



Puget Sound Regional Transportation Operations Committee

# Advanced Traveler Information Systems (ATIS) Technical Concept

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Submitted to the Puget Sound Regional Transportation Operations Committee  
by IBI Group

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Puget Sound Regional Transportation Operations Committee  
**ADVANCED TRAVELER INFORMATION SYSTEMS (ATIS) TECHNICAL CONCEPT**

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# 1. INTRODUCTION

## 1.1 Project Background

Intelligent Transportation Systems (ITS) can significantly improve the efficiency of a given roadway network by offering benefits such as real-time conditions monitoring, more reliable travel times, and more effective communication to the public. The Puget Sound region faces significant geographical limits on the physical expansion of its transportation system, and, to manage the impact of the limitations, various agencies in the region have been successfully implementing a wide range of ITS projects over the last 25 years.

An important element of ITS is the dissemination of useful and timely information to the traveling public. While a number of agencies have successfully implemented traveler information systems that provide information both pre-trip and en-route (primarily through websites and dynamic message signs, respectively), the missing link has been the cross-jurisdictional coordination to combine this information for presentation as a consolidated, usable source. The Puget Sound Regional Traffic Operations Committee (RTOC), a coalition of city, county and state agencies providing leadership for regional traffic operations initiatives, is serving as the stakeholder group for the development of a regional Advanced Traveler Information System (ATIS) as part of its Regional ITS Implementation Plan (RITSIP). The RITSIP was developed to provide the capital improvements to support better coordination amongst the region's transportation agencies and is intended to help create both a more seamless transportation network and a more livable, economically vibrant region. The ATIS provides a next step forward by further leveraging and consolidating travel condition data generated through the ITS projects to reach a broader audience of public users.

## 1.2 Purpose and Scope

The purpose of this report is to present a conceptual design and related high-level functionality for two complementary regional traffic information sharing projects in order to improve the availability of quality and timely transportation system information for both travelers and transportation system operators. One concept is a "one-stop" regional website for traveler information accessible to the public. The other concept is a standardized tool for operators at the region's Traffic Management Centers (TMC) to easily enter up-to-date conditions and event information for dissemination over the website and other media.

### 1.2.1 PUBLIC ADVANCED TRAVELER INFORMATION WEBSITE

The public traveler information website concept is intended to consolidate and present useful and timely traveler information that is currently available from various transportation agencies in the region and that will be expanded with the implementation of the RITSIP. It is envisioned that the website would include CCTV (closed-circuit television) traffic surveillance video and/or images, traffic condition flow maps, incident information, road work lane closures, detour routes, special events, transit information, and other useful traveler information.

This report presents an operational concept as well as the high-level functional requirements for the collection, integration, processing, and dissemination of this information via a user-friendly website geared towards the traveling public.

### 1.2.2 OPERATOR CONDITION INFORMATION AND REPORTING SYSTEM

In order for information to reach the public over the ATIS, first, the information has to be entered by either a human operator or via an automated data feed (such as a traffic surveillance cameras or traffic sensors). Some information, such as detailed road closure and incident notifications, still requires manual input into a reporting system. This input can be made directly into a condition reporting system (CRS) or an automated data interface can be built to extract the data from an secondary source system (such as law enforcement computer aided dispatch system) and submit it to the CRS on a periodic basis. A CRS would use a series of standardized data input fields to ensure that events are reported in a consistent format that can be readily shared and posted to other systems. National standards should be consulted in developing this format. The regional operator CRS concept is intended to improve the ability of TMC operators to provide timely updates on the conditions affecting the region's transportation systems through more convenient system access and conditions reporting mechanisms. Currently, few Puget Sound traffic operators use condition reporting systems.

This report will include a proposed technology concept and high-level functionality for the reporting and dissemination of transportation system condition information that is readily accessible to TMC operators and other key regional stakeholders.

## 1.3 Report Organization

This remainder of this report has been organized as follows:

**Section 2 – ATIS: An Overview:** this section discusses the types and sources of traveler information that will be considered for the ATIS and CRS design concepts.

**Section 3 – Puget Sound Region Current Conditions:** this section explains the existing conditions in the region, including discussion of published traveler information websites and current local agency CRS.

**Section 4 – Gap Analysis:** this section highlights the existing gaps between local conditions and common practices for regional ATIS, and includes a discussion of commonalities between systems, best practices, and lessons learned from similar projects.

**Section 5 – Technical Concept for Puget Sound:** this section provides an overview of the system architecture, data collection procedures, conditions reporting system, and information dissemination process.

**Section 6 – Operational Concept:** this section covers the planning and development of the regional ATIS, who and what will provide the content, how operations and maintenance should be handled, and potential interagency agreements that may be needed.

**Section 7 – Strategies and Opportunities:** this section provides suggestions for development of potential partnerships, phasing of projects and funding opportunities.

**Section 8 – Moving Forward:** this section looks forward to next steps in the process.

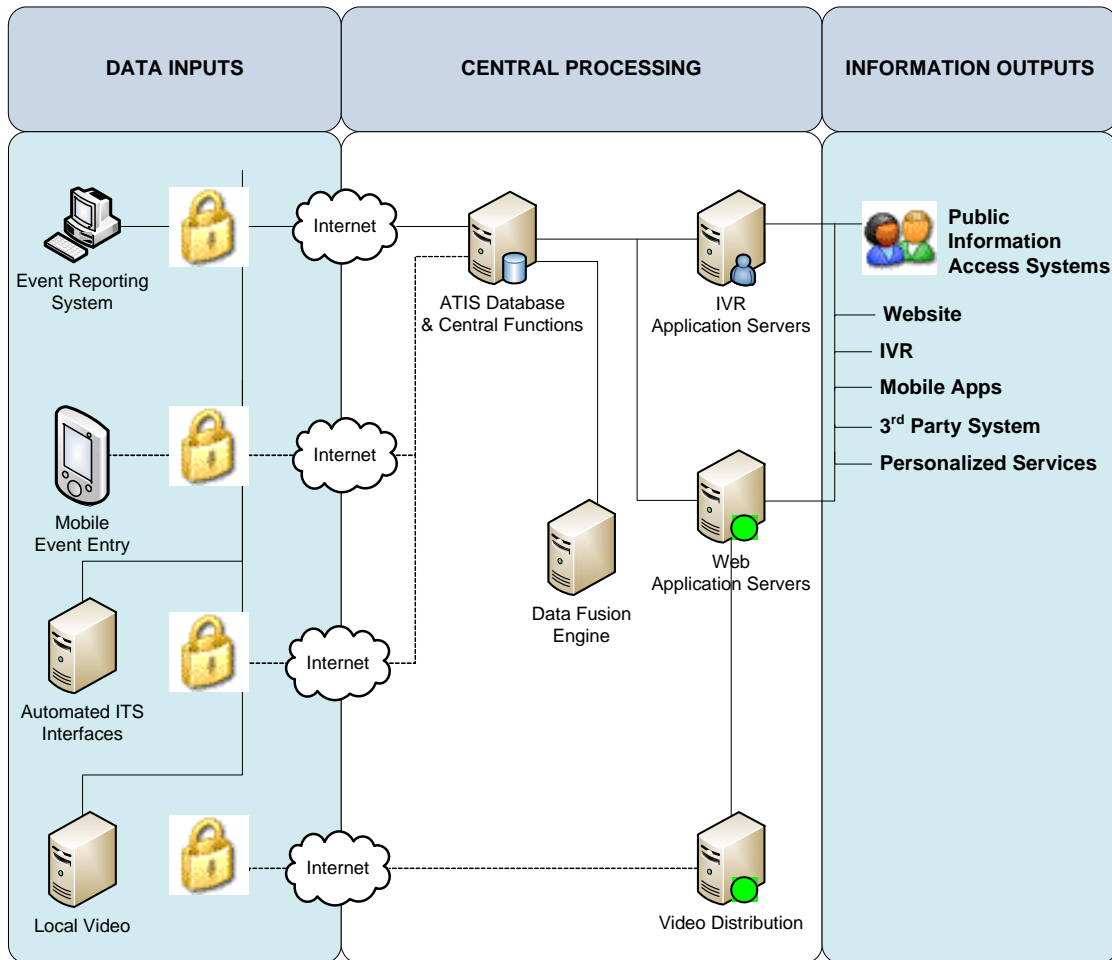
## 2. ATIS: AN OVERVIEW

Advanced Traveler Information Systems (ATIS) continue to gain in acceptance and necessity both for regional travelers planning their travel and for transportation agencies looking to improve incident response and data management. The following sections provide explanations of ATIS system architectures and common functionalities for websites and condition reporting systems.

## 2.1 System Features and Considerations

### 2.1.1 TYPICAL ATIS SYSTEM ARCHITECTURE

There are three basic elements of an ATIS system architecture: 1) input processes, 2) central processes and 3) output processes. A graphic example of these three components can be found below in Figure 1.



**Figure 1: Typical ATIS System Architecture**

Inputs can be manual entries by traffic operator staff (e.g., staff monitoring CCTV feeds entering an observed incident) or automatic interfaces to other systems (e.g., field systems such as vehicle detection sensors, DMS, etc; or center-to-center interfaces to other central traffic management systems) delivering data to a central processing system. Smaller systems may begin with only manual data entry, adding automated interfaces as the system grows.

Data processing, data fusion and data storage occur centrally. The padlocks represent the secure connections between the input sources and the data servers. The central system acts as a data quality manager standardizing the data retrieved so that a single, approved communication of received data is passed along to both travelers and operators.

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Outputs include Interactive Voice Response (including voice recognition) and websites, and have grown to offer additional dissemination methods such as Smartphone applications and in-vehicle information.

## 2.1.2 COMMON WEBSITE FUNCTIONALITY

The objective of this section is to summarize the high-level functionality and features commonly available from public travel information websites in order to set a baseline for the Puget Sound technical concept.

### 2.1.2.1 Real-Time Information

A public website allows for the display of dynamic content, which is continually updated with new information regarding traffic events and warning messages at regular intervals. This information is presented graphically on a map and/or on a tabulated list page. Below are examples of the real-time content that commonly appear on a public traveler information website.

