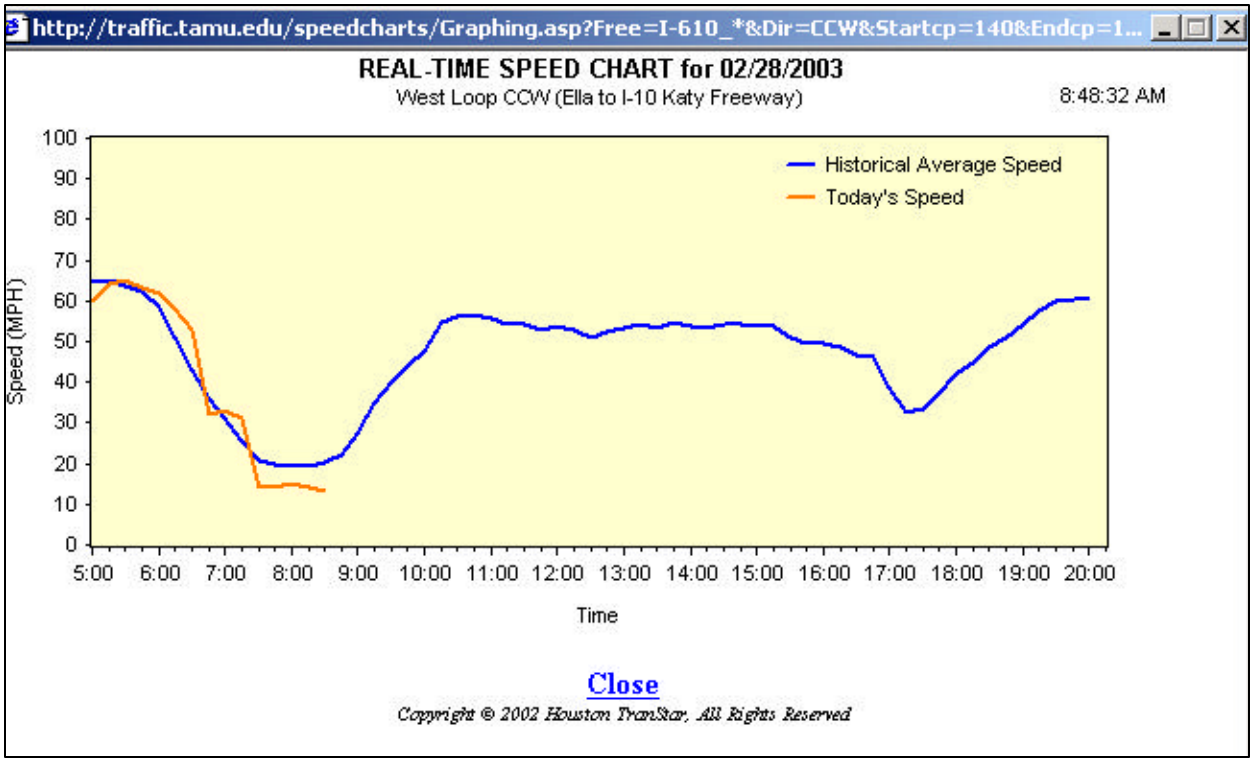

Figure 4

for the near-term only - such as the time horizon over which vehicles just beginning a road segment would be traveling; (2) there would need to be some sort of indication in the message that this information is predictive, such as using the word "expected" before travel time, speed or delay information; and (3) if providing both current and predicted travel times, care needs to be taken to ensure that an overly lengthy and confusing message does not result.

Who is responsible for data collection?

To date, most information provided by the public sector to the traveling public has been collected by the public sector. However, with several emerging technologies, particularly in traffic sensing data and calculating and forecasting flow data, it is possible in the future that public sector agencies could purchase data from private sector, either to supplement and enrich data they collect, or in some cases to eliminate the need to collect certain types of data altogether. While the Task Force creating this DAR cannot be sure of the direction and pace the data collection market will take, we do advise implementers to enter any 511 implementation planning efforts with an open mind in terms of how to collect data needed to deliver quality roadway content over 511.

What standards information is relevant to providing roadway content over 511?