- **Construction/Maintenance Projects:** current information on active projects that may affect traffic flow and/or restrict lanes on roadways, transitways or rail lines in the region.
- **Road Closures:** planned closures that shut down a roadway segment for an extended period of time with information updated during the closure.
- **Incidents:** unplanned events, accidents, and incidents that significantly restrict traffic for an extended period.
- **Special Events:** transportation-related information associated with significant special events (e.g., fairs, sporting events, concerts, etc.) with information updated during the closure. The information may go beyond transportation-related information to include event-related information such as times, locations, event descriptions, etc.
- **Road Surface Conditions:** timely weather or road surface condition information that could impact travel along the route segment.
- **Traffic Speed/Congestion:** the traffic speed or level of congestion along the route segment that is provided in near real time.
- **Travel Times or Delay:** estimated travel times across a route segment. Travel times could be provided in absolute terms (i.e., "segment travel time is 24 minutes") or in terms of delay from normal conditions (i.e., "segment travel time is delayed five minutes").
- **CCTV Cameras:** these include snapshot images, streaming video, and/or video tours of the segment.
- **DMS/CMS:** this displays messages appearing on the dynamic message sign (DMS) or changeable message sign (CMS) throughout the roadway.
- **Real-time Transit Information:** Transit vehicle location or "next bus" information, service alerts, detours, facility closures, and changes (such as snow routes) or delays due to inclement weather or other incidents.

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- **Weather:** weather along the route segment or in a region. This could be forecasted weather or current, observed weather known to be in existence that impacts travel along the route segment.

#### 2.1.2.2 Static Information

Static pages will display static content related to various subjects including general transit information, car-pooling, etc. 'Static information' is information that does not change, or changes only infrequently. Below are examples of the static content that would appear on a public traveler information website.

- **Transit Agency Information:** a brief description of the agency operations, the type of transportation service, and the geographic area served by the system. Other information can be provided as well, at the discretion of the agency, such as hours of operation of the customer service center, fare and pass information, and park & ride and transit center locations and amenities.
- **Public Transportation Trip Planning:** transit trip plans that could include routes, transfers, costs, and trip times. A trip planner may provide these trip plans for individual or multiple transit providers (as is the case in Puget Sound). A trip planner may be based on static schedules, or may incorporate real time vehicle location data to provide up-to-the-minute bus arrival and departure information.
- **Transportation Facilities Information:** travelers can obtain information about major transportation facilities in the service area, including airports; train stations; and ferry, freight, and cruise ports. Information could include parking and traffic conditions associated with the facilities.
- **Carpool and Vanpool Information:** travelers can obtain information on transportation programs in the service area, such as carpools and vanpools, and rideshare and car-share information.
- **Tourist Information:** specific information about local tourist attractions, tourist information centers, convention and visitors bureaus, etc.
- **Parking:** parking lot locations and possibly (near real-time) parking availability information. Parking availability information can range from the very specific (number of open spots) to a rolling utilization or probability, such as "X% full by Y time of day".
- **Bike/Ped Information:** cycling resources such as bike rentals, showers, lockers, etc. along with bike route maps by jurisdiction and information about the regional trail network.
- **Points of Interest:** information such as restaurant locations, gas stations, taxis, etc.; could be extended to include reservation services.
- **Emergency Information:** information pertaining to emergencies (e.g., hurricanes, fire, severe weather).
- **Interregional Information:** information pertaining to transportation conditions in other, perhaps adjacent, regions. Examples include website links and contact information of an interstate travel corridor, a major city in an adjacent state and mountain pass closures.

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- **Archived Data Access:** historical data stores provided by partner agencies to serve as a research and reporting resource. Archived data may be publicly available or require log-in access only.

#### 2.1.2.3 Presentation Methods

The presentation of traveler information to the public can be achieved through a variety of different methods. Whether the information is presented through a website, IVR, mobile application or other media, design and functional options available to agencies include the type of data available, the manner of interacting/retrieving information, the level of complexity of the interaction and the format for presenting the information. For example, in developing a traveler information website, presentation decisions needed include the mapping source, whether information is presented in layers or on separate maps, how traffic conditions are presented (travel times versus relative levels of congestion), and the availability of various types of static and dynamic information. While there are standards in how some information is presented (e.g., congested traffic is shaded red while a free-flowing traffic is green), arriving at a consensus for how regional information should be displayed can be a significant effort, as agencies may have differing opinions. Beyond aesthetic preferences, agencies may not have the resources to reformat their data to be displayed to regional standards. A centralized data reformatting/standardizing engine can help address this issue.

#### 2.1.2.4 Services

There are also additional services and/or information that might be included in order to facilitate the traveler's navigation of the website (e.g., bilingual services, site search, etc.). Below are examples of other services and/or information that would appear on a public traveler information website.

- **Personalized Services:** can be integrated into a website so the user gets customized/tailored information and views based upon a profile of preferred typical trips and routes, or more commonly, the website can provide the means to activate personalized services, such as a sign-up for email and text alerts that are pushed out independently from the website.
- **Mobile/PDA Services:** personalized alerts can be sent to the traveler's mobile phone or PDA after s/he updates their profile on the website to include his/her mobile number and the routes they are interested in.
- **Customer Feedback:** travelers can provide comments on the service, or this can be used by the deploying agency as a surveying tool.
- **Floodgate Messages:** broadcast or floodgate messages can be a critical tool for disseminating information to the traveling public during a major incident, be it weather-, event- or security-related. Broadcast messages can be implemented for various alerts, such as evacuation information, major incidents, homeland security and AMBER Alerts.
- **Location Filtering:** real-time and/or static information would be filterable for a specific location by the traveler.
- **Language Services:** all the information on the website, both real-time and static, would be translated to a different language depending on the traveler's preference.
- **Public Survey:** a short list of questions for the traveler to answer. The questions would be concerning the website performance and the travelers overall experience with the website.

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- **Sitemap:** all the pages of the website would be listed in the sitemap, and any page would be accessible from the sitemap page.
- **Site Search:** travelers can enter a word or phrase after which the system would search all the website pages for that word or phrase and would return these results to the traveler.
- **ADA Compliance:** disabled users (e.g., color-blind users) would be able to navigate the website.
- **Context-sensitive Help:** the help content that appears (when travelers navigate to the help page) would only be concerning the last page s/he was navigating on the website.
- **Copyright Notice:** the copyright notice is usually included at the bottom of the website.

### 2.1.3 COMMON CONDITION REPORTING SYSTEM FUNCTIONALITY

The goal of a reporting system is to allow authorized users to enter and manage the categories and types of roadway and transit events. The data entered via the reporting system would then be disseminated to the public in one form or another (e.g., public website, IVR, etc.).

Fundamentally, a Condition Reporting System (CRS) is a database with a user interface for entering data in a standardized format. The interface is broken down into two parts:

1. *Spatial:* reporting systems allow users to enter and/or view events spatially through a map.
2. *Textual:* reporting systems allow users to enter and/or view events from a tabulated list view.

Using the Traffic Management Data Dictionary (TMDD) of phrases to compose incident reports, along with National ITS standards for messaging and event reporting, can help ensure that the CRS can interface with a range of ITS, including 511 systems and dynamic message signs. 511 systems in particular typically leverage the data provided by a CRS. Because a standardized message set is used, the event reports can be readily translated from text to speech.

From an application development perspective, CRS can also have different operating bases. The CRS can either be an open-source application or a proprietary one. Open-source applications allow an agency to customize code and may have a lower capital cost, but requires the agency to maintain and address bugs. Proprietary software places the burden of maintenance on the software provider, but can be interchangeable with similar applications provided they adhere to the National ITS Standards. The CRS applications may also be designed as client-server application, requiring a customized program to be installed on each workstation from which the CRS is to be accessed, or as a web-based application which can be accessed from any Internet-accessible device. Web-based applications have the advantage of accessibility, in that no new software needs to be installed and that the application can be accessed from any web-enabled device.

The objective of this section is to present the high-level functionality and features of existing CRS, including some graphic examples of interfaces currently being used to manage other systems.

Three current CRS were reviewed for this section:

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1. Regional Condition Reporting System (RCRS): a web-based system currently covering the Vancouver area in Canada (eleven participating Vancouver municipalities and four supporting internal processes).
2. Event Reporting System (ERS): currently deployed in Drive BC, Massachusetts, Wisconsin, Los Angeles, Dublin (Ireland), DriveWest (Alberta), and Ontario.



**Figure 2: ERS Spatial Interface (Google Maps)**

3. Condition Acquisition Reporting System (CARS): CARS was previously used by WSDOT until the recent launch of the ROADS system, and is used by several other states. CARS was developed as part of a pooled-fund study, and is an open-source, non-proprietary system owned by the participating states.

2.1.3.1 Spatial (Map-based) Interface

Current map-based interfaces utilize either existing private-sector mapping systems, like Google Maps (see Figure 2), or in-house developed graphics. Private-sector map interfaces have proven to be the most user friendly and feature-rich systems as they are fully functional and proven systems boasting significant private sector developer support. They also provide an experience that is familiar to the general public user who is likely to have used the provider’s interface on other websites. However, these systems may also come with licensing fees and user agreement restrictions that can be difficult for a public agency to absorb, especially if the agency is acting as a single entity.

Typical spatial view interfaces include the following features:

- Search/filter by event type
- Special graphics/color coding of events to indicate the event type and priority
- Event details can be seen by selecting an event graphic
- Events automatically disappear from the map view once closed or expired

Some special features from each system worth considering include the ability to restrict actions based on Administrator-granted authorizations, dragging and dropping latitude/longitude information from the spatial interface to the textual interface, and the ability to see past events when filtering.

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2.1.3.2 Textual Interface

Textual interfaces usually allow users to enter information about an event via an online form. An example of this interface may be seen in Figure 3.

Typical textual view interfaces include the following features:

- Drop-down menus for selections to control/standardized the type of data entered
- Event types available for selection include road closures, planned events, incidents, and weather conditions.
- Views include active (current) and closed (deleted) events, and event history (archived events).

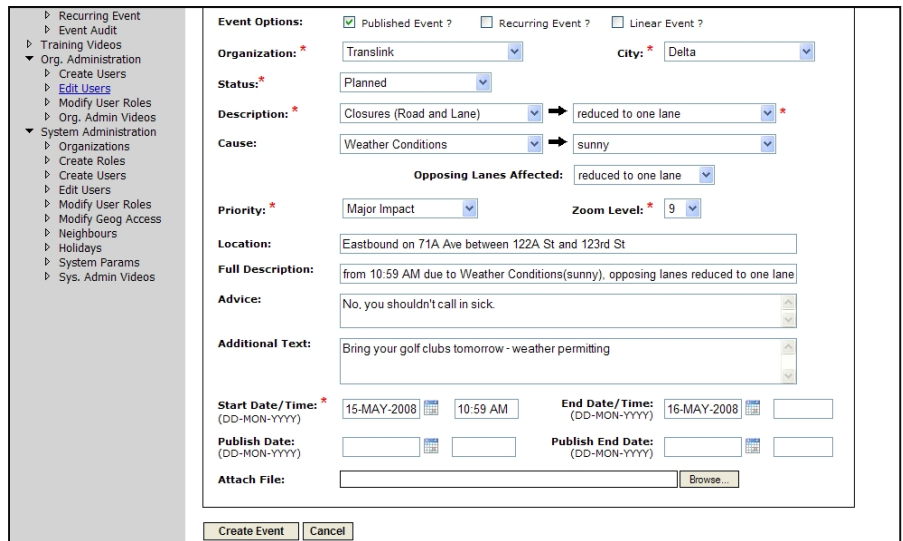


Figure 3: RCRS Textual Interface

2.2 Partnerships and Agreements

Given that a regional ATIS typically requires the cooperation of various regional jurisdictions working together to share data and pool resources, the objective of this section is to provide examples of regional agency consortiums successfully cooperating to deploy and maintain ATIS websites with the goal of getting more diverse traveler information to the public. Each partnership must make key decisions about the structure of the partnership, including, for example, which partner will be the Lead Agency that shall function as the primary contracting body and, perhaps, also the leading funding agency and project management lead.

The partnership must also decide where funding will come from for both the initial development and implementation, as well as the Operations & Maintenance (O&M) after the ATIS goes live. To provide travelers with a consistent experience across the region, data sharing agreements should be reached outlining what data agencies will share in order to deliver optimal website functionality for travelers. In addition, the agreement should outline how the data shall be shared among agencies; both in terms of delivery and format, and a common data exchange structure should be used to minimize costs and development efforts.

The regional partnership will also be required to implement a plan for inter-agency communication. This communication plan should include a schedule for meetings and memorandums regarding the status of the project through deployment as well as a plan for communication following publishing the website to include how partner agencies can provide feedback about website functionality and data availability. Table 1 provides examples of how some existing multi-agency partnerships have chosen to address these issues.

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**Table 1: Example Multi-Agency Partnerships**

Name	Member Agencies	Lead Agency and Role	Funding Source and Structure	Data Sharing	Operations & Maintenance	Communications
<p>Motorist Aid &amp; Traveler Information System (MATIS)</p>	<p>LA SAFE (a program of LA Metro)                      OCTA (Orange County Transportation Authority)                      VCTC (Ventura County Transportation Commission)                      Caltrans (California Department of Transportation)</p>	<p>LA SAFE: acts as contracting body; is the primary funding agency, and acts as the project management lead.</p>	<p>LA SAFE, primary. OCTA acts as financial partner to ensure OCTA is included within the functionality of the Transit Trip Planner (IVR and website).</p>	<p>Caltrans (participation includes 3 district offices) acts as data source partner.</p>	<p>LA SAFE is responsible for costs associated with system deployment. A contractor is engaged to provide ongoing support.                       Partner agencies may: contact 24-hour Operations Help Desk to report concerns which will be appropriately routed; all have access to Administrative Portal for ongoing data sharing.</p>	<p>Weekly status meeting was held through the deployment phase with all partners participating.                       During O&amp;M, meetings decrease to semi-monthly or monthly.                       A monthly Project Summary Report is issued summarizing activities of the previous month.                       A common data repository is used to share data and documents (e.g., SharePoint).</p>
<p>Transportation Operations Coordinating Committee (TRANSCOM)</p>	<p>16 participating transportation and public safety agencies in the NY, NJ and CT region.</p>	<p>Board of Trustees including representative from each agency acts as contracting body.</p>	<p>US DOT awarded a grant to NY/NJ/CT metropolitan region as part of Metropolitan Model Deployment Initiative (MMDI).                       Federal Highway Administration (FHWA) Funds will be used for IRVN.</p>	<p>Operation Information Center (OIC) collects and disseminates real-time regional information 24 hrs a day via extensive notification network.</p>	<p>TRANSCOM is responsible for costs associated with the OIC.                       Partner agencies are responsible for their own equipment, which are utilized by TRANSCOM to manage major incidents.</p>	<p>TRANSCOM prepares Weekly Traffic and Transit Advisory listing construction and special events issued over the pager network.                       Interagency Remote Video Network (IRVN) will be a digital network which will connect 13 of the member agencies' TOCs to allow sharing of video feeds.</p>

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Name	Member Agencies	Lead Agency and Role	Funding Source and Structure	Data Sharing	Operations & Maintenance	Communications
Niagara International Transportation Technology Coalition (NITTEC)	14 participating transportation agencies in Western NY and Southern ONT.	Niagara Frontier Transportation Authority (NFTA) acts as host for NITTEC and performs all contracting.	Currently funded by Federal CMAQ and STP dollars, which supports an executive director and 14 staff members.  Member agencies also provide "in-kind" contributions of member executives and staff who serve on oversight (or sub-) committees.	Rather than independent agencies sharing data, this coalition was formed specifically to gather and disseminate information to the public and member agencies.	NITTEC manages 40 cameras in the region. Member agency operators are able to disable the feed to any camera so it is not published to the public website.  20 DMS are managed by NITTEC as well. Though there are 5 vendors and 3 agencies represented, the signs are shown to the public seamlessly.	Rapid Application Development (RAD) workshop was conducted to gather agencies' perspectives (including requirements and preferences), improving the odds of participation.  Agencies were gathered again for an informal review of prototype pages part-way through development.

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Each of the partnerships highlighted in the above table approached the question of how to structure their partnership differently; however, they each also made clear choices about how to handle the major components of their partnerships in order to most effectively share the data required to maintain a functioning and useful ATIS, including how to share this information in real-time with travelers in their region across agency jurisdictions. Each of the partnerships above implemented a traveler information website as well as some form of IVR to disseminate information to the public while maintaining portals of data sharing available to participating agencies and other partners.

### 3. PUGET SOUND REGION CURRENT CONDITIONS

As the previous section reviewed and discussed common functionality and frameworks for regional ATIS, this section provides an overview of the current conditions in the Puget Sound region in regards to conditions reporting and traveler information websites.

#### 3.1 Public Sector Traveler Information Websites

This section inventories the available agency-operated traffic conditions websites in the Puget Sound Region. It should be noted that the three levels of government that are covered in this section are currently in limited partnering with regards to ATIS, which means there is no coordinated partnership effort or specific operational model that is being followed.

A summary of current regional website features may be found in the Appendix A: Existing Agency Websites.

##### 3.1.1 WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

The Washington State Department of Transportation (WSDOT) agency website offers a state-wide traveler information website with more detailed information for metropolitan areas. One of the main features on the website is the Puget Sound (Seattle and Tacoma) freeway flow map with surveillance cameras. Travelers are able to view real-time traffic flow and travel times on the major highways throughout the state. Incident alerts are updated every ten minutes. A construction and road closure schedule is also available. In addition, travelers can get traffic information sent to his/her mobile phone or email account. If available, similar information is provided for other parts of the state. Transit information is provided via links to different transit agency websites. Web users can view the messages currently displayed on the dynamic message signs along the highways. Travelers can also obtain 95% reliable travel time (as calculated by WSDOT) for a future trip by inputting start and end locations, as well as the required arrival time, and the system can approximate the "worst case" travel time based on historical data.

Incidents on the WSDOT ATIS are posted by operators using an in-house CRS described in Section 3.3.1. Incidents and traffic conditions available on the website are also published to the statewide 511 phone system operated by WSDOT.

In the Vancouver area, WSDOT uses the CRS to post arterial construction and traffic alerts in partnership with local agencies. These are generally in a limited quantity such that operations is not unduly burdened by the additional report.

Currently, the maps on the website are graphics (not GIS-based). WSDOT is working to develop a GIS-based, commercially-available map.

As the operator of the Washington State Ferries (WSF), WSDOT also provides traveler information for ferry users. The WSF area of the WSDOT site includes schedules, reservations, wait times, ticketing (Wave2Go) and ferry terminal cameras. Ferry information by phone is provided via 511.

### 3.1.2 COUNTY JURISDICTIONS

King County hosts an extensive, county-level traveler information website, which consists primarily of a GIS-based map with traffic cameras and road closure/condition alert icons. Because the County's jurisdiction is limited to posting information for roads that fall in unincorporated King County, the County has partnered with WSDOT and several cities in order to provide more detailed information for the remainder of the road network. The traveler can click on a camera icon on the map to see a still image from multiple agencies' cameras. The image refreshes every minute allowing the traveler to see real-time traffic conditions. The traveler can opt to view all camera images on one page. The user can also choose to show current, upcoming or both types of alerts on the map. There is also a list of road closures in the left panel of the website. The map on the site is interactive with pan and zoom features.

King County is currently testing the addition of WSDOT's incident information feed directly from the WSDOT condition reporting system. The County also has an internal CRS that is used by operators to enter the road closure event data that is shown on the website.

There are three other counties in the Puget Sound region: Pierce, Snohomish and Kitsap. Pierce County owns two cameras at the Anderson Island and Steilacoom ferry terminals. Links to different transit and transportation agencies are available via their website. Snohomish County's website provides road construction/closure alerts and an email alert subscription service. Their website also includes links and contact information for other transit and transportation agencies in the region. Snohomish County links their website directly to WSDOT's traffic conditions maps to offer real-time traveler information. Kitsap County offers a "Road Report" of major construction and maintenance activities on County-maintained roads along with an estimated static delay time. A schedule for road paving activities is also provided.