From DAR #4: 511 Regional Interoperability Issues which addresses data sharing:

Implementing agencies should provide their data sets in the SAE ATIS (J2354) message sets, available at:
http://www.sae.org/servlets/productDetail?PROD_TYP=STD&PROD_CD=J2354_199911
To obtain the latest draft version of the standard from the SAE ATIS committee contact Joel Markowitz (JMarkowitz@mtc.ca.gov) or David Kelley (davidkelley@ITSware.Net).

The SAE ATIS (J2354) standard has many important components for 511 systems, including transit information and vehicle routing.

Current 511 systems receive data from traffic management centers (TMCs) in standard format developed by AASHTO / Institute of Transportation Engineers (ITE) TMDD Committee. "Message Sets for External Traffic Management Center Communications" (MS/ETMCC) is the exact name of the approved Abstract Syntax Notation number One (ASN.1) message sets which are currently being updated in an "Expedited" standards process. The TMDD Committee has agreed to publish XML versions of its messages alongside ASN.1 in future releases. Currently the committee-approved standard for traffic event exchanges is the Event Report Message (ERM) of MS/ETMCC, as approved by the TMDD Committee.

From this data output, receiving agencies can either map data directly into their own systems or translate the data into a format that may be input to their systems.

Is there potential liability for providing information over 511?

State and local government agencies have been providing transportation-related information over the telephone for many years, decades in some cases. Each state is likely to have case law already established governing liability related to phone-based information provision by government agencies. The ability for a caller to access a transportation-based information service by dialing three digits (511) instead of seven or ten digits should have no effect on the underlying legal framework in each state.

As far as national experience regarding liability issues and 511, the Task Force drafting this report is not aware of any specific cases occurring as of yet where 511 services have been implicated or sued. But, process patents may have been granted for these types of services and deployers need to research their applicability.

Disclaimers related to weather information are available in the appendix of DAR #6: Weather and Environmental Content on 511 Services.

X. Implementer Self-Assessment Checklist

To aid implementers in planning for and providing quality roadway content via 511 services, we have developing the following checklist. We are certain that we do not have all steps identified or sufficient detail to completely cover all aspects an implement must consider, but we hope this provides a useful starting point to begin or re-examine your approach to roadway content.

1. Define Covered Road Segments.

a. Define Total System Coverage area.
b. Identify NHS roads and non-NHS limited access roads in urban areas, if appropriate.
c. Identify any travel corridors at the boundaries of your coverage area that should be included.
d. Determine if any other roadways should be "covered."
e. Segment covered roads into logical road segments considering weather factors.
f. Determine which agencies own, operate and patrol the covered road segments.
g. Inventory existing content sources for covered road segments from all involved agencies.

2. Determine location and type of flow sensing systems, including data interface(s).

a. Document the incident/event reporting system, processes and procedures, including data interface(s).
b. Identify real-time road and weather monitoring systems and any forecasting services being performed, including all data interfaces.

3. Define the desired content and quality of the content for each covered road segment.

a. Develop and implement an action plan to enable the provision of roadway content over 511 to the desired quality levels.
b. Determine and, if necessary, implement any improvements to be made to existing systems to increase data utility, either by increasing coverage, quality or relevance.
c. Determine and, if necessary, implement any improvements to the processes and procedures by which information is obtained, fused and shared to improve comprehensiveness, reliability, accuracy and timeliness, particularly related to incident/event reporting.
d. Determine and, if necessary, implement any new systems, processes or project that facilitate the integration of all forms of roadway content to support the production of integrated road segment reports.

4. Determine content integration strategy and conventions for creating integrated road segment reports.

a. Specify format of road segment report to clearly define how flow, incident/event and weather content will be provided in a seamless message.
b. Define introductory statement for each road segment report.
c. Determine if each road segment report will be for both directions of travel or if the caller selects their travel direction before receiving their report.

d. If both directions are provided in a report, establish the convention for order of reports (e.g., Northbound and Westbound first, Southbound and Eastbound second).
e. Determine how segment reports will be structured in cases where one or more of the desired report elements is not available for a given segment, either on a temporary or permanent basis.

5. Develop and implement a quality control assurance program to support the sustainable provision of quality content.

If implementers have suggestions for improvements, please provide this information electronically to 511feedback@aashto.org