### 3.1.3 MUNICIPAL JURISDICTIONS

The Cities of Seattle and Bellevue host the most fully-featured municipal websites in the region, while other cities shown in the Appendix table are in varying degrees of development.

The Seattle Department of Transportation's (SDOT) website currently hosts a traveler information map (as a separate pop-up window) that includes event alerts, some flow map data on major arterials and freeways, and some camera images. Flow map data is supplemented with data from a partnership with Traffic.com (NAVTEQ). Cameras on the map include both City of Seattle- and WSDOT-owned cameras. Traveler alert icons are displayed on the map directing travelers to additional information. A scrolling traffic alert information box can be found, and there are also additional resources links in the lower right panel that include, for example, a direct link to new information, FAQs, current construction and events list, as well as a link to a customer feedback form. Via the main SDOT webpage, travelers can sign up to receive specific email alerts and/or RSS feeds. The site also offers interest-specific traveler information such as area bicycle maps.

The City of Bellevue maintains a multimodal traveler information website called "Choose your way Bellevue – *One Trip at a Time*" developed under the City's Transportation Demand Management (TDM) program. Bellevue's is the only website that offers multimodal transportation information (e.g., pedestrians, buses, bicyclist maps, and etc.) in one location. The website provides links to a traffic flow map of Bellevue streets, traffic cameras, traffic alerts and transit information. It also provides a link to the WSDOT website for a regional traffic flow view. Travelers can register to receive email notifications when the traffic alert page is updated.

The City of Auburn's Real-Time Traffic Condition website uses Google Maps to display its cameras. All the camera shots are posted under the map. Each image refreshes every minute. Travelers can view a larger image by clicking on a camera located on the map. WSDOT's traffic flow map is also

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posted on the website. There is a link to construction and road closure notices. Travelers can subscribe to email alerts as well.

The City of Redmond's website shows sixteen camera displays. Each camera can be selected to display its image. Links to WSDOT and the King County Department of Transportation (KCDOT) are provided as well. Construction alerts are posted for travelers. The City also lists current and upcoming events on the website.

The City of Kent maintains a limited transportation website that provides links to WSDOT and KCDOT sites. Additionally, the City of Kent, as well as the Cities of Bremerton and Mercer Island, posts road construction/closure alerts. Transit links are also provided, as do the Cities of Everett, Bremerton and Renton.

Other larger cities in the region, including Bothell, Tacoma and Lakewood, do not currently offer traveler information via their websites.

Appendix A provides a summary table of the information available by agency.

### 3.1.4 TRANSIT AGENCIES

Transit information is available on the King County Metro, Sound Transit (serving King, Snohomish and Pierce Counties), Community Transit (serving Snohomish County) and Pierce Transit websites. The traveler can plan bus trips, search for bus schedules, and track buses by location and map (for a limited number of agencies at this time). Transit agencies are leading the traveler information public website charge via the trip planner feature, which combines the above listed transit agencies timetable information in to a central database that can be queried from any of the agency websites. The trip planner feature provides a good partnership model of multi-agency information and resource sharing. The interface offered on each of the transit agencies' websites utilizes the same graphical user interface (GUI) so that travelers are immediately familiar with the types of information required for input and what the expected output will be. The challenge for the transit agencies moving forward will be to integrate real-time information available through the installed computer aided dispatch/automated vehicle location (CAD/AVL) systems, now that these systems are in the implementation phase for several agencies. Without referencing the available CAD/AVL data, the information found on the websites is limited to fixed schedule information (with the exception of King County Metro's Tracker system, which provides real-time arrival predictions). Travelers are likely to be more apt to choose public transportation as a method of travel if given access to highly reliable real-time information about when the next bus will arrive, or the anticipated travel time for a given transit trip compared with a car trip.

It should be noted that there are private efforts, such as OneBusAway (based on the MyBus platform developed through the University of Washington and Metro's Tracker) and Google Transit, to provide transit information to travelers. These private sector programs are separate from the trip planner website program; however, they may provide partnering opportunities to disseminate real-time transit information to a wider audience. One drawback for transit agencies when partnering with private sector bus information programs is that the data is typically stripped of any agency branding, and thus the public may not realize that the service is being supported by the agency.

## 3.2 Private Sector Traveler Information Web Sites

Various private sector companies have recognized the demand for reliable and up-to-date traveler information offered online at low or no-cost. Several of the more well-known web sites offering good coverage of the Puget Sound region include:

- NAVTEQ ([www.traffic.com](http://www.traffic.com))

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- INRIX, Inc. ([www.inrixtraffic.com](http://www.inrixtraffic.com))
- Google Maps traffic overlay (<http://maps.google.com>, click Traffic button)
- TrafficLand, Inc. ([www.TrafficLand.com](http://www.TrafficLand.com))

These sites typically offer a consolidated source of dynamic traveler information unbound by jurisdictional lines, and traffic conditions information based on multiple public and private data sources, including agency-published traffic camera images, transit data, and incident reports. Proprietary algorithms are used to process and extrapolate the various data sources into near-real-time conditions information for freeways as well as many arterials. The depth and breadth of information provided by these private sector initiatives results in a level of coverage that agencies typically do not have the resources to develop. However, while agencies investing in ATIS should be aware of the private sector information already available so as not to duplicate an existing resource, caveats such as the verified accuracy of the private information and whether the information is freely and readily available to the public at large should also be weighed.

### 3.3 Condition Reporting Systems

WSDOT, King County Department of Roads and the Seattle Department of Transportation (SDOT) are the only agencies in the region currently utilizing CRS tools to provide operators with a reporting mechanism for disseminating information about incidents and roadway conditions.

#### 3.3.1 WSDOT ROADS

WSDOT has implemented a new CRS system, called Roadway Occurrence Activity Description System (ROADS), to replace the previously used CARS. ROADS was developed in-house in order to provide the specific functionality WSDOT required. There are versions available for Traffic Management Center (TMC) operators and Public Information Officers (PIOs).

All of the data recorded in ROADS is entered by TMC operators. Planned events are entered once scheduled. Unplanned events are entered by operators monitoring the CCTV camera feeds or the Washington State Patrol (WSP) CAD feed. The operator evaluates the observed incident and then, if the incident is found to be of significant impact, the operator enters the information about the number of lanes affected and expected duration of the incident. The incident then pops up on the website and in the map. Each incident expires (and disappears from the website) based on the entered end date. The incident reports are also integrated with the 511 system so that the information is accessible by phone.

WSDOT has indicated that the non-proprietary ROADS application could be shared with other agencies in order to provide greater reporting capability and a standardized format. However, because ROADS was developed for freeway incidents, local agencies would first need to assess whether ROADS would meet the needs of their operators and if so, information on principal arterials would need to be added before it would be useable. Additionally, a process for version control and system updates would need to be established.

#### 3.3.2 KING COUNTY ROAD ALERT

King County uses a program called Road Alert that was developed in-house using geographic information system (GIS) program called ArcGIS. Road Alert allows operators to remotely enter road closure information. The information entered in Road Alert only covers those roads under County control (unincorporated King County). This has led to gaps in information available to operators and travelers regarding, for example, multi-jurisdictional arterials. Only road closures are entered in Road Alert.

### 3.3.3 SEATTLE DEPARTMENT OF TRANSPORTATION

SDOT uses an online CRS program that allows traffic operators to enter road closures and incidents. Users can enter and update information for both planned events and unplanned incidents. The system links to both WSDOT's ROADS and the private-sector website Traffic.com to access metadata updates available to the system. Operators are able to import data from GIS and supplement this information with the incident/event type from a drop-down menu, as well as select the Start Date/Time and Expected End Date/Time to provide the basis for the traffic event to be reported to the public.

## 4. GAP ANALYSIS

Given the juxtaposition between the regional ATIS overview and the current conditions in the Puget Sound region, this section will provide an analysis of the gaps in the existing traveler information network. Identification of these gaps will pave the way towards developing a technical concept to fill the gaps and meet the needs of two main types of users: the traveling public and the region's traffic operators.

### 4.1 Traveler Information Websites

Since there is no central regional system for disseminating travel information, there are several gaps in information available via public traveler information websites. The most obvious gap in comparing the offerings from various agencies is the varying level of information available from each agency depending on the resources and information they have access to. The consistency and availability of information on key multijurisdictional arterials is particularly scarce. Without access to accurate arterial information, travelers are unable to make informed decisions about alternative routes or view conditions for non-freeway trips, and operators are unable to react to the ripple effect of incidents from one jurisdiction to another or from the freeway to the arterial roadway network. Other key issues include:

- **Lack of a "one-stop" website:** Travelers will often find themselves needing to visit multiple websites to get all the information for his or her trip. For example, on each of the existing agency websites, travelers must click on links to external sites for transit information and for most information on roads outside of the jurisdiction. This likely leads to frustration with the available information and difficulty in assessing current roadway conditions.
- **Lack of common look and feel:** Each site not only offers differing levels of information, they also organize and visually present the available information differently. Travelers visiting multiple sites to plan one trip are likely frustrated trying to locate the necessary information from several differently laid-out websites that also reference the information differently. If the websites were to offer the same types of information in the same format, referenced in the same way and located in similar locations, travelers could at least more efficiently surf multiple sites that have a similar look and feel.
- **Lack of specialized services/information available:** Existing websites typically focus on roadway traveler information, so integrating real-time transit alerts as well as construction and event alerts would provide benefits to the public. Additionally, other users may require wholly different kinds of information than the traveling public which could be integrated into the website. For example, the ability for freight users to be able to make informed decisions about travel times and routes, as well as travel restrictions (width, height and weight), can greatly affect freight travel patterns throughout the region.

## 4.2 Condition Reporting Systems

The primary gap in CRS in the Puget Sound region is that there are currently only three agencies (WSDOT, King County Department of Roads, and SDOT) with access to CRS programs. The CRS in use are not integrated with each other for the common sharing of information. Accordingly, no operational efficiencies and traffic network optimization benefits are easily realized. Because there is no central database, each agency is currently entering jurisdiction-specific data in a closed system and preventing the implementation of a regional traveler information portal. Each of the different agencies are also using their CRS in different ways and inputting data with varying levels of detail and information characterization. For example, road closures in King County are reported via manual updates and call-ins throughout the day, while road closure information in some King County cities might only updated a maximum of daily. These differences yield a different experience for visitors to the various websites that impacts both the value and timeliness of the information for making travel decisions.

A standardized data entry protocol and data exchange format could ensure a means for timely reporting of incidents/conditions that is accessible to all agencies and could be quickly disseminated to the traveler. However, even with a common CRS tool and/or data reporting standard, not all agencies will have the staff available to monitor roadways and enter incidents. Determining how best to gather information from those agencies unable to provide the necessary operational resources will be a key issue moving forward. Without widespread participation from municipal and county agencies, operators and travelers will continue to find gaps in roadway condition information, especially for arterials that cross multiple jurisdictions.

Another missing piece in many CRS applications is the lack of data management, meaning that limited data archival and historical analysis is performed on the event entries. With better data management, the CRS data could potentially be utilized as a larger regional planning tool to help identify safety problems and future transportation project needs. WSDOT has taken this step with ROADS by archiving all entries so they are available for analysis and planning.

## 4.3 Information Depth and Quality

With multijurisdictional arterials, each jurisdiction has only the depth of information pertaining to its own segment, and only within the limits of its monitoring capability. For example, WSDOT primarily manages freeways (plus a limited number of state route arterials), which means that the information available to WSDOT traffic operators and to travelers visiting the WSDOT website traffic flow map only reflects conditions on freeways and, sometimes, the on- and off-ramps. This lack of cross-jurisdictional information sharing is even more keenly felt at the county and municipal level where many major arterials cross several jurisdictions, frequently unbeknownst to travelers. The effect of this lack of information was demonstrated during the flooding of January 2009, when local travelers checking the King County website thought that SR 169 (shown on the King County map, but operated by WSDOT) was open when in fact it had been closed by WSDOT at Cedar Grove Road. Customer frustration over this situation drove King County and WSDOT to work together so that WSDOT road closures could be displayed to King County website visitors.

Given information about activity in other jurisdictions, a traffic operator could post more accurate information about delays and closures, or could change a signal timing plan in order to mitigate the effects of an incident in another jurisdiction. The traveler information public website would also be able to provide a greater depth of information to travelers, enabling them to make better-informed travel decisions to destinations all over the region.

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Other key gaps in the depth and quality of the available information include:

- **Lack of Multimodal Information:** Travelers only have access to car-based trip conditions on many of the jurisdictional websites, which are lacking multimodal information (e.g., bicycle maps, transit routes and timetables, ferry routes and timetables, walking distances, etc.). The noted exception is the City of Bellevue's website, which does offer some multimodal information, though each link does take the traveler away from the main site. Offering multimodal information allows travelers to make informed decisions about which forms of transportation to use for all segments of his or her journey, which can lessen the impact of many travelers on a roadway for an event, as travelers may opt to use another form of transportation if the ability to compare modes is provided.
- **Lack of Data Integration from Other Sources:** In addition to transit agencies, the integration of incident data from law enforcement agencies provides an opportunity to utilize CAD data flowing into these agencies regarding traffic-related incidents. Privacy issues and security concerns can be addressed through data filtering and information exchange standards, allowing transportation agencies to receive the appropriate information without placing an additional burden on transportation or law enforcement personnel.
- **Lack of Data Management Standards:** Currently, there is no means of resolving conflicting data between the various agencies in order to support a regional CRS or other data entry system. Standardization of data formats would allow agencies to more effectively communicate with each other, would decrease the likelihood of errors, and would provide consistent information to the traveling public. For example, WSDOT refers to roadway locations by route number and milepost while counties and cities generally use roadway names as reference points. In addition, roadways can be known by several different names, either within a single jurisdiction or as it crosses multiple jurisdictions. Therefore, providing a means of verifying and/or standardizing the location assigned to events, whether entered by the operator or automatically by the system, would ease sharing of information across agencies.

Additionally, there is no standard method for archiving data, which means that much of the data now collected may not be useable when planning future traffic and transportation projects. With a regional CRS or central database, data from multiple agencies and multiple jurisdictions could all be stored and either automatically disseminated to the public or evaluated by operators prior to being posted. Records of events that are cleared quickly or do not otherwise merit publishing to a public information system can still offer value when evaluating roadways and intersections for projects such as new signal timing plans or red light camera enforcement.

## 5. TECHNICAL CONCEPT FOR PUGET SOUND

The following sections provide a high-level technical concept for a potential Puget Sound region multi-agency ATIS, given the overview of current conditions and gaps in the previous sections.

### 5.1 System Architecture Overview

As noted previously, key pieces for a fully functional and robust ATIS are: system inputs (CRS), central processing, and system outputs (public traveler information website).

In addition to the conditional reporting system, the system inputs may also include other automated data, including weather, traffic and transit inputs from other sources. The central processing/data

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fusion engine should include an interface to the CRS as well as a web application server. Future expansions, such as an interface to adjacent regions and states, should also be enabled if not immediately implemented. Finally, the system outputs should include a public traveler information website and should allow for system growth to include personalized alert capabilities, email and mobile device delivery and integration with the 511 system.

Following is a graphical representation of the suggested system architecture showing the input, processing and output flows, including some future applications.

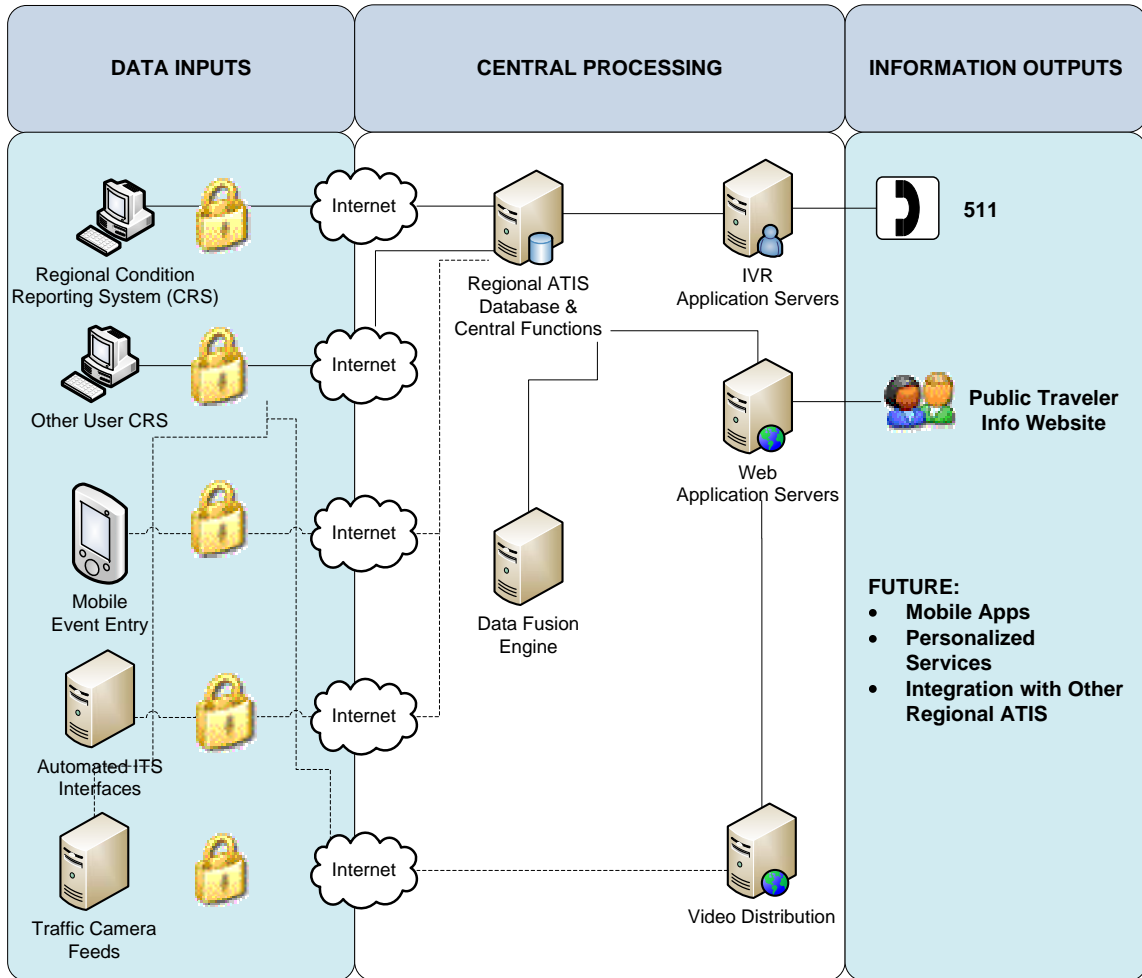


Figure 4: Puget Sound High-Level System Architecture

## 5.2 Regional Conditions Reporting and Data Collection

In order to support the input of arterial-level travel conditions and incidents by regional traffic agencies and other stakeholder users, a standardized CRS customized for local agency use is required. This CRS must include functionality to support a range of users with varying needs and operational capabilities. The potential to integrate with other CRS in the region should be required, as well as functionality to support data conflict resolution.

### 5.2.1 GENERAL FUNCTIONALITY

As described previously, there are several CRS currently in use in the region. These systems were developed in-house to meet specific agency requirements; however these systems still share some basic functional similarities. None of the existing CRS in the region currently offer a complete set of features, however for a regional tool that can meet the needs of multiple agencies, existing CRS could be expanded to provide increased functionality. Alternatively, a new regional CRS could be procured. The following are proposed high-level functional requirements for a regional CRS.

The regional CRS should:

- Utilize automatic and manually entered event data to generate traveler information that can be delivered over a public traveler information website.
- Offer features that automate event entry to the extent possible, and minimize re-entry of events.
- Accept operator event inputs from geographically diverse locations, allowing operators to log in remotely, preferably over a web-based interface.
- Allow entry of planned events (e.g., construction, concerts, etc.) and unplanned incidents (e.g., collisions, inclement weather, etc.) by operators and other authorized operating partners who have been assigned appropriate security levels.
- Allow operators to manually enter observed incidents from traffic cameras and emergency and law enforcement computer aided dispatch feeds through the use of a standardized input form that minimizes the use of free text.
- Use standardized data formats and data exchange structures for event locations, types and time periods.
- Provide a searchable archive of warehoused data filterable by event type, duration, affected areas and any other types of information that would be useful for future project planning, incident analysis, construction impact analysis, etc.
- Be able to integrate pushed information from field sources, such as traffic count detectors and approved third-party data, to supplement traffic flows and current conditions reporting.
- Support varying update frequencies for both automated and manual updates.
- Provide the ability to conduct quality assurance reviews on the information inputs versus outputs.
- Offer a scalable and modular design to allow for expansion and adaptation to future needs.

### 5.2.2 CAPABILITY TO INTEGRATE WITH OTHER ATIS

As noted previously, there are three existing CRS currently in use in the region. These include systems developed by KCDOT, SDOT and WSDOT. The options for the Puget Sound Region would include adopting and expanding one of these systems as the “standard” regional system, procuring a new system, or a hybrid approach where existing systems may be maintained and simply interoperate with a new “regional” system through a real-time standard data exchange format. The hybrid approach would allow flexibility for each agency to retain their existing software,

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if they wish, or join with agencies which currently do not have their own CRS to either use one of the existing CRS applications or the new regional one.

Additionally, several agencies offer websites with advanced traveler information functionality. It is likely that several websites will remain in use for an undetermined period of time after a regional strategy is adopted, either due to a transition period to a new regional system or due to individual agency preference. Therefore, regardless of the option chosen, consideration should therefore be given to integrating the data outputs of these CRS to a regionally-adopted standard, enabling condition reports to be posted from one CRS to any participating agency ATIS website or other dissemination means.

Looking forward, this integration should be considered to include opportunities with neighboring regions and states as well. The partnering agencies may find that a state-wide approach will be the most cost effective for the implementation of a truly effective ATIS. Knowing the effect of the gaps in jurisdiction-to-jurisdiction Puget Sound information, it is easy to extrapolate the benefits of even broader information sharing.

### 5.2.3 PROVIDE CONFLICT RESOLUTION

A centralized engine for “data fusion” and automated data review is an essential component of the system. When data is collected from multiple sources, each source may have its own data format, style, accuracy, map presentation, precision, etc. Data fusion is necessary to ensure that all data flows are properly amalgamated, formatted and presented to the public in a consistent, timely, and easy-to-use manner. This speaks to the potential for including automated data feeds with the manual data input by operators, and having this information from different sources presented in a consistent manner, one of the primary gaps identified earlier in this report. The fused information may potentially also be made openly available to Information Service Providers (or Value Added Service Providers) to remarket.

With the fusion of data from multiple sources, the potential for a conflict in the data exists where one source indicates no adverse travel conditions while another reports issues. In these instances, a conflict resolution engine can provide significant benefits by flagging the conflict to an operator for review/approval. The level of complexity of the engine could be limited to purely alerting an operator to multiple events happening on the same stretch of roadway for their acknowledgment or having the system evaluate the traffic detector data in comparison to incident data and determine which events are having an impact on the public and where new incidents may be occurring.

### 5.2.4 ACCOMMODATE OTHER USERS

The implementation of a regional ATIS is a significant undertaking that should also consider how other agency partners could be enlisted to provide greater regional benefit and return on investment.

Other potential CRS users could include:

- **Emergency Management:** linking with a regional, or even state-wide, emergency management system information feed could provide a wealth of information about extreme weather condition approved evacuation routes, as well as other key pieces of timely information that could be made immediately available to the public.
- **Transit Agencies:** offering transit as well as traffic data provides a multimodal element to trip planning that can encourage mode shifting. Additionally, providing regional transit agencies access to historical traffic and incident data could allow them to more completely review current transit systems for potential route improvements, in order to positively affect traffic flow during peak periods, holidays, and special events.

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- **Ports:** providing the access to Port staff to enter known events and current alerts could positively impact traffic flow on the arterials and freeways immediately surrounding Port areas, particularly in regards to freight, as well as travelers en-route to airport facilities.
- **Local Police and Fire:** mutually beneficial agreements with public safety agencies could enable traffic operators to have immediate access to large-scale incidents, while also providing information to the public safety agencies, allowing them to make real-time route changes in the event of an emergency. To be most effective, traffic operators may need access to public safety CAD feeds. Data from the CAD feeds could then be either manually or automatically (with the proper controls) entered as events in the CRS. .

### 5.3 Regional Information Dissemination

While there are various methods of disseminating traveler information to the public, the medium of primary interest to the region is via the internet. Other options, such as highway advisory radio (HAR) and interactive voice response (IVR)/511 will be touched on at the end of this section.

A website offers several advantages by allowing travelers to access information in a format that includes both static and real-time information on demand, whether pre-trip or en-route. A website can offer a greater breadth and depth of trip information, and, with the proliferation of web-enabled devices, offers greater accessibility than ever before.

#### 5.3.1 USERS

In considering the desirable functionality for the public website, it is necessary to identify the anticipated consumers of the information to be provided. Several distinct user types can be expected:

- **Commuters:** these users travel on a frequent basis (usually three to five days a week) often alone, typically travel the same route with potentially two or three alternate routes, and usually travel during morning and afternoon peak periods (6 a.m. to 9 a.m. and 4 p.m. to 7 p.m.). These users are probably the most likely to access traveler information/traffic conditions information in advance and via technology like a website or mobile/Smartphone alert.
- **Non-commuters:** these users are typically running errands/shopping, visiting friends and family, or are making recreation excursions. Non-commuters may have more flexibility in how and when to travel. These users may access information in advance via a website. A non-commuter would likely be more apt to access information in advance if the information were easily accessible.
- **Visitors:** these users are more likely to be traveling during non-peak hours and may be less likely to access traveler information in advance of traveling. When they do access traveler information systems, they may be more likely to rely on HAR or IVR systems.
- **Freight:** these users have limited control over time of travel, as this is usually dictated by customer requirements for delivery schedules; however, they do have more control over routes, so information such as truck-friendly alternate routes and expected durations of effects can be very valuable.
- **Researchers, Planners, and Modelers:** these users are interested in access to transportation system data for analysis and reporting purposes.

5.3.2 FEATURES AND FUNCTIONALITY

Whether a single, “one stop” website is hosted by an agency or partnership of agencies, the site should offer the following features:

- Current conditions via a clickable, zoom-able traffic flow map.
- Planned events.
- Multimodal travel options, including links or direct integration with transit and ferry agencies, bicycle route maps, ridesharing, etc.
- Customized services, such as language selection, ADA accessibility, freight information, etc.
- Coverage of the complete roadway network within the regional boundary defined by the scope of the project.

It is also possible to develop a single template of features and functionality that each jurisdiction can use to host its own website while maintaining the quality and depth of information required. Table 2 shows the various types of features and options a fully functional traveler information website could provide.

**Table 2: Potential Website Features**

FUNCTION	DESCRIPTION	BENEFIT FOR USERS	BENEFIT FOR SYSTEM
<b>Information</b>			
<i>Speeds and Travel Time</i>	Real-time average speed and point-to-point travel times for a given route.	Enables travelers to make informed decisions re: when to travel; alternate routes.	If travelers shift trips out of peak periods, system efficiency improves.
<i>Trip Time Predictions</i>	View predicted trip times for customizable routes.	Travelers can plan routes and shift travel times to less congested periods. Potential for change to different mode.	Shifts from single-occupant vehicles or peak periods increases system efficiency.
<i>Travel Alerts</i>	Construction and incidents, including closures, disruptions, as well as relative severity.	Enables travelers to make informed decisions re: when to travel; alternate routes.	If travelers shift trips out of peak periods, system efficiency improves.

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FUNCTION	DESCRIPTION	BENEFIT FOR USERS	BENEFIT FOR SYSTEM
<i>Weather</i>	Current weather and mountain pass conditions, road temperatures, and wind speeds at bridges.	Helps freight and visitors avoid mountain passes or plan to carry chains, travelers across bridges may choose to delay or alter routes.	Weather data can be used to help support maintenance decisions. System will work more efficiently if travelers prepare (e.g., chains for passes). Transit operators can reroute buses and/or transition to inclement weather schedules.
<b>Information</b>			
<i>Traffic Video</i>	Still images and streaming video from roadside cameras.	Camera feeds provide the “picture worth a thousand words” for real time road conditions	Travelers can see for themselves the live conditions on a given roadway and potentially modify their trip, shifting traffic away from the congested route. Operators benefit greatly from access to traffic cameras for incident detection and traffic management.
<i>ITS Device Status</i>	Current device status for DMS, ramp meters, etc.	Provides a more complete picture of the roadway network status, particularly for operators.	Operators can make more informed traffic management systems given the status of devices operated by other agencies (such as knowing that a freeway DMS sign is routing traffic onto city streets during an incident).
<i>Real-Time Transit Information</i>	Current bus locations and estimated arrival times at specific bus stops and transit centers.	Permits travelers to make choices about modes of transportation.	Shift from single-occupant vehicles to alternate modes improves system efficiency.
<i>Transit Routes and Schedule (General)</i>	Include transit routes on map to allow viewer to choose to see available routes for trip. Include clickable icons linked to schedules.	Allows travelers to make choices about modes of travel.	System efficiency improves when there are fewer single-occupant vehicles.

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FUNCTION	DESCRIPTION	BENEFIT FOR USERS	BENEFIT FOR SYSTEM
<i>Transit Routes (Customized)</i>	Create customized routes and see applicable transit routes and schedules.	Makes it easier for travelers to shift from single-occupant vehicles to alternate mode.	Shift from single-occupant vehicles to alternate modes improves system efficiency.
<i>Information for Commercial Vehicle Operators</i>	Restricted or closed bridges and roads, safe alternate routes for oversize/overweight vehicles, weigh station locations, legal truck parking	Freight users are able to plan faster, safer trips.	Mitigates impact of freight traffic, reduces potential bottlenecks increasing system efficiency.
<i>Ridesharing</i>	Create customized routes and see rideshare info specific to that route.	Enables user to plan trips and shift from single-occupant vehicle.	Shift from single-occupant vehicles to alternate modes improves system efficiency.
<i>Commuter Trip Reduction Products, Promotions, and Incentives</i>	Information about products (e.g., ORCA, reduced fare passes) promotions, and incentives (e.g., giveaways) that encourage use of alternate modes.	Encourages shift from single-occupant vehicles.	Shift from single-occupant vehicles to alternate modes improves system efficiency.
<i>Parking Facilities</i>	Provide locations, transit service options (for park & ride lots), and current available parking spaces.	Enables travelers to make choices about modes of transportation.	Shift from single-occupant vehicles to alternate modes improves system efficiency.
<i>Project Information</i>	Construction updates, anticipated benefits, progress, budget spent	Improves accountability to public, helps travelers avoid heavy construction periods/areas.	Greater accountability increases likelihood that a project is completed on time and within budget.
<i>Historical Data</i>	Data collected from various ITS and signal systems operated in the region.	Data may be of interest and benefit to operators, planners, modelers and researchers for various purposes.	Improved traffic management and roadway design/development as a result of more informed decision-making.

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FUNCTION	DESCRIPTION	BENEFIT FOR USERS	BENEFIT FOR SYSTEM
<b>User Interface</b>			
<i>Map Background</i>	Map allows user to select digital, satellite, or hybrid image.	Can identify location based on landmarks	Allows engineers to identify roadway landmarks (e.g., striping, utilities, poles) to assist in design and maintenance. Allows planners to identify traffic generators (e.g., malls, theaters, etc.) for forecasting.
<i>Optional Layers</i>	Select or hide layers (e.g., alerts, travel times, weather, transit, etc.) to display together or separately.	Easier to find information required.	
<b>User Interface</b>			
<i>Customizable</i>	Select specific routes and times to receive info specific to needs, including current conditions, rideshare info, real-time transit info, etc.	Easier to find information required.	
<i>Incident/Construction Information on the Map</i>	Clickable or roll-over icon links to or displays current conditions information for that locations	Easier to find information required.	
<i>Administrator Privileges</i>	Manage data displays Manage user permissions Modify system configurations		Allows agency staff to more easily manage the traveler information system.
<i>Custom Camera Page</i>	Select cameras to include on a customizable page.	Easier to find information required.	
<b>Information Delivery</b>			
<i>Push Information</i>	Subscriber can create a profile and receive info via email or SMS about current conditions along specific routes, including transit information.	Allows traveler to plan trips, change travel times and/or modes, as well as make decisions en-route.	Shifts to less congested routes and/or alternate modes improve system efficiency.

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FUNCTION	DESCRIPTION	BENEFIT FOR USERS	BENEFIT FOR SYSTEM
<i>In-Vehicle Integration</i>	Partner with GPS providers to include next generation of traveler information in their systems.	Allows traveler to make decisions en-route.	Shifts to less congested routes improves system efficiency.

5.3.3 FUTURE APPLICATIONS

The regional agencies are encouraged to look forward to future applications that can further expand the reach of traveler information. Once a central ATIS is in place, it will be easier to integrate the information in to an IVR (511) system, to create mobile phone applications, and local and state highway advisory radio (HAR) systems in order to reach the widest audience possible.

6. OPERATIONAL CONCEPT

As the region’s traffic agencies are well aware, no system concept is complete without a discussion on operations. This section explores the primary elements of the operational concept for a Puget Sound regional ATIS, from the initial stages to operations and maintenance, as well as the roles and responsibilities that may be agreed upon by the partnering agencies.

6.1 Program Planning and Development

During this stage, the agencies should come to some broad agreements on the key pieces of the system and which agencies should be responsible for those pieces. The RTOC has already begun the work of reaching consensus with some of the agencies that are anticipated to be involved in the ATIS project. Therefore, at this stage, the RTOC continues to take the lead and work to strengthen the information sharing relationships it has built with WSDOT and local transit agencies. The RTOC has taken this opportunity to coordinate with key staff at WSDOT headquarters that are planning expansions to the statewide ATIS. By strengthening this relationship, the RTOC could not only increase the access of partnering agencies to WSDOT resources, it could also play a key role in identifying local/arterial-level needs for the state-wide ATIS upgrade and possibly result in economies of scale for regional deployments. The RTOC has recently agreed to form a sub-committee to focus specifically on regional ATIS and coordination with WSDOT, transit and other stakeholders.

6.2 Content Providers

Numerous stakeholders will be involved in the providing of content to the operational system. The ability to generate and provide static and real-time information to the system from these many sources will be dependent upon the establishment of a regional data standard that could be applied either at the data source or as the data comes into the system. This would include both automatic (video, traffic and transit data) and manual (operator-entered events) information.

Additionally, several private sector data sources can provide current and historical traffic conditions data at a depth and breadth that has been difficult for public agencies to achieve. The potential to integrate this data with a regional ATMS would offer a “fast track” to filling in the many gaps in the roadway network where no conditions monitoring capability exists.

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Potential roles and responsibilities of regional content providers are explored in more detail in the following table.

**Table 3: Content Provider Roles and Responsibilities**

AGENCY	ROLES AND RESPONSIBILITIES
<i>Regional Traffic Operations Committee</i>	Coordinate between various agencies to ensure content is being provided as anticipated.
<i>City and County Traffic Operators</i>	Provide multimodal roadway information regarding traffic conditions, events, inclement weather emergencies, and other information pertaining to roadways not covered by the WSDOT traffic management system.
<i>Washington State DOT Traffic Operators</i>	Continue to provide real-time traffic and event information, including: traffic flow data, event and incident information, road closures, and future data, e.g., travel time.
<i>Washington State Patrol</i>	Source of incident information through automated CAD feed to WSDOT.
<i>Transit Providers</i> Includes both public sector and private sector transit agencies, such as: King County Metro, Sound Transit, Washington State Ferries, Community Transit, Pierce Transit, etc.	Near-term: provide reciprocal links to services, fares, routes, etc., including trip planning, as well as multimodal facility information.  Long-term: provide increased integration and functionality including real-time travel information.
<i>Local Emergency Responders</i>	Provide CAD data or other means of incident reporting through partnerships with local traffic agencies.
<i>Other Content Providers</i>	Provide additional content such as vanpool information, tourism and travel services information, emergency management instructions, ridesharing, bicycle/pedestrian information, etc. as deemed appropriate by the partnering agencies. These providers may include the Washington State Emergency Management Association, King County Office of Emergency Management, rideshare providers, event managers, the University of Washington and/or other providers.

### 6.3 Operations and Maintenance

A vital aspect of a functioning ATIS will be an effective operations and maintenance (O&M) plan. How the O&M works will depend in part on what sort of system is developed. For example, should the “one site” public traveler information website option be selected, the owner of the website will be responsible for maintaining that site; however, if the “common look and feel” option is selected, each agency will be responsible for maintaining its own website. The same would be true for the CRS. Should local agencies pursue the implementation of WSDOT’s ROADS as the CRS for the

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region, WSDOT would have primary responsibility for ensuring the program works and would likely manage all future development and system enhancements. However, modifications of the ROADS application would need to maintain and serve the existing needs of WSDOT. In addition, each local agency would likely remain responsible for maintaining and managing equipment (e.g., CCTV cameras) that were installed locally to track road conditions. Table 4 summarizes the probable O&M roles for partnering agencies.

**Table 4: Operations and Maintenance Roles and Responsibilities**

ORGANIZATION	ROLE
<i>Regional Traffic Operations Committee</i>	Facilitate ongoing communication and project management of entire ATIS. May be cooperative “owner” of regional CRS and ATIS, depending on eventual procurement approach.
<i>Washington State DOT</i>	Given the various planned ATIS updates and existing CRS, WSDOT will soon possess many of the desired ATIS functional capabilities. Depending on mutually-agreeable arrangements to be determined, WSDOT could potentially have a lead role in the operation and maintenance of the Puget Sound ATIS as part of their statewide ATIS operations. However, given the potential risks and liabilities to WSDOT, many operational and institutional issues would need to be resolved prior.
<i>Counties</i>	Own, operate and maintain necessary equipment on unincorporated roadways under County jurisdiction. Contribute roadway condition, event, road closure, and weather condition information via the regionally-adopted CRS.
<i>Municipalities</i>	Own, operate and maintain necessary equipment on arterials under City jurisdiction. Contribute roadway condition, event, road closure, and weather condition information via the regionally-adopted CRS.
<i>Transit Agencies</i>	Own, operate and maintain CAD/AVL systems from which real-time transit information shall be contributed, as well as maintenance of current schedule and route/trip planner information. Consider use of CRS for posting transit alerts and reroutes due to inclement weather.
<i>Other Content Providers</i>	Own, operate and maintain equipment and data systems necessary to provide the desired and agreed-upon information, such as status and conditions reports, historical data and up-to-date static information.

## 7. STRATEGIES AND OPPORTUNITIES

### 7.1 Partnerships

It is important to emphasize that the regional ATIS as a means for distributing traveler information can be only as valuable as the information provided to the system. In many cases, agencies in the Puget Sound region have yet to invest in data systems and operations infrastructure that generate meaningful real-time information that can be fed into the system. Therefore, a partnership of agencies sharing the operational and technical burdens of a new ATIS (and its ongoing maintenance) is likely to be the most operationally efficient and cost effective while also addressing the data gaps and issues discussed previously.

In order to create an effective partnership, first, agencies will need to agree on each agency's roles and responsibilities. For example, a Lead Agency, responsible for contracting, primary project management and perhaps the primary funder, should be selected. Which agencies will be data partners and who will be responsible for operations and maintenance of the system once it is in place must also be decided. The RTOC would be a logical choice to serve as a steering committee for the overall effort. Governance of a pooled-resource system such as a regional ATIS, particularly if agencies are forgoing other local projects to participate in a regional initiative, is a major issue. Lead agency responsiveness, credibility, system accuracy and performance guarantees, and branding will need to be addressed to the satisfaction of all partners.

Partnerships with private sector companies for data sharing and potentially operations and maintenance of the website and IVR should also be considered. A model partnership for information exchange between the private and public sector could improve the quality of information available to both operators and travelers for a potentially lower cost. For example, private sector arterial data could be integrated into the regional ATIS to supplement gaps in detector coverage.

Options for partnering with the private sector include the following business models:

- **Data/feature integration:** Procurement and integration of a particular data source or functionality for use in the Regional ATIS, where the data source or functionality has been developed and proven by the private sector and does not merit reinvention by the agencies. Examples might include GIS mapping and arterial conditions data.
- **Full system development:** Numerous companies offer ATIS development services, either as a standalone software product or as a system integrator (bringing together various vendor products to create a customized system).
- **System operations/maintenance:** Either as part of the development contract or as a separate contract, a contractor could be retained to provide the system operations (including condition reporting) and maintenance.
- **System development/operations with funding agreement:** Given the potentially high cost of developing a multi-agency integrated ATIS, some regions have entered into innovative partnerships with the private sector to raise funds to support the ongoing operation of the system. The Los Angeles County Service Authority for Freeway Emergencies (LA SAFE) website ([www.go511.com](http://www.go511.com)) is one such example where the operations agreement included a commitment from the contractor to raise a certain amount of ad revenue to cover the cost of the site.
- **Services support only:** If development and operations are performed by the agencies in-house, consultant support may only be necessary periodically to assist with needs assessment, consensus building, system documentation, or other specific services.

The Puget Sound agencies will need to jointly determine what key ATIS functions require some form of external support, and what could best be accomplished by the agencies themselves. The agencies should be prepared to “make the case” for the public sector’s role to decision makers and funding sources who are likely to compare the proposed public ATIS functionality to existing private sector services.

## 7.2 Phasing

Once the partnership agreement(s) is in place (formally or informally), the partnering agencies should agree on the first phase of the ATIS project, including the scope and budget for that phase. One approach would be to first tackle the establishment of a data standard for posting traffic conditions and video data to the ATIS and resolving data conflicts. A regionally-standardized CRS would make it possible for any participating agency to post incidents and road closures information to the extent that their operational resources allow. Having a common CRS tool would also enable the use of a common Application Programming Interface (API) that would allow other users to “subscribe” to the data relatively seamlessly. This is how WSDOT has been able to share data with other agencies.

From the common CRS, the next step could be to implement a standardized map interface with a common look and feel so that users have a similar experience even as they encounter different agency sites, similar to the regional transit trip planner model.

As a third phase, the agencies could implement a centralized website, data warehouse and reporting tool hosted by a single regional entity. The individual agencies could then migrate over to this centralized website, or continue to push data from the centralized reporting tool to both their local site and the central site. The third phase would integrate the first two phase above into a fully functional, integrated ATIS including multimodal transportation options, arterial and freeway flow information, and other current roadway conditions information made available by a public traveler information website, mobile/Smartphone applications and RSS feeds, and 511/IVR system integration.

As opportunities arise, efforts to integrate data from adjacent states or regions to provide a more user-friendly experience for corridor and inter-state travel can be included, where appropriate, at any phase.

## 7.3 Funding

Once the first phase is scoped and budgeted, the agencies will need to seek funding. Potential sources of funding include requesting funds through the state legislature (through WSDOT) and the PSRC regional competition for Surface Transportation Program (STP) and Congestion Mitigation and Air Quality (CMAQ) program (note: the next cycle for this competition falls in 2012). Other federal grants could be sought as well, especially if partnering with transit agencies. The Regional Mobility grant program administered by the State would be one example. Private industry partners may be willing to provide data and/or webhosting in exchange for advertising space on the site. The agencies could also opt to pool their resources to create a fund.

## 7.4 Agreements

A designated lead agency with contracting authority and acting with the support of other agencies may be the most appropriate organizational structure for the regional ATIS program. This agency could lead the program with a memorandum of agreement outlining the relationships, roles and responsibilities of the lead and partnering/participating agencies. The agreement should be fluid and give room for easy future system expansions that may be identified as the project moves

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forward. The agreement for participating agencies should identify who is providing content and in what format and frequency, any pooled fund obligations, operations and maintenance of hardware and software, compliance with the regional data standard (assuming one is developed) and/or national ITS standards, as well as any other responsibilities designated for lead or participating agencies, such as procurement, system development, system implementation oversight, testing, and/or program administration.

## 8. MOVING FORWARD

An important initial step is for the regional agencies to reach some level of agreement that the Advanced Traveler Information System is a vital addition to the ITS applications in the region and is worthy of multijurisdictional and multimodal agency support. Once this consensus is reached, the group will have several other key decision points to tackle, including:

- Required core functionality of the system: defining inputs, processing capabilities, and outputs;
- An approach to data standardizing: using a central translator that can conform incoming data to the adopted regional standard, versus each individual data source having to perform this transaction before uploading to the system;
- System maintenance and operations model;
- The role of private sector partnerships; and,
- An approach to how the various partner agencies will arrive at consensus on the website “look and feel”, including branding, data presentation and layout.

As noted previously, the RTOC has indicated their support of the regional ATIS by forming a subcommittee to further advance the effort. As this subcommittee begins to engage with other stakeholders and plot a course for initiating the ATIS, jointly developing a scope of work and cost estimate to complete an initial analysis of the above decision points will position the group to pursue funding through a grant or pooled fund.

## APPENDIX A

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### EXISTING AGENCY WEBSITES

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The following table provides a high-level inventory of the online traveler information available for the various Puget Sound agencies, and helps illustrate the disparity of information that is available by agency.

STATE	WEBSITE	MAP	REAL-TIME TRAFFIC INFO <i>Incidents, Closures/Construction, CCTV, DMS, Events, Travel Time</i>	REAL-TIME TRANSIT INFO	STATIC TRANSIT INFO	OTHER STATIC INFO	SERVICES <i>Personalization, Multilingual, Floodgates, Alerts</i>
WSDOT Puget Sound Traffic Page	<a href="http://www.wsdot.wa.gov/traffic/seattle/">http://www.wsdot.wa.gov/traffic/seattle/</a>	●	Incidents, Closures, CCTV, Events	●	●		Alerts
COUNTY	WEBSITE	MAP	REAL-TIME TRAFFIC INFO <i>Incidents, Closures/Construction, CCTV, DMS, Events, Travel Time</i>	REAL-TIME TRANSIT INFO	STATIC TRANSIT INFO	OTHER STATIC INFO	SERVICES <i>Personalization, Multilingual, Floodgates, Alerts</i>
King	<a href="http://www.kingcounty.gov/Transit%20and%20Traffic">http://www.kingcounty.gov/</a> "Transit and Traffic"	●	Incidents, Closures, CCTV, Events		●		Alerts
Pierce	<a href="http://www.co.pierce.wa.us/pc/abtus/ourorg/pwu/about/transpmenu.htm">http://www.co.pierce.wa.us/pc/abtus/ourorg/pwu/about/transpmenu.htm</a>		CCTV		●		
Snohomish	<a href="http://www1.co.snohomish.wa.us/County%20Information/Transportation.htm">http://www1.co.snohomish.wa.us/County Information/Transportation.htm</a>		Closures				Alerts
CITY	WEBSITE	MAP	REAL-TIME TRAFFIC INFO <i>Incidents, Closures/Construction, CCTV, DMS, Events, Travel Time</i>	REAL-TIME TRANSIT INFO	STATIC TRANSIT INFO	OTHER STATIC INFO	SERVICES <i>Personalization, Multilingual, Floodgates, Alerts</i>
Seattle	<a href="http://www.cityofseattle.net/html/citizen/traffic.htm">http://www.cityofseattle.net/html/citizen/traffic.htm</a>	●	Incidents, Closures, CCTV, Events, Parking Availability for certain facilities		●		Alerts
Auburn	<a href="http://www.auburnwa.gov/community/getting_around/real_time_traffic.asp">http://www.auburnwa.gov/community/getting_around/real_time_traffic.asp</a>	●	Incidents, Closures, CCTV, Events		●		Alerts

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CITY	WEBSITE	MAP	REAL-TIME TRAFFIC INFO <i>Incidents, Closures/Construction, CCTV, DMS, Events, Travel Time</i>	REAL-TIME TRANSIT INFO	STATIC TRANSIT INFO	OTHER STATIC INFO	SERVICES <i>Personalization, Multilingual, Floodgates, Alerts</i>
Lynnwood	<a href="http://www.ci.lynnwood.wa.us/Content/Services.aspx?id=491">http://www.ci.lynnwood.wa.us/Content/Services.aspx?id=491</a>	●	Closures, CCTV, Events		●		
Bellevue	<a href="http://www.ci.bellevue.wa.us/transportation-choices.htm">http://www.ci.bellevue.wa.us/transportation-choices.htm</a> and <a href="http://www.chooseyourwaybellevue.org/">http://www.chooseyourwaybellevue.org/</a>	●	Incidents, Closures, CCTV, Events		●	●	Alerts
Redmond	<a href="http://www.redmond.gov/">http://www.redmond.gov/</a> "Construction Traffic Alerts", "Redmond "Traffic Cameras"		Incidents, Closures, CCTV, Events				
Kent	<a href="http://www.ci.kent.wa.us/content.aspx?id=15979">http://www.ci.kent.wa.us/content.aspx?id=15979</a>		Closures		●	●	
Bremerton	<a href="http://www.ci.bremerton.wa.us/display.php?id=800">http://www.ci.bremerton.wa.us/display.php?id=800</a>		Closures		●		
Mercer Island	<a href="http://www.mercerisland.org/">http://www.mercerisland.org/</a> "Current Traffic Report"		Closures				
Everett	<a href="http://www.ci.everett.wa.us/">http://www.ci.everett.wa.us/</a> "Everett Transit"				●		
Renton	<a href="http://rentonwa.gov/living/default.aspx?id=1126">http://rentonwa.gov/living/default.aspx?id=1126</a>				●		